Linux in a Nutshell, 5th Edition

By Stephen Figgins, Robert Love, Arnold Robbins,
Ellen Siever, Aaron Weber

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Overview

Over the last few years, Linux has grown both as an operating system and a tool for personal and business use. Simultaneously becoming more user friendly and more powerful as a back-end system, Linux has achieved new plateaus: the newer filesystems have solidified, new commands and tools have appeared and become standard, and the desktop--including new desktop environments--have proved to be viable, stable, and readily accessible to even those who don't consider themselves computer gurus.

Whether you're using Linux for personal software projects, for a small office or home office (often termed the SOHO environment), to provide services to a small group of colleagues, or to administer a site responsible for millions of email and web connections each day, you need quick access to information on a wide range of tools. This book covers all aspects of administering and making effective use of Linux systems. Among its topics are booting, package management, and revision control. But foremost in *Linux in a Nutshell* are the utilities and commands that make Linux one of the most powerful and flexible systems available.

Now in its fifth edition, *Linux in a Nutshell* brings users up-to-date with the current state of Linux. Considered by many to be the most complete and authoritative command reference for Linux available, the book covers all substantial user, programming, administration, and networking commands for the most common Linux distributions.

Comprehensive but concise, the fifth edition has been updated to cover new features of major Linux distributions. Configuration information for the rapidly growing commercial network services and community update services is one of the subjects covered for the first time.

But that's just the beginning. The book covers editors, shells, and LILO and GRUB boot options.

There's also coverage of Apache, Samba, Postfix, sendmail, CVS, Subversion, Emacs, vi, sed, gawk, and much more. Everything that system administrators, developers, and power users need to know about Linux is referenced here, and they will turn to this book again and again.

PREV

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Preface

This is a book about Linux, a freely available clone of the Unix operating system whose uses range from embedded systems and personal data assistants (PDAs) to corporate servers, web servers, and massive clusters that perform some of the world's most difficult computations.

Whether you are using Linux for personal software projects, for a small office or home office (the so-called SOHO environment), to provide services to a small group of colleagues, or to administer a site responsible for millions of email and web connections each day, you need quick access to information on a wide range of tools. This book covers all aspects of administering and making effective use of Linux systems. Among its topics are booting, package management, and revision control. But foremost in *Linux in a Nutshell* are the immeasurable utilities and commands that make Linux one of the most powerful and flexible systems available.

In addition to the tools and features written specifically for it, Linux has inherited many from the Free Software Foundation's GNU project, the Berkeley Software Distribution (BSD), the X Window System and contributions from major corporations as well as the companies that created the major Linux distributions. More recent projects extend Linux in exciting ways, some through changes to the kerne and some through libraries and applications that radically change the user's experience.

This book is a quick reference for the basic commands and features of the Linux operating system. As with other books in O'Reilly's "In a Nutshell" series, this book is geared toward users who know what they want to do and have some idea how to do it, but can't always remember the correct command or option. The fifth edition has been examined from start to end and checked against the most common Linux distributions (Debian, Fedora, and SUSE) so that it reflects the most useful and popular commands.

Organization of This Book

This book is a reference to the most important commands and utilities available on Linux systems.

Chapter 1, *Introduction*, explains Linux's strengths and the key aspects of working with Linux, and lays out the scope of this book.

Chapter 2, *System and Network Administration Overview*, introduces TCP/IP networking and the Linux commands used for system administration and network management.

Chapter 3, Linux Commands, is the core of the book, a reference listing of hundreds of the most important shell commands available on Linux.

Chapter 4, Boot Methods, covers the commands used to control booting on Linux and dual-booting, particularly LILO, GRUB, and `initrd`.

Chapter 5, Package Management, explains the `apt` series of commands that manage updating and installation on Debian, and the RPM system used by Red Hat/Fedora, Novell/SUSE, and several other distributions of Linux.

Chapter 6, The Bash Shell and Korn Shell, documents the default command-line interpreter on Linux, Bash, and another popular interpreter, `ksh`.

Chapter 7, Pattern Matching, introduces regular expressions and explains how different tools interpre these powerful tools for searching and text processing.

Chapter 8, The Emacs Editor, provides reference information on Emacs, a text editor and full-featured development environment.

Chapter 9, The vi, ex, and vim Editors, describes the classic `vi` editor that is the most popular text-manipulation tool on Linux.

Chapter 10, The sed Editor, describes this "stream editor" that is useful for processing files in standardized ways.

Chapter 11, The gawk Programming Language, documents another valuable tool for processing text files, the GNU version of `awk` that is the default on Linux systems.

Chapter 12, Source Code Management: An Overview, provides the background for understanding CVS and Subversion, which are valuable tools for tracking changes to files and projects, and are discussed in the following two chapters.

Chapter 13, The Concurrent Versions System (CVS), provides a description of a popular source code management and version-control tool.

Chapter 14, The Subversion Version Control System, describes what is generally considered the next generation of CVS.

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Other Resources

This book doesn't tell you how to install and get up to speed on a Linux system. For that, you will probably want O'Reilly's *Running Linux*, an in-depth guide suitable for all major distributions. For networking information, check out *Linux Network Administrator's Guide* (O'Reilly). In addition to these and other Linux titles, O'Reilly's wide range of Unix, X, web-related, and scripting and programming language titles may also be of interest to the Linux user.

Online Documentation

The Internet is full of information about Linux. One of the best resources is the Linux Documentation Project at http://www.tldp.org (or one of the dozens of mirror sites around the world), which has numerous short guides called HOWTOs, along with some full manuals. For online information about the GNU utilities covered in this book, consulthttp://www.gnu.org (also widely mirrored). The Free Software Foundation, which is in charge of the GNU project, publishes its documentation in a number of hardcopy and online books about various tools.

Each distribution maintains its own web site, and contains documentation for the software it provides as well as guides to maintaining your system under that distribution.

Web Sites

As befits a hot phenomenon, Linux is the central subject of several web sites and a frequent topic of discussion on others. Some sites offer original content; others just have links to articles posted elsewhere and threaded discussions (which can be a useful service). Among the sites frequented by Linux users are:

http://lwn.net

Linux Weekly News, a site with weekly in-depth articles and frequent news updates

http://www.linuxgazette.net

Linux Gazette, a site published monthly with articles and tips in many languages

http://www.linuxquestions.org

A very popular source for technical guidance, including a growing Wiki (site maintained by user contributions) at *http://wiki.linuxquestions.org*

http://www.tuxmagazine.com

TUX, an online magazine focusing on tools and techniques for desktop Linux users

http://linuxsecurity.com

Linux Security, a collection of security-related news

http://linuxinsider.com

Linux Insider, a news feed

http://linuxtoday.com

Linux Today, another news feed

http://slashdot.org

Slashdot, a famous discussion list

http://newsforge.com

NewsForge, a more general computing-related news feed

Linux Journal and Linux Magazine

Linux Journal and *Linux Magazine* are monthly magazines for the Linux community, written and published by a number of Linux activists. With both print editions and web sites, they offer articles ranging from questions and answers for novices to kernel programming internals.*Linux Journal*, at http://www.linuxjournal.com, is the older magazine and is published by S.S.C. Incorporated, http://www.ssc.com. *Linux Magazine* is at http://www.linuxmagazine.com.

Usenet Newsgroups

Most people can receive Usenet news at work or through their ISPs. While this communications technology has lost ground in the past several years to web-based threaded discussions, it is still a valuable source of help and community connections on many topics. The following Linux-related newsgroups are popular:

comp.os.linux.announce

A moderated newsgroup containing announcements of new software, distributions, bug reports and goings-on in the Linux community. All Linux users should read this group. Submissions

may be mailed to linux-announce@news.ornl.gov.

comp.os.linux.development.apps

Guidance for using features of Linux for application development, and for understanding the effects of the operating system on user-space programs.

comp.os.linux.development.system

Discussions about developing the Linux kernel and the system itself.

comp.os.linux.networking

Discussions relating to networking with Linux.

comp.os.linux.x

Help on getting the X graphical window system to work. This list used to see some of the highest traffic of any Linux group back when distributions had more trouble setting up graphics automatically. This is no longer the case, thanks to the increasing sophistication of autodetection and configuration software.

There are also several newsgroups devoted to Linux in languages other than English, such as *fr.comp.os.linux* in French and *de.comp.os.linux* in German.

Online Linux Support

There are many ways of obtaining help online, where volunteers from around the world offer expertise and services to assist users with questions and problems.

The freenode IRC service is an Internet relay chat network devoted to so-called "peer-directed" projects, particularly those involving free software. Some of its channels are designed to provide online Linux support services.

Internet relay chat is a network service that allows you to talk interactively on the Internet to other users. IRC networks support multiple channels where different groups of people type their thoughts. Whatever you type in a channel is seen by all other users of that channel.

There are a number of active channels on the freenode IRC network, where you will find users 24 hours a day, 7 days a week who are willing and able to help you solve any Linux problems you may have, or just chat. You can use this service by installing an IRC client (some distributions install them by default), connecting to server name *irc.freenode.org:6667*, and joining a channel focusing on Linux, such as:

#linpeople

General help and discussion

#debian

Help for Debian distribution

#gentoo

Help for Gentoo distribution

#redhat

Help for Red Hat distribution

#suse

Help for SUSE distribution

And so on. Please be sure to read up on the rules of chat etiquette before chatting. In particular, the participants in these groups tend to expect people to read documentationand do some experimentation before asking for help with a problem.

Linux User Groups

Many Linux User Groups around the world offer direct support to users. Typically, Linux User Groups engage in such activities as installation days, talks and seminars, demonstration nights, and purely social events. Linux User Groups are a great way of meeting other Linux users in your area. There are a number of published lists of Linux User Groups. Some of the better-known ones are:

http://www.ssc.com/glue/groups

Groups of Linux Users Everywhere

http://www.linux.org/users

LUGregistry

Using Code Examples

This book is here to help you get your job done. In general, you may use the code in this book in your programs and documentation. You do not need to contact O'Reilly for permission unless you're reproducing a significant portion of the code. For example, writing a program that uses several chunks of code from this book does not require permission. Selling or distributing a CD-ROM of examples from O'Reilly books does require permission. Answering a question by citing this book and quoting example code does not require permission. Incorporating a significant amount of example code from this book into your product's documentation does require permission.

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Conventions

This desktop quick reference follows certain typographic conventions:

Bold

Used for commands, programs, and options. All terms shown in bold are typed literally.

Italic

Used to show arguments and variables that should be replaced with user-supplied values. Italic is also used to introduce new terms, indicate filenames and directories, and to highlight comments in examples.

`Constant Width`

Used to show the contents of files or the output from commands.

`Constant Width Bold`

Used in examples to show commands or other text that should be typed literally by the user.

`Constant Width Italic`

Used in examples to show text that should be replaced with user-supplied values.

`$`

Used in some examples as the bash shell prompt (`$`).

`[ ]`

Surround optional elements in a description of syntax. (The brackets themselves should never be typed.) Note that many commands show the argument [*files*]. If a filename is omitted, standard input (e.g., the keyboard) is assumed. End with an end-of-file character.

EOF

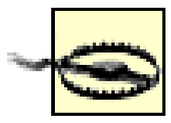
Indicates the end-of-file character (normally Ctrl-D).

|

Used in syntax descriptions to separate items for which only one alternative may be chosen at a time.

NOTE

This icon indicates a note, which is an important aside to its nearby text.



This icon indicates a warning.

A final word about syntax. In many cases, the space between an option and its argument can be omitted. In other cases, the spacing (or lack of spacing) must be followed strictly. For example,`-w`*n* (no intervening space) might be interpreted differently from `-w` *n*. It's important to notice the spacing used in option syntax.

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There is a web page for this book, which lists errata, examples, or any additional information. You can access this page at:

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Chapter 1. Introduction

It is hard to chart the rise of Linux without risking the appearance of exaggeration and hyperbole. During the past few years alone, Linux has grown from a student/hacker playground to an upstart challenger in the server market to a well-respected system taking its rightful place in educational and corporate networks. Many serious analysts claim that its trajectory has just begun, and that it will eventually become the world's most widespread operating system.

Linux was first developed by Linus Torvalds at the University of Helsinki in Finland. From his current location in Silicon Valley, Linus continues to centrally coordinate improvements. The Linux kernel continues to develop under the dedicated cultivation of a host of other programmers and hackers all over the world, joined by members of programming teams at major computer companies, all connected through the Internet.

By "kernel," we mean the core of the operating system itself, not the applications (such as the compiler, shells, and so forth) that run on it. Today, the term "Linux" is often used to mean a software environment with a Linux kernel, along with a large set of applications and other software components. In this larger meaning, many people prefer the term GNU/Linux, which acknowledges the central role played by tools from the Free Software Foundation's GNU project as complements to the development of the Linux kernel.

Linux systems cannot be technically referred to as a "version of Unix," as they have not undergone the required tests and licensing.[*] However, Linux offers all the common programming interfaces of standard Unix systems, and, as you can see from this book, all the common Unix utilities have been reimplemented on Linux. It is a powerful, robust, fully usable system.

[*] Before an operating system can be called "Unix," it must be branded by The Open Group.

The historical impact of Linux goes beyond its role as a challenge to all versions of Unix as well as Microsoft Windows, particularly on servers. Linux's success has also inspired countless other free software or open source (defined at http://opensource.org) projects, including Samba, GNOME, and a mind-boggling collection of innovative projects that you can browse at numerous sites like SourceForge (http://sourceforge.net) and Freshmeat (http://freshmeat.net). As both a platform for other developers and a development model, Linux gave a tremendous boost to the GNU project and has also become a popular platform for Java development. In short, Linux is a focal point in the most exciting and productive free-software movement ever seen.

If you haven't obtained Linux yet, or have it but don't know exactly how to get started using it, see Other Resources in the Preface.

1.1. The Excitement of Linux

Linux is, first of all, free software: anyone can download the source from the Internet or buy it on a low-cost CD-ROM. But Linux is becoming well known because it's more than just free softwareit's unusually good software. You can get more from your hardware with Linux and be assured of fewer crashes; even its security is better than many commercial alternatives.

Linux first appeared in organizations as ad hoc installations by hackers running modest web servers or development systems at universities and research institutions, but it now extends deeply into corporations around the world. People deploying Linux for mission-critical systems tend to talk about its ample practical advantages, such as the ability to deliver a lot of bang for the buck and the ease of deploying other powerful tools on Linux, such as Apache, Samba, and Java environments. They also cite Linux's ability to grow and sprout new features of interest to large numbers of users. But these advantages can be traced back to the concept of software freedom, which is the root of the broad wave of innovation driving Linux.

As free software, Linux revives the grand creativity and the community of sharing that Unix was long known for. The unprecedented flexibility and openness of Unixwhich newcomers usually found confusing and frustrating, but eventually found they couldn't live withoutcontinually inspired extensions, new tools, and experiments in computer science that sometimes ended up in mainstream commercial computer systems.

Many programmers fondly remember the days when AT&T provided universities with Unix source code at no charge and the University of Berkeley started distributing its version in any manner that allowed people to get it. For these older hackers, Linux brings back the spirit of working togetherall the more so because the Internet is now so widespread. And for the many who are too young to remember the first round of open systems or whose prior experience has been constricted by trying to explore and adapt proprietary operating systems, now is the time to discover the wonders of freely distributable source code and infinitely adaptable interfaces.

The economic power behind Linux's popularity is its supportfor an enormous range of hardware. People who are accustomed to MS-DOS and Microsoft Windows are often amazed at how much faster their hardware appears to work with Linuxit makes efficient use of its resources.

For the first several years after its appearance, users were attracted to Linux for a variety of financial and political reasons, but soon they discovered an unexpected benefit: Linux works better than many commercial systems. With the Samba file and print server, for instance, Linux provides stable Windows-based networking to a large number of end-user PCs. With the Apache web server, it provides more of the useful features web administrators want than competing products do. Embedded versions of the Linux kernel are growing in use because, although they are larger than the most stripped-down operating systems, they deliver a range of powerful features within a remarkably small footprint.

Opinions still differ on how suitable Linux is as a general-purpose desktop system. But the tremendous advances in usability and stability of the desktop software and its applications are undisputed. Soon (if not today), one will find Linux in many offices and other end-user environments

Meanwhile, the strides made by Linux in everyday computing tasks are reflected in the many new commands found in this edition.

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1.2. Distribution and Support

While it is convenient to download one or two new programs over the Internet and fairly feasible to download something as large as the Linux kernel, getting an entire working system over the Internet is difficult without a high-speed Internet connection. Also, because of the vast number and variety of tools beyond the kernel required for a functional computing environment, building a Linux installatior from scratch is quite complex. Over the years, therefore, commercial and noncommercial packages called *distributions* have emerged. The first distribution consisted of approximately 50 diskettes, at least one of which would usually turn out to be bad and have to be replaced. Since then, CD-ROM drives have become widespread and sharing Linux has become much easier.

After getting Linux, the average user is concerned next with support. While Usenet newsgroups offer very quick responses and meet the needs of many intrepid users, you can also buy support from the vendors of the major distributions and a number of independent experts. Linux is supported at least as well as commercial software. When you buy a distribution from a vendor, you typically are entitlec to a period of free support as well.

Intel's x86 family and other compatible chips are still by far the most common hardware running Linux, but Linux is also now commercially available on a number of other hardware systems, notably the PowerPC, the 64-bit Intel Itanium processor, Sun Microsystems' SPARC, and the Alpha (created by Digital Equipment Corporation).

1.3. Commands on Linux

Linux commands are not the same as standard Unix ones. They're better! This is because most of them are provided by the GNU project run by the Free Software Foundation (FSF). GNU means "GNU's Not Unix"--the first word of the phrase is expanded with infinite recursion.

Benefiting from years of experience with standard Unix utilities and advances in computer science, programmers on the GNU project have managed to create versions of standard tools that have more features, run faster and more efficiently, and lack the bugs and inconsistencies that persist in the original standard versions.

While GNU provided the programming utilities and standard commands such as`grep`, many of the system and network administration tools on Linux came from the Berkeley Software Distribution (BSD). In addition, some people wrote tools that specifically allow Linux to deal with special issues such as filesystems. This book documents all the standard Unix commands that are commonly available on most Linux distributions.

The third type of software most commonly run on Linux is the X Window System, ported by the XFree86 and X.org projects to standard Intel chips. This book does not discuss the X Window System; see the O'Reilly book *Running Linux* for an introduction to X.

1.4. What This Book Offers

Originally based on the classic O'Reilly quick reference,*Unix in a Nutshell*, this book has been expanded to include much information that is specific to Linux. These enhancements include chapters on:

- Package managers (which make it easy to install, update, and remove related software files)
- Boot methods
- The CVS and Subversion version control systems

The book also contains dozens of Linux-specific commands, along with tried-and-true Unix commands that have been supporting users for decades (though they continue to sprout new options).

This book does not cover the graphical toolscontained in most distributions of Linux. Many of these, to be sure, are quite useful and can form the basis of everyday work. Examples of these tools include OpenOffice (Sun Microsystems' free, open source version of the StarOffice suite), Evolution (a mail, calendar, and office productivity tool from Novell), Firefox and Mozilla (the open source cousins of the Netscape web browser), and the GIMP (a graphic image-manipulation program and provider of a powerful library used by the GNOME project). But they are not Linux-specific, and their graphical models do not fit well into the format of this book.

While you probably log in to one of the graphical desktop environmentssuch as GNOME or KDE and do much of your work with the graphical applications, the core of Linux use is the text manipulation and administration done from the command line, within scripts, or using text editorssuch as vi and Emacs. Linux remains largely a command-driven system, and this book continues to focus on this level of usage; for many tasks, the command line is the most efficient and flexible tool. In your day-to-day work, you'll likely find yourself moving back and forth between graphical programs and the commands listed in this book.

Every distribution of Linux is slightly different. There are variations in directory structure, choice of standard utilities, and software versions, but you'll find that the commands we document are the ones you use most of the time, and that they work the same on all distributions. Note, though, that some commands are only available with certain devices or configurations, or have alternatives that may be preferred in your environment. Basic commands, programming utilities, system administration, and network administration are all covered. However, some areas were so big that we had to leave them out. The many applications that depend on the X Window System didn't make the cut. Nor did the many useful programming languagessuch as Java, Perl, and Pythonwith which users can vastly expand the capabilities of their systems. XML isn't covered here, either. These subjects would stretch the book out of its binding.

Linux in a Nutshell doesn't teach you Linuxit is, after all, a quick referencebut novices as well as highly experienced users will find it of great value. When you have some idea of what command you want but aren't sure just how it works or what combinations of options give you the exact output required, this book is the place to turn. It can also be an eye-opener, making you aware of options

that you never knew about before.

Once you're over the hurdle of installing Linux, the first thing you need to do is get to know the common utilities run from the shell prompt. If you know absolutely nothing about Unix, we recommend you read a basic guide (introductory chapters in the O'Reilly books *Learning Red Hat Linux* and *Running Linux* can get you started.) This chapter and Chapter 2 offer a context for understanding different kinds of commands (including commands for programming, system administration, and network administration). Chapter 3 is the central focus of the book, containing about one half its bulk.

The shorter chapters immediately following Chapter 3 help you get your system set up. Since most users do not want to completely abandon other operating systems (whether a Microsoft Windows system, OS/2, or some Unix flavor), many users opt for a dual-boot system, with Linux residing on the same computer as other operating systems. Users can then boot to the system they need for a particular job. Chapter 4 describes the commonly used booting options on Intel systems, including LILO (Linux Loader) and GRUB (the GRand Unified Bootloader). Chapter 5 covers the Red Hat package manager (`rpm`)--which is supported by many distributions, including Red Hat, SUSE, and Mandriva (formerly Mandrake)--and the Debian package-management system, which is used by such distributions as Knoppix, Gnoppix, and Ubuntu. It also describes some of the newer frontend package-management tools that simplify package management and automatically resolve dependencies. These tools include `yum` and `up2date` for `rpm`-based systems and `aptitude` and `synaptic` for Debian-based systems. Package managers are useful for installing and updating software; they make sure you have all the files you need in the proper versions.

All commands are interpreted by the *shell*. The shell is simply a program that accepts commands from the user and executes them. Different shells sometimes use slightly different syntax to mean the same thing. Under Linux, the standard shell is `bash`. Others, such as the `ksh` Korn shell, the `tcsh` enhanced C shell, and `zsh`, are available. Chapter 6 provides thorough coverage of `bash` and the Korn shell; you may decide to read this chapter after you've used Linux for a while, because it mostly covers powerful, advanced features that you'll want when you're a steady user. Chapter 7 covers pattern matching, which is used by the Linux text-editing utilities for searching based on a pattern rather than an explicit string.

To get any real work done, you'll have to learn some big, comprehensive utilities, notably an editor and some scripting tools. Two major editors are used on Linux: `vi` and Emacs. Emacs is covered in Chapter 8, and `vi` is discussed in Chapter 9. Chapter 9 also describes `vim`, an extended version of `vi`, commonly found on Linux systems. Chapter 10 and Chapter 11 cover two classic Unix tools for manipulating text files on a line-by-line basis: `sed` and `gawk` (the GNU version of the traditional `awk`). O'Reilly offers separate books about these topics that you may find valuable, as they are not known for being intuitive upon first use. (Emacs does have an excellent built-in tutorial, though; to invoke it, press Ctrl-H followed by t for "tutorial.")

CVS (Concurrent Versions System) and Subversion manage files so you can retrieve old versions and maintain different versions simultaneously. Originally used by programmers, who have complicated requirements for building and maintaining applications, these tools have turned out to be valuable fo anyone who maintains files of any type, particularly when coordinating a team of people. CVS has become a distribution channel for thousands of free software projects. Chapter 12 offers a brief overview of version control, including basic terms and concepts. Chapter 13 presents CVS commands, and Chapter 14 presents Subversion commands.

Our goal in producing this book is to provide convenience, and that means keeping the book (relatively) small. It certainly doesn't have everything the manual pages have, but you'll find that it has what you need 95 percent of the time. See the `man` command in Chapter 3 for information on

reading the man pages. They can also be read with the info command, the GNU hypertext documentation reader, also documented in Chapter 3.

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1.5. Sources and Licenses

Some distributions contain the source code for Linux; it is also easily available for download at http://www.kernel.org and elsewhere. Source code is similarly available for all the utilities on Linux (unless your vendor offers a commercial application or library as a special enhancement). You may never bother looking at the source code, but it's key to Linux's strength. Under the Linux license, the source code has to be provided or made available by the vendor, and it permits those who are competent at such things to fix bugs, provide advice about the system's functioning, and submit improvements that benefit everyone. The license is the GNU project's well-known General Public License, also known as the GPL or "copyleft," invented and popularized by the Free Software Foundation (FSF).

The FSF, founded by Richard Stallman, is a phenomenon that many people might believe to be impossible if it did not exist. (The same goes for Linux, in fact--15 years ago, who would have imagined a robust operating system developed by collaborators over the Internet and made freely redistributable?) One of the most popular editors on Unix, GNU Emacs, comes from the FSF. So do gcc and g++ (C and C++ compilers), which for a while set the standard in the industry for optimization and the creation of fast code. One of the most ambitious projects within GNU is the GNOME desktop, which encompasses several useful general-purpose libraries and applications that use these libraries to provide consistent behavior and interoperability.

Dedicated to the sharing of software, the FSF provides all its code and documentation on the Interne and allows anyone with a whim for enhancements to alter the source code. One of its projects is the Debian distribution of Linux.

To prevent hoarding, the FSF requires that the source code for all enhancements be distributed unde the same GPL that it uses. This encourages individuals or companies to make improvements and share them with others. The only thing someone cannot do is add enhancements, withhold the sourc code, and then sell the product as proprietary software. Doing so would be taking advantage of the FSF and users of the GPL. You can find the text of the GPL in any software covered by that license, o online at http://www.gnu.org/copyleft/gpl.html.

As we said earlier, many Linux tools come from BSD instead of GNU. BSD is also free software. The license is significantly different, but that probably doesn't concern you as a user. The effect of the difference is that companies are permitted to incorporate the software into their proprietary products a practice that is severely limited by the GNU license.

1.6. Beginner's Guide

If you're just beginning to work on a Linux system, the abundance of commands might prove daunting. To help orient you, the following lists present a sampling of commands on various topics.

1.6.1. Communication

Command	Action
dig	Query DNS server.
ftp	File Transfer Protocol.
login	Sign on.
rsync	Transfer files, particularly across a network.
scp	Securely copy files to remote system.
ssh	Run shell or single command on remote system (secure).
talk	Exchange messages interactively with other terminals.
tftp	Trivial File Transfer Protocol.

1.6.2. Comparisons

Command	Action
cmp	Compare two files, byte by byte.
comm	Compare items in two sorted files.
diff	Compare two files, line by line.
diff3	Compare three files.
sdiff	Compare and interactively merge two files.

1.6.3. File Management

Command	Action
cat	Concatenate files or display them.
chfn	Change user information for finger, email, etc.
chgrp	Change group of files.
chmod	Change access modes on files.
chown	Change ownership of files.
chsh	Change login shell.
cksum	Compute checksum.
cp	Copy files.
csplit	Split a file into pieces with a specific size or at specific locations.
dd	Copy files in raw disk form.
file	Determine a file's type.
head	Show the first few lines of a file.
hexdump	Display files in hexadecimal format.
less	Display files by screenful.
ln	Create filename aliases.
ls	List files or directories.
merge	Merge changes from different files.
mkdir	Create a directory.
more	Display files by screenful.
mv	Move or rename files or directories.
newgrp	Change current group.
od	Display files in octal format.
pwd	Print working directory.
rm	Remove files.
rmdir	Remove directories.
shred	Securely delete files.
split	Split files evenly.
tac	Print lines of a file in reverse order.
tail	Show the last few lines of a file.
tailf	Follow the growth of a logfile.

Command	Action
touch	Update file timestamps and create the file if it doesn't exist.
wc	Count lines, words, and characters.

1.6.4. Media

Command	Action
cdda2wav	Rip a CD to create a computer-friendly WAV format.
cdparanoia	Rip a CD while providing extra features.
cdrdao	Copy a CD.
cdrecord	Record to a CD.
eject	Eject a removable disk or tape.
mkisofs	Generate a binary image from a directory tree.
mpg321	Play an MP3 file.
readcd	Read or write a data CD.
volname	Provide the volume name of a CD-ROM.

1.6.5. Printing

Command	Action
lpq	Show status of print jobs.
lpr	Send to the printer.
lprm	Remove print job.
lpstat	Get printer status.
pr	Format and paginate for printing.

1.6.6. Programming

Command	Action
ar	Create and update library files.

Command	Action
as	Generate object file.
bison	Generate parsing tables.
cpp	Preprocess C code.
flex	Lexical analyzer.
g++	GNU C++ compiler.
gcc	GNU C compiler.
ld	Link editor.
ldd	Print shared library dependencies.
m4	Macro processor.
make	Create programs.
ranlib	Regenerate archive symbol table.
rpcgen	Translate RPC to C code.
yacc	Generate parsing tables.

1.6.7. Program Maintenance

Command	Action
cvs	Manage different versions (revisions) of source files.
ctags	Generate symbol list for use with the vi editor.
etags	Generate symbol list for use with the Emacs editor.
gdb	GNU debugger.
gprof	Display object file's profile data.
make	Maintain, update, and regenerate related programs and files.
nm	Display object file's symbol table.
objcopy	Copy and translate object files.
objdump	Display information about object files.
patch	Apply patches to source code.
pmap	Print the memory map of a process.
size	Print the size of an object file in bytes.
strace	Trace system calls and signals.
strip	Strip symbols from an object file.

1.6.8. Searching

Command	Action
apropos	Search manpages for topic.
egrep	Extended version of grep.
fgrep	Search files for literal words.
find	Search the system for files by name and take a range of possible actions.
grep	Search files for text patterns.
locate	Search a preexisting database to show where files are on the system.
look	Search file for string at the beginning of lines.
strings	Search binary files for text patterns.
whereis	Find command.
which	Print pathname of a command.

1.6.9. Shell Programming

Command	Action
basename	Remove leading directory components from a path.
echo	Repeat command-line arguments on the output.
envsubst	Substitute the value of environment variables into strings.
expr	Perform arithmetic and comparisons.
mktemp	Generate temporary filename and create the file.
printf	Format and print command-line arguments.
sleep	Pause during processing.
test	Test a condition.

1.6.10. Storage

Command	Action
bzip2	Compress files to free up space.

Command	Action
cpio	Create and unpack file archives.
gunzip	Expand compressed (*.gz* and *.Z*) files.
gzip	Compress files to free up space.
tar	Copy files to or restore files from an archive medium.
zcat	Display contents of compressed files.
zforce	Force gzip files to have *.gz* extension.

1.6.11. System Status

Command	Action
at	Execute commands later.
atq	Show jobs queued by at.
atrm	Remove job queued by at.
crontab	Automate commands.
date	Display or set date.
df	Show free disk space.
du	Show disk usage.
env	Show environment variables.
finger	Display information about users.
free	Show free and used memory.
hostname	Display the system's hostname.
kill	Terminate a running command.
printenv	Show environment variables.
ps	Show processes.
quota	Display disk usage and limits.
stat	Display file or filesystem status.
stty	Set or display terminal settings.
top	Display tasks currently running.
tty	Display filename of the terminal connected to standard input.

Command	Action
uname	Display system information.
uptime	Show how long the system has been running.
vmstat	Show virtual memory statistics.
who	Show who is logged in.

1.6.12. Text Processing

Command	Action
col	Process control characters.
cut	Select columns for display.
emacs	Work environment with powerful text-editing capabilities.
ex	Line editor underlying vi.
expand	Convert tabs to spaces.
fmt	Produce roughly uniform line lengths.
fold	Break lines.
gawk	Process lines or records one by one.
groff	Format troff input.
gs	Display PostScript or PDF file.
ispell	Interactively check spelling.
join	Merge different columns into a database.
paste	Merge columns or switch order.
rev	Print lines in reverse.
sed	Noninteractive text editor.
sort	Sort or merge files.
tr	Translate (redefine) characters.
uniq	Find repeated or unique lines in a file.
vi	Visual text editor.
vim	Enhanced version of vi.

1.6.13. Miscellaneous

Command	Action
banner	Make posters from words.
bc	Arbitrary precision calculator.
cal	Display calendar.
clear	Clear the screen.
info	Get command information from the GNU hypertext reader.
man	Get information on a command.
nice	Reduce a job's priority.
nohup	Preserve a running job after logging out.
openvt	Run a program on the next available virtual terminal.
passwd	Set your login password.
script	Produce a transcript of your login session.
su	Become a different user, often the superuser.
sudo	Execute an authorized command as root or another user.
tee	Simultaneously store output in file and send to screen.
time	Time the execution of a command
wall	Send a message to all terminals.
whoami	Print the current user id.
xargs	Process many arguments in manageable portions.

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Chapter 2. System and Network Administration Overview

2.1. Common Commands

Following are lists of commonly used system administrationcommands.

2.1.1. Clocks

Command	Action
hwclock	Manage hardware clock.
rdate	Get time from network time server.
zdump	Print list of time zones.
zic	Create time-conversion information files.

2.1.2. Daemons

Command	Action
apmd	Advanced Power Management daemon.
atd	Queue commands for later execution.
bootpd	Internet Boot Protocol daemon.
cupsd	Printer daemon.
fingerd	Finger daemon.
ftpd	File Transfer Protocol daemon.
imapd	IMAP mailbox server daemon.
klogd	Manage syslogd.
mountd	NFS mount request server.
named	Internet domain nameserver.
nfsd	NFS daemon.
pppd	Maintain Point-to-Point Protocol (PPP) network connections.
rdistd	Remote file distribution server.
rexecd	Remote execution server.

Command	Action
rlogind	rlogin server.
routed	Routing daemon.
rpc.rusersd	Remote users server.
rpc.statd	NFS status daemon.
rshd	Remote shell server.
rwhod	Remote who server.
sshd	Secure shell daemon.
syslogd	System logging daemon.
talkd	Talk daemon.
tcpd	TCP network daemon.
tftpd	Trivial File Transfer Protocol daemon.
xinetd	Extended Internet services daemon. Starts other services as needed.
ypbind	NIS binder process.
yppasswdd	NIS password modification server.
ypserv	NIS server process.

2.1.3. Hardware

Command	Action
agetty	Start user session at terminal.
arp	Manage the ARP cache.
cardctl	Control PCMCIA cards.
cardmgr	PCMCIA card manager daemon.
fdisk	Maintain disk partitions.
hdparm	Get and set hard drive parameters.
kbdrate	Manage the keyboard's repeat rate.
ramsize	Print information about RAM disk.
setkeycodes	Change keyboard scancode-to-keycode mappings.
setserial	Set serial port information.
slattach	Attach serial lines as network interfaces.

2.1.4. Host Information

Command	Action
arch	Print machine architecture.
dig	Query Internet domain nameservers.
dnsdomainname	Print DNS domain name.
domainname	Print NIS domain name.
free	Print memory usage.
host	Print host and zone information.
hostname	Print or set hostname.
uname	Print host information.

2.1.5. Installation

Command	Action
cpio	Copy files to and from archives.
install	Copy files into locations providing user access and set permissions.
rdist	Distribute files to remote systems.
tar	Copy files to or restore files from an archive medium.

2.1.6. Mail

Command	Action
fetchmail	Retrieve mail from remote servers.
formail	Convert input to mail format.
mailq	Print a summary of the mail queue.
makemap	Update sendmail's database maps.
newaliases	Rebuild sendmail's alias database.
rmail	Handle uucp mail.
sendmail	Send and receive mail.

2.1.7. Managing Filesystems

To Unix systems, a *filesystem* is a device (such as a partition) that is formatted to store files. Filesystems can be found on hard drives, floppies, CD-ROMs, USB drives, or other storage media that permit random access.

The exact format and means by which the files are stored are not important; the system provides a common interface for all *filesystem types* that it recognizes. By default, almost all modern distributions of Linux use a journaling filesystem. When the kernel interacts with a journalling filesystem, writes to disk are first written to a log or journal before they are written to disk. This slows down writes to the filesystem, but reduces the risk of data corruption in the event of a power outage. It also speeds up reboots after a system unexpectedly loses power.

Most current Linux distributions default to the Third Extended (ext3) Filesystem. The ext3 filesystem was developed primarily for Linux and supports 256-character filenames and 4-terabyte maximum filesystem size. This ext3 filesystem is essentially a Second Extended (ext2) filesystemwith an added journal. Since it is in all other ways identical to the ext2 system, it is both forward- and backward-compatible with ext2--all ext2 utilities work with ext3 filesystems.

Although not covered in this edition of*Linux in a Nutshell*, Linux supports three other open source journaling filesystems: IBM's Journaled Filesystem (JFS), SGI's Extensible Filesystem (XFS), and the Naming System Venture's Reiser Filesystem (ReiserFS). In some situations these can be faster than ext3. Some Linux distributions use these alternative filesystems by default. Other common filesystems include the FAT and VFAT filesystems, which allow files on partitions and floppies of Microsoft Windows systems to be accessed under Linux, and the ISO 9660 filesystem used by CD-ROMs.

Command	Action
debugfs	Debug ext2 filesystem.
dosfsck	Check and repair a DOS or VFAT filesystem.
dump	Back up data from a filesystem.
dumpe2fs	Print information about superblock and blocks group.
e2fsck	Check and repair an ext2 filesystem.
e2image	Store disaster-recovery data for an ext2 filesystem.
edquota	Edit filesystem quotas with vim.
fdformat	Format floppy disk.
fsck	Another name for e2fsck.
fsck.ext2	Check and repair an ext2 filesystem.
mke2fs	Make a new ext2 filesystem.
mkfs	Make a new filesystem.

Command	Action
mkfs.ext2	Another name for mke2fs.
mkfs.ext3	Yet another name for mke2fs.
mklost+found	Make *lost+found* directory.
mkraid	Set up a RAID device.
mkswap	Designate swapspace.
mount	Mount a filesystem.
quotacheck	Audit stored quota information.
quotaon	Enforce quotas.
quotaoff	Do not enforce quotas.
quotastats	Display kernel quota statistics.
raidstart	Activate a RAID device.
raidstop	Turn off a RAID device.
rdev	Describe or change values for root filesystem.
repquota	Display quota summary.
resize2fs	Enlarge or shrink an ext2 filesystem.
restore	Restore data from a dump to a filesystem.
rootflags	List or set flags to use in mounting root filesystem.
setquota	Edit filesystem quotas.
showmount	List exported directories on a remote host.
swapoff	Cease using device for swapping.
swapon	Begin using device for swapping.
sync	Write filesystem buffers to disk.
tune2fs	Manage an ext2 filesystem.
umount	Unmount a filesystem.
warnquota	Mail disk usage warnings to users.

2.1.8. Managing the Kernel

Command	Action

Command	Action
depmod	Create module dependency listing.
lsmod	List kernel modules.
modinfo	Print kernel module information.
modprobe	Load and remove a module and its dependent modules.
sysctl	Examine or modify kernel parameters at runtime.

2.1.9. Networking

Command	Action
ifconfig	Manage network interfaces.
iptables	Administer firewall facilities (2.4 kernel).
named	Translate between domain names and IP addresses.
nameif	Assign names to network devices.
netstat	Print network status.
nfsstat	Print statistics for NFS and RPC.
nsupdate	Submit dynamic DNS update requests.
portmap	Map daemons to ports.
rarp	Manage RARP table.
rndc	Send commands to a BIND nameserver.
route	Manage routing tables.
routed	Dynamically keep routing tables up to date.
rpcinfo	Report RPC information.
ruptime	Check how long remote system has been up.
rwho	Show who is logged into remote system.
traceroute	Trace network route to remote host.
wvdial	Establish dial-up IP connections.

2.1.10. Printing

Command	Action
accept	Tell printer daemon to accept jobs.
lpadmin	Configure printer and class queues.
lpinfo	Show available printers and drivers.
lpmove	Move a print job to a different queue.
reject	Tell printer daemon to reject jobs.
tunelp	Tune the printer parameters.

2.1.11. Security and System Integrity

Command	Action
badblocks	Search for bad blocks.
chroot	Change root directory.

2.1.12. Starting and Stopping the System

Command	Action
chkconfig	Manage which services run in a runlevel.
ctrlaltdel	Shut down, then soft reboot system.
halt	Stop or shut down system.
init	Change runlevel.
reboot	Shut down, then hard reboot system.
runlevel	Print system runlevel.
shutdown	Shut down system.
telinit	Change the current runlevel.
uptime	Display uptimes of local machines.

2.1.13. System Activity and Process Management

A number of additional commands in Chapter 3 are particularly useful in controlling processes, including kill, killall, pidof, ps, and who.

Command	Action
fuser	Identify processes using file or filesystem.
renice	Change the priority of running processes.
top	Show most CPU-intensive processes.
vmstat	Print virtual-memory statistics and process statistics.

2.1.14. Users

Command	Action
chpasswd	Change multiple passwords.
groupadd	Add a new group.
groupdel	Delete a group.
groupmod	Modify groups.
grpck	Check the integrity of group system files.
grpconv	Convert group file to shadow group file.
lastlog	Generate report of last user login times.
newusers	Add new users in a batch.
pwck	Check the integrity of password system files.
pwconv	Convert password file to shadow passwords.
rusers	Print who-style information on remote machines.
rwall	Print a message to remote users.
useradd	Add a new user.
userdel	Delete a user and that user's home directory.
usermod	Modify a user's information.
w	List logged-in users.
wall	Write to all users.
whoami	Show how you are currently logged in.

2.1.15. Miscellaneous

Command	Action
anacron	Schedule commands for periodic execution.
atrun	Schedule commands for later execution.
cron	Schedule commands for specific times.
dmesg	Print bootup messages after the system is up.
ldconfig	Update library links and do caching.
logger	Send messages to the system logger.
logrotate	Compress and rotate system logs.
run-parts	Run all scripts in a directory.

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2.2. Overview of Networking

Networks connect computers so that the different systems can share information. For users and system administrators, Unix systems have traditionally provided a set of simple but valuable network services that let you check whether systems are running, refer to files residing on remote systems, communicate via electronic mail, and so on.

For most commands to work over a network, each system must be continuously running a server process in the background, silently waiting to handle the user's request. This kind of process is called a *daemon*. Common examples, on which you rely for the most basic functions of your Linux system, are `named` (which translates between numeric IP addresses and more human-readable alphanumeric names), `cupsd` (which sends documents to a printer, possibly over a network), and `ftpd` (which allows connections via `ftp`).

Most Unix networking commands are based on *Internet protocols*, standardized ways of communicating across a network on hierarchical layers. The protocols range from addressing and packet routing at a relatively low layer to finding users and executing user commands at a higher layer.

The basic user commands that most systems support over Internet protocols are generally called TCP/IP commands, named after the two most common protocols. You can use all of these commands to communicate with other Unix systems in addition to Linux systems. Many can also be used to communicate with non-Unix systems, as a wide variety of systems support TCP/IP.

This section also covers NFS and NISwhich allow for transparent file and information sharing across networksand `sendmail`.

2.2.1. TCP/IP Administration

Command	Action
dig	Query domain nameservers.
ftpd	Server for file transfers.
gated	Manage routing tables between networks.
host	Print host and zone information.
ifconfig	Configure network interface parameters.
named	Translate between domain names and IP addresses.
netstat	Print network status.
ping	Check that a remote host is online and responding.

Command	Action
pppd	Create PPP serial connection.
rdate	Notify time server that date has changed.
route	Manage routing tables.
routed	Dynamically keep routing tables up to date.
slattach	Attach serial lines as network interfaces.
sshd	Server for secure shell connections.
tcpdump	Write network packet information to screen or file.
telnetd	Server for Telnet sessions from remote hosts.
tftpd	Server for restricted set of file transfers.

2.2.2. NFS and NIS Administration

Command	Action
domainname	Set or display name of current NIS domain.
makedbm	Rebuild NIS databases.
portmap	DARPA port to RPC program number mapper.
rpcinfo	Report RPC information.
ypbind	Connect to NIS server.
ypcat	Print values in NIS database.
ypinit	Build new NIS databases.
ypmatch	Print value of one or more NIS keys.
yppasswd	Change user password in NIS database.
yppasswdd	Update NIS database in response to yppasswd.
yppoll	Determine version of NIS map at NIS server.
yppush	Propagate NIS map.
ypserv	NIS server daemon.
ypset	Point ypbind at a specific server.
yptest	Check NIS configuration.
ypwhich	Display name of NIS server or map master.
ypxfr	Transfer NIS database from server to local host.

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2.3. Overview of TCP/IP

TCP/IP is a suite of communications protocols that define how different types of computers talk to one another. It's named for its foundational protocols, the Transmission Control Protocol and the Internet Protocol. The Internet Protocol provides logical addressing as data moves between hosts: it splits data into packets, which are then forwarded to machines via the network. The Transmission Control Protocol ensures that the packets in a message are reassembled in the correct order at their final destination and that any missing datagrams are re-sent until they are correctly received. Other protocols provided as part of TCP/IP include:

Address Resolution Protocol (ARP)

Translates between Internet and local hardware addresses (Ethernet, etc.).

Internet Control Message Protocol (ICMP)

Error-message and control protocol.

Point-to-Point Protocol (PPP)

Enables TCP/IP (and other protocols) to be carried across both synchronous and asynchronous point-to-point serial links.

Reverse Address Resolution Protocol (RARP)

Translates between local hardware and Internet addresses (opposite of ARP).

Simple Mail Transport Protocol (SMTP)

Used by sendmail to send mail via TCP/IP.

Simple Network Management Protocol (SNMP)

Performs distributed network management functions via TCP/IP.

User Datagram Protocol (UDP)

Transfers data without first making a persistent connection between two systems the way TCP does. Sometimes called unreliable transport.

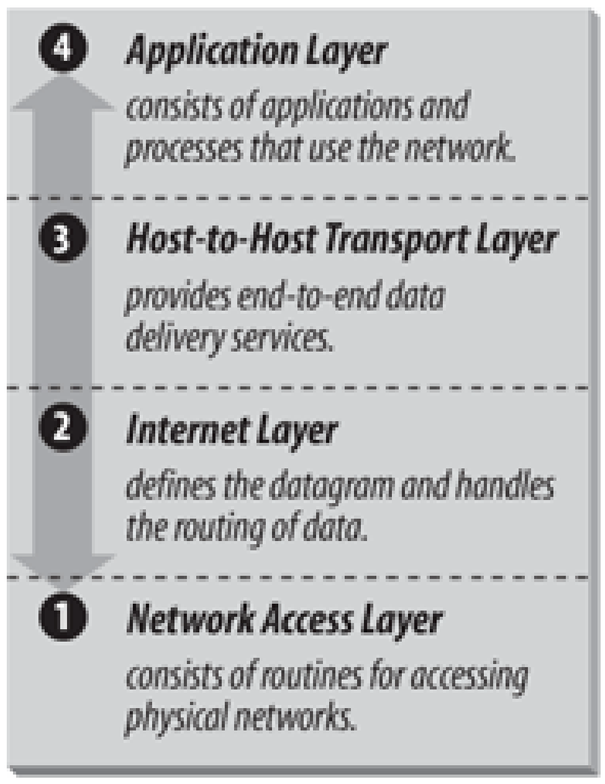
TCP/IP is covered in depth in the three-volume set *Internetworking with TCP/IP* (Prentice Hall). The commands in this chapter and the next are described in more detail in *TCP/IP Network Administration* and *Linux Network Administrator's Guide*, both published by O'Reilly.

In the architecture of TCP/IP protocols, data is passed down the stack (toward the Network Access Layer) when it is sent to the network, and up the stack when it is received from the network (see Figure 2-1).

2.3.1. IP Addresses

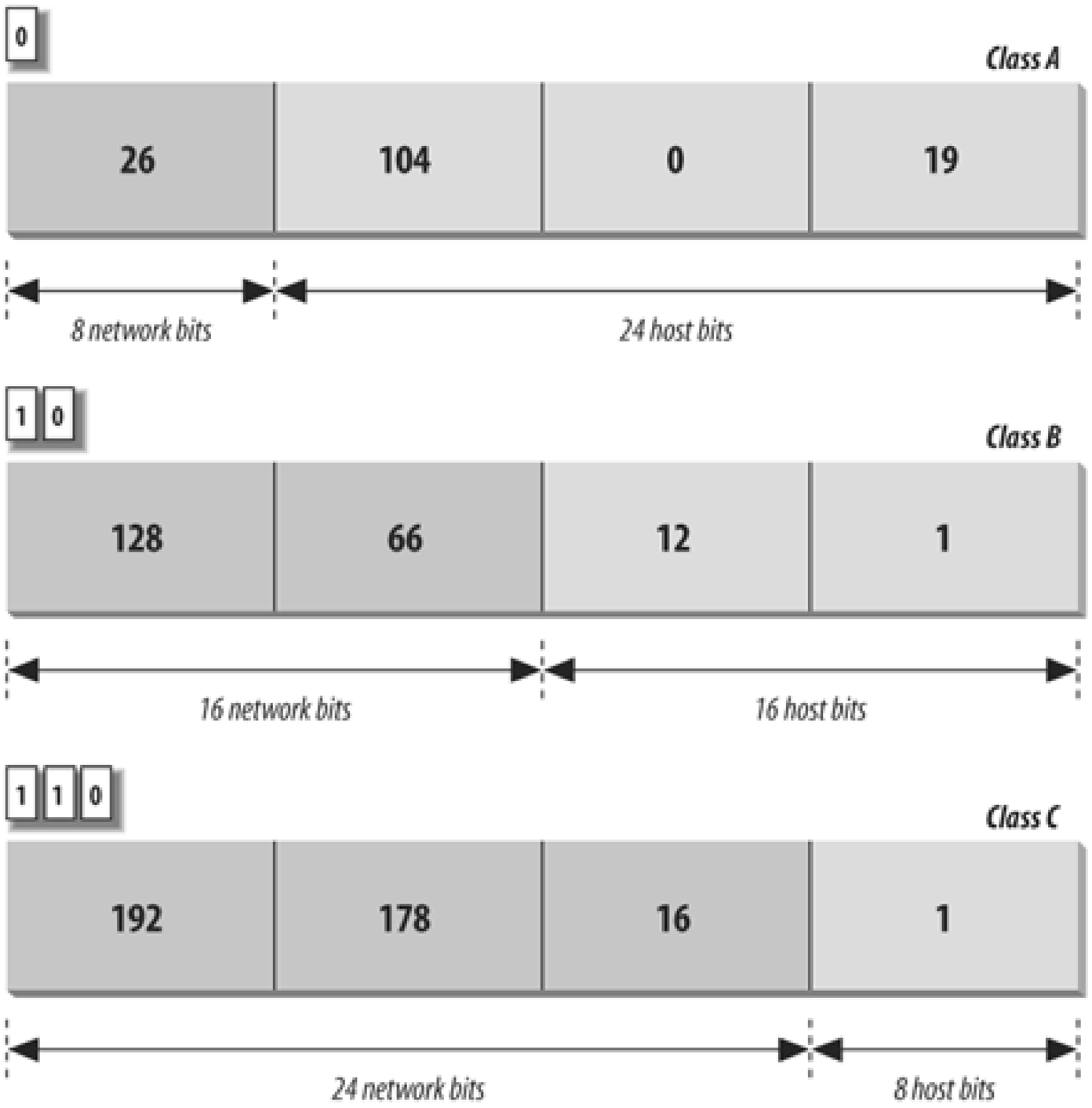
The IP (Internet protocol) address is a binary number that differentiates your machine from all others on the network. Each machine on the Internet must have

Figure 2-1. Layers in the TCP/IP protocol architecture



a unique IP address. The most common form of IP address used currently (IPv4) uses a 32-bit binary address. An IPv4 address contains two parts: a network part and a host part. The number of address bits used to identify the network and host differ according to the class of the address. There are three main address classes: A, B, and C (see Figure 2-2). The leftmost bits indicate what class each address is.

Figure 2-2. IP address structure



A standard called Classless Inter-Domain Routing (CIDR, or supernetting) extends the class system's idea of using initial bits to identify where packets should be routed. Under CIDR, a new domain can be created with any number of fixed leftmost bits (not just a multiple of eight). A CIDR address looks like a regular IPv4 address followed by a slash and a number indicating the number of network bits. For example: 192.168.32.1/24 or 128.66.128.1/17. Virtually all Internet gateway hosts now use CIDR.

IPv6, a newer standard, changes the method of addressing and increases the number of fields. An IPv6 address is 128 bits. Part of an IPv6 address is based on the Media Access Control (MAC) address of the network interface. The MAC address is unique for each network interface. When written, it is usually divided into eight 16-bit hexadecimal blocks separated by colons. For example:

```
FE80:0000:0000:0000:0202:B3FF:FE1E:8329
```

To shorten this, leading zeros may be skipped, and any one set of consecutive zeros can be replaced with double colons. For example, the above address can be reduced to:

```
FE80::202:B3FF:FE1E:8329
```

When IPv4 and IPv6 networks are mixed, the IPv4 address can be packed into the lower four bytes, yielding an address like 0:0:0:0:0:0:192.168.1.2, or ::192.168.1.2, or even ::C0A8:102.

Because improvements in IPv4, including CIDR, have relieved much of the pressure to migrate to IPv6, organizations have been slow to adopt IPv6. Some use it experimentally, but communication between organizations using IPv6 internally is still usually encapsulated inside IPv4 datagrams, and it will be a while before IPv6 becomes common.

If you wish to connect to the Internet, contact an Internet Service Provider (ISP). For most users, an ISP dynamically assigns an IP address to their systems. If you wish to always have the same address, have them assign you a static network address or range of addresses. If you are not connecting to an outside network, you can choose your own network address as long as it conforms to the IP address syntax. You should use the special reserved addresses provided in RFC 1597, which lists IP network numbers for private networks that don't have to be registered with the IANA (Internet Assigned Numbers Authority). An IP address is different from an Ethernet address, which is assigned by the manufacturer of the physical Ethernet card.

2.3.2. Gateways and Routing

Gateways are hosts responsible for exchanging routinginformation and forwarding data from one network to another. Each portion of a network that is under a separate local administration is called an *autonomous system* (AS). Autonomous systems connect to each other via exterior gateways. An AS also may contain its own system of networks, linked via interior gateways.

2.3.2.1 Gateway protocols

Gateway protocols include:

EGP (Exterior Gateway Protocol)

BGP (Border Gateway Protocol)

Protocols for exterior gateways to exchange information

RIP (Routing Information Protocol)

Interior gateway protocol; most popular for LANs

Hello Protocol

OSPF (Open Shortest Path First)

Interior gateway protocols

2.3.2.2 Routing daemons

While most networks will use a dedicated router as a gateway, GNU Zebra androuted, the routing daemons, can be run on a host to make it function as a gateway. Only one of them can run on a host at any given time. Zebra is the gateway routing daemon that replaces the oldergated routing daemon. It allows a host to function as both an exterior and interior gateway and simplifies the routing configuration by combining the protocols RIP, Hello, BGP, EGP, and OSPF into a single package. We do not cover GNU Zebra in this book.

routed, a network routing daemon that uses RIP, allows a host to function only as an interior gateway, and manages the Internet routing tables. For more details on routed, see Chapter 3.

2.3.2.3 Routing tables

Routing tables provide information needed to route packets to their destinations. This information includes destination network, gateway to use, route status, and number of packets transmitted. Routing tables can be displayed with thenetstat command.

2.3.3. Name Service

Each host on a network has a name that points to information about that host. Hostnames can be assigned to any device that has an IP address. A name servicetranslates the hostnames (which are easy for people to remember) to IP addresses (the numbers the computer deals with).

2.3.3.1 DNS and BIND

The Domain Name System (DNS) is a distributed database of information about hosts on a network. Its structure is similar to that of the Unix filesysteman inverted tree, with the root at the top. The branches of the tree are called *domains* (or *subdomains*) and correspond to IP addresses. The most popular implementation of DNS is the BIND (Berkeley Internet Name Domain)software.

DNS works as a client/server application. The *resolver* is the client, the software that asks questions about host information. The *nameserver* is the process that answers the questions. The server side of BIND is the named daemon. You can interactively query nameservers for host information with the dig and host commands. See Chapter 3 for more details on named, dig, and host.

The nameserver of a domain is responsible for keeping (and providing on request) the names of the machines in its domain. Other nameservers on the network forward requests for these machines to this nameserver.

2.3.3.2 Domain names

The full domain name is the sequence of names from the current domain back to the root, with a period separating the names. For instance, *oreilly.com* indicates the domain *oreilly* (for O'Reilly Media, Inc.), which is under the domain *com* (for commercial). One machine under this domain is www.oreilly.com. Top-level domains include:

aero

: Air-transport industry

biz

: Commercial organizations

com

: Commercial organizations

coop

: Cooperatives

edu

: United States educational organizations

gov

: United States government organizations

info

: Informative sites

int

: International organizations

mil

: United States military departments

museum

Museums

name

Names of individuals

net

Commercial Internet organizations, usually Internet service providers

org

Miscellaneous organizations

pro

Professionals, including accountants, lawyers, and physicians

Countries also have their own two-letter top-level domains based on two-letter country codes. For example, the Web server for the British Broadcasting System (BBC) in the United Kingdom has the following domain name: www.bbc.co.uk. Some domains (e.g., *edu, gov*, and *mil*) are sponsored by organizations that restrict their use; others (e.g.,*com, info, net*, and *org*) are unrestricted. One special domain, *arpa*, is used for technical infrastructure purposes. The Internet Corporation for Assigned Names and Numbers (ICANN) oversees top-level domains and provides contact information for sponsored domains.

2.3.4. Configuring TCP/IP

Certain commands are normally run in the system's startup files to enable a system to connect to a network. These commands can also be run interactively.

2.3.4.1 ifconfig

The network interface represents the way that the networking software uses the hardware: the driver, the IP address, and so forth. To configure a network interface, use theifconfig command. With ifconfig, you can assign an address to a network interface, setting the netmask, broadcast address, and IP address at boot time. You can also set network interface parameters, including the use of ARP, the use of driver-dependent debugging code, the use of one-packet mode, and the address of the correspondent on the other end of a point-to-point link. For more information on ifconfig, see Chapter 3.

2.3.4.2 Serial-line communication

There are two protocols for serial-line communication: Serial Line IP (SLIP)and Point-to-Point Protocol (PPP). These protocols let computers transfer information using the serial port instead of a network card, and a serial cable instead of an Ethernet cable. SLIP is rarely used anymore, having been replaced by PPP.

PPP was intended to remedy some of SLIP's failings; it can hold packets from non-Internet protocols, it implements client authorization and error detection/correction, and it dynamically configures each network protocol that passes through it. Under Linux, PPP exists as a driver in the kernel and as the daemon pppd. For more information on pppd, see Chapter 3.

2.3.5. Troubleshooting TCP/IP

The following commands can be used to troubleshoot TCP/IP. For more details on these commands, see Chapter 3:

dig

: Query the DNS name service.

ifconfig

: Provide information about the basic configuration of the network interface.

ifup and ifdown

: On many systems used to start or stop a network interface.

iwconfig, iwlist, and wlancfg

: Tools commonly used to configure a wireless network interface.

netstat

: Display network status.

ping

: Indicate whether a remote host can be reached.

route

: Allows you to read and set default gateway information, as well as static routes.

tcpdump

Dump network packet information to the screen or to file.

traceroute

Trace route taken by packets to reach network host.

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2.4. Overview of Firewalls and Masquerading

A firewall is a secure computer that sits between an internal network and an external network (i.e., the Internet). It is configured with a set of rules that it uses to determine what traffic is allowed to pass and what traffic is barred. While a firewall is generally intended to protect the network from malicious or even accidentally harmful traffic from the outside, it can also be configured to monitor traffic leaving the network. As the sole entry point into the system, the firewall makes it easier to construct defenses and monitor activity.

The firewall can also be set up to present a single IP address to the outside world, even though multiple IP addresses may be used internally. This is known as*masquerading*. Masquerading can act as additional protection, hiding the very existence of a network. It also saves the trouble and expens of obtaining multiple IP addresses.

IP firewalling and masquerading are implemented with*netfilter*, also known as iptables. Earlier Linux kernels used ipchains or ipfwadm, which will not be covered here. Unlike the older tools, the facilities provided by *netfilter* are designed to be extensible; if there is some function missing from the implementation, you can add it.

The packet filtering facilities provide built-in rule sets. Each network packet is checked against each rule in the rule set until the packet either matches a rule or is not matched by any rule. These sets of rules are called *chains*. These chains are organized into tables that separate filtering functions from masquerading and packet mangling functions. If a match is found, the counters on that rule are incremented and any target for that rule is applied. A target might accept, reject, or masquerade a packet, or even pass it along to another chain for processing. Details on the chains provided in iptables can be found in Chapter 3.

In addition to these chains, you can create your own user-defined chains. You might want a special chain for your PPP interfaces or for packets from a particular site. To call a user-defined chain, you just make it the target for a match.

It is possible to make it through a chain without matching any rules that have a target. If no rule matches the packet in a user-defined chain, control returns to the chain from which it was called, and the next rule in that chain is checked. If no rule matches the packet in a built-in chain, a default policy for that chain is used. The default policy can be any of the special targets that determine what is done with a packet. The valid targets are detailed inChapter 3.

You use the iptables command to define the rules. Once you have the rules defined you can use iptables-save to create a file with all the rule definitions, andiptables-restore to restore those definitions when you reboot.

For more information on the kinds of decisions you need to make and the considerations that go into defining the rules, see a general book on firewalls such as*Building Internet Firewalls* (O'Reilly). For more details on iptables, consult the *Linux Network Administrator's Guide* (O'Reilly), *Linux iptables Pocket Reference* (O'Reilly), or one of the relevant HOWTOs, such as the "Packet Filtering HOWTO." These HOWTOs and a number of tutorials are available on the Netfilter web site at http://www.netfilter.org/.

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2.5. Overview of NFS

The Network File System (NFS) is a distributed filesystem that allows users to mount remote filesystems as if they were local. NFS uses a client/server model in which a server exports directories to be shared and clients mount the directories to access the files in them. NFS eliminates the need to keep copies of files on several machines by letting the clients all share a single copy of a file on the server. NFS is an RPC-based application-level protocol. For more information on the architecture of network protocols, See Overview of TCP/IP.," earlier in this chapter.

2.5.1. Administering NFS

To set up NFS clients and servers, you must start the NFS daemonson the servers, export filesystems from the NFS servers, and mount the filesystems on the clients. The*/etc/exports* file is the NFS server configuration file; it controls which files and directories are exported and which kinds of access are allowed. Names and addresses for clients that should be allowed or denied access to NFS are kept in the */etc/hosts.allow* and */etc/hosts.deny* files.

2.5.2. Daemons

NFS server daemons, called *nfsd daemons*, run on the server and accept RPC calls from clients. NFS servers also run the `mountd` daemon to handle mount requests. On the client, caching and buffering are handled by `biod`, the block I/O daemon. The `portmap` daemon maps RPC program numbers to the appropriate TCP/IP port numbers. If the `portmap` daemon is not running properly, NFS will not work either.

2.5.3. Exporting Filesystems

To set up an NFS server, first check that all the hosts that will mount your filesystem can reach your host. Next, edit the */etc/exports* file on the server. Each entry in this file indicates the name of a directory to be exported, domain names of machines that will have access to that particular mount point, and any options specific to that machine. A typical entry looks like:

```
/projects hostname1(rw) hostname2(ro)
```

If you are running `mountd`, the files will be exported as allowed by the permissions in*/etc/exports*. See the `exports` manpage for all available export options.

2.5.4. Mounting Filesystems

To enable an NFS client, mount a remote filesystem after NFS is started, either by using the`mount` command or by specifying default remote filesystems in*/etc/fstab*. For example:

```
# mount servername:/projects /mnt/nfs/projects
```

A `mount` request calls the server's `mountd` daemon, which checks the access permissions of the client and returns a pointer to a filesystem. Once a directory is mounted, it remains attached to the local filesystem until it is unmounted with the`umount` command or until the local system is rebooted.

Usually, only a privileged user can mount filesystems with NFS. However, you can enable users to mount and unmount selected filesystems using the`mount` and `unmount` commands if the `user` option is set in */etc/fstab*. This can reduce traffic by having filesystems mounted only when needed. To enable user mounting, create an entry in */etc/fstab* for each filesystem to be mounted. You can verify filesystems that have been mounted by using the`mount` or `showmount` commands. Or, you can read the contents of the */etc/mtab* file.

2.6. Overview of NIS

The Network Information System (NIS) refers to the service formerly known as Sun Yellow Pages (YP). It is used to make configuration information consistent on all machines in a network. It does this by designating a single host as the master of all the system administration files and databases and distributing this information to all other hosts on the network. The information is compiled into databases called maps. NIS is built on the RPC protocol.

Another version of NIS, NIS+, adds encryption and strong authentication to NIS. NIS+ is a proprietary standard created by Sun Microsystems. This chapter discusses standard NIS, which is supported by most Linux systems. There are currently two NIS servers freely available for Linux,yps and ypserv. We describe ypserv in this book.

2.6.1. Servers

In NIS, there are two types of servers: master servers and slave servers. Master servers are responsible for maintaining the mapsand distributing them to the slave servers. The files are then available locally to requesting processes.

2.6.2. Domains

An NIS domain is a group of hosts that use the same set of maps. The maps are contained in a subdirectory of */var/yp* having the same name as the domain. The machines in a domain share password, host, and group file information. NIS domain names are set with thedomainname command.

2.6.3. NIS Maps

NIS stores information in database files called *maps*. Each map consists of a pair of dbm database files, one containing a directory of keys (a bitmap of indices) and the other containing data values. The non-ASCII structure of dbm files necessitates using NIS tools such as yppush to move maps between machines.

The file */var/yp/YP_MAP_X_LATE* contains a complete listing of active NIS maps, as well as NIS aliases for NIS maps. All maps must be listed in this file in order for NIS to serve them.

2.6.4. Map Manipulation Utilities

The following utilities are used to administer NIS maps:

makedbm

Make dbm files. Modify only ypserv's map and any nondefault maps.

ypinit

Build and install NIS databases. Manipulate maps when NIS is being initialized. Should not be used when NIS is already running.

yppush

Transfer updated maps from the master server.

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2.7. Administering NIS

NIS is enabled by setting up NIS servers and NIS clients. The descriptions given here describe NIS setup using ypserv, which does not support a master/slave server configuration. All NIS commands depend on the RPC portmap program, so make sure it is installed and running before setting up NIS

2.7.1. Setting Up an NIS Server

Setting up an NIS server involves the following steps:

1. Set a domain name for NIS using domainname.
2. Edit the *ypMakefile*, which identifies which databases to build and what sources to use in building them.
3. Copy the *ypMakefile* to */var/yp/Makefile*.
4. Run make from the */var/yp* directory, which builds the databases and initializes the server.
5. Start ypserv, the NIS server daemon.

2.7.2. Setting Up an NIS Client

Setting up an NIS client involves only the following steps:

1. Set the domain name for NIS using domainname, which should be the same name used by the NIS server.
2. Run ypbind.

2.7.3. NIS User Accounts

NIS networks have two kinds of user accounts: distributed and local. Distributed accounts must be administered from the master machine; they provide information that is uniform on each machine in an NIS domain. Changes made to distributed accounts are distributed via NIS maps. Local accounts are administered from the local computer; they provide account information unique to a specific machine. They are not affected by NIS maps, and changes made to local accounts do not affect NIS. When NIS is installed, preexisting accounts default to local accounts.

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2.8. RPC and XDR

RPC (Remote Procedure Call) is the session protocol used by both NFS and NIS. It allows a host to make a procedure call that appears to be local but is really executed remotely on another machine on the network. RPC is implemented as a library of procedures, plus a network standard for ordering bytes and data structures called XDR (eXternal Data Representation).

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Chapter 3. Linux Commands

This chapter presents Linux's user, programmer, and system administration commands. These are entered into a shell at the console or on a virtual terminal on a graphical desktop.

Each entry is labeled with the command name on the outer edge of the page. The syntax line is followed by a brief description and a list of available options. Many commands come with examples a the end of the entry. If you need only a quick reminder or suggestion about a command, you can ski directly to the examples.

Typographic conventions for describing command syntax are listed in the Preface. For help in locating commands, see the index at the back of this book.

We've tried to be as thorough as possible in listing options. The basic command information and mos options should be correct; however, there are many Linux distributions and many versions of commands. New options are added, and sometimes old options are dropped. You may, therefore, fin some differences between the options you find described here and the ones on your system. When there seems to be a discrepancy, check the manpage. For most commands, you can also use the option `--help` to get a brief usage message. (Even when it isn't a valid option, it will usually result in an "invalid option" error along with the usage message.)

Traditionally, commands take single-letter options preceded by a single hyphen, such as `-d`. A more recent convention allows long options preceded by two hyphens, such as `--debug`. Often, a feature can be invoked through either the old style or the new style of options.

3.1. Alphabetical Summary of Commands

accept

```
accept [option]destination
```

System administration command. Instruct printing system to accept jobs for the specified print queue or queues. Depending on queue settings, the system may prompt for a password. Also invoked as cupsaccept.

Option

-E

Require encryption when connecting.

access

```
access [mode] [filename]
```

Check whether a file is available for the action specified with the mode argument:r for read, w for write, x for execute. Used mostly in scripting, access works better than test because it uses a direct system call rather than looking at the file permissions, which can be misleading when a filesystem is mounted read-only.

Options

--help

Display help message, then quit.

--version

Display version, then quit.

aclocal

`aclocal [options]`

GNU autoconf tool. Place m4 macro definitions needed by autoconf into a single file. The aclocal command first scans for macro definitions in m4 files in its default directory (*/usr/share/aclocal* on some systems) and in the file *acinclude.m4*. It next scans for macros used in the *configure.in* file. It generates an *aclocal.m4* file that contains definitions of all m4 macros required by autoconf.

Options

--acdir=dir

Look for macro files in directory *dir* instead of the default directory.

--help

Print help message, then exit.

-I *dir*

Additionally, search directory *dir* for m4 macro definitions.

--output=file

Save output to *file* instead of *aclocal.m4*.

--print-ac-dir

Print the name of the directory to be searched for m4 files, then exit.

--verbose

Print names of files being processed.

--version

Print version number, then exit.

aconnect

```
aconnect [options] [sender] [receiver]
aconnect [options]
```

Like its GUI relative alsa-patch-bay, aconnect connects ports in MIDI hardware and software to route events, similar to running patch cables between different mixers and synthesizers in an all-hardware audio system. aconnect is part of the ALSA (Advanced Linux Sound Architecture) system.

Options

-d,--disconnect

Undo the connection described.

-e,--exclusive

The connection being created must be exclusive: the sender and receiver ports may not connect to any other port.

-i,--input

List all input (sender) ports. This flag is used without any other arguments or flags.

-o, --output

List all output (receiver) ports. This flag is used without any other arguments or flags.

-r, --real queue-name

All events processed through this connection get new timestamps from the named real-time queue. The receiving port must have access to, and use, the real-time queue.

-t, --tick queue-name

All events processed through this connection get new timestamps from the specified tick queue.

-x, --remove-all

Cancel all connections. This flag is used without any other arguments or flags.

acpi

`acpi [options]`

Displays information about the ACPI (Advanced Configuration and Power Interface) system, based or the */proc/acpi* file. Most kernels after 2.4 support ACPI hardware, and in both hardware and software, ACPI is gradually replacing the older APM (Advanced Power Management)system. Some operating systems, including SUSE, ship a combined ACPI/APM power interface called`powersaved`. Most, however, require either ACPI or APM software.

Note that some ACPI systems have special events that are not available on others. For example, IBM laptops have events related to their docking stations and keyboard lights that are not used on nondocking or unlighted laptops. On all systems, the*/proc/acpi* directory must be present for acpi commands to work.

Options

-b, --battery

Display battery information.

-B, --without-battery

Do not display battery information.

-t, --thermal

Display temperature information.

-T, --without-thermal

Do not display temperature information.

-a, --ac-adapter

Show whether the AC adapter is connected.

-A, --without-ac-adapter

Do not show information about the AC adapter.

-V, --everything

Show all information on every device.

-s, --show-empty

Display information even on devices that are not available or not installed, such as empty slots for extra batteries.

-S, --hide-empty

Do not display information on devices that are not operational or not installed.

-c, --celcius

Use degrees Celsius as the temperature unit. This is the default unit.

-d, --directory /path

Use the specified path to ACPI information. The default path is*/proc/acpi*.

-f, --fahrenheit

Use degrees Fahrenheit as the temperature unit.

-h, --help

Display help information.

-k, --kelvin

Use degrees Kelvin as the temperature unit.

-v, --version

Display version information.

acpi_available

`acpi_available`

Determine whether ACPI functionality exists. Returns 0 for true and 1 for false.

acpid

`acpid [options]`

Daemon that informs user-space programs about ACPI (Advanced Configuration and Power Interface) events, such as battery warnings, power-supply changes, and laptop lid closings. As ACPI hardware replaces older APM (Advanced Power Management) hardware, `acpid` replaces `apmd`. Like other daemons, this application is controlled primarily through a configuration file that determines which events merit action, and what those actions are. In some operating systems, including SUSE Linux and its relatives, all power management is handled by a combined ACPI/APM system called `powersave` and this daemon is not installed.

Options

`-c` directory, `--confdir=`directory

Set the directory used for configuration files. The default directory is /etc/acpi/events. All files in this directory, except those beginning with a period (.), are parsed as configuration files. Typically, a single file is used for each ACPI event to be acted upon.

In the configuration files, blank lines and those beginning with # are ignored. Other lines are expected to consist of a regular expression and a command to be executed when an ACPI event matches the expression.

`-d`, `--debug`

Debug mode: run the daemon in the foreground and send all log output to stderr and stdout, rather than a logfile.

-e filename,--eventfile=filename

Set the file used to find events. Normally this is */proc/acpi/event*.

-g group,--socketgroup=group

Set the group ownership of the socket to which acpid publishes events. This allows you to restrict which users on the system can access ACPI event information.

-l filename,--logfile=filename

Set the logfile location. Normally, it is */var/log/acpid*.

-m mode,--socketmode=mode

Set the permission mode of the socket. Normally, it is 666, with the sticky bit off.

-s filename,--socketfile=filename

Set the file used to define the socket. Normally, this is */var/run/acpid*.socket.

-S,--nosocket

Tells acpid not to open a socket at all. Overrides all other socket options.

-v,--version

Print version information and quit.

-h,--help

Print help message and quit.

addr2line

addr2line [*options*] [*addresses*]

Translate hexadecimal program addresses into filenames and line numbers for the executable given with the -e option, or *a.out* if -e is not specified. If *addresses* are given on the command line, display the filename and line number for each address. Otherwise, read the addresses from standard input and display the results on standard output (useful for use in a pipe).addr2line prints two question

marks (??) if it cannot determine a filename, and 0 if it cannot determine the line number.addr2line is used for debugging.

Options

-b *bfdname*, --target=bfdname

Set the binary file format using its binary file descriptor name,*bfdname*. Use the -h option for a list of supported formats for your system.

-C, --demangle[=*style*]

Decode (demangle) low-level symbol names into usernames. See the-h help output for a list of styles supported by your compiler.

-e *file*, --exe=file

Specify the filename of the executable to use. The default filename is*a.out*.

-f, --functions

Display function names in addition to filenames and line numbers.

-h, --help

Display help information and exit.

-s, --basenames

Strip directories off filenames and show only the basenames.

addresses

`addresses [-p  port]`

Connect to the PalmOS device on the specified port, and dump the addresses from the address book to stdout. Part of the pilot-link package of tools for managing PalmOS devices.

agetty

`agetty [options] port baudrate [term]`

System administration command. The Linux version of `getty`. Set terminal type, modes, speed, and line discipline. `agetty` is invoked by `init`. It is the second process in the series `init-getty-login-shell`, which ultimately connects a user with the Linux system. `agetty` reads the user's login name and invokes the `login` command with the user's name as an argument. While reading the name, `agetty` attempts to adapt the system to the speed and type of device being used.

You must specify a *port*, which `agetty` will search for in the */dev* directory. You may use `-`, in which case `agetty` reads from standard input. You must also specify *baudrate*, which may be a comma-separated list of rates through which `agetty` will step. Optionally, you may specify the *term*, which is used to override the TERM environment variable.

Options

`-f` *file*

Specify the use of *file* instead of */etc/issue* upon connection to terminal. It is overridden by `-i`.

`-h`

Specify hardware, not software, flow control.

`-H` *hostname*

Write login *hostname* into the *utmp* file. By default, no login host is specified.

`-I` *string*

Specify *string* to be sent to the tty or modem.

`-i`

Suppress printing of */etc/issue* before printing the login prompt.

`-l` *program*

Specify the use of *program* instead of */bin/login*.

-L

Do not require carrier detect; operate locally only. Use this when connecting terminals.

-m

Attempt to guess the appropriate baud rate.

-n

Don't prompt for a login name.

-t *timeout*

Specify that agetty should exit if the open on the line succeeds and there is no response to the login prompt in *timeout* seconds.

-w

Wait for carriage return or linefeed before sending login prompt. Use when sending an initialization string.

alsactl

`alsactl [options] [store|restore] card`

Controls advanced configuration settings for sound cards using the ALSA (Advanced Linux Sound Architecture) system. Settings are written to configuration files using the*store* function and loaded from those files with the *restore* function.

Options

-d,--debug

Debug mode: increased information output to the console.

-f *file*, --f=*file*

Specify the use of *file* instead of */etc/asound.state* as a configuration file.

-F,--force

Force the restoration of settings.

-h,--help

Display help message and quit.

-v,--version

Display version information and quit.

amidi

`amidi [options]`

Read and write raw MIDI files (*.syx* format, without timing information) to ALSA ports. For standard MIDI (*.mid*) files, use aplaymidi and arecordmidi.

Options

-a,--active-sensing

Record and send active-sensing (FEh) bytes in MIDI commands. By default, these bytes are ignored.

-d,--dump

Output all received data directly to the screen.

-h,--help

Display help information and quit.

-l,--list-devices

List all hardware MIDI ports.

-L,--list-rawmidis

List all RawMIDI definitions. Useful for debugging configuration files.

-p,--port=name

Use the specified port. This overrides the port set in the configuration file. If neither this flag nor the configuration file sets a port, the default is port 0 on device 0, which may or may not exist.

-r,--receive=filename

Write data from the port specified with the -p or --port flag to the file named here. This will be a raw file, and should end in *.syx*. Unless you use the -a option, it will not contain any Active Sensing (FEh) bytes.

-s,--send=filename

Send the file to the port specified with the -p or --port flag. Use raw (*.syx*) MIDI files only.

-S,--send-hex="hex-numbers..."

Send a string of hexadecimal numbers to the port specified with the -p or --port flag.

-t,--timeout=n

Stop listening after *n* seconds of receiving no data.

-V,--version

Display version information and quit.

amixer

`amixer [-c`*`card`*`] [`*`command`*`]`

Command-line ALSA mixer. For an ncurses interface, use alsamixer. amixer displays or changes the current mixer settings for the current sound card and sound device. To display all mixer settings, use with no flags or commands.

Commands

controls

Displays a complete list of card controls. These controls can be set with thecset command, in contrast to simple mixer controls, which useset or sset.

contents

List card controls and their contents.

cget [control]

Display the contents of the specified card control.

cset [control] [parameter]

Set the card control to the value specified in the parameter. Card controls may be identified by iface, name, index, device, subdevice, or numid. The parameter will normally be a number or percentage value. For example, the commandamixer -c 1 cset numid=16 50% will set the 16th element of the first sound card to 50%.

get,sget [control]

Display the current values for the specified control.

help

Display help message and quit.

info

Displays information about the card specified with the-c flag.

scontrols

Display a list of simple mixer controls. Simple mixer controls can be set with theset or sset commands, in contrast to card controls, which use thecset command.

set,sset [control] [parameter]

Set one of the controls listed byscontrols. You can specify the volume with a percentage from 0% to 100%, or a specific hardware value. By appending + or - to the number, you will increase or decrease the volume by that amount. To set recording and muting values, use the parameters cap (meaning capture, or record), nocap,mute,unmute, or toggle. To specify

individual channels, use the parametersfront, rear, center, or woofer. For example, the command amixer -c 1 sset Line,0 100% unmute will set Line 0 on the first sound card to 100% and unmute it.

Options

-c n

The number of the card to adjust.

-D devicename

Specify the name of the device. By default, the name is*default*.

-h

Display help information and quit.

-q

Quiet mode: do not show the results of changes made.

anacron

anacron [*options*] [*job*]

System administration command. Normally started in a system startup file. Execute commands periodically. By default, anacron reads a list of jobs from a configuration file, */etc/anacrontab*. The file consists of shell variables to use when running commands, followed by a list of tasks to run. Each task specifies how often in days it should be run, a delay in minutes to wait before running the task, a unique job identifier used to store a timestamp, and the shell command to execute. Timestamps fo the last run of each task are stored in the */var/spool/anacron* file. For each task, anacron compares the stored timestamp against the current time. If the command has not been executed within the specified frequency, the command is run. Upon completion,anacron records the new date in the timestamp file. Limit anacron to a specified task by providing the task's unique*job* identifier on the command line.

The anacron command is often used to support the cron daemon on systems that do not run continuously.

Options

`-d`

Run in foreground rather than as a background process. Send messages to standard error.

`-f`

Run tasks ignoring timestamps.

`-h`

Print help message, then exit.

`-n`

Run tasks now, ignoring delay specifications.

`-q`

Suppress messages to standard error when using the `-d` option.

`-s`

Execute tasks serially. Do not start new task until previous task is completed.

`-t` *file*

Read tasks from *file* instead of from */etc/anacrontab*.

`-u`

Update timestamps for tasks, but don't run them.

-V

Print version number, then exit.

aplay

`aplay [options] [file]`

Play sound files using the ALSA sound system. The related`arecord` records sound files.

Options

`-h`

Print help message, then exit.

`--version`

Print version and quit.

`-l,--list-devices`

List available sound cards and digital audio devices.

`-L,--list-pcms`

List all PCM (pulse-coded modulation, or digital audio) devices that have been defined. PCMs may be defined in the *.asoundrc* file.

`-D,--device=`devicename

Select a PCM device by name.

`-q`

Do not display messages.

`-t,--file-type=`type

Name the file type used. Files may be`voc`, `wav`, `raw`, or `au`.

`-c,--channels=n`

Use *n* channels: 1 for mono, 2 for stereo.

`-f,--format=`format

Specify the sample format. The sample formats available will depend on hardware. For CD and DAT output, use the cd and dat shortcuts, which set the sample rate, format, and channel numbers all at once.

-r,--rate=n

Set the sample rate in Hertz.

-d,--duration=n

Set an interrupt for *n* seconds after playback begins.

-s,--sleep-min=n

aplaymidi

`aplaymidi [options] [file]`

Play MIDI files using the ALSA sound system; output is to ALSA sequencer ports.

Options

-d,--delay=n

Delay *n* seconds at the end of a file to allow for reverberation of the final notes.

-h

Print help message, then exit.

-V

Print version and quit.

-l

List output ports available.

-p,--port=client:port

Specify the port to which the MIDI file will be sent. If no port is specified, the file will be sent to port 0.

apm

---

apm [*options*]

Display current Advanced Power Management hardware information, such as battery life, or send the system into standby or suspend-to-disk mode. Used on older systems, and replaced byacpi and related commands.

-V, --version

Display version information and quit.

-v,--verbose

Verbose mode. Display information about the APM BIOS and Linux APM driver.

-m, --minutes

Display estimated minutes of battery life remaining. Default format is in hours and minutes.

-s, --suspend

Suspend system to disk. Suspending the system to disk is equivalent to turning it off, but boot time will be faster and the system will resume exactly where it was before suspend.

-S, --standby

Set system to standby. This will normally turn off the monitor and spin down the disk drives, reducing energy consumption by approximately 50 percent. Recovery from this mode is more rapid than from a full suspend to disk, but the system is still running.

-i,--ignore

When the system is using AC power, ignore suspend or standby requests generated by the system.

-n,--noignore

Do not ignore any suspend or standby events. This overrides a previously issued-i flag.

apmd

---

apmd [*options*]

System administration command. apmd handles events reported by the Advanced Power Management BIOS driver. The driver reports on battery level and requests to enter sleep or suspend mode. apmd will log any reports it gets via syslogd and take steps to make sure that basic sleep and suspend requests are handled gracefully. You can fine-tune the behavior ofapmd by editing the apmd_proxy script, which apmd runs when it receives an event. Note that the APM hardware standard is gradually being replaced by the ACPI (Advanced Configuration and Power Interface) standard, and apmd by acpid. On SUSE Linux, both APM and ACPI hardware are handled by powersave and powersaved.

Options

-c *n*, --check *n*

Set the number of seconds to wait for an event before rechecking the power level. Default is to wait indefinitely. Setting this causes the battery levels to be checked more frequently.

-p *n*, --percentage *n*

Log information whenever the power changes by *n* percent. The default is 5. Values greater than 100 will disable logging of power changes.

-P *command*, --apmd_proxy *command*

Specify the apmd_proxy command to run when APM driver events are reported. This is generally a shell script. The *command* will be invoked with parameters indicating what kind of event was received. The parameters are listed in the next section.

-v, --verbose

Verbose mode; all events are logged.

-V, --version

Print version and exit.

-w *n*, --warn *n*

Log a warning at ALERT level when the battery charge drops below*n* percent. The default is 10. Negative values disable low-battery-level warnings.

-W, --wall

Use wall to alert all users of a low battery status.

-q, --quiet

Disable low-battery-level warnings.

-?, --help

Print help summary and exit.

Parameters

The apmd proxy script is invoked with the following parameters:

start

Invoked when the daemon starts.

stop

Invoked when the daemon stops.

suspend [system | user]

Invoked when the daemon receives a suspend request. The second parameter indicates whether the request was made by the system or by the user. Suspend, also known as "hibernate," effectively powers the system down but has a quicker recovery than a normal boo process.

standby [system | user]

Invoked when the daemon receives a standby request. The second parameter indicates whether the request was made by the system or by the user. Standby mode powers off the monitor and disks, but the system continues to run and use power.

resume [suspend | standby | critical]

Invoked when the system resumes normal operation. The second parameter indicates the mode the system was in before resuming. critical suspends indicate an emergency shutdown. After a critical suspend, the system may be unstable, and you can use the resume command to help you recover from the suspension.

change power

Invoked when system power is changed from AC to battery or from battery to AC.

change battery

Invoked when the APM BIOS driver reports that the battery is low.

change capability

Invoked when the APM BIOS driver reports that some hardware that affects its capability has been added or removed.

apropos

```
apropos string ...
```

Search the short manual page descriptions in the whatis database for occurrences of each *string* and display the result on the standard output. Like whatis, except that it searches for strings instead of words. Equivalent to man -k.

apt

```
apt
```

The Advanced Package Tool, the Debian package management system. A freely available packaging system for software distribution and installation. For detailed information onapt and its commands, see Chapter 5.

ar

```
ar key [args] [posname] [count] archive [files]
```

Maintain a group of *files* that are combined into a file *archive*. Used most commonly to create and update static library files, as used by the link editor (ld). Compiler frontends often call ar automatically. Only one key letter may be used, but each can be combined with additional *args* (with no separations between). *posname* is the name of a file in *archive*. When moving or replacing *files*, you can specify that they be placed before or after *posname*. ar has largely been superseded by tar and bzip2.

Keys

d

Delete *files* from *archive*.

m

Move *files* to end of *archive*.

p

Print *files* in *archive*.

q

Append *files* to *archive*.

r

Replace *files* in *archive*.

t

List the contents of *archive* or list the named *files*.

x

Extract contents from *archive* or only the named *files*.

Arguments

a

Use with r or m key to place *files* in the archive after *posname*.

b

Same as a, but before *posname*.

c

Create *archive* silently.

f

Truncate long filenames.

i

Same as b.

l

For backward compatibility; meaningless in Linux.

N

Use *count* parameter. Where multiple entries with the same name are found, use the*count* instance.

o

Preserve original timestamps.

P

Use full pathname. Useful for non-POSIX-compliant archives.

s

Force regeneration of *archive* symbol table (useful after running `strip`).

S

Do not regenerate symbol table.

u

Use with r to replace only *files* that have changed since being put in *archive*.

v

Verbose; print a description of actions taken.

V

Print version number.

Example

Replace `mylib.a` with object files from the current directory:

```
ar r mylib.a `ls *.o`
```

arch

`arch`

Print machine architecture type to standard output. Equivalent `touname -m`.

arecord

```
arecord [options] [filename]
```

Records sound using ALSA. Accepts the same arguments and options asaplay.

arecordmidi

`arecord [`*`options`*`] [`*`filename`*`]`

Records midi files using ALSA. You must specify the port using the-p flag.

Options

-p,--port=*host:port*

Set the sequencer host and port used. The default host is the local host, and the default is port 0.

-h,--help

Display help message.

-v,--version

Display version number.

-l, --list

List available ports.

-b,--bmp=n

Set the tempo value to *n* beats per minute. The default is 120.

-f,--fps=n

Set timing (SMPTE resolution) to *n* frames per second. The value is normally 24, 25, 29.97 (NTSC dropframe), or 30.

-t,--ticks=n

Set the frequency with which timestamps, or ticks, are used in the file. For MIDI files using

musical tempo, timestamps are set in ticks per beat (default 384), while those with SMPTE timing use ticks per frame (default 40).

-s,--split-channels

For each channel of input, create a separate track in the MIDI output file.

arp

`arp [options]`

TCP/IP command. Clear, add to, or dump the kernel's Address Resolution Protocol (ARP) cache (*/proc/net/arp*). ARP is used to translate protocol addresses to hardware interface addresses. Modifying your ARP cache can change which interfaces handle specific requests. ARP cache entries may be marked with the following flags: C (complete), M (permanent), and P (publish). While arp can create a proxy for a single system, subnet proxies are now handled by thearp kernel module, *arp*(7). See the "Linux 2.4 or later Advanced Routing HOWTO" for details.

Options

host option arguments may be given as either a hostname or an IP address. With the-D option, they may also be given as a hardware interface address (e.g., eth0, eth1).

-a [*hosts*], --display [*hosts*]

Display entries for *hosts* or, if none are specified, all entries.

-d *host [*pub], --delete *host [*pub]

Remove the specified *host*'s entry. To delete a proxy entry, add the pub argument and specify the interface associated with the proxy using-i.

-D, --use-device

Use the hardware address associated with the specified interface. This may be used with-s when creating a proxy entry.

-f *file*, --file *file*

Read entries from *file* and add them.

-H *type*, --hw-type *type*, -t *type*

Search for *type* entries when examining the ARP cache. *type* is usually ether (Ethernet), which is the default, but may be ax25 (AX.25 packet radio), arcnet (ARCnet), pronet (PROnet), or netrom (NET/ROM).

-i *interface*, --device *interface*

Select an interface. If you are dumping the ARP cache, this option will cause the command to display only the entries using that interface. When setting entries, this will cause the interface to be associated with that entry. If you do not use this option when setting an entry, the kerne will guess.

-n, --numeric

Display host IP addresses instead of their domain names.

-s *host hardware-address* [netmask *mask*] [pub], --set *host hardware-address* [pub]

Add a permanent entry for *host* at *hardware-address*. A *hardware-address* for type ether hardware is 6 hexadecimal bytes, colon-separated. The pub argument can be used to set the publish flag, creating a proxy entry.

-v, --verbose

Verbose mode.

Examples

Display entry for host eris:

```
arp -a eris
```

Set a permanent cache entry for host illuminati, whose hardware address you know:

```
arp -s illuminati 00:05:23:73:e6:cf
```

Set an ARP proxy for host fnord using the eth0 interface's hardware address:

```
arp -Ds fnord eth0 pub
```

Remove the fnord ARP proxy:

```
arp -i eth0 -d fnord pub
```

as

```
as [options] files
```

Generate an object file from each specified assembly-language source*file*. Object files have the same root name as source files but replace the *.s* suffix with *.o*. There may be some additional system-specific options.

Options

-- [| *files*]

Read input files from standard input, or from *files* if the pipe is used.

-a[cdhlmns][=*file*]

With only the -a option, list source code, assembler listing, and symbol table. The other options specify additional things to list or omit:

-ac

Omit false conditionals.

-ad

Omit debugging directives.

-ah

Include the high-level source code, if available.

-al

Include an assembly listing.

-am

Include macro expansions.

-an

Suppress forms processing.

-as

Include a symbol listing.

=*file*

Set the listing filename to *file*.

--defsym *symbol*=*value*

Define the *symbol* to have the value *value*, which must be an integer.

-f

Skip whitespace and comment preprocessing.

--fatal-warnings

Treat warnings as errors.

--gstabs

Generate debugging information in stabs format.

--gdwarf2

Generate DWARF2 debugging information.

-o *objfile*

Place output in object file *objfile* (default is *file*.o).

--statistics

Print information on how much time and space assembler uses.

-v

Display the version number of the assembler.

-I *path*

Include *path* when searching for .include directives.

-J

Don't warn about signed overflow.

-R

Combine both data and text in text section.

-W

Don't show warnings.

-Z

Generate object file even if there are errors.

at

`at [options] time [date]`

Execute commands at a specified *time* and optional *date*. The commands are read from standard input or from a file. (See also batch.) End input with EOF. *time* can be formed either as a numeric hour (with optional minutes and modifiers) or as a keyword. It can contain an optional*date*, formed as a month and date, a day of the week, or a special keyword (today or tomorrow). An increment can also be specified.

The at command can always be issued by a privileged user. Other users must be listed in the file

/etc/at.allow if it exists; otherwise, they must not be listed in */etc/at.deny*. If neither file exists, only a privileged user can issue the command.

Options

-c *job* [*job*...]

Display the specified jobs on the standard output. This option does not take a time specification.

-d *job* [*job*...]

Delete the specified jobs. Same as `atrm`.

-f *file*

Read job from *file*, not from standard input.

-l

Report all jobs that are scheduled for the invoking user. Same as `atq`.

-m

Mail user when job has completed, regardless of whether output was created.

-q *letter*

Place job in queue denoted by *letter*, where *letter* is any single letter from a-z or A-Z. Default queue is a. (The batch queue defaults to b.) Higher-lettered queues run at a lower priority.

-V

Display the version number.

Time

hh:[*mm]* [*modifiers*]

Hours can have one digit or two (a 24-hour clock is assumed by default); optional minutes can be given as one or two digits; the colon can be omitted if the format is *h*, *hh*, or *hhmm* (e.g.,

valid times are 5, 5:30, 0530, 19:45). If modifier am or pm is added, *time* is based on a 12-hour clock. If the keyword zulu is added, times correspond to Greenwich Mean Time.

midnight | noon | teatime | now

Use any one of these keywords in place of a numeric time. teatime translates to 4:00 p.m.; now must be followed by an *increment* (described in a moment).

Date

month num [, *year*]

month is one of the 12 months, spelled out or abbreviated to its first three letters; *num* is the calendar date of the month; *year* is the four-digit year. If the given *month* occurs before the current month, at schedules that month next year.

day

One of the seven days of the week, spelled out or abbreviated to its first three letters.

today | tomorrow

Indicate the current day or the next day. If *date* is omitted, at schedules today when the specified *time* occurs later than the current time; otherwise, at schedules tomorrow.

Increment

Supply a numeric increment if you want to specify an execution time or day *relative* to the current time. The number should precede any of the keywords minute, hour, day, week, month, or year (or their plural forms). The keyword next can be used as a synonym of + 1:

Examples

In typical usage, you run at and input commands that you want executed at a particular time, followed by EOF.

```
$ at 1:00 am tomorrow
at> ./total_up > output
at> mail joe < output
at> <EOT>          Entered by pressing Ctrl-D
job 1 at 2003-03-19 01:00
```

The two commands could also be placed in a file and submitted as follows:

```
$ at 1:00 am tomorrow < scriptfile
```

More examples of syntax follow. Note that the first two commands here are equivalent:

```
$ at 1945 December 9
$ at 7:45pm Dec 9
$ at 3 am Saturday
$ at now + 5 hours
$ at noon next day
```

atd

`atd` *options*

System administration command. Normally started in a system startup file. Execute jobs queued by the `at` command.

Options

`-b` *n*

Wait at least *n* seconds after beginning one job before beginning the next job. Default is 60.

`-d`

Print error messages to standard error instead of using `syslog`.

`-l` *average*

When system load average is higher than *average*, wait to begin a new job. Default is 0.8.

`-s`

Process queue once, then exit.

atq

```
atq [options]
```

List the user's pending jobs, unless the user is a privileged user; in that case, list everybody's jobs. Same as `at -l`, and related to `batch` and `atrm`.

Options

`-q` *queue*

Query only the specified queue and ignore all other queues.

`-v`

Show jobs that have completed but have not yet been deleted.

`-V`

Print the version number.

atrm

```
atrm [options] job [job...]
```

Delete jobs that have been queued for future execution. Same as `at -d`.

Options

`-q` *queue*

Remove job from the specified queue.

-V

Print the version number and then exit.

audiosend

```
audiosend [email@address]
```

Send an audio recording as an email from a properly equipped workstation (Sun and Sony, with microphones). After prompting for address, subject, and Cc: fields, the program asks the user to record a message, then allows him to re-record, send, or cancel.`audiosend` is one of the `metamail` tools for processing nontext MIME mail messages.

aumix

```
aumix [options]
```

Audio mixer tool. Run without any options or arguments for an ncurses-based interactive mode.

Options

The first set of options sets the volume level of a channel to a percentage of the maximum. Each channel is represented by a single letter or number: v for overall volume, b for bass, t for treble, s for synthesizer, w for PCM channels, c for CD, m for microphone, i for line in, o for line out, l for the main line, x for imix, and 1, 2, or 3 for lines 1, 2, and 3. Passing q as an argument to any of those flags displays their current status. Passing + or - will increase or decrease the channel volume by one, and +*n* or -*n* will adjust them by *n*.

For example, `aumix -c q -l 10` will display the CD value and set the main line to 10%.

Additional options:

-C filename

Use the color-scheme file specified to determine the appearance of the ncurses interface.

-d devicename

Specify the mixer device to be used. The default is*/dev/mixer*.

-f filename

Specify a settings file.

-h

Display a help message and quit.

-I

Interactive mode: provides an ncurses-based UI similar to`alsamixer`.

-L

Load settings from the default*.aumixrc* file.

-q

Query all devices, and display the results.

-S

Save settings to the default*.aumixrc* file.

autoconf

`autoconf [*options*] [*template_file*]`

Generate a configuration script from m4 macros defined in *template_file*, if given, or in a *configure.ac* or *configure.in* file in the current working directory. The generated script is almost invariably called *configure*.

Options

-d, --debug

Don't remove temporary files.

-f, --force

Replace files generated previously by autoconf.

-h, --help

Print help message, then exit.

-i, --initialization

When tracing calls with the -t option, report calls made during initialization.

-o *file*, --output=file

Save output to *file*.

-t *macro*, --trace=macro

Report the list of calls to *macro*.

-v, --verbose

Verbosely print information about the progress of autoconf.

-B *dir*, --prepend-include=dir

Prepend directory *dir* to the search path.

-I *dir*, --include=dir

Append directory *dir* to the search path.

-V, --version

Print version number, then exit.

-W *category*, --warnings=category

Print any warnings related to *category*. Accepted categories are:

cross

Cross compilation.

obsolete

Obsolete constructs.

syntax

Questionable syntax.

all

All warnings.

no-*category*

Turn off warnings for *category*.

none

Turn off all warnings.

error

Treat warnings as errors.

autoheader

```
autoheader [options] [template_file]
```

GNU autoconf tool. Generate a template file of C #define statements from m4 macros defined in *template_file*, if given, or in a *configure.ac* or *configure.in* file in the current working directory. The generated template file is almost invariably called *config.h.in*.

Options

-d, --debug

Don't remove temporary files.

-f, --force

Replace files generated previously by autoheader.

-h, --help

Print help message, then exit.

-o file, --output=*file*

Save output to *file*.

-v, --verbose

Verbosely print information about the progress of autoheader.

-B *dir*, --prepend-include=*dir*

Prepend directory *dir* to the search path.

-I *dir*, --include=*dir*

Append directory *dir* to the search path.

-V, --version

Print version number, then exit.

-W *category*, --warnings=*category*

Print any warnings related to *category*. Accepted categories are:

obsolete

Obsolete constructs.

all

All warnings.

no-*category*

Turn off warnings for *category*.

none

Turn off all warnings.

error

Treat warnings as errors.

automake

`automake [options] [template_file]`

GNU automake tool. Create GNU standards-compliant *Makefile.in* files from *Makefile.am* template files and can be used to ensure that projects contain all the files and install options required to be standards-compliant. Note that Versions 1.4 and 1.6 differ enough that many distributions include an *automake14* package for backward compatibility.

Options

-a, --add-missing

Add any missing files that automake requires to the directory by creating symbolic links to automake's default versions.

-c, --copy

Used with the -a option. Copy missing files instead of creating symbolic links.

--cygnus

Specifies project has a Cygnus-style source tree.

-f, --force-missing

Used with the -a option. Replace required files even if a local copy already exists.

--foreign

Treat project as a non-GNU project. Check only for elements required for proper operation.

--gnu

Treat project as a GNU project with the GNU project structure.

--gnits

A stricter version of --gnu, performing more checks to comply with GNU project structure rules.

--help

Print help message, then exit.

-i, --ignore-deps

Disable automatic dependency tracking.

--libdir=*dir*

Used with the -a option. Search in directory *dir* for default files.

--no-force

Update only *Makefile.in* files that have updated dependents.

-v, --verbose

List files being read or created by automake.

--version

Print version number, then exit.

-Werror

Treat warnings as errors.

autoreconf

```
autoreconf [options]
```

GNU autoconf tool. Update configure scripts by running autoconf, autoheader, aclocal, automake, and libtoolize in specified directories and subdirectories. This command is seldom invoked manually. It is usually called automatically from otherautoconf tools.

Options

-d, --debug

Don't remove temporary files.

-f, --force

Remake all configure scripts, even when newer than their template files.

-h, --help

Print help message, then exit.

-i, --install

Add any default files missing from package by copying versions included withautoconf and automake.

-s, --symlink

Used with the -i option. Create symbolic links to default files instead of copying them.

-v, --verbose

Verbosely print information about the progress ofautoreconf.

-I *dir*, --include=*dir*

Search in directory *dir* for input files.

-V, --version

Print version number, then exit.

-W *category*, --warnings=*category*

Print any warnings related to *category*. Accepted categories are:

cross

Cross compilation.

obsolete

Obsolete constructs.

syntax

Questionable syntax.

all

All warnings.

no-*category*

Turn off warnings for *category*.

none

Turn off all warnings.

error

Treat warnings as errors.

autoscan

```
autoscan [options] [directory]
```

GNU autoconf tool. Create or maintain a preliminary *configure.ac* file named *configure.scan* based on source files in specified *directory*, or current directory if none given. If a *configure.ac* file already exists, autoconf will check it for completeness and print suggestions for correcting any problems it finds.

Options

-d, --debug

Don't remove temporary files.

-h, --help

Print help message, then exit.

-v, --verbose

Verbosely print information about the progress of autoscan.

-I *dir*, --include=*dir*

Search in directory *dir* for input files. Use multiple times to add multiple directories.

-B *dir*, --prepend-include=*dir*

Search *dir* for input files before searching in other directories. Use multiple times to add multiple directories.

-V, --version

Print version number, then exit.

autoupdate

```
autoupdate [options] [file]
```

GNU autoconf tool. Update the configure template file *file*, or *configure.ac* if no file is specified. This command is seldom invoked manually. It is usually called automatically from otherautoconf tools.

Options

-d, --debug

Don't remove temporary files.

-f, --force

Remake all configure scripts, even when newer than their template files.

-h, --help

Print help message, then exit.

-v, --verbose

Verbosely print information about the progress of autoupdate.

-I *dir*, --include=*dir*

Search in directory *dir* for input files.

-V, --version

Print version number, then exit.

badblocks

`badblocks [options] device block-count`

System administration command. Search *device* for bad blocks. You must specify the number of blocks on the device (*block-count*). e2fsck and mke2fs will invoke badblocks automatically when given the -c option.

Options

-b *blocksize*

Expect *blocksize*-byte blocks.

-c *blocksize*

Test *blocksize*-byte blocks at a time. Default is 16.

-f

Force a read/write or nondestructive write test on a mounted device. Use only when */etc/mtab* incorrectly reports a device as mounted.

-i *file*

Skip test of known bad blocks listed in *file*.

-n

Perform a nondestructive test by writing to each block and then reading back from it while preserving data.

-o *file*

Direct output to *file*.

-p *number*

Repeat search of device until no new bad blocks have been found in *number* passes. Default is 0.

-s

Show block numbers as they are checked.

-t *pattern*

Test blocks by reading and writing the specified *pattern*. You may specify *pattern* as a positive integer or as the word `random`. If you specifiy multiple patterns, `badblocks` will test all blocks with one pattern, and then test all blocks again with the next pattern. Read-only mode will accept only one pattern. It will not accept `random`.

-v

Verbose mode.

-w

Test by writing to each block and then reading back from it.

banner

---

banner [*option*] [*characters*]

Print *characters* as a poster. If no *characters* are supplied, banner prompts for them and reads an input line from standard input. By default, the results go to standard output, but they are intended to be sent to a printer.

Option

-w *width*

Set width to *width* characters. Note that if your banner is in all lowercase, it will be narrower than *width* characters. If -w is not specified, the default width is 132. If-w is specified but *width* is not provided, the default is 80.

Example

```
/usr/games/banner -w50 Happy Birthday! |lpr
```

basename

basename *name* [*suffix*]
basename *option*

Remove leading directory components from a path. If*suffix* is given, remove that also. The result is printed to standard output. This is useful mostly in a script when you need to work with a filename but can't predict its full path in every instance.

Options

--help

Print help message and then exit.

--version

Print the version number and then exit.

Examples

```
$ basename /usr/lib/libm.a
libm.a

$ basename /usr/lib/libm.a .a
libm
```

bash

```
bash [options] [file [arguments]
sh [options] [file [arguments]]
```

Standard Linux shell, a command interpreter into which all other commands are entered. For more information, see Chapter 6.

batch

```
batch [options] [time]
```

Execute commands entered on standard input. If *time* is omitted, execute commands when the system load permits (when the load average falls below 0.8). Very similar to at, but does not insist that the execution time be entered on the command line. See at for details.

Options

-f *file*

Read job from *file*, not standard input.

-m

Mail user when job has completed, regardless of whether output was created.

-q *letter*

Place job in queue denoted by *letter*, where *letter* is one letter from a-z or A-Z. The default queue is b. (The at queue defaults to a.) Higher-lettered queues run at a lower priority.

-V

Print the version number and then exit.

-v

Display the time a job will be executed.

bc

`bc [options] [files]`

bc is a language (and compiler) whose syntax resembles that of C, but with unlimited-precision arithmetic. bc consists of identifiers, keywords, and symbols, which are briefly described in the following entries. Examples are given at the end.

Interactively perform arbitrary-precision arithmetic or convert numbers from one base to another. Input can be taken from *files* or read from the standard input. To exit, type quit or EOF.

Options

-h, --help

Print help message and exit.

-i, --interactive

Interactive mode.

-l, --mathlib

Make functions from the math library available.

-s, --standard

Ignore all extensions, and process exactly as in POSIX.

-w, --warn

When extensions to POSIX bc are used, print a warning.

-q, --quiet

Do not display welcome message.

-v, --version

Print version number.

Identifiers

An identifier is a series of one or more characters. It must begin with a lowercase letter but may also contain digits and underscores. No uppercase letters are allowed. Identifiers are used as names for variables, arrays, and functions. Variables normally store arbitrary-precision numbers. Within the same program you may name a variable, an array, and a function using the same letter. The following identifiers would not conflict:

x

Variable *x*.

x[*i*]

Element *i* of array *x*. *i* can range from 0 to 2047 and can also be an expression.

x(*y*,*z*)

Call function *x* with parameters *y* and *z*.

Input-output keywords

ibase, obase, scale, and last store a value. Typing them on a line by themselves displays their current value. You can also change their values through assignment. The letters A-F are treated as digits whose values are 10-15.

ibase = *n*

Numbers that are input (e.g., typed) are read as base *n* (default is 10).

obase = *n*

Numbers that are displayed are in base *n* (default is 10). Note: once ibase has been changed from 10, use A to restore ibase or obase to decimal.

scale = *n*

Display computations using *n* decimal places (default is 0, meaning that results are truncated to integers). scale is normally used only for base-10 computations.

last

Value of last printed number.

Statement keywords

A semicolon or a newline separates one statement from another. Curly braces are needed when grouping multiple statements:

if (rel-expr) {statements} [else {*statements*}]

Do one or more *statements* if relational expression *rel-expr* is true. Otherwise, do nothing, or if else (an extension) is specified, do alternative *statements*. For example:

```
if (x=  =y) {i = i + 1} else {i = i - 1}
```

while (*rel-expr*) {*statements*}

Repeat one or more *statements* while *rel-expr* is true. For example:

```
while (i>0) {p = p*n; q = a/b; i = i-1}
```

for (expr1; *rel-expr*; *expr2*) {statements}

Similar to while. For example, to print the first 10 multiples of 5, you could type:

```
for (i=1; i<=10; i++) i*5
```

GNU bc does not require three arguments to for. A missing argument 1 or 3 means that those expressions will never be evaluated. A missing argument 2 evaluates to the value 1.

break

Terminate a while or for statement.

print *list*

GNU extension. It provides an alternate means of output. *list* consists of a series of comma-separated strings and expressions; print displays these entities in the order of the list. It does not print a newline when it terminates. Expressions are evaluated, printed, and assigned to the special variable last. Strings (which may contain special charactersi.e., characters beginning with \) are simply printed. Special characters can be:

a

Alert or bell

b

Backspace

f

Form feed

n

Newline

r

Carriage return

q

Double quote

t

Tab

\

Backslash

continue

GNU extension. When within a for statement, jump to the next iteration.

halt

GNU extension. Cause the bc processor to quit when executed.

quit

GNU extension. Cause the bc processor to quit whether line is executed or not.

limits

GNU extension. Print the limits enforced by the local version ofbc.

Function keywords

define *f*(args) {

Begin the definition of function *f* having the arguments *args*. The arguments are separated by commas. Statements follow on successive lines. End with }.

auto *x*, *y*

Set up *x* and *y* as variables local to a function definition, initialized to 0 and meaningless

outside the function. Must appear first.

return(*expr*)

Pass the value of expression *expr* back to the program. Return 0 if (*expr*) is left off. Used in function definitions.

sqrt(*expr*)

Compute the square root of expression *expr*.

length(*expr*)

Compute how many significant digits are in *expr*.

scale(*expr*)

Same as length, but count only digits to the right of the decimal point.

read( )

GNU extension. Read a number from standard input. Return value is the number read, converted via the value of ibase.

Math library functions

These are available when bc is invoked with -l. Library functions set scale to 20:

s(*angle*)

Compute the sine of *angle*, a constant or expression in radians.

c(*angle*)

Compute the cosine of *angle*, a constant or expression in radians.

a(*n*)

Compute the arctangent of *n*, returning an angle in radians.

e(*expr*)

Compute e to the power of *expr*.

l(*expr*)

Compute the natural log of *expr*.

j(n, *x*)

Compute the Bessel function of integer order *n*.

Operators

These consist of operators and other symbols. Operators can be arithmetic, unary, assignment, or relational:

arithmetic

+ - * / % ^

unary

- + + --

assignment

= + = - = * = / = % = ^ =

relational

< < = > > = = = !=

Other symbols

/ * * /

Enclose comments.

( )

Control the evaluation of expressions (change precedence). Can also be used around assignment statements to force the result to print.

{ }

Use to group statements.

[ ]

Indicate array index.

"*text*"

Use as a statement to print *text*.

Examples

Note in these examples that when you type some quantity (a number or expression), it is evaluated and printed, but assignment statements produce no display.

```
ibase = 8          Octal input
20                 Evaluate this octal number
16                Terminal displays decimal value

obase = 2          Display output in base 2 instead of base 10
20                 Octal input
10000             Terminal now displays binary value
ibase = A          Restore base-10 input
scale = 3          Truncate results to 3 decimal places
8/7                Evaluate a division
1.001001000       Oops!  Forgot to reset output base to 10
obase = 10         Input is decimal now, so A isn't needed
8/7
1.142             Terminal displays result (truncated)
```

The following lines show the use of functions:

```
define p(r,n){     Function p uses two arguments
auto v             v is a local variable
v = r^n            r raised to the n power
return(v)}         Value returned

scale = 5
x = p(2.5,2)       x = 2.5 ^ 2
x                  Print value of x
6.25
length(x)          Number of digits
```

```
3
scale(x)          Number of places right of decimal point
2
```

biff

```
biff [arguments]
```

Notify user of mail arrival and sender's name. biff operates asynchronously. Mail notification works only if your system is running the comsat(8) server. The command biff y enables notification, and the command biff n disables notification. With no arguments, biff reports biff's current status.

bison

```
bison [options] file
```

Given a *file* containing context-free grammar, convert into tables for subsequent parsing while sending output to *file.c*. To a large extent, this utility is compatible with yacc, and is in fact named for it. All input files should use the suffix *.y*; output files will use the original prefix. All long options (those preceded by --) may instead be preceded by +.

Options

-b *prefix*, --file-prefix=*prefix*

Use *prefix* for all output files.

-d, --defines

Generate *file.h*, producing #define statements that relate bison's token codes to the token names declared by the user.

-r, --raw

Use bison token numbers, not yacc-compatible translations, in *file.h*.

-k, --token-table

Include token names and values of YYNTOKENS, YYNNTS, YYNRULES, and YYNSTATES in *file.c*.

-l, --no-lines

Exclude #line constructs from code produced in *file.c*. (Use after debugging is complete.)

-n, --no-parser

Suppress parser code in output, allowing only declarations. Assemble all translations into a switch statement body and print it to *file.act*.

-o *file*, --output-file=*file*

Output to *file*.

-p *prefix*, --name-prefix=*prefix*

Substitute *prefix* for yy in all external symbols.

-t, --debug

Compile runtime debugging code.

-v, --verbose

Verbose mode. Print diagnostics and notes about parsing tables to *file.output*.

-V, --version

Display version number.

-y, --yacc, --fixed-output-files

Duplicate yacc's conventions for naming output files.

bzcmp

`bzcmp [options] file1 file2`

Apply cmp to the data from files in the bzip2 format without requiring on-disk decompression. See bzip2 and cmp for usage.

bzdiff

```
bzdiff [options] file1 file2
```

Apply diff to data from files in the bzip2 format without requiring on-disk decompression. See bzip2 and cmp for usage.

bzgrep

```
bzgrep [options] pattern [file...]
```

Apply grep to data from files in the bzip2 format without requiring on-disk decompression. See bzip2 and grep for usage.

bzip2

```
bzip2 [options] filenames
bunzip2 [options] filenames
bzcat [option] filenames
bzip2recover filenames
```

File compression and decompression utility similar to gzip, but uses a different algorithm and encoding method to get better compression. bzip2 replaces each file in *filenames* with a compressed version of the file and with a *.bz2* extension appended. bunzip2 decompresses each file compressed by bzip2 (ignoring other files, except to print a warning). bzcat decompresses all specified files to standard output, and bzip2recover is used to try to recover data from damaged files.

Additional related commands include bzcmp, which compares the contents of bzipped files; bzdiff, which creates diff (difference) files from a pair of bzip files; bzgrep, to search them; and the bzless and bzmore commands, which apply the more and less commands to bzip output, as bzcat does with the cat command. See cat, cmp, diff, and grep for information on how to use those

commands.

Options

--

End of options; treat all subsequent arguments as filenames.

-*dig*

Set block size to *dig* x 100 KB when compressing, where *dig* is a single digit from 1 to 9.

-c, --stdout

Compress or decompress to standard output.

-d, --decompress

Force decompression.

-f, --force

Force overwrite of output files. Default is not to overwrite. Also forces breaking of hard links to files.

-k, --keep

Keep input files; don't delete them.

-L, --license, -V, --version

Print license and version information, and exit.

-q, --quiet

Print only critical messages.

--repetitive-fast, --repetitive-best

Obsolete flags, occasionally useful in versions earlier than 0.9.5 (which has an improved sortin algorithm) for providing some control over the algorithm.

`-s, --small`

Use less memory, at the expense of speed.

`-t, --test`

Check the integrity of the files, but don't actually compress them.

`-v, --verbose`

Verbose mode. Show the compression ratio for each file processed. Add more `-v`'s to increase the verbosity.

`-z, --compress`

Force compression, even if invoked as `bunzip2` or `bzcat`.

`-1, --fast`

Perform fast compression, creating a relatively large file. This has no effect on decompression. Higher numbers, up to 9, create progressively better-compressed files. See `-9`, `--best`.

`-9, --best`

Get the best possible compression, although it will take longer.

Examples

To produce two files: *fileone.txt.bz2* and *filetwo.ppt.bz2*, while deleting the two original files:

```
bzip2 fileone.tzt filetwo.ppt
```

To produce a single compressed file, *output.bz2*, which can be decompressed to reconstitute the original *fileone.txt* and *filetwo.txt*:

```
bzip2 -c fileone.txt filetwo.txt > output.bz2
```

The tar command, combined with the `-j` or `--bzip2` option, creates the output file *nutshell.tar.bz2*:

```
tar -cjf nutshell.tar.bz2 /home/username/nutshell
```

bzless

```
bzless [options] file
```

Applies less to datafiles in the bzip2 format without requiring on-disk decompression. See bzip2 and less for usage.

bzmore

```
bzmore [options] file
```

Applies more to datafiles in the bzip2 format without requiring on-disk decompression. See bzip2 and more for usage.

c++

```
c++ [options] files
```

See g++.

c++filt

```
c++filt [options] [symbol]
```

Decode the specified C++ or Java function name *symbol*, or read and decode symbols from standard input if no symbol is given. This command reverses the name mangling used by C++ and Java compilers to support function overloading, multiple functions that share the same name.

Options

-_ , --strip-underscores

Remove initial underscores from symbol names.

--help

Print usage information, then exit.

-j, --java

Print names using Java syntax.

-n, --no-strip-underscores

Preserve initial underscores on symbol names.

-s *format*, --format=*format*

Expect symbols to have been coded in the specified format. Format may be one of the following:

arm

C++ Annotated Reference Manual.

edg

EDG (Intel) compiler.

gnu

Gnu compiler (the default).

gnu-new-abi

Gnu compiler with the new application binary interface (forgcc 3.x.)

hp

HP compiler.

lucid

Lucid compiler.

--version

Print version number, then exit.

cal

```
cal [options] [[month] year]
```

Print a 12-month calendar (beginning with January) for the given*year*, or a one-month calendar of the given *month* and *year*. *month* ranges from 1 to 12. *year* ranges from 1 to 9999. With no arguments, print a calendar for the current month.

Options

-j

Display Julian dates (days numbered 1 to 365, starting from January 1).

-m

Display Monday as the first day of the week.

-y

Display entire year.

Examples

```
cal 12 2006
cal 2006 > year_file
```

cardctl

`cardctl [options] command`

System administration command. Control PCMCIA sockets or select the current scheme. The current scheme is sent along with the address of any inserted cards to configuration scripts (by default located in */etc/pcmcia*). The scheme command displays or changes the scheme. The other commands operate on a named card socket number, or all sockets if no number is given.

Commands

config [socket]

Display current socket configuration.

eject [socket]

Prepare the system for the card(s) to be ejected.

ident [socket]

Display card identification information.

info [*socket*]

Display card identification information as Bourne shell variable definitions for use in scripts.

insert [*socket*]

Notify system that a card has been inserted.

reset [*socket*]

Send reset signal to card.

resume [*socket*]

Restore power to socket and reconfigure for use.

scheme [*name*]

Display current scheme or change to specified scheme*name*.

status [*socket*]

Display current socket status.

suspend [*socket*]

Shut down device and cut power to socket.

Options

-c *directory*

Look for card configuration information in *directory* instead of */etc/pcmcia*.

-f *file*

Use *file* to keep track of the current scheme instead of */var/run/pcmcia-scheme*.

-s *file*

Look for current socket information in *file* instead of */var/run/stab*.

cardmgr

`cardmgr [options]`

System administration command. The PCMCIA card daemon. `cardmgr` monitors PCMCIA sockets for devices that have been added or removed. When a card is detected, it attempts to get the card's ID and configure it according to the card configuration database (usually stored in */etc/pcmcia/config*). By default, `cardmgr` does two things when it detects a card: it creates a system log entry, and it beeps. Two high beeps mean it successfully identified and configured a device. One high beep followed by one low beep means it identified the device, but was unable to configure it successfully. One low beep means it could not identify the inserted card. Information on the currently configured cards can be found in */var/run/stab*.

Options

-c *directory*

Look for the card configuration database in *directory* instead of */etc/pcmcia*.

-f

Run in the foreground to process the current cards, then run as a daemon.

-m *directory*

Look in *directory* for card device modules. Default is */lib/modules/RELEASE*, where *RELEASE* is the current kernel release.

-o

Configure the cards present in one pass, then exit.

-p *file*

Write cardmgr's process ID to *file* instead of to */var/run/cardmgr.pid*.

-q

Run in quiet mode. No beeps.

-s *file*

Write current socket information to *file* instead of */var/run/stab*.

-v

Verbose mode.

-V

Print version number and exit.

cat

```
cat [options] [files]
```

Read (concatenate) one or more *files* and print them on standard output. Read standard input if no *files* are specified or if - is specified as one of the files; input ends with EOF. You can use the> operator to combine several files into a new file, or > > to append files to an existing file. When appending to an existing file, use Ctrl-D, the end-of-file symbol, to end the session.

Options

-A, --show-all

Same as -vET.

-b, --number-nonblank

Number all nonblank output lines, starting with 1.

-e

Same as -vE.

-E, --show-ends

Print $ at the end of each line.

-n, --number

Number all output lines, starting with 1.

-s, --squeeze-blank

Squeeze down multiple blank lines to one blank line.

-t

Same as -vT.

-T, --show-tabs

Print TAB characters as ^I.

`-u`

Ignored; retained for Unix compatibility.

`-v, --show-nonprinting`

Display control and nonprinting characters, with the exception of LINEFEED and TAB.

Examples

```
cat ch1                          Display a file
cat ch1 ch2 ch3 > all     Combine files
cat note5 >> notes     Append to a file
cat > temp1          Create file at terminal. To exit, enter EOF
                                                (Ctrl-D).
cat > temp2 << STOP       Create file at terminal. To exit, enter STOP.
```

cc

`cc [options] files`

See gcc.

cdda2wav

`cdda2wav [options] [output.wav]`

Convert Compact Disc Digital Audio (CDDA) to the WAV format. This process is often called "ripping" a CD-ROM and is generally performed before using an encoder to convert the file to a compressed music format, such as OGG or MP3.

Options

Some of the following options use sectors as a unit of measurement. Each sector of data on a CD represents approximately 1/75 second of play time.

-A, --auxdevice *drivename*

Specify a different drive for ioctl purposes.

-a, --divider n

Set the sample rate to a value equal to 44100/*n* samples per second. The -R option, used by itself, lists the possible values.

-B,--bulk

Copy each track into its own file. This is the single most commonly used flag.

-b, --bits-per-sample *n*

Set the quality of samples to *n* bits per sample per channel. Possible values are 8, 12, and 16.

-C byteorder, --cdrom-endianness byteorder

Set the byte order, or "endianness" of the input data. You may set the order tolittle, big, or guess. This is useful when your CD-ROM drive uses an unexpected or unusual byte order for your platform.

-c channel, --channels channel

Set stereo instructions. Set *channel* to 1 for mono; 2 for stereo; or s for stereo, but swapped left-to-right. You can also use -s (--stereo) to record in stereo and -m (--mono) to record in mono.

--cddbp-server=*servername*

Set the name of the CD lookup server used. A reliable choice isfreedb.freedb.org, which assigns requests to one of several official mirrors for the free CD database project.

--cddbp-port=*portnumber*

Select the port on which to access the CD lookup server. The servers at*freedb.org* use cddbp on port 8880, and http on port 80.

-D, --device *devicename*

Specify the device. The device must work with the-i (--interface) settings.

-d, --duration

Set to a number followed by f for frames (sectors) or s for seconds. Set time to zero to record an entire track. For example, to copy two minutes, enter 120s.

-E byteorder,--output-endianness byteorder

Set the byte order or "endianness" of the output data. As with -C, you may set the order to little, big, or guess.

-e, --echo device

Send output to an audio output device instead of to a file.

-g, --gui

Format all text output for easy parsing by GUI frontends.

-H, --no-infofile

Do not copy any info or CDDB files, only the audio files.

-I, --interface *ifname*

Specify the type of interface. For Linux systems, the most appropriate value is usually cooked_ioctl.

-i, --index *n*

Set the start index to *n* when recording.

-J, --info-only

Use this option by itself to display information about the disc, but do nothing else.

-L *n* --cddb-mode *n*

cdda2wav automatically looks up CD information online, if possible. This option determines what happens when there are multiple entries identifying the CD. If the mode is 0, the user is prompted to select an entry. If the mode is 1, the application will use the first entry returned.

-M *n*, --md5 *n*

Create MD5 checksums for the first *n* bytes of each track copied.

-N, --no-write

For debugging purposes, this option suppresses writing an output file.

-n, --sectors-per-request *n*

Read *n* sectors in each request.

-O, --output-format=format

Choose the output file format. Normal file options are *wav*, *aiff*, *aifc*, *au*, and *sun*. You can also use *cdr* and *raw* for headerless files dumped into recording devices.

-o, --offset *n*

Start recording *n* sectors before the beginning of the first track.

-P, --set-overlap *n*

Use *n* sectors of overlap for jitter correction. Very fast systems with absolutely perfect drives and unscratched CDs can set this to 0.

-p, --set-pitch *n*

Adjust the pitch by *n* percent when copying data to an audio device.

--paranoia

Read and interpret the CD using the `paranoia` library instead of the `cdda2wav` code. Paranoia provides more sound correction routines; see `cdparanoia` for more information.

-q, --quiet

Quiet mode; the program will not send any data to the screen.

-R, --dump-rates

Output a list of possible sample rates and dividers. This option is typically used with no other option flags or arguments.

-r,--rate *n*

Set the sample rate in samples per second. To get a list of possible values, use the-R option by itself.

-S, --speed *n*

Specify the speed at which your system will read the CD-ROM. Set the value to the multiple of normal playback speed given as your CD-ROM drive speed (4, 16, 32, and so forth). Setting the speed lower than the maximum can prevent errors in some cases.

-t, --track *n*

Set start track to *n.* Optionally, use + and a second track number for the end track: 1+10 copies tracks one through ten.

-v, --verbose-level *comma,separated,list*

Determines what sort of information about the CD is displayed. The options, which should be provided as a comma separated list, are as follows: for no information, usedisable; or for all information, use all. Alternatively, use toc for the table of contents, summary for the disc summary, indices for disc indices, catalog for the disc catalog, trackid for track IDs, sectors for sectors, and titles for title information, if available.

--version

Display version and quit.

-w, --wait

Wait for a signal before recording anything.

-x, --max

Set recording quality (and amount of hard disk usage) to maximum.

Examples

For most systems, you should be able to copy a complete CD to a single WAV file with the following command:

```
cdda2wav
```

To copy a complete CD to a set of WAV files, one per track:

```
cdda2wav -B
```

After using `cdda2wav`, you will probably want to use an encoder to compress and convert the files to a more usable format, such as MP3 or Ogg Vorbis.

cdparanoia

`cdparanoia [`*`options`*`] `*`span`*` [`*`outfile`*`]`

Like `cdda2wav`, `cdparanoia` records Compact Disc audio files as WAV, AIFF, AIFF-C, or raw format files. It uses additional data-verification and sound-improvement algorithms to make the process more reliable and is used by a number of graphical recording programs as a backend.

Options

-a, --output-aifc

Output in AIFF-C format.

-B, --batch

Split output into multiple files, one per track. Each file will begin with the track number. This is the single most commonly used flag for this command.

-C, --force-cdrom-big-endian

Force cdparanoia to treat the drive as a big-endian device.

-c, --force-cdrom-little-endian

Force cdparanoia to treat the drive as a little-endian device.

-d, --force-cdrom-device *devicename*

Specify a device name to use instead of the first readable CD-ROM available.

-e, --stderr-progress

Send all progress messages to stderr instead of stdout; used by wrapper scripts.

-f, --output-aiff

Output in AIFF format. The default format is WAV.

-h, --help

Display options and syntax.

-p, --output-raw

Output headerless raw data.

-R, --output-raw-big-endian

Output raw data in big-endian byte order.

-r, --output-raw-little-endian

Output raw data in little-endian byte order.

-Q, --query

Display CD-ROM table of contents and quit.

-q, --quiet

Quiet mode.

-S, --force-read-speed *n*

Set the read speed to *n* on drives that support it. This is useful if you have a slow hard disk or not much RAM.

-s, --search-for-drive

Search for a drive, even if */dev/cdrom* exists.

-V, --version

Print version information and quit.

-v, --verbose

Verbose mode.

-w, --output-wav

Output in WAV format. This is the default.

-X, --abort-on-skip

If a read fails and must be skipped, skip the entire track and delete any partially completed output file.

-Z, --disable-paranoia

Disable data verification and correction. Causes cdparanoia to behave exactly as cdda2wav would.

-z, --never-skip[=*retries*]

If a read fails (for example, due to a scratch in the disc), try again and again. If you specify a number, cdparanoia will try that number of times. If you do not, cdparanoia will retry until it succeeds. The default number of attempts is 20.

Progress symbols

The output during operation of cdparanoia includes both smiley faces and more standard progress symbols. They are:

:-)

Operation proceeding normally.

:-|

Operation proceeding normally, but with jitter during reads.

:-/

Read drift.

8-|

Repeated read problems in the same place.

:-O

SCSI/ATAPI transport error (hardware problem not related to the disc itself).

:-(

Scratch detected.

;-(

Unable to correct problem.

8-X

Unknown and uncorrectable error.

:^D

Finished.

Blank space in the progress indicator means that no corrections were necessary.

-

Jitter correction was required.

+

Read errors.

!

Errors even after correction; repeated read errors.

e

Corrected transport errors.

V

An uncorrected error or a skipped read.

The span argument

The cdparanoia command takes exactly one argument, which describes how much of the CD to record. It uses numbers followed by bracketed times to designate track numbers and time within them. For example, the string 1[2:23]-2[5] indicates a recording from the two-minute and twenty-three-second mark of the first track up to the fifth second of the second track. The time format is demarcated by colons, *hours*:*minutes*:*seconds*:.*sectors*, with the last item, *sectors*, preceded by a decimal point (a sector is 1/75 of a second). It's best to put this argument within quotes.

If you use the -B option, the span argument is not required.

cdrdao

---

cdrdao *command* [*options*] *toc-file*

Write all content specified in description file*toc-file* to a CD-R disk drive in one step. This is called disk-at-once (DAO) mode, as opposed to the more commonly used track-at-once (TAO) mode. DAO mode allows you to change the length of gaps between tracks and define data to be written in these gaps (like hidden bonus tracks or track intros). The toc file can be created by hand or generated from an existing CD using cdrdao's read-toc command. A cue file, as generated by other audio programs, can be used instead of a toc file. The file format for toc files is discussed at length in the cdrdao manpage.

Commands

The first argument must be a command. Note that not all options are available for all commands.

show-toc

Print a summary of the CD to be created.

read-toc

Read from a CD and create a disk image and toc file that will allow creation of duplicates.

read-cddb

Check a CDDB server for data about the CD represented by a given toc file; then write that data to the toc file as CD-TEXT data.

show-data

Print out the data that will be written to the CD-R. Useful for checking byte order.

read-test

Check the validity of the audio files described in the toc file.

disk-info

Display information about the CD-R currently in the drive.

msinfo

Display multisession information. Useful mostly for wrapper scripts.

scanbus

Scan the system bus for devices.

simulate

A dry run: do everything except write the CD.

unlock

Unlock the recorder after a failure. Run this command if you cannot eject the CD after using cdrdao.

write

Write the CD.

copy

Copy the CD. If you use a single drive, you will be prompted to insert the CD-R after reading. An image file will be created unless you use the--on-the-fly flag and two CD drives.

Options

--buffers n

Set the number of seconds of data to be buffered. Default is 32; set to a higher number if your read source is unreliable or is slower than the CD-R.

--cddb-servers server,server

Enter hosts for servers. Servers may include ports, paths, and proxies; you can list multiple servers separated by spaces or commas.

--cddb-timeout s

Set the timeout for CDDB server connections to *s* seconds.

--cddb-directory localpath

CDDB data that is fetched will be saved in the directory *localpath*.

--datafile *filename*

When used with the read-toc command, this option specifies the datafile placed in the toc file. When used with read-cd and copy, it specifies the name of the image file created.

--device bus,id,logicalunit

Set the SCSI address of the CD-R using the bus number, ID number, and logical-unit number.

--driver driver-id:option-flags

Force cdrdao to use the driver you choose with the driver options named, instead of the driver it autodetects.

--eject

Eject the disc when done.

--force

Override warnings and perform the action anyway.

--keepimage

Used only with the copy command. Keeps the image file created during the copy process.

--multi

Record as a multisession disc.

-n

Do not wait 10 seconds before writing the disc.

--on-the-fly

Do not create an image file: pipe data directly from source to CD-R.

--overburn

If you are using a disc with more storage space than cdrdao detects, use this option to keep writing even when cdrdao thinks you're out of space.

--paranoia-mode n

Specify the amount of error correction in the CD read, where *n* is a value from 0 to 3. 0 is none; 3 is full (see cdparanoia for information about error correction). Set error correction to a lower number to increase read speed. The default is 3.

--read-raw

Used only with the read-cd command. Write raw data to the image file.

--reload

Allow the drive to be opened before writing, without interrupting the process. Used with simulation runs.

--save

Save current options to the settings file *$HOME/.cdrdao*.

--session n

Used only with the read-toc and read-cd commands when working with multisession CDs. Specify the number of the session to be processed.

--source-device bus,id,logicalunit

Used only with the copy command. Set the SCSI address of the source device.

--source-driver driver-id:option-flags

Used only with the copy command. Set the source device driver and flags.

--speed value

Set the write speed to *value*. The default is the highest available speed; use a lower value if higher values give poor results.

--swap

Swap byte order for all samples.

-v verbose-level

Set the amount of information printed to the screen. 0, 1, and 2 are fine for most users; greater numbers are useful for debugging.

--with-cddb

Use CDDB to fetch information about the disc and save it as CD-TEXT data. Used with the copy, read-toc, and read-cd commands.

Examples

To find devices on the system:

```
cdrdao scanbus
```

To copy from a CD device (at 1,1,0) to a CD-R device (at 1,0,0):

```
cdrdao copy --source 1,1,0 --device 1,0,0 --buffers 64
```

cdrecord

```
cdrecord [general-options] dev=device [track-options]
track1,track2...
```

Record data or audio compact discs. This program normally requires root access. It has a large number of options and settings. A number of useful examples can be found in the manpage.

General options

General option flags go directly after the cdrecord command. Options affecting the track arguments are placed after the device argument and before the track arguments themselves. The general options are:

--atip

Display the ATIP (Absolute Time In Pregroove) information for a disc. Only some drives allow you to read this information.

--blank=*type*

Erase data from a CD-RW in one of the following ways:

help

Display a possible list of blanking methods.

all

Erase all information on the disc. May take a long time.

fast

Perform a quick erase of the disc, erasing only the PMA, TOC, and pregap.

track

Blank a track.

unreserve

Unreserve a track previously marked as reserved.

trtail

Blank the tail of a track only.

unclose

Unclose the last session.

session

Blank the last session.

--checkdrive

Check to see if there are valid drivers for the current drive. Returns 0 if the drive is valid.

--dao

Disk-at-once mode. Works only with MMC drives that support non-raw session-at-once modes.

--debug=*n*, -d

Set the debug level to an integer (greater numbers are more verbose), or use multiple-d flags as with the -v and -V flags.

--driver=*name*

Lets you specify a driver for your system. Suggested for experts only. The special drivers cdr_simul and dvd_simul are used for simulation and profiling tests.

--driveropts=*optlist*

Specify a comma-separated list of driver options. To get a list of valid options, use driveropts=help and --checkdrive.

--dummy

Perform a dry run, doing all the steps of recording with the laser turned off. This will let you know whether the process is going to work.

--eject

Eject disc after recording. Some hardware may need to eject a disc after a dummy recording and before the actual recording.

--fix

Close ("fixate") the session, preventing future multisession recordings and allowing the disc to be played in standard audio CD players (some can also play a disc that has not been closed).

--force

Override errors if possible. May allow you to blank an otherwise broken CD-RW.

--fs=*n*

Set the fifo buffer size to *n*, in bytes. You may use k, m, s, or f to specify kilobytes, megabytes, or units of 2048 and 2352 bytes, respectively. The default is 4 MB.

--kdebug=*n*, --kd=*n*

Set the kernel's debug notification value to *n* during SCSI command execution. Works through the scg-driver.

--load

Load media and exit. Works with tray-loading mechanisms only.

--mcn=*n*

Set the Media Catalog Number to *n*.

--msinfo

Get multisession information from the CD. Used only with multisession discs onto which you can still record more sessions.

--multi

Set to record in multisession mode. Must be present on all sessions but the last one for a multisession disc.

--nofix

Do not close the disc after writing.

--reset

Attempt to reset the SCSI bus. Does not work on all systems.

-s, --silent

Silent mode. Do not print any SCSI error commands.

--speed=*n*

Set the speed to *n*, a multiple of the audio speed. Normally, cdrecord will get this from the

CDR_SPEED environment variable. If your drive has trouble with higher numbers, try 0 as a value.

--timeout=*n*

Set the timeout to *n* seconds. Defaults to 40.

--toc

Display the table of contents for the CD currently in the drive. Works for CD-ROM, as well as CD-R and CD-RW drives.

--scanbus

Scan SCSI devices.

--useinfo

Use *.inf* files to override audio options set elsewhere.

-V

As with the -v, a verbose mode counter. However, this applies only to SCSI transport messages. This will slow down the application.

-v

Verbose mode. Use one v for each level of verbosity. -vv would be very verbose, and -vvv would be even more so.

--version

Print version information and exit.

The device argument

The device argument should be specified not as a file but as three integers that represent the bus, target, and logical unit, as in the cdrdao command. To check the options that are available, use the --scanbus option.

Track options and arguments

Track options may be mixed with track arguments, and normally apply to the track immediately after

them or to all tracks after them. The track arguments themselves should be the files that you will be writing to the CD. Options are:

--audio

Write all tracks after this track in digital audio format (playable by standard CD players). If you do not use this flag or the --data flag, cdrecord will assume that *.au* and *.wav* files are to be recorded as raw audio and that all other files are data.

--cdi

Write subsequent tracks in CDI format.

--data

Record subsequent tracks as CD-ROM data. If you do not use this flag or the --audio flag, all files except for those that end in *.wav* or *.au* are assumed to be data.

--index=*a,b,c*

Set the index list for the next track. The values should be increasing comma-separated integers, starting with index 1 and counting in sectors (75ths of a second). For example, you could set three indices in a track with index=0,750,7500 and they would occur at the beginning of the track, after 10 seconds, and after 100 seconds.

--isosize

The size of the next track should match the size of the ISO-9660 filesystem. This is used when duplicating CDs or copying from raw-data filesystems.

--isrc=*n*

Set the International Standard Recording Number for the track argument following this option.

--mode2

Write all subsequent tracks in CD-ROM mode 2 format.

--nopad

Do not insert blank data between data tracks following this flag. This is the default behavior.

--pad

Insert 15 sectors of blank data padding between data tracks. Applies to all subsequent tracks or until you use the --nopad argument, and is overridden by the padsize=*n* argument.

--padsize=*n*

Insert *n* sectors of blank data padding after the next track. Applies only to the track immediately after it.

--swab

Declare that your data is in byte-swapped (little-endian) byte order. This is not normally necessary.

--tsize=*n*

Set the size of the next track. Useful only if you are recording from a raw disk for which cdrecord cannot determine the file size. If you are recording from an ISO 9660 filesystem, use the --isosize flag instead.

--xa1, --xa2

Write subsequent tracks in CD-ROM XA mode 1 or CD-ROM XA mode 2 format.

cfdisk

cfdisk [*options*] [*device*]

System administration command. Partition a hard disk using a full-screen display. Normally,*device* will be */dev/hda*, */dev/hdb*, */dev/sda*, */dev/sdb*, */dev/hdc*, */dev/hdd*, and so on; the default is the first device on the system. See also fdisk.

Options

-a

Use an arrow on the left side to highlight the currently selected partition, instead of reverse video.

-c *cylinders*

Specify the number of cylinders to use to format the specified*device*.

-g

Ignore driver-provided geometry; guess one instead.

-h *heads*

Specify the number of heads to use to format the specified*device*.

-s *sectors*

Specify the number of sectors per track to use to format the specified*device*.

-v

Print version number and exit.

-z

Do not read the partition table; partition from scratch.

-P *format*

Display the partition table in*format*, which must be r (raw data), s (sector order), or t (table format). See the manpage for the meaning of the fields in the raw format, which shows what will be written by cfdisk for each partition. The sector format shows information about the sectors used by each partition. The table format shows the starting and ending head, sector, and cylinder for each partition.

Commands

up arrow, down arrow

Move among partitions.

left arrow, right arrow

Move among commands at the bottom of the screen.

Enter key

Select currently highlighted command or value.

b

Toggle flag indicating whether selected partition is bootable.

d

Delete partition (allow other partitions to use its space).

g

Alter the disk's geometry. Prompt for what to change: cylinders, heads, or sectors (c, h, or s, respectively).

h

Help.

m

Attempt to ensure maximum usage of disk space in the partition.

n

Create a new partition. Prompt for more information.

p

Print the partition table to a file. Possible formats are the same as for the-P option.

q

Quit without saving information.

t

Prompt for a new filesystem type, and change to that type.

u

Change the partition-size units. The choice of units rotates from megabytes to sectors to cylinders and back.

W

Save information. Must be uppercase, to prevent accidental writing.

chage

```
chage [options] user
```

Change information about user password expirations. If run without any option flags,chage will prompt for values to be entered; you may also use option flags to change or view information.

Options

-l

This flag is used without any others and causeschage to display the current password expiration attributes for the user.

-m *mindays*

Minimum number of days between password changes. Default is zero, meaning that the user may change the password at any time.

-M *maxdays*

Maximum number of days between password changes.

-d *lastday*

Date of last password change. This may be expressed as a date in*YYYY-MM-DD* format, or as the number of days between January 1, 1970 and the last password change.

-I *inactive-days*

If a password expires and the user does not log in for this number of days, the account will be locked and the user must contact a system administrator before logging in. Set to0 to disable the feature.

-E *expiredate*

Set the date when the account will be locked. This is not a date for password expiration, but fo account expiration. It may be expressed as a *YYYY-MM-DD* date or as a number of days since January 1, 1970.

-W *warning*

The number of days before password expiration that a user will be warned to change passwords.

chattr

```
chattr [options] mode files
```

Modify file attributes. Specific to Linux Second and Third Extended Filesystem (ext2 and ext3). Behaves similarly to symbolic `chmod`, using `+`, `-`, and `=`. *mode* is in the form *opcode attribute*. See also lsattr.

Options

-R

Modify directories and their contents recursively.

-V

Print modes of attributes after changing them.

-v *version*

Set the file's version.

Opcodes

+

Add attribute.

-

Remove attribute.

=

Assign attributes (removing unspecified attributes).

Attributes

A

Don't update access time on modify.

a

Append only for writing. Can be set or cleared only by a privileged user.

c

Compressed.

d

No dump.

i

Immutable. Can be set or cleared only by a privileged user.

j

Journalled file. This is useful only in cases where you are using an ext3 filesystem mounted with the data="ordered" or data="writeback" attributes. The data="journalled" option for the filesystem causes this operation to be performed for all files in the system and makes this option irrelevant.

S

Synchronous updates.

s

Secure deletion. The contents are zeroed on deletion, and the file cannot be undeleted or recovered in any way.

u

Undeletable. This causes a file to be saved even after it has been deleted, so that a user can undelete it later.

Example

```
chattr +a myfile        As superuser
```

chfn

```
chfn [options] [username]
```

Change the information that is stored in */etc/passwd* and displayed to the finger query. Without *options*, chfn enters interactive mode and prompts for changes. To make a field blank, enter the keyword none. Only a privileged user can change information for another user. For regular users, chfn prompts for the user's password before making the change.

Options

-f, --full-name

Specify new full name.

-h, --home-phone

Specify new home phone number.

-o, --office

Specify new office number.

-p, --office-phone

Specify new office phone number.

-u, --usage, --help

Print help message and then exit.

-v, --version

Print version information and then exit.

Example

```
chfn -f "Ellen Siever" ellen
```

chgrp

```
chgrp [options] newgroup files
chgrp [options]
```

Change the group of one or more *files* to *newgroup*. *newgroup* is either a group ID number or a group name located in */etc/group*. Only the owner of a file or a privileged user may change the group.

Options

-c, --changes

Print information about files that are changed.

-f, --silent, --quiet

Do not print error messages about files that cannot be changed.

--help

Print help message and then exit.

-R, --recursive

Traverse subdirectories recursively, applying changes.

--reference=*filename*

Change the group to that associated with *filename*. In this case, *newgroup* is not specified.

-v, --verbose

Verbosely describe ownership changes.

--version

Print version information and then exit.

chkconfig

```
chkconfig [options] [service [flag]]
```

System administration command. Manipulate symbolic links in the*/etc/rc.d/rc[0-6].d* directories. chkconfig manages which services will run in a specified runlevel. Valid flags areon, off, or reset to reset the service to defaults given in its initialization script in*/etc/rc.d/init.d*. To specify defaults in an standard initialization script, add a comment line to the script beginning withchkconfig: followed by the runlevels in which the service should run, and the start and kill priority numbers to assigne.g., chkconfig: 2345 85 15

Options

--add *service*

Create a start or kill symbolic link in every runlevel for the specified service according to defaul behavior specified in the service's initialization script.

--del *service*

Remove entries for specified service from all runlevels.

--level *numbers*

Specify by number the runlevels to change. Provide *numbers* as a numeric string: e.g., 016 for levels 0, 1 and 6. Use this to override specified defaults.

--list [*service*]

Print whether the specified service is on or off in each level. If no service is specified, print runlevel information for all services managed by `chkconfig`.

chmod

```
chmod [options] mode files
chmod [options] --reference=filename files
```

Change the access *mode* (permissions) of one or more *files*. Only the owner of a file or a privileged user may change the mode. *mode* can be numeric or an expression in the form of *who opcode permission*. *who* is optional (if omitted, default is `a`); choose only one *opcode*. Multiple modes are separated by commas.

Options

-c, --changes

Print information about files that are changed.

-f, --silent, --quiet

Do not notify user of files that `chmod` cannot change.

--help

Print help message and then exit.

-R, --recursive

Traverse subdirectories recursively, applying changes.

--reference=*filename*

Change permissions to match those associated with *filename*.

-v, --verbose

Print information about each file, whether changed or not.

--version

Print version information and then exit.

Who

u

User.

g

Group.

o

Other.

a

All (default).

Opcode

+

Add permission.

-

Remove permission.

=

Assign permission (and remove permission of the unspecified fields).

Permissions

r

Read.

w

Write.

x

Execute.

s

Set user (or group) ID.

t

Sticky bit; used on directories to prevent removal of files by non-owners.

u

User's present permission.

g

Group's present permission.

o

Other's present permission.

Alternatively, specify permissions by a three-digit octal number. The first digit designates owner permission; the second, group permission; and the third, other's permission. Permissions are calculated by adding the following octal values:

4

Read.

2

Write.

1

Execute.

Note that a fourth digit may precede this sequence. This digit assigns the following modes:

4

Set user ID on execution to grant permissions to process based on the file's owner, not on permissions of the user who created the process.

2

Set group ID on execution to grant permissions to process based on the file's group, not on permissions of the user who created the process.

1

Set sticky bit.

Examples

Add execute-by-user permission to *file*:

```
chmod u+x  file
```

Either of the following will assign read/write/execute permission by owner (7), read/execute permission by group (5), and execute-only permission by others (1) to*file*:

```
chmod 751  file
chmod u=rwx,g=rx,o=x  file
```

Any one of the following will assign read-only permission to*file* for everyone:

```
chmod =r  file
```

```
chmod 444  file
chmod a-wx,a+r  file
```

The following makes the executable setuid, assigns read/write/execute permission by owner, and assigns read/execute permission by group and others:

```
chmod 4755  file
```

chown

```
chown [options] newowner files
chown [options] --reference=filename files
```

Change the ownership of one or more *files* to *newowner*. *newowner* is either a user ID number or a login name located in */etc/passwd*. chown also accepts users in the form *newowner*:*newgroup* or *newowner.newgroup*. The last two forms change the group ownership as well. If no owner is specified, the owner is unchanged. With a period or colon but no group, the group is changed to that of the new owner. Only the current owner of a file or a privileged user may change the owner.

Options

-c, --changes

Print information about files that are changed.

--dereference

Follow symbolic links.

-f, --silent, --quiet

Do not print error messages about files that cannot be changed.

-h, --no-dereference

Change the ownership of each symbolic link (on systems that allow it), rather than the referenced file.

-v, --verbose

Print information about all files that chown attempts to change, whether or not they are actually changed.

-R, --recursive

Traverse subdirectories recursively, applying changes.

--reference=*filename*

Change owner to the owner of *filename* instead of specifying a new owner explicitly.

--help

Print help message and then exit.

--version

Print version information and then exit.

chpasswd

```
chpasswd [option]
```

System administration command. Change user passwords in a batch. chpasswd accepts input in the form of one *username*:*password* pair per line. If the -e option is not specified, *password* is encrypted before being stored.

Option

-e

Passwords given are already encrypted.

chroot

```
chroot newroot [command]
```

System administration command. Change root directory for*command* or, if none is specified, for a new copy of the user's shell. This command or shell is executed relative to the new root. The meaning of any initial / in pathnames is changed to*newroot* for a command and any of its children. In addition, the initial working directory is*newroot*. This command is restricted to privileged users.

chrt

```
chrt [options] [prio] [pid |command ...]
```

Set or retrieve the real-time scheduling properties of a given process, or run a new process with the given real-time scheduling properties.

Options

-f, --fifo

Use the FIFO (first-in, first-out) scheduling policy.

-h, --help

Display usage information and then exit.

-m, --max

Show the minimum and maximum valid scheduling priorities.

-o, --other

Use the normal (called "other") scheduling policy.

-p, --pid

Operate on the given, existing PID and do not execute a new command.

-r, --rr

Use the round-robin scheduling policy.

-v, --version

Output version information and then exit.

chsh

```
chsh [options] [username]
```

Change your login shell, either interactively or on the command line. Warn if*shell* does not exist in */etc/shells*. Specify the full path to the shell.chsh prompts for your password. Only a privileged user can change another user's shell.

Options

-l, --list-shells

Print valid shells, as listed in */etc/shells*, and then exit.

-s *shell*, --shell *shell*

Specify new login shell.

-u, --help

Print help message and then exit.

-v, --version

Print version information and then exit.

Example

```
chsh -s /bin/tcsh
```

chvt

```
chvt N
```

Switch to virtual terminal *N* (that is, switch to */dev/ttyN*). If you have not created */dev/ttyN*, it will be created when you use this command. There are keyboard shortcuts for this functionality as well. From a graphical desktop, you can press Ctrl-Alt-F1 through F12 to switch to different virtual terminals. In text mode, you can skip the Ctrl key and just use Alt-F1 through F12. To switch back to graphical mode, use Alt-F7.

cksum

```
cksum [files]
```

Compute a cyclic redundancy check (CRC) checksum for all *files*; this is used to ensure that a file was not corrupted during transfer. Read from standard input if the character - is given or no files are given. Display the resulting checksum, the number of bytes in the file, and (unless reading from standard input) the filename.

clear

```
clear
```

Clear the terminal display. Equivalent to pressing Ctrl-L.

cmp

```
cmp [options] file1 file2 [skip1 [skip2]]
```

Compare *file1* with *file2*. Use standard input if *file1* is - or missing. This command is normally used for comparing binary files, although files can be of any type. (See alsodiff.) *skip1* and *skip2* are optional offsets in the files at which the comparison is to start.

Options

-c, --print-chars

Print differing bytes as characters.

-i *num*, --ignore-initial=*num*

Ignore the first *num* bytes of input.

-l, --verbose

Print offsets and codes of all differing bytes.

-s, --quiet, --silent

Work silently; print nothing, but return exit codes:

0

Files are identical.

1

Files are different.

2

Files are inaccessible.

Example

Print a message if two files are the same (exit code is 0):

```
cmp -s old new && echo 'no changes'
```

col

```
col [options]
```

A postprocessing filter that handles reverse linefeeds and escape characters, allowing output fromtbl or nroff to appear in reasonable form on a terminal.

Options

-b

Ignore backspace characters; helpful when printing manpages.

-f

Process half-line vertical motions, but not reverse line motion. (Normally, half-line input motion is displayed on the next full line.)

-l *n*

Buffer at least *n* lines in memory. The default buffer size is 128 lines.

-x

Normally, col saves printing time by converting sequences of spaces to tabs. Use -x to suppress this conversion.

Examples

Run *myfile* through tbl and nroff, then capture output on screen by filtering throughcol and more:

```
tbl myfile | nroff | col | more
```

Save manpage output for the ls command in *out.print*, stripping out backspaces (which would otherwise appear as ^H):

```
man ls | col -b > out.print
```

colcrt

`colcrt [options] [files]`

A postprocessing filter that handles reverse linefeeds and escape characters, allowing output fromtbl or nroff to appear in reasonable form on a terminal. Put half-line characters (e.g., subscripts or superscripts) and underlining (changed to dashes) on a new line between output lines.

Options

-

Do not underline.

-2

Double space by printing all half-lines.

colrm

`colrm [start [stop]]`

Remove specified columns from a file, where a column is a single character in a line. Read from standard input and write to standard output. Columns are numbered starting with 1; begin deleting columns at (including) the *start* column, and stop at (including) the *stop* column. Entering a tab increments the column count to the next multiple of either the*start* or *stop* column; entering a backspace decrements it by 1.

Example

```
colrm 3 5 < test1 > test2
```

column

```
column [options] [files]
```

Format input from one or more *files* into columns, filling rows first. Read from standard input if no files are specified.

Options

-c *num*

Format output into *num* columns.

-s *char*

Delimit table columns with *char*. Meaningful only with -t.

-t

Format input into a table. Delimit with whitespace, unless an alternate delimiter has been provided with -s.

-x

Fill columns before filling rows.

comm

```
comm [options] file1 file2
```

Compare lines common to the sorted files *file1* and *file2*. Output is in three columns, from left to right: lines unique to *file1*, lines unique to *file2*, and lines common to both files. comm is similar to diff in that both commands compare two files. But comm can also be used like uniq; comm selects duplicate or unique lines between *two* sorted files, whereas uniq selects duplicate or unique lines

within the *same* sorted file.

Options

-

Read the standard input.

-*num*

Suppress printing of column *num*. Multiple columns may be specified and should not be space-separated.

--help

Print help message and exit.

--version

Print version information and exit.

Example

Compare two lists of top-10 movies, and display items that appear in both lists:

```
comm -12 siskel_top10 ebert_top10
```

compress

```
compress [options] files
```

Compress one or more *files*, replacing each with the compressed file of the same name with *.Z* appended. If no file is specified, compress standard input. Each file specified is compressed separately. `compress` ignores files that are symbolic links. See also the more common commands `tar`, `gzip`, and `bzip2`.

Options

`-b` *maxbits*

Limit the maximum number of bits.

`-c`

Write output to standard output, not to a *.Z* file.

`-d`

Decompress instead of compressing. Same as `uncompress`.

`-f`

Force generation of an output file even if one already exists.

`-r`

If any of the specified files is a directory, compress recursively.

`-v`

Print compression statistics.

`-V`

Print version and compilation information and then exit.

cp

```
cp [options] file1 file2
cp [options] files directory
```

Copy *file1* to *file2*, or copy one or more *files* to the same names under *directory*. If the destination is an existing file, the file is overwritten; if the destination is an existing directory, the file is copied into the directory (the directory is *not* overwritten).

Options

-a, --archive

Preserve attributes of original files where possible. The same as-dpr.

-b, --backup

Back up files that would otherwise be overwritten.

-d, --no-dereference

Do not dereference symbolic links; preserve hard-link relationships between source and copy.

-f, --force

Remove existing files in the destination.

-i, --interactive

Prompt before overwriting destination files. On most systems, this flag is turned off by default except for the root user, who is normally prompted before overwriting files.

-l, --link

Make hard links, not copies, of nondirectories.

-p, --preserve

Preserve all information, including owner, group, permissions, and timestamps.

-P, --parents

Preserve intermediate directories in source. The last argument must be the name of an existing directory. For example, the command:

```
cp --parents jphekman/book/ch1 newdir
```

copies the file *jphekman/book/ch1* to the file *newdir/jphekman/book/ch1*, creating intermediate directories as necessary.

-r, -R, --recursive

Copy directories recursively.

-S *backup-suffix*, --suffix=*backup*-suffix

Set suffix to be appended to backup files. This may also be set with the SIMPLE_BACKUP_SUFFIX environment variable. The default is ~. You need to explicitly include a period if you want one before the suffix (for example, specify*.bak*, not *bak*).

-s, --symbolic-link

Make symbolic links instead of copying. Source filenames must be absolute.

--sparse=[always|auto|never]

Handle files that have "holes" (are defined as a certain size but have less data).always creates a sparse file, auto creates one if the input file is sparse, and never creates a non-sparse file without holes.

-u, --update

Do not copy a file to an existing destination with the same or newer modification time.

-v, --verbose

Before copying, print the name of each file.

-V *type*, --version-control=*type*

Set the type of backups made. You may also use theVERSION_CONTROL environment variable. The default isexisting. Valid arguments are:

t, numbered

Always make numbered backups.

nil, existing

Make numbered backups of files that already have them; otherwise, make simple backups.

never, simple

Always make simple backups.

-x, --one-file-system

Ignore subdirectories on other filesystems.

Example

Copy the contents of the *guest* directory recursively into the */archives/guest/* directory, and display a message for each file copied:

```
cd /archives && cp -av /home/guest guest
```

cpio

```
cpio flags [options]
```

Copy file archives from or to tape or disk, or to another location on the local machine. Each of the three flags -i, -o, or -p accepts different options.

Flags

-i, --extract [*options*] [*patterns*]

Copy in (extract) from an archive files whose names match selected *patterns*. Each pattern can include Bourne shell filename metacharacters. (Patterns should be quoted or escaped so that they are interpreted by cpio, not by the shell.) If *pattern* is omitted, all files are copied in. Existing files are not overwritten by older versions from the archive unless -u is specified.

-o, --create [*options*]

Copy out to an archive a list of files whose names are given on the standard input.

-p, --pass-through [*options*] *directory*

Copy (pass) files to another directory on the same system. Destination pathnames are interpreted relative to the named *directory*.

Comparison of valid options

Options available to the -i, -o, and -p flags are shown here (the - is omitted for clarity):

```
i:   bcdf mnrtsuv B SVCEHMR IF
o: 0a c          vABL VC HM O F
p: 0a  d lm    uv  L V    R
```

Options

-0, --null

Expect list of filenames to be terminated with null, not newline. This allows files with a newline in their names to be included.

-a, --reset-access-time

Reset access times of input files after reading them.

-A, --append

Append files to an existing archive, which must be a disk file. Specify this archive with -O or -F.

-b, --swap

Swap bytes and half-words to convert between big-endian and little-endian 32-bit integers.

-B

Block input or output using 5120 bytes per record (default is 512 bytes per record).

--blocksize=*size*

Set input or output block size to *size* x 512 bytes.

-c

Read or write header information as ASCII characters; useful when source and destination machines are different types.

-C *n*, --io-size=*n*

Like -B, but block size can be any positive integer *n*.

-d, --make-directories

Create directories as needed.

-E *file*, --pattern-file=*file*

Extract from the archives filenames that match patterns in *file*.

-f, --nonmatching

Reverse the sense of copying; copy all files *except* those that match *patterns*.

-F *file*, --file=*file*

Use file as the archive, not stdin or stdout. *file* can reside on another machine, if given in the form user@hostname:file (where *user*@ is optional).

--force-local

Assume that *file* (provided by -F, -I, or -O) is a local file, even if it contains a colon (:) indicating a remote file.

-H *type*, --format=*type*

Use *type* format. Default for copy-out is bin; default for copy-in is autodetection of the format. Valid formats (all caps also accepted) are:

bin

Binary.

odc

Old (POSIX.1) portable format.

newc

New (SVR4) portable format.

crc

New (SVR4) portable format with checksum added.

tar

Tar.

ustar

POSIX.1 tar (also recognizes GNU tar archives).

hpbin

HP-UX's binary (obsolete).

hpodc

HP-UX's portable format.

-I *file*

Read *file* as an input archive. May be on a remote machine (see -F).

-k

Ignored. For backward compatibility.

-l, --link

Link files instead of copying.

-L, --dereference

Follow symbolic links.

-m, --preserve-modification-time

Retain previous file modification time.

-M *msg*, --message=*msg*

Print *msg* when switching media, as a prompt before switching to new media. Use variable %d in the message as a numeric ID for the next medium. -M is valid only with -I or -O.

-n, --numeric-uid-gid

When verbosely listing contents, show user ID and group ID numerically.

--no-absolute-filenames

Create all copied-in files relative to the current directory.

--no-preserve-owner

Make all copied files owned by yourself, instead of the owner of the original. Can be used only i
you are a privileged user.

-O *file*

Archive the output to *file*, which may be a file on another machine (see -F).

--only-verify-crc

For a CRC-format archive, verify the CRC of each file; don't actually copy the files in.

--quiet

Don't print the number of blocks copied.

-r

Rename files interactively.

-R [*user*][*:group*], --owner [*user*][*:group*]

Reassign file ownership and group information to the user's login ID (privileged users only).

-s, --swap-bytes

Swap bytes of each two-byte half-word.

-S, --swap-half-words

Swap half-words of each four-byte word.

--sparse

For copy-out and copy-pass, write files that have large blocks of zeros as sparse files.

-t, --list

Print a table of contents of the input (create no files). When used with the-v option, resembles output of ls -l.

-u, --unconditional

Unconditional copy; old files can overwrite new ones.

-v, --verbose

Print a list of filenames processed.

-V, --dot

Print a dot for each file read or written (this shows cpio at work without cluttering the screen).

--version

Print version number and then exit.

Examples

Generate a list of files whose names end in *.old* using find; use the list as input to cpio:

```
find . -name "*.old" | cpio -ocBv > /dev/rst8
```

Restore from a tape drive all files whose names contain save (subdirectories are created if needed):

```
cpio -icdv "*save*" < /dev/rst8
```

Move a directory tree:

```
find . -depth | cpio -padm /mydir
```

cpp

`cpp [options] [ifile [ofile]]`

GNU C language preprocessor. `cpp` is normally invoked as the first pass of any C compilation by the `gcc` command. The output of `cpp` is a form acceptable as input to the next pass of the C compiler. The *ifile* and *ofile* options are, respectively, the input and output for the preprocessor; they default to standard input and standard output.

Options

`-$`

Do not allow $ in identifiers.

`-ansi`

Use 1990 ISO C standard. This is equivalent to `-std=c89`.

`-dD`

Similar to `-dM`, but exclude predefined macros and include results of preprocessing.

`-dM`

Suppress normal output. Print series of `#defines` that create the macros used in the source file.

`-dN`

Similar to `-dD`, but don't print macro expansions.

`-dI`

Print `#include` directives in addition to other output.

`-fpreprocessed`

Treat file as already preprocessed. Skip most processing directives, remove all comments, and tokenize file.

-ftabstop=*width*

Set distance between tabstops so columns will be reported correctly in warnings and errors. Default is 8.

-fno-show-column

Omit column numbers in warnings and errors.

-gcc

Define _ _GNUC_ _, _ _GNUC_MINOR_ _, and _ _GNUC_PATCHLEVEL_ _ macros.

--help

Print usage message and exit.

-idirafter *dir*

Search *dir* for header files when a header file is not found in any of the included directories.

-imacros *file*

Process macros in *file* before processing main files.

-include *file*

Process *file* before main file.

-iprefix *prefix*

When adding directories with -iwithprefix, prepend *prefix* to the directory's name.

-isystem *dir*

Search *dir* for header files after searching directories specified with -I but before searching standard system directories.

-iwithprefix *dir*

Append *dir* to the list of directories to be searched when a header file cannot be found in the main include path. If -iprefix has been set, prepend that prefix to the directory's name.

-iwithprefixbefore *dir*

Insert *dir* at the beginning of the list of directories to be searched when a header file cannot be found in the main include path. If -iprefix has been set, prepend that prefix to the directory's name.

-lang-c, -lang-c++, -lang-objc, -lang-objc++

Expect the source to be in C, C++, Objective C, or Objective C++, respectively.

-lint

Display all lint commands in comments as #pragma lint *command*.

-nostdinc

Search only specified, not standard, directories for header files.

-nostdinc++

Suppress searching of directories believed to contain C++-specific header files.

-o *file*

Write output to *file*. (Same as specifying a second filename in the command line.)

-pedantic

Warn verbosely.

-pedantic-errors

Produce a fatal error in every case in which -pedantic would have produced a warning.

-std=*standard*

Specify C *standard* of input file. Accepted values are:

iso9899:1990, c89

1990 ISO C standard.

iso9899:199409

1994 amendment to the 1990 ISO C standard.

iso9899:1999, c99, iso9899:199x, c9x

1999 revised ISO C standard.

gnu89

1990 C Standard with gnu extensions. The default value.

gnu99, gnu9x

1999 revised ISO C standard with gnu extensions.

-traditional

Behave like traditional C, not ANSI.

-trigraphs

Convert special three-letter sequences, meant to represent missing characters on some terminals, into the single character they represent.

-undef

Suppress definition of all nonstandard macros.

-v

Verbose mode.

-version

Print version number, then process file.

--version

Print version number, then exit.

-w

Don't print warnings.

-x *language*

Specify the language of the input file. *language* may be c, c++, objective-c, or assembler-with-cpp. By default, language is deduced from the filename extension. If the extension is unrecognized, the default is c.

-A *name*[=*def*]

Assert *name* with value *def* as if defined by #assert. To turn off standard assertions, use -A-.

-A -name[=*def*]

Cancel assertion *name* with value *def*.

-C

Retain all comments except those found on cpp directive lines. By default, cpp strips C-style comments.

-D*name*[=*def*]

Define *name* with value *def* as if by a #define. If no =*def* is given, *name* is defined with value 1. -D has lower precedence than -U.

-E

Preprocess the source files, but do not compile. Print result to standard output. This option is usually passed from gcc.

-H

Print pathnames of included files, one per line, on standard error.

-I*dir*

Search in directory *dir* for #include files whose names do not begin with / before looking in directories on standard list. #include files whose names are enclosed in double quotes and do not begin with / will be searched for first in the current directory, then in directories named on -I options, and last in directories on the standard list.

-I-

Split includes. Search directories specified by-I options preceding this one for header files included with quotes (#include "file.h") but not for header files included with angle brackets (#include <file.h>). Search directories specified by-I options following this one for all header files.

-M [-MG]

Suppress normal output. Print a rule for make that describes the main source file's dependencies. If -MG is specified, assume that missing header files are actually generated files and look for them in the source file's directory.

-MF *file*

Print rules generated by -M or -MM to *file*.

-MD *file*

Similar to -M, but output to *file*; also compile the source.

-MM

Similar to -M, but describe only those files included as a result of #include "*file*".

-MMD *file*

Similar to -MD, but describe only the user's header files.

-MQ *target*

Similar to -MT, but quote any characters that are special to make.

-MT *target*

Specify the *target* to use when generating a rule for make. By default, the target is based on the name of the main input file.

-P

Preprocess input without producing line-control information used by next pass of the C compiler.

-U*name*

Remove any initial definition of *name*, where *name* is a reserved symbol predefined by the preprocessor, or a name defined on a -D option. Names predefined by cpp are unix and i386 (for Intel systems).

-Wall

Warn both on nested comments and trigraphs.

-Wcomment, -Wcomments

Warn when encountering the beginning of a nested comment.

-Wtraditional

Warn when encountering constructs that are interpreted differently in ANSI than in traditional C.

-Wtrigraphs

Warn when encountering trigraphs, which are three-letter sequences meant to represent missing characters on some terminals.

Special names

cpp understands various special names, some of which are:

_ _DATE_ _

Current date (e.g., Jan 10 2003).

_ _FILE_ _

Current filename (as a C string).

_ _LINE_ _

Current source line number (as a decimal integer).

_ _TIME_ _

Current time (e.g., 12:00:00).

These special names can be used anywhere, including in macros, just like any other defined names. cpp's understanding of the line number and filename may be changed using a#line directive.

Directives

All cpp directive lines start with # in column 1. Any number of blanks and tabs is allowed between the # and the directive. The directives are:

#assert *name (string)*

Define a question called *name*, with an answer of *string*. Assertions can be tested with #if directives. The predefined assertions for #system, #cpu, and #machine can be used for architecture-dependent changes.

#unassert *name*

Remove assertion for question *name*.

#define *name token-string*

Define a macro called *name*, with a value of *token-string*. Subsequent instances of *name* are replaced with *token-string*.

#define *name(arg, ... , arg) token-string*

This allows substitution of a macro with arguments. *token-string* will be substituted for *name* in the input file. Each call to *name* in the source file includes arguments that are plugged into the corresponding *args* in *token-string*.

#undef *name*

Remove definition of the macro *name*. No additional tokens are permitted on the directive line after *name*.

#ident *string*

Put *string* into the comment section of an object file.

#include "*filename*",#include<*filename*>

Include contents of *filename* at this point in the program. No additional tokens are permitted on the directive line after the final " or >.

#line *integer-constant* "*filename*"

Cause cpp to generate line-control information for the next pass of the C compiler. The compiler behaves as if *integer-constant* is the line number of the next line of source code and *filename* (if present) is the name of the input file. No additional tokens are permitted on the directive line after the optional *filename*.

#endif

End a section of lines begun by a test directive (#if, #ifdef, or #ifndef). No additional tokens are permitted on the directive line.

#ifdef *name*

Lines following this directive and up to matching #endif or next #else or #elif will appear in the output if *name* is currently defined. No additional tokens are permitted on the directive line after *name*.

#ifndef *name*

Lines following this directive and up to matching #endif or next #else or #elif will appear in the output if *name* is not currently defined. No additional tokens are permitted on the directive line after *name*.

#if *constant-expression*

Lines following this directive and up to matching #endif or next #else or #elif will appear in the output if *constant-expression* evaluates to nonzero.

#elif *constant-expression*

An arbitrary number of #elif directives are allowed between an #if, #ifdef, or #ifndef directive and an #else or #endif directive. The lines following the #elif and up to the next #else, #elif, or #endif directive will appear in the output if the preceding test directive and all intervening #elif directives evaluate to zero, and the *constant-expression* evaluates to nonzero. If *constant-expression* evaluates to nonzero, all succeeding #elif and #else directives will be ignored.

#else

Lines following this directive and up to the matching #endif will appear in the output if the preceding test directive evaluates to zero, and all intervening #elif directives evaluate to zero. No additional tokens are permitted on the directive line.

#error

Report fatal errors.

#warning

Report warnings, but then continue processing.

crond

```
crond [options]
```

System administration command. Normally started in a system startup file. Execute commands at scheduled times, as specified in users' files in */var/spool/cron*. Each file shares its name with the user who owns it. The files are controlled via the command `crontab`. The `crond` command will also read commands from the */etc/crontab* file and from the */etc/cron.d/* directory. See anacron for scheduling events on systems that are frequently rebooted or powered off, such as notebook computers.

Options

`-n`

Run the command in the foreground.

`-p`

Remove security restrictions on crontab file permissions.

crontab

```
crontab [options] [file]
```

View, install, or uninstall your current *crontab* file. A privileged user can run `crontab` for another user by supplying `-u` *user*. A *crontab* file is a list of commands, one per line, that will execute automatically at a given time. Numbers are supplied before each command to specify the execution time. The numbers appear in five fields, as follows:

```
Minute          0-59
Hour            0-23
Day of month    1-31
Month           1-12
                                              Jan, Feb, Mar, ...
Day of week     0-6, with 0 = Sunday
                                              Sun, Mon, Tue, ...
```

Use a comma between multiple values, a hyphen to indicate a range, and an asterisk to indicate all possible values. For example, assuming these *crontab* entries:

```
59 3 * * 5          find / -print | backup_program
0 0 1,15 * *        echo "Timesheets due" | mail user
```

the first command backs up the system files every Friday at 3:59 a.m., and the second command mails a reminder on the 1st and 15th of each month.

The superuser can always issue the `crontab` command. Other users must be listed in the file */etc/cron.allow* if it exists; otherwise, they must not be listed in */etc/cron.deny*. If neither file exists, only the superuser can issue the command.

Options

The `-e`, `-l`, and `-r` options are not valid if any *files* are specified.

`-e`

Edit the user's current *crontab* file (or create one).

`-l`

Display the user's *crontab* file on standard output.

`-r`

Delete the user's *crontab* file.

`-u` *user*

Indicate which *user*'s *crontab* file will be acted upon.

csplit

```
csplit [options] file arguments
```

Separate *file* into context-based sections and place sections in files named xx00 through xx*n* (*n* < 100), breaking *file* at each pattern specified in *arguments*. See also split.

Options

-

Read from standard input.

-b *suffix*, --suffix-format=*suffix*

Append *suffix* to output filename. This option causes -n to be ignored. *suffix* must specify how to convert the binary integer to readable form by including one of the following: %d, %i, %u, %o, %x, or %X. The value of *suffix* determines the format for numbers as follows:

%d

Signed decimal.

%i

Same as %d.

%u

Unsigned decimal.

%o

Octal.

%x

Hexadecimal.

%X

Same as %x.

-f *prefix*, --prefix=*prefix*

Name new files *prefix*00 through *prefix*n (default is xx00 through xx*n*).

-k, --keep-files

Keep newly created files even when an error occurs (which would normally remove these files) This is useful when you need to specify an arbitrarily large repeat argument,{*n*}, and you don't want an out-of-range error to cause removal of the new files.

-n *num*, --digits=*num*

Use output filenames with numbers*num* digits long. The default is 2.

-s, -q, --silent, --quiet

Suppress all character counts.

-z, --elide-empty-files

Do not create empty output files. However, number as if those files had been created.

Arguments

Any one or a combination of the following expressions may be specified as arguments. Arguments containing blanks or other special characters should be surrounded by single quotes.

/*expr*/ [*offset*]

Create file from the current line up to the line containing the regular expression*expr*. *offset* should be of the form +*n* or -*n*, where *n* is the number of lines below or above*expr*.

%*expr*% [*offset*]

Same as /*expr*/, except no file is created for lines previous to line containing*expr*.

num

Create file from current line up to (but not including) line number*num*. When followed by a repeat count (number inside { }), put the next *num* lines of input into another output file.

{*n*}

Repeat argument *n* times. May follow any of the preceding arguments. Files will split at instances of *expr* or in blocks of *num* lines. If * is given instead of *n*, repeat argument until input is exhausted.

Examples

Create up to 20 chapter files from the file *novel*:

```
csplit -k -f chap. novel '/CHAPTER/' '{20}'
```

Create up to 100 address files (xx00 through xx99), each four lines long, from a database named *address_list*:

```
csplit -k address_list 4 {99}
```

ctags

```
ctags [options] files
```

Create a list of function and macro names defined in a programming source *file*. More than one file may be specified. `ctags` understands many programming languages, including C, C++, FORTRAN, Java, Perl, Python, flex, yacc, and bison. The output list (named *tags* by default) contains lines of the form:

```
name     file     context
```

where *name* is the function or macro name, *file* is the source file in which *name* is defined, and *context* is a search pattern that shows the line of code containing *name*. After the list of tags is created, you can invoke `vi` on any file and type:

```
:set tags= tagsfile
:tag  name
```

This switches the `vi` editor to the source file associated with the *name* listed in *tagsfile* (which you specify with `-t`).

`etags` produces an equivalent file for tags to be used with Emacs.

Options

-a

Append tag output to existing list of tags.

-e

Create tag files for use with emacs.

-h *extensionlist*

Interpret files with filename extensions specified in*extensionlist* as header files. The default list is ".h.H.hh.hpp.hxx.h++.inc.def". To indicate that files without extensions should be treated as header files, insert an additional period in the list before another period or at the end of the list or use just a period by itself. To use this option multiple times and have the specified lists ANDed together, use a plus sign as the first character in the list. To restore the default, use the word "default".

-n

Use numeric ex commands to locate tags. Same as --excmd= number.

-o *file*, -f *file*, --output=*file*

Write to *file*.

--packages-only

Include tag entries for members of structure-like constructs.

-R

Recursively read files in subdirectories of the directory given on the command line.

-u

Don't sort tag entries.

-x

Produce a tabular listing of each function, and its line number, source file, and context.

-B

Search for tags backward through files.

-I *tokenlist*

Specify a list of tokens to be specially handled. If *tokenlist* is given as a file, use ex pattern commands to locate tags. Same as --excmd=pattern.

-N

Use ex pattern commands to locate tags. Same as --excmd= pattern.

-S, --ignore-indentation

Normally ctags uses indentation to parse the tag file; this option tells ctags to rely on indentation less.

-T, --typedefs-and-c++

Include tag entries for typedefs, structs, enums, unions, and C++ member functions.

-V, --version

Print the version number and exit.

cupsd

cupsd *options*

System administration command. Start the print scheduler for the Common UNIX Printing System.

Options

-c *file*

Use specified configuration *file* instead of */etc/cups/cupsd.conf*.

-f

Run scheduler in foreground.

-F

Run scheduler in foreground but detach it from the controlling terminal and current directory. Sometimes used when running `cupsd` from `init`.

cut

`cut` *`options`* [*`files`*]

Cut out selected columns or fields from one or more *files*. In the following options, *list* is a sequence of integers. Use a comma between separate values, and a hyphen to specify a range (e.g.,1-10,15,20 or 50-). See also paste and join.

Options

-b *list*, --bytes *list*

Specify *list* of positions; only bytes in these positions will be printed.

-c *list*, --characters *list*

Cut the column positions identified in *list*. Column numbers start with 1.

-d *c*, --delimiter *c*

Use with -f to specify field delimiter as character *c* (default is tab); special characters (e.g., a space) must be quoted.

-f *list*, --fields *list*

Cut the fields identified in *list*.

-n

Don't split multibyte characters.

-s, --only-delimited

Use with -f to suppress lines without delimiters.

--output-delimiter=*string*

Use *string* as the output delimiter. By default, the output delimiter is the same as the input delimiter.

--help

Print help message and exit.

--version

Print version information and exit.

Examples

Extract usernames and real names from */etc/passwd*:

```
cut -d: -f1,5 /etc/passwd
```

Find out who is logged on, but list only login names:

```
who | cut -d" " -f1
```

Cut characters in the fourth column of *file*, and paste them back as the first column in the same file:

```
cut -c4 file | paste - file
```

cvs

```
cvs [options] cvs-command [command-options] [command-args]
```

CVS (Concurrent Versions System) is a version-control system. Like earlier version-control systems such as RCS, CVS tracks versions, permits the storage and retrieval of earlier versions, and allows tracking of the history of a file or an entire project. In addition, it permits multiple users on different systems across a network to work in a file simultaneously and merge their changes. All CVS commands start with cvs, followed by any global options, the command to execute, and any command options or arguments. For more information on CVS and its commands, seeChapter 1.

date

```
date [options] [+format] [date]
```

Print the current date and time. You may specify a display *format*. *format* can consist of literal text strings (blanks must be quoted) as well as field descriptors, whose values will appear as described in the following entries (the listing shows some logical groupings). A privileged user can change the system's date and time.

Options

+format

Display current date in a nonstandard format. For example:

```
$date +"%A %j %n%k %p"
Tuesday 248
15 PM
```

The default is %a %b %e %T %Z %Y (e.g., Tue Sep 5 14:59:37 EDT 2005).

-d *date*, --date *date*

Display *date*, which should be in quotes and may be in the format *d* days or *m* months *d* days, to print a date in the future. Specify ago to print a date in the past. You may include formatting (see the following section).

-f *datefile*, --file=*datefile*

Like -d, but printed once for each line of *datefile*.

-I [*timespec*], --iso-8601[=*timespec*]

Display in ISO-8601 format. If specified, *timespec* can have one of the following values: date (for date only), hours, minutes, or seconds to get the indicated precision.

-r *file*, --reference=*file*

Display the time *file* was last modified.

-R, --rfc-822

Display the date in RFC 822 format.

--help

Print help message and exit.

--version

Print version information and exit.

-s *date*, --set *date*

Set the date.

-u, --universal

Set the date to Greenwich Mean Time, not local time.

Format

The exact result of many of these codes is locale-specific and depends upon your language setting, particularly the LANG environment variable. See locale.

%

Literal %.

- (hyphen)

Do not pad fields (default: pad fields with zeros).

_ (underscore)

Pad fields with space (default: zeros).

%a

Abbreviated weekday.

%b

Abbreviated month name.

%c

Country-specific date and time format.

%d

Day of month (01-31).

%h

Same as %b.

%j

Julian day of year (001-366).

%k

Hour in 24-hour format, without leading zeros (0-23).

%l

Hour in 12-hour format, without leading zeros (1-12).

%m

Month of year (01-12).

%n

Insert a new line.

%p

String to indicate a.m. or p.m.

%r

Time in %I:%M:%S %p (12-hour) format.

%s

Seconds since "the Epoch," which is 1970-01-01 00:00:00 UTC (a nonstandard extension).

%t

Insert a tab.

%w

Day of week (Sunday = 0).

%x

Country-specific date format based on locale.

%y

Last two digits of year (00-99).

%z

RFC 822-style numeric time zone.

%A

Full weekday.

%B

Full month name.

%D

Date in %m/%d/%y format.

%H

Hour in 24-hour format (00-23).

%I

Hour in 12-hour format (01-12).

%M

Minutes (00-59).

%S

Seconds (00-59).

%T

Time in %H:%M:%S format.

%U

Week number in year (00-53); start week on Sunday.

%V

Week number in year (01-52); start week on Monday.

%W

Week number in year (00-53); start week on Monday.

%X

Country-specific time format based on locale.

%Y

Four-digit year (e.g., 2006).

%Z

Time-zone name.

Strings for setting date

Strings for setting the date may be numeric or nonnumeric. Numeric strings consist of*time*, *day*, and *year* in the format *MMDDhhmm[[CC]YY][.ss]*. Nonnumeric strings may include month strings, time zones, a.m., and p.m.

time

A two-digit hour and two-digit minute (*hhmm*); *hh* uses 24-hour format.

day

A two-digit month and two-digit day of month (*MMDD*); default is current day and month.

year

The year specified as either the full four-digit century and year or just the two-digit year; the default is the current year.

Examples

Set the date to July 1 (0701), 4 a.m. (0400), 2005 (05):

```
date 0701040095
```

The command:

```
date +"Hello%t Date is %D %n%t Time is %T"
```

produces a formatted date as follows:

```
Hello     Date is 05/09/05
     Time is 17:53:39
```

dd

```
dd options
```

Make a copy of an input file (if) using the specified conditions, and send the results to the output file (or standard output if of is not specified). Any number of options can be supplied, althoughif and of are the most common and are usually specified first. Becausedd can handle arbitrary block sizes, it is useful when converting between raw physical devices.

Options

bs=*n*

Set input and output block size to*n* bytes; this option overrides ibs and obs.

cbs=*n*

Set the size of the conversion buffer (logical record length) to*n* bytes. Use only if the conversion *flag* is ascii, ebcdic, ibm, block, or unblock.

conv=*flags*

Convert the input according to one or more (comma-separated)*flags* listed next. The first five *flags* are mutually exclusive.

ascii

EBCDIC to ASCII.

ebcdic

ASCII to EBCDIC.

ibm

ASCII to EBCDIC with IBM conventions.

block

Variable-length records (i.e., those terminated by a newline) to fixed-length records.

unblock

Fixed-length records to variable-length records.

lcase

Uppercase to lowercase.

ucase

Lowercase to uppercase.

noerror

Continue processing after read errors.

notrunc

Don't truncate output file.

swab

Swap each pair of input bytes.

sync

Pad input blocks to ibs with trailing zeros.

count=*n*

Copy only *n* input blocks.

ibs=*n*

Set input block size to *n* bytes (default is 512).

if=*file*

Read input from *file* (default is standard input).

obs=*n*

Set output block size to *n* bytes (default is 512).

of=*file*

Write output to *file* (default is standard output).

seek=*n*

Skip *n* output-sized blocks from start of output file.

skip=*n*

Skip *n* input-sized blocks from start of input file.

--help

Print help message and then exit.

--version

Print the version number and then exit.

You can multiply size values (*n*) by a factor of 1024, 512, or 2 by appending the letter k, b, or w, respectively. You can use the letter x as a multiplication operator between two numbers.

Examples

Convert an input file to all lowercase:

```
dd if=caps_file of=small_file conv=lcase
```

Retrieve variable-length data and write it as fixed-length to out:

```
[data_retrieval_cmd ] | dd of=out conv=sync,block
```

deallocvt

```
deallocvt N
```

Deallocate and destroy the unused virtual console */dev/ttyN*. Multiple consoles may be named with additional spaces and integers: deallocvt 1 4 will deallocate the */dev/tty1* and */dev/tty4* consoles. Consoles are considered unused if they are not in the foreground, have no open processes, and have

no selected text. The command will not destroy consoles that are still active.

debugfs

```
debugfs [[option] device]
```

System administration command. Provide direct access to data structure of an ext2 or ext3 filesystem in order to debug problems with the device.*device* is the special file corresponding to the device containing the filesystem (e.g.,*/dev/hda3*). debugfs may be used on a mounted filesystem device.

Option

-b *blocksize*

Use the specified *blocksize* for the filesystem.

-c

Catastrophic mode. Open the filesystem in read-only mode; do not read the inode and group bitmaps initially.

-f *file*

Read commands from *file*. Exit when done executing commands.

-i

Specify filesystem *device* is an ext2 image file created by e2image.

-s *block*

Read the superblock from the specified *block*.

-w

Open the filesystem in read-write mode.

-R *request*

Execute the given *request* (see list below) then exit.

-V

Print version number, then exit.

Requests

bmap*file logicalblock*

Given the *logicalblock* of inode *file*, print the corresponding physical block.

cat *file*

Dump the contents of an inode to standard output.

cd *directory*

Change the current working directory to *directory*.

chroot *directory*

Change the root directory to be the specified inode.

close

Close the currently open filesystem.

clri *file*

Clear the contents of the inode corresponding to *file*.

dump [-p] *file out_file*

Dump the contents of inode *file* to *out_file*. Change ownership and permissions of *out_file* to match *file* if -p is specified.

expand_dir *directory*

Expand *directory*.

feature [[-]*feature*]

Set filesystem *feature* listed on the command line, then print current feature settings. Use- to clear a *feature*.

find_free_block [[*n*] *goal*]

Find and allocate first *n* free blocks starting from *goal* (if specified).

find_free_inode [*dir* [*mode*]]

Find a free inode and allocate it.

freeb *block* [*n*]

Free *n* blocks beginning from *block*. Default is 1 block.

freei *file*

Free the inode corresponding to *file*.

help

Print a list of commands understood by debugfs.

icheck *block*

Do block-to-inode translation.

imap*file*

Print the location of the inode data structure for *file*.

init_filesys *device blocksize*

Create an ext2 filesystem on *device*.

kill_file *file*

Remove *file* and deallocate its blocks.

lcd *directory*

Change current working *directory* on native filesystem.

ln *source_file dest_file*

Create a link.

logdump [-acs] [-b*block*] [-i*inode*] [-f*journal_file*] [*out_file*]

Print the ext3 journal contents to screen or to the specified*out_file*. Prints the superblock journal by default. Specify other journal information by*block* or *inode*. You can also specify a *journal_file* containing journal data. Use -a to print the contents of descriptor blocks. Use -b to print records referring to a specified block. Use-c to print the hexadecimal and ASCII contents of blocks referenced by the logdump.

ls [-l] [-d] [*pathname*]

Emulate the ls command. Use -l for verbose format and -d to list deleted entries.

modify_inode *file*

Modify the contents of the inode corresponding to*file*.

mkdir *directory*

Make *directory*.

mknod *file* [p|[[c|b] *major minor*]]

Create a special device file.

ncheck *inode*

Do inode-to-name translation.

open [-b blocksize] [-c] [-f] [-i] [-w] [-s block] *device*

Open a filesystem. The options are identical to options fordebugfs.

pwd

Print the current working directory.

quit

Quit debugfs.

rdump *directory dest_directory*

Recursively dump *directory* and its contents to *dest_directory* on the native filesystem.

rm *file*

Remove *file*.

rmdir *directory*

Remove *directory*.

setb *block* [*n*]

Mark *n* blocks as allocated, beginning from *block*. Default is 1 block.

seti *file*

Mark in use the inode corresponding to *file*.

set_super_value [-l] *field value*

Set superblock *field* to *value*. Use -l to print a list of valid fields.

show_super_stats [-h]

List the contents of the superblock and block group descriptors. Use -h to list only the superblock contents.

stat *file*

Dump the contents of the inode corresponding to *file*.

testb *block* [*n*]

Print whether each of *n* blocks is in use, beginning with *block*. By default, just check the specified *block*.

testi *file*

Test whether the inode corresponding to *file* is marked as allocated.

unlink *file*

Remove a link.

write *source_file file*

Create a file in the filesystem named *file*, and copy the contents of *source_file* into the destination file.

depmod

`depmod [options] modules`

System administration command. Create a dependency file for the modules given on the command line. This dependency file can be used by modprobe to automatically load the relevant *modules*. The normal use of depmod is to include the line /sbin/depmod -a in one of the files in */etc/rc.d* so that the correct module dependencies will be available after booting the system.

Options

-a, --all

Create dependencies for all modules listed in */etc/modules.conf*.

-b *dir*, --basedir *dir*

Specify a base directory to use instead of */lib/modules*.

-e, --errsyms

Print a list of all unresolved symbols.

-d

Debug mode. Show all commands being issued.

-h, --help

Print help message, then exit.

-n, --show

Write dependency file to standard output.

-q, --quiet

Don't display error messages about missing symbols.

-r, --root

Allow root to load modules not owned by root.

-s, --syslog

Write error messages to the syslog daemon instead of to standard error.

-v

Print a list of all processed modules.

-A, --quick

Check timestamps and update the dependency file if anything has changed.

-C *file*, --config *file*

Use the specified configuration file instead of*/etc/modules.conf*. May also be set using the MODULECONF environment variable.

-F *file*, --kernelsyms *file*

Use the specified kernel symbol file to build dependencies. Usually this is either a copy of a system's *System.map* file or the output of */proc/ksyms*.

-V, --version

Print version number.

Files

/etc/modules.conf

Information about modules: which ones depend on others, and which directories correspond to particular types of modules.

/sbin/insmod, */sbin/rmmod*

Programs that depmod relies on.

devdump

```
devdump isoimage
```

Interactively display the contents of the device or filesystem image*isoimage*. devdump displays the first 256 bytes of the first 2048-byte sector and waits for commands. The prompt shows the extent number (zone) and offset within the extent, and the contents display at the top of the screen.

Commands

+

Search forward for the next instance of the search string.

a

Search backward within the image.

b

Search forward within the image.

f

Prompt for a new search string.

g

Prompt for a new starting block and go there.

q

Exit.

df

---

df [*options*] [*name*]

Report the amount of free disk space available on all mounted filesystems or on the given *name*. (df cannot report on unmounted filesystems.) Disk space is shown in 1 KB blocks (default) or 512-byte blocks (if the environment variable POSIXLY_CORRECT is set). *name* can be a device name (e.g., */dev/hd**), the directory name of a mounting point (e.g., */usr*), or a directory name (in which case df reports on the entire filesystem in which that directory is mounted).

Options

-a, --all

Include empty filesystems (those with 0 blocks).

--block-size=*n*

Show space as *n*-byte blocks.

-h, --human-readable

Print sizes in a format friendly to human readers (e.g., 1.9G instead of 1967156).

-H, --si

Like -h, but show as power of 1000 rather than 1024.

-i, --inodes

Report free, used, and percent-used inodes.

-k, --kilobytes

Print sizes in kilobytes.

-l, --local

Show local filesystems only.

-m, --megabytes

Print sizes in megabytes.

--no-sync

Show results without invoking sync first (i.e., without flushing the buffers). This is the default.

-P, --portability

Use POSIX output format (i.e., print information about each filesystem on exactly one line).

--sync

Invoke sync (flush buffers) before getting and showing sizes.

-t *type*, --type=*type*

Show only *type* filesystems.

-T, --print-type

Print the type of each filesystem in addition to the sizes.

-x *type*, --exclude-type=*type*

Show only filesystems that are not of type *type*.

--help

Print help message and then exit.

--version

Print the version and then exit.

diff

diff [*options*] [*diroptions*] *file1 file2*

Compare two text files. diff reports lines that differ between *file1* and *file2*. Output consists of lines of context from each file, with *file1* text flagged by a < symbol and *file2* text by a > symbol. Context lines are preceded by the ed command (a, c, or d) that would be used to convert *file1* to *file2*. If one of the files is -, standard input is read. If one of the files is a directory, diff locates the filename in that directory corresponding to the other argument (e.g., diff my_dir junk is the same as diff my_dir/junk junk). If both arguments are directories, diff reports lines that differ between all pairs of files having equivalent names (e.g., *olddir/program* and *newdir/program*); in addition, diff lists filenames unique to one directory, as well as subdirectories common to both. See also cmp.

Options

-a, --text

Treat all files as text files. Useful for checking to see if binary files are identical.

-b, --ignore-space-change

Ignore repeating blanks and end-of-line blanks; treat successive blanks as one.

-B, --ignore-blank-lines

Ignore blank lines in files.

-c

Context diff: print 3 lines surrounding each changed line.

-C *n*, --context[=*n*]

Context diff: print *n* lines surrounding each changed line. The default context is 3 lines.

-d, --minimal

To speed up comparison, ignore segments of numerous changes and output a smaller set of changes.

-D *symbol*, --ifdef=*symbol*

When handling C files, create an output file that contains all the contents of both input files, including #ifdef and #ifndef directives that reflect the directives in both files.

-e, --ed

Produce a script of commands (a, c, d) to re-create *file2* from *file1* using the ed editor.

-F *regexp*, --show-function-line[=*regexp*]

For context and unified diff, show the most recent line containing *regexp* before each block of changed lines.

-H

Speed output of large files by scanning for scattered small changes; long stretches with many changes may not show up.

--help

Print brief usage message.

--horizon-lines=*n*

In an attempt to find a more compact listing, keep *n* lines on both sides of the changed lines when performing the comparison.

-i, --ignore-case

Ignore case in text comparison. Uppercase and lowercase are considered the same.

-I *regexp*, --ignore-matching-lines=*regexp*

Ignore lines in files that match the regular expression *regexp*.

-l, --paginate

Paginate output by passing it to pr.

-L *label*, --label *label*, --label=*label*

For context and unified diff, print *label* in place of the filename being compared. The first such option applies to the first filename and the second option to the second filename.

--left-column

For two-column output (-y), show only left column of common lines.

-n, --rcs

Produce output in RCS diff format.

-N, --new-file

Treat nonexistent files as empty.

-p, --show-c-function

When handling files in C or C-like languages such as Java, show the function containing each block of changed lines. Assumes -c, but can also be used with a unified diff.

-P, --unidirectional-new-file

If two directories are being compared and the first lacks a file that is in the second, pretend that an empty file of that name exists in the first directory.

-q, --brief

Output only whether files differ.

-r, --recursive

Compare subdirectories recursively.

-s, --report-identical-files

Indicate when files do not differ.

-S *filename*, --starting-file=*filename*

For directory comparisons, begin with the file *filename*, skipping files that come earlier in the standard list order.

--suppress-common-lines

For two-column output (-y), do not show common lines.

-t, --expand-tabs

Produce output with tabs expanded to spaces.

-T, --initial-tab

Insert initial tabs into output to line up tabs properly.

-u

Unified diff: print old and new versions of lines in a single block, with 3 lines surrounding each block of changed lines.

-U *n*, --unified[=*n*]

Unified diff: print old and new versions of lines in a single block, with*n* lines surrounding each block of changed lines. The default context is 3 lines.

-v, --version

Print version number of this version of diff.

-w, --ignore-all-space

Ignore all whitespace in files for comparisons.

-W *n*, --width=*n*

For two-column output (-y), produce columns with a maximum width of*n* characters. Default is 130.

-x *regexp*, --exclude=*regexp*

Do not compare files in a directory whose names match*regexp*.

-X *filename*, --exclude-from=*filename*

Do not compare files in a directory whose names match patterns described in the file*filename*.

-y, --side-by-side

Produce two-column output.

-*n*

For context and unified diff, print *n* lines of context. Same as specifying a number with -C or -U.

diff3

`diff3 [`*`options`*`] `*`file1 file2 file3`*

Compare three files and report the differences. No more than one of the files may be given as- (indicating that it is to be read from standard input). The output is displayed with the following codes

`= = = =`

All three files differ.

`= = = =1`

file1 is different.

`= = = =2`

file2 is different.

`= = = =3`

file3 is different.

diff3 is also designed to merge changes in two differing files based on a common ancestor file (i.e., when two people have made their own set of changes to the same file).diff3 can find changes between the ancestor and one of the newer files and generate output that adds those differences to the other new file. Unmerged changes occur where both of the newer files differ from each other and at least one of them differs from the ancestor. Changes from the ancestor that are the same in both of the newer files are called *merged changes*. If all three files differ in the same place, it is called an *overlapping change*.

This scheme is used on the command line, with the ancestor being*file2*, the second filename. Comparison is made between *file2* and *file3*, with those differences then applied to*file1*.

Options

-3, --easy-only

Create an ed script to incorporate into *file1* unmerged, nonoverlapping differences between *file1* and *file3*.

-a, --text

Treat files as text.

-A, --show-all

Create an ed script to incorporate all changes, showing conflicts in bracketed format.

-e, --ed

Create an ed script to incorporate into *file1* all unmerged differences between *file2* and *file3*.

-E, --show-overlap

Create an ed script to incorporate unmerged changes, showing conflicts in bracketed format.

-x, --overlap-only

Create an ed script to incorporate into *file1* all differences where all three files differ (overlapping changes).

-X

Same as -x, but show only overlapping changes, in bracketed format.

-m, --merge

Create file with changes merged (not an ed script).

-L *label*, --label=*label*

Use *label* to replace filename in output.

-i

Append the w (save) and q (quit) commands to ed script output.

-T, --initial-tab

To line tabs up properly in output, begin lines with a tab instead of two spaces.

-v, --version

Print version information and then exit.

dig

```
dig [@server] [options] [name] [type] [class] [query-options]
dig @server name type
dig -h
```

The dig command is used to query DNS servers; it is more flexible than the deprecatednslookup command. When invoked with just the -h option, it displays a list of options for the command. If you use it without any options or arguments, it will search for the root server. The standard arguments are:

server

The server to query. If no server is supplied, dig will check the nameservers listed in */etc/resolv.conf*. The address may be an IPv4 dotted address or an IPv6 colon-delimited address. It may also be a hostname, which dig will resolve (through the nameservers in */etc/resolv.conf*).

name

The domain name to look up.

type

The type of query to perform, such as A, ANY, MX, SIG, and so forth. The default is A, but you may use any valid BIND9 query type.

Options

You may use the following option flags withdig:

-b *address*

Set the source IP address for the query.

-c *class*

Set the class of query. The default value is IN (internet), but you can choose HS for Hesiod or CH for CHAOSNET.

-f *filename*

Operate in batch mode, performing the queries in the file you specify.

-p *portnumber*

Choose the port number for the query. The default value is the standard DNS port, 53.

-t *type*

Set the type of query, as with the query argument. The default value isA, but you may use any valid BIND9 query.

-x *addr*

Use the -x flag for reverse lookups, specifying an IPv4 or IPv6 address. You do not need the name, class, or type arguments if you use the-x flag.

-k *filename*

Specify a TSIG keyfile; used for signed transactions. You can also use the-y key, although this is less secure.

-y *keyname: keyvalue*

Enter the actual key name and value when conducting a signed transaction. Because the key and value can be seen in the output ofps, this is not recommended for use on multiuser systems; use -k instead.

Query options

There are a large number of query optionsfor dig. Each query option is preceded by+, and many have an opposite version beginning withno. For example, the tcp flag is passed as +tcp, and negated with +notcp. Because there are so many options, only a few are discussed here. For greate detail, see the dig manpage.

+tcp, +notcp

Use (or do not use) the TCP protocol instead of the default UDP.

+domain>=*searchdomain*

Perform a search in the domain specified; this is equivalent to using the+search option and

having "searchdomain" as the sole entry in the search list or domain directive of */etc/resolv.conf*.

+search, +nosearch

Use (or do not use) the search list provided in */etc/resolv.conf*. The default is not to use the search list.

+time=*t*

Timeout for queries, in seconds. The default is 5, and the minimum is 1.

+tries=*n*

The number of times to retry UDP queries. The default is 3, and the minimum is 1.

dir

`dir [options] [file]`

List directory contents. `dir` is equivalent to the command `ls -C -b` (list files in columns, sorted vertically, special characters escaped), and it takes the same arguments as`ls`. This is an alternate invocation of the `ls` command and is provided for the convenience of those converting from Microsoft Windows and the DOS shell.

dircolors

`dircolors [options] [file]`

Set the color options for `ls` by changing the LS_COLORS environment variable. If you specify a file, `dircolors` will read it to determine which colors to use. Otherwise, it will use a default set of colors.

Options

The program takes three options in addition to the standard `--help` and `--version` flags:

-p, --print-database

Display the default colors. You can copy this information into a file and change it to suit your preferences, and then run the program with the file as its argument to set the colors to your new values.

-c, --csh, --c-shell

Use csh (C shell) syntax when setting the LS_COLORS variable.

-b, --sh, --bourne-shell

Use the Bourne shell syntax when setting the LS_COLORS variable.

dirname

`dirname` *`pathname`*

Print *pathname*, excluding the last level. Useful for stripping the actual filename from a pathname. If there are no slashes (no directory levels) in *pathname*, `dirname` prints `.` to indicate the current directory. See also `basename`.

disable

`disable` [*`options`*] *`destination`*

Disables access to a printer. Equivalent to `reject`.

Options

`-c`

Cancel all jobs on the destination printer.

`-r` [*reason*]

Enter a reason for your action. If this is left blank, the message is set to "Reason Unknown."

dlpsh

```
dlpsh [-p port]
```

Desktop Link Protocol (DLP) shell. Connects to a PalmOS device on the specified port to execute DLP commands. Within the shell, adding the `--help` flag to any command displays additional help about that command.

Commands

`user`

Display or set username, ID, PCID, and ViewerID.

`ls`

List files. As in Bash and other shells, the `-l` option displays a long-format list, and the `-r` option shows a short list. No other flags are supported.

`df`

Display the amount of free memory (RAM and ROM) on the device. Accepts no flags or arguments.

`time`

Set the PalmOS device time to the current desktop time.

`rm`

Delete a file. There is no undelete process.

`quit`

Exit the shell.

dmesg

`dmesg [options]`

System administration command. Display the system control messages from the kernel ring buffer. This buffer stores all messages since the last system boot, or the most recent ones if the buffer has been filled.

Options

`-c`

Clear buffer after printing messages.

`-n`*level*

Set the level of system message that will display on console.

`-s`*buffersize*

Specify *buffersize* of kernel ring buffer. This is useful if you have changed the kernel default.

dnsdomainname

`dnsdomainname`

TCP/IP command. Print the system's DNS domain name. See also `hostname`.

dnssec-keygen

`dnssec-keygen [options] domain-name`

System administration command. Generate encrypted Secure DNS (DNSSEC) or Transaction

Signatures (TSIG) keys for *domain-name*. When the key is completed, dnssec-keygen prints the key identifier to standard output and creates public and private keyfiles whose names are based on the key identifier and the filename extensions *.key* and *.private*. It creates both files even when using an asymmetric algorithm, such as HMAC-MD5. For more information on Secure DNS, see *DNS and BIND* (O'Reilly), or read RFC 2535.

Options

-a *algorithm*

Specify the cryptographic *algorithm* to use. Accepted values are RSAMD5, RSA, DSA, DH, or HMAC-MD5. DSA or RSA should be used for Secure DNS, and HMAC-MD5 for TSIG.

-b *bitsize*

Specify the key *bitsize*. Accepted values depend on the encryption algorithm used, but, in general, a larger key size means stronger encryption. 128 bits is usually considered reasonably secure, and 512 quite good.

-c *class*

The domain record for which the key is being generated should contain *class*. When this option is not given, a *class* of IN is assumed.

-e

Use a large exponent when generating an RSA key.

-g *generator*

Specify the number to use as a generator when creating a DH (Diffie Hellman) key. Accepted values are 2 and 5.

-h

Print a help message, then exit.

-n *type*

The owner of the key must be of the specified *type*. Accepted values are ZONE, HOST, ENTITY, or USER.

-p *protocol*

Specify the protocol value for the generated key. Accepted values are given in RFC 2535 and other DNS Security RFCs. By default, the value is either 2 (email) or 3 (DNSSEC).

-r *device*

Specify the *device* to use as a source of randomness when creating keys. This can be a device file, a file containing random data, or the string `keyboard` to specify keyboard input. By default, */dev/random* will be used when available, and keyboard input will be used when it is not.

-s *type*

Specify whether the key can be used for authentication, confirmation, both, or neither. Accepted values for *type* are AUTHCONF, NOAUTHCONF, NOAUTH, or NOCONF.

dnssec-makekeyset

`dnssec-makekeyset [options] key-identifiers`

System administration command. Generate a domain keyset from one or more DNS Security keys generated by `dnssec-keygen`. Keysets can be sent to parent zone administrators to be signed with the zone key. The keyset is written to a file with the name *keyset-domainname*. For more information on Secure DNS, see *DNS and BIND* (O'Reilly), or read RFC 2535.

Options

-a

Verify all generated signatures.

-e *end-time*

Specify the date and time the records will expire. The *end-time* may be specified in *yyyymmddhhmmss* notation, or as +*n* seconds from the *start-time*. The default is 30 days from *start-time*.

-h

Print help message, then exit.

-p

Use pseudo-random data to sign the zone key.

-r *device*

Specify the *device* to use as a source of randomness when creating keys. This can be a device file, a file containing random data, or the stringkeyboard to specify keyboard input. By default, */dev/random* will be used when available, and keyboard input will be used when it is not.

-s *start-time*

Specify the date and time the records become valid. The*end-time* may be specified in *yyyymmddhhmmss* notation, or as +*n* seconds from the current time. The default is the current time.

-t *ttl*

Specify the TTL (time to live) in seconds for the KEY and SIG records. Default is 3600 seconds.

dnssec-signkey

```
dnssec-signkey [options] keyset key-identifiers
```

System administration command. Sign a secure DNS*keyset* with the key signatures specified in the list of *key-identifiers*. A zone administrator would use this command to sign a child zone's keyset with the parent zone's keys. For more information on Secure DNS, see*DNS and BIND* (O'Reilly), or read RFC 2535.

Options

-a

Verify generated signatures.

-c *class*

Specify the DNS *class* of the keyset.

-e *end-time*

Specify the date and time the records will expire. The*end-time* may be specified in *yyyymmddhhmmss* notation, or as +*n* seconds from the *start-time*. The default is 30 days from *start-time*.

-h

Print help message, then exit.

-p

Use pseudo-random data to sign the zone key.

-r *device*

Specify the *device* to use as a source of randomness when creating keys. This can be a device file, a file containing random data, or the stringkeyboard to specify keyboard input. By default, */dev/random* will be used when available, and keyboard input will be used when it is not.

-s *start-time*

Specify the date and time the records become valid. The*end-time* may be specified in *yyyymmddhhmmss* notation, or given as +*n* seconds from the current time. The default is the current time.

dnssec-signzone

```
dnssec-signzone [options] zonefile [key-identifiers]
```

System administration command. Sign a secure DNS*zonefile* with the signatures in the specified list of *key-identifiers*. If signed keysets associated with the zone are found in the current directory, include their signatures in the signed zone file. Thednssec-signzone command writes the signed zone information to a file named db-*domainname*.signed. This file should be referenced in a zone statement in a *named.conf* file. For more information on Secure DNS, see *DNS and BIND* (O'Reilly), or read RFC 2535.

Options

-a

Verify generated signatures.

-c *class*

Specify the DNS *class* of the keyset.

-d *directory*

Search *directory* for signed keyfiles.

-e *end-time*

Specify the date and time the records will expire. The*end-time* may be specified in *yyyymmddhhmmss* notation, or given as +*n* seconds from the *start-time*. The default is 30 days from *start-time*.

-f *file*

Write output to the specified *file* instead of the default output file.

-h

Print help message, then exit.

-i *days*

When signing a previously signed zone, replace any records due to expire within the specified number of *days*. The default is one quarter of the number of days between the signature's *start-time* and *end-time*.

-n *threads*

Specify the number of *threads* to use when signing the zone file. The default is one for each detected CPU.

-o *origin*

Specify the zone *origin*. The name of the zone file is the default origin.

-p

Use pseudo-random data to sign the zone key.

-r *device*

Specify the *device* to use as a source of randomness when creating keys. This can be a device file, a file containing random data, or the stringkeyboard to specify keyboard input. By default, */dev/random* will be used when available, and keyboard input will be used when it is not.

-s *start-time*

Specify the date and time the records become valid. The*end-time* may be specified in *yyyymmddhhmmss* notation, or given as +*n* seconds from the current time. The default is the current time.

-t

Print statistics when complete.

doexec

`doexec */path/to/command* [*argv*[0]] ... [*argv*[*n*]]`

Execute the specified command with the specified options and arguments. Differs from the normal exec command in that *argv*[0] may be completely arbitrary, and in that it passes all options to the executable being run.

domainname

`domainname [*name*]`

NFS/NIS command. Set or display name of current NIS domain. With no argument,domainname displays the name of the current NIS domain. Only a privileged user can set the domain name by giving an argument; this is usually done in a startup script.

dosfsck

`dosfsck [*options*] *device*`

`fsck.msdos [`*`options`*`] `*`device`*

System administration command. Similar to `fsck`, but specifically intended for MS-DOS filesystems. When checking an MS-DOS filesystem, `fsck` calls this command. Normally `dosfsck` stores all changes in memory, then writes them when checks are complete.

Options

`-a`

Automatically repair the system; do not prompt the user.

`-d` *file*

Drop the named file from the file allocation table. Force checking, even if kernel has already marked the filesystem as valid. `dosfsck` will normally exit without checking if the system appears to be clean.

`-f`

Save unused cluster chains to files.

`-l`

List pathnames of files being processed.

`-r`

Repair the system, prompting user for advice.

`-t`

Mark unreadable clusters as bad.

`-u` *file*

Attempt to undelete the named file.

`-v`

Verbose mode.

-w

Write changes to disk immediately.

-y

When queried, answer "yes."

-A

Filesystem is an Atari version of MS-DOS.

-V

Repeat test to verify all errors have been corrected.

du

```
du [options] [directories]
```

Print disk usage (as the number of 1 KB blocks used by each named directory and its subdirectories; default is the current directory).

Options

-a, --all

Print disk usage for all files, not just subdirectories.

-b, --bytes

Print sizes in bytes.

-c, --total

In addition to normal output, print grand total of all arguments.

-D, --dereference-args

Follow symbolic links, but only if they are command-line arguments.

-h, --human-readable

Print sizes in human-readable format.

-H, --si

Like -h, but show as power of 1000 rather than 1024.

-k, --kilobytes

Print sizes in kilobytes (this is the default).

-l, --count-links

Count the size of all files, whether or not they have already appeared (i.e., via a hard link).

-L, --dereference

Follow symbolic links.

--exclude=*pattern*

Exclude files that match *pattern*.

--max-depth=*num*

Report sizes for directories only down to *num* levels below the starting point (which is level 0).

-m, --megabytes

Print sizes in megabytes.

-s, --summarize

Print only the grand total for each named directory.

-S, --separate-dirs

Do not include the sizes of subdirectories when totaling the size of parent directories.

-x, --one-file-system

Display usage of files in current filesystem only.

-X, --exclude-from=*file*

Exclude files that match any pattern in*file*.

--help

Print help message and then exit.

--version

Print the version and then exit.

dump

```
dump [options] files
```

System administration command. This simple backup utility accesses ext2 and ext3 file devices directly, quickly backing up files without affecting file access times.*files* may be specified as a mount point or as a list of files and directories to back up. While you can use this on a mounted system, dump may write corrupted information to the backup when the kernel has written only part of its cached information. Dump maintains a record of which files it has saved in*/etc/dumpdates*, and will perform incremental backups after creating an initial full backup. Use therestore command to restore a dump backup.

Options

-a

Write until end-of-media. Default behavior when writing to tape drives.

-A *file*

Create a table of contents for the archive in the specified*file.*

-b*blocksize*

Block size in kilobytes to use in dumped records. By default, it is 10, or 32 when dumping to a tape with a density greater than 6250BPI.

-B*blocks*

Specify number of blocks to write per volume.

-c

Treat target as a 1700-foot-long cartridge tape drive with 8000 bpi. Override end-of-media detection.

-d *density*

Specify tape density.

-D *file*

Write dump information to *file* instead of */etc/dumpdates*.

-E *file*

Exclude inodes specified in *file*.

-f *files*

Write backup volumes to the specified files or devices. Use- to write to standard output. Separate multiple files with a comma. Use*host:file* or user@host*:file* to write to a networked host using either the rmt program or the program specified by the RMT environment variable.

-F *script*

Run *script* at the end of each volume other than the last. dump will pass the current device and volume number to the script. The script should return 0 to continue, 1 to prompt for a new tape, or any other exit value to abort the dump. The script will run with the processes real user and group ID.

-i *inodes*

Specify a comma-separated list of *inodes* to skip.

-l *n*

Ignore the first *n* read errors. dump ignores 32 read errors by default. Specify 0 to ignore all errors. You may need to do this when dumping a mounted filesystem.

-j [*level*]

Compress each block using the bzlib library at the specified compression*level*. By default dump uses level 2 compression.

-k

Use Kerberos authentication when writing to a remote system.

-L *label*

Write the specified volume *label* into the dump header.

-m

Save only metadata when backing up changed but not modified files.

-M

Create a multivolume backup. Treat any filename provided with -f as a prefix.

-n

Use wall to notify members of group operator when prompting for information.

-q

Abort the backup instead of prompting for information when operator input is required.

-Q *file*

Create Quick Access information in the specified file for use byrestore.

-s *n*

Write only *n* feet of tape in a single volume. Prompt for a new tape upon reaching this limit.

-S

Calculate and print the amount of space required to perform the backup, then exit.

-T *date*

Only back up files changed or modified since*date*. This overrides the time given in */etc/dumpdates*.

-u

Update */etc/dumpdates* after completing the backup.

-v

Print verbose information about the dump.

-W

Generate a report on the backup status of all filesystems based on information in */etc/dumpdates* and*/etc/fstab*.

-W

Generate a report of filesystems that need to be backed up. Only report on filesystems listed ir */etc/fstab* and */etc/mtab* that need to be backed up.

-y

Compress each block using the lzo library.

-z[*level*]

Compress each block using the zlib library. If provided, use the specified compression*level*. The default is 2.

dumpe2fs

```
dumpe2fs device
```

System administration command. Print information about*device*'s superblock and blocks group.

Options

-b

List blocks marked as bad.

-f

Force display of filesystems with unknown feature flags.

-h

Display superblock information only.

-i

Specify device is an image file created bye2image.

-ob *superblock*

Specify location of the superblock.

-oB *blocksize*

Specify *blocksize* to use when examining filesystem.

-x

Print block numbers in hexadecimal.

-V

Print version number and exit.

dumpkeys

dumpkeys [*options*]

Print information about the keyboard driver's translation tables to standard output. Further information is available in the manual pages under *keymaps*(5).

Options

-1, --separate-lines

Print one line for each modifier/keycode pair, and prefixplain to each unmodified keycode.

-c*charset*, --charset=*charset*

Specify character set with which to interpret character code values. The default character set is iso-8859-1. The full list of valid character sets is available with the--help option.

--compose-only

Print compose key combinations only. Requires compose key support in the kernel.

-f, --full-table

Output in canonical, not short, form: for each key, print a row with modifier combinations divided into columns.

--funcs-only

Print function-key string definitions only; do not print key bindings or string definitions.

-h, --help

Print help message and the version.

-i, --short-info

Print in short-info format, including information about acceptable keycode keywords in the keytable files; the number of actions that can be bound to a key; a list of the ranges of action codes (the values to the right of a key definition); and the number of function keys that the kernel supports.

--keys-only

Print key bindings only; do not print string definitions.

-l, --long-info

Print the same information as in --short-info, plus a list of the supported action symbols and their numeric values.

-n, --numeric

Print action code values in hexadecimal notation; do not attempt to convert them to symbolic notation.

-S *num*, --shape=*num*

Print using *num* to determine table shape. Values of *num* are:

0

Default.

1

Same as --full-table.

2

Same as --separate-lines.

3

One line for each keycode up to the first hole, then one line per modifier/keycode pair.

e2fsck

```
e2fsck [options] device
fsck.ext2 [options] device
```

System administration command. Checks and repairs a disk, as doesfsck, but specifically designed for ext2 (Linux Second Extended) and ext3 (Third Extended, a journaling version of ext2) filesystems. fsck actually uses this command when checking ext2 and ext3 filesystems. Most often used after a sudden shutdown, such as from a power outage, or when damage to the disk is suspected.

Options

-b *superblock*

Use *superblock* instead of the default superblock.

-c

Find bad blocks using the badblocks command. Specify this option twice to perform the scan with a nondestructive read-write test.

-d

Debugging mode.

-f

Force checking, even if kernel has already marked the filesystem as valid.e2fsck will normally exit without checking if the system appears to be clean.

-j *file*

Use the specified external journal *file*.

-k

Preserve all previously marked bad blocks when using the-c option.

-l *file*

Consult *file* for a list of bad blocks, in addition to checking for others.

-n

Ensure that no changes are made to the filesystem. When queried, answer "no."

-p

"Preen." Repair all bad blocks noninteractively.

-s

Byte-swap the filesystem if necessary to standard (little-endian) byte-order.

-t

Display timing statistics.

-v

Verbose.

-y

When queried, answer "yes."

-B *size*

Expect to find the superblock at *size*; if it's not there, exit.

-C filedescriptor

Write completion information to the specified *filedescriptor*. If 0, print a completion bar.

-D

Optimize directories by reindexing, sorting, and compressing them where possible.

-F

Flush buffer caches before checking.

-L *file*

Consult *file* for list of bad blocks instead of checking filesystem for them.

-S

Byte-swap the filesystem.

e2image

```
e2image [option] device file
```

System administration command. Store disaster recovery data for ext2 filesystem on *device* to image file *file*. Weekly filesystem images can be an important part of a disaster recovery plan.

Option

-r

Create a raw image file that can be checked and debugged using filesystem utilities such as e2fsck or debugfs. Raw images are created as sparse files. Either compress the image file before moving it, or use the --sparse=always option when copying it with cp.

--sparse=[always|auto|never]

Handle files that have "holes" (are defined as a certain size, but have less data).always creates a sparse file, auto creates one if the input file is sparse, and never creates a non-sparse file without holes.

e2label

---

e2label *device* [*label*]

System administration command. Display the filesystem label on an ext2 filesystem*device*. Change filesystem label to *label* if specified.

echo

echo [*options*] [*string*]

Send (echo) the input *string* to standard output. This is the /bin/echo command. echo also exists as a command built into bash. The following character sequences have special meanings:

\a

Alert (bell).

\b

Backspace.

\c

Suppress trailing newline.

\f

Form feed.

\n

Newline.

\r

Carriage return.

\t

Horizontal tab.

\v

Vertical tab.

\\

Literal backslash.

nnn

The octal character whose ASCII code is *nnn*.

Options

-e

Enable character sequences with special meaning. (In some versions, this option is not required in order to make the sequences work.)

-E

Disable character sequences with special meaning.

-n

Suppress printing of newline after text.

--help

Print help message and then exit.

--version

Print version information and then exit.

Examples

```
/bin/echo "testing printer" | lp
/bin/echo "TITLE" > file ; cat doc1 doc2 >> file
/bin/echo "Warning: ringing bell \a"
```

edquota

```
edquota [options] [name]
```

System administration command. Edit filesystem quotas using a text editor. When edits are complete, edquota writes the new information to the binary quota files. Uses the editor specified in the EDITOR environment variable, or vi by default.

Options

-f*filesystem*

Only apply changes to the specified *filesystem*.

-F*format*

Specify filesystem quota *format* to use. See quota for a list of accepted values.

-g

Edit group quotas.

-p*prototype*

Apply the same settings as used for the specified user or group:*prototype*.

-r

Edit quotas on remote systems.

-t

Edit grace times for block and inode quotas.

-T

Edit grace times for individual user or group*name*.

-u

Edit user quotas. (This is the default.)

egrep

```
egrep [options] [regexp] [files]
```

Search one or more *files* for lines that match an extended regular expression *regexp*. `egrep` doesn't support the regular expressions \(, \), *n*, \<, \>, \{, or \}, but it does support the other expressions, as well as the extended set +, ?, |, and ( ). Remember to enclose these characters in quotes. Regular expressions are described in Chapter 7. Exit status is 0 if any lines match, 1 if none match, and 2 for errors.

See `grep` for the list of available options. Also see `fgrep`.

Examples

Search for occurrences of Victor or Victoria in *file*:

```
egrep 'Victor(ia)*'  file
egrep '(Victor|Victoria)'  file
```

Find and print strings such as `old.doc1` or `new.doc2` in *files*, and include their line numbers:

```
egrep -n '(old|new)\.doc?'  files
```

eject

`eject [options] [device]`

Eject removable media such as a CD-ROM, floppy, tape, or JAZ or ZIP disk. You may name the device by its */dev* or */mnt* filename. The */dev* and */mnt* prefixes are optional for any items in the */dev* and */mnt* directories. If no device is named, it is assumed that "cdrom" should be ejected.

Options

The eject command takes the following option flags:

`-h`

Display help information.

`-v, --verbose`

Verbose mode: display additional information about actions.

`-d, --default`

List the default device name rather than doing anything.

`-a, --auto on|1|off|0`

Set the auto-eject mode to on or off (equivalent to 1 or 0, respectively). If auto-eject mode is on, the device is ejected when closed or unmounted.

`-c, --changerslot slotnumber`

If using a CD-ROM changer, select a CD from one of the slots. Slots are enumerated starting with 0, and the CD-ROM drive must not be playing music or mounted to read data.

-t, --trayclose

Close the CD-ROM drive. Not all drives will respond to this command.

-x, --cdspeed speed

Set the speed multiplier for the CD-ROM to an integer, usually a power of 2. Not all devices support this command. Setting the speed to 0 indicates that the drive should operate at its maximum speed.

-n, --noop

Do not perform any actions; merely display the actions that would be performed.

-r, --cdrom

Use CD-ROM commands to eject the drive. Normally, the system will try all methods (CD-ROM, SCSI, floppy, tape) to eject.

-s, --scsi

Use SCSI commands to eject the drive. Normally, the system will try all methods (CD-ROM, SCSI, floppy, tape) to eject.

-f, --floppy

Use floppy commands to eject the drive. Normally, the system will try all methods (CD-ROM, SCSI, floppy, tape) to eject.

-q, --tape

Use tape commands to eject the drive. Normally, the system will try all methods (CD-ROM, SCSI, floppy, tape) to eject.

-p, --proc

Use the mounted files listed in */proc/mounts* rather than in */etc/mtab*.

-V, --version

Display version information, then quit.

elvtune

```
elvtune [options] devices
```

System administration command. Set the latency in the elevator algorithm used to schedule I/O activities for the specified block *devices*. If no options are given, print the current settings for *devices*.

Options

-b *n*

Set the maximum coalescing factor allowed on writes when reads are pending to *n*.

-h

Print help message, then exit.

-r *n*

Set the maximum read latency (basically, the number of sectors to read before writes are allowed) to *n*. The default is 8192.

-v

Print version number, then exit.

-w *n*

Set the maximum write latency (sectors to write before allowing a read) to *n*. The default is 16384.

emacs

```
emacs [options] [files]
```

A text editor and all-purpose work environment. For more information, see Chapter 8.

enable

```
enable -E [destination]
```

Enable printers or printer classes. Part of the CUPS system. More often invoked as accept.

env

```
env [option] [variable=value ... ] [command]
```

Display the current environment or, if an environment *variable* is specified, set it to a new *value* and display the modified environment. If *command* is specified, execute it under the modified environment.

Options

-, -i, --ignore-environment

Ignore current environment entirely.

-u *name*, --unset *name*

Unset the specified variable.

--help

Print help message and then exit.

--version

Print version information and then exit.

envsubst

`envsubst [options] [shell-format]`

Substitutes environment variables in a shell string or script. When used with no options, copies stdin to stdout, replacing any environment variable string, such as $*VARIABLE* or ${*VARIABLE*}, with the appropriate environment variable value. So, "My editor is $EDITOR" would be converted to "My edito is /usr/bin/emacs." Specifying a shell format limits the substitutions to those variables referenced in the shell format.

Options

-h,--help

Print help message and then exit.

-V,--version

Print version information and then exit.

-v,--variables

Display the variables referenced in the shell format, and then exit.

esd

`esd [options]`

Start the Enlightened Sound Daemon, also called EsounD, a sound-mixing daemon that allows multiple applications to access a single audio device at one time.

Options

-d devicename

Use the specified device *devicename*. Some common sound devices are */dev/dsp* and */dev/dsp2*.

-b

Play eight-bit sound.

-r *rate*

Specify the sample rate for the server.

-as *n*

After *n* seconds of inactivity, release the audio device. Set to -1 for "never."

-unix

Use UNIX domain sockets. Default is TCP/IP.

-tcp

Use TCP/IP sockets. This is the default.

-public

Allow remote systems to access the daemon over TCP/IP.

-promiscuous

Disable authentication. Not recommended.

-terminate

When last client exits, quit.

-nobeeps

Do not beep when starting.

-beeps

Beep when starting.

-trust

Allow esd to start even if the */tmp/.esd* directory may be insecure.

-port *n*

Listen on TCP/IP port *n*.

-bind address

Bind to the TCP/IP address specified.

-v, --version

Print version information and quit.

esd-config

```
esd-config [options]
```

Determine the compiler and linker flags that should be used when compiling applications that need tc use EsounD.

Options

--cflags

Display the compiler flags that should be used.

--exec-prefix=[directory]

Determine compiler and linker flags using the specified execution prefix, instead of the one EsounD provides. This option must come before the --libs and --cflags options.

--libs

Display linker flags used to link applications to EsounD.

--prefix=[directory]

Determine compiler and linker flags using the specified installation prefix instead of the one EsounD provides. This option must come before the --libs and --cflags options.

--version

Display the version of esd.

esdcat

---

esdcat [*options*]< *file*

Send audio data from the specified file (usually a pipe) to a sound device using the Enlightened Sound Daemon.

Options

-s servername

Hostname of the server where esd is running. The default is localhost.

-b

Output eight-bit sound.

-m

Output monophonic sound.

-r rate

Specify the sample rate of the output.

esdctl

esdctl [*options*] *command*

Control program for the Enlightened Sound Daemon.

Options

-s *servername:port*

Hostname of the server where esd is running (default is localhost). Port number is optional.

Commands

lock

Allow only local clients to access the daemon.

unlock

Allow remote clients to access the daemon.

standby, off

Stop sound output.

resume, on

Start sound output.

cache *sample*

Cache the specified sample in the daemon's memory.

getid *name*

Retrieve the named sample from the memory.

free *name*

Free the named sample.

play *name*

Play the named sample.

loop *name*

Loop the named sample.

stop *name*

Stop an ongoing loop at the end of the next cycle.

serverinfo

Get server information.

allinfo

Get all available information from server: server, player, sample information.

panstream *id left right set*

Pan for a stream.

pansample *id left right set*

Pan for a sample. Default left and right values are scaled to 256.

standbymode

Check whether the server is in standby mode.

esddsp

`esddsp [options]player args`

Reroute non-esd audio data through esd. This permits you to control all the audio on the system using only esd.

Options

-s, --server=*servername*:port

Host name of the server where esd is running. The default is localhost.

-h, --help

Show help message.

-m, --mixer

Use esd as a mixer.

-n, --name=*player*

Specify name of player.

-v, --verbose

Verbose output: show parameters.

--mmap

Use memory-mapping emulation. Good for memory-intensive applications such as 3-D games.

esdmon

esdmon [*options*]*file*

Duplicate the sound being sent to the sound device, and send it to a secondary location as well. The file argument specifies where the output stream should go; default is stdout.

Options

-s servername:port

Set the EsounD server to be used.

-b

Eight bit output.

-m

Monophonic output.

-r *rate*

Set the output sample rate.

esdplay

`esdplay [options]file`

Play the file through the EsounD system.

Options

-s,--server=*servername*:port

Set the EsounD server that will play the audio.

-h,--help

Set the EsounD server that will play the audio.

-v,--version

Display version information and quit.

esdrec

esdrec [*options*]< *file*

Record audio to the specified file.

Options

-s *servername:port*

Set the EsounD server to be used.

-b

Eight bit output.

-m

Monophonic output.

-r *rate*

Set the output sample rate.

esdsample

`esdsample [options]< file`

Sample audio using esd.

Options

-s *servername:port*

Set the EsounD server to be used.

-b

Eight bit output.

-m

Monophonic output.

-r

Set the sample rate in bits per second.

-d

Set the duration of the sample in seconds.

etags

`etags [options] files`

Create a list of function and macro names defined in a programming source *file*. `etags` generates tags for use by `emacs`. (`ctags` produces an equivalent tags file for use with `vi`.) More than one file may be specified. `etags` understands many programming languages, including C, C++, FORTRAN, Java, Perl, Python, `flex`, `yacc`, and `bison`. The output list (named *TAGS* by default) contains lines of the form:

name file context

where *name* is the function or macro name, *file* is the source file in which *name* is defined, and *context* is a search pattern that shows the line of code containing *name*. After the list of tags is created, you can invoke Emacs on any file and type:

M-x visit-tags-table

You will be prompted for the name of the tag table; the default is *TAGS*. To switch to the source file associated with the *name* listed in *tagsfile*, type:

M-x find-tag

You will be prompted for the tag you would like Emacs to search for.

Options

-a, --append

Append tag output to existing list of tags.

-d, --defines

Include tag entries for C preprocessor definitions.

-i *file*, --include=*file*

Add a note to the tags file that *file* should be consulted in addition to the normal input file.

-l *language*, --language=*language*

Consider the files that follow this option to be written in *language*. Use the -h option for a list of languages and their default filename extensions.

-o *file*, --output=*file*

Write to *file*.

-r *regexp*, --regex=*regexp*

Include a tag for each line that matches *regexp* in the files following this option.

-C, --c++

Expect *.c* and *.h* files to contain C++, not C, code.

-D, --no-defines

Do not include tag entries for C preprocessor definitions.

-H, -h, --help

Print usage information.

-R, --noregex

Do not include tags based on regular-expression matching for the files that follow this option.

-S, --ignore-indentation

Normally, etags uses indentation to parse the tag file; this option tells it to rely on it less.

-V, --version

Print the version number.

ex

```
ex [options] file
```

An interactive command-based editor. For more information, seeChapter 9.

expand

```
expand [options] [files]
```

Convert tabs in given files (or standard input, if the file is named -) to appropriate number of spaces; write results to standard output.

Options

-tabs, -t tabs, --tabs *tabs*

tabs is a comma-separated list of integers that specify the placement of tab stops. If exactly one integer is provided, the tab stops are set to every *integer* spaces. By default, tab stops are eight spaces apart. With -t and --tabs, the list may be separated by whitespace instead of commas.

-i, --initial

Convert tabs only at the beginning of lines.

--help

Print help message and then exit.

--version

Print version information and then exit.

expr

`expr` *arg1 operator arg2* [*operator arg3 ...*]

Evaluate arguments as expressions and print the results. Arguments and operators must be separated by spaces. In most cases, an argument is an integer, typed literally or represented by a shell variable. There are three types of operators: arithmetic, relational, and logical, as well as keyword expressions. Exit status for `expr` is 0 (expression is nonzero and nonnull), 1 (expression is 0 or null), or 2 (expression is invalid).

Arithmetic operators

Use these to produce mathematical expressions whose results are printed:

+

Add *arg2* to *arg1*.

-

Subtract *arg2* from *arg1*.

*

Multiply the arguments.

/

Divide *arg1* by *arg2*.

%

Take the remainder when *arg1* is divided by *arg2*.

Addition and subtraction are evaluated last, unless they are grouped inside parentheses. The symbols *, (, and) have meaning to the shell, so they must be escaped (preceded by a backslash or enclosed in single quotes).

Relational operators

Use these to compare two arguments. Arguments can also be words, in which case comparisons are defined by the locale. If the comparison statement is true, the result is 1; if false, the result is 0. Symbols > and < must be escaped.

=, ==

Are the arguments equal?

!=

Are the arguments different?

>

Is *arg1* greater than *arg2*?

>=

Is *arg1* greater than or equal to *arg2*?

<

Is *arg1* less than *arg2*?

<=

Is *arg1* less than or equal to *arg2*?

Logical operators

Use these to compare two arguments. Depending on the values, the result can be*arg1* (or some portion of it), *arg2*, or 0. Symbols | and & must be escaped.

|

Logical OR; if *arg1* has a nonzero (and nonnull) value, the result is *arg1*; otherwise, the result is *arg2*.

&

Logical AND; if both *arg1* and *arg2* have a nonzero (and nonnull) value, the result is *arg1*; otherwise, the result is 0.

:

Like `grep`; *arg2* is a pattern to search for in *arg1*. *arg2* must be a regular expression. If part of the *arg2* pattern is enclosed in `\( \)` (escaped parentheses), the result is the portion of *arg1* that matches; otherwise, the result is simply the number of characters that match. By default, a pattern match always applies to the beginning of the first argument (the search string implicitly begins with a `^`). Start the search string with `.*` to match other parts of the string.

Keywords

index *string character-list*

Return the first position in *string* that matches the first possible character listed in *character-list*. Continue through *character-list* until a match is found, or return 0.

length *string*

Return the length of *string*.

match *string regex*

Same as *string* : *regex*.

quote *token*

Treat *token* as a string, even if it would normally be a keyword or an operator.

substr *string start length*

Return a section of *string*, beginning with *start*, with a maximum length of *length* characters. Return null when given a negative or nonnumeric *start* or *length*.

Examples

Division happens first; result is 10:

```
expr 5 + 10 / 2
```

Addition happens first; result is 7 (truncated from 7.5):

```
expr \( 5 + 10 \) / 2
```

Add 1 to variable *i*. This is how variables are incremented in shell scripts:

```
i=`expr $i + 1`
```

Print 1 (true) if variable a is the string "hello":

```
expr $a = hello
```

Print 1 (true) if b plus 5 equals 10 or more:

```
expr $b + 5 \>= 10
```

Find the 5th, 6th, and 7th letters of the word *character*:

```
expr substr character 5 3
```

In the examples that follow, variable p is the string "version.100". This command prints the number of characters in p:

```
expr $p : '.*'      Result is 11
```

Match all characters and print them:

```
expr $p : '\(.*\)'    Result is "version.100"
```

Print the number of lowercase letters at the beginning of `p`:

```
expr $p : '[a-z]*'    Result is 7
```

Match the lowercase letters at the beginning of `p`:

```
expr $p : '\([a-z]*\)'     Result is "version"
```

Truncate `$x` if it contains five or more characters; if not, just print `$x`. (Logical OR uses the second argument when the first one is 0 or null, i.e., when the match fails.)

```
expr $x : '\(.....\)' \| $x
```

In a shell script, rename files to their first five letters:

```
mv $x `expr $x : '\(.....\)' \| $x`
```

(To avoid overwriting files with similar names, use `mv -i`.)

factor

```
factor [options] n
```

Calculate and display the prime factors of number *n*. If *n* is not specified, numbers are read from stdin, separated by commas, spaces, or tabs. This may take a very long time for numbers that are the product of two primes.

Options

--help

Display help information.

--version

Display version information.

Example:

```
user@systemname:~> factor 60
60: 2, 2, 3 5
```

false

```
false
```

A null command that returns an unsuccessful (nonzero) exit status. Normally used inbash scripts. See also `true`.

fc-cache

```
fc-cache [options] [dirs]
```

Create font information caches for fontconfig system. This enables applications that use fontconfig to load fonts more rapidly. If no directory is specified, the current font configuration directories are used. Only fonts readable by FreeType are cached.

Options

-f,--force

Regenerate cache files, even if they seem to be up to date.

-s,--system-only

Scan directories of fonts for the whole system, not the fonts in the user's home directory.

-v,--verbose

Verbose mode: display status information during operation.

-V,--version

Display version information.

-?,--help

Display help information.

fc-list

`fc-list [options] [pattern] [element]`

Part of the fontconfig system. Lists available fonts and font styles. The first argument will limit listed fonts to those matching the pattern, and the second displays the listed font attribute or element. To set the element argument without setting a pattern, use the `:` character to match all fonts. For example, `fc-list : family` will display all available fonts, with their font family information.

Options

-v,--verbose

Verbose mode: display status information during operation.

-?,--help

Display help message

-V,--version

Display version information and quit.

fdformat

```
fdformat [option] device
```

Low-level format of a floppy disk. The device for a standard format is usually*/dev/fd0* or */dev/fd1*.

Option

-n

Do not verify format after completion.

fdisk

```
fdisk [options] [device]
```

System administration command. fdisk displays information about disk partitions, creates and deletes disk partitions, and changes the active partition. It is possible to assign a different operating system to each of the four possible primary partitions, though only one partition is active at any given time. You can also divide a physical partition into several logical partitions. The minimum recommended size for a Linux system partition is 40 MB. Normally, each*device* will be */dev/hda*, */dev/hdb*, */dev/sda*, */dev/sdb*, */dev/hdc*, */dev/hdd*, and so on. An interactive, menu-driven mode is also available. Note that this command can be destructive if used improperly.

Options

-b sectorsize

Set the size of individual disk sectors. May be 512, 1024, or 2048. Most systems now recognize sector sizes, so this is not necessary.

-l

List partition tables and exit.

-u

Report partition sizes in sectors instead of cylinders.

-s *partition*

Display the size of *partition*, unless it is a DOS partition.

-v

Print version number, then exit.

-C cylinders

Specify the number of *cylinders* on the disk.

-H *heads*

Specify the number of heads per cylinder.

-S sectors

Specify *sectors* per track for partitioning.

Commands

a

Toggle a bootable flag on current partition.

b

Edit disklabel of a BSD partition.

c

Toggle DOS compatibility flag.

d

Delete current partition.

l

List all partition types.

m

Main menu.

n

Create a new partition; prompt for more information.

o

Create an empty DOS partition table.

p

Print a list of all partitions and information about each.

q

Quit; do not save.

t

Replace the type of the current partition.

u

Modify the display/entry units, which must be cylinders or sectors.

v

Verify: check for errors, and display a summary of the number of unallocated sectors.

w

Save changes and exit.

x

Switch to expert commands.

Example

To list all partitions currently on the system:

```
fdisk -l
```

fetchmail

```
fetchmail [options] [servers...]
```

System administration command. Retrieve mail from mail servers and forward it to the local mail delivery system. fetchmail retrieves mail from servers that support the common mail protocols POP2, POP3, IMAP2bis, and IMAP4. Messages are delivered via SMTP through port 25 on the local host and through your system's mail delivery agent (such as*sendmail*), where they can be read through the user's mail client. fetchmail settings are stored in the *~/.fetchmailrc* file. Parameters and servers can also be set on the command line, which will override settings in the*.fetchmailrc* file. fetchmail is compatible with the popclient program, and users can use both without having to adjust file settings.

Options

-a,--all

Retrieve all messages from server, even ones that have already been seen but are left on the server. The default is to retrieve only new messages.

--auth *type*

Specify an authentication type. *type* can be: password, kerberos_v5, kerberos, gssapi, cram-md5, otp, ntlm, ssh, or any. When using the default value, any, fetchmail will use the highest authentication available. In decreasing order of security,*types* are gssapi, kerberos, cram, x-otp, ntlm, and login. Using ssh suppresses authentication. Use ssh when using an end-to-end secure connection.

-b *n*,--batchlimit *n*

Set the maximum number of messages sent to an SMTP listener per connection. When this limit is reached, the connection will be broken and reestablished. The default of 0 means no limit.

-bsmtp *file*

Append fetched mail to the specified batched sendmail (BSMTP)*file*. If *file* is -, send to standard output.

-B *n*,--fetchlimit n

Set the maximum number of messages (*n*) accepted from a server per query.

-c,--check

Check for mail on a single server without retrieving or deleting messages. Works with IMAP, and is partially functional for POP3 systems, but not POP2 systems.

-d n,--daemon n

Detach from current process and run as a daemon, fetching mail every*n* seconds. A user may run only one fetchmail daemon process. See option--quit.

-D [domain],--smtpaddress [domain]

Specify the *domain* name placed in RCPT TO lines sent to SMTP. The default is the local host.

-e n,--expunge n

Tell an IMAP server to EXPUNGE (i.e., purge messages marked for deletion) after*n* deletes. A setting of 0 indicates expunging only at the end of the session. Normally, an expunge occurs after each delete.

-E header,--envelope header

Change the header assumed to contain the mail's envelope address (usually "X-Envelope-to:") to *header*.

-f file,--fetchmailrc file

Specify a nondefault name for the fetchmail configuration file.

--fetchdomains hosts

Specify the domains to which mail should be sent when operating in ETRN or ODMR mode.

-F,--flush

For POP3 and IMAP servers, remove previously retrieved messages from the server before retrieving new ones.

-i file,--idfile file

Store POP3 UIDs in *file* instead of the default *.fetchids* file.

--invisible

Suppress Received header and spoof the MTA so it looks like mail comes directly from the mailserver host.

-I specification,--interface specification

Require that the mail server machine is up and running at a specified IP address (or range) before polling. The *specification* is given as *interface/ipaddress/mask*. The first part indicates the type of TCP connection expected (*sl0*, *ppp0*, etc.), the second is the IP address, and the third is the bit mask for the IP, assumed to be 255.255.255.255.

-k,--keep

Keep copies of all retrieved messages on the mail server.

-K,--nokeep

Delete all retrieved messages from the mail server.

-l size,--limit size

Set the maximum message size that will be retrieved from a server. Messages larger than this size will be left on the server and marked unread.

-lmtp

Deliver fetched mail via LMTP instead of SMTP. The server, specified with the-S option, must explicitly include the port to be used.

-L file,--logfile file

Redirect status messages to the specified *file*. This option is primarily for use in debugging. See the --syslog option.

-m command,--mda command

Pass mail directly to mail delivery agent instead of sending to port 25. The*command* is the path and options for the mailer, such as /usr/lib/sendmail -oem. A %T in the command will be replaced with the local delivery address, and an %F will be replaced with the message's From address.

-M interface,--monitor interface

In daemon mode, monitor the specified TCP/IP *interface* for any activity besides itself, and skip the poll if there is no other activity. Useful for PPP connections that automatically time out with no activity.

-n,--norewrite

Do not expand local mail IDs to full addresses. This option will disable expected addressing and should be used only to find problems.

--nobounce

Do not bounce error messages back to the sender; send them to the postmaster instead.

--nosyslog

Turn off logging to syslogd. This option overrides resource file settings and the -L option.

-N,--nodetach

Run command in the foreground. Useful for debugging a configuration file that normally would run fetchmail as a daemon. Also causes fetchmail to ignore -L or --syslog options.

-p proto,--protocol proto

Specify the protocol to use when polling a mail server.*proto* can be:

AUTO

Attempt IMAP, POP3, then POP2.

POP2

Post Office Protocol 2.

POP3

Post Office Protocol 3.

APOP

POP3 with MD5 authentication.

KPOP

POP3 with Kerberos v4 authentication on port 1109.

RPOP

POP3 with RPOP authentication.

SDPS

Demon Internet's Standard Dial-up POP3 Service.

IMAP

IMAP2bis, IMAP4, or IMAP4rev1. fetchmail autodetects their capabilities.

ETRN

Extended SMTP with Extended TURN command.

ODMR

On Demand Mail Relaying.

--plugin command

Use external program to establish the TCP connection. The *command* is the path and options for the external program. Use escape codes %h and %p in *command* to pass the hostname and port as arguments to the external program. When using this command, fetchmail will write to the program's standard input and read from its standard output.

--plugout command

Same as the --plugin option, but used to establish SMTP connections.

--principal principal

Authenticate using the specified service *principal*. Used with POP3 or IMAP with Kerberos

authentication.

--postmaster name

If unable to deliver mail, deliver it to *name*. Set *name* to "" to have undeliverable mail discarded.

-P n,--port n

Specify a port to connect to on the mail server. The default port numbers for supported protocols are usually sufficient.

-q,--quit

Kill a running daemon process before performing any other commands.

-Q string,--qvirtual string

Remove the prefix *string*, which is the local user's hostid, from the address in the envelope header (such as "Delivered-To:").

-r folder,--folder folder

Retrieve the specified mail *folder* from the mail server.

-s,--silent

Suppress status messages during a fetch.

--showdots

Always display progress dots. By default, fetchmail prints progress dots only when the current tty is standard output.

--smtpname user

Specify the user and domain name to use in RCPT TO lines sent to SMTP. *user* should be in the form *user@domain*. By default, fetchmail uses the local user and domain.

--syslog

Redirect status and error messages to the syslog daemon.

--ssl

Encrypt connection to mail server using Secure Socket Layer.

--sslcert file

Specify the *file* containing the client-side public SSL certificate.

--sslkey file

Specify the *file* containing the client-side private SSL key.

--sslproto proto

Specify a specific SSL protocol to use.*proto* may be ssl2, ssl3, or tls1.

--sslcertck

Fail unless the server's certificate has been signed by a local list of trusted certificates.*proto* may be ssl2, ssl3, or tls1.

--sslcertpath directory

Specify the directory containing trusted certificates to be used with--sslcertck.

--sslfingerprint hash

Fail unless the server's key fingerprint matches the specified fingerprint*hash*. *hash* is an MD5 hash of the server's key given in hexadecimal notation, using colons to separate groups of two digits. Letter hex digits must be in uppercase.

-S hostlist,-smtphost hostlist

Attempt to forward mail to one of the SMTP hosts listed in the comma-separated*hostlist*. The hosts are tried in the order they are given. The host may be a domain name, IP address, or the directory path to an LMTP socket. Port numbers can be appended to domain names and IP addresses using */port* notation.

-t n,--timeout n

Set the nonresponse timeout to *n* seconds.

--tracepolls

Add information about the account and server being polled to the Received header of each message received.

-u name,--username name

Specify the user *name* to use when logging into the mail server.

-U,--uidl

For POP3, track the age of kept messages via unique ID listing.

-v,--verbose

Display all status messages during a fetch.

-V,--version

Print the version information for fetchmail and display the options set for each mail server. Perform no fetch.

-w n,--warnings n

When issuing warnings about oversized messages, wait *n* seconds after each warning before sending another warning.

-Z nnn,--antispam nnn

Specify the SMTP error *nnn* to signal a spam block from the client. If *nnn* is -1, this option is disabled. Multiple SMTP codes may be given as a comma-separated list. By default, fetchmail discards messages with error codes 571, 550, 501, and 554.

fgconsole

`fgconsole`

Print the number of the current virtual console. For example, if you are using */dev/tty1*, the command would return 1.

fgrep

`fgrep [options] string [files]`

Search one or more *files* for lines that match the specified text *string*. Exit status is 0 if any lines match, 1 if not, and 2 for errors. fgrep is faster than normal grep searches, but less flexible: it can only find fixed text, not regular expressions.

See grep for the list of available options. Also see egrep.

Examples

Print lines in *file* that don't contain any spaces:

```
fgrep -v ' '  file
```

Print lines in *file* that contain the words in the file spell_list:

```
fgrep -f spell_list  file
```

file

```
file [options] files
```

Classify the named *files* according to the type of data they contain. file checks the magic file (usually */usr/share/magic*) to identify some file types.

Options

`-b`

Brief mode; do not prepend filenames to output lines.

`-c`

Check the format of the magic file (*files* argument is invalid with `-c`). Usually used with `-m`.

-f file

Read the names of files to be checked from *file*.

-L

Follow symbolic links. By default, symbolic links are not followed.

-m file

Search for file types in *file* instead of */usr/share/magic*.

-n

Flush standard output after checking a file.

-s

Check files that are block or character special files in addition to checking ordinary files.

-v

Print the version.

-z

Attempt checking of compressed files.

Many file types are understood. Output lists each filename, followed by a brief classification such as:

```
ascii text
c program text
c-shell commands
data
empty
iAPX 386 executable
directory
[nt]roff, tbl, or eqn input text
shell commands
symbolic link to ../usr/etc/arp
```

Example

List all files that are deemed to be `troff`/`nroff` input:

```
file * | grep roff
```

find

```
find [pathnames] [conditions]
```

An extremely useful command for finding particular groups of files (numerous examples follow this description). find descends the directory tree beginning at each *pathname* and locates files that meet the specified *conditions*. The default pathname is the current directory. The most useful conditions include -name and -type (for general use), -exec and -size (for advanced use), and -mtime and -user (for administrators).

Conditions may be grouped by enclosing them in \(\) (escaped parentheses), negated with !, given as alternatives by separating them with -o, or repeated (adding restrictions to the match; usually only for -name, -type, or -perm). Note that "modification" refers to editing of a file's contents, whereas "change" means a modification, or permission or ownership changes. In other words,-ctime is more inclusive than -atime or -mtime.

Conditions and actions

-amin +n| -n| n

Find files last accessed more than *n* (+*n*), less than *n* (-*n*), or exactly *n* minutes ago.

-anewer file

Find files that were accessed after *file* was last modified. Affected by -follow when after -follow on the command line.

-atime +n| -n| n

Find files that were last accessed more than *n* (+*n*), less than *n* (-*n*), or exactly *n* days ago. Note that find changes the access time of directories supplied as *pathnames*.

-cmin +n| -n| n

Find files last changed more than *n* (+*n*), less than *n* (-*n*), or exactly *n* minutes ago.

-cnewer file

Find files that were changed after they were last modified. Affected by-follow when after -follow on the command line.

-ctime +n| -n| n

Find files that were changed more than*n* (+*n*), less than *n* (-*n*), or exactly *n* days ago. A change is anything that changes the directory entry for the file, such as achmod.

-daystart

Calculate times from the start of the day today, not 24 hours ago.

-depth

Descend the directory tree, skipping directories and working on actual files first, and then the parent directories. Useful when files reside in unwritable directories (e.g., when usingfind with cpio).

-empty

Continue if file is empty. Applies to regular files and directories.

-exec command{ } \ ;

Run the Linux *command*, from the starting directory on each file matched by find (provided *command* executes successfully on that filei.e., returns a 0 exit status). When*command* runs, the argument { } substitutes the current file. Follow the entire sequence with an escaped semicolon (\;). In some shells, the braces may need to be escaped as well.

-false

Return false value for each file encountered.

-follow

Follow symbolic links and track the directories visited (don't use with-type l).

-fstype type

Match files only on *type* filesystems. Acceptable types include minix, ext, ext2, xia, msdos, umsdos, vfat, proc, nfs, iso9660, hpfs, sysv, smb, and ncpfs.

-gid num

Find files with numeric group ID of *num*.

-group gname

Find files belonging to group *gname*. *gname* can be a group name or a group ID number.

-ilname pattern

A case-insensitive version of -lname.

-iname pattern

A case-insensitive version of -name.

-inum n

Find files whose inode number is *n*.

-ipath pattern

A case-insensitive version of -path.

-iregex pattern

A case-insensitive version of -regex.

-links n

Find files having *n* links.

-lname pattern

Search for files that are symbolic links, pointing to files named *pattern*. *pattern* can include shell metacharacters and does not treat / or . specially. The match is case-insensitive.

-maxdepth num

Do not descend more than *num* levels of directories.

-mindepth num

Begin applying tests and actions only at levels deeper than *num* levels.

-mmin +n| -n| n

Find files last modified more than *n* (+*n*), less than *n* (-*n*), or exactly *n* minutes ago.

-mount, -xdev

Search only for files that reside on the same filesystem as *pathname*.

-mtime +n| -n| n

Find files that were last modified more than *n* (+*n*), less than *n* (-*n*), or exactly *n* days ago. A modification is a change to a file's data.

-name pattern

Find files whose names match *pattern*. Filename metacharacters may be used but should be escaped or quoted.

-newer file

Find files that were modified more recently than *file*; similar to -mtime. Affected by -follow only if it occurs after -follow on the command line.

-nogroup

The file's group ID does not correspond to any group.

-noleaf

Normally, find assumes that each directory has at least two hard links that should be ignored (a hard link for its name and one for "."--i.e., two fewer "real" directories than its hard link count indicates). -noleaf turns off this assumption, a useful practice when find runs on non-Unix-style filesystems. This forces find to examine all entries, assuming that some might prove to be directories into which it must descend (a time-waster on Unix).

-nouser

The file's user ID does not correspond to any user.

-ok command { } \;

Same as -exec, but prompts user to respond with y before *command* is executed.

-path pattern

Find files whose names match *pattern*. Expect full pathnames relative to the starting pathname (i.e., do not treat / or . specially).

-perm nnn

Find files whose permission flags (e.g., rwx) match octal number *nnn* exactly (e.g., 664 matches -rw-rw-r--). Use a minus sign before *nnn* to make a "wildcard" match of any unspecified octal digit (e.g., -perm -600 matches -rw-******, where * can be any mode).

-print

Print the matching files and directories, using their full pathnames. Return true. This is the default behavior.

-regex pattern

Like -path, but uses grep-style regular expressions instead of the shell-like globbing used in -name and -path.

-size n[c]

Find files containing *n* blocks, or if *c* is specified, *n* characters long.

-type c

Find files whose type is *c*. *c* can be b (block special file), c (character special file), d (directory), p (fifo or named pipe), l (symbolic link), s (socket), or f (plain file).

-user user

Find files belonging to *user* (name or ID).

Examples

List all files (and subdirectories) in your home directory:

```
find $HOME -print
```

List all files named *chapter1* in the */work* directory:

```
find /work -name chapter1
```

List all files beginning with *memo* owned by *ann*:

```
find /work -name 'memo*' -user ann -print
```

Search the filesystem (begin at root) for manpage directories:

```
find / -type d -name 'man*' -print
```

Search the current directory, look for filenames that don't begin with a capital letter, and send them to the printer:

```
find . \! -name '[A-Z]*' -exec lpr {  }\;
```

Find and compress files whose names don't end with *.gz*:

```
gzip `find . \! -name '*.gz' -print`
```

Remove all empty files on the system (prompting first):

```
find / -size 0 -ok rm {  } \;
```

Search the system for files that were modified within the last two days (good candidates for backing up):

```
find / -mtime -2 -print
```

Recursively `grep` for a pattern down a directory tree:

```
find /book -print | xargs grep '[Nn]utshell'
```

If the files *kt1* and *kt2* exist in the current directory, their names can be printed with the command:

```
$ find . -name 'kt[0-9]'
./kt1
./kt2
```

Since the command prints these names with an initial ./ path, you need to specify the ./ when using the -path option:

```
$ find . -path './kt[0-9]'
./kt1
./kt2
```

The -regex option uses a complete pathname, like -path, but treats the following argument as a regular expression rather than a glob pattern (although in this case the result is the same):

```
$ find . -regex './kt[0-9]'
./kt1
./kt2
```

finger

```
finger [options] users
```

Display data about one or more *users*, including information listed in the files *.plan* and *.project* in each user's home directory. You can specify each user either as a login name (exact match) or as a first or last name (display information on all matching names). Networked environments recognize arguments of the form user@host and @host.

Options

-l

Force long format (default): everything included by the -s option, as well as home directory, home phone, login shell, mail status, *.plan*, *.project*, and *.forward*.

-m

Suppress matching of users' "real" names.

-p

Omit *.plan* and *.project* files from display.

-s

Show short format: login name, real name, terminal name, write status, idle time, office location, and office phone number.

fingerd

`in.fingerd [options]`

TCP/IP command. Remote user information server. fingerd provides a network interface to the finger program. It listens for TCP connections on the finger port and, for each connection, reads a single input line, passes the line to finger, and copies the output of finger to the user on the client machine. fingerd is started by xinetd and must have an entry in xinetd's configuration file, */etc/xinetd.conf*.

Options

-f

Allow finger forwarding in the form of user@host1@host2.

-p command, -L path

Use alternate finger program specified by *command*.

-l

Log finger requests.

-t n

Set timeout period to *n* seconds.

-u

Reject requests in the form of @*host*.

-w

Include a welcome banner with additional information, such as uptime and the name of the operating system.

flex

```
flex [options] [file]
```

flex (Fast Lexical Analyzer Generator) is a faster variant of lex. It generates a lexical analysis program (named *lex.yy.c*) based on the regular expressions and C statements contained in one or more input *files*. See also bison, yacc, and the O'Reilly book *lex & yacc*.

Options

-b

Generate backup information to *lex.backup*.

-d

Debug mode.

-f

Use a faster scanner. The result is larger but faster.

-h

Help summary.

-i

Scan case-insensitively.

-l

Maximum lex compatibility.

-o file

Write output to *file* instead of *lex.yy.c*.

-p

Print performance report.

-s

Exit if the scanner encounters input that does not match any of its rules.

-t

Print to standard output. (By default, flex prints to *lex.yy.c*.)

-v

Print a summary of statistics.

-w

Suppress warning messages.

-B

Generate batch (noninteractive) scanner.

-F

Use the fast scanner table representation. This option is usually as fast as-f and often generates smaller data (although for some data sets, it generates larger data).

-I

Generate an interactive scanner (default).

-L

Suppress #line directives in *lex.yy.c*.

-P prefix

Change default yy prefix to *prefix* for all globally visible variable and function names.

-V

Print version number.

-7

Generate a 7-bit scanner.

-8

Generate an 8-bit scanner (default).

-+

Generate a C++ scanner class.

-C

Compress scanner tables but do not use equivalence classes.

-Ca

Align tables for memory access and computation. This creates larger tables but gives faster performance.

-Ce

Construct equivalence classes. This creates smaller tables and sacrifices little performance (default).

-Cf

Generate full scanner tables, not compressed.

-CF

Generate faster scanner tables, like -F.

-Cm

Construct metaequivalence classes (default).

-Cr

Bypass use of the standard I/O library; use `read( )` system calls instead.

fmt

`fmt [options] [files]`

Convert text to specified width by filling lines and removing newlines. Concatenate files on the command line, or read text from standard input if - (or no file) is specified. By default, preserve blan lines, spacing, and indentation. `fmt` attempts to break lines at the end of sentences and to avoid breaking lines after a sentence's first word or before its last.

Options

-c,--crown-margin

Crown margin mode. Do not change indentation of each paragraph's first two lines. Use the second line's indentation as the default for subsequent lines.

-p *prefix*,--prefix=*prefix*

Format only lines beginning with *prefix*.

-s,--split-only

Suppress line-joining.

-t,--tagged-paragraph

Tagged paragraph mode. Same as crown mode when the indentations of the first and second lines differ. If the indentation is the same, treat the first line as its own separate paragraph.

`-u`,`--uniform-spacing`

Reduce spacing to a maximum of one space between words and two between sentences.

`-w` width,`--width=`*width*

Set output width to *width*. The default is 75.

`--help`

Print help message and then exit.

`--version`

Print version information and then exit.

fold

`fold` [*option*] [*files*]

Break the lines of the named *files* so that they are no wider than the specified width. `fold` breaks lines exactly at the specified width, even in the middle of a word. Reads from standard input when given - as a file. By default, `fold` cuts at 80 columns; tab counts as multiple columns, and a backspace as negative one.

Options

`-b`,`--bytes`

Count bytes instead of columns, making tab, backspace, and return characters count as one byte instead of altering the column count, as in the default behavior.

`-c`,`--characters`

Count characters, not columns. Similar to counting by bytes.

`-s`,`--spaces`

Break at spaces only, if possible.

`-w,--width width,-width`

Set the maximum line width to *width*. The flags `-w 6`, `--width 6`, and `-6` will all set the maximum width to six columns.

formail

`formail [options]`

Filter standard input into mailbox format. Useful for splitting mail digests or passing the contents of a mail file to another program, such as a spam filter, for additional processing. If no sender is apparent, provide the sender foo@bar. By default, escape bogus `From` lines with `>`.

Options

`+skip`

Do not split first *skip* messages.

`-total`

Stop after splitting *total* messages.

`-a headerfield`

Append *headerfield* to header, unless it already exists. If *headerfield* is `Message-ID` or `Resent-Message-ID` with no contents, generate a unique message ID.

`-b`

Do not escape bogus `From` lines.

`-c`

When header fields are more than one line long, concatenate the lines.

`-d`

Do not assume that input must be in strict mailbox format. This option disables recognition of

the Content-Length field so you can split digests or use nonstandard mailbox formats.

-e

Allow messages to begin one immediately after the other; do not require empty space between them.

-f

Do not edit non-mailbox-format lines. By default, *formail* prepends From to such lines.

-i headerfield

Append *headerfield* whether or not it already exists. Rename each existing *headerfield* to Old-*headerfield*, unless it is empty.

-k

For use only with -r. Keep the body as well as the fields specified by -r.

-m minfields

Require at least this many *minfields* before recognizing the beginning of a new message. Default is 2.

-n

Allow simultaneous formail processes to run.

-p prefix

Escape lines with *prefix* instead of >.

-q

Do not display write errors, duplicate messages, and mismatched Content-Length fields. This is the default; use -q- to turn it off.

-r

Throw away all existing fields, retaining only X-Loop, and generate autoreply header instead. You can preserve particular fields with the -i option.

-s

Must be the last option; everything following it will be assumed to be its arguments. Divide input to separate mail messages, and pipe them to the program specified or concatenate them to standard output (by default).

-t

Assume sender's return address to be valid. (By default, formail favors machine-generated addresses.)

-u headerfield

Delete all but the first occurrence of *headerfield*.

-x headerfield

Display the contents of *headerfield* on a single line.

-z

When necessary, add a space between field names and contents. Remove ("zap") empty fields.

-A headerfield

Append *headerfield* whether or not it already exists.

-B

Assume that input is in BABYL rmail format.

-D maxlen idcache

Remember old message IDs (in *idcache*, which will grow no larger than approximately *maxlen*). When splitting, refuse to output duplicate messages. Otherwise, return true on discovering a duplicate. With -r, look at the sender's mail address instead of the message ID.

-I headerfield

Append *headerfield* whether or not it already exists. Remove existing fields.

-R oldfield newfield

Change all fields named *oldfield* to *newfield*.

-U headerfield

Delete all but the last occurrence of *headerfield*.

-Y

Format in traditional Berkeley style (i.e., ignoreContent-Length fields).

-X headerfield

Display the field name and contents of *headerfield* on a single line.

free

```
free [options]
```

Display statistics about memory usage: total free, used, physical, swap, shared, and buffers used by the kernel.

Options

-b

Calculate memory in bytes.

-k

Default. Calculate memory in kilobytes.

-m

Calculate memory in megabytes.

-o

Do not display "buffer adjusted" line. The-o switch disables the display "-/+ buffers" line that shows buffer memory subtracted from the amount of memory used and added to the amount of free memory.

-s time

Check memory usage every *time* seconds.

-t

Display all totals on one line at the bottom of output.

-V

Display version information.

fsck

```
fsck [options] [filesystem] ...
```

System administration command. Call the filesystem checker for the appropriate system type to check and repair unmounted filesystems. If a filesystem is consistent, the number of files, number of blocks used, and number of blocks free are reported. If a filesystem is inconsistent,fsck prompts before each correction is attempted. fsck's exit code can be interpreted as the sum of all conditions that apply:

1

Errors were found and corrected.

2

Reboot suggested.

4

Errors were found but not corrected.

8

fsck encountered an operational error.

16

fsck was called incorrectly.

128

A shared library error was detected.

Options

--

Pass all subsequent options to filesystem-specific checker. All options thatfsck doesn't recognize will also be passed.

-s

Serial mode. Check one filesystem at a time.

-t fstype

Specify the filesystem type. Do not check filesystems of any other type.

-A

Check all filesystems listed in */etc/fstab*. The root filesystem is checked first.

-C

Display completion (progress) bar.

-N

Suppress normal execution; just display what would be done.

-P

Meaningful only with -A: check root filesystem in parallel with other systems. This option is potentially dangerous.

-R

Meaningful only with -A: check all filesystems listed in */etc/fstab* except the root filesystem.

-T

Suppress printing of title.

-V

Verbose mode.

ftp

`ftp [options] [hostname]`

Transfer files to and from remote network site *hostname*. ftp prompts the user for a command. The commands are listed after the options. Some of the commands are toggles, meaning they turn on a feature when it is off and vice versa. Note that versions may have different options.

Options

-d

Enable debugging.

-g

Disable filename globbing.

-i

Turn off interactive prompting.

-n

No autologin upon initial connection.

-v

Verbose. Show all responses from remote server.

Commands

!\[command [args]]

Invoke an interactive shell on the local machine. If arguments are given, the first is taken as a command to execute directly, with the rest of the arguments as that command's arguments.

$macro-name [args]

Execute the macro *macro-name* that was defined with the macdef command. Arguments are passed to the macro unglobbed.

account [passwd]

Supply a supplemental password that will be required by a remote system for access to resources once a login has been successfully completed. If no argument is given, the user will be prompted for an account password in a non-echoing mode.

append local-file [remote-file]

Append a local file to a file on the remote machine. If*remote-file* is not given, the local filename is used after being altered by any ntrans or nmap setting. File transfer uses the current settings for *type*, *format*, *mode*, and *structure*.

ascii

Set the file transfer type to network ASCII (default).

bell

Sound a bell after each file transfer command is completed.

binary

Set file transfer type to support binary image transfer.

bye

Terminate FTP session and then exit ftp.

case

Toggle remote-computer filename case mapping during mget. The default is off. When case is on, files on the remote machine with all-uppercase names will be copied to the local machine with all-lowercase names.

cd remote-directory

Change working directory on remote machine to *remote-directory*.

cdup

Change working directory of remote machine to its parent directory.

chmod [mode] [remote-file]

Change file permissions of *remote-file*. If options are omitted, the command prompts for them.

close

Terminate FTP session and return to command interpreter.

cr

Toggle carriage-return stripping during ASCII-type file retrieval.

delete remote-file

Delete file *remote-file* on remote machine.

debug [debug-value]

Toggle debugging mode. If *debug-value* is specified, it is used to set the debugging level.

dir [remote-directory] [local-file]

Print a listing of the contents in the directory *remote-directory* and, optionally, place the output in *local-file*. If no directory is specified, the current working directory on the remote machine is used. If no local file is specified or - is given instead of the filename, output comes to the terminal.

disconnect

Synonym for close.

form format

Set the file transfer form to *format*. Default format is *file*.

get remote-file [local-file]

Retrieve the *remote-file* and store it on the local machine. If the local filename is not specified,

it is given the same name it has on the remote machine, subject to alteration by the current case, ntrans, and nmap settings. If local file is -, output comes to the terminal.

glob

Toggle filename expansion for mdelete, mget, and mput. If globbing is turned off, the filename arguments are taken literally and not expanded.

hash

Toggle hash sign (#) printing for each data block transferred.

help [command]

Print help information for *command*. With no argument, ftp prints a list of commands.

idle [seconds]

Get/set idle timer on remote machine. *seconds* specifies the length of the idle timer; if omitted, the current idle timer is displayed.

image

Same as binary.

lcd [directory]

Change working directory on local machine. If *directory* is not specified, the user's home directory is used.

ls [remote-directory] [local-file]

Print listing of contents of directory on remote machine, in a format chosen by the remote machine. If *remote-directory* is not specified, current working directory is used.

macdef macro-name

Define a macro. Subsequent lines are stored as the macro *macro-name*; a null line terminates macro input mode. When $i is included in the macro, loop through arguments, substituting the current argument for $i on each pass. Escape $ with \.

mdelete remote-files

Delete the *remote-files* on the remote machine.

mdir remote-files local-file

Like dir, except multiple remote files may be specified.

mget remote-files

Expand the wildcard expression *remote-files* on the remote machine and do a get for each filename thus produced.

mkdir directory-name

Make a directory on the remote machine.

mls remote-files local-file

Like nlist, except multiple remote files may be specified, and the local file must be specified.

mode [mode-name]

Set file transfer mode to *mode-name*. Default mode is stream mode.

modtime [file-name]

Show last modification time of the file on the remote machine.

mput [local-files]

Expand wildcards in *local-files* given as arguments and do a put for each file in the resulting list.

newer remote-file [local-file]

Get file if remote file is newer than local file.

nlist [remote-directory] [local-file]

Print list of files in a directory on the remote machine to*local-file* (or to the screen if *local-file* is not specified). If *remote-directory* is unspecified, the current working directory is used.

nmap [inpattern outpattern]

Set or unset the filename mapping mechanism. The mapping follows the pattern set by *inpattern*, a template for incoming filenames, and*outpattern*, which determines the resulting mapped filename. The sequences $1 through $9 are treated as variables; for example, the *inpattern* $1.$2, along with the input file *readme.txt*, would set $1 to readme and $2 to txt.

An *outpattern* of $1.data would result in an output file of *readme.data*. $0 corresponds to the complete filename. [*string1*, *string2*] is replaced by *string1* unless that string is null, in which case it's replaced by *string2*.

ntrans [inchars [outchars]]

Set or unset the filename character translation mechanism. Characters in a filename matching a character in *inchars* are replaced with the corresponding character in *outchars*. If no arguments are specified, the filename mapping mechanism is unset. If arguments are specified:

- Characters in remote filenames are translated during mput and put commands issued without a specified remote target filename.
- Characters in local filenames are translated during mget and get commands issued without a specified local target filename.

open host [port]

Establish a connection to the specified *host* FTP server. An optional *port* number may be supplied, in which case ftp will attempt to contact an FTP server at that port.

prompt

Toggle interactive prompting.

proxy ftp-command

Execute an FTP command on a secondary control connection (i.e., send commands to two separate remote hosts simultaneously).

put local-file [remote-file]

Store a local file on the remote machine. If *remote-file* is left unspecified, the local filename is used after processing according to any ntrans or nmap settings in naming the remote file. File transfer uses the current settings for *type*, *file*, *structure*, and *transfer mode*.

pwd

Print name of the current working directory on the remote machine.

quit

Synonym for bye.

quote arg1 arg2...

Send the arguments specified, verbatim, to the remote FTP server.

recv remote-file [local-file]

Synonym for get.

reget remote-file [local-file]

Retrieve a file (like get), but restart at the end of *local-file*. Useful for restarting a dropped transfer.

remotehelp [command-name]

Request help from the remote FTP server. If *command-name* is specified, remote help for that command is returned.

remotestatus [filename]

Show status of the remote machine or, if *filename* is specified, of *filename* on remote machine.

rename [from] [to]

Rename file *from* on remote machine to *to*.

reset

Clear reply queue.

restart marker

Restart the transfer of a file from a particular byte count.

rmdir [directory-name]

Delete a directory on the remote machine.

runique

Toggle storing of files on the local system with unique filenames. When this option is on, rename files as .1 or .2, and so on, as appropriate, to preserve unique filenames, and report each such action. Default value is off.

send local-file [remote-file]

Synonym for put.

sendport

Toggle the use of PORT commands.

site [command]

Get/set site-specific information from/on remote machine.

size filename

Return size of *filename* on remote machine.

status

Show current status of ftp.

struct [struct-name]

Set the file transfer structure to *struct-name*. By default, stream structure is used.

sunique

Toggle storing of files on remote machine under unique filenames.

system

Show type of operating system running on remote machine.

tenex

Set file transfer type to that needed to talk to TENEX machines.

trace

Toggle packet tracing.

type [type-name]

Set file transfer type to *type-name*. If no type is specified, the current type is printed. The default type is network ASCII.

umask [mask]

Set user file-creation mode mask on the remote site. If *mask* is omitted, the current value of the mask is printed.

user username [password] [account]

Identify yourself to the remote FTP server. ftp will prompt the user for the password (if not specified and the server requires it) and the account field.

verbose

Toggle verbose mode.

? [command]

Same as help.

ftpd

in.ftpd [*options*]

TCP/IP command. Internet File Transfer Protocol server. The server uses the TCP protocol and listens at the port specified in the ftp service specification. ftpd is usually started by xinetd and must have an entry in xinetd's configuration file, */etc/xinetd.conf*. It can also be run in standalone mode using the -p option. There are several FTP daemons available. On many Linux distributions, the default is the Kerberos-supporting DARPA version, which we document here.

Options

-a

Require authentication via ftp AUTH. Allow anonymous users as well, if configured to do so.

-A

Require authentication via ftp AUTH, but allow only users who are authorized to connect without a password. Allow anonymous users as well, if configured to do so.

-C

Require local credentials for non-anonymous users. Prompt for a password unless the user forwards credentials during authentication.

-d, -v

Write debugging information to syslogd.

-l

Log each FTP session in syslogd.

-p port

Use *port* as the FTP control port instead of reading the appropriate port from */etc/services*. This option will launch ftpd in standalone mode.

-q

Use PID files to record the process IDs of running daemons. This is the default. These files are needed to determine the current number of users.

-r file

Read Kerberos configuration from *file* instead of */etc/krb5.conf*.

-s file

Read Kerberos V4 authentication information from *file* instead of */etc/srvtab*.

-t n

Set default inactivity timeout period to *n* seconds. (The default is 15 minutes.)

-T n

Allow ftp clients to request a different timeout period of up to *n* seconds. (The default is 2 hours.)

-u umask

Set the default umask to *umask*.

-U file

Read the list of users denied remote access from *file* instead of */etc/ftpusers*.

-w format

Specify the format for the remote hostname passed to `login`. Use one of the following formats:

ip

Pass the IP address.

n[,[no]striplocal]

Pass hostnames less than *n* characters in length, and IP addresses for longer hostsnames. Set *n* to 0 to use the system default. The `striplocal` portion of the option determines whether or not to strip local domains from hostnames. The default is to strip them.

fuser

```
fuser [options] [files | filesystems]
```

Identifies and outputs the process IDs of processes that are using the*files* or local *filesystems*. Each process ID is followed by a letter code: c if process is using *file* as the current directory; e if executable; f if an open file; m if a shared library; and r if the root directory. Any user with permission to read */dev/kmem* and */dev/mem* can use `fuser`, but only a privileged user can terminate another user's process. `fuser` does not work on remote (NFS) files.

If more than one group of files is specified, the options may be respecified for each additional group of files. A lone dash (-) cancels the options currently in force, and the new set of options applies to the next group of files. Like a number of other administrator commands, `fuser` is usually installed to the */sbin* directory. You may need to add that directory to your path or execute the command as */sbin/fuser*.

Options

-

Return all options to defaults.

-signal

Send *signal* instead of SIGKILL.

-a

Display information on all specified files, even if they are not being accessed by any processes.

-i

Request user confirmation to kill a process. Ignored if -k is not also specified.

-k

Send SIGKILL signal to each process.

-l

List signal names.

-m

Expect *files* to exist on a mounted filesystem; include all files accessing that filesystem.

-n space

Set the namespace checked for usage. Acceptable values are file for files, udp for local UPD ports, and tcp for local TCP ports.

-s

Silent.

-u

User login name, in parentheses, also follows process ID.

-v

Verbose.

-V

Display version information.

g++

g++ [*options*] *files*

Invoke gcc with the options necessary to make it recognize C++. g++ recognizes all the file extensions gcc does, in addition to C++ source files (*.C*, *.cc*, or *.cxx* files) and C++ preprocessed files (*.ii* files). See also gcc.

gawk

gawk [*options*] '*script*' [*var=value...*] [*files*]
gawk [*options*] -f *scriptfile* [*var=value...*] [*files*]

The GNU version of awk, a program that does pattern matching, record processing, and other forms of text manipulation. For more information, see Chapter 1.

gcc

gcc [*options*] *files*

GNU Compiler Collection. gcc, formerly known as the GNU C Compiler, compiles multiple languages (C, C++, Objective-C, Ada, FORTRAN, and Java) to machine code. Here we document its use to compile C, C++, or Objective-C code. gcc compiles one or more programming source files; for example, C source files (*file.c*), assembler source files (*file.s*), or preprocessed C source files (*file.i*). If the file suffix is not recognizable, assume that the file is an object file or library.gcc normally invokes the C preprocessor, compiles the process code to assemble language code, assembles it, and then links it with the link editor. This process can be stopped at one of these stages using the -c, -S, or -E option. The steps may also differ depending on the language being compiled. By default, output is placed in *a.out*. In some cases, gcc generates an object file having a *.o* suffix and a corresponding root name.

Preprocessor and linker options given on the gcc command line are passed on to these tools when they are run. These options are briefly described here, but some are more fully described under entries for cpp, as, and ld. The options that follow are divided into general, preprocessor, linker, and

warning options. gcc accepts many system-specific options not covered here.

Note: gcc is the GNU form of cc; on most Linux systems, the command cc will invoke gcc. The command g++ will invoke gcc with the appropriate options for interpreting C++.

General options

-a

Provide profile information for basic blocks.

-aux-info *file*

Print prototyped declarations and information on their origins to *file*.

-ansi

Enforce full ANSI conformance.

-b *machine*

Compile for use on *machine* type.

-c

Create linkable object file for each source file, but do not call linker.

-dumpmachine

Print compiler's default target machine, then exit.

-dumpspecs

Print built-in specification strings, then exit.

-dumpversion

Print version number, then exit.

-f*option*

Set the specified compiler *option*. Many of these control debugging, optimization of code, and special language options. Use the --help -v options for a full listing.

`-g`

Include debugging information for use with `gdb`.

`-g`*level*

Provide *level* amount of debugging information. *level* must be 1, 2, or 3, with 1 providing the least amount of information. The default is 2.

`--help`

Print most common basic options, then exit. When used with option `-v`, print options for all of `gcc`'s subprocesses. For options specific to a target, use `--target-help`.

`-m`*option*

Set the specified machine specific *option*. Use the `--target-help` option for a full listing.

`-o` *file*

Specify output file as *file*. Default is *a.out*.

`-p`

Provide profile information for use with `prof`.

`-pass-exit-codes`

On error, return highest error code as the exit code, instead of 1.

`-pedantic`

Warn verbosely.

`-pedantic-errors`

Generate an error in every case in which `-pedantic` would have produced a warning.

`-pg`

Provide profile information for use with `gprof`.

-print-file-name=*file*

Print the full path to the library specified by filename*file*, then exit. This is the library gcc would use for linking.

-print-search-dirs

Print installation directory and the default list of directoriesgcc will search to find programs and libraries, then exit.

-pipe

Transfer information between stages of compiler by pipes instead of temporary files.

-save-temps

Save temporary files in the current directory when compiling.

-std=*standard*

Specify C *standard* of input file. Accepted values are:

iso9899:1990, c89

1990 ISO C standard.

iso9899:199409

1994 amendment to the 1990 ISO C standard.

iso9899:1999, c99, iso9899:199x, c9x

1999 revised ISO C standard.

gnu89

1990 C Standard with GNU extensions (the default value).

gnu99, gnu9x

1999 revised ISO C standard with GNU extensions.

-time

Print statistics on the execution of each subprocess.

-v

Verbose mode. Print subprocess commands to standard error as they are executed. Include gcc version number and preprocessor version number. To generate the same output without executing commands, use the option -###.

-w

Suppress warnings.

-x *language*

Expect input file to be written in *language*, which may be c, objective-c, c-header, c++, ada, f77, ratfor, assembler, java, cpp-output, c++-cpp-output, objc-cpp-output, f77-cpp-output, assembler-with-cpp, or ada. If none is specified as *language*, guess the language by filename extension.

-B*path*

Specify the *path* directory in which the compiler files are located.

-E

Preprocess the source files, but do not compile. Print result to standard output. This option is useful to meaningfully pass some cpp options that would otherwise break gcc, such as -C, -M, or -P.

-I*dir*

Include *dir* in list of directories to search for include files. If *dir* is -, search those directories specified by -I before the -I- only when #include "*file*" is specified, not #include <*file*>.

-L*dir*

Search *dir* in addition to standard directories.

-O[*level*]

Optimize. *level* should be 1, 2, 3, or 0 (the default is 1). 0 turns off optimization; 3 optimizes the most.

-S

Compile source files into assembler code, but do not assemble.

-V *version*

Attempt to run gcc version *version*.

-Wa,*options*

Pass *options* to the assembler. Multiple options are separated by commas.

-Wl,*options*

Pass *options* to the linker. Multiple options are separated by commas.

-Wp,*options*

Pass *options* to the preprocessor. Multiple options are separated by commas.

-Xlinker *options*

Pass *options* to the linker. A linker option with an argument requires two-Xlinkers, the first specifying the option and the second specifying the argument. Similar to-Wl.

Preprocessor options

gcc will pass the following options to the preprocessor:

-$

Do not allow $ in identifiers.

-dD, -dI, -dM, -dN

Suppress normal output; print preprocessor instructions instead. See cpp for details.

-idirafter *dir*

Search *dir* for header files when a header file is not found in any of the included directories.

-imacros *file*

Process macros in *file* before processing main files.

-include *file*

Process *file* before main file.

-iprefix *prefix*

When adding directories with -iwithprefix, prepend *prefix* to the directory's name.

-isystem *dir*

Search *dir* for header files after searching directories specified with -I but before searching standard system directories.

-iwithprefix *dir*

Append *dir* to the list of directories to be searched when a header file cannot be found in the main include path. If -iprefix has been set, prepend that prefix to the directory's name.

-iwithprefixbefore *dir*

Insert *dir* at the beginning of the list of directories to be searched when a header file cannot be found in the main include path. If -iprefix has been set, prepend that prefix to the directory's name.

-nostdinc

Search only specified, not standard, directories for header files.

-nostdinc++

Suppress searching of directories believed to contain C++-specific header files.

-trigraphs

Convert special three-letter sequences, meant to represent missing characters on some terminals, into the single character they represent.

-undef

Suppress definition of all nonstandard macros.

-A *name*[=*def*]

Assert *name* with value *def* as if defined by #assert. To turn off standard assertions, use -A-.

-A -name[=*def*]

Cancel assertion *name* with value *def*.

-C

Retain all comments except those found on cpp directive lines. By default, the preprocessor strips C-style comments.

-Dname[=*def*]

Define *name* with value *def* as if by #define. If no =*def* is given, *name* is defined with value 1. -D has lower precedence than -U.

-H

Print pathnames of included files, one per line, on standard error.

-M, -MG, -MF, -MD, -MMD, -MQ, -MT

Suppress normal output and print *Makefile* rules describing file dependencies. Print a rule for make that describes the main source file's dependencies. If -MG is specified, assume that missing header files are actually generated files, and look for them in the source file's directory Most of these options imply -E. See cpp for further details.

-U*name*

Remove definition of symbol *name*.

Linker options

gcc will pass the following options to the linker:

-l*lib*

Link to *lib*.

-nostartfiles

Force linker to ignore standard system startup files.

-nostdlib

Suppress linking to standard library files.

-s

Remove all symbol table and relocation information from the executable.

-shared

Create a shareable object.

-shared-libgcc

Link to a shared version of libgcc if available.

-static

Suppress linking to shared libraries.

-static-libgcc

Link to a static version of libgcc if available.

-u *symbol*

Force the linker to search libraries for a definition of *symbol* and to link to the libraries found.

Warning options

-pedantic

Warn verbosely.

-pedantic-errors

Produce a fatal error in every case in which -pedantic would have produced a warning.

-w

Don't print warnings.

-W

Warn more verbosely than normal.

-Waggregate-return

Warn if any functions that return structures or unions are defined or called.

-Wall

Enable -W, -Wchar-subscripts, -Wcomment, -Wformat, -Wimplicit, -Wmain, -Wmissing-braces, -Wparentheses, -Wreturn-type, -Wsequence-point, -Wswitch, -Wtemplate-debugging, -Wtrigraphs, -Wuninitialized, -Wunknown-pragmas, -Wstrict-aliasing and -Wunused.

-Wcast-align

Warn when encountering instances in which pointers are cast to types that increase the required alignment of the target from its original definition.

-Wcast-qual

Warn when encountering instances in which pointers are cast to types that lack the type qualifier with which the pointer was originally defined.

-Wchar-subscripts

Warn when encountering arrays with subscripts of type char.

-Wcomment

Warn when encountering the beginning of a nested comment.

-Wconversion

Warn in particular cases of type conversions.

-Werror

Exit at the first error.

-Wformat

Warn about inappropriately formatted printfs and scanfs.

-Wimplicit

Warn when encountering implicit function or parameter declarations.

-Winline

Warn about illegal inline functions.

-Wmain

Warn about malformed main functions.

-Wmissing-braces

Enable more verbose warnings about omitted braces.

-Wmissing-declarations

Warn if a global function is defined without a previous declaration.

-Wmissing-prototypes

Warn when encountering global function definitions without previous prototype declarations.

-Wnested-externs

Warn if an extern declaration is encountered within a function.

-Wno-import

Don't warn about use of #import.

-Wparentheses

Enable more verbose warnings about omitted parentheses.

-Wpointer-arith

Warn when encountering code that attempts to determine the size of a function or void.

-Wredundant-decls

Warn if anything is declared more than once in the same scope.

-Wreturn-type

Warn about violations of sequence point rules defined in the C standard.

-Wreturn-type

Warn about functions defined without return types or with improper return types.

-Wshadow

Warn when a local variable shadows another local variable.

-Wstrict-prototypes

Insist that argument types be specified in function declarations and definitions.

-Wswitch

Warn about switches that skip the index for one of their enumerated types.

-Wtraditional

Warn when encountering code that produces different results in ANSI C and traditional C.

-Wtrigraphs

Warn when encountering trigraphs.

-Wuninitialized

Warn when encountering uninitialized automatic variables.

-Wundef

Warn when encountering a nonmacro identifier in an #if directive.

-Wunknown-pragmas

Warn when encountering a #pragma directive not understood by gcc.

-Wunused

Warn about unused variables, functions, labels, and parameters.

Pragma directives

#pragma interface [*header-file*]

Used in header files to force object files to provide definition information via references instead of including it locally in each file. C++-specific.

#pragma implementation [*header-file*]

Used in main input files to force generation of full output from*header-file* (or, if it is not specified, from the header file with the same basename as the file containing the pragma directive). This information will be globally visible. Normally the specified header file contains a #pragma interface directive.

gdb

`gdb [options] [program [core|pid]]`

GDB (GNU DeBugger) allows you to step through the execution of a program in order to find the point at which it breaks. It fully supports C and C++, and provides partial support for FORTRAN, Java, Chill, assembly, and Modula-2. The program to be debugged is normally specified on the command line; you can also specify a core or, if you want to investigate a running program, a process ID.

Options

-b *bps*

Set line speed of serial device used by GDB to*bps*.

-batch

Exit after executing all the commands specified in*.gdbinit* and -x files. Print no startup messages.

-c *file*, -core=*file*

Consult *file* for information provided by a core dump.

-cd=*directory*

Use *directory* as gdb's working directory.

-d *directory*, -directory=*directory*

Include *directory* in path that is searched for source files.

-e *file*, -exec=*file*

Use *file* as an executable to be read in conjunction with source code. May be used in conjunction with -s to read the symbol table from the executable.

-f, -fullname

Show full filename and line number for each stack frame.

-h, -help

Print help message, then exit.

-n, -nx

Ignore *.gdbinit* file.

-q, -quiet

Suppress introductory and copyright messages.

-s *file*, -symbols=*file*

Consult *file* for symbol table. With -e, also uses *file* as the executable.

-tty=*device*

Set standard in and standard out to *device*.

-write

Allow gdb to write into executables and core files.

-x *file*, -command=*file*

Read gdb commands from *file*.

Common commands

These are just some of the more common gdb commands; there are too many to list them all.

bt

Print the current location within the program and a stack trace showing how the current location was reached. (where does the same thing.)

break

Set a breakpoint in the program.

cd

Change the current working directory.

clear

Delete the breakpoint where you just stopped.

commands

List commands to be executed when a breakpoint is hit.

c

Continue execution from a breakpoint.

delete

Delete a breakpoint or a watchpoint; also used in conjunction with other commands.

display

Cause variables or expressions to be displayed when program stops.

down

Move down one stack frame to make another function the current one.

frame

Select a frame for the next `continue` command.

`info`

Show a variety of information about the program. For instance, `info breakpoints` shows all outstanding breakpoints and watchpoints.

`jump`

Start execution at another point in the source file.

`kill`

Abort the process running under `gdb`'s control.

`list`

List the contents of the source file corresponding to the program being executed.

`next`

Execute the next source line, executing a function in its entirety.

`print`

Print the value of a variable or expression.

`ptype`

Show the contents of a datatype, such as a structure or C++ class.

`pwd`

Show the current working directory.

`quit`

Exit `gdb`.

`reverse-search`

Search backward for a regular expression in the source file.

run

Execute the program.

search

Search for a regular expression in the source file.

set variable

Assign a value to a variable.

signal

Send a signal to the running process.

step

Execute the next source line, stepping into a function if necessary.

undisplay

Reverse the effect of the display command; keep expressions from being displayed.

until

Finish the current loop.

up

Move up one stack frame to make another function the current one.

watch

Set a watchpoint (i.e., a data breakpoint) in the program.

whatis

Print the type of a variable or function.

getent

```
getent [options] database key
```

Search the specified database for the specified key. The database may be any one of*passwd, group, hosts, services, protocols,* o*rnetworks.*

Options

-s,--service=*CONFIG*

Specify the service configuration to be used. See*nsswitch.conf(5)* for information about name-service switching.

-?,--help

Display a help message.

--usage

Display a very short syntax synopsis.

-V,--version

Print version information and quit.

getkeycodes

```
getkeycodes
```

Print the kernel's scancode-to-keycode mapping table.

gpasswd

```
gpasswd [options] group
```

Change group password. May only be used by an administrator. Uses the encryption algorithm from the GROUP_CRYPT environment variable, falling back to the CRYPT variable set in */etc/default/passwd*. If neither of those is set, DES is used.

Options

`-a`

Add a new group.

`-d`

Delete a group.

`-M`

Create members of the group.

`-R`

Disable access to the group. Also prevent creation of a new group with the same name.

`-r`

Remove the password entirely.

gpg

`gpg [options] command [options]`

The GNU Privacy Guard application allows you to encrypt and decrypt information, create public and private encryption keys, and use or verify digital signatures. GPG is based on the use of a pair of keys, one public and one private (or "secret"). Data encrypted with one key can only be decrypted with the other. To encrypt a message to you, someone would use your public key to create a message that could only be unlocked with your private key. To sign information, you would lock it with your private key, allowing anyone to verify that it came from you by unlocking it with your publi key.

GPG has dozens of additional options that fine-tune its available options. For a complete list, plus a guide to careful use of encryption and a deeper explanation of how public-key encryption works, visit

www.gnupg.org.

Key Commands

--check-sigs[*keyname*]

Lists keys and signatures like --list-sigs, but also verifies them.

--delete-key *keyname*

Delete the specified key from the keyring.

--delete-secret-key *keyname*

Delete the named secret key from the keyring.

--delete-secret-and-public-key *keyname*

Delete the secret (if any) and then the public key for the specified name.

--desig-revoke *keyname*

Create a revocation certificate for a key pair and designate authority to issue it to someone else. This allows the user to permit someone else to revoke the key, if necessary.

--edit-key [*keyname*]

Edit key options using a menu-driven tool. Key options are too numerous to list here, but include everything from trust settings to images attached to keys for user identification purposes.

--export [*keyname*]

Output the specified key or, if no key is named, the entire keyring. Use the--output flag to send the key information to a file, and--armor to make the key mailable as ASCII text.

--export-secret-keys [*keyname*]

Outputs the specified secret key or keys. Operation is the same as--export, except with secret keys. This is a security risk and should be used with caution.

--export-secret-subkeys [*keyname*]

Outputs the specified secret subkeys. Operation is the same as--export, except with secret keys. This is a security risk and should be used with caution.

--fingerprint [*keyname*]

List keys and their fingerprints for keys named, or all keys if no name is specified. If repeated, shows fingerprints of secondary keys.

--gen-key

Generate a new pair of keys, prompting for several preferences and a passphrase. For most purposes, the default answers to the questions about algorithm and key length are fine.

--gen-revoke *keyname*

Create a revocation certificate for a key pair. A revocation certificate is designed to assure all parties that the key pair is no longer valid and should be discarded.

--keyserver keyserver

Specifies the name of the *keyserver* holding the key.

--list-keys [*keyname*]

List keys with the specified name, or all keys if no name is specified.

--list-public-keys [*keyname*]

List public keys with the specified name, or all public keys if no name is specified.

--list-secret-keys [*keyname*]

List secret keys with the specified name, or all secret keys if no name is specified.

--list-sigs [*keyname*]

Lists keys as --list-keys does, but also lists the signatures.

--gen-revoke *keyname*

Delete the secret (if any) and then the public key for the specified name.

--import *file*

Read keys from a file and add them to your keyring. This is most often used with public keys that are sent by email, but can also be used to move private keys from one system to another. Combined with the --merge-only option, adds only new signatures, subkeys, and user IDs, not keys.

--lsign-key *keyname*

Sign a public key, but mark it as non-exportable.

--nrsign-key *keyname*

Sign a public key and mark it as nonrevocable.

--recv-keys *keyname*

Download and import keys from a keyserver. The key name here should be the key ID as known to the keyserver, and the server must be specified with the--keyserver option.

--refresh-keys [*keyname*]

Check the keyserver for updates to keys already in the keyring. You can specify which keys to check for updates using the key IDs known to the server, and you must specify the server with the --keyserver option.

--search-keys [*string*]

Search the names of keys on the keyserver. Specify the keyserver with--keyserver.

--send-keys [*keyname*]

Send one or more keys to a keyserver. Specify the keyserver with--keyserver.

--sign-key *keyname*

Sign a public key using your private key. Often used to send the public key to a third party. This is the same as selecting "sign" from the--edit-key menu.

Signature Commands

-b,--detach-sign

Create a signature that is not attached to anything.

--clearsign

Create a signature in clear text.

-s,--sign

Create a signature. May be combined with --encrypt.

--verify [*detached-signature*] [*signed-file*]

Verify the signature attached to a file. If the signature and data are in the same file, only one file needs to be specified. For detached signatures, the first file should be the *.sig* or *.asc* signature file, and the second the datafile. If you wish to use stdin instead of a file for the non-attached data, you must specify a single dash (-) as the second filename.

--verify-files [*files*]

Verify one or more files entered on the command line or to stdin. Signatures must be part of the files submitted, and files sent to stdin should be one file per line. This is designed to check many files at once.

Encryption Commands

--encrypt

Encrypt data. May be used with --sign to create signed, encrypted data.

--encrypt-files [*files*]

Encrypt files one after another, either at the command line or sent to stdin one per line.

-c,--symmetric

Encrypt using a symmetric cipher. The cipher is encrypted using the CAST5 algorithm unless you specify otherwise using the --cipher-algo flag.

--store

Create a PGP message packet (RFC 1991). This does not encrypt data; it just puts it into the right packet format.

Decryption Commands

--decrypt [*file*]

Decrypt a file. If no file is specified, stdin is decrypted. Decrypted data is sent to stdout or to the file specified with the--output flag. If the encrypted data is signed, the signature is also verified.

--decrypt-files [*files*]

Decrypt files one after another, either at the command line or sent to stdin one per line.

Other Commands

--check-trustdb

Check the list of keys with defined trust levels to see if they have expired or been revoked.

--export-ownertrust

Create a backup of the trust values for keys.

--h,--help

Display a help message.

--import-ownertrust [*file*]

Import trust values from a file or stdin. Overwrites existing values.

--list-packets

Display packet sequence for an encrypted message. Used for debugging.

--update-trustdb

Update the database of trusted keys. For each key that has no defined level of trust,--update-trustdb prompts for an estimate of how much the key's owner can be trusted to certify other keys. This builds a web of more-trusted and less-trusted keys by which the overal security of a given key can be estimated.

--version

Display version information and quit.

--warranty

Display warranty information. There is no warranty.

gpgsplit

`gpgsplit [options] [files]`

Split an OpenPGP format message into individual packets. If no file is specified, the message is read from stdin. The split packets are written as individual files.

Options

-h, -?, --help

Display a short help message.

--no-split

Write to stdout instead of splitting the packets into individual files.

-p, --prefix *string*

Begin each filename with the specified string.

--secret-to-public

Convert any secret keys in the message to public keys.

--uncompress

Uncompress any compressed packets.

-v, --verbose

Verbose mode. More informative.

gpgv

gpgv [*options*] [*detached-signature*] [*signed-files*]

Check the signature of one or more OpenPGP-signed files. This is similar in operation togpg --verify but uses a different keyring, *~/.gnupg/trustedkeys.gpg*. Also, gpgv assumes that the keyring is trusted, and it cannot edit or update it. By contrast, gpg --verify can go to a keyserver to verify signatures that are not in the local keyring, and offers various levels of trust. In both cases, you can use a detached signature file

Options

-h,-?, --help

Display a short help message.

--ignore-time-conflict

Use this flag to ignore incorrect dates on signatures. An incorrect date can be a sign of fraud, but is often just a result of an incorrectly set clock.

-k,--keyring *file*

Use the specified file as a keyring, in addition to the default*~/.gnupg/trustedkeys.gpg*.

--homedir *dir*

Use the specified directory as the GPG home directory, instead of the default (set in the GNUPGHOME variable, or, if that is unset, *~/.gnupg*).

--logger-fd *FD*

Send log output to the specified file descriptor. By default, log output goes to stderr. Use of file descriptors is described in the DETAILS section of the GPG documentation.

-q,--quiet

Minimal output.

--status-fd *FD*

Send special status messages to the specified file descriptor.

-v,--verbose

Verbose mode. More informative.

gpm

---

gpm [*options*]

System administration command. Provide a mouse server and cut-and-paste utility for use on the Linux console. gpm acts like a daemon, responding to both mouse events and client input. If no clients are connected to the active console, gpm provides cut-and-paste services.

Options

-2

Force two buttons. If there is a middle button, it is treated as the right button.

-3

Force three buttons. With a three-button mouse, the left button makes a selection, the right button extends the selection, and the middle button pastes it. Using this option with a two-button mouse results in being unable to paste.

-a *accel*

Set the acceleration for a single motion longer than the delta specified with the-d option.

-A [*limit*]

Start up with pasting disabled for security. If specified,*limit* gives the time in seconds during which a selection can be pasted. If too much time has passed, the paste is not allowed.

-b *baud*

Specify the baud rate.

-B *seq*

Set a three-digit button sequence, mapping the left, middle, and right buttons to buttons 1, 2, and 3. The default is 123. The sequence 321 is useful if you are left-handed, or 132 for a two-button mouse.

-d *delta*

Set the delta value for use with -a. When a mouse motion event is longer than the specified delta, use *accel* as a multiplier. *delta* must be 2 or greater.

-D

Debugging mode. When set, gpm does not put itself into the background, and it logs messages to standard error instead of syslog.

-g *num*

For a glidepoint device, specify the button to be emulated by a tap.*num* must be 1, 2, or 3 and refers to the button number before any remapping is done by the -B option. Applies to mman and ps2 protocol decoding.

-h

Print a help message and exit.

-i *interval*

Specify the upper time limit, in milliseconds, between mouse clicks for the clicks to be considered a double or triple click.

-k

Kill a running gpm. For use with a bus mouse to kill gpm before running X. See also -R.

-l *charset*

Specify the inword( ) lookup table, which determines which characters can appear in a word. *charset* is a list of characters. The list can include only printable characters. Specify a range with -, and use \ to escape the following character or to specify an octal character.

-m *filename*

Specify the mouse file to open. The default is */dev/mouse*.

-M

Enable the use of more than one mouse. Options appearing before -M apply to the first mouse; those appearing after it apply to the second mouse. Forces the use of -R.

-o *extra-options*

Specify a comma-separated list of additional mouse-specific options. See the gpm info page for a description of the mouse types and the possible options.

-p

Keep the pointer visible while text is being selected. The default is not to show the pointer.

-r *num*

Specify the responsiveness. A higher number causes the cursor to move faster.

-R *name*

Act as a repeater and pass any mouse data received while in graphical mode to the fifo */dev/gpmdata* in the protocol specified by *name* (default is msc). In addition to certain protocol types available with -t, you can specify raw to repeat the data with no protocol translation.

-s *num*

Specify the sample rate for the mouse device.

-S [*commands*]

Enable special-command processing (see the next section). Custom *commands* can be specified as a colon-separated list to associate commands with the left button, middle button, and right button. If a command is omitted, it defaults to sending a signal to init.

-t *type*

Specify the mouse protocol type. Use -t help for a list of types; those marked with an asterisk (*) can be used with -R.

-v

Print version information and exit.

-V [*increment*]

Make gpm more or less verbose by the specified *increment*. The default verbosity level is 5, and the default increment is 1. A larger value of *increment* causes more messages to be logged. The increment can be negative, but must be specified with no space (e.g.,-V-3).

Special commands

Special commands, activated with the -S option, are associated with each mouse button. You can also use -S to customize the commands. To execute a special command, triple-click the left and right buttons (hold down one of the buttons and triple-click the other). A message appears on the console, and the speaker beeps twice. At this point, release the buttons and press the desired button within three seconds to activate the associated special command. The default special commands are:

Left button

Reboot by signalling init.

Middle button

Shut down the system with /sbin/shutdown -h now.

Right button

Reboot with /sbin/shutdown -r now.

gprof

`gprof [options] [object_file]`

Display the profile data for an object file. The file's symbol table is compared with the call graph profile file *gmon.out* (previously created by compiling with gcc -pg). Many of gprof's options take a symbol-specification argument, or symspec, to limit the option to specified files or functions. The symspec may be a filename, a function, or a line number. It can also be given as *filename:function* or *filename:linenumber* to specify a function or line number in a specific file.gprof expects filenames to contain a period and functions to not contain a period.

Options

-a, --no-static

Do not display statically declared functions. Since their information might still be relevant, append it to the information about the functions loaded immediately before.

-b, --brief

Do not display information about each field in the profile.

-c, --static-call-graph

Consult the object file's text area to attempt to determine the program's static call graph. Display static-only parents and children with call counts of 0.

--demangle[=*style*], --no-demangle

Specify whether C++ symbols should be demangled or not. They are demangled by default. If profiling a program built by a different compiler, you may need to specify the mangling style.

--function-ordering

Print suggested function order based on profiling data.

--file-ordering *file*

Print suggested link line order for *.o* files based on profiling data. Read function name to object file mappings from *file*. This file can be created using the nm command.

-i, --file-info

Print summary information on datafiles, then exit.

-k *from to*

Remove arcs between the routines *from* and *to*.

-m *n*, --min-count[=*n*]

Don't print count statistics for symbols executed less than *n* times.

-n[*symspec*], --time[=*symspec*]

Propogate time statistics in call graph analysis.

-p[*symspec*], --flat-profile[=*symspec*]

Print profile statistics.

-q[*symspec*], --graph[=*symspec*]

Print call graph analysis.

-s, --sum

Summarize profile information in the file *gmon.sum*.

-v, --version

Print version and exit.

-w *n*, --width=*n*

Print function index formatted to width *n*.

-x, --all-lines

When printing annotated source, annotate every line in a basic block, not just the beginning.

-y, --separate-files

Print annotated-source output to separate files instead of standard output. The annotated source for each source file is printed to *filename-ann*.

-z, --display-unused-functions

Include zero-usage calls.

-A[*symspec*], --annotated-source[=*symspec*]

Print annotated source code.

-C[*symspec*], --exec-counts[=*symspec*]

Print statistics on the number of times each function is called. When used with option-l, count basic-block execution.

-F *routine*

Print only information about *routine*. Do not include time spent in other routines.

-I *dirs*, --directory-path=*dirs*

Set directory path to search for source files. The *dirs* argument may be given as a colon-separated list of directories.

-J[*symspec*], --no-annotated-source[=*symspec*]

Don't print annotated source code.

-L, --print-path

Print the path information when printing filenames.

-N[*symspec*], --no-time[=*symspec*]

Don't propogate time statistics in call graph analysis.

-P[*symspec*], --no-flat-profile[=*symspec*]

Don't print profile statistics

-Q[*symspec*], --no-graph[=*symspec*]

Don't print call graph analysis.

-T, --traditional

Print output in BSD style.

-Z[*symspec*], --no-exec-counts[=*symspec*]

Don't print statistics on the number of times each function is called.

grep

```
grep [options] pattern [files]
```

Search one or more *files* for lines that match a regular expression *pattern*. Regular expressions are

described in Chapter 7. Exit status is 0 if any lines match, 1 if none match, and 2 for errors. See also egrep and fgrep.

Options

-a, --text

Don't suppress output lines with binary data; treat as text.

-b, --byte-offset

Print the byte offset within the input file before each line of output.

-c, --count

Print only a count of matched lines. With -v or --revert-match option, count nonmatching lines.

-d *action*, --directories=*action*

Define an *action* for processing directories. Possible actions are:

read

Read directories like ordinary files (default).

skip

Skip directories.

recurse

Recursively read all files under each directory. Same as -r.

-e *pattern*, --regexp=*pattern*

Search for *pattern*. Same as specifying a pattern as an argument, but useful in protecting patterns beginning with -.

-f *file*, --file=*file*

Take a list of patterns from *file*, one per line.

-h, --no-filename

Print matched lines but not filenames (inverse of -l).

-i, --ignore-case

Ignore uppercase and lowercase distinctions.

-l, --files-with-matches

List the names of files with matches but not individual matched lines; scanning per file stops or the first match.

--mmap

Try to use memory mapping (mmap) to read input in order to save time.

-n, --line-number

Print lines and their line numbers.

-q, --quiet, --silent

Suppress normal output in favor of quiet mode; scanning stops on the first match.

-r, --recursive

Recursively read all files under each directory. Same as -d recurse.

-s, --no-messages

Suppress error messages about nonexistent or unreadable files.

-v, --invert-match

Print all lines that don't match *pattern*.

-w, --word-regexp

Match on whole words only. Words are divided by characters that are not letters, digits, or underscores.

-x, --line-regexp

Print lines only if *pattern* matches the entire line.

-A *num*, --after-context=*num*

Print *num* lines of text that occur after the matching line.

-B *num*, --before-context=*num*

Print *num* lines of text that occur before the matching line.

-C[*num*], --context[=*num*], -*num*

Print *num* lines of leading and trailing context. Default context is 2 lines.

-E, -extended-regexp

Act like egrep, recognizing extended regular expressions such as(UN|POS)IX to find UNIX and POSIX.

-F, --fixed-strings

Act like fgrep, recognizing only fixed strings instead of regular expressions. Useful when searching for characters that grep normally recognizes as metacharacters.

-G, --basic-regexp

Expect the regular expressions traditionally recognized bygrep (the default).

-H, --with-filename

Display, before each line found, the name of the file containing the line. This is done by default if multiple files are submitted to a singlegrep command.

-V, --version

Print the version number and then exit.

-Z, --null

When displaying filenames, follow each with a zero byte instead of a colon.

Examples

List the number of users who use `tcsh`:

```
grep -c /bin/tcsh /etc/passwd
```

List header files that have at least one `#include` directive:

```
grep -l '^#include' /usr/include/*
```

List files that don't contain *pattern*:

```
grep -c  pattern  files  | grep :0
```

groff

```
groff [options] [files]
TRoff [options] [files]
```

Frontend to the `groff` document-formatting system, which normally runs `troff` along with a postprocessor appropriate for the selected output device. Options without arguments can be grouped after a single dash (-). A filename of - denotes standard input.

Options

-a

Generate an ASCII approximation of the typeset output.

-b

Print a backtrace.

-C

Enable compatibility mode.

-d*cs*, -d*name*=*s*

Define the character *c* or string *name* to be the string *s*.

-e

Preprocess with eqn, the equation formatter.

-E

Don't print any error messages.

-f*fam*

Use *fam* as the default font family.

-F*dir*

Search *dir* for subdirectories with DESC and font files before searching the default directory */usr/lib/groff/font*.

-h

Print a help message.

-i

Read standard input after all *files* have been processed.

-l

Send the output to a print spooler (as specified by the print command in the device description file).

-L*arg*

Pass *arg* to the spooler. Each argument should be passed with a separate -L option.

-m*name*

Read the macro file *tmac.name*.

-M*dir*

Search directory *dir* for macro files before searching the default directory */usr/lib/groff/tmac*.

-n*num*

Set the first page number to *num*.

-N

Don't allow newlines with eqn delimiters; equivalent to eqn's -N option.

-o*list*

Output only pages specified in *list*, a comma-separated list of page ranges.

-p

Preprocess with pic.

-P*arg*

Pass *arg* to the postprocessor. Each argument should be passed with a separate -P option.

-r*cn*, -name=*n*

Set the number register *c* or *name* to *n*. *c* is a single character, and *n* is any troff numeric expression.

-R

Preprocess with refer.

-s

Preprocess with soelim.

-S

Use safer mode (that is, pass the -S option to pic and use the -msafer macros with troff).

-t

Preprocess with tbl.

-T*dev*

Prepare output for device *dev*; the default is ps.

-v

Make programs run by groff print out their version number.

-V

Print the pipeline on stdout instead of executing it.

-w*name*

Enable warning *name*. You can specify multiple -w options. See the troff manpage for a list of warnings.

-W*name*

Disable warning *name*. You can specify multiple -W options. See the troff manpage for a list of warnings.

-z

Suppress troff output (except error messages).

-Z

Do not postprocess troff output. Normally groff automatically runs the appropriate postprocessor.

Devices

ascii

Typewriter-like device.

dvi

TEX dvi format.

latin1

Typewriter-like devices using the ISO Latin-1 character set.

ps

PostScript.

X75

75-dpi X11 previewer.

X100

100-dpi X11 previewer.

lj4

HP LaserJet4-compatible (or other PCL5-compatible) printer.

Environment variables

GROFF_COMMAND_PREFIX

If set to be X, groff will run Xtroff instead of troff.

GROFF_FONT_PATH

Colon-separated list of directories in which to search for the*devname* directory.

GROFF_TMAC_PATH

Colon-separated list of directories in which to search for the macro files.

GROFF_TMPDIR

If set, temporary files will be created in this directory; otherwise, they will be created in TMPDIR (if set) or */tmp* (if TMPDIR is not set).

GROFF_TYPESETTER

Default device.

PATH

Search path for commands that groff executes.

groffer

```
groffer [viewing_options] [man_options] [groff_options]
        [file-spec...]
groffer filespec
```

Groffer displays manpages and groff documents. It accepts the option flags from both *man* and *groff*. The filespec argument can be a filename or a manpage or section specified in the format *man:page* or *man:section*. For more information, see groff and man.

groupadd

```
groupadd [options] group
```

System administration command. Create new group of accounts for the system.

Options

-f

Exit with error if group being added already exists. If a*gid* requested with -g already exists and the -o option has not been specified, assign a different*gid* as if -g had not been specified. This option is not available on all distributions.

-g *gid*

Assign numerical group ID. (By default, the first available number above 500 is used.) The value must be unique, unless the -o option is used.

--help

Display a help message.

-o

Accept a nonunique *gid* with the -g option.

-p,--password string

Use the string encrypted by `crypt(3)`, as the initial password for the group.

-P,--path pathname

Specify the path for the group definition file. Normally, the file is placed in */etc/group*.

-r,--system

Add a system account. Assign the first available number lower than 499.

--service *servicename*

Add the group to a special service category. Normally, this is "files," but it may also be "ldap."

--usage

Display a very short list of acceptable options for the command.

-v,--version

Print the version number, then quit.

groupdel

```
groupdel group
```

System administration command. Remove *group* from system account files. You may still need to find and change permissions on files that belong to the removed group.

groupmod

```
groupmod [options] group
```

System administration command. Modify group information for *group*.

Options

-g *gid*

Change the numerical value of the group ID. Any files that have the old *gid* must be changed manually. The new *gid* must be unique, unless the -o option is used.

-n *name*

Change the group name to *name*.

-o

Override. Accept a nonunique *gid*.

groups

```
groups [options] [users]
```

Show the groups that each *user* belongs to (default user is the owner of the current group). Groups are listed in */etc/passwd* and */etc/group*.

Options

--help

Print help message.

--version

Print version information.

grpck

`grpck [option] [files]`

System administration command. Remove corrupt or duplicate entries in the*/etc/group* and */etc/gshadow* files. Generate warnings for other errors found. `grpck` will prompt for a "yes" or "no" before deleting entries. If the user replies "no," the program will exit. If run in a read-only mode, the reply to all prompts is "no." Alternate group and gshadow*files* can be checked. If other errors are found, the user will be encouraged to run the `groupmod` command.

Option

-r

Read-only mode.

Exit codes

0

Success.

1

Syntax error.

2

One or more bad group entries found.

3

Could not open group files.

4

Could not lock group files.

5

Could not write group files.

grpconv

grpconv
grpunconv

System administration command. Like pwconv, the grpconv command creates a shadowed group file to keep your encrypted group passwords safe from password-cracking programs.grpconv creates the */etc/gshadow* file based on your existing */etc/groups* file and replaces your encrypted password entries with x. If you add new entries to the */etc/groups* file, you can run grpconv again to transfer the new information to */etc/gshadow*. It will ignore entries that already have a password of x and convert those that do not. grpunconv restores the encrypted passwords to your */etc/groups* file and removes the */etc/gshadow* file.

gs

gs [*options*] [*files*]

GhostScript, an interpreter for Adobe Systems' PostScript and PDF (Portable Document Format) languages. Used for document processing. With - in place of*files*, standard input is used.

Options

-- *filename arg1 ...*

Take the next argument as a filename, but use all remaining arguments to define ARGUMENTS in *userdict* (not *systemdict*) as an array of those strings before running the file.

-g*number1*x*number2*

Specify width and height of device; intended for systems like the X Window System.

-q

Quiet startup.

-r*number*, -r*number1*x*number2*

Specify X and Y resolutions (for the benefit of devices, such as printers, that support multiple X and Y resolutions). If only one number is given, it is used for both X and Y resolutions.

-D*name=token*, -d*name=token*

Define a name in *systemdict* with the given definition. The token must be exactly one token (as defined by the token operator) and must not contain any whitespace.

-D*name*, -d*name*

Define a name in *systemdict* with a null value.

-I*directories*

Add the designated list of directories at the head of the search path for library files.

-S*name=string*, -s*name=string*

Define a name in *systemdict* with a given *string* as value.

Special names

-dDISKFONTS

Cause individual character outlines to be loaded from the disk the first time they are encountered.

-dNOBIND

Disable the bind operator. Useful only for debugging.

-dNOCACHE

Disable character caching. Useful only for debugging.

-dNODISPLAY

Suppress the normal initialization of the output device. May be useful when debugging.

-dNOPAUSE

Disable the prompt and pause at the end of each page.

-dNOPLATFONTS

Disable the use of fonts supplied by the underlying platform (e.g., the X Window System).

-dSAFER

Disable the deletefile and renamefile operators, and the ability to open files in any mode other than read-only.

-dWRITESYSTEMDICT

Leave *systemdict* writable.

-sDEVICE=*device*

Select an alternate initial output device.

-sOUTPUTFILE=*filename*

Select an alternate output file (or pipe) for the initial output device.

gunzip

`gunzip [options] [files]`

Uncompress *files* compressed by gzip. See gzip for a list of options.

gzexe

`gzexe [option] [files]`

Compress executables. When run, these files automatically uncompress, thus trading time for space. gzexe creates backup files with a tilde at the end (*filename*~). These backup files can be deleted once you are sure the compression has worked properly.

Option

-d

Decompress files.

gzip

```
gzip [options] [files]
gunzip [options] [files]
zcat[options] [files]
```

Compress specified files (or data read from standard input) with Lempel-Ziv coding (LZ77). Rename compressed file to *filename.gz*; keep ownership modes and access/modification times. Ignore symbolic links. Uncompress with gunzip, which takes all of gzip's options except those specified. zcat is identical to gunzip -c and takes the options -fhLV, described here. Files compressed with the compress command can be decompressed using these commands.

Options

-*n*, --fast, --best

Regulate the speed of compression using the specified digit*n*, where -1 or --fast indicates the fastest compression method (less compression), and -9 or --best indicates the slowest compression method (most compression). The default compression level is-6.

-a, --ascii

ASCII text mode: convert end-of-lines using local conventions. This option is supported only or some non-Unix systems.

-c, --stdout, --to-stdout

Print output to standard output, and do not change input files.

-d, --decompress, --uncompress

Same as gunzip.

-f, --force

Force compression. gzip would normally prompt for permission to continue when the file has multiple links, its *.gz* version already exists, or it is reading compressed data to or from a terminal.

-h, --help

Display a help screen and then exit.

-l, --list

Expects to be given compressed files as arguments. Files may be compressed by any of the following methods: gzip, deflate, compress, lzh, or pack. For each file, list uncompressed and compressed sizes (the latter being always-1 for files compressed by programs other than gzip), compression ratio, and uncompressed name. With-v, also print compression method, the 32-bit CRC of the uncompressed data, and the timestamp. With-N, look inside the file for the uncompressed name and timestamp.

-L, --license

Display the gzip license and quit.

-n, --no-name

When compressing, do not save the original filename and timestamp by default. When decompressing, do not restore the original filename if present, and do not restore the original timestamp if present. This option is the default when decompressing.

-N, --name

Default. Save original name and timestamp. When decompressing, restore original name and timestamp.

-q, --quiet

Print no warnings.

-r, --recursive

When given a directory as an argument, recursively compress or decompress files within it.

-S *suffix*, --suffix *suffix*

Append .*suffix*. Default is gz. A null suffix while decompressing causesgunzip to attempt to decompress all specified files, regardless of suffix.

-t, --test

Test compressed file integrity.

-v, --verbose

Print name and percent size reduction for each file.

-V, --version

Display the version number and compilation options.

halt

```
halt [options]
```

System administration command: turns off the computer. Insert a note in the file*/var/log/wtmp*; if the system is in runlevel 0 or 6, stop all processes; otherwise, callshutdown -h.

Options

-d

Suppress writing to */var/log/wtmp*.

-f

Call halt even when shutdown -nf would normally be called (i.e., force a call tohalt, even when not in runlevel 0 or 6).

-h

Place hard drives in standby mode before halt or power off.

-i

Shut down network interfaces before halt.

-n

No sync before reboot or halt.

-p

Perform power-off when halting system.

-n

Suppress normal call to sync.

-w

Suppress normal execution; simply write to */var/log/wtmp*.

hdparm

`hdparm [options] [device]`

System administration command. Read or set the hard drive parameters. This command can be used to tune hard drive performance; it is mostly used with IDE drives, but can also be used with SCSI drives.

Options

The hdparm command accepts many option flags, including some that can result in filesystem corruption if misused. Flags can be used to set or get a parameter. To get a parameter, just pass the flag without a value. To set a parameter, follow the flag with a space and the appropriate value.

-a [*n*]

Get or set the number of sectors to read ahead in the disk. The default is 8 sectors (4 KB); a larger value is more efficient for large, sequential reads, and a smaller value is better for small random reads. Many IDE drives include this functionality in the drive itself, so this feature is nc

always necessary.

-A

Enable or disable the IDE read-ahead feature. Usually on by default.

-b [*n*]

Get or set the bus state for the drive.

-B

Set the Advanced Power Management (APM) data if the drive supports it.

-c [*n*]

Get or set 32-bit I/O values for IDE drives. Acceptable values are 0 (32-bit support off), 1 (32-bit support on), and 3 (on, but only with a sync sequence).

-C

Check the power status of the drive. This will tell you unknown, active/idle, standby, or sleeping. Use -S, -y, -Y, and -Z to set the power status.

-d [*n*]

Get or set the using_dma flag for the drive, which may be 0 (not using DMA) or 1 (using DMA).

-D

Enable or disable defect-handling features that are controlled by the hard drive itself.

-E *n*

Set CD-ROM read speed to *n* times normal audio playback speed. Not normally necessary.

-f

Flush and sync the buffer cache on exit.

-g

Query and display drive size and geometry information, such as number of cylinders, heads,

and sectors.

-h

Display a short help message.

-i

Display the drive identification information obtained at boot time. If the drive has changed since boot, this information may not be current.

-I

Display more detailed identification information for the drive.

-Istdin

Read identify data from standard input.

-Istdout

Write identify data to standard output.

-k [*n*]

Get or set the keep_settings_over_reset variable. Valid settings are 0 and 1, and a value of 1 will keep the -dmu options when rebooting (soft reset only).

-K [*n*]

Get or set the keep_features_over_reset variable. Valid settings are 0 and 1, and a value of 1 will keep settings for the flags -APSWXZ over a soft reset.

-L *n*

Set the door lock flag for the drive. Used for Syquest, ZIP, and JAZ drives.

-m [*n*]

Get or set the number of sectors used for multiple sector count reading. A value of0 disables the feature, and values of 2, 4, 8, 16, and 32 are common. Drives that try to support this feature and fail may suffer corruption and data loss.

-M [*n*]

Get or set the level for Automatic Acousting Management (AAM) features. Newer drives suppor this feature, which can slow down head movements to reduce hard disk noise. Values range from 128 (quiet, but slow) to 254 (fast, but loud). Some drives support only 128 and 254, while others support multiple levels between the extremes. At the time of writing, this feature was still considered experimental and not recommended for production use.

-n [*n*]

Set to 0 or 1 to disable or enable, respectively, the "ignore write errors" flag. This can cause massive data loss if used incorrectly, and is for development purposes only.

-p *n*

Tune the IDE interface to use PIO mode *n*, usually an integer between 0 and 5. Incorrect values can result in massive data loss. Support for the PIO mode-setting feature varies between IDE chips, so tuning it is not for the faint of heart.

-P *n*

Set the internal prefetch sector count. Not all drives support the feature.

-q

Suppress output for the flag after this one, unless it is the-i, -v, -t, or -T flag.

-Q [*n*]

Set the depth of tagged queues. 0 disables tagged queues. This is supported only on specific drives, and only for kernels 2.5.x and later.

-r [*n*]

Get or set the flag for read-only on the device. A value of1 marks the device as read-only.

-R

This option should be used by experts only. It registers an IDE interface. See the-U option for further details.

-S *n*

Set the amount of time a disk is inactive before it spins down and goes into standby mode. Settings from 1 to 240 represent chunks of five seconds (for timeout values between 5 seconds and 20 minutes); values from 241 to 251 are increments of 30 minutes (for 30 minutes to 5.5 hours). A value of 252 sets the timeout to 21 minutes, 253 to the vendor default, and 255 to 20 minutes and 15 seconds.

-T

Time cache reads to determine performance.

-t

Time device reads to determine performance.

-u [*n*]

Get or set the interrupt-unmask value for the drive. A value of 1 lets the drive unmask other interrupts and can improve performance; when used with older kernels and hardware, it can cause data loss.

-U

Unregister an IDE interface. Use this feature and the -R feature only with hot-swappable hardware, such as very high-end servers and some laptops. It can damage or hang other systems, and should be used with caution.

-v

Display all appropriate settings for device except -i. This is the same as the default behavior with no flags.

-w

Reset the device. Use as a last resort only; may cause data loss.

-W

Enable or disable the write-cache feature for the drive. The default varies among drive manufacturers.

-x

Sets tristate. Use only for hot-swappable devices. See the -R and -U entries.

-X *n*

Set the IDE transfer mode. Possible values include 34 (multiword DMA mode2 transfers) and 66 (UltraDMA mode2 transfers), or any PIO mode number plus 8. This option is suggested for experts only, and is useful only with newer EIDE/IDE/ATA2 drives. Often used in combination with -d.

-y

Put the IDE drive into standby (spin-down) mode, saving power.

-Y

Put the IDE drive into sleep mode.

-z

Force the kernel to reread the partition table.

-Z

Disable automatic powersaving on some drives, which can prevent them from idling or spinning down at inconvenient moments. This will increase the electrical power consumption of your system.

head

`head [options] [files]`

Print the first few lines (default is 10) of one or more*files*. If *files* is missing or -, read from standard input. With more than one file, print a header for each file.

Options

-c *num*[b|k|m], --bytes *num* [b|k|m]

Print first *num* bytes or, if *num* is followed by b, k, or m, first *num* 512-byte blocks, 1-kilobyte blocks, or 1-megabyte blocks.

--help

Display help and then exit.

-n *num*, --lines *num*, -num

Print first *num* lines. Default is 10.

-q, --quiet, --silent

Quiet mode; never print headers giving filenames.

-v, --verbose

Print filename headers, even for only one file.

--version

Output version information and then exit.

Examples

Display the first 20 lines of `phone_list`:

```
head -20 phone_list
```

Display the first 10 phone numbers having a 202 area code:

```
grep '(202)' phone_list | head
```

hexdump

`hexdump [options] file`

Display specified file or input in hexadecimal, octal, decimal, or ASCII format. Option flags are used to specify the display format.

Options

-b

Use a one-byte octal display, meaning the input offset is in hexadecimal and is followed by 16 three-column octal data bytes, filled in with zeroes and separated by spaces.

-c

Use a one-byte character display, meaning the input offset is in hexadecimal and is followed by 16 three-column entries, filled in with zeroes and separated with spaces.

-C

Canonical mode. Display hexadecimal offset, two sets of eight columns of hexadecimal bytes, then a | followed by the ASCII representation of those same bytes.

-d

Use a two-byte decimal display. The input offset is again in hexadecimal, but the display has only eight entries per line, of five columns each, containing two bytes of unsigned decimal format.

-e format_string

Choose a format string to be used to transform the output data. Format strings consist of:

Iteration count

The iteration count is optional. It determines the number of times to use the transformation string. The number should be followed by a slash character (/) to distinguish it from the byte count.

Byte count

The number of bytes to be interpreted by the conversion string. It should be preceded by a slash character to distinguish it from the iteration count.

Format characters

The actual format characters should be surrounded by quotation marks and are interpreted as fprintf (see printf) formatting strings, although the *, h, l, n, p, and q options will not work as expected. Format string usage is discussed at greater length in the hexdump manpage.

-f filename

Choose a file that contains several format strings. The strings should be separated by newlines the # character marks a line as a comment.

-n length

Limit the number of bytes of input to be interpreted.

-o

Two-byte octal display, meaning a hexadecimal offset followed by eight five-column data entries of two bytes each, in octal format.

-s offset

Skip to specified *offset*. The offset number is assumed to be decimal unless it starts with 0x or 0X (hexadecimal), or O (octal). Numbers may also be designated in megabytes, kilobytes, or half-kilobytes with the addition of m, k, or b at the end of the number.

-v

Display all input data, even if it is the same as the previous line. Normally, a duplicate line is replaced by an asterisk (*).

-x

Display data in a two-byte hexadecimal format. The offset is, as usual, in hexadecimal, and is followed by eight space-separated entries, each of which contains four-column, two-byte chunks of data in hexadecimal format.

host

```
host [options] name [server]
```

System administration command. Print information about hosts or zones in DNS. Hosts may be IP addresses or hostnames; host converts IP addresses to hostnames by default and appends the local domain to hosts without a trailing dot. Default servers are determined in */etc/resolv.conf*. For more information about hosts and zones, read Chapters 1 and 2 of *DNS and BIND* (O'Reilly).

Options

-a

Same as -t ANY.

-c *class*

Search for specified resource record class (IN, CH, CHAOS, HS, HESIOD, or ANY). Default is IN.

-d

Verbose output. Same as -v.

-l

List mode. This also performs a zone transfer for the named zone. Same as-t AXFR.

-n

Perform reverse lookups for IPv6 addresses using IP6.INT domain and "nibble" labels instead o IP6.ARPA and binary labels.

-r

Do not ask contacted server to query other servers, but require only the information that it has cached.

-t *type*

Look for *type* entries in the resource record. *type* may be any recognized query type, such as A, AXFR, CNAME, NS, SOA, SIG, or ANY. If *name* is a hostname, host will look for A records by default. If *name* is an IPv4 or IPv6 address, it will look for PTR records.

-v

Verbose. Include all fields from resource record, even time-to-live and class, as well as "additional information" and "authoritative nameservers" (provided by the remote nameserver).

-w

Never give up on queried server.

-C

Display SOA records from all authoritative nameservers for the specified zone.

-N *n*

Consider names with fewer than *n* dots in them to be relative. Search for them in the domains listed in the search and domain directives of */etc/resolv.conf*. The default is usually 1.

-R *n*

Retry query a maximum of *n* times. The default is 1.

-T

Use TCP instead of UDP to query nameserver. This is implied in queries that require TCP, such as AXFR requests.

-W *n*

Wait a maximum of *n* seconds for reply.

hostid

`hostid`

Print the ID number in hexadecimal of the current host.

hostname

`hostname [option] [nameofhost]`

Set or display name of current host system. A privileged user can set the hostname with the *nameofhost* argument.

Options

-a, --alias

Display the alias name of the host (if used).

-d, --domain

Display DNS domain name.

-f, --fqdn, --long

Display fully qualified domain name.

-F *file*, --file *file*

Consult *file* for hostname.

-h, --help

Display a help message and then exit.

-i, --ip-address

Display the IP address(es) of the host.

-n, --node

Display or set the DECnet node name.

-s, --short

Trim domain information from the display output.

-v, --verbose

Verbose mode.

-V, --version

Display version information and then exit.

-y, --yp, --nis

Display the NIS domain name. A privileged user can set a new NIS domain name with *nameofhost*.

htdigest

```
htdigest [-c] filename realm username
```

Create or update user authentication files used by the Apache web server. The-c option is used if you wish to create the file, and will overwrite any existing files rather than update them. The three arguments are the file you wish to use as the authentication file, the realm name to which the user belongs, and the username you will update in the password file. You will be prompted for a password when you run the command.

The Apache manual contains information about authentication mechanisms, including more detail about using htdigest and the ways in which you can control access to the resources served by Apache.

hwclock

```
hwclock [option]
```

System administration command. Read or set the hardware clock. This command maintains change information in */etc/adjtime*, which can be used to adjust the clock based on how much it drifts over time. hwclock replaces the clock command. The single-letter options are included for compatibility with the older command.

Options

You may specify only one of the following options:

-a, --adjust

Adjust the hardware clock based on information in */etc/adjtime* and set the system clock to the new time.

--getepoch

Print the kernel's hardware clock epoch value, then exit.

-r, --show

Print the current time stored in the hardware clock.

-s, --hctosys

Set the system time in accordance with the hardware clock.

--setepoch, --epoch=*year*

Set the hardware clock's epoch to *year*.

--set --date=*date*

Set the hardware clock to the specified *date*, a string appropriate for use with the date command.

-v, --version

Print version and exit.

-w, --systohc

Set the hardware clock in accordance with the system time.

The following may be used with the above options.

--debug

Print information about what hwclock is doing.

--localtime

The hardware clock is stored in local time.

--noadjfile

--noadjfile

Disable */etc/adjtime* facilities.

--test

Do not actually change anything. This is good for checking syntax.

-u, --utc

The hardware clock is stored in Universal Coordinated Time.

iconv

```
iconv [options] files
```

Convert the contents of one or more *files* from one character encoding to another and write the results to standard output.

Options

-c

Omit invalid output characters.

-f *code1*, --from-code=*code1*

Convert input characters from the *code1* encoding.

-?, --help

Print help message and exit.

-l, --list

Print a list of valid encodings to standard output.

-o *file*, --output=*file*

Write the converted output to *file* instead of standard output.

-s, --silent

Operate silently; don't print warning messages.

-t *code2*, --to-code=*code2*

Convert input characters to the *code2* encoding.

--usage

Print a brief usage message showing only the command syntax and then exit.

-V, --version

Print version information and exit.

--verbose

Operate verbosely; print progress messages.

id

```
id [options] [username]
```

Display information about yourself or another user: user ID, group ID, effective user ID and group ID if relevant, and additional group IDs.

Options

-g, --group

Print group ID only.

-G, --groups

Print supplementary groups only.

-n, --name

With -u, -g, or -G, print user or group name, not number.

-r, --real

With -u, -g, or -G, print real, not effective, user ID or group ID.

-u, --user

Print user ID only.

--help

Print help message and then exit.

--version

Print version information.

ifconfig

```
ifconfig [interface]
ifconfig [interface address_family parameters addresses]
```

TCP/IP command. Assign an address to a network interface and/or configure network interface parameters. ifconfig is typically used at boot time to define the network address of each interface or a machine. It may be used at a later time to redefine an interface's address or other parameters. Without arguments, ifconfig displays the current configuration for a network interface. Used with a single *interface* argument, ifconfig displays that particular interface's current configuration. Note that interfaces are numbered starting at zero: eth0, eth1, eth2, and so forth. In most cases, eth0 will be the primary PCI Ethernet interface, and wireless network interfaces will begin withath0 or wlan0.

Arguments

interface

String of the form *name unit*: for example, en0.

address_family

Since an interface may receive transmissions in differing protocols, each of which may require separate naming schemes, you can specify the*address_family* to change the interpretation of the remaining parameters. You may specify inet (for TCP/IP, the default), ax25 (AX.25 Packet Radio), ddp (Appletalk Phase 2), or ipx (Novell).

parameters

The following *parameters* may be set with ifconfig:

add *address*/*prefixlength*

Add an IPv6 address and prefix length.

address *address*

Assign the specified IP *address* to the interface.

allmulti/-allmulti

Enable/disable sending of incoming frames to the kernel's network layer.

arp/-arp

Enable/disable use of the Address Resolution Protocol in mapping between network-level addresses and link-level addresses.

broadcast [*address*]

(inet only) Specify address to use to represent broadcasts to the network. Default is the address with a host part of all ones (i.e., x.y.z.255 for a class C network).

debug/-debug

Enable/disable driver-dependent debugging code.

del *address*/*prefixlength*

Delete an IPv6 address and prefix length.

down

Mark an interface "down" (unresponsive).

hw *class address*

Set the interface's hardware class and address. *class* may be ether (Ethernet), ax25 (AX.25 Packet Radio), or ARCnet.

io_addr *addr*

I/O memory start address for device.

irq *addr*

Set the device's interrupt line.

metric *n*

Set routing metric of the interface to *n*. Default is 0.

mem_start *addr*

Shared memory start address for device.

media *type*

Set media type. Common values are 10base2, 10baseT, and AUI. If auto is specified, ifconfig will attempt to autosense the media type.

mtu *n*

Set the interface's Maximum Transfer Unit (MTU).

multicast

Set the multicast flag.

netmask *mask*

(inet only) Specify how much of the address to reserve for subdividing networks into subnetworks. *mask* can be specified as a single hexadecimal number with a leading0x, with a dot notation Internet address, or with a pseudo-network name listed in the network table */etc/networks*.

pointopoint/-pointopoint [*address*]

Enable/disable point-to-point interfacing, so that the connection between the two machines is dedicated.

promisc/-promisc

Enable/disable promiscuous mode. Promiscuous mode allows the device to receive all packets on the network.

txqueuelen *n*

Specify the transmit queue length.

tunnel *addr*

Create an IPv6-in-IPv4 (SIT) device, tunneling to IPv4 address *addr*.

up

Mark an interface "up" (ready to send and receive).

addresses

Each address is either a hostname present in the hostname database (*/etc/hosts*), or an Internet address expressed in the Internet standard dot notation.

Examples

To list all interfaces:

```
ifconfig -a
```

To add a second IP address to wlan0:

```
ifconfig wlan0:1 192.168.2.41 netmask 255.255.255.0
```

To change the hardware address (MAC address) assigned to eth0 (useful when setting up a router fo a DSL or cable modem):

```
ifconfig eth0 hw ether 01:02:03:04:05:06
```

imapd

```
imapd [options]
```

TCP/IP command. The Interactive Mail Access Protocol (IMAP) server daemon `imapd` is invoked by `xinetd` and listens on port 143 for requests from IMAP clients. IMAP allows mail programs to access

remote mailboxes as if they were local. IMAP is a richer protocol than POP because it allows a client to retrieve message-level information from a server mailbox instead of the entire mailbox. IMAP can be used for online and offline reading. The popular Pine mail client contains support for IMAP. There are several versions of imapd available. Here we document the Cyrus IMAP server.

Options

-C *file*

Read configuration options from *file* instead of */etc/imapd.conf*.

-s

Encrypt data using the Secure Socket Layer (SSL).

-T *n*

Wait *n* seconds for a new connection before closing the process. The default is 60.

-U *n*

Reuse process for new connections no more than *n* times.

inetd

```
inetd [options] [configuration_file]
```

TCP/IP command. The Internet services daemon. See xinetd.

info

```
info [options] [topics]
```

GNU hypertext reader. Display online documentation previously built from Texinfo input. Info files are arranged in a hierarchy and can contain menus for subtopics. When entered without options, the command displays the top-level info file (usually */usr/local/info/dir*). When *topics* are specified, find a

subtopic by choosing the first *topic* from the menu in the top-level info file, the next *topic* from the new menu specified by the first *topic*, and so on. The initial display can also be controlled by the -f and -n options. If a specified *topic* has no info file but does have a manpage, info displays the manpage; if there is neither, the top-level info file is displayed.

Options

-d *directories*, --directory *directories*

Search *directories*, a colon-separated list, for info files. If this option is not specified, use the INFOPATH environment variable or the default directory (usually */usr/local/info*).

--dribble *file*

Store each keystroke in *file*, which can be used in a future session with the --restore option to return to this place in info.

-f *file*, --file *file*

Display specified info file.

-n *node*, --node *node*

Display specified node in the info file.

-o *file*, --output *file*

Copy output to *file* instead of displaying it on the screen.

--help

Display brief help.

--restore *file*

When starting, execute keystrokes in *file*.

--subnodes

Display subtopics.

--version

Display version.

--vi-keys

Use vi-like key bindings.

init

`init [bootflags] [runlevel]`

System administration command. Initialize system. Usually run from the boot loadere.g.,lilo or grub.

Boot flags

-a,auto

Set the AUTOBOOT environment variable to *yes*. The boot loader will do this automatically when booting with the default command line.

-b

Boot directly into a single-user shell for emergency recovery.

-s,S,single

Single-user mode.

-b,emergency

Boot into single-user mode but do not run any other startup scripts.

-z *characters*

The specified *characters* are ignored, but will make the command line take up a bit more room on the stack. *init* uses the extra space to show the current runlevel when running theps command.

Files

init is the first process run by any Unix machine at boot time. It verifies the integrity of all filesystems and then creates other processes, using fork and exec, as specified by */etc/inittab*. Which processes may be run is controlled by *runlevel*. All process terminations are recorded in */var/run/utmp* and */var/log/wtmp*. When the runlevel changes, init sends SIGTERM and then, after 20 seconds, SIGKILL to all processes that cannot be run in the new runlevel.

Runlevels

The current runlevel may be changed by telinit, which is often just a link to init. The default runlevels vary from distribution to distribution, but these are standard:

0

Halt the system.

1, s, S

Single-user mode.

3

Multiuser mode, console login. This is commonly used in server configurations.

5

Full graphical mode. This is a common default for desktop configurations.

6

Reboot the system. Never set the default runlevel to 6.

q, Q

Reread */etc/inittab*.

Check the */etc/inittab* file for runlevels on your system.

insmod

```
insmod filename [module-options]
```

System administration command. Load the module *filename* into the kernel. Simpler but less flexible than the `modprobe` command. Error messages from `insmod` may be vague, because the kernel performs module operations internally and therefore sends error information to the kernel log instead of standard output; see `dmesg`.

install

`install [options] [source] destination`

System administration command. Used primarily in *Makefile*s to update files. `install` copies files into user-specified directories. Similar to `cp`, but attempts to set permission modes, owner, and group. The *source* may be a file or directory, or a list of files and directories. The *destination* should be a single file or directory.

Options

`-b, --backup[=control]`

Back up any existing files. When using the long version of the command, the optional *control* parameter controls the kind of backup. When no control is specified, `install` will attempt to read the control value from the VERSION_CONTROL environment variable. Accepted values are:

`none, off`

Never make backups.

`numbered, t`

Make numbered backups.

`existing, nil`

Match existing backups, numbered or simple.

`simple, never`

Always make simple backups.

-d, --directory

Create any missing directories.

-g *group*, --group *group*

Set group ID of new file to *group* (privileged users only).

--help

Print help message, then exit.

-m *mode*, --mode *mode*

Set permissions of new file to *mode* (octal or symbolic). By default, the mode is 0755.

-o [*owner*], --owner[=*owner*]

Set ownership to *owner* or, if unspecified, to root (privileged users only).

-p, --preserve-timestamps

Preserve access and modification times on source files and directories.

-s, --strip

Strip symbol tables.

-v, --verbose

Print name of each directory as it is created.

--version

Print version, then exit.

-C

Do not overwrite file when the target exists and is identical to the new file. Preserve original timestamp.

-D

Create leading components of destination except the last, then copy source to destination.

-S *suffix*, --suffix=*suffix*

Use *suffix* instead of the default backup suffix, usually ~.

ipcrm

```
ipcrm [options]
```

System administration command. Remove interprocess communication (IPC) message queues, shared memory segments, or semaphore arrays. These may be specified either by numeric identifier or by key, using the following options.

Options

-m *identifier*, -M *key*

Remove specified shared memory segment and its associated data structures after the last detach is performed.

-q *identifier*, -Q *key*

Remove specified message queue and its associated data structures.

-s *identifier*, -S *key*

Remove specified semaphore array and its associated data structures.

ipcs

```
ipcs [options]
```

System administration command. Print report on interprocess communication (IPC) message queues

shared memory segments, and semaphore arrays for which the current process has read access. Options can be used to specify the type of resources to report on and the output format of the report

Options

Resource specification options:

-a

Report on all IPC facilities: shared memory segments, message queues, and semaphore arrays. This is the default.

-m

Report on shared memory segments.

-q

Report on message queues.

-s

Report on semaphore arrays.

Output format options:

-b

Print information on maximum size of the resource: size in bytes of messages or shared memory segments, and the number of semaphores per set in the case of semaphore arrays.

-c

Print creator and owner user IDs for IPC facilities.

-l

Print resource maximum and minimum limits.

-o

Print outstanding usage of the resource in question: the number of messages and the total size of the message queue, or the number of processes using shared memory segments.

-p

Print creator and last operation process identifiers.

-t

Print attach, detach, and change times for shared memory segments, last operation and change times for semaphore arrays, and send, receive, and change times for message queues.

-u

Print summary of current resource usage.

Other options:

-h

Print help message, then exit.

-i *identifier*

Used in combination with the -m, -q, or -s options. Report only on the resource specified by numeric *identifier*.

iptables

```
iptables command [options]
```

System administration command. Configure *netfilter* filtering rules for kernels 2.4 and later. Rules for iptables consist of some matching criteria and a target, a result to be applied if the packet matches the criteria. The rules are organized into chains. You can use these rules to build a firewall, masquerade your local area network, or just reject certain kinds of network connections.

There are three built-in tables for iptables: one for network filtering (filter), one for Network Address Translation (nat), and the last for specialized packet alterations (mangle). Firewall rules are organized into chains, ordered checklists of rules that the kernel works through looking for matches. The filter table has three built-in chains: INPUT, OUTPUT, and FORWARD. The INPUT and OUTPUT chains handle packets originating from or destined for the host system. TheFORWARD chain handles packets just passing through the host system. Thenat table also has three built-in chains: PREROUTING, POSTROUTING, and OUTPUT. mangle has only two chains: PREROUTING and OUTPUT.

netfilter checks packets entering the system. After applying any PREROUTING rules, it passes them to the INPUT chain, or to the FORWARD chain if the packet is just passing through. Upon leaving, the system packets are passed to the OUTPUT chain and then on to any POSTROUTING rules. Each of these chains has a default target (a policy) in case no match is found. User-defined chains can also be created and used as targets for packets but do not have default policies. If no match can be found in a user-defined chain, the packet is returned to the chain from which it was called and tested against the next rule in that chain.

iptables changes only the rules in the running kernel. When the system is powered off, all changes are lost. You can use the iptables-save command to make a script you can run with iptables-restore to restore your firewall settings. Such a script is often called at bootup. Many distributions have an iptables initialization script that uses the output from iptables-save.

Commands

iptables is almost always invoked with one of the following commands

-A *chain rules*, --append *chain rules*

Append new *rules* to *chain*.

-D *chain rules*, --delete *chain rules*

Delete *rules* from *chain*. Rules can be specified by their ordinal number in the chain as well as by a general rule description.

-E *old-chain new-chain*, --rename-chain *old-chain new-chain*

Rename *old-chain* to *new-chain*.

-F [*chain*], --flush [*chain*]

Remove all rules from *chain*, or from all chains if *chain* is not specified.

-I *chain number rules*, --insert *chain number rules*

Insert *rules* into *chain* at the ordinal position given by *number*.

-L [*chain*], --list [*chain*]

List the rules in *chain*, or all chains if *chain* is not specified.

-N *chain*, --new-chain *chain*

Create a new *chain*. The chain's name must be unique. This is how user-defined chains are created.

-P *chain target*, --policy *chain target*

Set the default policy for a built-in *chain*; the target itself cannot be a chain.

-R *chain number rule*, --replace *chain number rule*

Replace a rule in *chain*. The rule to be replaced is specified by its ordinal *number*.

-X [*chain*], --delete-chain [*chain]*

Delete the specified user-defined *chain*, or all user-defined chains if *chain* is not specified.

-Z [*chain*], --zero [*chain]*

Zero the packet and byte counters in *chain*. If no chain is specified, all chains will be reset. When used without specifying a chain and combined with the-L command, list the current counter values before they are reset.

Targets

A target may be the name of a chain or one of the following special values:

ACCEPT

Let the packet through.

DROP

Drop the packet.

QUEUE

Send packets to the user space for processing.

RETURN

Stop traversing the current chain and return to the point in the previous chain from which this one was called. If RETURN is the target of a rule in a built-in chain, the built-in chain's default policy is applied.

Rule specification parameters

These options are used to create rules for use with the preceding commands. Rules consist of some matching criteria and usually a target to jump to (-j) if the match is made. Many of the parameters for these matching rules can be expressed as a negative with an exclamation point (!) meaning "not. Those rules will match everything except the given parameter.

-c *packets bytes*, --set-counters *packets bytes*

Initialize packet and byte counters to the specified values.

-d [!] *address*[/*mask*] [!] [*port*], --destination [!] *address*[/*mask*] [*port*]

Match packets from the destination *address*. The address may be supplied as a hostname, a network name, or an IP address. The optional mask is the netmask to use and may be supplied either in the traditional form (e.g., /255.255.255.0) or in the modern form (e.g., /24).

[!] -f, [!]--fragment

The rule applies only to the second or further fragments of a fragmented packet.

-i [!] *name*[+], --in-interface *name*[+]

Match packets being received from interface *name*. *name* is the network interface used by your system (e.g., eth0 or ppp0). A + can be used as a wildcard, so ppp+ would match any interface name beginning with ppp.

-j *target*, --jump *target*

Jump to a special target or a user-defined chain. If this option is not specified for a rule, matching the rule only increases the rule's counters, and the packet is tested against the next rule.

-o [!] *name*[+], --out-interface *name*[+]

Match packets being sent from interface *name*. See the description of -i for the syntax for *name*.

-p [!] *name*, --protocol [!] *name*

Match packets of protocol *name*. The value of *name* can be given as a name or number, as found in the file */etc/protocols*. The most common values are tcp, udp, icmp, or the special value all. The number 0 is equivalent to all, and this is the default value when this option is not used. If there are extended matching rules associated with the specified protocol, they will be loaded automatically. You need not use the -m option to load them.

-s [!] *address*[/*mask*] [!] [*port*], --source [!] *address*[/*mask*] [!] [*port*]

Match packets with the source *address*. See the description of -d for the syntax of this option.

Options

-h [icmp], --help [icmp]

Print help message. If icmp is specified, a list of valid ICMP type names will be printed. -h can also be used with the -m option to get help on an extension module.

--line-numbers

Used with the -L command. Add the line number to the beginning of each rule in a listing, indicating its position in the chain.

-m *module*, --match module

Explicitly load matching rule extensions associated with *module*. See the next section.

--modprobe=*command*

Use specified *command* to load any necessary kernel modules while adding or inserting rules into a chain.

-n, --numeric

Print all IP address and port numbers in numeric form. By default, text names are displayed when possible.

-t *name*, --table *name*

Apply rules to the specified table. Rules apply to the filter table by default.

-v, --verbose

Verbose mode.

-x, --exact

Expand all numbers in a listing (-L). Display the exact value of the packet and byte counters instead of rounded figures.

Match extensions

Several modules extend the matching capabilities of netfilter rules. Using the-p option will cause iptables to load associated modules implicitly. Others need to be loaded explicitly with the-m or --match options. Here we document those modules used most frequently.

icmp

Loaded when -p icmp is the only protocol specified:

--icmp-type [!] *type*

Match the specified ICMP *type*. *type* may be a numeric ICMP type or one of the ICMP type names shown by the command iptables -p icmp -h.

multiport

Loaded explicitly with the -m option. The multiport extensions match sets of source or destination ports. These rules can be used only in conjunction with-p tcp and -p udp. Up to 15 ports can be specified in a comma-separated list:

--source-port [*ports*]

Match the given source *ports*.

--destination-port [*ports*]

Match the given destination *ports*.

--port [*ports*]

Match if the packet has the same source and destination port and that port is one of the given *ports*.

state

Loaded explicitly with the -m option. This module matches the connection state of a packet:

--state *states*

Match the packet if it has one of the states in the comma-separated list *states*. Valid states are INVALID, ESTABLISHED, NEW, and RELATED.

tcp

Loaded when -p tcp is the only protocol specified:

--source-port [!] [*port*][:*port*], --sport [!] [*port*][:*port*]

Match the specified source ports. Using the colon specifies an inclusive range of services to match. If the first port is omitted, 0 is the default. If the second port is omitted, 65535 is the default. You can also use a dash instead of a colon to specify the range.

--destination-port [!] [*port*][:*port*], --dport [!] [*port*][:*port*]

Match the specified destination ports. The syntax is the same as for --source-port.

--mss *n*[:*n*]

Match if TCP SYN or SYN/ACK packets have the specified MSS value or fall within the specified range. Use this to control the maximum packet size for a connection.

[!] --syn

Match packets with the SYN bit set and the ACK and FIN bits cleared. These are packets that request TCP connections; blocking them prevents incoming connections. Shorthand for --tcp-flags SYN,RST,ACK SYN.

--tcp-flags [!] *mask comp*

Match the packets with the TCP flags specified by *mask* and *comp*. *mask* is a comma-separated list of flags that should be examined. *comp* is a comma-separated list of flags that must be set for the rule to match. Valid flags are SYN, ACK, FIN, RST, URG, PSH, ALL, and NONE.

--tcp-option [!] *n*

Match if TCP option is set.

udp

Loaded when -p udp is the only protocol specified:

--source-port [!] [*port*][:*port*], --sport [!] [*port*][:*port*]

Match the specified source ports. The syntax is the same as for the--source-port option of the TCP extension.

--destination-port [!] [*port*][:*port*], --dport [!] [*port*][:*port*]

Match the specified destination ports. The syntax is the same as for the--source-port option of the TCP extension.

Target extensions

Extension targets are optional additional targets supported by separate kernel modules. They have their own associated options. We cover the most frequently used target extensionsbelow.

DNAT

Modify the destination address of the packet and all future packets in the current connection. DNAT is valid only as a part of the POSTROUTING chain in the nat table:

--to-destination *address*[-*address*][*port-port*]

Specify the new destination address or range of addresses. The arguments for this optior are the same as the --to-source argument for the SNAT extension target.

LOG

Log the packet's information in the system log:

--log-level *level*

Set the syslog level by name or number (as defined by*syslog.conf*).

--log-prefix *prefix*

Begin each log entry with the string*prefix*. The prefix string may be up to 30 characters long.

--log-tcp-sequence

Log the TCP sequence numbers. This is a security risk if your log is readable by users.

--log-tcp-options

Log options from the TCP packet header.

--log-ip-options

Log options from the IP packet header.

MASQUERADE

Masquerade the packet so it appears that it originated from the current system. Reverse packets from masqueraded connections are unmasqueraded automatically. This is a legal target only for chains in the nat table that handle incoming packets and should be used only with dynamic IP addresses (like dial-up.) For static addresses useDNAT:

--to-ports *port*[-*port*]

Specify the port or range of ports to use when masquerading. This option is valid only if a tcp or udp protocol has been specified with the -p option. If this option is not used, the masqueraded packet's port will not be changed.

REJECT

Drop the packet and, if appropriate, send an ICMP message back to the sender indicating the packet was dropped. If the packet was an ICMP error message, an unknown ICMP type, or a nonhead fragment, or if too many ICMP messages have already been sent to this address, no message is sent:

--reject-with *type*

Send specified ICMP message type. Valid values areicmp-net-unreachable, icmp-host-unreachable, icmp-port-unreachable, or icmp-proto-unreachable. If the packet was an ICMP ping packet, *type* may also be echo-reply.

SNAT

Modify the source address of the packet and all future packets in the current connection.SNAT is valid only as a part of the POSTROUTING chain in the nat table:

--to-source *address*[-*address*][*port-port*]

Specify the new source address or range of addresses. If atcp or udp protocol has been specified with the -p option, source ports may also be specified. If none is specified, map the new source to the same port if possible. If not, map ports below 512 to other ports

below 512, those between 512 and 1024 to other ports below 1024, and ports above 1024 to other ports above 1024.

Examples

To reject all incoming ICMP traffic on eth0:

```
iptables -A INPUT -p ICMP -i eth0 -j  REJECT
```

iptables-restore

```
iptables-restore [options]
```

System administration command. Restore firewall rules from information provided on standard input. iptables-restore takes commands generated by iptables-save and uses them to restore the firewall rules for each chain. This is often used by initialization scripts to restore firewall settings on boot.

Options

`-c, --counters`

Restore packet and byte counter values.

`-n, --noflush`

Don't delete previous table contents.

iptables-save

```
iptables-save [options]
```

System administration command. Print the IP firewall rules currently stored in the kernel to stdout. Output may be redirected to a file that can later be used byiptables-restore to restore the firewall.

Options

-c, --counters

Save packet and byte counter values.

-t *name*, --table *name*

Print data from the specified table only.

isodump

`isodump` *isoimage*

Interactively display the contents of the ISO9660 image*isoimage*. Used to verify the integrity of the directory inside the image. `isodump` displays the first portion of the root directory and waits for commands. The prompt shows the extent number (zone) and offset within the extent, and the contents display at the top of the screen.

Commands

+

Search forward for the next instance of the search string.

a

Search backward within the image.

b

Search forward within the image.

f

Prompt for a new search string.

g

Prompt for a new starting block and go there.

q

Exit.

isoinfo

---

isoinfo [*options*]

Display information about ISO9660 images. You can use isoinfo to list the contents of an image, extract a file, or generate a find-like file list. The -i option is required to specify the image to examine.

Options

-d

Print information from the primary volume descriptor (PVD) of the ISO9660 image, including information about Rock Ridge and Joliet extensions if they are present.

-f

Generate output similar to the output of a find . -print command. Do not use with -l.

-h

Print help information and exit.

-i *isoimage*

Specify the path for the ISO9660 image to examine.

-j *charset*

Convert any Joliet filenames to the specified character set.

-J

Extract filename information from any Joliet extensions.

-l

Generate output similar to the output of an ls -lR command. Do not use with -f.

-N *sector*

To help examine single-session CD files that are to be written to a multisession CD. Specify the sector number at which the ISO9660 image is to be written when sent to the CD writer.

-p

Display path table information.

-R

Extract permission, filename, and ownership information from any Rock Ridge extensions.

-T *sector*

To help examine multisession images that have already been burned to a multisession CD. Use the specified sector number as the start of the session to display.

-x *path*

Extract the file at the specified path to standard output.

isosize

`isosize [option] iso9660-img-file`

Display the length of an ISO9660 filesystem contained in the specified file. The image file can be a normal file or a block device such as */dev/sr0*. With no options, the length is displayed in bytes. Only one of the two options can be specified.

Options

-d *num*

Display the size in bytes divided by *num*.

-x

Display the number of blocks and the block size (although the output refers to blocks as sectors).

isovfy

```
isovfy isoimage
```

Verify the integrity of the specified ISO9660 image and write the results to standard output.

ispell

```
ispell [options] [files]
```

Compare the words of one or more named *files* with the system dictionary. Display unrecognized words at the top of the screen, accompanied by possible correct spellings, and allow editing via a series of commands.

Options

-b

Back up original file in *filename.bak*.

-B

Count two correctly spelled words without a space between them as a spelling error.

-C

Count two correctly spelled words without a space between them as a legitimate compound word.

-d *file*

Search *file* instead of standard dictionary file.

-H

File is in HTML/XML format.

-m

Suggest combinations of known roots and affixes, even if the result is not known. For example, "generous" and "ly" are known, so "generously" would be suggested as a word, even if it were not in the dictionary.

-n

Expect nroff or troff input file.

-P

Do not guess new words using known roots and affixes. The opposite of-m.

-p *file*

Search *file* instead of personal dictionary file.

-t

Expect TEX or LATEX input file.

-w *chars*

Consider *chars* to be legal, in addition to a-z and A-Z.

-x

Do not back up original file.

-B

Search for missing blanks (resulting in concatenated words) in addition to ordinary misspellings.

-C

Do not produce error messages in response to concatenated words.

-L *number*

Show *number* lines of context.

-M

List interactive commands at bottom of screen.

-N

Suppress printing of interactive commands.

-P

Do not attempt to suggest more root/affix combinations.

-S

Sort suggested replacements by likelihood that they are correct.

-T *type*

Expect all files to be formatted by *type*.

-W *n*

Never consider words that are *n* characters or fewer to be misspelled.

-V

Use hat notation (^L) to display control characters, and M- to display characters with the high bit set.

Interactive commands

?

Display help screen.

space

Accept the word in this instance.

number

Replace with suggested word that corresponds to *number*.

!*command*

Invoke shell and execute *command* in it. Prompt before exiting.

a

Accept word as correctly spelled, but do not add it to personal dictionary.

i

Accept word and add it (with any current capitalization) to personal dictionary.

l

Search system dictionary for words.

q

Exit without saving.

r

Replace word.

u

Accept word and add lowercase version of it to personal dictionary.

x

Skip to the next file, saving changes.

^L

Redraw screen.

^Z

Suspend ispell.

join

`join [options] file1 file2`

Join lines of two sorted files by matching on a common field. If either*file1* or *file2* is -, read from standard input. Often used to merge data stored in text-based file formats such as comma-separated-value formatted spreadsheets.

Options

-a *filenum*

Print a line for each unpairable line in file*filenum*, in addition to the normal output.

-e *string*

Replace missing input fields with*string*.

-i, --ignore-case

Ignore case differences when comparing keys.

-1 *fieldnum1*

The join field in *file1* is *fieldnum1*. Default is the first field.

-2 *fieldnum2*

The join field in *file2* is *fieldnum2*. Default is the first field.

-o *fieldlist*

Order the output fields according to *fieldlist*, where each entry in the list is in the form *filenum*.*fieldnum*. Entries are separated by commas or blanks.

-t *char*

Specifies the field-separator character (default is whitespace).

-v *filenum*

Print only unpairable lines from file *filenum*.

--help

Print help message and then exit.

--version

Print the version number and then exit.

kbd_mode

`kbd_mode [option]`

Print or set the current keyboard mode, which may be RAW, MEDIUMRAW, XLATE, or UNICODE.

Options

-a

Set mode to XLATE (ASCII mode).

-k

Set mode to MEDIUMRAW (keycode mode).

-s

Set mode to RAW (scancode mode).

-u

Set mode to UNICODE (UTF-8 mode).

kbdrate

`kbdrate [options]`

System administration command. Control the rate at which the keyboard repeats characters, as well as its delay time. Using this command without options sets a repeat rate of 10.9 characters per second; the default delay is 250 milliseconds. On boot, most Linux systems set the keyboard rate to 30 characters per second.

Options

-s

Suppress printing of messages.

-r *rate*

Specify the repeat rate, which must be one of the following numbers (all in characters per second): 2.0, 2.1, 2.3, 2.5, 2.7, 3.0, 3.3, 3.7, 4.0, 4.3, 4.6, 5.0, 5.5, 6.0, 6.7, 7.5, 8.0, 8.6, 9.2, 10.0, 10.9, 12.0, 13.3, 15.0, 16.0, 17.1, 18.5, 20.0, 21.8, 24.0, 26.7, or 30.0.

-d *delay*

Specify the delay, which must be one of the following (in milliseconds):250, 500, 750, or 1000.

kernelversion

`kernelversion`

This command tells you what version of the Linux kernel you are using. It is also used by*modutils*

and the */etc/modules.conf* file to determine where to put kernel modules. It accepts no arguments or options.

kill

```
kill [options] [pids | commands]
```

Send a signal to terminate one or more process IDs. You must own the process or be a privileged user. If no signal is specified, TERM is sent.

This entry describes the `/bin/kill` command, which offers several powerful features. There are also built-in shell commands of the same name; the `bash` and `ksh` versions are described in Chapter 6.

In particular, `/bin/kill` allows you to specify a command name, such as `gcc` or `xpdf`, instead of a process ID (PID). All processes running that command with the same UID as the process issuing `/bin/kill` will be sent the signal.

If `/bin/kill` is issued with a *pid* of 0, it sends the signal to all processes of its own process group. If `/bin/kill` is issued with a *pid* of `-1`, it sends the signal to all processes except process 1 (the system's *init* process).

Options

`-a`

Kill all processes of the given name (if privileges allow), not just processes with the same UID. To use this option, specify the full path (e.g., `/bin/kill -a gcc`).

`-l`

List all signals.

`-p`

Print the process ID of the named process, but don't send it a signal. To use this option, specify the full path (e.g., `/bin/kill -p`).

`-s` *SIGNAL*, `-SIGNAL`

The signal number (from */usr/include/sys/signal.h*) or name (from `kill -l`). With a signal number of 9 (KILL), the kill cannot be caught by the process; use this to kill a process that a

plain kill doesn't terminate. The default is TERM. The letter flag itself is optional: bothkill -9 1024 and kill -s 9 1024 terminate process 1024.

killall

`killall [options] names`

Kill processes by command name. If more than one process is running the specified command, kill all of them. Treats command names that contain a / as files; kill all processes that are executing that file.

Options

-signal

Send *signal* to process (default is TERM). *signal* may be a name or a number. The most commonly used signal is 9, which terminates processes no matter what.

-e

Require an exact match to kill very long names (i.e., longer than 15 characters). Normally, killall kills everything that matches within the first 15 characters. With -e, such entries are skipped. (Use -v to print a message for each skipped entry.)

-g

Kill the process group to which the process belongs.

-i

Prompt for confirmation before killing processes.

-l

List known signal names.

-q

Quiet; do not complain of processes not killed.

-v

Verbose; after killing process, report success and process ID.

-V

Print version information.

-w

Wait for all killed processes to die. Note that killall may wait forever if the signal was ignored or had no effect, or if the process stays in zombie state.

killall5

`killall5`

The System V equivalent of killall, this command kills all processes except those on which it depends.

klogd

`klogd [options]`

System administration command. Control which kernel messages are displayed on the console, prioritize all messages, and log them through syslogd. On many operating systems, syslogd performs all the work of klogd, but on Linux the features are separated. Kernel messages are gleaned from the */proc* filesystem and from system calls to syslogd. By default, no messages appear on the console. Messages are sorted into eight levels, 0-7, and the level number is prepended to each message.

Priority levels

0

Emergency situation (KERN_EMERG).

1

A crucial error has occurred (KERN_ALERT).

2

A serious error has occurred (KERN_CRIT).

3

An error has occurred (KERN_ERR).

4

A warning message (KERN_WARNING).

5

The situation is normal but should be checked (KERN_NOTICE).

6

Information only (KERN_INFO).

7

Debugging message (KERN_DEBUG).

Options

-c *level*

Print all messages of a higher priority (lower number) than *level* to the console.

-d

Debugging mode.

-f *file*

Print all messages to *file*; suppress normal logging.

-i

Signal executing daemon to reload kernel module symbols.

-k *file*

Use *file* as source of kernel symbols.

-n

Avoid auto-backgrounding. This is needed when klogd is started from init.

-o

One-shot mode. Prioritize and log all current messages, then immediately exit.

-p

Reload kernel-module symbol information whenever an Oops string is detected.

-s

Suppress reading of messages from the */proc* filesystem. Read from kernel message buffers instead.

-v

Print version, then exit.

-x

Don't translate instruction pointers (EIP). klogd will not read the *System.map* file.

-l

Signal executing daemon to reload both static kernel symbols and kernel module symbols.

-2

Print two lines for each symbol, one showing the symbol and the other showing its numerical value (address).

Files

/usr/include/linux/kernel.h, */usr/include/sys/syslog.h*

Sources for definitions of each logging level.

/proc/kmsg

A file examined by klogd for messages.

/var/run/klogd.pid

klogd's process ID.

kudzu

`kudzu [`*`options`*`]`

Red Hat Linux and relatives only. Detects new and changed hardware by comparing existing hardware against a database in */etc/sysconfig/hwconfig*. Users are then given the opportunity to configure the hardware. Runs automatically at boot time.

Options

-b,--bus bus

Probe only on the bus specified.

-c,--class class

Probe only for the class of hardware specified.

-f,--file filename

Read hardware info from the specified file instead of probing for existing hardware.

-?,--help

Display help information.

-k,--kernel *n*

Check for kernel modules only in the specified kernel version.

-p,--probe

Probe only: print hardware information to stdout, but do not configure any devices found.

-q,--quiet

Do not prompt user for any information; perform only non-interactive configurations.

-s,--safe

Safe mode: skip probes that interrupt hardware currently in use. This does not check serial ports, DDC monitors, or PS/2 ports.

-t,--timeout *n*

Number of seconds to wait for user input on initial configuration dialog. No configuration will be written to disk if there is no user input during this time.

--usage

Display short usage message.

last

`last [options] [username] [ttynumber]`

Display a list of the most recent logins, taken from the file */var/log/wtmp* by default. If you specify a tty number or username, the output will display only the logins for that user or terminal.

Options

-n *number*, *-number*

Choose how many lines of logins to display. Thus, `last -7` or `last -n 7` displays seven lines.

`-R`

Do not show the hostname from which logins originated.

`-a`

Display the hostname from which logins originated.

`-d`

Display both IP address and hostname.

`-f filename`

Get the list of logins from a file you choose. The default source is */var/log/wtmp*.

`-i`

Display IP address and hostname. Display the IP address in the numbers-and-dots notation.

`-o`

Read an old-style (libc5 application) *wtmp* file. Not likely to be useful on newer systems.

`-x`

Display shutdown messages and runlevel messages.

lastb

```
lastb [options] [username] [ttynumber]
```

Display a list of recent bad login attempts (from the */var/log/btmp* file). Accepts the same option flags and arguments as `last`.

lastlog

`lastlog [options]`

System administration command. Print the last login times for system accounts Login information is read from the file */var/log/lastlog*.

Options

-t*n*, --time*n*

Print only logins more recent than *n* days ago.

-u*name*, --user*name*

Print only login information for user *name*.

ld

`ld [options] objfiles`

Combine several *objfiles*, in the specified order, into a single executable object module (*a.out* by default). ld is the link editor and is often invoked automatically by compiler commands.ld accepts many options, the most common of which are listed here.

Options

-b *format*, --format=*format*

If ld is configured to accept more than one kind of object file, this option can be used to specify the input format. *format* should be a GNU Binary File Descriptor (BFD), as described in the BFD library. Use objdump -i to list available formats.

-call_shared

Link with dynamic libraries.

-d, -dc, -dp

Force the assignment of space to common symbols.

-defsym *symbol*=*expression*

Create the global *symbol* with the value *expression*.

-demangle[=*style*]

Force demangling of symbol names. Optionally set the demangling style. Turn off demangling with -nodemangle.

-e *symbol*

Set *symbol* as the address of the output file's entry point.

-f *name*

Set the DT_AUXILIARY field of ELF shared object to *name*.

-fini *name*

Set the DT_FINI field of ELF shared object to the address of function *name*. The default function is _fini.

-h *name*

Set the DT_SONAME field of ELF shared object to *name*.

--help

Print help message, then exit.

-i

Produce a linkable output file; attempt to set its magic number to OMAGIC.

-init *name*

Set the DT_INIT field of ELF shared object to the address of function *name*. The default function is _init.

-l*arch*, --library=*archive*

Include the archive file *arch* in the list of files to link.

-m *linker*

Emulate *linker*. List supported emulations with the -V option.

-n

Make text read-only; attempt to set NMAGIC.

-o *output*

Place output in *output*, instead of in *a.out*.

-oformat *format*

Specify output format.

-q

Retain relocation sections and contents in linked executables.

-r

Produce a linkable output file; attempt to set its magic number to OMAGIC.

-rpath *dir*

Add directory *dir* to the runtime library search path. Ignore additional paths normally read from the LD_RUN_PATH environment variable.

-rpath-link *dirs*

Specify path to search for shared libraries required by another shared library. The*dirs* argument can be a single directory, or multiple directories separated by colons. This overrides search paths specified in shared libraries themselves.

-s

Do not include any symbol information in output.

-shared

Create a shared library.

-static

Do not link with shared libraries.

-sort-common

Do not sort global common symbols by size.

-t

Print each input file's name as it is processed.

--target-help

Print target-specific options, then exit.

-u *symbol*

Force *symbol* to be undefined.

-v, --version

Show version number.

--verbose

Print information about ld; print the names of input files while attempting to open them.

-warn-common

Warn when encountering common symbols combined with other constructs.

-warn-once

Provide only one warning per undefined symbol.

-x

With -s or -S, delete all local symbols. These generally begin withL.

-z *keyword*

Mark the object for special behavior specified by*keyword*. ld recognizes the following

keywords:

combreloc

Object combines and sorts multiple relocation sections for dynamic symbol lookup caching.

defs

Disallow undefined symbols.

initfirst

Initialize object first at runtime.

interpose

Interpose object's symbol table before all but the primary executable's symbol table.

loadfltr

Process object's filter immediately at runtime.

multidefs

Allow multiple definitions of a single symbol. Use the first definition.

nocombreloc

Disable combining multiple relocation sections.

nocopyreloc

Disable copy relocation.

nodefaultlib

Ignore default library search path when seeking dependencies for object.

nodelete

Do not unload object at runtime.

nodlopen

Object is not available to dlopen.

nodump

Object cannot be dumped by dldump.

now

Non-lazy runtime binding.

origin

Object may contain *$ORIGIN*.

-E, --export-dynamic

Add all symbols to dynamic symbol table, not just those referenced by linked objects.

-EB

Link big-endian objects.

-EL

Link little-endian objects.

-F *name*

Set DT_FILTER field of ELF shared object to *name*.

-L*dir*, --library-path=*dir*

Search directory *dir* before standard search directories (this option must precede the -l option that searches that directory).

-M

Display a link map on standard output.

-Map *file*

Print a link map to *file*.

-N

Allow reading of and writing to both data and text. Mark ouput if it supports Unix magic numbers. Do not page-align data.

-O *level*

Optimize. *level* should be 1, 2, 3, or 0. The default is 1. 0 turns off optimization; 3 optimizes the most.

-R *file*

Obtain symbol names and addresses from *file*, but suppress relocation of *file* and its inclusion in output.

-S

Do not include debugger symbol information in output.

-T *file*

Execute script *file* instead of the default linker script.

-Tbss *address*

Begin bss segment of output at *address*.

-Tdata *address*

Begin data segment of output at *address*.

-Ttext *address*

Begin text segment of output at *address*.

-Ur

Synonymous with -r except when linking C++ programs, where it resolves constructor references.

-X

With -s or -S, delete local symbols beginning with L.

-V

Show version number and emulation linkers for -m option.

ldconfig

```
ldconfig [options] directories
```

System administration command. Examine the libraries in the given*directories*, */etc/ld.so.conf*, */usr/lib*, and */lib*; update links and cache where necessary. Usually run in startup files or after the installation of new shared libraries.

Options

-C *filename*

Use *filename* instead of */etc/ld.so.cache*

-f*filename*

Use *filename* instead of */etc/ld.so.conf*

-l

Library mode. Expect libraries as arguments, not directories. Manually link specified libraries.

-n

Suppress examination of */usr/lib* and */lib* and reading of */etc/ld.so.conf*; do not cache.

-N

Do not cache; only link.

-p

Print all directories and candidate libraries in the cache. Used without arguments.

-v

Verbose mode. Include version number, and announce each directory as it is scanned and links as they are created.

-X

Do not link; only rebuild cache.

Files

/lib/ld.so

Linker and loader.

/etc/ld.so.conf

List of directories that contain libraries.

/etc/ld.so.cache

List of the libraries found in those libraries mentioned in*/etc/ld.so.conf*.

ldd

`ldd [options] programs`

Display a list of the shared libraries each*program* requires.

Options

-d, --data-relocs

Process data relocations. Report missing objects (for ELF objects only).

-r, --function-relocs

Process relocations for both data objects and functions. Report any that are missing (for ELF objects only).

-v, --verbose

Verbose mode. Display extra information, including symbol versions.

--help

Print help message, then exit.

--version

Display the linker's version, then exit.

less

`less [options] [filename]`

less is a program for paging through files or other output. It was written in reaction to the perceived primitiveness of more (hence its name). Some commands may be preceded by a number.

Options

-[z]*num*, --window=*num*

Set number of lines to scroll to *num*. Default is one screenful. A negative *num* sets the number to *num* lines less than the current number.

+[+]*command*

Run *command* on startup. If *command* is a number, jump to that line. The option ++ applies this command to each file in the command-line list.

-?, --help

Print help screen. Ignore all other options; do not page through file.

-a, --search-screen

When searching, begin after last line displayed. (Default is to search from second line displayed.)

-b*buffers*, --buffers=*buffers*

Use this many *buffers* for each file (default is 10). Buffers are 1 KB in size.

-c, --clear-screen

Redraw screen from top, not bottom.

-d, --dumb

Suppress dumb-terminal error messages.

-e, --quit-at-eof

Automatically exit after reaching EOF twice.

-f, --force

Force opening of directories and devices; do not print warning when opening binaries.

-g, --hilite-search

Highlight only string found by past search command, not all matching strings.

-h*num*, --max-back-scroll=*num*

Never scroll backward more than *num* lines at once.

-i, --ignore-case

Make searches case-insensitive, unless the search string contains uppercase letters.

-j*num*, --jump-target=*num*

Position target line on line *num* of screen. Target line can be the result of a search or a jump. Count lines beginning from 1 (top line). A negative *num* is counted back from bottom of screen.

-k*file*, --lesskey-file=*file*

Read *file* to define special key bindings.

-m, --long-prompt

Display more-like prompt, including percent of file read.

-n, --line-numbers

Do not calculate line numbers. Affects -m and -M options and = and v commands (disables passing of line number to editor).

-o*file*, --log-file=*file*

When input is from a pipe, copy output to *file* as well as to screen. (Prompt for overwrite authority if *file* exists.)

-p*pattern*, --pattern=*pattern*

At startup, search for first occurrence of *pattern*.

-q, --quiet, --silent

Disable ringing of bell on attempts to scroll past EOF or before beginning of file. Attempt to use visual bell instead.

-r, --raw-control-chars

Display "raw" control characters instead of using ^*x* notation. This sometimes leads to display problems, which might be fixed by using -R instead.

-s, --squeeze-blank-lines

Print successive blank lines as one line.

-t*tag*, --tag=*tag*

Edit file containing *tag*. Consult *./tags* (constructed by ctags).

-u, --underline-special

Treat backspaces and carriage returns as printable input.

-w, --hilite-unread

Show the line to which a movement command has skipped, phrases displayed by a search command, or the first unread line during a normal scroll by highlighting text in reverse video.

-x *n*, --tabs=*n*

Set tab stops to every *n* characters. Default is 8.

-y *n*, --max-forw-scroll=*n*

Never scroll forward more than *n* lines at once.

-B, --auto-buffers

Do not automatically allocate buffers for data read from a pipe. If -b specifies a number of buffers, allocate that many. If necessary, allow information from previous screens to be lost.

-C, --CLEAR-SCREEN

Redraw screen by clearing it and then redrawing from top.

-E, --QUIT-AT-EOF

Automatically exit after reaching EOF once.

-F, --quit-if-one-screen

Exit without displaying anything if first file can fit on a single screen.

-G, --HILITE-SEARCH

Never highlight matching search strings.

-I, --IGNORE-CASE

Make searches case-insensitive, even when the search string contains uppercase letters.

-J, --status-column

Used with -w or -W, highlight a single column on the left edge of the screen instead of the whole text of an unread line.

-K *charset*

Use the specified *charset*.

-M

Prompt more verbosely than with -m, including percentage, line number, and total lines.

-N, --LINE-NUMBERS

Print line number before each line.

-O *file*, --LOG-FILE=*file*

Similar to -o, but do not prompt when overwriting file.

-P[mM=]*prompt*

Set the prompt displayed by less at the bottom of each screen to *prompt*. The m sets the prompt invoked by the -m option, the M sets the prompt invoked by the -M option, and the = sets the prompt invoked by the = command. Special characters (described in the manpage for less), can be used to print statistics and other information in these prompts.

-Q, --QUIET, --SILENT

Never ring terminal bell.

-R, --RAW-CONTROL-CHARS

Like r, but adjust screen to account for presence of control characters.

-S, --chop-long-lines

Cut, do not fold, long lines.

-T *file*, --tag-file=*file*

With the -t option or :t command, read *file* instead of *./tags*.

-U, --UNDERLINE-SPECIAL

Treat backspaces and carriage returns as control characters.

-V, --version

Display version and exit.

-W, --HILITE-UNREAD

Show phrases displayed by a search command, or the first unread line of any forward movement that is more than one line, by highlighting text in reverse video.

-X, --no-init

Do not send initialization and deinitialization strings from termcap to terminal.

Commands

Many commands can be preceded by a numeric argument, referred to as *number* in the command descriptions.

SPACE, ^V, f, ^F

Scroll forward the default number of lines (usually one windowful).

z

Similar to SPACE, but allows the number of lines to be specified, in which case it resets the default to that number.

RETURN, ^N, e, ^E, j, ^J

Scroll forward. Default is one line. Display all lines, even if the default is more lines than the screen size.

d, ^D, PageDown

Scroll forward. Default is one-half the screen size. The number of lines may be specified, in which case the default is reset.

b, ^B, ESC-v

Scroll backward. Default is one windowful.

w

Like b, but allows the number of lines to be specified, in which case it resets the default to that number.

y, ^Y, ^P, k, ^K

Scroll backward. Default is one line. Display all lines, even if the default is more lines than the screen size.

u,^U,PageUp

Scroll backward. Default is one-half the screen size. The number of lines may be specified, in which case the default is reset.

r,^R,^L

Redraw screen.

R

Like r, but discard buffered input.

F

Scroll forward. When an EOF is reached, continue trying to find more output, behaving similarly to tail -f.

g,<,ESC-<

Skip to a line. Default is 1.

G,>,ESC->

Skip to a line. Default is the last line.

p,%

Skip to a position *number* percent of the way into the file.

{

If the top line on the screen includes a {, find its matching }. If the top line contains multiple {s, use *number* to determine which one to use in finding a match.

}

If the bottom line on the screen includes a }, find its matching {. If the bottom line contains multiple }s, use *number* to determine which one to use in finding a match.

(

If the top line on the screen includes a (, find its matching). If the top line contains multiple (s

use *number* to determine which one to use in finding a match.

)

If the bottom line on the screen includes a), find its matching (. If the bottom line contains multiple)s, use *number* to determine which one to use in finding a match.

[

If the top line on the screen includes a [, find its matching]. If the top line contains multiple [s use *number* to determine which one to use in finding a match.

]

If the bottom line on the screen includes a], find its matching [. If the bottom line contains multiple]s, use *number* to determine which one to use in finding a match.

ESC-^F

Behave like { but prompt for two characters, which it substitutes for { and } in its search.

ESC-^B

Behave like } but prompt for two characters, which it substitutes for { and } in its search.

m

Prompt for a lowercase letter and then use that letter to mark the current position.

' (single apostrophe)

Prompt for a lowercase letter and then go to the position marked by that letter. There are some special characters:

^

Beginning of file.

$

End of file.

^X^X

Same as '.

/*pattern*

Find next occurrence of *pattern*, starting at second line displayed. Some special characters can be entered before *pattern*:

!

Find lines that do not contain *pattern*.

*

If current file does not contain *pattern*, continue through the rest of the files in the command-line list.

@

Search from the first line in the first file specified on the command line, no matter what the screen currently displays.

?*pattern*

Search backward, beginning at the line before the top line. Treats !, *, and @ as special characters when they begin *pattern*, as / does.

ESC-/*pattern*

Same as /*.

ESC-?*pattern*

Same as ?*.

n

Repeat last *pattern* search.

N

Repeat last *pattern* search in the reverse direction.

ESC-n

Repeat previous search command, but as though it were prefaced by *.

ESC-N

Repeat previous search command, but as though it were prefaced by * and in the reverse direction.

ESC-u

Toggle search highlighting.

:e [*filename*]

Read in *filename* and insert it into the command-line list of filenames. Without*filename*, reread the current file. *filename* may contain special characters:

%

Name of current file.

#

Name of previous file.

^X^V,E

Same as :e.

:n

Read in next file in command-line list.

:p

Read in previous file in command-line list.

:x

Read in first file in command-line list.

:f, =, ^G

Print filename, position in command-line list, line number on top of window, total lines, byte

number, and total bytes.

- (single dash)

Expects to be followed by a command-line option letter. Toggle the value of that option or, if appropriate, prompt for its new value.

-+

Expects to be followed by a command-line option letter. Reset that option to its default.

--

Expects to be followed by a command-line option letter. Reset that option to the opposite of its default, where the opposite can be determined.

_ (underscore)

Expects to be followed by a command-line option letter. Display that option's current setting.

+*command*

Execute *command* each time a new file is read in.

q,:q,:Q,ZZ

Exit.

v

Not valid for all versions. Invoke editor specified by $VISUAL or $EDITOR, or vi if neither is set.

! [*command*]

Not valid for all versions. Invoke $SHELL or sh. If *command* is given, run it and then exit. Special characters:

%

Name of current file.

#

Name of previous file.

!!

Last shell command.

| *mark-letter* command

Not valid for all versions. Pipe fragment of file (from first line on screen to*mark-letter*) to *command*. *mark-letter* may also be:

^

Beginning of file.

$

End of file.

.,newline

Current screen is piped.

Prompts

The prompt interprets certain sequences specially. Those beginning with % are always evaluated. Those beginning with ? are evaluated if certain conditions are true. Some prompts determine the position of particular lines on the screen. These sequences require that a method of determining that line be specified. See the -P option and the manpage for more information.

lesskey

`lesskey [-o output-file | --output=output-file] [input-file]`

Configure keybindings for the less command using a configuration file. The input file defaults to *~/.lesskey* and the output file to *~/.less* unless you specify otherwise.

Configuration file format

The configuration file for lesskey has one to three sections. These are marked by a line containing a # symbol and the name of the section: #command, #line-edit, and #env.

The #command section

The command section determines the keys used for actions withinless. Each line should contain the key or key combination you wish to define, a space or tab, and the name of the action to perform. You may also add an extra string at the end, which will be performed at the end of the first action.

Keys you define should be entered as you plan to type them, with the following exceptions:

The actions that can be defined are:

invalid (creates error)
noaction
forw-line
back-line
forw-line-force
forw-scroll
back-scroll
forw-screen
back-screen
forw-window
back-window
forw-screen-force
forw-forever
repaint-flush
repaint
undo-hilite
goto-line
percent
left-scroll
right-scroll
forw-bracket
back-bracket
goto-end
status
forw-search
back-search
repeat-search
repeat-search-all
set-mark
goto-mark
examine
next-file
index-file
prev-file
toggle-option
display-option
pipe

visual
shell
firstcmd
help
version (display version)
digit (display number)
quit

The #line-edit section

The line editing section lets you choose keys for the line-editing capabilities ofless in a similar manner to the #command section, although without the "extra" string after the command. The line editing actions that can be defined are:

forw-complete
back-complete
expand
literal
right
left
word-left
word-right
insert
delete
word-delete
word-backspace
home
end
up
down

The #env section

The third section, like the second, is optional, and you can use it to override environment variables that affect less. Each line consists of a variable, the equals sign (=), and the value to which you wish to set the variable. The most important ones areLESS, which allows you to select additional flags to pass to less when you run it, and LESSCHARSET, which lets you choose a character set. See the less manpage for a complete list of environment variables that affect the program.

lftp

```
lftp [options] [url]
```

File transfer program with more features than ftp. The lftp command allows FTP and HTTP protocol

transfers, plus other protocols including FISH (SSH based), FTPS, and HTTPS. It uses a shell-like command interface and offers job control in a manner similar to bash. lftp has two important reliability features: it resumes failed or interrupted transactions, and it goes into the background automatically if it is quit in the middle of a file transfer.

Options

-d

Run in debug mode.

-e *commands*

Start, execute the specified commands, and then wait for further instructions.

-p *portnumber*

Connect to the specified port number.

-u *user*[,*pass*]

Login to the server with the username (and, optionally, password) you specify.

-f *scriptfile*

Run the specified script file of lftp commands, then exit.

-c *commands*

Run the commands specified, then exit.

Commands

The lftp commands are similar to those for ftp. However, lftp lacks or uses different mechanisms for a number of commands, including $, ascii, binary, case, and macdef. It also adds the following:

alias [*name* [*value*]]

Create an alias for a command. For example, you could set dir to be an alias for ls -lf.

anon

Set the username to anonymous. This is the default username.

at

Execute a command at a given time, as with the at command in an actual shell.

bookmark [*arguments*]

The lftp bookmark command used with the following arguments will add, delete, edit, import, or list bookmarks, respectively:

- add *name url*
- del *name*
- edit
- import *type*
- list

cache

Work with the local memory cache. This command should be followed by the arguments:

stat

Display the status for the cache.

on|off

Turn caching on or off.

flush

Empty the cache.

size n

Set the maximum size for the cache. Setting it to -1 means unlimited.

expire nu

Set the cache to expire after *n* units of time. You can set the unit to seconds (s), minutes

(m), hours (h), or days (d). For example, for a cache that expires after an hour, use the syntax cache expire 1h.

close

Where the ftp version of this command just stops all sessions, this version closes idle connections with the current server. If you have connections to multiple servers and wish to close all idle connections, add the -a flag.

command cmd args

Execute the specified lftp command, with the specified arguments, ignoring any aliases created with the alias command.

mirror [options] [remotedir [localdir]]

Copy a directory exactly. The mirror command accepts the following arguments:

-c, --continue

If mirroring was interrupted, resume it.

-e, --delete

Delete local files that are not present at the remote site.

-s, --allow-suid

Keep the suid/sgid bits as set on the remote site.

-n, --only-newer

Get only those files from the remote site that have more recent dates than the files on the local system. Cannot be used with the -c argument.

-r, --no-recursion

Do not get any subdirectories.

--no-umask

Do not use umask when getting file modes. See umask for more information about file modes.

-R, --reverse

Mirror files from the local system to the remote system. With this argument, make sure that you specify the local directory first and the remote directory second. If you do not specify both directories, the second is assumed to be the same as the first. If you choose neither, the operation occurs in the current working directories.

-L, --dereference

When mirroring a link, download the file the link points to rather than just the link.

-N, --newer-than filename

Get all files newer than the file *filename*.

-P, --parallel[=*n*]

Download *n* files in parallel.

-i, --include regex

Get only the files whose names match the regular expression *regex*. See grep for more information about regular expressions.

-x, --exclude regex

Do not get the files whose names match *regex*. See grep for more information about regular expressions.

-t, time-prec n

Set the precision of time measurement for file comparison; if file dates differ by amounts less than *n*, they are assumed to be the same. You can specify *n* in seconds (s), minutes (m), hours (h), or days (d).

-T, --loose-time-prec n

Set the precision for loose time comparisons. You can specify *n* in seconds (s), minutes (m), hours (h), or days (d).

-v, --verbose=*n*

Set the verbose level. You can set *n* from 0 (no output) to 3 (full output) using a number or by repeating the *v*. For example, -vvv is level 3 verbose mode.

--use-cache

Use the cache to get directory listings.

--remove-source-files

Move, rather than copy, files when mirroring.

set [setting | value]

Set one of the preference variables for lftp. If run without arguments, list the variables that have been changed; without arguments and with the -a or -d flags, list all values or default values, respectively.

See the lftp manpage for a complete list of preference variables that can be set.

wait [n | all]

Wait for the job or jobs you specify by number, or all jobs, to terminate.

lftpget

`lftpget [options] url`

Uses the lftp program to fetch the specified URL, which may be HTTP, FTP, or any of the protocols supported by lftp.

Options

lftpget takes only three options.

-c

Continue or restart a paused transaction.

-d

Display debugging output.

-v

Verbose mode; display more information about transactions.

link

```
link file1 file2
```

Create a link between two files. This is the same as the ln command, but it has no error checking because it uses the link( ) system call directly.

ln

```
ln [options] sourcename [destname]
ln [options] sourcenames destdirectory
```

Create pseudonyms (links) for files, allowing them to be accessed by different names. Links may be "hard" or "soft." A hard link creates two names for the same file, and a soft, or symbolic, link creates a second file which acts as a shortcut to the first.

The first form links *sourcename* to *destname*, where *destname* is usually either a new filename or (by default) a file in the current directory with the same name as *sourcename*. If *destname* is an existing file, it is overwritten; if *destname* is an existing directory, a link named *sourcename* is created in that directory. The second form creates links in *destdirectory*, each link having the same name as the file specified.

Options

-b, --backup[=control]

Back up any existing files. When using the long version of the command, the optional *control* parameter controls the kind of backup. When no control is specified, ln will attempt to read the control value from the VERSION_CONTROL environment variable. Accepted values are:

none, off

Never make backups.

numbered, t

Make numbered backups.

existing, nil

Match existing backups, numbered or simple.

simple, never

Always make simple backups.

-d, -F, --directory

Allow hard links to directories. Available to privileged users.

-f, --force

Force the link (don't prompt for overwrite permission).

--help

Print a help message and then exit.

-i, --interactive

Prompt for permission before removing files.

-n, --no-dereference

Replace symbolic links to directories instead of dereferencing them. --force is useful with this option.

-s, --symbolic

Create a symbolic link. This lets you link across filesystems, and also see the name of the link when you run ls -l (otherwise, there's no way to know the name that a file is linked to).

-S *suffix*, --suffix=*suffix*

Append *suffix* to files when making backups, instead of the default ~.

--target-directory= *directory*

Create links in the specified *directory*.

-v, --verbose

Verbose mode.

--version

Print version information and then exit.

loadkeys

---

loadkeys [*options*] [*filename*]

Load a keymap from a specified file, usually one of the keymaps stored in */lib/kbd/keymaps*. If you create your own keymap file, the related commands showkey, keymaps, and dumpkeys will be useful as well. Note that loadkeys applies only to virtual consoles; to change your X keyboard configuration, use xmodmap or setxkbmap, or the graphical keyboard-layout switching tools that are included with your desktop environment.

Options

-c, --clearcompose

Clear the compose, or accent, table in the kernel.

-d, --default

Load the default keymap. The same as running loadkeys defkeymap.

-h, --help

Display help and usage information.

-m, --mktable

Instead of loading the table, output maps as C language declarations.

-q, --quiet

Operate in quiet mode.

-s, --clearstrings

Clear the string table in the kernel.

-v, --verbose

Operate verbosely. For extra effect, repeat.

locale

`locale [options] [name]`

Print report on current locale settings. Locales determine the country-specific settings for a system, including character encodings, the formatting of dates, honorifics, diagnostic messages, currency, printer-paper sizes, and default measurements. Locale settings are essentially a dictionary of settings specified by keyword. The keywords are grouped together into related categories whose names begin with LC_. Each category has a related environment variable of the same name from which it will read its locale setting. Supply keyword or category names as *name* to examine their values. Multiple names may be given. You can also use the special keyword `charmap` to see the current character mapping. When executed with no arguments, locale prints the value of all locale-related environment variables.

Options

-a

Print all available locale settings installed on the system.

-c

Print the category related to each *name* argument.

-k

Print keywords along with their settings for each *name* argument.

-m

Print all available character maps.

Environment variables

LANG

The default value for unset internationalization variables. If not set, the system's default value is used.

LC_ADDRESS

Postal settings, country, and language names and abbreviation.

LC_COLLATE

String and character sorting and comparison settings.

LC_CTYPE

Character attributes, including case conversion mappings, and categories of characters (whitespace, digit, lower, upper, punctuation, etc.).

LC_IDENTIFICATION

Information related to the current locale definition, including its title, source, revision, and contact information for its author.

LC_MEASUREMENT

Measurement units, metric or other.

LC_MESSAGES

Settings for yes/no prompts and other informative and diagnostic messages.

LC_MONETARY

Currency formats and symbols.

LC_NAME

Formats for names and honorifics.

LC_NUMERIC

Nonmonetary number formats.

LC_PAPER

Default paper sizes for printing and pagination.

LC_TELEPHONE

Telephone number formats.

LC_TIME

Date and time formats.

LC_ALL

When set, overrides the values of all other internationalization variables.

NLSPATH

The path for finding message catalogs used in processing messages.

Examples

Print the category name and all keywords for date and time settings:

```
locale -ck LC_TIME
```

Print the strings used for days of the week and months of the year:

```
locale day mon
```

locate

```
locate [options] pattern
```

Search database(s) of filenames and print matches. Matches include all files that contain*pattern* unless *pattern* includes metacharacters, in which case`locate` requires an exact match. *, ?, [, and] are treated specially; / and . are not. Searches are conducted against a database of system contents that is updated periodically. To update the database, use the`updatedb` command.

Options

`-d` *path*, `--database=`*path*

Search databases in *path*. *path* must be a colon-separated list.

`-h`, `--help`

Print a help message and then exit.

`--version`

Print version information and then exit.

lockfile

`lockfile` [*options*] *filenames*

Create semaphore file(s), used to limit access to a file. When`lockfile` fails to create some of the specified files, it pauses for eight seconds and retries the last one on which it failed. The command processes flags as they are encountered (i.e., a flag that is specified after a file will not affect that file). This command is most often used by scripts and applications as a way to avoid multiple users changing the same file at once.

Options

-sleeptime

Number of seconds `lockfile` waits before retrying after a failed creation attempt. Default is 8.

-!

Invert return value. Useful in shell scripts.

-l *lockout_time*

Time (in seconds) after a lockfile was last modified at which it will be removed by force. See also -s.

-ml, -mu

If the permissions on the system mail spool directory allow it or iflockfile is suitably setgid, lockfile can lock and unlock your system mailbox with the options -ml and -mu, respectively.

-r *retries*

Stop trying to create *files* after this many *retries*. The default is -1 (never stop trying). When giving up, remove all created files.

-s *suspend_time*

After a lockfile has been removed by force (see -l), a suspension of 16 seconds takes place by default. (This is intended to prevent the inadvertent immediate removal of any lockfile newly created by another program.) Use -s to change the default suspend time.

logger

```
logger [options] [message...]
```

TCP/IP command. Add entries to the system log (via syslogd). If no message is given on the command line, standard input is logged.

Options

-d

When writing to a socket with -s, use a datagram instead of a stream.

-f *file*

Read *message* from *file*.

-i

Include the process ID of the logger process.

-p *pri*

Enter message with the specified priority *pri*. Default is user.notice.

-s

Log message to standard error as well as to the system log.

-t *tag*

Mark every line in the log with the specified *tag*.

-u *socket*

Write log to *socket* instead of to the syslog.

--

Accept no further options. Consider whatever is to the right of the hyphens as the message to be logged.

login

`login [name | option]`

Log into the system. login asks for a username (*name* can be supplied on the command line) and password (if appropriate).

If successful, login updates accounting files, sets various environment variables, notifies users if they have mail, and executes startup shell files.

Only the root user can log in when */etc/nologin* exists. That file is displayed before the connection is terminated. Furthermore, root may connect only on a tty that is listed in */etc/securetty*. If *~/.hushlogin* exists, execute a quiet login. If */var/adm/lastlog* exists, print the time of the last login.

Options

-f

Suppress second login authentication.

-h *host*

Specify name of remote host. Normally used by servers, not humans; may be used only by root.

-p

Preserve previous environment.

logname

```
logname [option]
```

Consult */var/run/utmp* for user's login name. If found, print it; otherwise, exit with an error message

Options

--help

Print a help message and then exit.

--version

Print version information and then exit.

logrotate

```
logrotate [options] config_files
```

System administration command. Manipulate logfiles according to commands given in*config_files*.

Options

-d, --debug

Debug mode. No changes will be made to logfiles.

-f, --force

Force rotation of logfiles.

-h, --help

Describe options.

-m *command*, --mail *command*

Use the specified *command* to mail logfiles. The default command is /bin/mail -s.

-s *file*, --state *file*

Save state information in *file*. The default is */var/lib/logrotate.status*.

--usage

Show syntax and options.

-v, --verbose

Describe what is being done and what logfiles are affected.

Configuration Commands

Logrotate directives may appear on their own or as part of logfile definitionsinstructions for specific logfiles. You may use wildcards to specify those files. Enclose directives for logfile definitions in a beginning and ending curly brace. For example:

```
compress
/var/log/messages {
    rotate 5
```

```
    weekly
}
```

compress

Compress old versions of logfiles with `gzip`.

compresscmd *command*

Use *command* to compress logfiles. Default is `gzip`.

compressext *extension*

Append filename `extension` to compressed files instead of the `compress` command's default.

compressoptions *options*

Specify *options* to pass to the `compress` command. Default for `gzip` is `-9` for maximum compression.

copy

Copy logfile, but do not change the original.

copytruncate

Copy logfile, then truncate it in place. For use with programs whose logging cannot be temporarily halted.

create [*permissions*] [*owner*] [*group*]

After rotation, re-create logfile with the specified *permissions*, *owner*, and *group*. *permissions* must be in octal. If any of these parameters is missing, the logfile's original attributes will be used.

daily

Rotate logfiles every day.

delaycompress

Don't compress logfile until the next rotation.

endscript

End a postrotate or prerotate script.

extension *extension*

Give rotated logfiles the specified *extension*. Any compression extension will be appended to this.

firstaction

May only be used as part of a logfile definition. Begin a shell script to execute once if any files match. The script ends when the endscript directive is read.

ifempty

Rotate logfile even if it is empty. Overrides the default notifempty option.

include *file*

Read the *file* into current file. If *file* is a directory, read all files in that directory into the current file.

lastaction

May only be used as part of a logfile definition. Begin a shell script to execute once after rotating all matching files and running any postrotate script. The script ends when the endscript directive is read.

mail *address*

Mail any deleted logs to *address*.

mailfirst

When using the mail command, mail the newly rotated log instead of the one being deleted.

maillast

When using the mail command, mail the log that is about to expire. This is the default behavior.

missingok

Skip missing logfiles. Do not generate an error.

monthly

Rotate logfiles only the first time logrotate is run in a month.

nocompress

Override compress.

nocopy

Override copy.

nocopytruncate

Override copytruncate.

nocreate

Override create.

nodelaycompress

Override delaycompress.

nomail

Override mail.

nomissingok

Override missingok.

noolddir

Override olddir.

nosharedscipts

Override sharedscripts. Run prerotate and postrotate scripts for each log rotated. This is the default.

notifempty

Override ifempty.

olddir *directory*

Move logs into *directory* for rotation. *directory* must be on the same physical device as the original logfiles.

postrotate

May only be used as part of a logfile definition. Begin a shell script to apply after the logfile is rotated. The script ends when the endscript directive is read.

prerotate

May only be used as part of a logfile definition. Begin a shell script to apply before a logfile is rotated. The script ends when the endscript directive is read.

rotate *number*

The *number* of times to rotate a logfile before removing it.

size *n*[k|M]

Rotate logfile when it is greater than *n* bytes. *n* can optionally be followed by k for kilobytes or M for megabytes.

sharedscripts

Run prescript and postscript only once for the session.

start *n*

Use *n* as the starting number for rotated logs. Default is 0.

tabooext [+] *extlist*

Replace taboo extension list with the given*extlist*. If + is specified, add to existing list. The default list is .rpmorig .rpmsave ,v .swp .rpmnew ~.

weekly

Rotate logfiles if more than a week has passed since their last rotation.

uncompresscmd *command*

Use *command* to uncompress logfiles. Default is `gunzip`.

look

```
look [options] string [file]
```

Search for lines in *file* (*/usr/dict/words* by default) that begin with *string*.

Options

`-a`

Use alternate dictionary, */usr/dict/web2*.

`-d`

Compare only alphanumeric characters.

`-f`

Search is not case-sensitive.

`-t` *character*

Stop checking after the first occurrence of *character*.

losetup

```
losetup [options] loopdevice [file]
```

System administration command. Set up and control loop devices. Attach a loop device to a regular file or block device, detach a loop device, or query a loop device. A loop device can be used to mount an image file as if it were a normal device.

Options

-d

Detach specified *loopdevice*.

-e *encryption,* -E*number*

Use specified kernel *encryption* module when performing writes and reads. (Usually NONE, DES, and XOR.) You may also specify the encryption module by *number*. When using DES encryption, you will be prompted for an initialization passphrase.

-o *offset*

Start reading data at *offset* bytes from the beginning of *file*.

-p *fd*

Read the passphrase from file descriptor *fd*.

lpadmin

`lpadmin [options]`

System administration command. Configure CUPS printer queues. The command requires one of the following options: `-d`, `-p`, or `-x`. When a queue is configured to require a password, the`lpadmin` command will prompt for one.

Options

-d *queue*

Set the default destination for CUPS commands like`lp` and `lpr` to the specified *queue*.

-E

Always use encryption when connecting to the server.

-h *server*

Apply configuration commands remotely to the specified CUPS*server*.

-p *printer print-options*

Apply *print-options* (documented below) to the specified *printer*.

-x *queue*

Delete the specified *queue*. Abort any current print job and discard any pending print jobs.

Print options

Use these additional options with the -p option listed above.

-c *class*

Add printer to the specified *class*. Create *class* if it does not already exist.

-D *description*

Set the text *description* of the printer.

-E

Enable printer.

-L *location*

Set the printer *location* text.

-i *script*

Use the specified System V-style interface*script*.

-m *filename*

Use the specified System V interface script or PPD file found in the model directory.

-o *name=value*

Set the *value* of PPD or server option *name*. For a list of available PPD options, use the

lpoptions command.

-P *filename*

Use the PPD specified by *filename*. This option overrides the -i printer option.

-r *class*

Remove printer from the specified *class*. Remove *class* if it has no printer entries.

-u allow:[@]*name*, -u deny:[@]*name*

Set user level access control. To specify a group instead of a user *name*, preface the *name* with @. You may also use the special names all and none.

-v *uri*

Set the device universal resource indicator, *uri*. If given as a filename, the command will automatically convert it to a file URI.

lpinfo

`lpinfo` *`options`*

System administration command. Print information on available printer devices and drivers.

Options

-E

Force the use of encryption connecting to the server.

-l

Show a long, or verbose, listing.

-m

List available printer drivers.

-v

List available printer devices.

lpmove

```
lpmove [option] job destination
```

System administration command. Move the specified print*job* to a new *destination*.

Option

-E

Force the use of encryption connecting to the server.

lpq

```
lpq [options] [+interval]
```

Check the print spool queue for status of print jobs. For each job, display username, rank in the queue, filenames, job number, and total file size (in bytes). We document the CUPS printing system here; other versions will vary slightly.

Options

-a

Report on all printers listed in the server's printcap database.

-E

Use encryption when connecting to a print server.

-l

Verbose mode. Print information about each file composing a job. Use-l multiple times to increase the information provided.

-P *printer*

Specify which printer to query. Without this option,lpq uses the default printer, normally set through lpadmin.

+interval

Check the queue every *interval* seconds until it is empty. For example, +10 reloads the queue every ten seconds.

lpr

```
lpr [options] [files]
```

Send files to be printed. If no *files* are given, accept standard input. We document the CUPS printing system here; the older LPRng and BSD systems will vary slightly. CUPSlpr, for example, does not accept the options c, d, f, g, i, m, n, t, v, or w, used by LPRng.

Options

-C, J, T *name*

Sets a name for the print job.

-E

Use encryption when connecting to a print server.

-l

Expect a binary or literal file on which minimal processing should be done. The same as-o raw.

-o *option*

Set printer-specific options. These vary by printer, but may include paper type and orientation, paper-tray selection, output order, and so forth. Check the complete CUPS user manual and your printer's PPD file for the full list.

-P *printername*

Print to the specified printer. If no printer is given, prints to the default printer, usually set with lpadmin.

-p

Pretty-print a text document. Provides a shaded header containing page numbers, the job name, and the time and date of printing. Equivalent to-o prettyprint.

-r

Delete files after printing them.

Example

Print a simple file:

```
lpr  filename .txt
```

lprm

```
lprm [options] [jobid]
```

Cancel print jobs. Job IDs can be obtained from lpq; if no job is specified, cancels the current job on the default printer.

Options

-

Remove all jobs available to the user. Same as using the*jobid* ALL.

-E

Use encryption.

-P *printer*

Specify printer queue. If no printer is specified, the default printer is used.

lpstat

```
lpstat [options] [queues]
```

Show the status of the print queue or queues. With options that take a*list* argument, omitting the list produces all information for that option. *list* can be separated by commas or, if enclosed in double quotes, by spaces. For the LPRng print service, `lpstat` is a frontend to the `lpq` program.

Options

-a [*list*]

Show whether the *list* of printer or class names is accepting requests.

-c [*list*]

Show information about printer classes named in*list*.

-d

Show the default printer destination.

-f [*list*]

Verify that the *list* of forms is known to `lp`.

-l

Use after `-f` to describe available forms, after `-p` to show printer configurations, or after `-s` to

describe printers appropriate for the specified character set or print wheel.

`-o` [*list*]

Show the status of output requests. *list* contains printer names, class names, or request IDs.

`-p` [*list*]

Show the status of printers named in *list*.

`-r`

Show whether the print scheduler is on or off.

`-s`

Summarize the print status (show almost everything).

`-t`

Show all status information (report everything).

`-u` [*list*]

Show request status for users on *list*. Use all to show information on all users.

`-A`

Use authentication.

ls

```
ls [options] [names]
```

List contents of directories. If no *names* are given, list the files in the current directory. With one or more *names*, list files contained in a directory *name* or that match a file *name*. *names* can include filename metacharacters. The options let you display a variety of information in different formats. The most useful options include `-F`, `-R`, `-l`, and `-s`. Some options don't make sense together (e.g., `-u` and `-c`).

Options

-1, --format=single-column

Print one entry per line of output.

-a, --all

List all files, including the normally hidden files whose names begin with a period.

-b, --escape

Display nonprinting characters in octal and alphabetic format.

-c, --time-ctime, --time=status

List files by status change time (not creation/modification time).

--color =*when*

Colorize the names of files depending on the type of file. Accepted values for*when* are never, always, or auto.

-d, --directory

Report only on the directory, not its contents.

-f

Print directory contents in exactly the order in which they are stored, without attempting to sort them.

--full-time

List times in full, rather than using the standard abbreviations.

-g

Long listing like -l, but don't show file owners.

-h

Print sizes in kilobytes and megabytes.

--help

Print a help message and then exit.

-i, --inode

List the inode for each file.

--indicator-style=none

Display filenames without the flags assigned by -p or -f (default).

-k, --kilobytes

If file sizes are being listed, print them in kilobytes. This option overrides the environment variable POSIXLY_CORRECT.

-l, --format=long, --format=verbose

Long format listing (includes permissions, owner, size, modification time, etc.).

-m, --format=commas

Merge the list into a comma-separated series of names.

-n, --numeric-uid-gid

Like -l, but use group ID and user ID numbers instead of owner and group names.

-o

Long listing like -l, but don't show group information.

-p, --filetype, --indicator-style=file-type

Mark directories by appending / to them.

-q, --hide-control-chars

Show nonprinting characters as ? (default for display to a terminal).

-r, --reverse

List files in reverse order (by name or by time).

-s, --size

Print file size in blocks.

--show-control-chars

Show nonprinting characters verbatim (default for printing to a file).

--si

Similar to -h, but uses powers of 1,000 instead of 1,024.

-t, --sort=time

Sort files according to modification time (newest first).

-u, --time=atime, --time=access, --time=use

Sort files according to file-access time.

--version

Print version information on standard output, then exit.

-x, --format=across, --format=horizontal

List files in rows going across the screen.

-v, --sort=version

Interpret the digits in names such as *file.6* and *file.6.1* as versions, and order filenames by version.

-w, --width=*n*

Format output to fit *n* columns.

-A, --almost-all

List all files, including the normally hidden files whose names begin with a period. Does not include the . and .. directories.

-B, --ignore-backups

Do not list files ending in ~ unless given as arguments.

-C, --format=vertical

List files in columns (the default format).

-D, --dired

List in a format suitable for Emacs dired mode.

-F, --classify, --indicator-style=classify

Flag filenames by appending / to directories, * to executable files, @ to symbolic links, | to FIFOs, and = to sockets.

-G, --no-group

In long format, do not display group name.

-H, --dereference-command-line

When symbolic links are given on the command line, follow the link and list information from the actual file.

-I, --ignore *pattern*

Do not list files whose names match the shell pattern*pattern*, unless they are given on the command line.

-L, --dereference

List the file or directory referenced by a symbolic link rather than the link itself.

-N, --literal

Display special graphic characters that appear in filenames.

-Q, --quote-name

Quote filenames with "; quote nongraphic characters.

-R, --recursive

List directories and their contents recursively.

-Rfile, --reload-state *file*

Load state from *file* before starting execution.

-S, --sort=size

Sort by file size, largest to smallest.

-U, sort=none

Do not sort files.

-X, sort=extension

Sort by file extension, then by filename.

lsattr

`lsattr [options] [files]`

Print attributes of *files* on a Linux Second Extended File System. See also chattr.

Options

-a

List all files in specified directories.

-d

List attributes of directories, not of contents.

-v

List version of files.

-R

List directories and their contents recursively.

-V

List version of lsmod, then exit.

lspci

```
lspci [options]
```

System administration command. List all Peripheral Component Interconnect (PCI) devices. This command has many options that are useful for debugging device drivers. Here we document some of the more common options.

Options

-b

Show IRQ and addresses as seen by the cards instead of the kernel.

-t

Print a tree showing connections between devices.

-m

Print information with quoted strings suitable for use by scripts.

-n

Print vendor and device codes as numbers.

-v, -vv

List devices verbosely. Use the second form for very verbose listings.

lsmod

`lsmod`

System administration command. List all loaded modules: name, size (in 4 KB units), and, if appropriate, a list of referring modules. The same information is available in*/proc/modules* if the */proc* directory is enabled on the system.

lsusb

`lsusb [options]`

System administration command. List all Universal Serial Bus (USB) devices. This command has many options of use for debugging device drivers. Here we document some of the more common options.

Options

`-b`

Show IRQ and addresses as seen by the cards instead of the kernel.

`-D` *device*

Only show information about the specified*device*. This should be given as a file in the */proc/bus/usb* directorye.g., */proc/bus/usb/001/001*.

`-t`

Print a tree showing connections between devices.

`-v, -vv`

List devices verbosely. Use the second form for very verbose listings.

m4

`m4 [`*`options`*`] [`*`macros`*`] [`*`files`*`]`

Macro processor for C and other files.

Options

-e, --interactive

Operate interactively, unbuffered, ignoring interrupts.

-d*flags*, --debug=*flags*

Specify *flag*-level debugging.

--help

Print help message, then exit.

-l*n*, --arglength=*n*

Specify the length of debugging output.

-o *file*, --error-output=*file*

Place output in *file*. Despite the name, print error messages on standard error.

-P, --prefix-built-ins

Prepend m4_ to all built-in macro names.

-s, --synclines

Insert #line directives for the C preprocessor.

-t*name*, --trace=*name*

Insert *name* into symbol table as undefined. Trace macro from the point it is defined.

--version

Print version, then exit.

-B*n*

Set the size of the pushback and argument collection buffers to*n* (default is 4096).

-D*name*[=*value*], --define=*name*[=*value*]

Define *name* as *value* or, if *value* is not specified, define *name* as null.

-E, --fatal-warnings

Consider all warnings to be fatal, and exit after the first of them.

-F*file*, --freeze-state=*file*

Record m4's frozen state in *file* for later reloading.

-G, --traditional

Behave like traditional m4, ignoring GNU extensions.

-H*n*, --hashsize=*n*

Set symbol-table hash array to *n* (default is 509).

-I*directory*, --include=*directory*

Search *directory* for include files.

-Ln, --nesting-limit=*n*

Change artificial nesting limit to*n*.

-Q, --quiet, --silent

Suppress warning messages.

-R*file*, --reload-state=*file*

Load state from *file* before starting execution.

-U*name*, --undefine=*name*

Undefine *name*.

mail

```
mail [options] [users]
```

Read mail or send mail to other *users*. The mail utility allows you to compose, send, receive, forward, and reply to mail. mail has two main modes: compose mode, in which you create a message, and command mode, in which you manage your mail.

While mail is a powerful utility, it can be tricky for a novice user. It is most commonly seen nowadays in scripts. Most Linux distributions include several utilities that are richer in features and much easier to use: mailers built into browsers such as Mozilla and Firefox, graphical mail programs distributed with GNOME (Evolution) and KDE (Kmail), and the terminal-based, full-screen utilities pine and elm. The GNU Emacs editor can also send and receive mail.

This section presents mail commands, options, and configuration options. To get you started, here are two of the most basic commands.

To enter interactive mail-reading mode, type:

```
mail
```

To begin writing a message to *user*, type:

```
mail  user
```

Enter the text of the message, one line at a time, pressing Enter at the end of each line. To end the message, enter a single period (.) in the first column of a new line and press Enter.

You can also provide much of the information on the command line, as shown in the following example:

```
mail james -s "System Log" </var/log/messages
```

This command sends a message to the user *james*, with a subject line of System Log, and the text of

the message read from the system logfile, */var/log/messages*.

Command-line options

-b *list*

Set blind-carbon-copy field to comma-separated *list*.

-c *list*

Set carbon-copy field to comma-separated *list*.

-d

Print debugging information.

-f [*file*]

Process contents of *file* instead of */var/spool/mail/$user*. If *file* is omitted, process *mbox* in the user's home directory.

-i

Do not respond to tty interrupt signals.

-I

Run interactively even if the input is not from a terminal.

-n

Do not consult */etc/mail.rc* when starting up.

-N

When printing a mail message or entering a mail folder, do not display message headers.

-p

Read mail in POP mode.

-s *subject*

Set subject to *subject*. Use quotes around subjects that contain spaces.

-u*user*

Process contents of */var/spool/mail/$user* for the specified user.

-v

Verbose; print information about mail delivery to standard output.

-P

Disable POP mode.

Compose-mode commands

~!*command*

Execute a shell escape from compose mode and run the specified command.

~?

List compose-mode escapes.

~b *names*

Add names to or edit the Bcc: header.

~c *names*

Add names to or edit the Cc: header.

~d

Read in the *dead.letter* file.

~e

Invoke text editor.

~f *messages*

Insert *messages* into message being composed.

~F *messages*

Similar to ~f, but include message headers.

~h

Add to or change all headers interactively.

~m *messages*

Similar to ~f, but indent with a tab.

~M *messages*

Similar to ~m, but include message headers.

~p

Print message header fields and message being sent.

~q

Abort current message composition.

~r *filename*

Include file in current message.

~s *string*

Change Subject: header to *string*.

~t *names*

Add names to or edit the To: list.

~v

Invoke editor specified with the VISUAL environment variable.

~| *command*

Pipe message through *command*.

~: *mail-command*

Execute *mail-command*.

~~*string*

Insert *string* in text of message, prefaced by a single tilde (~). If string contains a ~, it must be escaped with a \.

Command-mode commands

?

List summary of commands (help screen).

!

Execute a shell command.

- [*nm*]

Print *num*th previous message; defaults to immediately previous.

alias (a)

Print or create alias lists.

alternates (alt)

Specify remote accounts on remote machines that are yours. Tell mail not to reply to them.

chdir (c)

cd to home or specified directory.

copy (co)

Similar to save, but do not mark message for deletion.

delete (d)

Delete message.

dp (dt)

Delete current message and display next one.

edit (e)

Edit message.

exit (ex, x)

Exit mail without updating folder or user's system mailbox.

file (fi)

Switch folders.

folder (fold)

Read messages saved in a file. If no file is specified, display the name of the current file. In addition to filenames, the following are allowed:

#

Previous file

%

System mailbox

%user

user's system mailbox

&

mbox

+folder

File in *folder* directory.

folders

List folders.

from (f)

Print headers for messages.

headers (h)

List message headers at current prompt.

headers+ (h+)

Move forward one window of headers.

headers- (h-)

Move back one window of headers.

help

Same as ?.

hold (ho)

Hold messages in system mailbox.

ignore

Append list of fields to ignored fields. With no arguments, list currently ignored fields.

mail *user* (m)

Compose message to *user*.

mbox

Move specified messages to *mbox* on exiting (the default).

next (n)

Type next message or next message that matches argument.

preserve (pr)

Synonym for hold.

print [*list]* (p)

Display each message in *list*.

Print [*list]* (P)

Similar to print, but include header fields.

quit (q)

Exit mail and update folder.

reply (r)

Send mail to all on distribution list.

Reply (R)

Send mail to author only.

respond

Same as reply.

retain

Always include this list of header fields when printing messages. With no arguments, list retained fields.

save (s)

Save message to folder.

saveignore

Remove ignored fields when saving.

saveretain

Override saveignore to retain specified fields.

set (se)

Set or print mail options.

shell (sh)

Enter a new shell.

size

Print size of each specified message.

source

Read commands from specified file.

top

Print first few lines of each specified message.

type (t)

Same as print.

Type (T)

Same as Print.

unalias

Discard previously defined aliases.

undelete (u)

Restore deleted message.

unread (U)

Mark specified messages as unread.

unset (uns)

Unset mail options.

visual (v)

Edit message with editor specified by the VISUAL environment variable.

write (w)

Write message, without headers, to file.

xit (x)

Same as exit.

z

Move mail's attention to next windowful of text. Use z- to move it back.

Configuration options

These options are set inside the user's *.mailrc* configuration file. The syntax is set *option* or unset *option*. The system default configuration is in */etc/mail.rc*.

append

Append (do not prepend) messages to *mbox*.

ask, asksub

Prompt for subject.

askbcc

Prompt for blind-carbon-copy recipients.

askcc

Prompt for carbon-copy recipients.

autoprint

Print next message after a delete.

crt*num*

Use the default pager to display a message of more than *num* lines. Defaults to the height of the terminal screen.

debug

Same as -d on command line.

dot

Interpret a solitary . as an EOF.

escape *char*

Specify escape character to use instead of a tilde (~).

folder*dir*

Define directory to hold mail folders.

hold

Keep message in system mailbox upon quitting.

ignore

Ignore interrupt signals from terminal. Print them as @.

ignoreeof

Do not treat ^D as an EOF.

indentprefix *string*

Use the specified string with ~m as the prefix for indented messages.

metoo

Do not remove sender from groups when mailing to them.

noheader

Same as -N on command line.

nosave

Do not save aborted letters to *dead.letter*.

Replyall

Switch roles of Reply and reply.

quiet

Do not print version at startup.

record *file*

Use *file* as the path to record outgoing mail. If not set, outgoing mail is not saved.

searchheaders

When given the specifier */x*:*y*, expand all messages that contain the string *y* in the *x* header field.

toplines *num*

Print *num* lines of message with the top command. Default value is 5.

verbose

Same as -v on command line.

mailq

`mailq [`*`options`*`]`

System administration command. List all messages in the `sendmail` mail queue. Equivalent to `sendmail -bp`.

Options

-Ac

Show queue specified in */etc/mail/submit.cf* instead of queue specified in */etc/mail/sendmail.cf*.

-q*[*
!
*]*I*substring*

Show items in mail queue with queue ids containing*substring*. In this, and in similar options below, invert the match when **!** is specified.

-qL

Show lost items in mail queue.

-qQ

Show quarantined items in the mail queue.

-q*[*
!
*]*Q*substring*

Show quarantined messages with quarantine reasons containing*substring*.

-q*[*
!
*]*R*substring*

Show items in mail queue with recipients containing*substring.*

-q*[*
!
*]*S*substring*

Show items in mail queue with senders containing*substring*.

-v

Verbose mode.

mailstats

```
mailstats [options]
```

System administration command. Display a formatted report of the currentsendmail mail statistics.

Options

-c

Use configuration in */etc/mail/submit.cf* instead of */etc/mail/sendmail.cf*.

-C *file*

Use sendmail configuration file *file* instead of the default *sendmail.cf* file.

-f *file*

Use sendmail statistics file *file* instead of the file specified in thesendmail configuration file.

-o

Don't show the name of the mailer in the report.

-p

Print stats without headers or separators. Output suitable for use by other programs. Reset statistics.

-P

Print stats without headers or separators. Output suitable for use by other programs. Do not reset statistics.

mailto

```
mailto [options] [recipients]
```

Send mail with MIME types and text formatting. If no recipients are specified,mailto prompts for the

names. This program has a very similar interface to that of the mail command, with two differences: it only sends mail, and it adds a number of text-formatting and MIME-handling features, described here. For features not covered here, see the mail command. mailto uses the metamail backend and relies on the mailcap configuration files.

Options

-a *charset*

Specify an alternate character set.

-c *name*

Specify a name for the CC: field. Specify multiple names with a comma-separated list inside double quotes.

-s *subj*

Specify the Subject: field. Use double quotes if there are any spaces.

Text formatting

Mail formatting is handled with escape sequences that begin with the tilde (~) character. Those for text formatting are:

~b

Turn bold text on or off.

~i

Turn italic text on or off.

~jc, ~jl, ~jr

Set justification to center, left, or right, respectively.

~k

Toggle whether to send a blind copy to yourself.

~n

Hard line break (newline).

~>, ~<

Increase or decrease left margin.

~<R, ~>R

Increase or decrease right margin.

~Q

Quotation mode (indent and mark selection as excerpt).

~z

Append ~/.*signature* as the signature for this message.

Including objects in mail

You can include a variety of objects in your messages, again using tilde escape sequences. To do so, enter ~*, and the program will prompt you for the type of data you wish to add. The available content types will vary from installation to installation.

make

```
make [options] [targets] [macro definitions]
```

Update one or more *targets* according to dependency instructions in a description file in the current directory. By default, this file is called *makefile* or *Makefile*. Options, targets, and macro definitions can be in any order. Macro definitions are typed as:

```
name=string
```

For more information on make, see *Managing Projects with GNU Make* (O'Reilly).

Options

-d, --debug

Print detailed debugging information.

-e, --environment-overrides

Override *Makefile* macro definitions with environment variables.

-f *Makefile*, --file=*Makefile*, --makefile=*Makefile*

Use *Makefile* as the description file; a filename of - denotes standard input.

-h, --help

Print options to make command.

-i, --ignore-errors

Ignore command error codes (same as .IGNORE).

-j [*jobs*], --jobs [=*jobs*]

Attempt to execute this many *jobs* simultaneously or, if no number is specified, as many jobs as possible.

-k, --keep-going

Abandon the current target when it fails, but keep working with unrelated targets.

-l [*load*], --load-average [=*load*], --max-load [=*load*]

Attempt to keep load below *load*, which should be a floating-point number. Used with-j.

-n, --just-print, --dry-run, --recon

Print commands but don't execute (used for testing).

-o *file*, --old-file=*file*, --assume-old=*file*

Never remake *file* or cause other files to be remade on account of it.

-p, --print-data-base

Print rules and variables in addition to normal execution.

-q, --question

Query; return 0 if file is up to date, nonzero otherwise.

-r, --no-built-in-rules

Do not use default rules.

-s, --silent, --quiet

Do not display command lines (same as .SILENT).

-t, --touch

Touch the target files without remaking them.

-v, --version

Show version of make.

-w, --print-directory

Display the current working directory before and after execution.

--warn-undefined-variables

Print warning if a macro is used without being defined.

-C *directory*, --directory *directory*

cd to *directory* before beginning make operations. A subsequent -C directive will cause make to attempt to cd into a directory relative to the current working directory.

-I *directory*, --include-dir *directory*

Include *directory* in list of directories containing included files.

-S, --no-keep-going, --stop

Cancel previous -k options. Useful in recursive makes.

-W *file*, --what-if *file*, --new-file *file*, --assume-new *file*

Behave as though *file* has been recently updated.

Description-file lines

Instructions in the description file are interpreted as single lines. If an instruction must span more than one input line, use a backslash (\) at the end of the line so that the next line is considered a continuation. The description file may contain any of the following types of lines:

Blank lines

Blank lines are ignored.

Comment lines

A pound sign (#) can be used at the beginning of a line or anywhere in the middle.make ignores everything after the #.

Dependency lines

Depending on one or more targets, certain commands that follow will be executed. Possible formats include:

```
targets : dependencies
targets : dependencies ; command
```

Subsequent commands are executed if dependency files (the names of which may contain wildcards) do not exist or are newer than a target. If no prerequisites are supplied, then subsequent commands are always executed (whenever any of the targets are specified). No tab should precede any targets.

Conditionals

Conditionals are evaluated when the *Makefile* is first read and determine what make seesi.e., which parts of the *Makefile* are obeyed and which parts are ignored. The general syntax for a conditional is:

```
conditional
Text if true
else
Text if false
endif
```

ifeq (*arg1*, *arg2*), ifeq "*arg1*" "*arg2*"

True if the two arguments are identical. The arguments should either be placed in parentheses and separated by a comma--(*arg1*, *arg2*)--or individually quoted with either single or double quotes.

ifneq (*arg1*, *arg2*), ifneq "*arg1*" "*arg2*"

True if the two arguments are not identical. The arguments should either be placed in parentheses and separated by a comma, or individually quoted with either single or double quotes.

ifdef *variable*

True if *variable* has a nonempty value.

ifndef *variable*

True if *variable* has an empty value.

Suffix rules

These specify that files ending with the first suffix can be prerequisites for files ending with the second suffix (assuming the root filenames are the same). Either of these formats can be used

```
.suffix.suffix:
.suffix:
```

The second form means that the root filename depends on the filename with the corresponding suffix.

Commands

Commands are grouped below the dependency line and are typed on lines that begin with a tab. If a command is preceded by a hyphen (-), make ignores any error returned. If a command is preceded by an at sign (@), the command line won't echo on the display (unless make is called with -n).

Macro definitions

These have the following form:

```
name = string
```

or:

```
define name
string
endef
```

Blank space is optional around the =.

Include statements

Similar to the C include directive, these have the form:

```
include files
```

Internal macros

$?

The list of prerequisites that have been changed more recently than the current target. Can be used only in normal description-file entries, not in suffix rules.

$@

The name of the current target, except in description-file entries for making libraries, where it becomes the library name. Can be used both in normal description-file entries and in suffix rules.

$<

The name of the current prerequisite that has been modified more recently than the current target.

$*

The name (without the suffix) of the current prerequisite that has been modified more recently

than the current target. Can be used only in suffix rules.

$ %

The name of the corresponding *.o* file when the current target is a library module. Can be used both in normal description-file entries and in suffix rules.

$ ^

A space-separated list of all dependencies with no duplications.

$ +

A space-separated list of all dependencies, which includes duplications.

Pattern rules

These are a more general application of the idea behind suffix rules. If a target and a dependency both contain %, GNU make will substitute any part of an existing filename. For instance, the standard suffix rule:

```
$(cc) -o $@ $<
```

can be written as the following pattern rule:

```
%.o : %.c
$(cc) -o $@ $<
```

Macro modifiers

D

The directory portion of any internal macro name except $?. Valid uses are:

```
$(*D)    $$(@D)    $(?D)    $(<D)
$(%D)    $(@D)     $(^D)
```

F

The file portion of any internal macro name except $?. Valid uses are:

$(*F) $$(@F) $(?F) $(<F)
$(%F) $(@F) $(^F)

Functions

$(subst *from*,*to*,*string*)

Replace all occurrences of *from* with *to* in *string*.

$(patsubst *pattern*,*to*,*string*)

Similar to subst, but treat % as a wildcard within *pattern*. Substitute *to* for any word in *string* that matches *pattern*.

$(strip *string*)

Remove all extraneous whitespace.

$(findstring *substring*,*mainstring*)

Return *substring* if it exists within *mainstring*; otherwise, return null.

$(filter *pattern*,*string*)

Return those words in *string* that match at least one word in *pattern*. *pattern* may include the wildcard %.

$(filter-out *pattern*,*string*)

Remove those words in *string* that match at least one word in *pattern*. *pattern* may include the wildcard %.

$(sort *list*)

Return *list*, sorted in lexical order.

$(dir *list*)

Return the directory part (everything up to the last slash) of each filename in*list*.

$(notdir *list*)

Return the nondirectory part (everything after the last slash) of each filename in*list*.

$(suffix *list*)

Return the suffix part (everything after the last period) of each filename in*list*.

$(basename *list*)

Return everything but the suffix part (everything up to the last period) of each filename in*list*.

$(addsuffix *suffix*,*list*)

Return each filename given in*list* with *suffix* appended.

$(addprefix *prefix*,*list*)

Return each filename given in*list* with *prefix* prepended.

$(join *list1*,*list2*)

Return a list formed by concatenating the two arguments word by word (e.g.,$(join a b,.c .o) becomes a.c b.o).

$(word *n*,*string*)

Return the *n*th word of *string*.

$(wordlist *start*,*end*,*string*)

Return words in*string* between word *start* and word *end*, inclusive.

$(words *string*)

Return the number of words in*string*.

$(firstword *list*)

Return the first word in the list*list*.

$(wildcard *pattern*)

Return a list of existing files in the current directory that match *pattern*.

$(foreach *variable*,*list*,*string*)

For each whitespace-separated word in *list*, expand its value and assign it to *variable*; then expand *string*, which usually contains a function referencing *variable*. Return the list of results.

$(if *condition*,*then-string*[,*else-string*])

Expand string *condition* if it expands to a nonempty string, then expand the *then-string*. If *condition* expands to an empty string, return the empty string or, if specified, expand and return the *else-string*.

$(call *variable*,*parameters*)

Expand each item in comma-separated list *parameters* and assign it to a temporary variable, $(*n*), where *n* is an incremented number beginning with 0. Then expand *variable*, a string referencing these temporary variables, and return the result.

$(origin *variable*)

Return one of the following strings that describes how *variable* was defined: undefined, default, environment, environment override, file, command line, override, or automatic.

$(shell *command*)

Return the results of *command*. Any newlines in the result are converted to spaces. This function works similarly to backquotes in most shells.

$(error *string*)

When evaluated, generate a fatal error with the message *string*.

$(warning *string*)

When evaluated, generate a warning with the message *string*.

Macro string substitution

$(*macro*:*s1*=*s2*)

Evaluates to the current definition of $(*macro*), after substituting the string *s2* for every occurrence of *s1* that occurs either immediately before a blank or tab, or at the end of the macro definition.

Special target names

.DEFAULT:

Commands associated with this target are executed if make can't find any description-file entries or suffix rules with which to build a requested target.

.DELETE_ON_ERROR:

If this target exists in a *Makefile*, delete the target of any rule whose commands return a nonzero exit status.

.EXPORT_ALL_VARIABLES:

If this target exists, export all macros to all child processes.

.IGNORE:

Ignore error codes. Same as the -i option.

.INTERMEDIATE:

This target's dependencies should be treated as intermediate files.

.NOTPARALLEL:

If this target exists in a *Makefile*, run make serially, ignoring option -j.

.PHONY:

Always execute commands under a target, even if it is an existing, up-to-date file.

.PRECIOUS:

Files you specify for this target are not removed when you send a signal (such as an interrupt) that aborts make or when a command line in your description file returns an error.

.SECONDARY:

Like .INTERMEDIATE, this target's dependencies should be treated as intermediate files, but never automatically deleted.

.SILENT:

Execute commands, but do not echo them. Same as the -s option.

.SUFFIXES:

Suffixes associated with this target are meaningful in suffix rules. If no suffixes are listed, the existing list of suffix rules is effectively "turned off."

makedbm

makedbm [*options*] *infile outfile*makedbm [*option*]

NFS/NIS command. Create or dump an NIS dbm file. makedbm will take a text *infile* and convert it to a gdbm database file named *outfile*. This file is suitable for use with ypserv. Each line of the input file is converted to a single record. All characters up to the first TAB or SPACE form the key, and the rest of the line is the data. If a line ends with \&, the data for that record is continued onto the next line. The # character is given no special treatment.*infile* can be -, in which case the standard input is read.

makedbm generates two special keys: the YP_M*ER_NAME key, which is the value of the current host (unless another name is specified with -m), and the YP_L*_MODIFIED key, which is the date of *infile* (or the current time if *infile* is -).

Options

-a

Add support for mail aliases.

-b

Insert YP_INTERDOMAIN key into map. This indicates that ypserv should fall back to DNS lookups when a host's address is not found in NIS.

-c

Send a YPPROC_CLEAR signal to ypserv, causing it to clear all cached entries.

-i *file_name*

Create a YP_INPUT_NAME key with the value *file_name*.

-l

Convert keys of the given map to lowercase.

-m *master_name*

Specify the value of the YP_M*ER_NAME key. The default value is the current hostname.

--no-limit-check

Don't enforce NIS size limits for keys or data.

-o *file_name*

Create a YP_OUTPUT_NAME key with the value *file_name*.

-r

Treat lines beginning with # as comments. Do not include them in the datafile.

-s

Add the key YP_SECURE, indicating that ypserv should accept connections to the database only from secure NIS networks.

-u *filename*

Undo a gdbm file: print out a dbm file, one entry per line, with a single space separating keys from values.

Example

It's easy to write shell scripts to convert standard files such as */etc/passwd* to the key-value form used by makedbm. For example, the awk program:

```
BEGIN { FS =":";OFS = "\t";}
{ print $1, $0}
```

takes the */etc/passwd* file and converts it to a form that can be read by `makedbm` to make the NIS file *passwd.byname*. That is, the key is a username and the value is the remaining line in the */etc/passwd* file.

makemap

```
makemap [options] type name
```

System administration command. Create database maps for use by `sendmail` in keyed map lookups. `makemap` will read from standard input and create a database file of type *type* with filename *name*.db. If the `TrustedUser` option is set in */etc/sendmail.cf* and `makemap` is invoked as root, the ouput file will be owned by `TrustedUser`.

Input should be formatted as:

```
key value
```

Comment lines with `#`. Indicate parameter substitution with %*n*. Specify a literal % character by entering it twice: `% %`. The *type* may be `btree` or `hash`.

Options

-c *size*

Specify hash or B-Tree cache size.

-C *file*

Look up `TrustedUser` in the specified `sendmail` configuration *file*.

-d

Allow duplicate entries. Valid only with `btree` type maps.

-D *x*

Treat *x* as the comment marker instead of #.

-e

Allow empty value data fields.

-f

Suppress conversion of uppercase to lowercase.

-l

List supported map types.

-N

Append the zero-byte string terminator specified in sendmail's configuration file to mapped entries.

-o

Append to existing file instead of replacing it.

-r

If some keys already exist, replace them. (By default, makemap will exit when encountering a duplicated key.)

-s

Ignore safety checks.

-t *delimiter*

Use *delimiter* instead of whitespace.

-u

Undo a map: print out the specified database file, one entry per line.

-v

Verbose mode.

man

`man [options] [section] [title]`

Display information from the online reference manuals. `man` locates and prints the named *title* from the designated reference *section*.

Traditionally, manpages are divided into nine sections, where section 1 consists of user commands, section 2 contains system calls, and so forth. By default, all sections are consulted, so the *section* option serves to bypass the most common entry and find an entry of the same name in a different section (e.g., `man 2 nice`).

Numerous other utilitiessuch as `info`, `xman`, and the Konqueror browsercan also display manpages.

Options

`-7, --ascii`

Expect a pure ASCII file, and format it for a 7-bit terminal or terminal emulator.

`-a, --all`

Show all pages matching *title*.

`-b`

Leave blank lines in output.

`-d, --debug`

Display debugging information. Suppress actual printing of manual pages.

`-f, --whatis`

Same as `whatis` command.

`-k, --apropos`

Same as `apropos` command.

-l *filename*, --local-file=filename

Search local files, not system files, for manual pages. If i is given as *filename*, search standard input.

-m *systems*, --systems=*systems*

Search *systems*' manual pages. *systems* should be a comma-separated list.

-p *preprocessors*, --preprocessor=*preprocessors*

Preprocess manual pages with *preprocessors* before turning them over to nroff, troff, or groff. Always runs soelim first to read in files to be included in the one currently being processed. *preprocessors* can be any combination of e for equations, p for pictures, t for tables, and r for bibliographical references.

-r *prompt*, --prompt=*prompt*

Set prompt if less is used as pager.

-t, --troff

Format the manual page with /usr/bin/groff -Tgv -mandoc. Implied by -T and -Z.

-u, --update

Perform a consistency check between manual page cache and filesystem.

-w, -W, --path, --where

Print pathnames of entries on standard output.

-D

Display debugging information about how the page was retrieved.

-K *directory*

A kind of super-k option. Search for a term in all manpages and display the name of each page, along with a prompt asking whether you want to view the page.

-L *locale*, --locale=*locale*

Assume current locale to be *locale*; do not consult the setlocale( ) function.

-M *path*, --manpath=*path*

Search for manual pages in *path*. Ignore -m option.

-Ppager, --pager=*pager*

Select paging program *pager* to display the entry.

-S *sections*

Sections to look in for an entry. Like specifying *section* on the command line, except that multiple section numbers can be specified, separated by colons.

-T *device*, --troff-device[=*device*]

Format groff or troff output for *device*, such as dvi, latin1, X75, and X100.

-Z, --ditroff

Do not allow postprocessing of manual page after groff has finished formatting it.

Section names

Manual pages are divided into sections for various audiences:

1

Executable programs or shell commands.

2

System calls (functions provided by the kernel).

3

Library calls (functions within system libraries).

4

Special files (usually found in */dev*).

5

File formats and conventions (e.g., */etc/passwd*).

6

Games.

7

Macro packages and conventions.

8

System administration commands (usually only for a privileged user).

9

Kernel routines (nonstandard).

manpath

```
manpath [options]
```

Attempt to determine path to manual pages. Check $MANPATH first; if that is not set, consult */etc/man.conf*, user environment variables, and the current working directory. The `manpath` command is a symbolic link to `man`, but most of the options are ignored for `manpath`.

Options

`-d, --debug`

Print debugging information.

`-h`

Print help message and then exit.

mattrib

`mattrib [options] filenames`

Change attributes of MS-DOS files. See mtools for more information.

Attributes

To set an attribute, use one of the following letters preceded by a + (to turn the attribute on) or - (to turn it off):

a

Archive; mark the file as a new file that should be archived by backup programs.

r

Read-only.

s

System; files with this attribute are marked as operating system files.

h

Hide this file when displaying directory contents with DIR.

Options

-/

When listing attributes, descend into all subdirectories recursively.

-X

Concise output.

-p

Display commands for mformat that can reproduce the current attributes and settings for a given disk.

mbadblocks

```
mbadblocks drive
```

Check MS-DOS filesystems for bad blocks. See badblocks and mtools. As with other mtools items, the drive is named with a letter rather than as a Unix device.

mcat

```
mcat [option] drive
```

Dump raw data, especially for a disk image on a remote floppy accessed through thefloppyd tool. See cat and mtools for more information. The only option accepted, -w, accepts data from stdin and writes it to the given device.

mcd

```
mcd [dosdir]
```

Change to the specified directory on an MS-DOS disk. With no directory specified, display the current device and directory. See cd and mtools for more information.

mcopy

```
mcopy [options] sourcefile target
```

Copy files between Unix and MS-DOS format partitions. See cp and mtools for more information.

Multiple source files can be specified and written to a target directory.

Options

The mcopy option flags differ from the flags passed to the Unixcp command. The flags are:

-t

Convert Unix line breaks to MS-DOS line breaks and vice versa when copying text files.

-b

Operate in batch mode; use for large copies of data.

-s

Copy recursively.

-P

Preserve attributes of copied files.

-Q

When copying multiple files, if one copy fails, stop. Useful if you think you may run out of disk space.

-a

Assume that all incoming files are ASCII and convert carriage return/line feed to plain line feed

-T

Convert line breaks as with -a, but also convert PC-8 characters to ISO-8859-1 characters. Replace untranslatable characters with # or . for Unix and DOS respectively.

-n

Do not ask for confirmation when overwriting Unix files.

-o

Turn off confirmation for overwriting DOS files.

-m

Preserve file modification time.

-v

Display the names of files as they are copied.

-D *clash-option*

Specify the action to take if the specified directory name already exists. See mmd for the possible clash options.

md5sum

```
md5sum [option] [files]
md5sum [option] --check [file]
```

Compute or check 128-bit MD5 checksums. Used to verify that no change has been made to a file. With no files or - specified, read from standard input. The exit status is 0 for success and nonzero for failure.

Options

-b, --binary

Read the files in binary mode. The default on DOS or Windows.

-c, --check

Check the MD5 sum and file information in the *file* argument (or standard input) against the corresponding files and verify that they are consistent. The input must have been generated by an earlier md5sum command.

--help

Print usage information and exit.

--status

Don't generate output messages; the exit code indicates success or failure. Used only with--check.

--string=*string*

Compute the MD5 sum for the specified string. This option does not take a*file* argument. Put quotes around the string if it contains spaces.

-t, --text

Read files in text mode. The default.

--version

Print version information and exit.

-w, --warn

Warn about improperly formatted checksum lines. Used only with--check.

mdel, mdeltree

mdel [*option*] *file*mdeltree [*option*] *tree*

Delete an MS-DOS file or file tree. See rm and mtools for more information.

Option

-v

Run in verbose mode, printing the names of the MS-DOS files to be deleted.

mdir

mdir [*options*] *dir*

List directory contents on an MS-DOS filesystem. See ls, dir, and mtools for more information.

Options

-/

Display output recursively, listing the contents of subdirectories.

-a

Include hidden files in the output.

-b

Produce a concise listing, showing each directory or file on a separate line, with no heading or summary information.

-f

Operate in fast mode, without determining the amount of free space. Not required on FAT32 filesystems, which store the free-space information explicitly.

-w

Produce wide output, printing filenames across the page with no file-size or creation-date information.

-V

Print version information and exit.

mdu

```
mdu [option] dir
```

Display disk usage, in clusters, for a directory and its subdirectories and files on an MS-DOS filesystem. See du and mtools for more information, and see minfo for the cluster size. Only one of

-a or -s can be specified.

Options

-a

Show the space used by individual files in a directory as well as the total space.

-s

Show only the total space used.

merge

`merge [options] file1 file2 file3`

Perform a three-way file merge, putting the result in *file1*. The effect is easiest to understand if *file2* is considered the original version of a file, *file3* an altered version of *file2*, and *file1* a later altered version of *file2*.

After the merge, *file1* contains both the changes from *file2* to *file1* and the changes from *file2* to *file3*. In other words, *file1* keeps its changes and incorporates the changes in *file3* as well. `merge` does not change *file2* or *file3*.

If a line from *file2* was changed in different ways in both *file1* and *file3*, `merge` recognizes a conflict. By default, the command outputs a warning and puts brackets around the conflict, with lines preceded by `<<<<<<<` and `>>>>>>>`. A typical conflict looks like this:

```
<<<<<<< file1
relevant lines from file1
=======
relevant lines from file3
>>>>>>> file3
```

If there are conflicts, the user should edit the result and delete one of the alternatives.

Options

-e

Don't warn about conflicts.

-p

Send results to standard output instead of overwriting *file1*.

-q

Quiet; do not warn about conflicts.

-A

Output conflicts using the -A style of diff3. This merges all changes leading from *file2* to *file3* into *file1* and generates the most verbose output.

-E

Output conflict information in a less verbose style than -A; this is the default.

-L *label*

Specify up to three labels to be used in place of the corresponding filenames in conflict reports. That is:

```
merge -L x -L y -L z file_a file_b file_c
```

generates output that looks as if it came from *x*, *y*, and *z* instead of from *file_a*, *file_b*, and *file_c*.

-V

Print version number.

mesg

```
mesg [option]
```

Change the ability of other users to send write messages to your terminal. With no options, display the permission status.

Options

n

Forbid write messages.

y

Allow write messages (the default).

metamail

`metamail [options] [filename]`

Normally invisible to users, metamail is used to send and display rich text or multimedia email using MIME typing metadata. Mail-reading programs normally call metamail to determine how to handle the data, but metamail can be called directly by developers who want to use it for their own mail software, or by system administrators and power users adding lines to their*printcap* files. Any argument passed to metamail that is not preceded by a hyphen (-) is assumed to be the name of a file to read. If no filename is specified, standard input is assumed.

Options

-b

The message is not in RFC 822 format; treat as the body of the message. Requires-c.

-B

Display the message in the background, if noninteractive. Cannot be used with-p or -P.

-c *type*

Use the specified content type instead of the one in the headers.

-d

Don't ask before running an interpreter to view the message. The default is to ask.

-e

Remove ("eat") leading newlines in the message body. Useful for MH-format mail.

-f *addr*

Specify the name of the message sender. The default is to try to determine the name from the header.

-h

Specify that a message is to be printed. Automatically sets-d.

-m *mailer*

Specify the mail program that called metamail, for use by any interpreters that metamail calls.

-p

If necessary, display the output one page at a time. The default is to pipe the output through more, but the environment variable METAMAIL_PAGER can be set to specify an alternative command. Use -p rather than piping the message to a pager.

-P

Like -p, but also print "Press RETURN to go on" at the end of each page. Cannot be used with-B.

-q

Run quietly.

-r

Specify that metamail can be run as root.

-R

Run */usr/ucb/reset* to reset the terminal before performing any other I/O.

-s *subject*

Specify the Subject field. By default, the subject is determined from the headers.

-T

Turn off the effect of the environment variable MM_TRANSPARENT. Intended to be used recursively by metamail, and should be used only when the program restarts itself in a terminal emulator window.

-w

Don't consult a *mailcap* file to determine how to display the data, but simply decode each part and write to a file in its raw format (which might be binary). Depending on howmetamail is called, the filename is determined from the message headers, by asking the user, or by generating a unique temporary filename.

-x

Tell metamail that it is not running on a terminal. The environment variable MM_NOTTY can be set instead of specifying -x.

-y

Try to "yank" a MIME-format message from the body of the message.

-z

Delete the input file when done. This option requires a filename argument tometamail.

metasend

```
metasend [options] [filename]
```

A largely developer-oriented interface for sending nontext email using MIME typing metadata. If no arguments are specified, metasend prompts the user for the information it needs. See mailto for a possible alternative with a friendlier interface.

Options

-/ *subtype*

Specify the MIME multipart subtype other than mixed.

-b

Batch mode. All information must be provided on the command line.

-c *cc*

Specify any CC addresses.

-D *string*

Specify a string to be used as the `Content-description` value.

-e *encoding*

Specify the encoding to use. Possible values are `base64`, `quoted-printable`, `7bit` (no encoding is done), or `x-uue`.

-E

The file to be included is already MIME-encoded and doesn't need any `Content-` or other header fields added.

-f *file*

The file to be included. If more than one file is specified with separate `-f` options (see `-n`), they are combined into a single multipart MIME object.

-F *from*

The `From` address.

-i *content-id*

The content ID value for the MIME entity. Must be a valid content ID enclosed in angle brackets (<>).

-I *content-id*

The content ID value for a multipart entity being created by `metasend`. Must be a valid content ID enclosed in angle brackets (<>).

-m *type*

The MIME content type.

-n

Specify that an additional file is to be included. Must appear after one occurrence of at least -m, -c, and -f, and must be specified for each included file.

-o *outfile*

Send the output to the specified file instead of delivering as mail.

-P *preamblefile*

Specify a file containing alternative text for the preamble portion of a multipart MIME message

-s *subject*

The Subject field.

-S *splitsize*

Specify the maximum size before the file is split into parts to be sent separately.

-t *to*

The To field.

-z

Delete temporary files even if the send fails.

mformat

```
mformat [options] drive
```

Format a blank disk in MS-DOS format. See mtools for more information about how to handle MS-DOS filesystems. After using mformat to format a disk, you should use mbadblocks to check for bad blocks.

Options

The mformat command accepts many of the same options as the MS-DOS FORMAT command.

-1

Format a single side. Equivalent to -h 1.

-4

Format a 360K double-sided disk. Equivalent to -f 360.

-8

Format with eight sectors per track.

-v [*label*]

Choose a label for this volume. Maximum length is 11 characters.

-f *n*

If you are using a floppy disk, use this flag and note the size of the disk in kilobytes as 160, 180, 320, 360, 720, 1200, 1440, or 2280. For most relatively recent systems, only the last two are relevant. If you are not using a floppy, you must use the -h, -t, or -n flags.

-t *n*

The number of tracks on the disk.

-h *n*

The number of heads, or sides, on the disk (either 1 or 2).

-n *n*

The number of sectors per track.

You can also use a number of option flags that are not included in the MS-DOS version of FORMAT, including:

-F

Format as a FAT32 partition.

-S *n*

Size code. You are defining a sector that is the (*n*+7)th power of two.

-X

Format as an XDF (OS/2) disk.

-0 *rate*

Data transfer rate on track 0.

-2

Use a 2m format.

-3

Don't use a 2m format, even if the disk looks like a 2m disk.

-A *rate*

Data transfer rate on all tracks other than track 0.

-B *file*

Use the boot sector stored in the specified file.

-c *n*

Set the cluster size to *n* sectors.

-C

Create a disk image file. Useful only for virtual disks.

-H *n*

Set the number of hidden sectors.

-k

Keep the existing boot sector as much as possible.

-L *n*

Set the length of the File Allocation Table (FAT).

-M *n*

Set the software sector size to *n*. The default is the physical sector size. Possible values of*n* are 512, 1024, 2048, or 4096.

-N *serialno*

Choose a serial number. Use -a for an Atari-style serial number, stored in the OEM label.

-r *n*

Set the root directory size to *n* sectors for 12- and 16-bit FAT formats.

mimencode

`mimencode [options] [filename] [-o output_file]`

Translate to and from MIME multimedia mail-encoding formats. By default, `mimencode` reads standard input and sends a base64-encoded version of the input to standard output.

Options

-b

Use the (default) base64 encoding.

-o *output_file*

Send output to the named file rather than to standard output.

-p

Translate decoded CRLF sequences into the local newline convention during decoding, and do the reverse during encoding. Meaningful only for base64 encoding.

`-q`

Use the quoted-printable encoding instead of base64.

`-u`

Decode the standard input rather than encode it.

minfo

`minfo [option] drive`

Display information about an MS-DOS filesystem. See mtools for more information.

Option

`-v`

Print a hex dump of the boot sector in addition to the normal output.

mkdir

`mkdir [options] directories`

Create one or more *directories*. You must have write permission in the parent directory in order to create a directory. See also rmdir. The default mode of the new directory is 0777, modified by the system or user's umask.

Options

-m *mode*, --mode *mode*

Set the access *mode* for new directories. See chmod for an explanation of acceptable formats for *mode*.

-p, --parents

Create intervening parent directories if they don't exist.

-v, --verbose

Print a message for each directory created.

--help

Print help message and then exit.

--version

Print version number and then exit.

-Z *context*, --context=*context*

Set security context in SELinux.

Examples

Create a read-only directory named personal:

```
mkdir -m 444 personal
```

The following sequence:

```
mkdir work; cd work
mkdir junk; cd junk
mkdir questions; cd ../..
```

can be accomplished by typing this:

```
mkdir -p work/junk/questions
```

mkdosfs

```
mkdosfs [options] device [blocks]
mkfs.msdos [options] device [blocks]
```

System administration command. Format *device* as an MS-DOS filesystem. You may specify the number of blocks on the device or allow `mkdosfs` to guess.

Options

`-A`

Create an Atari MS-DOS filesystem.

`-b` *backup-sector*

Specify sector for backup boot sector. The default value depends on the number of reserved sectors, but is usually sector 6.

`-c`

Scan *device* for bad blocks before execution.

`-C`

Create and format a file suitable for use on a floppy disk. The *device* given on the command line should be a filename, and the number of *blocks* must also be specified.

`-f` *n*

Specify number of File Allocation Tables (FATs) to create (either 1 or 2).

`-F` *fat-size*

Create File Allocation Tables (FATs) of size *fat-size*. By default this will be between 12 and 16 bits. Set to 32 to create a FAT32 filesystem.

-i *volume-id*

Use the specified 32-bit hexadecimal *volume-id* instead of calculating a number based on the time of creation.

-I

Force installation to a device without partitions. This is useful when formating magneto-optical disks.

-l *file*

Read list of bad blocks from *file*.

-m *message-file*

Set the message to be used when the filesystem is booted without an installed operating system to the contents of the file *message-file*. The message may be up to 418 bytes in size. If filename is a hyphen, read text from standard input.

-n *label*

Set volume name for filesystem to *label*. The volume name may be up to 11 characters long.

-r *maximum-entries*

Set the *maximum-entries* allowed in the root directory. The default is 112 or 224 for floppies, and 512 for hard disks.

-R *reserved-sectors*

Create the specified number of *reserved-sectors*. The default depends on the size of the File Allocation Table (FAT). For 32-bit FAT, the default is 32; for all other sizes, the default is 1.

-s *sectors*

Set the number of disk *sectors* per cluster. The number must be a power of 2.

-S *sector-size*

Create logical sectors of *sector-size* bytes. Size must be a power of 2 and at least 512 bytes.

-v

Print verbose information about progress.

mke2fs

```
mke2fs [options] device [blocks]
mkfs.ext2 [options] device [blocks]
```

System administration command. Format *device* as a Linux Second Extended Filesystem. You may specify the number of blocks on the device or allow mke2fs to guess.

Options

-b *block-size*

Specify block size in bytes.

-c

Scan *device* for bad blocks before execution.

-E *featurelist*

Specify extended features. This option's parameters may be given in a comma-separated list:

stride=*size*

Configure filesystem for a RAID array. Set stride size to*size* blocks per stripe.

resize=*blocks*

Reserve descriptor table space to grow filesystem to the specified number of blocks.

-f *fragment-size*

Specify fragment size in bytes.

-F

Force mke2fs to run even if filesystem is mounted or device is not a block special device. This option is probably best avoided.

-i *bytes-per-inode*

Create an inode for each *bytes-per-inode* of space. *bytes-per-inode* must be 1024 or greater; it is 4096 by default.

-j

Create an ext3 journal. This is the same as invoking mkfs.ext3.

-J *parameterlist*

Use specified *parameterlist* to create an ext3 journal. The following two parameters may be given in a comma-separated list:

size=*journal*-size

Create a journal of *journal-size* megabytes. The size may be between 1024 filesystem blocks and 102,400 filesystem blocks in size (e.g., 1-100 megabytes if using 1K blocks, 4-400 megabytes if using 4K blocks).

device=*journal*-device

Use an external *journal-device* to hold the filesystem journal. The *journal-device* can be specified by name, by volume label, or by UUID.

-l *filename*

Consult *filename* for a list of bad blocks.

-L *label*

Set volume *label* for filesystem.

-m *percentage*

Reserve *percentage* percent of the blocks for use by privileged users.

-M *directory*

Set the last mounted directory for filesystem to *directory*.

-n

Don't create the filesystem; just show what would happen if it were run. This option is overridden by -F.

-N *inodes*

Specify number of *inodes* to reserve for filesystem. By default, this number is calculated from the number of blocks and the inode size.

-o *os*

Set filesystem operating system type to *os*. The default value is usually Linux.

-O *featurelist*

Use specified *featurelist* to create filesystem. The sparse_super and filetype features are used by default on kernels 2.2 and later. The following parameters may be given in a comma-separated list:

dir_index

Use hashed B-trees to index directories.

filetype

Store file type information in directory entries.

has_journal

Create an ext3 journal. Same as using the -j option.

journal_dev

Prepare an external journaling device by creating an ext3 journal on *device* instead of formatting it.

sparse_super

Save space on a large filesystem by creating fewer superblock backup copies.

-q

Quiet mode.

-r *revision*

Set filesystem revision number to *revision*.

-S

Write only superblock and group descriptors; suppress writing of inode table and block and inode bitmaps. Useful only when attempting to salvage damaged systems.

-T *use*

Set bytes-per-inode based on the intended *use* of the filesystem. Supported filesystem types are:

news

Four kilobytes per inode.

largefile

One megabyte per inode.

largefile4

Four megabytes per inode.

-v

Verbose mode.

-V

Print version number, then exit.

mkfifo

`mkfifo [option] names`

Make one or more named pipes (FIFOs) with the specified names.

Options

-m *mode*, --mode=*mode*

Set permission mode. Default is 666, with the bits in the umask subtracted.

--help

Print help information and exit.

--version

Print version information and exit.

mkfs

```
mkfs [options] [fs-options] filesys [blocks]
```

System administration command. Construct a filesystem on a device (such as a hard disk partition). *filesys* is either the name of the device or the mountpoint. mkfs is actually a frontend that invokes the appropriate version of mkfs according to a filesystem type specified by the -t option. For example, a Linux Second Extended Filesystem uses mkfs.ext2 (which is the same as mke2fs); MS-DOS filesystems use mkfs.msdos. *fs-options* are options specific to the filesystem type. *blocks* is the size of the filesystem in 1024-byte blocks.

Options

-V

Produce verbose output, including all commands executed to create the specific filesystem.

-t *fs-type*

Tells mkfs what type of filesystem to construct.

Filesystem-specific options

These options must follow generic options and cannot be combined with them. Most filesystem

builders support these three options:

-c

Check for bad blocks on the device before building the filesystem.

-l *file*

Read the file *file* for the list of bad blocks on the device.

-v

Produce verbose ouput.

mkfs.ext3

`mkfs.ext3 [options] device size`

Create a journaling ext3 filesystem. Options are identical to `mke2fs`. See `mkfs`.

mkisofs

`mkisofs [options] -o file pathspecs`

Generate an ISO9660/Joliet/HFS filesystem for writing to a CD with a utility such as `cdrecord`. (HFS is the native Macintosh Hierarchical File System.) `mkisofs` takes a snapshot of a directory tree and generates a binary image that corresponds to an ISO9660 or HFS filesystem when it is written to a block device. Each specified *pathspec* describes the path of a directory tree to be copied into the ISO9660 filesystem; if multiple paths are specified, the files in all the paths are merged to form the image.

Options

-A *id*, -appid *id*

Specify a text string *id* that describes the application to be written into the volume header.

-abstract *file*

Specify the abstract filename. Overrides an ABST=*file* entry in *.mkisofsrc*.

-allow-lowercase

Allow ISO9660 filenames to be lowercase. Violates the ISO9660 standard.

-allow-multidot

Allow more than one dot in ISO9660 filenames. Violates the ISO9660 standard.

-b *image*

Specify the path and filename of the boot image to be used for making a bootable CD based or the El Torito specification.

-B *sun-images*

Specify a comma-separated list of boot images needed to make a bootable CD for a Sun Sparc system.

-biblio *file*

Specify bibliographic filename. Overrides aBIBLIO=*file* entry in *.mkisofsrc*.

-boot-info-table

Specify that a 56-byte table with information on the CD layout is to be patched in at offset 8 of the boot file. If specified, the table is patched into the source boot file, so make a copy if the file isn't recreatable.

-boot-load-seg *addr*

Specify the load segment address of the boot image for a no-emulation El Torito CD.

-boot-load-size *size*

Specify the number of virtual 512-byte sectors to load in no-emulation mode. The default is to load the entire boot file. The number may need to be a multiple of 4 to prevent problems with some BIOSes.

-c *catalog*

Specify the path, relative to the source *pathspec*, and the filename of the boot catalog for an El Torito bootable CD. Required for making a bootable CD.

-C *last-start*,*next-start*

Required for creating a CDExtra or a second or higher-level session for a multisession CD. *last-start* is the first sector number in the last session on the disk, and *next-start* is the first sector number for the new session. Use the command:

```
cdrecord -msinfo
```

to get the values. Use -C with -M to create an image that is a continuation of the previous session; without -M, create an image for a second session on a CDExtra (a multisession CD with audio data in the first session and an ISO9660 filesystem image in the second).

-[no-]cache-inodes

Cache [do not cache] inode and device numbers to find hard links to files. The default on Linux is to cache. Use -no-cache-inodes for filesystems that do not have unique inode numbers.

-check-oldnames

Check all filenames imported from old sessions for mkisofs compliance with ISO9660 file-naming rules. If not specified, check only those files with names longer than 31 characters.

-check-session *file*

Check all old sessions for mkisofs compliance with ISO9660 file-naming rules. This option is the equivalent of:

```
-M file -C 0,0 -check-oldnames
```

where *file* is the pathname or SCSI device specifier that would be specified with -M.

-copyright *file*

Specify the name of the file that contains the copyright information. Overrides aCOPY=*file* entry in *.mkisofsrc*.

-d

Omit trailing period from files that do not have one. Violates the ISO9660 standard, but works on many systems.

-D

Do not use deep directory relocation. Violates the ISO9660 standard, but works on many systems.

-dir-mode *mode*

Specify the mode for directories used to create the image. Automatically enables the Rock Ridge extensions.

-eltorito-alt-boot

Start with a new set of El Torito boot parameters. Allows putting more than one El Torito boot image on a CD (maximum is 63).

-exclude-list *file*

Check filenames against the globs contained in the specified file and exclude any that match.

-f

Follow symbolic links when generating the filesystem.

-file-mode *mode*

Specify the mode for files used to create the image. Automatically enables the Rock Ridge extensions.

-force-rr

Do not use automatic Rock Ridge detection for the previous session.

-G *image*

Specify the path and filename of the generic boot image for making a generic bootable CD.

-gid *gid*

Set the group ID to *gid* for the source files. Automatically enables the Rock Ridge extensions.

-graft-points

Allow the use of graft points for filenames, which permits paths to be grafted at locations other than the root directory. -graft-points checks all filenames for graft points and divides the filename at the first unescaped equals sign (=).

-gui

Switch the behavior for a GUI. Currently, the only effect is to make the output more verbose.

-hard-disk-boot

Specify that the boot image to be used to create an El Torito bootable CD is a hard disk image and must begin with a master boot record containing a single partition.

-hidden *glob*

Set the hidden (existence) ISO9660 directory attribute for paths or filenames matching the shell-style pattern *glob*. To match a directory, the path must not end with a trailing /.

-hidden-list *file*

Specify a file containing a list of *globs* that are to be hidden with -hidden.

-hide *glob*

Find paths or files that match the shell-style pattern *glob* and hide them from being seen on the ISO9660 or Rock Ridge directory. The files are still included in the image file. If the pattern matches a directory, the contents of the directory are hidden. To match a directory, the path must not end with a trailing /. Use with the -hide-joliet option.

-hide-joliet *glob*

Hide paths or files that match the shell-style pattern *glob* so they will not be seen in the Joliet directory. If the pattern matches a directory, the contents of the directory are hidden. To match a directory, the path must not end with a trailing /. Should be used with -hide.

-hide-joliet-list *file*

Specify a file containing a list of *globs* to be hidden with -hide-joliet.

-hide-joliet-trans-tbl

Hide the *TRANS.TBL* files from the Joliet tree.

-hide-list *file*

Specify a file containing a list of*globs* to be hidden with -hide.

-hide-rr-moved

Rename the directory *RR_MOVED* to *.rr_moved* to hide it as much as possible from the Rock Ridge directory tree. Use the -D option to omit the file entirely.

-input-charset *charset*

Specify the character set for characters used in local filenames. Specifyhelp in place of a *charset* for a list of valid character sets.

-iso-level *level*

Set the ISO9660 conformance level. Possible values are:

1

Filenames are restricted to 8.3 characters, and files may have only one section.

2

Files may have only one section.

3

No restrictions.

-J

Generate Joliet directory records in addition to regular ISO9660 filenames.

-jcharset *charset*

The equivalent of -input-charset -J.

-l

Allow full 31-character filenames instead of restricting them to the MS-DOS-compatible 8.3 format.

-L

Allow ISO9660 filenames to begin with a period.

-log-file *file*

Send all messages to the specified logfile.

-m *glob*

Exclude files matching the shell-style pattern*glob*.

-M *path*

Specify the path to an existing ISO9660 image to be merged.*path* can also be a SCSI device specified in the same syntax as cdrecord's dev= parameter. May be used only with -C.

-max-iso9660-filenames

Allow up to 37 characters in ISO9660 filenames. Forces -N. Violates the ISO9660 standard.

-N

Omit version numbers from ISO9660 filenames. Violates the ISO9660 standard. Use with caution.

-new-dir-mode *mode*

Specify the mode to use for new directories in the image. The default is 0555.

-nobak, -no-bak

Do not include backup files on the ISO9660 filesystem.

-no-boot

Mark the El Torito CD to be created as not bootable.

-no-emul-boot

Specify that the boot image for creating an El Torito bootable CD is a no-emulation image.

-no-iso-translate

Do not translate the # and ~ characters. Violates the ISO9660 standard.

-no-rr

Do not use Rock Ridge attributes from previous sessions.

-no-split-symlink-components

Do not split symlink components.

-no-split-symlink-fields

Do not split symlink fields.

-o *file*

Specify the filename of the output ISO9660 filesystem image.

-output-charset *charset*

Specify the output character set for Rock Ridge filenames. The default is the input character set.

-p *prepid*

Specify a text string of up to 128 characters describing the preparer of the CD. Overrides a PREP= parameter set in the file *.mkisofsrc*.

-P *pubid*

Specify a text string of up to 128 characters describing the publisher of the CD to be written to the volume header. Overrides a PUBL= parameter set in *.mkisofsrc*.

-[no -]pad

Pad [do not pad] the ISO9660 filesystem by 16 sectors (32 KB). If the resulting size is not a multiple of 16 sectors, add sectors until it is. The default is-pad.

-path-list *file*

Specify a file that contains a list of*pathspec* directories and filenames to add to the ISO9660 filesystem. Note that at least one*pathspec* must be given on the command line.

-print-size

Print estimated filesystem size and exit.

-quiet

Run in quiet mode; do not display progress output.

-r

Like -R, but set UID and GID to zero, set all file read bits to write, and turn off all file write bits
If any execute bit is set for a file, set all execute bits; if any search bit is set for a directory, se
all search bits; if any special mode bits are set, clear them.

-R

Generate SUSP (System Use Sharing Protocol) and Rock Ridge records using the Rock Ridge protocol.

-relaxed-filenames

Allow ISO9660 filenames to include seven-digit ASCII characters except lowercase characters. Violates the ISO9660 standard.

-sort *file*

Sort file locations according to the rules in the specified file, which contains pairs of filenames and weights, with one space or tab between them. A higher weight puts the file closer to the beginning of the media.

-sysid *id*

Specify the system ID. Overrides a SYSI = parameter set in the file *.mkisofsrc*.

-T

Generate the file *TRANS.TBL* in each directory for establishing the correct filenames on non-Rock Ridge-capable systems.

-table-name *table*

Use *table* as the translation table name instead of *TRANS.TBL*. Implies -T. For a multisession image, the table name must be the same as the previous session.

-U

Allow untranslated filenames. Violates the ISO9660 standard. Forces the following options:-d, -l, -L, -n, -relaxed-filenames, -allow-lowercase, -allow-multidot, -no-iso-translate. Use with extreme caution.

-ucs-level *num*

Set the Unicode conformance level to the specified number, which can be between 1 and 3 (default is 3).

-use-fileversion

Use file version numbers from the filesystem. The version number is a string from 1 to 32767. The default is to set a version of 1.

-v

Run in verbose mode. Specify twice to run even more verbosely.

-V *volid*

Specify the volume ID (volume name or label) to be written to the master block. Overrides a VOLI= parameter specified in the file *.mkisofsrc*.

-volset *id*

Specify the volume set ID. Overrides a VOLS= parameter specified in *.mkisofsrc*.

-volset-seqno *num*

Set the volume set sequence number to *num*. Must be specified after -volset-size.

-volset-size *num*

Set the volume set size (the number of CDs in a set) to *num*. Must be specified before -volset-seqno.

-x *path*

Exclude *path* from being written to the CD, where *path* is the complete pathname derived from the concatenation of the pathname from the command line and the path relative to this directory. May be specified more than once to exclude multiple paths.

HFS options

-apple

Create an ISO9660 CD with Apple's extensions.

-auto *file*

Set *file* as the Autostart file to make the HFS CD use the QuickTime 2.0 Autostart feature.*file* must be the name of an application or document at the top level of the CD and must be less than 12 characters long.

-boot-hfs-file *file*

Install *file* as the driver file that may make the CD bootable on a Macintosh.

-cluster-size *size*

Specify the size in bytes of a cluster or allocation units of PC Exchange files.

-hfs

Create a hybrid ISO9660/HFS CD. Use with -map, -magic, and/or the various --HFS options (see manpage).

-hfs-bless *folder*

"Bless" the specified directory (folder), specified as the full pathname tomkisofs. This is usually the System Folder and is used in creating HFS bootable CDs. The pathname must be in quotes if it contains spaces.

-hfs-creator *creator*

Set the four-character default creator for all files.

-hfs-type *type*

Set the four-character default type for all files.

-hfs-unlock

Leave the HFS volume unlocked so other applications can modify it. The default is to lock the volume.

-hfs-volid *id*

Specify the volume name for the HFS partition. This name is assigned to the CD on a Macintosh and replaces the ID set with the -V option.

-hide-hfs *glob*

Hide files or directories matching the shell-style pattern*glob* from the HFS volume, although they still exist in the ISO9660 and/or Joliet directory. May be specified multiple times.

-hide-hfs-list *file*

The specified file contains a list of globs to be hidden.

-input-hfs-charset *charset*

Specify the input character set used for HFS filenames when used with the-mac-name option. The default is cp10000 (Mac Roman).

-mac-name

Use the HFS filename as the starting point for the ISO9660, Joliet, and Rock Ridge filenames.

-magic *file*

Use the specified magic file to set a file's creator and type information based on the file's*magic number*, which is usually the first few bytes of the file. The magic file contains entries consistin of four tab-separated columns specifying the byte offset, type, test, and a message.

-map *file*

Use the specified mapping file to set a file's creator and type information based on the filename extension. Only files that are not known Apple or Unix file types need to be mapped. The mapping file consists of five-column entries specifying the extension, file translation, creator, type, and a comment. Creator and type are both four-letter strings.

-no-desktop

Do not create empty Desktop files. The default is to create such files.

-output-hfs-charset *charset*

Specify the output character set used for HFS filenames. Defaults to the input character set.

-part

Generate an HFS partition table. The default is not to generate the table.

-probe

Search the contents of files for known Apple or Unix file types.

--format

Look for Macintosh files of the specified file format type. The valid formats arecap (Apple/Unix File System (AUFS) CAP files), netatalk, double, ethershare, ushare, exchange, sgi, xinet, macbin, single, dave, and sfm.

mklost+found

```
mklost+found
```

System administration command. Create a *lost+found* directory in the current working directory. Intended for Linux Second Extended Filesystems.

mkmanifest

```
mkmanifest [files]
```

Create a list of filenames and their DOS 8.3 equivalentsin the form of a series of mv commands. By default, the output is written to standard output; to create a shell script, redirect the output to a file. Useful if you use mcopy to move the files to an MS-DOS diskette, and you want to be able to later restore them to a Linux system. Files with names that already fit into the 8.3 format are not written to the manifest. See mtools for more information.

Example

```
$ mkmanifest mylong.filename.html mylonger.filename.html \
> mymanifest
$ cat mymanifest
mv mylongxf.htm mylong.filename.html
mv mylonger.htm mylonger.filename.html
```

The file *mymanifest* can later be made executable and run to rename the files to their original names

mknod

```
mknod [options] name type [major minor]
```

Create a special file (a file that can send or receive data). Special files can be character files (read one character at a time), block files (read several characters at a time), or FIFO pipes (see mkfifo).

To choose which type of device to create, use one of the following arguments:

p

Create a FIFO file (named pipe). You do not need to specify the major and minor device numbers.

b

Create a block file. You must specify the major and minor device numbers the file represents.

c or u

Create a character file. You must specify the major and minor device numbers the file represents.

Linux's */dev/MAKEDEV* utility is useful for creating one or more devices of a given type in a single command.

Options

--help

Print usage information and exit.

-m *mode*, --mode=*mode*

Set the file mode of the device, as with chmod. The default mode is a=rw unless you have chosen other settings via umask.

--version

Print version information and exit.

mkraid

```
mkraid [options] devices
```

System administration command. Set up RAID array *devices* as defined in the */etc/raidtab* configuration file. mkraid can be used to initialize a new array or upgrade older RAID devicearrays for the new kernel. Initialization will destroy any data on the disk devices used to create the array.

Options

-c *file*, --configfile *file*

Use *file* instead of */etc/raidtab*.

-f, --force

Initialize the devices used to create the RAID array even if they currently have data.

-h, --help

Print a usage message and then exit.

-o, --upgrade

Upgrade an older array to the current kernel's RAID version. Preserve data on the old array.

-V, --version

Print version information and then exit.

mkswap

```
mkswap [options] device
```

System administration command. Prepare swapspace on *device*: a disk partition or a prepared file. This command can create old and new style swap areas. The older style provides backward compatibility with 2.2 kernels, but is less efficient and more limited in size. The `mkswap` command has some dangerous options we have omitted here. They provide backward compatibility and solutions to problems with older libraries, but can destroy a disk if specified incorrectly.

Options

`-c`

Check for bad blocks before creating the swapspace.

`-L label`

Create a label for use with `swapon`.

`-v0`

Create an old style swap area.

`-v1`

Create a new style swap area. (The default behavior on newer kernels.)

mktemp

`mktemp [options] [template]`

Generate a unique temporary filename for use in a script. The filename is based on the specified template, which may be any filename with at least six Xs appended (e.g.,*/tmp/mytemp.XXXXXX*). `mktemp` replaces the Xs with the current process number and/or a unique letter combination. The file is created with mode 0600 (unless `-u` is specified), and the filename is written to standard output With no template specified, the default file*tmp.XXXXXXXXXX* is created and the `-t` option is implied.

Options

`-d`

Make a directory, not a file.

`-q`

Fail silently in case of error. Useful to prevent error output from being sent to standard error.

`-p` *directory*

Generate the temporary file in the specified directory.

`-t`

Generate a path to the file rooted in a temporary directory. The directory is taken from the TMPDIR environment variable if it is set, or from the `-p` option. If neither is set, */tmp* is used.

`-u`

Operate in "unsafe" mode and unlink the temporary file before `mktemp` exits. Use of this option is not recommended.

`-V`

Print version information and exit.

mlabel

`mlabel [`*`options`*`] `*`drive`*`[`*`label`*`]`

Label an MS-DOS filesystem (maximum of 11 characters), first displaying the current label if there is one. See `mtools` for more information. If no label is specified, prompt the user for one.

Options

`-c`

Overwrite any existing labels.

`-s`

Show the existing label.

-n

Create a random serial number for the disk.

-N serialno

Choose a new serial number for the disk. It should be an eight-digit hexadecimal number with no spaces in it.

mmd

`mmd [option] dirname`

Create a directory on an MS-DOS filesystem. See mkdir and mtools for more information.

Option

-D *clash-option*

Specify the action to take if the specified directory name already exists. The possible clash options are as follows. (The primary name is the long name if it exists and the short name otherwise; the secondary name is the short name if a long name exists.)

a

Auto-rename the primary name.

A

Auto-rename the secondary name.

m

Ask the user what to do with the primary name.

M

Ask the user what to do with the secondary name.

o

Overwrite the primary name.

O

Overwrite the secondary name.

r

Rename the primary name, prompting the user for the name.

R

Rename the secondary name, prompting the user for the name.

s

Skip the primary name.

S

Skip the secondary name.

mmount

```
mmount drive [mount-arguments]
```

Mount an MS-DOS filesystem, passing the *mount-arguments* to mount. If no *mount-arguments* are specified, the device name is used. See mount and mtools for more information.

mmove

```
mmove [options] sourcefile targetfile
mmove [options] sourcefiles targetdir
```

Move or rename an MS-DOS file or directory within a single filesystem. If no drive letter is specified for the target file or directory, the source drive is assumed. If no drive letter is specified for either the source or the target, drive a: is assumed. See mv and mtools for more information.

Options

-D *clash-option*

Specify the action to take if the specified target file or directory already exists. See mmd for the possible clash options.

-v

Verbose; display names of the files or directories being moved.

modinfo

```
modinfo [options] object-file
```

System administration command. Print information about kernel module*object-file*. Information is read from tag names in the mod-info section of the module file. By default, it will print the module's filename, description, author, license, and parameters.

Options

-0, --null

Separate fields with the null character instead of newlines.

-a, --author

Print author information.

-d, --description

Print module description.

-F *fieldname*, --field *fieldname*

Print only the value of the specified*fieldname* (e.g., author, license, depends, etc.).

-h, --help

Print usage message, then exit.

-l, --license

Print module license information.

-n, --filename

Print the module's filename.

-p, --parameters

Print the module's typed parameters.

-V, --version

Print version number of the module.

modprobe

`modprobe [`*`options`*`] [`*`modules`*`][`*`moduleoptions`*`]`

System administration command. With no options, attempt to load the specified module, as well as all modules on which it depends. If more than one module is specified, attempt to load further modules only if the previous module failed to load. When specifying a module, use only its name without its path or trailing*.o*. modprobe will pass to the kernel any options following the module name.

Options

-a, --all

Load all modules matching the given wildcard.

-c, --showconfig

Print modprobe's current configuration.

-f, --force

Ignore all versioning information during module insertion. Even if the module does not match the running kernel, modprobe will try to insert it anyway.

--force-modversion

Ignore module versioning mismatches.

--force-vermagic

Ignore kernel versioning mismatches.

--first-time

Return failure if told to insert a module that is already present or remove a module that is not loaded. Normally, modprobe will return success if asked to perform an unnecessary action.

-i, --ignore-install,--ignore-remove

Ignore any *install* and *remove* directives in the configuration file.

-l, --list

List modules matching the given wildcard (or "*" if no wildcard is given).

-n, --dry-run

Perform all of the actions except actually inserting or removing the module.

-q,--quiet

Suppress warnings during failure to load a module and continue processing other modules.

-r, --remove

Remove the specified modules, as well as the modules on which they depend.

-s, --syslog

Send error messages to syslogd instead of to standard error.

-t*type*, --type *type*

Load only a specific type of module.

-v, --verbose

Print commands as they are executed.

-C *file*, --config *file*

Read additional configuration from *file* instead of */etc/modules.conf*.

-V, --version

Print version, then exit.

more

```
more [options] [files]
```

Display the named *files* on a terminal, one screenful at a time. See less for an alternative to more.

Options

+*num*

Begin displaying at line number *num*.

-num *number*

Set screen size to *number* lines.

+/*pattern*

Begin displaying two lines before *pattern*.

-c

Repaint screen from top instead of scrolling.

-d

Display the prompt "[Press space to continue, `q' to quit]" instead of ringing the bell. Also display "[Press `h' for instructions]" in response to illegal commands.

-f

Count logical rather than screen lines. Useful when long lines wrap past the width of the screen.

-l

Ignore form-feed (Ctrl-L) characters.

-p

Page through the file by clearing each window instead of scrolling. This is sometimes faster.

-s

Squeeze; display multiple blank lines as one.

-u

Suppress underline characters.

Commands

All commands in more are based on vi commands. You can specify a number before many commands to have them executed multiple times. For instance, 3:p causes more to skip back three files, the same as issuing :p three times. The optional number is indicated by *num* in the following list.

SPACE

Display next screen of text.

z

Display next *num* lines of text, and redefine a screenful to *num* lines. Default is one screenful.

RETURN

Display next *num* lines of text, and redefine a screenful to *num* lines. Default is one line.

d, ^D

Scroll *num* lines of text, and redefine scroll size to *num* lines. Default is one line.

q, Q, INTERRUPT

Quit.

s

Skip next *num* lines of text. Default is one line.

f

Skip forward *num* screens of text. Default is one screen.

b, ^B

Skip backward *num* screens of text. Default is one screen. Does not work on pipes.

'

Return to point where previous search began.

=

Print number of current line.

/*pattern*

Search for *pattern*, skipping to *num*th occurrence if an argument is specified.

?, h

Display a summary of commands.

n

Repeat last search, skipping to *num*th occurrence if an argument is specified.

!cmd, :!cmd

Invoke shell and execute *cmd* in it.

v

Invoke an editor on the file at the current line. Use the editor in the environment variable VISUAL if defined, or EDITOR if that is defined; otherwise, default tovi.

^L

Redraw screen.

:n

Skip to next file, or *num*th file if an argument is specified.

:p

Skip to previous file, or *num*th previous if an argument is specified.

:f

Print current filename and line number.

.

Re-execute previous command.

Examples

Page through *file* in "clear" mode, and display prompts:

```
more -cd  file
```

Format *doc* to the screen, removing underlines:

```
nroff  doc | more -u
```

View the manpage for the more command; begin at the first appearance of the word "scroll":

```
man more|more +/scroll
```

mount

```
mount [options] [[device] directory]
```

System administration command. Mount a file structure. The file structure on*device* is mounted on *directory*. If no *device* is specified, mount looks for an entry in */etc/fstab* to find out what device is associated with the given directory. The directory, which must already exist and should be empty, becomes the name of the root of the newly mounted file structure. Ifmount is invoked with no arguments, it displays the name of each mounted device, the directory on which it is mounted, its filesystem type, and any mount options associated with the device.

Options

-a

Mount all filesystems listed in */etc/fstab*. Use -t to limit this to all filesystems of a particular type.

--bind *olddirectory newdirectory*

Bind a mounted subtree to a new location. The tree will be available from both the old and new directory. This binding does not include any volumes mounted below the specified directory.

-f

Fake mount. Go through the motions of checking the device and directory, but do not actually mount the filesystem.

-F

When used with -a, fork a new process to mount each system.

-h

Print help message, then exit.

-l

When reporting on mounted filesystems, show filesystem labels for filesystems that have them

-L *label*

Mount filesystem with the specified label.

--move *olddirectory newdirectory*

Move a mounted device to a new location. Keep in place any options and submounts.

-n

Do not record the mount in */etc/mtab*.

-o *option*

Qualify the mount with a mount option. Many filesystem types have their own options. The following are common to most filesystems:

async

Read input and output to the device asynchronously.

atime

Update inode access time for each access. This is the default behavior.

auto

Allow mounting with the -a option.

defaults

Use all options' default values (async, auto, dev, exec, nouser, rw, suid).

dev

Interpret any special devices that exist on the filesystem.

dirsync

Perform all directory updates to the filesystem synchronously.

exec

Allow binaries to be executed.

_netdev

Filesystem is a network device requiring network access.

noatime

Do not update inode access time for each access.

noauto

Do not allow mounting via the -a option.

nodev

Do not interpret any special devices that exist on the filesystem.

noexec

Do not allow the execution of binaries on the filesystem.

nosuid

Do not acknowledge any suid or sgid bits.

nouser

Only privileged users will have access to the filesystem.

remount

Expect the filesystem to have already been mounted, and remount it.

ro

Allow read-only access to the filesystem.

rw

Allow read/write access to the filesystem.

suid

Acknowledge suid and sgid bits.

sync

Read input and output to the device synchronously.

user

Allow unprivileged users to mount or unmount the filesystem. The defaults on such a system will be nodev, noexec, and nosuid, unless otherwise specified.

users

Allow any user to mount or unmount the filesystem. The defaults on such a system will be nodev, noexec, and nosuid, unless otherwise specified.

-O *option*

Limit systems mounted with -a by -O's filesystem options (as used with -o). Use a comma-separated list to specify more than one option, and prefix an option withno to exclude filesystems with that option. Options -t and -O are cumulative.

-r

Mount filesystem read-only.

--rbind *olddirectory newdirectory*

Bind a mounted subtree to a new location. The tree will be available from both the old and new directory. Include any volumes mounted below the specified directory.

-s

Where possible, ignore mount options specified by -o that are not supported by the filesystem.

-t *type*

Specify the filesystem type. Possible values includeadfs, affs, autofs, coda, cramfs, devpts, efs, ext2, ext3, hfs, hpfs, iso9660, jfs, minix, msdos, ncpfs, nfs, nfs4, ntfs, proc, qnx4, reiserfs, romfs, smbfs, sysv, tmpfs, udf, ufs, umsdos, vfat, xfs, and xiafs. The default type is iso9660. The type auto may also be used to set mount to autodetect the filesystem. When used with -a, this option can limit the types mounted. Use a comma-separated list to specify more than one type to mount. Prefix a list (or type) withno to exclude those types.

-U *uuid*

Mount filesystem with the specified*uuid*.

-v

Display mount information verbosely.

-V

Print version, then exit.

-w

Mount filesystem read/write. This is the default.

Files

/etc/fstab

List of filesystems to be mounted and options to use when mounting them.

/etc/mtab

List of filesystems currently mounted and the options with which they were mounted.

/proc/partitions

Used to find filesystems by label and uuid.

mountd

```
rpc.mountd [options]
```

NFS/NIS command. NFS mount request server. mountd reads the file */etc/exports* to determine which filesystems are available for mounting by which machines. It also provides information about which filesystems are mounted by which clients. See also nfsd.

Options

-d *kind*, --debug *kind*

Specify debugging facility. Accepted values for *kind* are general, call, auth, parse, and all.

-f *file*, --exports-file *file*

Read the export permissions from *file* instead of */etc/exports*.

-F, --foreground

Run mountd in the foreground.

-h, --help

Print help message, then exit.

-n, --no-tcp

Use UDP for mounts.

-N *n*, --no-nfs-version *n*

Do not offer NFS version *n*.

-o *n*, --descriptors *n*

Allow no more than *n* open file descriptors. The default is 256.

-p *n*, --port *n*

Bind to specified port instead of accepting a port from portmapper.

-v, --version

Print the version number, then exit.

-V *n*, --nfs-version *n*

Explicity offer NFS version *n*.

Files

/etc/exports

Information about mount permissions.

/var/lib/nfs/rmtab

List of filesystems currently mounted by clients.

mpartition

`mpartition [*options*] *drive*`

Create the MS-DOS partition specified by *drive*; used mostly on proprietary Unix systems where fdisk is unavailable. See mtools for more information. When a partition is being created, the default is for the number of sectors and heads and the length to be automatically determined, but they can also be specified as options.

Options

-a

Activate the partition, making it the bootable partition.

-b *offset*

The starting offset of the partition to be created, in sectors. The default is the start of the disk (partition 1) or immediately after the end of the previous partition.

-B *bootsector*

Read the template master boot record from the file specified by *bootsector*. Can be specified with -I.

-c

Create the partition.

-d

Deactivate the partition, making it nonbootable.

-f

Allow overriding of safeguards that perform consistency checking before any change is made to a partition. Can be specified with any operation that modifies the partition table.

-h *heads*

The number of heads for a partition being created.

-I

Initialize the partition table and remove all partitions.

-l *length*

The size of the partition to be created, in sectors.

-p

Print a command line to re-create the partition. With -v, print the current partition table.

-r

Remove the partition.

-s *sectors*

The number of sectors per track of the partition to be created.

-t *cylinders*

The number of cylinders of the partition to be created.

-v

With -p, print the current partition table; otherwise, for commands that modify the partition table, print it after it has been modified.

-vv

Print a hexadecimal dump of the partition table when reading and writing it.

mpg123

mpg123 [*options*] *file*

Command-line MP3 player. See mpg321.

mpg321

mpg321 [*options*] *file*mpg123 [*options*] *file*

Command-line MP3 players, often used as backends for GUI music players. The files played may be local files or URLs. mpg321 and mpg123 behave the same way, except that mpg123 lacks the option --skip-printing-frames.

Options

-o *devicetype*

Name the type of audio device you are using. Valid types areoss (Open Sound System), sun (Sun audio system), alsa (Advanced Linux Sound Architecture), alsa09 (ALSA, version 0.9), esd (Enlightened Sound Daemon), and arts (Analog Real-Time Synthesizer).

-a *device*, --audiodevice *device*

Name the actual device (e.g., */dev/sound/dsp1*) you are using. This option is ignored if you have chosen -o arts. For esd running on remote systems, you must specify the host, and for alsa, you must specify the card and device (default is0:0).

-g *n*, --gain *n*

Set the volume (gain) to an integer between 1 and 100.

-k *n*, --skip *n*

Do not play the first *n* frames of the file or stream.

-n *n*, --frames *n*

Play only the first *n* frames of the file or stream.

-@ *filename*, --list *filename*

Specify a playlist file. The format of *filename* is just a list of filenames, one file per line, to be played.

-z, --shuffle

Shuffle the files in the playlist and any files supplied on the command line, and play the list once. Each file will be played once.

-Z, --random

Each time one file is finished playing, choose a new file at random. Files may be played more than once, and mpg321 will continue playing songs at random until it is stopped.

-v, --verbose

Verbose mode. Display additional information about the file, including ID3 tags and time played/time remaining.

-s, --stdout

Mostly useful for developers, this option uses stdout instead of an audio device for its output. The output is 16-bit PCM, little-endian data.

-w *filename*, --wav *filename*

Instead of playing the song, write the output to the *.wav* file you specify. Choosing - as the filename sends the WAV data to stdout. This option is usually used with the--cdr option.

--cdr *filename*

Write to a CDR file. Choosing - as the filename sends the data to stdout.

--au *filename*

Instead of playing the file, write the output to the *.au* file you specify. Choosing - as the filename sends the data to stdout.

-t, --test

Test mode. Do not play or write any data.

-q, --quiet

Quiet mode. This still plays the file, but does not display any data about the file or about mpg321.

-R

Operate in "remote control" mode, allowing seek and pause. This option is useful almost exclusively for developers of graphical frontends for mpg321.

--stereo

Play in stereo. If audio is mono, send two identical streams as stereo output.

--aggressive

Aggressive mode takes a higher priority in the system if possible. It requires root access because it can preempt processes owned by other users.

--skip-printing-frames=*n*

Save CPU cycles by displaying a status update only once every *n* frames. This option is not available in mpg123.

--help, --longhelp

Display usage information and exit.

-V, --version

Display the version of mpg321 and exit.

mrd

```
mrd [option] directory
```

Delete an MS-DOS directory. The directory should be empty. To delete a full directory and its contents, use mdeltree. See rmdir and mtools for more information.

Option

-v

Operate in verbose mode, displaying each directory as it is deleted.

mren

```
mren [options] oldfile newfile
```

Rename an MS-DOS file or directory. See rename and mtools for more information.

Options

-D *clash-option*

Specify the action to take if the specified new name already exists. See mmd for the possible clash options.

-v

Operate verbosely, showing the names of files and directories as they are renamed.

-V

Print version information and exit.

mshowfat

`mshowfat` *file*

Display the FAT clusters associated with a file on an MS-DOS system. See mtools for more information.

mt

`mt` [*option*] *operation* [*count*] [*arguments*]

Control a magnetic tape drive used to back up or restore system data. The version of the `mt` command documented here is `mt-st`, which includes support for the `st` driver for SCSI tape devices. The *operation* argument determines what action will be taken, and, unless the `-f` or `-t` option is used, the action is applied to the default tape drive named in the TAPE environment variable. The *count* argument determines how many times the operation is to be repeated. If not specified, it defaults to 1. Some operations take one or more arguments other than a count, as noted in the descriptions below.

Options

`-f` *device*, `-t` *device*

Name the tape device to use. This may be a local device, a character special file (see `mknod`), or a remote device, named in the format *host*:*/path/to/drive* or user@host:*path/to/drive*.

`-h`, `--help`

Print usage message and exit. `-h` prints a simple usage message, while `--help` also prints a list of commands.

`-V`, `--version`

Print version number and exit. Also tells you if you are running `mt-st` or the GNU version of `mt`.

Operations

mt can perform the following operations on tape drives. Operations applicable only to SCSI tape drives are marked as such.

asf *n*

Move to file number *n* on the tape. This is the same as rewinding the tape and moving forward *n* files with fsf.

bsf *n*

Move backward *n* files, positioning the tape at the last block of the previous file.

bsfm *n*

Move backward *n* file marks, to a position on the side of the file mark closer to the beginning of the tape.

bsr *n*

Move backward *n* records.

bss *n*

SCSI drives only. Move backward *n* set marks.

compression

SCSI drives only. Allow the internal drive compression to be turned on and off with the MTCOMPRESSION *ioctl*. Overrides the default value for the current tape. Not supported by all drives.

defblksize *n*

SCSI drives only. Set the default block size to *n*, overriding the default for this tape. Setting *n* to -1 disables the default block size. Requires superuser privileges.

defcompression *n*

SCSI drives only. Set the default compression state. Set *n* to -1 to disable the default compression. Use compression to override the default for the current tape. Requires superuser privileges.

defdensity *n*

SCSI drives only. Set the default density code. Set *n* to -1 to disable the default density. Use setdensity to override the default for the current tape. Requires superuser privileges.

defdrvbuffer *n*

SCSI drives only. Set the default drive buffer code. Set *n* to -1 to disable the default drive buffer code. Use drvbuffer to override the default for the current tape. Requires superuser privileges.

densities

SCSI drives only. Display information about data densities to standard output.

drvbuffer *n*

SCSI drives only. Set the buffer value. For no buffering, choose 0, and for normal buffering, choose 1. Other values may have different effects depending on the drive. Use to override the default buffer value for the current tape.

eod, seod

Move to the end of valid data on the tape. Used with streamer tapes to append data to the end of the tape.

eof, weof *n*

Write *n* end-of-file (EOF) notations at the current location on the tape.

erase

Erase the tape.

fsf *n*

Move forward *n* files, positioning the tape at the first block of the next file.

fsfm *n*

Move forward *n* file marks, to a position on the side of the file mark closer to the beginning of the tape.

fsr *n*

Move forward *n* records.

fss *n*

SCSI drives only. Move forward *n* set marks.

load[*n*]

SCSI drives only. Load the tape, usually used when a new cartridge is inserted. The count,*n*, can usually be omitted.

lock

SCSI drives only. Lock the tape drive door.

mkpartition *n*

SCSI drives only. Format the tape. If *n* is 0, format with one partition. Otherwise, format with two partitions, using *n* as the size of the second partition. Partition support must be enabled for the drive, and the drive must be able to format partitioned tapes with the user specifying the partition size.

offline, rewoffl, eject

Rewind and unload the tape (if drive supports unload).

partseek *n* [*partition*]

SCSI drives only. Set the tape position to block *n* in the specified partition. The default partition is 0.

retension

Used when the tape has become loosely wound, usually because it has been dropped, shaken, or transported. Rewinds the tape, moves forward to the end of the tape, then rewinds again.

rewind

Return to the beginning of the tape.

seek *n*

SCSI drives only. Seek to block *n* on the tape. Use tell to first find the block number.

setblk *n*

SCSI drives only. Set the block size to *n* bytes per record.

setdensity *n*

SCSI drives only. Set the data density for your tape drive to*n*. The appropriate value should be in the tape or tape drive documentation. For more information, see the densities operation. Use to override the default density for the current tape.

setpartition [*n*]

SCSI drives only. Switch to the partition specified by*n*. The default partition is 0.

status

Display the status of the tape drive.

stclearoptions *bits*

SCSI drives only. Clear the selected driver option bits, specified as described forstoptions. Requires superuser privileges.

stlongtimeout *secs*

Set the long timeout for the drive, in seconds. Requires superuser privileges.

stoptions *n*

SCSI drives only. Set the driver option bits for the device. Requires superuser privileges. Set by ORing the option bits from */usr/include/linux/mtio.h* to *n*, or with the following keywords. Multiple keywords can be specified, and unambiguous abbreviations are allowed.

async-writes

Enable asynchronous writes.

auto-lock

Automatically lock and unlock the drive door.

buffer-writes

Enable buffered writes.

can-bsr

Drive can space backwards.

can-partitions

Drive supports partitioned tapes.

debug

Turn on debugging (must have been compiled into the driver).

def-writes

Block size and density are for writes.

fast-eod

Space directly to the end of the valid data; file number is lost.

no-blklimits

Drive does not support read block limits.

no-wait

Don't wait for operations, such as rewind, to complete.

read-ahead

Enable read-ahead for fixed block size.

scsi2logical

seek and tell operations use SCSI-2 logical block addresses instead of device-dependen addresses.

sysv

Enable the use of System V semantics.

two-fms

Write two file marks when a file is closed.

stsetcln *n*

Set the cleaning-request interpretation parameters.

stsetoptions

SCSI drives only. Set the selected driver option bits, specified as described forstoptions. Requires superuser privileges.

sttimeout secs

Set the normal timeout for the drive, in seconds. Requires superuser privileges.

stwrthreshold *n*

SCSI drives only. Set the write threshold for the tape drive to*n* kilobytes. This value may not be higher than the driver buffer value. Requires superuser privileges.

tell

SCSI drives only. Report the number of the current block on the tape.

unlock

SCSI drives only. Unlock the tape drive door.

wset *n*

SCSI drives only. Write *n* set marks at current position.

Return codes

0

Operation succeeded

1

Invalid operation or device name

2

Operation failed

mtools

command [*options*] [*arguments*]

A collection of tools for working with MS-DOS files and filesystems, especially for accessing files on floppy disks without mounting them as Unix filesystems. The various commands aremattrib, mbadblocks, mcat, mcd, mcopy, mdel, mdeltree, mdir, mdu, mformat, minfo, mkmanifest, mlabel, mmd, mmount, mmove, mpartition, mrd, mren, mshowfat, mtoolstest, mtype, and mzip.

For the purposes of mtools, all MS-DOS file names begin with a drive letter and colon, followed by the path. mtools accepts both / and \ for directory separators. For example, an MS-DOS file might be referred to as *a:/directory/subdirectory/file.txt*. If you use the backslash or any standard Unix wildcards or special characters, put the filename in quotation marks.

FAT filesystem filenames are normally a maximum of eight characters long with a three-letter extension, and are not case-sensitive. Even in the more recent VFAT system, which does preserve case sensitivity, two files with the same letters in their names, regardless of case, cannot coexist. Unix filenames that are too long, that use reserved characters (; + = [ ] ' , \ " * \ \ < > / ? : or |), o that conflict with MS-DOS devices (PRN, for example) are converted to VFAT names. This means replacing reserved characters with an underscore (_) and shortening files as needed, replacing several characters with a single tilde (~).

mtoolstest

mtoolstest

Display the configuration for mtools. See mtools for more information.

mtype

mtype [*options*] *files*

Display the contents of MS-DOS files, as with the MS-DOS commandtype. See mtools for more information.

Options

-s

Strip the high bit from the data.

-t

View as a text file, changing carriage return/line feeds to line feeds.

mv

```
mv [option] sources target
```

Move or rename files and directories. The source (first column) and target (second column) determine the result (third column):

Source	Target	Result
File	*name* (nonexistent)	Rename file to *name*.
File	Existing file	Overwrite existing file with source file.
Directory	*name* (nonexistent)	Rename directory to *name*.
Directory	Existing directory	Move directory to be a subdirectory of existing directory.
One or more files	Existing directory	Move files to directory.

The mv command is often aliased as mv -i in the *.bashrc* file, especially for the root account, to prevent inadvertently overwriting files.

Options

-b

Back up files before removing.

--backup[=*type*]

Like -b, but can take an argument specifying the type of version-control file to use for the backup. The value of *type* overrides the VERSION_CONTROL environment variable, which determines the type of backups made. The acceptable values for version control are:

t, numbered

Always make numbered backups.

nil, existing

Make numbered backups of files that already have them, and make simple backups of the others. This is the default.

never, simple

Always make simple backups.

none, off

Never make backups.

-f, --force

Force the move, even if *target* file exists; suppress messages about restricted access modes. Same as --reply=yes.

--help

Print a help message and then exit.

-i, --interactive

Query user before removing files. Same as --reply=query.

--reply=*prompt*

Specify how to handle prompt if the destination exists already. Possible values areyes, no, and query.

--strip-trailing-slashes

Remove trailing slashes from source paths.

-S *suffix*, --suffix=*suffix*

Override the SIMPLE_BACKUP_SUFFIX environment variable, which determines the suffix used for making simple backup files. If the suffix is not set either way, the default is a tilde (~).

--target-directory=*dir*

Move all source files and directories into the specified directory.

-u, --update

Do not remove a file or link if its modification date is the same as or newer than that of its replacement.

-v, --verbose

Print the name of each file before moving it.

--version

Print version information and then exit.

mzip

```
mzip [options] [drive:]
```

Set modes or eject an MS-DOS-formatted ZIP or JAZ disk. See mtools for information about handling MS-DOS filesystems. Unix-formatted ZIP and JAZ drivescan be handled as you would a floppy or other removable media, using the mount and umount commands.

Note that a ZIP drive is usually referred to as drive Z:, and a JAZ drive as drive J:.

Options

-e

Eject the disk.

-f

Force eject (even if the disk is mounted). Must be used in combination with-e.

-P

Prevent writing to the disk without a password.

-q

Query and display the disk status.

-r

Put disk into read-only mode.

-u

Make the disk writable, but restore write protection on eject.

-w

Put disk into read/write mode.

-x

Prevent read or write access to the disk without a password.

named

named [*options*]

TCP/IP command. Internet domain nameserver. named is used by resolver libraries to provide access to the Internet distributed naming database. With no arguments,named reads */etc/named.conf* for any initial data and listens for queries on a privileged port. See RFC 1034 and RFC 1035 for more details.

There are several named binaries available at different Linux archives, displaying various behaviors. Here we describe named as provided by Internet Software Consortium's Berkeley Internet Name Domain (BIND) Version 9.2.x.

Options

-c *file*

Read configuration information from *file* instead of */etc/named.conf*.

-d *debuglevel*

Print debugging information. *debuglevel* is a number indicating the level of messages printed.

-f

Run named in the foreground.

-g

Run named in the foreground and send all log messages to standard error.

-n *n*

Specify the number of processors in a multiprocessor system. Normallynamed can autodetect the number of CPUs.

-p *port*

Use *port* as the port number. Default is 53.

-t *dir*

Change root to specified directory after reading command arguments but before reading the configuration file. Useful only when running with option-u.

-u *user*

Set the user ID to *user* after completing any privileged operations.

-v

Print version, then exit.

File

/etc/named.conf

Read when named starts up.

namei

`namei [options] pathname [pathname . . .]`

Follow a pathname until a terminal point is found (e.g., a file, directory, char device, etc.). If namei finds a symbolic link, it shows the link and starts following it, indenting the output to show the context. namei prints an informative message when the maximum number of symbolic links has been exceeded, making it helpful for resolving errors resulting from too many levels of links.

Options

-m

Show mode bits of each file type in the style of ls (e.g., "rwxr-xr-x").

-x

Show mountpoint directories with a D rather than a d.

File-type characters

For each line of output, namei prints the following characters to identify the file types found:

-

A regular file.

?

An error of some kind.

b

A block device.

c

A character device.

d

A directory.

f:

The pathname namei is currently trying to resolve.

l

A symbolic link (both the link and its contents are output).

s

A socket.

nameif

```
nameif [options] [name macaddress]
```

System administration command. Assign an interface *name* to a network device specified by *macaddress*, the unique serial number that identifies a network card. If no *name* and *macaddress* are given, nameif will attempt to read addresses from the configuration file */etc/mactab*. Each line of the configuration file should contain either a comment beginning with # or an interface name and MAC address.

Options

-c *filename*

Read interface names and MAC addresses from *filename* instead of */etc/mactab*.

-s

Send any error messages to syslog.

netstat

`netstat [`*`options`*`] [`*`delay`*`]`

TCP/IP command. Show network status. Print information on active sockets, routing tables, interfaces, masquerade connections, or multicast memberships. By default, `netstat` lists open sockets. When a *delay* is specified, `netstat` will print new information every *delay* seconds.

Options

The first five options (`-g`, `-i`, `-M`, `-r`, and `-s`) determine what kind of information `netstat` should display.

`-g, --groups`

Show multicast group memberships.

`-i, --interface[=`*`name`*`]`

Show all network interfaces, or just the interface specified by *name*.

`-M, --masquerade`

Show masqueraded connections.

`-r, --route`

Show kernel routing tables.

`-s, --statistics`

Show statistics for each protocol.

`-a, --all`

Show all entries.

`-A` *family*, `--protocol=`*family*

Show connections only for the specified address *family*. Accepted values are inet, unix, ipx, ax25, netrom, and ddp. Specify multiple families in a comma-separated list.

-c, --continuous

Display information continuously, refreshing once every second.

-C

Print routing information from the route cache.

-e, --extend

Increase level of detail in reports. Use twice for maximum detail.

-F

Print routing information from the forward information database (FIB). This is the default.

-l, --listening

Show only listening sockets.

-n, --numeric

Show network addresses, ports, and users as numbers.

--numeric-hosts

Show host addresses as numbers, but resolve others.

--numeric-ports

Show ports as numbers, but resolve others.

--numeric-users

Show user ID numbers for users, but resolve others.

-N, --symbolic

Where possible, print symbolic host, port, or usernames instead of numerical representations. This is the default behavior.

-o, --timers

Include information on network timers.

-p, --program

Show the process ID and name of the program owning the socket.

-t, --tcp

Limit report to information on TCP sockets.

-u, --udp

Limit report to information on UDP sockets.

-v, --verbose

Verbose mode.

-w, --raw

Limit report to information on raw sockets.

newaliases

```
newaliases
```

Rebuild the mail aliases database, */etc/aliases*, after a change. Return 0 on success, or a number greater than 0 if there was an error. newaliases must be run whenever */etc/aliases* has been changed for the change to take effect. Identical tosendmail -bi.

newgrp

```
newgrp [group]
```

Change user's group ID to the specified group. If no group is specified, change to the user's login

group. The new group is then used for checking permissions.

newusers

```
newusers file
```

System administration command. Create or update system users from entries in *file*. Each line in *file* has the same format as an entry in */etc/passwd*, except that passwords are unencrypted and group IDs can be given as a name or number. During an update, the password age field is ignored if the user already exists in the */etc/shadow* password file. If a group name or ID does not already exist, it will be created. If a home directory does not exist, it will be created.

nfsd

```
rpc.nfsd [option] n
```

System administration command. Launch *n* kernel threads for the Network File System (NFS) kernel module. The threads will handle client filesystem requests. By default, only one thread is launched. Most systems require eight or more, depending on the number of NFS clients using the system. Use `nfsstat` to check NFS performance.

Option

`-p` *port*

Listen for NFS requests on *port* instead of the default port 2049.

nfsstat

```
nfsstat [options]
```

System administration command. Print statistics on NFS and remote procedure call (RPC) activity for both clients and server.

Options

`-a`

Display all statistics.

`-c`

Display only client-side statistics.

`-n`

Display only NFS statistics.

`-r`

Display only RPC statistics.

`-s`

Display only server-side statistics.

`-o` *facility*

Only display statistics for the specified *facility*. The following are valid values for *facility*:

fh

Server file handle cache.

net

Network layer statistics.

nfs

Same as -n.

rc

Server request reply cache.

rpc

Same as -r.

-z

Reset statistics to zero. Use with above options to zero out specific sets of statistics (e.g.-zr to reset the RPC statistics.)

nice

nice [*option*] [*command* [*arguments*]]

Execute a *command* (with its *arguments*) with lower priority (i.e., be "nice" to other users). With no command, nice prints the current scheduling priority (niceness). If nice is a child process, it prints the parent process's scheduling priority. Niceness has a range of -20 (highest priority) to 19 (lowest priority).

Options

--help

Print a help message and then exit.

-n *adjustment*, -*adjustment*, --adjustment=*adjustment*

Run *command* with niceness incremented by *adjustment* (1-19); default is 10. A privileged user can raise priority by specifying a negative *adjustment* (e.g., -5).

--version

Print version information and then exit.

nm

```
nm [options] [objfiles]
```

Print the symbol table in alphabetical order from one or more object files. If no object files are specified, perform operations on *a.out*. Output includes each symbol's value, type, size, name, and so on. A key letter categorizing the symbol can also be displayed.

Options

-a, --debug-syms

Print debugger symbols.

--defined-only

Display only defined symbols.

-f *format*, --format=*format*

Specify output format (bsd, sysv, or posix). Default is bsd.

-g, --extern-only

Print external symbols only.

--help

Print help message, then exit.

-l, --line-numbers

Print source filenames and line numbers for each symbol from available debugging information

-n, -v, --numeric-sort

Sort the external symbols by address.

-p, --no-sort

Don't sort the symbols at all.

-r, --reverse-sort

Sort in reverse, alphabetically or numerically.

-s, --print-armap

Include mappings stored by ar and ranlib when printing archive symbols.

--size-sort

Sort by size.

-t *radix*, --radix=*radix*

Use the specified *radix* for printing symbol values. Accepted values are d for decimal, o for octal, and x for hexadecimal.

--target=*format*

Specify an object code *format* other than the system default.

-u, --undefined-only

Report only the undefined symbols.

-A, -o, --print-file-name

Print input filenames before each symbol.

-B

Same as --format=bsd.

-C, --demangle[=*style*]

Translate low-level symbol names into readable versions. You may specify a style to use when demangling symbol names from a foreign compiler.

-D, --dynamic

Print dynamic, not normal, symbols. Useful only when working with dynamic objects (some kinds of shared libraries, for example).

-P, --portability

Same as -f posix.

-S, --print-size

Print the size of defined symbols.

-V, --version

Print nm's version number on standard error.

nohup

---

nohup *command* [*arguments*]
nohup *option*

Run the named *command* with its optional command *arguments*, continuing to run it even after you log out (make *command* immune to hangupsi.e., no hangup). Terminal output is appended to the file *nohup.out* by default, or *$HOME/nohup.out* if *nohup.out* can't be written to. Modern shells preserve background commands by default; this command is necessary only in the original Bourne shell.

Options

--help

Print usage information and exit.

--version

Print version information and exit.

nslookup

nslookup

TCP/IP command. Query Internet domain nameservers. nslookup is deprecated; its functionality is

replaced by the dig and host commands. nslookup may not be included in some distributions.

nsupdate

`nsupdate [options] [filename]`

System administration command. Interactively submit dynamic DNS update requests to a nameserver. Use nsupdate to add or remove records from a zone without manually editing the zone file. Commands may be entered interactively or read from *filename*. An update message is built from multiple commands, some establishing prerequisites, some adding or deleting resource records. Messages are executed as a single transaction. A blank line or the send command will send the current message. Lines beginning with a semicolon are treated as comments. For additional information on dynamic DNS updates, see RFC 2136.

Options

-d

Print additional tracing information usable for debugging.

-k *keyfile*

Read encrypted transaction signature key from *keyfile*. The key should be encrypted using the HMAC-MD5 algorithm. Keyfiles are generated by the dnssec-keygen command.

-v

Use TCP instead of UDP to send update requests.

-y *keyname*:*secret*

Generate transaction signature from specified *keyname* and *secret*.

Interactive commands

class *classname*

Set default class to *classname* instead of the normal default IN.

key *keyname secret*

Generate transaction signature from specified *keyname* and *secret*. This command overrides command-line options -k or -y.

local *address* [*port*]

Use local *address* and, if specified, *port* to send updates.

prereq *criteria*

Specify prerequisites for updating a domain. Provide the criteria in one of the following forms:

nxdomain *domain-name*

Perform updates only if there are no preexisting records with the name*domain-name*.

nxrset *domain-name* [*class*] type

Perform updates only if there is no preexisting record of the specified*type* and *class* for *domain-name*. When no *class* is given, IN is assumed.

yxdomain *domain-name*

Perform updates only if there is a preexisting record with the name*domain-name*.

yxrset *domain-name* [*class*] type [*data*]

Perform updates only if there is a preexisting record of the specified*type* and *class* for *domain-name*. If *data* is given, the RDATA of the specified resource must match it exactly. When no *class* is given, IN is assumed.

send

Send the current message. Same as entering a blank line.

server *servername* [*port*]

Update records on DNS server *servername* instead of the master server listed in the MNAME field of the appropriate zone's SOA record.

show

Print all commands in current message.

update *command*

Update the records according to one of the following*commands*:

add *domain-name* [*ttl*] [*class*] *type data*

Add a resource record with the specified values.

delete *domain-name* [*ttl*] [*class*] [*type* [*data*]]

Delete resource records for *domain-name*. The *ttl* field is always ignored, but if other fields are given, only delete records that match all criteria.

zone *zonename*

Apply updates to the specified *zonename*. If no zone command is given, nsupdate attempts to determine the correct zone based on other input.

objcopy

`objcopy [options] infile [outfile]`

Copy the contents of the input object file to another file, optionally changing the file format in the process (but not the endian-ness). If *outfile* is not specified, objcopy creates a temporary file and renames it to *infile* when the copy is complete, destroying the original input file. The GNU Binary File Descriptor (BFD) library is used to read and write the object files.

Options

--add-section *section*=*file*

Add a new section to the output object file with the specified section name and the contents taken from the specified file. Available only for formats that allow arbitrarily named sections.

--alt-machine-code=*n*

If the output architecture has alternate machine codes, use the*n*th code instead of the default.

-b *n*, --byte=n

Copy only every *n*th byte. Header data is not affected. The value of*n* can be from 0 to *interleave*-1, where *interleave* is specified by -i (default is 4). This option is useful for creating files to program ROM and is typically used withsrec as the output format.

-B *bfdarch*, --binary-architecture=*bfdarch*

Set the output architecture to *bfdarch* (e.g., i386) for transforming a raw binary file into an object file. Otherwise, this option is ignored. After the conversion, your program can access data inside the created object file by referencing the special symbols_binary_objfile_start, _binary_objfile_end, and _binary_objfile_size.

--change-addresses=*incr*, --adjust-vma=*incr*

Change the VMA and LMA addresses of all sections, plus the start address, by adding*incr*. Changing section addresses is not supported by all object formats. Sections are not relocated.

--change-leading-char

For object formats that use a special character (such as an underscore) to begin symbols, change the leading character when converting between formats. If the character is the same in both formats, the option has no effect. Otherwise, it adds, removes, or changes the leading character as appropriate for the output format.

--change-section-address *section*{=|+|-}*val*,

--adjust-section-vma *section*{=|+|-}*val*

Set or change the VMA and LMA addresses of the specified section. With=, set the section address to the specified value; otherwise, add or subtract the value to get the new address.

--change-section-lma *section*{=|+|-}*val*

Set or change the LMA address of the specified section. With=, set the section address to the specified value; otherwise, add or subtract the value to get the new address.

--change-section-vma *section*{=|+|-}*val*

Set or change the VMA address of the specified section. With=, set the section address to the specified value; otherwise, add or subtract the value to get the new address.

--change-start *incr*, --adjust-start *incr*

Add *incr* to the start address to get a new start address. Not supported by all object formats.

--change-warnings, --adjust-warnings

Issue a warning if the section that is specified in one of the options--change-section-address, --change-section-lma, or --change-section-vma does not exist.

--debugging

Convert debugging information if possible.

-F *bfdname*, --target=*bfdname*

Set the binary format for both input and output files to the binary file descriptor name *bfdname*. No format translation is done. Use the -h option for a list of supported formats for your system.

-g, --strip-debug

Do not copy debugging information.

-G *symbol*, --keep-global-symbol=*symbol*

Copy only the specified global symbol, making all other symbols local to the file. May be specified multiple times.

--gap-fill=*val*

Fill gaps between sections with the specified value; applies to the load address (LMA) of the sections.

-h, --help

Print help information, including a list of supported target object formats, then exit.

-i *interleave*, --interleave=*interleave*

Copy one out of every *interleave* bytes. Use -b to set the byte to copy (default is 4). This option is ignored if -b is not specified.

-I *bfdname*, --input-target=*bfdname*

Set the binary file format of the input file using its binary file descriptor name,*bfdname*.

-j *section*, --only-section=*section*

Copy only the specified section. May be specified multiple times.

-K *symbol*, --keep-symbol=symbol

Copy only the specified symbol from the source file. May be specified multiple times.

--keep-global-symbols=*filename*

Apply the option --keep-global-symbol to each symbol listed in the specified file. The file should have one symbol per line, with comments beginning with a hash mark (#). May be specified multiple times.

--keep-symbols=*file*

Apply the option --keep-symbol to each symbol listed in the specified file. The file should have one symbol per line, with comments beginning with a hash mark (#). May be specified multiple times.

-L *symbol*, --localize-symbol=*symbol*

Make the specified symbol local. May be specified multiple times.

--localize-symbols=*filename*

Apply the option --localize-symbol to each symbol listed in the specified file. The file should have one symbol per line, with comments beginning with a hash mark (#). May be specified multiple times.

-N *symbol*, --strip-symbol=*symbol*

Do not copy the specified symbol. May be specified multiple times.

--no-change-warnings, --no-adjust-warnings

Do not issue a warning even if the section specified in one of the options--change-section-address, --change-section-lma, or --change-section-vma does not exist.

-O *bfdname*, --output-target=*bfdname*

Set the binary file format of the output file using its binary file descriptor name,*bfdname*. The format srec generates S-records (printable ASCII versions of object files), and binary generates a raw binary file. Use -h for other available formats.

-p, --preserve-dates

Preserve the input file's access and modification dates in the output file.

--pad-to=*addr*

Pad the output file up to the load address. Use the fill value specified by--gap-fill (default is 0).

-R *section*, --remove-section=*section*

Do not copy any section with the specified name. May be specified multiple times.

--redefine-sym *old*=*new*

Change the name of the symbol *old* to *new*.

--remove-leading-char

If the first character of a global symbol is a special character (such as an underscore) used by the input object file format, remove it. Unlike--change-leading-char, this option always changes the symbol name when appropriate, regardless of the output object format.

--rename-section *oldname*=*newname*[,*flags*]

Rename a section from *oldname* to *newname*, optionally also changing the flags to*flags*.

-S, --strip-all

Do not copy relocation and symbol information.

--set-section-flags *section*=*flags*

Set flags for the specified section as a comma-separated string of flag names. Not all flags are meaningful for all object formats. The possible flags arealloc, code, contents, data, debug, load, noload, readonly, rom, and share.

--set-start=*val*

Set the start address of the new file to the specified value. Not supported by all object formats

--srec-forceS3

Force all srec output records to be type S3 records.

--srec-len=*ival*

Set the maximum length of srec output records to the specified value. The length includes the address, data, and crc fields.

--strip-symbols=*filename*

Apply the option --strip-symbol to each symbol listed in the specified file. The file should have one symbol per line, with comments beginning with a hash mark (#). May be specified multiple times.

--strip-unneeded

Strip all symbols not needed for relocation processing.

-v, --verbose

Run in verbose mode, listing all object files modified; for archives, list all archive members.

-V, --version

Print version information and exit.

-W *symbol*, --weaken-symbol=*symbol*

Make the specified symbol weak. May be specified multiple times.

--weaken

Make all global symbols weak.

--weaken-symbols=*filename*

Apply the option --weaken-symbol to each symbol listed in the specified file. The file should have one symbol per line, with comments beginning with a hash mark (#). May be specified multiple times.

-x, --discard-all

Do not copy nonglobal symbols.

-X, --discard-locals

Do not copy compiler-generated local symbols (usually those starting with L or..).

objdump

```
objdump [options] objfiles
```

Display information about one or more object files. If an archive is specified,objdump displays information on each object file in the archive. At least one of the options-a, -d, -D, -f, -g, -G, -h, -H, -p, -r, -S, -t, -T, -V, or -x must be given to tell objdump what information to show.

Options

-a, --archive-header

If any input files are archives, display the archive header information. The output includes the object file format of each archive member.

--adjust-vma=*offset*

Add *offset* to all section headers before dumping information. Useful if the section addresses do not correspond to the symbol table.

-b *bfdname*, --target=*bfdname*

Set the binary file format using its binary file descriptor name,*bfdname*. Use the -h option for a list of supported formats for your system.

-C [*style*], --demangle[=*style*]

Decode (demangle) low-level symbol names into user-level names, optionally specifying a mangling style. Removes any initial underscores and makes C++ function names readable.

-d, --disassemble

Display assembler mnemonic names for the machine instructions. Disassemble only sections that are expected to contain instructions.

-D, --disassemble-all

Disassemble all sections, not just those expected to contain instructions.

-EB, --endian=big

-EL, --endian=little

Specify whether the object files are big- or little-endian, for disassembling. Useful for disassembling formats such as S-records (printable ASCII versions of object files) that do not include that information.

-f, --file-header

Display overall header summary information.

--file-start-context

When using -S and displaying source code from a file that hasn't been displayed yet, include context from the start of the file.

-g, --debugging

Display debugging information.

-G, --stabs

Display any stabs (debugging symbol table entries) information, in addition to the contents of any sections requested.

-h, --section-header, --header

Display section-header summary information.

-H, --help

Display help information and exit.

-i, --info

Display the architectures and object formats available on your system for use with-b or -m.

-j *name*, --section=*name*

Display information for section *name*.

-l, --line-numbers

Label the display with filename and source code line numbers corresponding to the object code or relocation entries shown. Use with -d, -D, or -r.

-m *arch*, --architecture=*arch*

Specify the architecture for disassembling object files. Useful when disassembling files such as S-records that do not include this information.

-M *options*, --disassembler-options=*options*

Pass target-specific information to the disassembler. Supported only on some targets.

--no-show-raw-insn

Do not show instructions in hexadecimal when disassembling. This is the default with--prefix-addresses.

-p, --private-headers

Display information specific to the object format. For some formats, no additional information is displayed.

--prefix-addresses

When disassembling, print the complete address on each line.

-r, --reloc

Display relocation entries. With -b or -D, the entries are intermixed with the disassembly.

-R, --dynamic-reloc

Print dynamic relocation entries. Meaningful only for dynamic objects such as certain types of shared libraries.

-s, --full-contents

Display the full contents of any requested sections.

-S, --source

Display source code intermixed with disassembly, if possible. Implies-d.

--show-raw-insn

When disassembling, show instructions in hexadecimal as well as symbolic form. This is the default, except with --prefix-addresses.

--start-address=*addr*

Start displaying data at the specified address. Applies to-d, -r, and -s.

--stop-address=*addr*

Stop displaying data at the specified address. Applies to-d, -r, and -s.

-t, --syms

Print symbol table entries.

-T, --dynamic-syms

Print dynamic symbol table entries. Meaningful only for dynamic objects such as certain types of shared libraries.

-V, --version

Print version information and exit.

-w, --wide

Format lines for output devices wider than 80 characters, and do not truncate symbol table names.

-x, --all-headers

Display all available header information. Equivalent to specifying-a -f -h -r -t.

-z, --disassemble-zeroes

Disassemble blocks of zeroes. The default is to skip such blocks.

od

```
od [options] [files]
od --traditional [file] [[+]offset [[+]label]]
```

Dump the specified files to standard output. The default is to dump in octal format, but other formats can be specified. With multiple files, concatenate them in the specified order. If no files are specified or *file* is -, read from standard input. With the second form, using the `--traditional` option, only one file can be specified.

Options

For the following options, see the later Arguments section for an explanation of the arguments *bytes*, *size*, and *type*. If no options are specified, the default is `-A o -t d2 -w 16`.

`-a`

Print as named characters. Same as `-ta`.

`-A` *radix*, `--address-radix=`*radix*

Specify the radix (base) for the file offsets printed at the beginning of each output line. The possible values are:

d

Decimal.

n

None; do not print an offset.

o

Octal; the default.

x

Hexadecimal.

`-b`

Print as octal bytes. Same as `-toC`.

`-c`

Print as ASCII characters or backslash escapes. Same as `-tc`.

`-d`

Print as unsigned decimal shorts. Same as `-tu2`.

`-f`

Print as floating-point. Same as `-tfF`.

`-h`

Print as hexadecimal shorts. Same as `-tx2`.

`--help`

Display a usage message and exit.

`-i`

Print as decimal shorts. Same as `-td2`.

`-j` *bytes*, `--skip-bytes=`*bytes*

Skip the specified number of input bytes before starting.

`-l`

Print as decimal longs. Same as `-td4`.

`-N` *bytes*, `--read-bytes=`*bytes*

Format and print only the specified number of input bytes.

`-o`

Print as octal shorts. Same as `-to2`.

`-s` *bytes*, `--strings[=`*bytes*`]`

Output strings that are at least *bytes* ASCII graphic characters long (default is 3 if *bytes* is not specified for `--strings`).

-t *type*, --format=*type*

Format the output according to *type*, where *type* is a string of one or more of the characters listed in the Arguments section. If more than one type is specified, each output line is written once in each specified format. If a trailing z is appended to *type*, od appends any printable characters to the end of each output line.

--traditional

Accept arguments in the traditional form, which takes a single file specification with an optiona offset and label, as shown in the second form of the command. *offset* is an octal number indicating how many input bytes to skip over. *label* specifies an initial pseudo-address, which is printed in parentheses after any normal address. Both the offset and the label can begin with an optional plus sign (+), and can have a trailing decimal point (.) to force the offset to be interpreted as a decimal number and/or a trailing b to multiply the number of bytes skipped by *offset* by 512.

-v, --output-duplicates

Print all lines, including duplicates. By default, only the first of a series of identical lines is printed, and an asterisk is printed at the beginning of the following line to indicate that there were duplicates.

--version

Display version information and exit.

-w *bytes*, --width[=*bytes*]

Dump *bytes* input bytes to each output line. Defaults to 16 if this option is omitted. If --width is specified but *bytes* is omitted, the default is 32.

-x

Print as hexadecimal shorts. Same as -tx2.

Arguments

bytes

Specify a number of bytes. Treated as hexadecimal if it begins with 0x or 0X, as octal if it begins with 0, or as decimal otherwise. Append b to multiply by 512, k to multiply by 1024, or m to multiply by 10248576.

size

Specified as part of *type* to indicate how many bytes to use in interpreting each number. Types a and c do not take a size. For other types, *size* is a number. For type f, *size* can also be one of the following:

D

Double.

F

Float.

L

Long double.

For the remaining types (d, o, u, x), *size* can be one of the following in addition to a number:

C

Character.

I

Integer.

L

Long.

S

Short.

type

Specify the format type. The possible types are:

a

Named character.

c

ASCII character or backslash escape.

d*size*

Signed decimal, with *size* bytes per integer.

f*size*

Floating point, with *size* bytes per integer.

o

Octal, with *size* bytes per integer.

u

Unsigned decimal, with *size* bytes per integer.

x

Hexadecimal, with *size* bytes per integer.

openvt

`openvt [*options*] [--] [*command*] [*arguments*]`

Locate the first available virtual terminal (VT) and run*command* with any *arguments* given. If no command is specified, the shell $SHELL is started.

Options

--

Indicates the end of `openvt` options. Required before the command name to pass options to the command.

-c *vt*

Use the specified VT number instead of the first available. You must have write access to*vt*.

-e

Execute *command* without forking. For use in */etc/inittab*, rather than on the command line.

-l

Run the command as a login shell, prepending a dash (-) to the command name.

-s

Switch to the new VT when the command is started and make it the current VT.

-u

Determine the owner of the current VT, and log in as that user. You must be root to use this option, which is also suitable for calling by`init`. Don't use with -l.

-v

Verbose mode.

-w

Wait for the command to complete. If used with-s, switch back to the controlling terminal when the command is done.

passwd

`passwd [options] [user]`

Create or change a password associated with a*user* name. Only the owner or a privileged user may change a password. Owners need not specify their*user* name. Users can change their own passwords. For any other operation, you must be root.

Options

-d, --delete

Delete the password for the user's account.

-f, --force

Force the operation. Overrides -u.

-?, --help

Display a help message describing the options. See also --usage.

-i *days*, --inactive=*days*

Set the number of days after a password has expired before the account is disabled.

-k, --keep-tokens

Keep passwords (authentication tokens) that have not expired.

-l, --lock

Lock the user's account.

-n *days*, --minimum=*days*

Set the minimum number of days that the password is valid.

-S, --status

Print the status of the user's password.

--stdin

Read new passwords from standard input.

-u, --unlock

Unlock the user's account

--usage

Display a brief usage message. See also --help.

-w *days*, --warning=*days*

Set the number of days of warning users will get before their password expires.

-x *days*, --maximum=*days*

Set the maximum number of days that the password is valid.

paste

```
paste [options] files
```

Merge corresponding lines of one or more *files* into tab-separated vertical columns. Use - to read from standard input, instead of specifying a file. See also cut, join, and pr.

Options

-d*char*, --delimiters=*char*

Separate columns with *char* instead of a tab. You can separate columns with different characters by supplying more than one *char*.

--help

Print a help message and then exit.

-s, --serial

Merge lines from one file at a time.

--version

Print version information and then exit.

Examples

Create a three-column *file* from files *x*, *y*, and *z*:

```
paste x y z > file
```

List users in two columns:

```
who | paste - -
```

Merge each pair of lines into one line:

```
paste -s -d"\t\n" list
```

patch

`patch [options] [original [patchfile]]`

Apply the patches specified in *patchfile* to *original*. Replace the original with the new, patched version; move the original to *original.orig* or *original~*. The patch file is a difference listing produced by the diff command.

Options

`-b, --backup`

Back up the original file.

`--backup-if-mismatch, --no-backup-if-mismatch`

When not backing up all original files, these options control whether a backup should be made when a patch does not match the original file. The default is to make backups unless `--posix` is specified.

`-c, --context`

Interpret *patchfile* as a context diff.

-d *dir*, --directory=*dir*

cd to *directory* before beginning patch operations.

--dry-run

Print results of applying a patch, but don't change any files.

-e, --ed

Treat the contents of *patchfile* as ed commands.

-f, --force

Force all changes, even those that look incorrect. Skip patches if the original file does not exist force patches for files with the wrong version specified; assume patches are never reversed.

-g *num*, --get *num*

Specify whether to check the original file out of source control if it is missing or read-only. If *num* is a positive number, get the file. If it is negative, prompt the user. If it is0, do not check files out of source control. The default is negative or the value of the PATCH_GET environment variable when set, unless the --posix option is given. In that case, the default is 0.

--help

Print help message, then exit.

-i *file*, --input=*file*

Read patch from *file* instead of stdin.

-l, --ignore-whitespace

Ignore whitespace while pattern matching.

-n, --normal

Interpret patch file as a normal diff.

-o *file*, --output=*file*

Print output to *file*.

-p[*num*], --strip[=*num*]

Specify how much of preceding pathname to strip. A*num* of 0 strips everything, leaving just the filename. 1 strips the leading /. Each higher number after that strips another directory from the left.

--quoting-style=*style*

Set the quoting style used when printing names. The default style isshell, unless set by the environment variable QUOTING_STYLE. *style* may be one of the following:

c

Quote as a C language string.

escape

Like c, but without surrounding double-quote characters.

literal

Print without quoting.

shell

Quote for use in shell when needed.

shell-always

Quote for use in shell even if not needed.

--posix

Conform more strictly to the POSIX standard.

-r *file*, --reject-file=*file*

Place rejects (hunks of the patch file thatpatch fails to place within the original file) in*file*. Default is *original.rej*.

-s, --silent, --quiet

Suppress commentary.

-t, --batch

Skip patches if the original file does not exist.

-u, --unified

Interpret patch file as a unified context diff.

--verbose

Verbose mode.

-v, --version

Print version number and exit.

-z *suffix*, --suffix=*suffix*

Back up the original file in *original.suffix*.

-B *prefix*, --prefix=*prefix*

Prepend *prefix* to the backup filename.

-D *string*, --ifdef=*string*

Mark all changes with:

```
#ifdef
   string
#endif
```

-E, --remove-empty-files

If patch creates any empty files, delete them.

-F *num*, --fuzz=*num*

Specify the maximum number of lines that may be ignored (fuzzed over) when deciding where to install a hunk of code. The default is 2. Meaningful only with context diffs.

-N, --forward

Ignore patches that appear to be reversed or to have already been applied.

-R, --reverse

Do a reverse patch: attempt to undo the damage done by patching with the old and new files reversed.

-T, --set-time

When original file timestamps match the times given in the patch header, set timestamps for patched files according to the context diff headers. Use option-f to force date changes. Assume timestamps are in local time.

-V *method*, --version-control=*method*

Specify method for creating backup files (overridden by-B):

t, numbered

Make numbered backups.

nil, existing

Back up files according to preexisting backup schemes, with simple backups as the default. This is patch's default behavior.

never, simple

Make simple backups.

-Y *prefix*, --basename-prefix=*prefix*

Use the specified *prefix* with a file's basename to create backup filenames. Useful for specifying a directory.

-Z, --set-utc

When original file timestamps match the times given in the patch header, set timestamps for patched files according to the context diff headers. Use option-f to force date changes. Assume timestamps are in Coordinated Universal Time (UTC).

Environment variables

TMPDIR, TMP, TEMP

Specify the directory for temporary files; */tmp* by default.

SIMPLE_BACKUP_SUFFIX

Suffix to append to backup files instead of *.orig* or ~.

QUOTING_STYLE

Specify how output should be quoted (see --quoting-style).

PATCH_GET

Specify whether patch should retrieve missing or read-only files from source control (see -g).

POSIXLY_CORRECT

When set, patch conforms more strictly to the POSIX standard (see --posix).

VERSION_CONTROL, PATCH_VERSION_CONTROL

Specify what method to use in naming backups (see -V).

pathchk

`pathchk [option] filenames`

Determine validity and portability of *filenames*. Specifically, determine if all directories within the path are searchable and if the length of the *filenames* is acceptable.

Options

--help

Print a help message and then exit.

-p, --portability

Check portability for all POSIX systems.

--version

Print version information and then exit.

perl

`perl`

A powerful text-processing language that combines many of the most useful features of shell programs, C, `awk`, and `sed`, as well as adding extended features of its own. For more information, see *Learning Perl* and *Programming Perl* (both from O'Reilly).

pidof

`pidof [`*`options`*`] `*`programs`*

Display the process IDs of the listed program or programs. `pidof` is actually a symbolic link to `killall5`.

Options

-o *pids*

Omit all processes with the specified process IDs.

-s

Return a single process ID.

-x

Also return process IDs of shells running the named scripts.

ping

```
ping [options] host
```

System administration command. Confirm that a remote host is online and responding.ping is intended for use in network testing, measurement, and management. Because of the load it can impose on the network, it is unwise to use ping during normal operations or from automated scripts.

Options

-a

Make ping audible. Beep each time response is received.

-A

Adapt to return interval of packets. Like -f ping, sends packets at approximately the rate at which they are received. This option may be used by an unprivileged user.

-b

Ping a broadcast address.

-B

Bind to original source address and do not change.

-c *count*

Stop after sending (and receiving) *count* ECHO_RESPONSE packets.

-f

Flood ping-output packets as fast as they come back or 100 times per second, whichever is greater. This can be very hard on a network and should be used with caution. Only a privileged user may use this option.

-i *wait*

Wait *wait* seconds between sending each packet. Default is to wait one second between each packet. This option is incompatible with the -f option.

-I *name*

Set source address to interface *name*. *name* may also be specified as an IP address.

-l *preload*

Send *preload* number of packets as fast as possible before falling into normal mode of behavior.

-L

If destination is a multicast address, suppress loopback.

-M *hint*

Specify Path MTU Discovery strategy. Accepted values are do, want, or dont.

-n

Numeric output only. No attempt will be made to look up symbolic names for host addresses.

-p *digits*

Specify up to 16 pad bytes to fill out packet sent. This is useful for diagnosing data-dependent problems in a network. *digits* are in hex. For example, -p ff will cause the sent packet to be filled with all 1s.

-q

Quiet outputnothing is displayed except the summary lines at startup time and when finished.

-Q *tos*

Set Quality of Service on ICMP datagrams.

-r

Bypass the normal routing tables and send directly to a host on an attached network.

-R

Set the IP record route option, which will store the route of the packet inside the IP header. The contents of the record route will be printed if the -v option is given, and will be set on return packets if the target host preserves the record route option across echoes or if the -l option is given.

-s *packetsize*

Specify number of data bytes to be sent. Default is 56, which translates into 64 ICMP data bytes when combined with the 8 bytes of ICMP header data.

-S *size*

Set send buffer (SNDBUF) size. The default is the size of one packet.

-t *n*

Set the IP Time to Live to *n* seconds.

-T *option*

Set IP timestamp options. Accepted *option* values are:

tsonly

Timestamps only.

tsandaddr

Timestamps and addresses.

tsprespec *hosts*

Timestamps with prespecified hops of one or more hosts.

-U

Use older ping behavior and print full user-to-user latency instead of network round-trip time.

-v

Verbose; list ICMP packets received other than ECHO_RESPONSE.

-V

Print version, then exit.

-w *n*

Exit ping after *n* seconds.

-W *n*

When waiting for a response, time out after *n* seconds.

pinky

`pinky [options] [users]`

Print user information. A light-weight finger program that has both long and short formats. If no users are specified, prints information for all logged-on users.

Options

-b

In long format, omit the home directory and shell.

-f

In short format, omit column headings.

-h

In long format, omit the project file.

--help

Print help message and exit.

-i

In short format, omit the full name and remote host.

-l

Produce long-format output for the specified users. At least one user must be specified.

-p

In long format, omit the plan file.

-q

In short format, omit the full name, remote host, and idle time.

-s

Produce short format output; the default.

--version

Print version information and exit.

-w

In short format, omit the full name.

pmap

pmap [*options*] *pids*

Display the memory maps of a process.

Options

-d

Display the offset and device number of each mapping.

`-q`

Be more quiet. Displays less header and footer information.

`-x`

Provide a more detailed and verbose display.

`-V`

Display the version number and exit.

portmap

`rpc.portmap [options]`

NFS/NIS command. RPC program number to IP port mapper. `portmap` is a server that converts RPC program numbers to IP port numbers. It must be running in order to make RPC calls. When an RPC server is started, it tells `portmap` which port number it is listening to and which RPC program numbers it is prepared to serve. When a client wishes to make an RPC call to a given program number, it first contacts `portmap` on the server machine to determine the port number where RPC packets should be sent. `portmap` must be the first RPC server started.

Options

`-d`

Run `portmap` in debugging mode. Does not allow `portmap` to run as a daemon.

`-l`

Bind to loopback device. This only works from the localhost.

`-v`

Verbose mode.

poweroff

```
poweroff [options]
```

System administration command. Close out filesystems, shut down the system, and power off. Because this command immediately stops all processes, it should be run only in single-user mode. If the system is not in runlevel 0 or 6, poweroff calls shutdown -h, then performs a poweroff.

Options

-d

Suppress writing to */var/log/wtmp*.

-f

Call reboot or halt and not shutdown, even when shutdown would normally be called. This option is used to force a hard halt or reboot.

-h

Place hard drives in standby mode before halt or poweroff.

-i

Shut down network interfaces before reboot.

-n

Suppress normal call to sync.

-w

Suppress normal execution; simply write to */var/log/wtmp*.

pppd

```
pppd [tty] [speed] [options]
```

System administration command. PPP stands for the Point-to-Point Protocol; it allows datagram transmission over a serial connection. pppd attempts to configure *tty* for PPP (searching in */dev*) or, by default, the controlling terminal. You can also specify a baud rate of*speed*. pppd accepts many options. Only the most common options are listed here.

Options

[*local_IP_address*]:[*remote_IP_address*]

Specify the local and/or remote interface IP addresses, as hostnames or numeric addresses.

asyncmap *map*

Specify which control characters cannot pass over the line. *map* should be a 32-bit hex number, where each bit represents a character to escape. For example, bit 00000001 represents the character 0x00; bit 80000000 represents the character 0x1f or _. You may specify multiple characters.

auth

Require self-authentication by peers before allowing packets to move.

call *file*

Read options from *file* in */etc/ppp/peers/*. Unlike the file option, call *file* may contain privileged options, even when pppd is not run by root.

connect *command*

Connect as specified by *command*, which may be a binary or shell command.

crtscts

Use hardware flow control.

debug

Log contents of control packets to syslogd.

defaultroute

Add a new default route in which the peer is the gateway. When the connection shuts down, remove the route.

nodetach

Operate in the foreground. By default, pppd forks and operates in the background.

disconnect *command*

Close the connection as specified by *command*, which may be a binary or shell command.

escape *character-list*

Escape all characters in *character-list*, which should be a comma-separated list of hex numbers. You cannot escape 0x20-0x3f or 0x5e.

file *file*

Consult *file* for options.

init *script*

Run specified command or shell script to initialize the serial line.

lock

Allow only pppd to access the device.

mru *bytes*

Refuse packets of more than *bytes* bytes.

mtu *bytes*

Do not send packets of more than *bytes* bytes.

passive, -p

Do not exit if peer does not respond to attempts to initiate a connection. Instead, wait for a valid packet from the peer.

silent

Send no packets until after receiving one.

Files

/var/run/pppn.pid

pppd's process ID. The *n* in *pppn.pid* is the number of the PPP interface unit corresponding to this pppd process.

/etc/ppp/ip-up

Binary or script to be executed when the PPP link becomes active.

/etc/ppp/ip-down

Binary or script to be executed when the PPP link goes down.

/etc/ppp/pap-secrets

Contains usernames, passwords, and IP addresses for use in PAP authentication.

/etc/ppp/options

System defaults. Options in this file are set*before* the command-line options.

~/.ppprc

The user's default options. These are read before command-line options but after the system defaults.

/etc/ppp/options.ttyname

Name of the default serial port.

pr

`pr [options] [files]`

Convert a text file or files to a paginated or columned version, with headers, suitable for printing. If- is provided as the filename, read from standard input.

Options

+*beg_pag*[:*end-pag*], --pages=*beg_pag*[:*end-pag*]

Begin printing on page *beg_pag* and end on *end-pag* if specified.

-*num*_cols, --columns=*num_cols*

Print in *num_cols* number of columns, balancing the number of lines in the columns on each page.

-a, --across

Print columns horizontally, not vertically.

-c, --show-control-chars

Convert control characters to hat notation (such as ^C), and other unprintable characters to octal backslash format.

-d, --double-space

Double space.

-D format, --date-format=*format*

Format the header date using *format*. See the date command for the possible formats.

-e[tab-char[width]], --expand-tabs[=tab-char[width]]

Convert tabs (or *tab-char*s) to spaces. If *width* is specified, convert tabs to *width* characters (default is 8).

-f, -F, --form-feed

Separate pages with form feeds, not newlines. With -F, print a three-line page header; otherwise print a five-line header and trailer.

-h *header*, --header=*header*

Use *header* for the header instead of the filename.

--help

Print a help message and then exit.

-i[*out-tab-char*[*out-tab-width*]],

--output-tabs[=out-tab-char[*out-tab-width*]]

Replace spaces with tabs on output. Can specify alternative tab character (default is tab) and width (default is 8).

-J, --join-lines

Merge full lines; ignore -W if set.

-l *lines*, --length=*lines*

Set page length to *lines* (default is 66). If *lines* is less than 10, omit headers and footers. Thus the default number of lines of text (i.e., not header or trailer) is 56, or 63 with-F.

-m, --merge

Print all files, one per column.

-n[*delimiter*[*digits*]], --number-lines[=*delimiter*[*digits*]]

Number columns, or, with the -m option, number lines. Append *delimiter* to each number (default is a tab) and limit the size of numbers to*digits* (default is 5).

-N *num*, --first-line-number=*num*

Start counting with *num* at the first line of the first page printed. Also see +*beg_page*.

-o *width*, --indent=*width*

Set left margin to *width*. Does not affect the page width set with -w or -W.

-r, --no-file-warnings

Continue silently when unable to open an input file.

-s[*delimiter*], --separator[=*delimiter*]

Separate columns with the single-character *delimiter* (default is a tab) instead of spaces.

-S[*string*], --sep-string[=*string*]

Separate columns with *string*. Default is a tab with -J and a space otherwise.

-t, --omit-header

Suppress headers, footers, and fills at end of pages.

-T, --omit-pagination

Like -t but also suppress form feeds.

-v, --show-non-printing

Convert unprintable characters to octal backslash format.

-w *page_width*, --width=*page_width*

Set the page width to *page_width* characters for multicolumn output. Default is 72.

-W *page_width*, --page-width=*page_width*

Set the page width to always be *page_width* characters. Lines longer than the specified width are truncated unless -J is also specified. Default is 72.

--version

Print version information and then exit.

praliases

praliases [*options*] [*keys*]

System administration command. praliases prints the current sendmail mail aliases. (Usually defined in the */etc/aliases* or */etc/aliases.db* file.) Limit output to the specified *keys* when given.

Options

-f *file*

Read the aliases from the specified file instead ofsendmail's default alias files.

-C *file*

Read sendmail configuration from the specified file instead of from */etc/mail/sendmail.cf*.

printenv

```
printenv [variables]
printenv option
```

Print values of all environment variables or, optionally, only the specified*variables*.

Options

--help

Print usage information and exit.

--version

Print version information and exit.

printf

```
printf formats [strings]
printf option
```

Print *strings* using the specified *formats*. *formats* can be ordinary text characters, C-language escape characters, C format specifications ending with one of the lettersdiouxXfeEgGcs or, more commonly, a set of conversion arguments listed here.

Options

--help

Print usage information and exit.

--version

Print version information and exit.

Arguments

% %

Print a single %.

%b

Print *string* with \ escapes interpreted.

%s

Print the next *string*.

%*n*$s

Print the *n*th *string*.

%[-]*m*[.*n*]*s*

Print the next *string*, using a field that is *m* characters wide. Optionally, limit the field to print only the first *n* characters of *string*. Strings are right-adjusted unless the left-adjustment flag, -, is specified.

Examples

```
printf '%s %s\n' "My files are in" $HOME
printf '%-25.15s %s\n' "My files are in" $HOME
```

ps

```
ps [options]
```

Report on active processes. ps has three types of options. GNU long options start with two hyphens, which are required. BSD options may be grouped and do not start with a hyphen, while Unix98 options may be grouped and require an initial hyphen. The meaning of the short options can vary depending on whether or not there is a hyphen. In options, list arguments should either be comma-separated or space-separated and placed inside double quotes. In comparing the amount of output produced, note that e prints more than a and l prints more than f for each entry.

Options

nums, p *nums*, -p *nums*, --pid=*nums*

Include only specified processes, which are given in a space-delimited list.

-nums, -s *nums*, --sid=*nums*

Include only specified session IDs, which are given in a space-delimited list.

[-]a

As a, list all processes on a terminal. As -a, list all processes except session leaders and processes not associated with a terminal.

[-]c

As -c, show different scheduler information with -l. As c, show the true command name.

-C *cmds*

Select by command name.

--cols=*cols*, --columns=*cols*

Set the output width (the number of columns to display).

-d

Select all processes except session leaders.

-e, -A

Select all processes.

e

Include environment information after the command.

[-]f, --forest

As -f, display full listing. As f or --forest, display "forest" family tree format, with ASCII art showing the relationships.

-F

Set extra-full format; implies -f.

-g *list*, -G *list*, --group=*groups*, --Group=*groups*

For -g, select by session leader if *list* contains numbers, or by group if it contains group names. For -G, select by the group IDs in *list*. --group selects by effective group and --Group selects by real group, where *groups* can be either group names or group IDs.

h, --no-headers

Suppress header. If you select a BSD personality by setting the environment variable PS_PERSONALITY to bsd, then h prints a header on each page.

-H

Display "forest" family tree format, but without ASCII art.

H

Display threads as if they were processes.

--headers

Repeat headers on every output page.

--help

Display help information and exit.

--info

Print debugging information.

[-]j

Jobs format. j prints more information than -j.

-k *spec*, --sort *spec*

Specify sort order. Syntax for the specification is:

`[+|-]key[,[+|-]key...]]`

The default direction is +, for increasing numerical or alphabetic order. See Format and sort specifiers for possible keys.

[-]l

Produce a long listing. -l prints more information than l and is often used with -y.

L

Print list of field specifiers that can be used for output formatting or for sorting.

-L

Show threads, possibly with LWP and NLWP columns.

--lines=*num*, --rows=*num*

Set the screen height to *num* lines. If --headers is also set, the headers repeat every *num* lines.

[-]m

Show threads after processes.

n

Print user IDs and WCHAN numerically.

-n *file*, N *file*

Specify the *System.map* file for ps to use as a namelist file. The map file must correspond to the Linux kernele.g., */boot/System.map-2.4.19*.

-N, --deselect

Negate the selection, selecting all processes that do not meet the specified conditions.

[-]o *fields*, --format=*fields*

As -o, o, or --format, specify user-defined format with a list of fields to display.

[-]O *fields*

As -O, this option is like -o, but some common fields are predefined. AsO, this option can be either the same as -O in specifying fields to display, or can specify single-letter fields for sorting. For sorting, each field specified as a key can optionally have a leading + (return to default sort direction on key) or - (reverse the default direction).

--ppid=*nums*

Select by parent process IDs.

r

Show only processes that are currently running.

s

Display signal format.

-S, --cumulative

Include some dead child process data in parent total.

[-]tttys, --tty=*ttys*

Display processes running on the specified terminals.t with no terminal list displays processes for the terminal associated with ps. Specify - to select processes not associated with any terminal.

T

Display all processes on this terminal. Like t with no argument.

-T

Display threads, possibly with SPID column,

[-]u [*users*], --user=*users*

As u with no argument, display user-oriented output. As -u or --user, display by effective user ID (and also support names), showing results for *users*. With no argument, -u displays results for the current user.

[-]U *users*, --User=*users*

As U, display processes by effective user ID. As -U or --User, display processes for *users* by real user ID (and also support names).

v

Display virtual memory format.

[-]V, --version

Display version information and then exit.

[-]w

Wide format. Don't truncate long lines. Use twice to set an unlimited width.

--width=*cols*

Set screen width.

x

Display processes without an associated terminal.

X

Use old Linux i386 register format.

-y

Do not show flags; show rss instead of addr. Requires -l.

Format and sort specifiers

The following are the keywords for formatting and for sorting with--sort, followed by a desciption and the output column header in parentheses:

%cpu, pcpu

Percent of CPU time used recently. (%CPU)

%mem, pmem

Percent of memory used. (%MEM)

args, cmd, command

The command the process is running with all its arguments. (CMD forcmd; otherwise COMMAND)

blocked, sig_block, sigmask

Mask, in hexadecimal, of blocked signals. (BLOCKED)

bsdstart

Command start time. (START)

bsdtime

Accumulated CPU time for user plus system. (TIME)

c

Integer value of %cpu. (C)

caught, sig_catch, sigcatch

Mask, in hexadecimal, of caught signals. (CAUGHT)

class, cls, policy

Scheduling class. (POL for policy, otherwise CLS). Possible values are:

-

Unreported

?

Unknown value

FF

SCHED_FIFO (first in, first out)

RR

SCHED_RR (round robin)

TS

SCHED_OTHER (standard time-sharing)

comm, ucmd, ucomm

Name of the command executable. (CMD for ucmd, otherwise COMMAND)

cp

Per-mill CPU usage, where mill is 1000. Equivalent to %cpu with no decimal point. (CP)

cputime, time

Cumulative CPU time. (TIME)

egid, gid

Effective group ID number in decimal. (EGID or GID, respectively)

egroup, group

Effective group ID; as text value if it is available and if it fits, otherwise shown as decimal value. (EGROUP or GROUP, respectively)

eip

Effective instruction pointer. (EIP)

esp

Effective stack pointer. (ESP)

etime

Elapsed time since the start of the process. (ELAPSED)

euid, uid

Effective user ID. (EUID or UID, respectively)

euser, uname, user

Effective username; as text value if it is available and if it fits, otherwise shown as decimal value (EUSER for euser; otherwise USER).

f, flag, flags

Process flags. Can be summed. (F) Possible values are:

1

Forked but didn't exec.

4

Used superuser privileges.

fgid, fsgid

Filesystem access group ID. (FGID)

fgroup, fsgroup

Filesystem access group ID; as text if available and if it fits, otherwise as a decimal number. (FGROUP)

fname

First eight bytes of the executable's basename. (COMMAND)

fuid, fsuid

Filesystem access user ID. (FUID)

fuser

Filesystem access user ID; as text if available and if it fits, otherwise as a decimal number. (FUSER)

ignored, sig_ignore, sigignore

Mask of ignored signals in hexadecimal format. (IGNORED)

lstart

Command start time. (LSTART)

lwp, spid, tid

Light-weight process, or thread, ID. (LWP, SPID, TID, respectively)

ni, nice

The nice value of the process. A higher number indicates less CPU time. (NI)

nlwp, thcount

Number of LWPs, or threads, in the process. (NLWP or THCNT, respectively)

nwchan

Address of kernel function where process is sleeping. See also wchan to get the function by name. (WCHAN)

pending, sig, sig_pend

Mask of pending signals. Use with the m or -m option to see both signals pending on the process and on individual threads. (PENDING)

pgid, pgrp

Process group ID or ID of process group leader, which are equivalent. (PGID or PGRP, respectively)

pid

Process ID. (PID)

ppid

Parent process ID. (PPID)

pri

Process's scheduling priority. A higher number indicates lower priority. (PRI)

psr

Current processor that the process is running on. (PSR)

rgid

Real group ID. (RGID)

rgroup

Real group name; as text if available and it fits, otherwise as a decimal number. (RGROUP)

rss, rssize, rsz

Resident set size (the amount of physical memory), in kilobytes. (RSZ forrsz; otherwise RSS)

rtprio

Real-time priority. (RTPRIO)

ruid

Real user ID number. (RUID)

ruser

Real user ID; as text if available and it fits, otherwise as a decimal number. (RUSER)

s, state

A single-character state display. See stat for the possible characters or for a multicharacter

display. (S)

sched

Scheduling policy. Also see class. (SCH) Possible values are:

0

SCHED_OTHER

1

SCHED_FIFO

2

SCHED_RR

sess, session, sid

Session ID, or the process ID of the session leader, which is equivalent. (SID forsid; otherwise SESS)

sgi_p

Processor on which the process is currentlly running, or "*" if the process is not running. (P)

sgid, svgid

Saved group ID. (SGID or SVGID, respectively)

sgroup

Saved group name; as text if available and it fits, otherwise as a decimal number.

size

Size of virtual image. Provides a rough estimate of the swapspace required to swap the process out. Note that sz uses the same column header, but has a different meaning. (SZ)

stackp

Address of the stack bottom (start of the stack). (STACKP)

start

Start time of the command. (STARTED)

start_time

Starting time or date of the process. (START)

stat

Status. Multiple status characters can appear. See also s to display a single character. (STAT)

+

Part of foreground process group.

<

High priority (not "nice").

D

Asleep and not interruptible.

l

Multi-threaded.

L

Pages locked into memory.

N

Low priority ("nice").

R

Runnable.

s

Session leader.

S

Asleep.

T

Stopped.

W

No resident pages (second field).

Z

Zombie.

suid, svuid

Saved user ID. (SUID or SVUID respectively)

suser, svuser

Saved username; as text if it is available and it fits, otherwise as a decimal number. (SUSER or SVUSER respectively)

sz

Physical page size of the core image of the process, including text, data and stack space. (SZ)

tpgid

ID of the foreground process group on the associated terminal for the process, or -1 if not connected to a terminal. (TPGID)

tt, tty, tname

Associated (controlling) terminal. (TTY for tname; otherwise TT)

uid

User ID. (UID)

vsz, vsize

Virtual memory size, in kilobytes of the entire process. (VSZ)

wchan

Kernel function in which process is sleeping, or "-" if running, or "*" if multithreaded process and ps is not displaying threads. (WCHAN)

ptx

```
ptx [options] [infiles]
ptx -G [options] [infile [outfile]]
```

Create a permuted index, including context, from the contents of the specified input files. If the input files are omitted, or are -, read from standard input. The results are written to standard output. In the second form, with the -G option, ptx behaves like the System V version rather than the GNU version; you specify only one input file, and you can also specify an output file. Because they show words in context, permuted indexesare often used in such places as bibliographic or medical databases, thesauruses, or web sites to aid in locating entries of interest.

Options

-A, --auto-reference

Produce automatically generated references, consisting of the filename and line number, separated by a colon, and print them at the beginning of each line.

-b *file*, --break-file=*file*

The specified file contains word-break characterscharacters that are not part of words, but separate them.

-C, --copyright

Display the ptx copyright information and exit.

-f, --ignore-case

Ignore case when sorting, by folding lowercase into uppercase.

-F *string*, --flag-truncation=*string*

Use *string* to flag line truncations.

-g *num*, --gap-size=*num*

Specify the number of spaces between output columns.

-G, --traditional

Behave like System V ptx; don't use the GNU extensions. If an output file is specified, any existing contents are lost.

--help

Display a help message and exit.

-i *file*, --ignore-file=*file*

Read the list of words that are not to be used as keywords in the concordance output from*file*.

-M *string*, --macro-name=*string*

Select a string for use when generating output suitable fornroff, troff or TEX. The default is xx.

-o *file*, --only-file=*file*

Specify the "only" file, which contains a list of words to be used in the concordance output. Any words not in *file* are ignored. If both an only file and an ignore file are specified, a word must appear in the only file and not appear in the ignore file to be used as a keyword.

-O [roff], --format=roff

Format the output as roff directives suitable to be used as input to nroff or troff. Use -T for TEX output.

-r, --references

Use the first field of each line as a reference to identify the line in the permuted index.

-R, --right-side-refs

Put references on the right, instead of the left. Used with -r and -A. The space taken up by the references is not taken into account by -w, even if -R is specified without -r or -A.

-S *regexp*, --sentence-regexp=*regexp*

Specify a regular expression to identify the end of a line or a sentence. Without-G and without -r, the end of a sentence is used. With -G, or with -r, the end of a line is used. An empty *regex* disables end-of-line or end-of-sentence recognition.

-T [*tex*], --format=*tex*

Format the output as TEX directives suitable to be used as TEX input. Use -O for roff output.

--version

Print version information and exit.

-w *num*, --width=*num*

Select the maximum output-line width (excluding the width of any reference if-R is specified).

-W *regexp*, --word-regexp=*regexp*

Use the specified regular expression to match each keyword.

pwck

pwck [*options*] [*files*]

System administration command. Remove corrupt or duplicate entries in the */etc/passwd* and */etc/shadow* files. pwck will prompt for a "yes" or "no" before deleting entries. If the user replies "no," the program will exit. Alternate passwd and shadow *files* can be checked. If correctable errors are found, the user will be encouraged to run the usermod command.

Option

-q

Run in quiet mode. Only report serious problems.

-r

Run in noninteractive read-only mode, answering all questionsno.

-s

Don't check integrity, just sort entries by UID.

Exit status

0

Success.

1

Syntax error.

2

One or more bad password entries found.

3

Could not open password files.

4

Could not lock password files.

5

Could not write password files.

pwconv

pwconv
pwunconv

System administration command. Convert unshadowed entries in */etc/passwd* into shadowed entries in */etc/shadow*. Replace the encrypted password in */etc/password* with an x. Shadowing passwords keeps them safe from password-cracking programs. pwconv creates additional expiration information for the */etc/shadow* file from entries in your */etc/login.defs* file. If you add new entries to the */etc/passwd* file, you can run pwconv again to transfer the new information to */etc/shadow*. Already shadowed entries are ignored. pwunconv restores the encrypted passwords to your */etc/passwd* file and removes the */etc/shadow* file. Some expiration information is lost in the conversion. See also grpconv and grpunconv.

pwd

---

pwd

Print the full pathname of the current working directory. See also thedirs shell command built into bash.

python

python

A powerful object-oriented scripting language often compared to Perl or Java.python drives many of the configuration scripts used in Red Hat and other Linux distributions. For more information, see *Learning Python* and *Programming Python* (both from O'Reilly).

quota

quota [*options*] [*user*|*group*]

Display disk usage and total space allowed for a designated user or group. With no argument, the quota for the current user is displayed. Most users can display only their own quota information, but the superuser can display information for any user. This command reports quotas for all filesystems listed in */etc/mtab*. For NFS-mounted filesystems, quota calls rpc.rquotad on the server machine for the information.

Options

-F format

Show quota for the specified format. If not specified, autodetects the format.

-g

Given with a *user* argument, display the quotas for the groups of which the user is a member, instead of the user's quotas. With no argument, shows group quotas for the current user.

-i

Igonore mountpoints that are mounted by the automounter.

-l

Only report quotas on local filesystems.

-q

Display information only for filesystems in which the user is over quota.

-Q

For NFS-mounted filesystems. do not print an error message if the connection torpc.rquotad is refused (usually because it is not running on the server).

-s

Try to choose units for displaying limits, space used, and inodes used.

-u

The default behavior. When used with -g, display both user and group quota information.

-v

Display quotas for filesystems even if no storage is currently allocated.

Formats

rpc

Quota over NFS.

vfsold

Version 1 quota.

vfsv0

Version 2 quota.

xfs

Quota on XFS filesystem.

quotacheck

`quotacheck [`*`options`*`] [`*`filesystems`*`]`

System administration command. Audit and correct quota information by building a table of current disk usage and comparing it to the recorded usage in both the kernel and the quota files. `quotacheck` will update quota information when possible and prompt the user if it requires input. Most systems that support quotas run this command at system startup. To prevent damage to *filesystems* or loss of quota data, turn off quotas with `quotaoff` and `umount` the system. `quotacheck` will attempt to remount any mounted filesystem as read-only before scanning.

Options

`-a`

Check all non-NFS filestystems in */etc/mtab*.

`-b`

Back up quota files before writing new data to them.

`-c`

Skip reading existing quota information; just write new files.

-f

Force checking on filesystems with quotas currently enabled.

-F *format*

Check quota files for the specified format. (See quota for valid formats.)

-g

Only check group quotas.

-i

Prompt user for input upon finding errors.

-m

Don't try to remount mounted filesystems.

-M

Force check to run in read-write mode if it cannot successfully remount the filesystem in read-only mode.

-n

If multiple entries for a user or group are found in a corrupt quota file, use the first entry found.

-R

Don't check the root filesystem when using the -a option.

-u

Only check user quotas. This is the default.

-v

Print information on the progress of the command.

quotaon

```
quotaon [options] [filesystems]
```

System administration command. Turn on enforcement of filesystem quotas. To work, the*filesystems* must have a gpquota, quota, or usrquota option listed in the */etc/fstab* file. On most filesystems, user and group quota files must also exist. XFS filesystems store quota information as metadata instead of as files. Use edquota or setquota to create the appropriate quota information.

Options

-a

Turn on quotas for all autoloading filesystems in*/etc/fstab* that support them.

-f

Invoke quotaoff instead of quotaon.

-g

Turn group quotas on.

-p

Print current quota status, then exit.

-u

Turn user quotas on.

-v

Print a message for each filesystem affected by the command.

quotaoff

`quotaoff [options] [filesystems]`

System administration command. Turn off enforcement of filesystem quotas. This command is a synonym for `quotaon -f`

Options

`-a`

Turn off quotas for all filesystems in */etc/fstab*.

`-F format`

Show quota for the specified format. (See quota for valid formats.)

`-g`

Turn group quotas off.

`-p`

Print current quota status, then exit.

`-u`

Turn user quotas off.

`-v`

Print a message for each filesystem affected by the command.

`-x` *command*

On an XFS system, perform one of the following *commands*:

delete

Remove quota metadata from the XFS filesystem.

enforcement

Turn off limit enforcement on an XFS filesystem.

quotastats

```
quotastats
```

System administration command. Print a report of quota system statistics gathered from the kernel.

raidstart

```
raidstart [options] [devices]
raidstop [options] [devices]
```

System administration command. Start or stop RAID *devices* as defined in the RAID configuration file */etc/raidtab*. If option -a (or --all) is used, no *devices* need to be given; the command will be applied to all the devices defined in the configuration file.

Options

-a, --all

Apply command to all devices defined in the RAID configuration file.

-c *file*, --configfile *file*

Use *file* instead of */etc/raidtab*.

-h, --help

Print usage message and exit.

-V, --version

Print version and exit.

ramsize

`ramsize [option] [image [size [offset]]]`

System administration command. If no options are specified, print usage information for the RAM disk. The pair of bytes at offset 504 in the kernel image normally specify the RAM size; with a kernel *image* argument, print the information found at that offset. To change that information, specify a new *size* (in kilobytes). You may also specify a different *offset*. `rdev -r` is the same as `ramsize`.

Option

`-o` *offset*

Same as specifying an *offset* as an argument.

ranlib

`ranlib filename`ranlib `option`

Generate an index for archive file *filename*. This is equivalent to running `ar -s`.

Option

-v, -V, --version

Print version information and exit.

rarpd

`rarpd [options] [interface]`

System administration command. Respond to Reverse Address Resolution Protocol (RARP)requests. Some machines (primarily diskless SUN machines) will use RARP requests at boot time to discover their IP address and retrieve boot images. The request contains the booting machine's Ethernet address, and rarpd tells it which IP to use. To answer requests, rarpd checks the *ethers* database (either the */etc/ethers* file, or read from NIS+) and performs DNS lookups as needed. rarpd will respond to RARP requests only from machines for which it has a bootable image, usually stored in th TFTP boot directory */tftpboot*. The daemon will bind to the given*interface* if specified. This daemon replaces the kernel-based RARP support found in kernels previous to 2.2.

Options

-a

Do not bind to the specified*interface*.

-b *directory*

Look for boot images in the specified*directory* instead of the default */tftpboot*.

-d

Do not detach and run in daemon mode. Used for debugging.

-e

Answer requests without checking the TFTP boot directory.

-v

Verbose mode.

-A

Respond to ARP requestes as well as RARP requests.

rcp

```
rcp [options] file1 file2
rcp [options] file ... directory
```

Copy files between two machines. Each *file* or *directory* is either a remote filename of the form rname@rhost:path, or a local filename. Files can be copied between two remote machines, where neither *file1* nor *file2* is on the local machine. Use of rcp has generally been replaced by scp, which offers better security.

Options

-c *ccachefile*

Use *ccachefile* for the credentials cache file.

-C *configfile*

Use *configfile* as the configuration file.

-D *port*

Connect to the specified port on the remote system.

-N

Always use a network connection, even when doing a local copy. Useful for testing.

-k

Attempt to get tickets for remote host; query krb_realmofhost to determine realm.

-p

Preserve modification times and modes of the source files.

-PN, -PO

Request either the new (-PN) or old (-PO) version of the Kerberos rcmd protocol.

-r

If any of the source files are directories, descend into each directory and recursively copy all files and directories within it. The destination must be a directory.

-x

Turn on DES encryption for all data passed by `rcp`.

rdate

```
rdate [options] [host...]
```

TCP/IP command. Retrieve the date and time from a host or hosts on the network and optionally set the local system time.

Options

`-l`

Send errors and output to `syslogd`.

`-p`

Print the retrieved dates.

`-s`

Set the local system time from the host; must be specified by root.

`-t` *n*

Timeout each retrieval attempt after *n* seconds.

`-u`

Use UDP instead of TCP.

rdev

```
rdev [options] [image [value [offset]]]
```

System administration command. If invoked with no arguments, show the current root filesystem in */etc/mtab* syntax. Otherwise, change the values in the kernel image that specify the RAM disk size (by default located at decimal byte offset 504 in the kernel), VGA mode (default 506), and root device (default 508). You must specify the kernel*image* to be changed, and may specify a new *value* and a different *offset*. Using rdev to change these values directly in an image file is discouraged. These values can all be set by a boot loader such aslilo or grub.

Options

-o *offset*

Same as specifying an *offset* as an argument. The offset is given in decimal.

-r

Behave like ramsize.

-v

Behave like vidmode.

-R

Behave like rootflags.

rdist

`rdist [options] [names]`

System administration command. Remote file distribution client program rdist maintains identical copies of files over multiple hosts. It reads commands from a file named*distfile* to direct the updating of files and/or directories. An alternative*distfile* can be specified with the -f option or the -c option.

Options

-a *num*

Do not update filesystems with fewer than *num* bytes free.

-A *num*

Specify the minimum number of inodes that rdist requires.

-c *name* [*login*@]*host*[:*dest*]

Interpret the arguments as a small *distfile*, where *login* is the user to log in as, *host* is the destination host, *name* is the local file to transfer, and *dest* is the remote name where the file should be installed.

-d *var*=*value*

Define *var* to have *value*. This option defines or overrides variable definitions in the*distfile*. Set the variable *var* to *value*.

-D

Debugging mode.

-f *file*

Read input from *file* (by default, *distfile*). If *file* is -, read from standard input.

-F

Execute all commands sequentially, without forking.

-I *options*

Specify logging options on the local machine.

-L *options*

Specify logging options on the remote machine.

-m *machine*

Update only *machine*. May be specified multiple times for multiple machines.

-M *num*

Do not allow more than *num* child rdist processes to run simultaneously. Default is 4.

-n

Suppress normal execution. Instead, print the commands that would have been executed.

-o*options*

Specify one or more *options*, which must be comma-separated.

chknfs

Suppress operations on files that reside on NFS filesystems.

chkreadonly

Check filesystem to be sure it is not read-only before attempting to perform updates.

chksym

Do not update files that exist on the local host but are symbolic links on the remote host

compare

Compare files; use this comparison rather than age as the criteria for determining which files should be updated.

follow

Interpret symbolic links, copying the file to which the link points instead of creating a link on the remote machine.

ignlnks

Ignore links that appear to be unresolvable.

nochkgroup

Do not update a file's group ownership unless the entire file needs updating.

nochkmode

Do not update file mode unless the entire file needs updating.

nochkowner

Do not update file ownership unless the entire file needs updating.

nodescend

Suppress recursive descent into directories.

noexec

Suppress rdist of executables that are in *a.out* format.

numchkgroup

Check group ownership by group ID instead of by name.

numchkowner

Check file ownership by user ID instead of by name.

quiet

Quiet mode; do not print commands as they execute.

remove

Remove files that exist on the remote host but not the local host.

savetargets

Save updated files in *name.old*.

sparse

Check for sparse filesfor example, ndbm files.

verify

Print a list of all files on the remote machine that are out of date, but do not update them.

whole

Preserve directory structure by creating subdirectories on the remote machine. For example, if you rdist the file */foo/bar* into the directory */baz*, it would produce the file */baz/foo/bar* instead of the default */baz/bar*.

younger

Do not update files that are younger than the master files.

-p *path*

Specify the path to search for rdistd on the remote machine.

-P *path*

Specify path to the transport command to use on the local machine. This is normallyrsh, but may also be ssh. The *path* argument may also be specified as a colon-separated list of acceptable transports to use in order of preference.

-t *seconds*

Specify the timeout period (default 900 seconds) after whichrdist will sever the connection if the remote server has not yet responded.

-V

Display version, then exit.

rdistd

`rdistd` *options*

System administration command. Start the rdist server. Note that you *must* specify the -S option unless you are simply querying for version information with-V.

Options

-D

Debugging mode.

-S

Start the server.

-V

Display the version number and exit.

readcd

`readcd dev=`*`device`* `[`*`options`*`]`

Read or write compact discs. The device is usually specified as`dev=`*`scsibus/target/lun`* or `dev=`*`target/lun`* if the device is on the default SCSI bus). The default SCSI bus is bus 0, the*target* is the ID number, and the *lun* is the logical unit number.

Options

-c2scan

Do a C2 error scan. If any C2 errors are found, specifying the`speed=` option to reduce the speed may help.

-clone

Read all data and the table of contents, and put the table-of-contents data into a file with the same filename as specified with`f=` but with a *.toc* extension.

-d, debug=*num*

Increment the debugging level by 1 with`-d` or set the level to *num*. Specifying `-dd` is the equivalent of `debug=2`.

dev=*target*

Set the SCSI target.

f=*filename*

Specify the file from which input should be read, or to which output should be written. If the filename is given as `-`, use standard input or standard output respectively.

-factor

Print the speed factor for the meshpoints= option, based on the current medium's single speed. Works only if readcd can determine the current medium type.

-fulltoc

Read the full table of contents from the current CD and display it in hexadecimal.

kd=*num*, kdebug=*num*

Modify the kernel debugging level while SCSI commands are running, to do kernel debugging.

meshpoints=*num*

Print the read speed at *num* locations, and produce a list of values suitable for plotting. The output is written to standard output.

-nocorr

Ignore read errors, doing no error correction. Switches the drive into a mode to ignore the errors; if readcd completes, it switches the drive back to the previous mode.

-noerror

Do not abort if an uncorrectable error is found in the data stream.

-notrunc

Do not truncate the output file on open.

-overhead

Measure SCSI command overhead. The measurement is done by running several commands 1000 times and printing the total time used for each.

retries=*num*

Set the retry count to *num*. The default is 128.

-s, -silent

Do not print a status report for SCSI command failures.

-scanbus

Scan all SCSI devices on all SCSI buses, print the results, and exit. Useful for finding the SCSI addresses of devices.

sectors=*range*

Specify the range of sectors to read.

speed=*num*

Set the reading and writing speed, as an integer value. Useful only for MMC-compliant drives. Defaults to maximum speed.

timeout=*num*

Set the default SCSI command timeout to *num* seconds. Defaults to 40 seconds.

ts=*num*

Set the maximum transfer size for a single SCSI command to *num*. Defaults to 256 KB.

-v, -verbose

Increment the general verbosity level by 1. Useful for displaying progress.

-V, -Verbose

Increment the verbosity level for SCSI command transport by 1. Useful for debugging. Specifying -VV adds data-buffer content to the output.

-version

Print version information and exit.

-w

Switch to write mode. The default is to read from the device.

readelf

```
readelf option[...] elffiles
```

Display information about one or more ELF (Executable and Linking Format) object files. At least one option is required to specify the information to be displayed for each file.readelf does not currently work on archive files or 64-bit ELF files.

Options

-a, --all

Display all. Equivalent to -A -d -h -I -l -r -s -S -V.

-A, --arch-specific

Display architecture-specific information, if any.

-d, --dynamic

Display the dynamic section.

-D, --use-dynamic

When displaying symbols, use the symbol table in the dynamic section, not the symbols section.

-e, --headers

Display all headers. Equivalent to -h -l -s.

-h, --file-header

Display the ELF header at the beginning of the file.

-H, --help

Display help information and exit.

-I, --histogram

Display a histogram of bucket bit lengths when displaying the symbol tables.

-l, --program-headers, --segments

Display the segment headers, if any.

-n, --notes

Display the NOTE segment, if any.

-r, --relocs

Display the relocation segment, if any.

-s, --symbols, --syms

Display entries in symbol table sections, if any.

-S, --section-headers, --sections

Display the section headers, if any.

-u, --unwind

Display the unwind section, if any (currently applies only to IA64 ELF files).

-v, --version

Display version information and exit.

-V, --version-info

Display the version sections, if any.

-w[*option*], --debug-dump[=*option*]

Display the debug sections. If specified with an option, display only that section. The options shown here in parentheses are for -w; the words preceding them are for --debug-dump. The options are abbrev (a), frames (f), frames-interp (F), info (i), line (l), loc (o), macro (m), pub-names (p), ranges (r) and str (s).

-W, --wide

Don't break output lines at 80 columns. The default is to break them. Useful for wide terminals

-x *num*, --hex-dump=*num*

Display a hexadecimal dump of the section *number*.

readlink

```
readlink file
readlink option
```

Print the contents of the symbolic link *file*--that is, the name of the file to which the link points.

Options

-f, --canonicalize

Canonicalize by recursively following symbolic links.

--help

Print usage information and exit.

-n, --no-newline

Do not output a trailing newline.

-q, --quiet, -s, --silent

Suppress most error messages.

-v, --verbose

Print all error messages.

--version

Print version information and exit.

reboot

```
reboot [options]
```

System administration command. Close out filesystems, shut down the system, then reboot. Because this command immediately stops all processes, it should be run only in single-user mode. If the system is not in runlevel 0 or 6, reboot calls shutdown -r.

Options

-d

Suppress writing to */var/log/wtmp*.

-f

Call reboot even when shutdown would normally be called.

-i

Shut down network interfaces before reboot.

-n

Suppress normal call to sync.

-w

Suppress normal execution; simply write to */var/log/wtmp*.

reject

```
reject [options] destination
```

System administration command. Instruct printing system to reject jobs for the specified print queue *destinations*. Depending on queue settings, the system may prompt for a password. Also invoked as cupsreject.

Options

-E

Require encryption when connecting.

-h *server*

Apply command remotely to the specified CUPS *server*.

-r *reason*

Reject with the specified *reason* instead of the default "Reason Unknown."

rename

`rename *from to files*`

Rename *files* by replacing the first occurrence of *from* in each filename with *to*.

Example

Rename files that start with *test* so they start with *mytest*:

```
$ rename test mytest test*
```

renice

`renice [*priority*] [*options*] [*target*]`

Control the scheduling priority of running processes May be applied to a process, process group, or user (*target*). A privileged user may alter the priority of other users' processes.*priority* must, for ordinary users, lie between 0 and the environment variable PRIO_MAX (normally 20), with a higher number indicating increased niceness. A higher niceness value means that the process will run at a lower priority. A privileged user may set a negative priority, as low as PRIO_MIN (normally -20), to speed up processes. See the nice command for setting the scheduling priority for processes when they are initially run.

Options

+num

Specify number by which to increase current priority of process, rather than an absolute priority number.

-num

Specify number by which to decrease current priority of process, rather than an absolute priority number.

`-g`

Interpret *target* parameters as process group IDs.

`-n` *increment*

Adjust the priority by the value of *increment*, which is a positive or negative integer.

`-p`

Interpret *target* parameters as process IDs (default).

`-u`

Interpret *target* parameters as usernames.

repquota

`repquota [`*`options`*`] [`*`filesystem`*`]`

System administration command. Generate a report on disk usage and quotas for the specified *filesystem*.

Options

-a

Generate report for all filesystems in */etc/mtab* that support quotas.

-c

Translate UIDs and GIDs in batches. (Faster for */etc/passwd*.)

-C

Translate UIDs and GIDs individually. (Faster for database lookups.)

-F *format*

Report on quotas for the specified format. (See quota for valid formats.)

-g

Report group quotas.

-i

Ignore automount mount points.

-n

Use UIDs and GIDs instead of names. (Generates faster reports.)

-p

Interpret *target* parameters as process IDs (default).

-s

Report sizes in more human-readable units.

-t

Truncate user and group names to 9 characters.

-u

Report user quotas. (This is the default.)

reset

```
reset [options] [terminal]
```

Clear screen (reset terminal). If *terminal* is specified on the command line, the value is used as the terminal type. reset is a symbolic link to the tset command. Invoking the command as reset is useful for clearing your terminal when a program dies and leaves the terminal in an abnormal state. You may have to run the command with a linefeed character (usually Ctrl-J) before and after it:

```
Ctrl-J reset  Ctrl-J
```

See the tset command for the available options.

resize2fs

```
resize2fs [options] device [size]
```

System administration command. Enlarge or shrink an ext2 filesystem on*device* so it has *size* blocks. The filesystem *size* cannot be larger than the underlying partition. This command changes only the filesystem size, not the underlying partition. To change the partition, usefdisk.

Options

-d *flags*

Print debugging information on resize activity. The value of the*flags* parameter determines what activity is reported. Compute its value by summing the numbers of the items you wish to debug:

1

Disk I/O.

2

Block relocations.

8

Inode relocations.

16

Inode table movement.

-f

Force resize, overriding safety checks.

-p

Print progress information for each resize task.

restore

`restore` *flag* [*options*] [*files*]

System administration command. Restore backed up *files* from a `dump` archive. Execute this command with one of the following flags.

Flags

-C

Compare files on disk to files in the backup and print report.

-i

Restore files interactively. This will open a shell-like interface that accepts the following commands.

add [*name*]

Add the current working directory, or the specified file or directory*name* to the list of files to extract.

cd *directory*

Change the current working directory.

delete [*name*]

Remove the current working directory or the specified file or directory*name* from the list of files to extract.

extract

Extract selected files. This will prompt for the volume on which the files to be extracted can be found. Once the files are extracted, the system will prompt if you want to change the ownership and mode of the current directory (the one to which you extracted the files) to match the settings on the dump's original base directory.

help

Print a command summary.

ls [*name*]

Like the shell command, list files in the current working directory, or the specified file or directory name. A * before a name indicates items marked for extraction. In verbose mode, the listing will include each item's inode.

pwd

Like the shell command, print the working directory.

quit

Exit the command.

setmodes

Set ownership and mode of the directory to which you extract the files to match the settings on the dump's original base directory.

quit

Exit the command.

verbose

Verbose mode. Print inodes along with file and directory names when usingls.

-P filename

Create a Quick File Access file suitable for use with the-Q option.

-R

Prompt for the tape volume to fully restore.

-r

Fully restore the backup to a clean, newly created ext2 filesystem. Execute this command in the root directory of the new filesystem.

-t

Print *files* if they exist in the archive or an error if they do not. If no files are specified, list all files in the archive.

-x

Recursively extract *files* if they exist in the archive. Restore owner, modification times, and modes. If no files are specified, restore the entire backup.

Options

-a

Read all volumes to find the files to extract, beginning with volume 1. This will skip any volume prompts.

-A file

Read the table of contents from the specified archive*file*.

-b*blocksize*

Specify the block size in kilobytes used for a block in the archive. Restore can usually determine this when reading the dump media.

-c

Read dumps made prior to Version 4.4.

-d

Print debugging information.

-D *filesystem*

When using the -C flag, compare the dump to files on the specified *filesystem*.

-f *file*

Read the backup from the specified *file*: a device file, an ordinary file, or - to read from standard input. Use *host:file* or user@host*:file* to read from a networked host using either the rmt program or the program specified by the RMT environment variable.

-F *script*

Run the specified *script* at the beginning of each volume. restore will pass the current device and volume number to the script. The script should return 0 to continue, 1 to prompt for a new tape, or any other exit value to abort the restore. The script will run with the process's real user and group ID.

-h

Do not recursively restore directory. Only restore the specified directory.

-k

Use Kerberos authentication when connecting to a remote server.

-l

Treat *file* as a regular file instead of a tape device. Use this option when restoring from remote compressed files.

-L *n*

Used with the -C flag. Abort the comparison after encountering *n* errors.

-m

Expect *filenames* to be given as inodes.

-M

Restore from a multivolume backup. Treat any filename provided with-f as a prefix.

-N

Perform all actions indicated by other flags and options, but don't write anything to the disk.

-o

Automatically set ownership and mode of the current directory to match the original base directory of the dump.

-Q *file*

Read tape positions from the specified Quick File Access mode*file*.

-S *n*

Read from volume *n* of a multifile backup.

-u

Unlink (remove) any existing files before writing a file with the same name.

-v

Verbose mode. Print information about files being restored.

-V

Enable multivolume mode for devices other than tapes.

-X *file*

Read list of files and directories to extract from the specified*file*. Use - to retrieve list of files from standard input.

-y

Attempt to skip over errors without prompting for operator input.

rev

```
rev [file]
```

Reverse the order of characters on each line of the specified file and print the results on standard output. If no file is specified, `rev` reads from standard input.

rexec

```
rexec [options] rhost command
```

Execute commands remotely. This client program connects to a remote host running `rexecd`, and passes it *command*. It uses login name and password for authentication. These can be passed on the command line using options below, provided through the *$HOME/.netrc* file or the environment variables REXEC_USER and REXEC_PASS. If it cannot determine the username and password, it will prompt the user for the information. Because it sends passwords to the remote system in clear text, use `rexec` only on a secure network. See `ssh` for a more secure alternative.

Options

`-a`

Send both error messages and output to standard out.

`-b`

When received locally, only echo signals `SIGINT`, `SIGQUIT` and `SIGTERM` to the remote process.

`-c`

Leave remote standard input open when the local input closes.

`-d`

Debugging mode. Echo commands sent locally.

-l *username*

Specify a different *username* for the remote login. Default is the same as your local username.

-p *password*

Specify the *password* for the remote account.

-n

Prompt user for name and password even if otherwise provided.

-s

Do not echo any signals to the remote process.

rexecd

`rexecd` *`command-line`*

TCP/IP command. Server for the `rexec` routine, providing remote execution facilities with authentication based on usernames and passwords. `rexecd` is started by `inetd` and must have an entry in `inetd`'s configuration file, */etc/inetd.conf*.

richtext

`richtext` [*`options`*] [*`file`*]

Display MIME ("richtext") files on an ASCII terminal on standard output, by means such as highlighting bold or italic text and displaying underlined text correctly. Intended primarily for use with `metamail`. If no file is specified, input is taken from standard input.

Options

-c

Don't do any formatting; simply correct the raw richtext and write the results to standard output.

-f

Use termcap-derived escape codes for bold and italic text, even ifrichtext was called in a pipe.

-m

In multibyte Japanese and Korean sequences, treat < as a real <, not as the start of a richtext command.

-n

Do not correct the raw richtext input.

-o

Use overstrikes for underlines.

-p

Use a pager to view the output. This option has no effect if standard input or standard output is redirected.

-s *charset*

Use the specified character set as the default. Valid values for*charset* are us-ascii (default), iso-2022-jp, and iso-2022-kr.

-t

Use * and _ instead of termcap-derived escape codes to highlight text.

rlogin

`rlogin [options] rhost`

Remote login. rlogin connects the terminal on the current local host system to the remotehost system *rhost*. The remote terminal type is the same as your local terminal type. The terminal or window size is also copied to the remote system if the server supports it. Use ofrlogin has generally been replaced with ssh, which offers better security.

Options

-8

Allow an 8-bit input data path at all times.

-d

Debugging mode.

-ec

Specify escape character *c* (default is ~).

-E

Do not interpret any character as an escape character.

-k

Attempt to get tickets from remote host, requesting them in the realm as determined by krb_realm-ofhost.

-l *username*

Specify a different *username* for the remote login. Default is the same as your local username.

-L

Allow rlogin session to be run without any output postprocessing (i.e., run inlitout mode).

rlogind

in.rlogind [*options*]

TCP/IP command. Server for the rlogin program, providing a remote login facility, with authentication based on privileged port numbers from trusted hosts. rlogind is invoked by inetd when a remote login connection is requested. The login process propagates the client terminal's bauc rate and terminal type as found in the TERM environment variable.

Options

-a

Verify hostname.

-h

Permit superuser *.rhosts* files to be used. Ignored if pluggable authentication module (PAM) support is enabled. Control through */etc/pam.conf* instead.

-l

Do not authenticate hosts via a nonroot *.rhosts* file. Ignored if pluggable authentication module (PAM) support is enabled. Control through */etc/pam.conf* instead.

-L

Do not authenticate hosts via *.rhosts* or *hosts.equiv* files. Ignored if pluggable authentication module (PAM) support is enabled. Control through */etc/pam.conf* instead.

-n

Suppress keep-alive messages.

rm

`rm [options] files`

Delete one or more *files*. To remove a file, you must have write permission in the directory that contains the file, but you need not have permission on the file itself. If you do not have write permission on the file, you will be prompted (y or n) to override. rm is often aliased to rm -i, especially for the root user, to protect against inadvertently deleting files.

Options

-d, --directory

Remove directories, even if they are not empty. Available only to a privileged user.

-f, --force

Remove write-protected files without prompting.

--help

Print a help message and then exit.

-i, --interactive

Prompt for y (remove the file) or n (do not remove the file).

--no-preserve-root

Do not treat root (/) specially. This is the default.

--preserve-root

Do not operate recursively on root (/).

-r, -R, --recursive

If *file* is a directory, remove the entire directory and all its contents, including subdirectories. Be forewarned: use of this option can be dangerous.

-v, --verbose

Verbose mode (print the name of each file before removing it).

--version

Print version information and then exit.

--

Mark the end of options. Use this when you need to supply a filename beginning with -.

rmail

```
rmail [options] users
```

TCP/IP command. Handle remote mail received via uucp. rmail transforms trace information from mail in UUCP format to the equivalent RFC 822 format, then forwards messages to sendmail.

Options

-D *domain*

Use *domain* instead of UUCP as the UUCP hostname in From fields.

-T

Print debugging information.

rmdir

```
rmdir [options] directories
```

Delete the named *directories* (not the contents). *directories* are deleted from the parent directory and must be empty (if not, rm -r can be used instead). See also mkdir.

Options

--help

Print a help message and then exit.

--ignore-fail-on-non-empty

Ignore failure to remove directories that are not empty.

-p, --parents

Remove *directories* and any intervening parent directories that become empty as a result. Useful for removing subdirectory trees.

--verbose

Verbose mode; print message for each directory as it is processed.

--version

Print version information and then exit.

rmmod

`rmmod [options] modules`

System administration command. Unload a module or list of modules from the kernel. This command is successful only if the specified modules are not in use and no other modules are dependent on them. This simplified program provides some backward compatibility. In general, use `modprobe -r` instead.

Options

-s, --syslog

Write messages to syslogd instead of to the terminal.

-v, --verbose

Verbose mode.

-V, --version

Print version number, then exit.

-w, --wait

If module is in use, disable it so no new processes can use it. Remove the module when it is nc longer in use.

rndc

```
rndc [options] [command]
```

TCP/IP command. Send commands to a BIND DNS server via a TCP connection (see the named command.) This command reads authentication and connection information from the file */etc/rndc.conf*, and its authentication key from */etc/rndc.key*. If entered without a *command*, display a help message listing the available commands.

Options

-c *file*

Read configuration information from file instead of */etc/rndc.conf*.

-k*file*

Perform command on the routing cache instead of the forwarding information base (FIB) routing table.

-p*port*

Connect to the specified *port* instead of the default control channel port, 953.

-s *server*

Send command to the specified *server*. There must be an entry for *server* in the configuration file.

-V

Use verbose log messages.

-y *keyname*

Specify the key to use by keyname. There must be a key entry for keyname in the

/etc/rndc.conf file.

Commands

You can send the following commands to a BIND nameserver.

dumpdb

Dump current cache to the dump file (specified in*/etc/named.conf*), or to *named_dump.db* when not specified.

flush [*view*]

Flush all server caches, or only the cache for the specified*view*.

halt

Stop server immediately.

querylog

Toggle query logging.

reconfig

Reload the configuration file and any new zones.

reload [*zone* [*class* [*view*]]]

Reload configuration file and zones. When specified, limit the reload to the given*zone*, *class*, or *view*.

refresh *zone*

Refresh database information for *zone*.

stats

Write statistics to the statistics file (specified in*/etc/named.conf*).

status

Display server status.

stop

Save any recent dynamic zone transfer updates (IXFR) to the master files, then stop the server.

trace [*debuglevel*], notrace

Increase the server's debug level by 1, or set it to the specified*debuglevel*. Use the notrace command to set the level to 1.

rootflags

```
rootflags [option] image [flags [offset]]
```

System administration command. Set *flags* for a kernel *image*. If no arguments are specified, print *flags* for the kernel image. *flags* is a 2-byte integer located at offset 498 in a kernel*image*. Currently the only effect of *flags* is to mount the root filesystem in read-only mode if *flags* is nonzero. You may change *flags* by specifying the kernel *image* to change, the new *flags*, and the byte offset at which to place the new information (the default is 498). Note that`rdev -R` is a synonym for `rootflags`. If LILO is used, `rootflags` is not needed. *flags* can be set from the LILO prompt during a boot.

Option

-o *offset*

Same as specifying an *offset* as an argument.

route

```
route [options] [command]
```

TCP/IP command. Add or remove entries in the routing tables maintained by`routed`. `route` accepts two commands: `add`, to add a route, and `del`, to delete a route. The two commands have the following syntax:

add [-net | -host] *address* [*modifiers*]
del [-net | -host] *address* [*modifiers*]

address is treated as a plain route, unless `-net` is specified or *address* is found in */etc/networks*. `-host` can be used to specify that *address* is a plain route whether or not it is found in */etc/networks*. Using route *modifiers*, you can specify the gateway through which to route packets headed for that address, its netmask, TCP mss, or the device with which to associate the route; you can also mask certain routes. Only a privileged user may modify the routing tables.

If no command is specified, `route` prints the routing tables.

Options

-A *family*, *--family*

Specify an address family to use with an `add` or `del` command. *family* may be `inet`, `inet6`, `ax25`, `netrom`, `ipx`, `ddp`, or `x25`.

-C, --cache

Perform command on the routing cache instead of the forwarding information base (FIB) routing table.

-e, --extend

Use `netstat -r` format to print routing table. Use twice to print extended information. Same as `netstat -ree`.

-F, --fib

Perform command on the forwarding information base (FIB) routing table. This is the default behavior.

-h, --help

Print help message, then exit.

-n, --numeric

Show numerical addresses; do not look up hostnames. (Useful if DNS is not functioning properly.)

-v, --verbose

Verbose mode.

-V, --version

Print version and configuration options, then exit.

Route modifiers

[dev] *interface*

Associate route with specified device. When the*interface* is given as the last argument on a command line, the word dev is optional.

netmask *mask*

Use netmask *mask*.

gw *gateway*

Route packets through *gateway*.

metric *n*

Set routing metric to *n*.

mss *bytes*

Set maximum segment size for connections over this route.

reject

Cause route lookup for target to fail. Used to mask out networks from a default route.

Example

Add a default gateway for interface eth0:

```
route add default gw 192.168.0.1 dev eth0
```

routed

```
routed [options] [logfile]
```

TCP/IP command. Network routing daemon. routed is invoked by a privileged user at boot time to manage the Internet routing tables. The routing daemon uses a variant of the Xerox NS Routing Information Protocol in maintaining up-to-date kernel routing-table entries. Whenrouted is started, it uses the SIOCGIFCONF ioctl call to find those directly connected interfaces configured into the system and marked up. routed transmits a REQUEST packet on each interface and then enters a loop, listening for REQUEST and RESPONSE packets from other hosts. When a REQUEST packet is received, routed formulates a reply based on the information maintained in its internal tables. The generated RESPONSE packet contains a list of known routes. Any RESPONSE packets received are used to update the routing tables as appropriate.

When an update is applied, routed records the change in its internal tables, updates the kernel routing table, and generates a RESPONSE packet reflecting these changes to all directly connected hosts and networks.

Options

-d

Debugging mode. Log additional information to the*logfile*.

-g

Offer a route to the default destination.

-q

Do not supply routing information. This is the default behavior when a system has only one network interface and no point-to-point links. Opposite of-s.

-s

Force routed to supply routing information, whether it is acting as an internetwork router or not. This is the default behavior when a system has multiple network interfaces or a point-to-point link.

-t

Stop routed from going into background and releasing itself from the controlling terminal, so that interrupts from the keyboard will kill the process.

rpcgen

```
rpcgen [options] file
```

Parse *file*, which should be written in the RPC (Remote Procedural Call) language, and produce a program written in C that implements the RPC code. Place header code generated from *file.x* in *file.h*, XDR routines in *file_xdr.c*, server code in *file_svc.c*, and client code in *file_clnt.c*. Lines preceded by % are not parsed. By default, rpcgen produces Sun OS 4.1-compatible code.

`-a`

Produce all files (client and server).

`-b`

Produce SunOS 4.1-compatible code. This is the default.

`-5`

Produce SVR4-compatible code.

`-c`

Create XDR routines. Cannot be used with other options.

`-C`

Produce ANSI C code (the default).

`-k`

Produce K&R C code.

`-D`*name*`[=`*value*`]`

Define the symbol *name*, and set it equal to *value* or 1.

-h

Produce a header file. With -T, make the file support RPC dispatch tables. Cannot be used with other options.

-I

Produce an inetd-compatible server.

-K *secs*

Specify amount of time that the server should wait after replying to a request and before exiting. Default is 120. Setting *secs* to -1 prevents the program from ever exiting.

-l

Produce client code. Cannot be used with other options.

-m

Produce server code only, suppressing creation of a "main" routine. Cannot be used with other options.

-N

New style. Allow multiple arguments for procedures. Not necessarily backward-compatible.

-o [*file*]

Print output to *file* or standard output.

-Sc

Print sample client code to standard output.

-Ss

Create skeleton server code only.

-t

Create RPC dispatch table. Cannot be used with other options.

-T

Include support for RPC dispatch tables.

rpcinfo

`rpcinfo [`*`options`*`] [`*`host`*`] [`*`program`*`] [`*`version`*`]`

NFS/NIS command. Report RPC information. *program* can be either a name or a number. If a *version* is specified, `rpcinfo` attempts to call that version of the specified *program*. Otherwise, it attempts to find all the registered version numbers for the specified *program* by calling Version 0, and then attempts to call each registered version.

Options

`-b`

Make an RPC broadcast to the specified *program* and *version* using UDP, and report all hosts that respond.

`-d`

Delete the specified *version* of *program*'s registration. Can be executed only by the user who added the registration or by a privileged user.

`-n` *portnum*

Use *portnum* as the port number for the `-t` and `-u` options, instead of the port number given by the portmapper.

`-p`

Probe the portmapper on *host* and print a list of all registered RPC programs. If *host* is not specified, it defaults to the value returned by `hostname`.

`-t`

Make an RPC call to *program* on the specified *host* using TCP, and report whether a response was received.

`-u`

Make an RPC call to *program* on the specified *host* using UDP, and report whether a response was received.

rpm

```
rpm [options]
```

The Red Hat Package Manager. A freely available packaging system for software distribution and installation. RPM packages are built, installed, and queried with the `rpm` and `rpmbuild` commands. For detailed information on RPM, see Chapter 5.

rsh

```
rsh [options] host [command]
```

Execute *command* on remote host, or, if no command is specified, begin an interactive shell on the remote host using `rlogin`. The options can be specified before or after *host*. Use of `rsh` has generally been replaced with `ssh`, which offers better security.

Options

`-d`

Enable socket debugging.

`-f`

Forward nonforwardable Kerberos credentials to the remote machine and remove them after the command completes. `-f` and `-F` are mutually exclusive.

`-F`

Forward forwardable Kerberos credentials to the remote machine and remove them after the command completes. `-f` and `-F` are mutually exclusive.

-k *realm*

Use the specified realm to obtain tickets for the remote host. By default, thersh command gets the information from the function *krb_realmofhost(3)*.

-l *username*

Attempt to log in as *username*. By default, the name of the user executing rsh is used.

-n

Redirect the input to rsh from the special device */dev/null*. (This should be done when backgrounding rsh from a shell prompt, to direct the input away from the terminal.)

-PN, -PO

Request the new or old Kerberos rcmd protocol, respectively.

-x

Encrypt the network session traffic (except the command line).

rshd

```
rshd [options]
```

TCP/IP command. Remote shell server for programs such as rcmd and rcp, which need to execute a noninteractive shell on remote machines. rshd is started by inetd and must have an entry in inetd's configuration file, */etc/inetd.conf*.

All options are exactly the same as those in rlogind, except for -L, which is unique to rshd.

Option

-L

Log all successful connections and failed attempts viasyslogd.

rsync

```
rsync [options] sources dest
```

Transfer files; used frequently for updating files across a network. File transfer withrsync is fast and efficient because it checks local files against remote files in small chunks, or*blocks*, and transfers only the blocks that differ between the files.

sources and the final *dest* are in the form of:

```
user@host:port/filename
```

If the file is on the local host, a plain*filename* can be specified. If the file is on a remote host, the *host* must also be specified. *user* can optionally be specified to log in as a different user on the remote site (in which case a password prompt might appear) and*port* can optionally be specified with a remote host to make rsync use a TCP port other than its default, 873.

Relative filenames (names without initial slashes) are handled relative to the user's home directory. I a source directory is listed with a trailing slash, the whole directory is transferred and will appear under the destination directory; if the directory is listed without the slash, its files and subdirectories will appear directly under the destination directory. Normally, regular directories and files are transferred, but not symbolic links or other special files such as sockets and FIFOs.

Two other formats for *sources* and *dest*, which refer to files on an rsync server (rsyncd), are:

```
user@host::filename
rsync://user@host:port/filename
```

rsync servers are beyond the scope of this book.

Options

-0

Specify that the file specified in options such as--files-from is formatted with null characters to separate the filenames; when this option is not used, the file must include each filename on a separate line.

-a, --archive

Like -r, but reproduce nearly all characteristics of the files and directories being transferred, such as modification times, symbolic links, ownership, and permissions.

--address=*addr*

Specify the IP address of an rsync server to connect to; useful when multiple servers are running on the same host.

-b, --backup

Preserve existing files at the destination by appending a suffix such as~ while transferring new versions of those files.

-B *n*, --block-size=*n*

Change block size used for transfers.

--backup-dir

Specify where files created by the--backup option are stored.

--blocking-io

Use blocking I/O when starting the remote shell used for transfer.

--bwlimit=*n*

Set a limit to the speed of transfer, specified in kilobytes per second.

-c, --checksum

Perform a full checksum on each file transferred.

-C, --cvs-exclude

Don't transfer files that are normally considered temporary or otherwise uninteresting; obeys the same rules for ignoring files as CVS (described inChapter 1).

--compare-dest=*dir*

Compare source files to files of the same name in*dir* as well as the destination directory.

--compress

Use compression during transmission.

--config=*configfile*

When running as server, take configuration from *configfile* instead of */etc/rsyncd.conf*.

--copy-links

Transfer the files to which symbolic links are made instead of just the pointer information in th links.

--copy-unsafe-links

If files to which symbolic links point are being transferred, copy even those files that exist outside the directories being transferred.

--daemon

Run rsync as server.

-D, --devices

Transfer device (*/dev*) files; requires superuser permission on both systems.

--delete-after

After transferring files from a source directory, delete any files from the destination directory that do not exist in the source directory.

--delete

Before transferring files from a source directory, delete any files from the destination directory that do not exist in the source directory.

--delete-excluded

Invoke --delete, and additionally delete from the destination directory any files that match exclude options.

--dry-run

Display the names of files that would be transferred and statistics related to a transfer, without performing a transfer.

-e *shell*

Use *shell* (which can be a complete command with arguments, enclosed in quotes) to create the connection between two systems for file transfer. rsync uses rsh by default. Nowadays, most users prefer the secure shell ssh. This can be made the default by setting the environment variable RSYNC_RSH=ssh.

--exclude-from=*file*

Like --exclude, but globbing patterns are taken from *file*. each pattern on a separate line.

--exclude=*glob-pattern*

Don't transfer files whose names match *glob-pattern*. Rules for *glob-pattern* are complex and are described in the manpage. In general, filenames can include the shell globbing characters * to match everything, ? to match a single character, and [] to enclose a set of matching characters. Furthermore, to specify the beginning of a filename, start the name with a / character (it does not mean the file has to be an absolute pathname).

--existing

Transfer only files that already exist on the destination host.

--files-from=*file*

Take names of files to transfer from *file*.

--force

Allow a file to replace a non-empty directory of the same name.

--from0

Synonym for -0.

-g, --group

Set the group (normally identified by name, not number) of the destination file to match that o the source file, instead of using the group running thersync program.

-H, --hard-links

Set hard links on destination system to match source system.

-h, --help

Display command syntax and options.

--ignore-errors

Delete files even when there are I/O errors.

--ignore-existing

Do not transfer files to replace existing files of the same name.

-I, --ignore-times

Consider files for transfer even if they have the same size and timestamp as destination files.

--include-from=*file*

Like --include, but globbing patterns are taken from *file*, which has each pattern listed on a separate line.

--include=*glob-pattern*

Specify files to be transferred even if further exclude options would cause them to be ignored. rsync processes the include and exclude options in the order they appear on the command line, so earlier include options override later exclude options.

-l, --links

Set symbolic links on destination system to match source system.

-L

Synonym for --copy-links.

--log-format=*format*

Display information about each file transferred in a format specified by % sequences; see rsyncd.conf manpage for formats.

--max-delete=*n*

Delete at most *n* files when deleting from destination host.

-n

Synonym for --dry-run.

--no-blocking-io

Do not use blocking I/O when starting the remote shell used for transfer.

--no-detach

When running as a daemon, do not restart as a background process.

--no-implied-dirs

When preserving directory structures with --relative, do not force the creation of new directories or symbolic links if the destination host is set up differently from the source host.

--no-relative

Transfer only the plain files without preserving the entire directory structure of files whose names include directories; otherwise, --files-from would create the entire directory structure to contain the file.

--no-whole-file

Use rsync's block checks to transfer parts of files where possible.

--numeric-ids

Set user and group IDs on destination files by number rather than name.

-o, --owner

Set the user (normally identified by name, not number) of the destination file to match that of the source file, instead of settng it to the user running thersync program.

--one-file-system

When traversing directories, do not transfer files on directories that are mounted on other filesystems.

-p, --perms

Set the permissions of the destination file to match that of the source file, instead of using the existing file's permissions or the default umask of the destination user.

-P

Combination of --partial and --progress.

--partial

Preserve partial files transferred if rsync is interrupted.

--password-file=*file*

Take password for accessing a remote rsync server from *file*.

--port=*n*

Use port *n* instead of default rsync port.

--progress

Display ongoing statistics about the progress of the transfer of each file.

-q, --quiet

Do not display statistics or server error messages.

--read-batch=*prefix*

Syncronize systems by reading the files whose names start with the*prefix* specified by a preceding --write-batch option.

-r, --recursive

Copy directories with all their contents.

-R, --relative

Preserve the entire path of a specified source file or directory, instead of creating the file directly under the destination directory. That is, if*project/tmp/main.c* is specified, create *project/tmp/main.c* instead of just *main.c*. Create intermediate directories if needed.

--rsh=*shell*

Synonym for -e.

--rsync-path=*file*

Use the rsync binary located in *file* on the destination system.

--safe-links

Don't copy links that point to absolute paths or to files outside the directories being transferred

--size-only

Skip files that have the same size on the source and destination hosts, even if their timestamps differ; usually, this check is based on both size and timestamp.

-S, --sparse

Perform special optimizations on sparse files (files that contain holes and actually contain less data than their sizes indicate).

--stats

Like -v, but also prints a number of statistics about each file transferred, such as the number of bytes actually transferred and the number transferred to compare the files on the two hosts.

--suffix=*string*

Set the suffix placed on backup files to*string*. Default is a tilde (~).

--timeout=*n*

Stop rsync if *n* seconds pass with no data being transferred.

-t, --times

Set the timestamps of the destination file to match those of the source file, instead of using the time of transfer (that is, reflecting the existence of a new file on the destination host).

-T *dir*, --temp-dir=*dir*

Use *dir* as rsync's temporary directory instead of the destination directory.

-u, --update

Don't change a destination file if it is newer than the source file.

--version

Display rsync's version and compiled-in features.

-v, --verbose

Display the names of files transferred and statistics related to the transfer.

-W, --whole-file

Transfer the entire files, instead of using rsync's block checks to transfer just parts of files where possible.

--write-batch=*prefix*

Prepare to syncronize systems by writing files, whose names start with *prefix*, that describe the transfers to take place.

-x

Synonym for --one-file-system.

-z

Synonym for --compress.

Examples

Transfer the entire directory *proj* to the */planning* directory on remote host *ourhub*:

```
$ rsync -r proj/ ourhub:/planning
```

Transfer the files and subdirectories under *proj* to the */planning* directory on remote host *ourhub*:

```
$ rsync -r proj ourhub:/planning
```

Return files from local directory *active* to the */tmp/active* directory on remote host *ourhub*. Files to be transferred are listed in *active/current_work.txt*:

```
$ cat active/current_work.txt
workplan.doc
workplan.sxw
```

```
$ rsync -v --files-from=active/current_work.txt active \
 ourhub:/tmp/active
building file list ... done
workplan.doc
workplan.sxw
...
```

Copy the source directory's OpenOffice.org (*.sxw*) files and Kim's status report, but exclude the other status reports.

```
$ ls proj
conclusion.sxw    Status_joem  Status_leigh
incentives.sxw    Status_kim   unified.sxw
$ rsync -rv --include=*kim --exclude=/proj/Status* proj \
 ourhub:tmp
building file list ... done
proj/Status_kim
proj/conclusion.sxw
proj/incentives.sxw
proj/unified.sxw
...
```

runlevel

```
runlevel [utmp]
```

System administration command. Display the previous and current system runlevels as reported in the *utmp* file. The default *utmp* file is */var/run/utmp*. See init for a summary of runlevels.

rup

```
rup [options] [hosts]
```

TCP/IP command. Query statd for system status on RPC *hosts*: current time, uptime, and load averages (the average number of jobs in the run queue).

Options

-d

Report local time on each host.

-h

Sort information by hostname.

-l

Sort information by load average.

-s

Print times in seconds. Useful for scripts.

-t

Sort information by uptime.

ruptime

`ruptime [`*`options`*`]`

TCP/IP command. Provide information on how long each machine on the local network has been up and which users are logged into each. If a machine has not reported in for 11 minutes, assume it is down. The listing is sorted by hostname. `ruptime` depends on `rwhod`.

Options

-a

Include users who have been idle for more than one hour.

-l

Sort machines by load average.

-r

Reverse the normal sort order.

-t

Sort machines by uptime.

-u

Sort machines by the number of users logged in.

rusers

`rusers [options] [host]`

TCP/IP command. List the users logged into *host*, or to all local machines, in `who` format (hostname, usernames). `rusers` depends on `rwhod`.

Options

-a

Include machines with no users logged in.

-l

Include more information: tty, date, time, idle time, remote host.

rusersd

`rpc.rusersd`

System administration command. Report information on users logged into the system. Answers queries from rusers.

rwall

```
rwall host [file]
```

TCP/IP command. Use RPC to print a message to all users logged into*host*. If *file* is specified, read the message from it; otherwise, read from standard input.

rwho

```
rwho [option]
```

Report who is logged on for all machines on the local network (similar towho). rwho depends on rwhod.

Option

-a

List users even if they've been idle for more than one hour.

rwhod

```
rwhod [options]
```

TCP/IP command. System-status server that maintains the database used by therwho and ruptime programs. Its operation is predicated on the ability to broadcast messages on a network. As a producer of information, rwhod periodically queries the state of the system and constructs status messages, which are broadcast on a network. As a consumer of information, it listens for other rwhod servers' status messages, validates them, then records them in a collection of files located in the directory */var/spool/rwho*. Messages received by the rwhod server are discarded unless they

originated at an rwhod server's port. Status messages are generated approximately once every three minutes.

Options

-a

Use both broadcast and point-to-point interfaces. This is the default.

-b

Use only broadcast interfaces.

-p

Use only point-to-point interfaces.

-u *user*

Run daemon as specified *user*.

sane-find-scanner

`sane-find-scanner [options]`

Locate SCSI and USB scanners and print their device files, to be sure the scanners can be detected by SANE (Scanner Access Now Easy) backends.

Options

devname

Check only the specified device for a scanner.

-f

Force the opening of any SCSI and USB devices specified with*devname*, in case the command

is wrong in determining the device type.

`-h`, `-?`

Print a usage message and exit.

`-p`

Test for parallel-port scanners. Note that most parallel-port scanners won't be detected, even with this option.

`-q`

Run quietly, printing only the devices.

`-v`

Run verbosely. When specified as `-v`, show every device name and test result; as `-vv`, also print SCSI inquiry information and USB device descriptors.

scanadf

`scanadf [`*`options`*`]`

Control scanners with an automatic document feeder (ADF), which can return multiple documents. The images are written to output files specified by the `--outputfile` option. `scanadf` uses the SANE interface to access the scanner and can support any device for which there is a SANE backend.

Options

`-d` *device*, `--device-name` *device*

Specify a SANE device name. The default is to attempt to open the first available device.

`-e` *num*, `--end-count` *num*

Specify the last page number to scan.

`-h`, `--help`

Print help message and exit. You can get device-specific help by runningscanadf as follows:

scanadf -h -d *device*

-L, --list-devices

Display a list of available devices. The list may not be complete, particularly when accessing scanners across the network. Only scanners listed in a configuration file (typically in the directory */etc/sane.d*) are displayed. A scanner with no configuration file entry must be accessed by its full device name.

-o *string*, --output-file *string*

Specify a format string used to generate the output filename. Use %d replacement to insert the current page number in the name. The default format string isimage-%04d.

-r, --raw

Write raw image data to the output file without attempting to interpret it. Usually used togethe with --scan-script.

-s *num*, --start-count *num*

Specify the page number of the first scanned image.

-S *name*, --scan-script *name*

Specify the name of a script to run after each image is scanned.

-v, --verbose

Run in verbose mode, providing additional status messages.

-V, --version

Print version information and exit.

scanimage

scanimage [*options*]

Read images from devices such as scanners and cameras, writing the images to standard output in PNM (Portable aNyMap) format. scanimage uses the SANE interface to access the scanner and can support any device for which there is a SANE backend.

Formats

PBM

Black-and-white

PGM

Grayscale

PPM

Color

TIFF

Black-and-white, grayscale, or color

Options

--accept-md5-only

Only accept MD5 authorization requests.

-b [*format*], --batch[=*format*]

Work in batch mode, using a document feeder. Each page is written to a file, as specified by *format*, using a printf-type string. The default format is out%d.pnm for the PNM formats and out%d.tif for TIFF.

--batch-count=*num*

The number of pages to scan in batch mode. Use this option for scanners that do not signal when they are empty; the default is to continue scanning until such a signal is received.

--batch-double

Increment the page number by 2 in batch mode. Used for scanning two-sided originals on a single-sided scanner.

--batch-increment=*num*

Increment the number in the filename by *num* in batch mode.

--batch-prompt

In batch mode, prompt the user to press Return before scanning a page. Useful for manually feeding multiple pages.

--batch-start=*num*

Specify the page number in batch mode to use in the first filename. The default is 0.

-d *device*, --device-name=*device*

Specify the scanner device to usee.g., */dev/scanner*.

-f *format*, --formatted-device-list=*format*

Show the available scanner devices, as with -L, but also format the output. Possible format specifications are:

%d

Device name

%i

Index number

%m

Model

%t

Type

%v

Vendor

--format=*format*

Specify the file format of the output file. The possible values arepnm and tiff.

-h, --help

Print a help message and exit. You can get device-specific help by runningscanimage as follows:

scanimage -h -d *device*

-i *profile*, --icc-profile=*profile*

Include the specified ICC profile in the TIFF output file.

-L, --list-devices

Display a list of available devices. The list may not be complete, particularly when accessing scanners across the network. Only scanners listed in a configuration file (typically in the directory */etc/sane.d*) are displayed. A scanner with no configuration file entry must be accessed by its full device name.

-n, --dont-scan

Set the specified options, but don't actually scan anything.

-T, --test

Run some sanity tests to be sure the backend works as defined by the SANE API.

-v, --verbose

Run in verbose mode, providing additional messages.

-V, --version

Print version information and exit.

scp

`scp [`*`options`*`] `*`file1`*`[...] `*`file2`*

Securely copy files between hosts on a network, using `ssh`. Part of the OpenSSH suite of network tools. `scp` requests a password or passphrase if required. The transfer can be between two remote hosts. If more than one file is specified for *file1*, *file2* should be a directory; otherwise, only the last file in the list is copied. *file1* and *file2* can be specified in any of the following ways:

`file`
`host:file`
`user@host`*`:file`*

The first format is used for a local file; a remote file can be specified in either of the other two formats.

Options

-1

Force the use of SSH protocol 1.

-2

Force the use of SSH protocol 2

-4

Use IPv4 addresses.

-6

Use IPv6 addresses.

-B

Run in batch mode. Don't ask for passwords or passphrases.

-c *cipher*

Specify the *cipher* to be used for encrypting the data.

-C

Enable ssh compression.

-F *config*

Specify an ssh user configuration file (default is *$HOME/.ssh/config*).

-i *file*

Specify the file that contains the identity (private key) for RSA authentication.

-l *limit*

Limit bandwidth used to *limit*, specified in kilobits/second.

-o *option*

Specify an option to pass to ssh.

-p

Preserve modification time, access time, and mode.

-P *port*

Connect to *port* on the remote host.

-q

Don't display the progress meter.

-r

Copy directories recursively.

-S *program*

Specify the program to use for the encrypted connection. The program must understandssh options.

-v

Verbose mode.

Example

Copy the local file *user.server1.pub* to the remote system *server2*, putting it in james's home directory:

```
$ scp user.server1.pub james@server2:/home/james/
```

screen

```
screen [options] [command [args]]
```

Provide ANSI/VT100 terminal emulation, making it possible to run multiple full-screen pseudo-terminals from one real terminal, and letting you manipulate and save your screen input and output, copy and paste between windows, etc.

Options

-a

Include all capabilities in each window's termcap.

-A

Adapt all windows to the size of the current terminal. Default is to try to use the previous window size.

-c *file*

Use *file* as the configuration file instead of the default *$HOME/.screenrc*.

-d

Detach session running elsewhere. With -r, reattach to this terminal. With -R, reattach to this terminal or create it if it doesn't already exist. With -RR, use the first session when reattaching

if more than one session is available.

-D

Detach session running elsewhere, logging out before detaching. With-r, reattach to this terminal. With -R, reattach to this terminal or create it if it doesn't already exist. With-RR, do whatever is necessary to create a new session.

-e *xy*

Change command characters. Specify *x* as the command character (default Ctrl-a) and *y* as the character that generates a literal command character (default a). Specify in caret notation (e.g., -e ^Pp to set Ctrl-p as the command character, which is useful for emacs-mode shell).

-f, -fn, -fa

Turn flow control on, off, or to automatic-switching mode.

-h *num*

Specify the size of the history scrollback buffer.

-i

Cause the interrupt key (usually Ctrl-c) to interrupt the display immediately when flow control is on. Use of this option is discouraged.

-l, -ln

Turn login mode on or off for */etc/utmp* updating.

-ls, -list

Print list of *pid.tty.host* strings identifying screen sessions.

-L

Tell screen that automargin terminal has a writable last position.

-m

Ignore the $STY environment variable and create a new session. With-d, start session in detached mode; useful for scripts. With-D, start session in detached mode but don't fork a new process; the command exits if the session terminates.

-O

Use optimal output mode for terminal rather than true VT100 emulation.

-p *window*

Preselect the specified window if it exists.

-q

Suppress error message printing on startup. Exit with nonzero return code if unsuccessful.

-r [*pid.tty.host*]

-r *sessionowner*/[*pid.tty.host*]

Resume detached session. No other options except -d or -D can be specified. With *sessionowner*, resume another user's detached session; requires setuid root.

-R

Attempt to resume the first session found, or start a new session with the specified options. Se by default if screen is run as a login shell.

-s *shell*

Set the default shell, overriding the $SHELL environment variable.

-S *name*

Specify a name for the session being started.

-t *name*

Set the window's title.

-T *term*

Set $TERM to *term* instead of "screen".

-U

Run in UTF-8 mode and set the default for new windows to*UTF-8.ctrl*.

-v

Print version information and exit.

-wipe [*match*]

Like -ls, but remove destroyed sessions instead of marking them dead. If a match is specified, it should be in the same form as the argument to the -r option.

-x

Attach to a session that is not detached. Requires multi-display mode.

-X

Run specified command in specified session. Requires multi-display mode, and session must not be password-protected.

Key bindings

screen commands consist of a command character (Ctrl-a by default) followed by another character. For many of the commands, you can also specify the character as Ctrl-*character*--e.g., Ctrl-a Ctrl-d as well as Ctrl-a d. The default key bindings are listed here. You can change the bindings for yourself in the *$HOME/.screenrc* configuration file, or for all users in */etc/screenrc*. The term in parentheses that follows the description is the equivalent configuration-file command for changing the key binding.

Ctrl-a '

Prompt for window name or number to switch to. (select)

Ctrl-a "

List all windows for selection. (windowlist -b)

Ctrl-a *num*

Switch to window *num*, where *num* is a digit in the range 0-9 or - (the blank window). (select *num*)

Ctrl-a Tab

Switch input focus to next region. (focus)

Ctrl-a Ctrl-a

Toggle to previously displayed window. (other)

Ctrl-a a

Send the command character (Ctrl-a) to the window. (meta)

Ctrl-a A

Prompt user to enter a name for the current window. (title)

Ctrl-a b

Send a break to the window. (break)

Ctrl-a B

Reopen the terminal line and send a break. (pow-break)

Ctrl-a c

Create a new window with a shell and switch to it. (screen)

Ctrl-a C

Clear the screen. (clear)

Ctrl-a d

Detach screen from this terminal. (detach)

Ctrl-a D D

Detach and log out. (pow-detach)

Ctrl-a f

Toggle flow control between on, off, and auto. (flow)

Ctrl-a F

Resize window to current region size. (fit)

Ctrl-a Ctrl-g

Toggle visual bell mode. (vbell)

Ctrl-a h

Write contents of the current window to the file*hardcopy.n.* (hardcopy)

Ctrl-a H

Begin/end logging of the current window to the file*screenlog*.*n.* (log)

Ctrl-a i

Show information about this window. (info)

Ctrl-a k

Kill current window. (kill)

Ctrl-a l

Refresh current window. (redisplay)

Ctrl-a L

Toggle window's login slot. Requires thatscreen be configured to update the utmp database. (login)

Ctrl-a m

Redisplay last message. (lastmsg)

Ctrl-a M

Toggle monitoring of the current window. (monitor)

Ctrl-a Space

Ctrl-a n

Switch to next window. (next)

Ctrl-a N

Show number and title of current window. (number)

Ctrl-a Backspace

Ctrl-a h

Ctrl-a p

Switch to previous window. (prev)

Ctrl-a q

Send a start signal (associated with Ctrl-q by terminals) to current window. (xon)

Ctrl-a Q

Delete all regions except the current one. (only)

Ctrl-a r

Toggle current window's line-wrap setting. (wrap)

Ctrl-a s

Send a stop signal (associated with Ctrl-s by terminals) to current window. (xoff)

Ctrl-a S

Split current region into two new regions. (split)

Ctrl-a t

Show system information, including time and date. (time)

Ctrl-a v

Display version information. (version)

Ctrl-a Ctrl-v

Enter digraph for entering characters that can't normally be entered. (digraph)

Ctrl-a w

List all windows. (windows)

Ctrl-a W

Toggle 80/132 columns. (width)

Ctrl-a x

Lock terminal. (lockscreen)

Ctrl-a X

Kill the current region. (remove)

Ctrl-a z

Suspend screen. (suspend)

Ctrl-a Z

Reset virtual terminal to its "power-on" values. (reset)

Ctrl-a .

Write out a *.termcap* file. (dumptermcap)

Ctrl-a ?

Show all key bindings. (help)

Ctrl-a Ctrl-\

Kill all windows and terminatescreen. (quit)

Ctrl-a :

Enter command-line mode. (colon)

Ctrl-a [

Ctrl-a Esc

Enter copy/scrollback mode. (copy)

Ctrl-a]

Write contents of the paste buffer to the standard input queue of the current window. (paste)

Ctrl-a {

Ctrl-a }

Copy and paste a previous line. (history)

Ctrl-a >

Write paste buffer to a file. (writebuf)

Ctrl-a <

Read screen-exchange file into paste buffer. (readbuf)

Ctrl-a =

Remove file used by Ctrl-a < and Ctrl-a >. (removebuf)

Ctrl-a ,

Show where screen comes from, where it went to, and why you can use it. (license)

Ctrl-a _

Start/stop monitoring the current window for inactivity. (silence)

Ctrl-a *

List all currently attached displays. (displays)

script

```
script [option] [file]
```

Fork the current shell and make a typescript of a terminal session. The typescript is written to*file*. If no *file* is given, the typescript is saved in the file*typescript*. The script ends when the forked shell exits, usually with Ctrl-D or exit.

Options

-a

Append to *file* or *typescript* instead of overwriting the previous contents.

-c *command*

Run the specified command instead of an interactive shell.

-f

Flush output after each write. Useful if another person is monitoring the output file.

-q

Operate in quiet mode.

-t

Write timing data to standard error. Each entry has two fields: the first is the elapsed time since the last output, and the second is the number of characters in the current output.

sdiff

```
sdiff -o outfile [options] from to
```

Find differences between the two files*from* and *to* and merge interactively, writing the results to *outfile*.

Options

--

Treat remaining options as filenames, even if they begin with-.

-a, --text

Treat all files as text and compare line by line.

-b, --ignore-space-change

Ignore differences in whitespace.

-B, --ignore-blank-lines

Ignore added or missing blank lines.

-d, --minimal

Use a different algorithm to find fewer changes. This option causessdiff to run more slowly.

-H, --speed-large-files

Heuristically speed comparison of large files with many small scattered changes.

-i, --ignore-case

Ignore case changes.

-I *regexp*, --ignore-matching-lines=*regexp*

Ignore any changes that insert or delete lines matching the regular expression*regexp*.

--ignore-all-space

Ignore whitespace when comparing lines.

-l, --left-column

Print only the left column of common lines.

-o *file*, --output=*file*

Write merged output to the specified file.

-s, --suppress-common-lines

Suppress common lines.

-t, --expand-tabs

Convert tabs to spaces in the output to preserve alignment.

-v, --version

Print version information and exit.

-w *cols*, --width=*cols*

Set the output to *cols* columns wide.

-W

Ignore horizontal whitespace when comparing lines.

Interactive commands

ed

Edit, then use both versions, with a header for each.

eb

Edit, then use both versions.

el

Edit, then use the left version.

er

Edit, then use the right version.

e

Edit a new version to replace the others.

h,?

Display a list of these commands.

l

Use the left version.

r

Use the right version.

s

Silently include common lines.

v

Verbosely include common lines.

q

Quit.

sed

```
sed [options] [command] [files]
```

Stream editor. Edit one or more *files* without user interaction. See Chapter 1 for more information.

sendmail

```
sendmail [flags] [address...]
```

System administration command. sendmail is a mail transfer agent (MTA) or, more simply, a mail router. It accepts mail from a user's mail program, interprets the mail address, rewrites the address into the proper form for the delivery program, and routes the mail to the correct delivery program.

Command-line flags

--

End of options marker. Only addresses should follow this option.

-Ac

Use local submission configuration file */etc/mail/submit.cf*, even when no mail is sent from the command line.

-Am

Use configuration file */etc/mail/sendmail.cf*, even when mail is sent from the command line.

-B*type*

Set message body type. Accepted values are 7BIT and 8BITMIME.

-b*x*

Set operation mode to *x*. Operation modes are:

a

Run in ARPAnet mode.

d

Run as a daemon.

D

Run as a daemon, but remain in the foreground.

h

Print persistent host status information.

H

Purge expired entries from persistent host status information.

i

Initialize the alias database.

m

Deliver mail (the default).

p

Print the mail queue.

s

Speak SMTP on input side.

t

Run in test mode.

v

Verify addresses; do not collect or deliver.

-C *file*

Use configuration file *file*.

-d *level*

Set debugging level.

-F *name*

Set full name of user to *name*.

-f *name*

Sender's name is *name*.

-G

Relay message submission. Used by rmail.

-i

Do not interpret dots on a line by themselves as a message terminator.

-h *cnt*

Set hop count (number of times message has been processed by sendmail) to *cnt*.

-L *identifier*

Use the specified log *identifier* for messages sent to syslogd.

-N *conditions*

Specify conditions for delivery status notification (DSN) as a comma-separated list. Accepted values are never, delay, failure, and success.

-n

Do not alias or forward.

-O *option=value*

Set an option specified by its long name. Options are described in the next section.

-o*Xvalue*

Set an option specified by its short name *X*. Options are described in the next section.

-p*protocol*

Receive messages via the *protocol* protocol.

-q[*time*]

Process queued messages immediately, or at intervals indicated by *time* (for example, -q30m for every half hour).

-qp[*time*]

Same as -q, but create a persistent process to handle the queue instead of initiating a new process at each time interval.

-qf

Process saved messages in the queue using the foreground process.

-qG *group*

Process saved messages in the named queue *group*.

-q[!]I*substring*

Process jobs for named queues containing *substring*. Use ! to process mail for all queues not containing *substring*.

-q[!]Q*substring*

Process quarantined messages containing *substring*. Use ! to process mail for recipients not containing *substring*.

-q[!]R*substring*

Process jobs with recipients containing *substring*. Use ! to process mail for recipients not containing *substring*.

-q[!]S*substring*

Process jobs from senders containing *substring*. Use ! to process mail from senders not containing *substring*.

-Q[*reason]*

Quarantine messages for the given *reason*. Use query options above to specify the message to quarantine.

-R *portion*

When bouncing messages, return only the specified *portion* of the bounced message. *portion* may be hdrs for headers, or full for the full message.

-t

Read header for To:, Cc:, and Bcc: lines, and send to everyone on those lists.

-v

Verbose mode.

-V *envid*

Use *envid* as the original envelope ID.

-X *file*

Log all traffic to *file*. Not to be used for normal logging.

Configuration options

Command-line configuration options are the same options normally set with an O in the sendmail configuration file. On the command line, they are set using -O and the option's long name. Many of these options have short-name variations that are used with the -o option. Here, we document items most likely to be useful on the command line, providing both their short- and long- name forms. Many of the commands call for *timeout* values. These should be given as a number followed by a letter indicating the interval: s for seconds, m for minutes, h for hours, or d for days. For example, 30s is 30 seconds, 10m is 10 minutes, and 3d is 3 days. The default is minutes when no letter is given.

Aliasfile=*file*, Afile

Use alternate alias file.

AliasWait=min, amin

If the D option is set, wait *min* minutes for the aliases file to be rebuilt before returning an alias database out-of-date warning.

BlankSub=char, Bchar

Set unquoted space replacement character.

CheckAliases, n

When running newaliases, validate the right side of aliases.

CheckpointInterval=*num*, Cnum

Checkpoint the queue when mailing to multiple recipients.sendmail will rewrite the list of recipients after each group of *num* recipients has been processed.

ClassFactor=*factor*, zfactor

Multiplier for priority increments. This determines how much weight to give to a message's precedence header. sendmail's default is 1800.

ConnectionCacheSize=num, knum

Specify the maximum number of open connections to cache.

ConnectionCacheTimeout=timeout, Ktimeout

Time out connections after *timeout*.

ConnectionRateThrottle=*num*

Restrict SMTP connections per second to *num*.

DefaultUser=uid[:*gid*], uuid[:*gid*]

Use user ID and group ID for mailers instead of 1:1. If no group ID is specified, the user's default group is used.

DefaultCharSet=*label*

Use the specified label for 8-bit data.

DeliveryMode=*x*, dx

Set the delivery mode to *x*. Delivery modes are d for deferred delivery, i for interactive (synchronous) delivery, b for background (asynchronous) delivery, and q for queue only (i.e., deliver the next time the queue is run).

DialDelay=*seconds*

Specify the number of seconds to wait before redialing after a connection fails.

DontPruneRoutes, R

Don't prune route addresses.

EightBitMode=*mode*, 8mode

Specify how to handle 8-bit input. Accepted values for *mode* are mimefy (convert to 7-bit), pass (send as is), or strict (bounce the message).

ErrorHeader=text, Etext

Set error-message header. *text* is either text to add to an error message, or the name of a file. A filename must include its full path and begin with a /.

ErrorMode=x, ex

Set error processing to mode *x*. Valid modes are m to mail back the error message, w to write back the error message, p to print the errors on the terminal (default), q to throw away error messages, and e to do special processing for the BerkNet.

FallbackMXhost=host, Vhost

Set fallback MX host. *host* should be the fully qualified domain name of the fallback host.

ForkEachJob, Y

Deliver each job that is run from the queue in a separate process. This helps limit the size of running processes on systems with very low amounts of memory.

ForwardPath=path, Jpath

Set an alternative *.forward* search path.

HelpFile=file, Hfile

Specify SMTP help file to use instead of */etc/mail/helpfile*.

HoldExpensive, c

On mailers that are considered "expensive" to connect to, don't initiate immediate connection.

IgnoreDots, i

Do not take dots on a line by themselves as a message terminator.

LogLevel=n, Ln

Specify log level. Default is 9.

MatchGECOS, G

Compare local mail names to the GECOS section in the password file.

MaxDaemonChildren=*num*

Restrict incoming SMTP daemon to no more than num child processes.

MaxHopCount=*num*, hnum

Allow a maximum of *num* hops per message.

MeToo, m

Also send to me (the sender) if I am in an alias expansion.

MinFreeBlocks=*minblocks*, bminblocks

Require at least *minblocks* on the filesystem to be free.

MinQueueAge=*timeout*

Wait the specified time before processing a new job in the queue.

NoRecipientAction=*action*

Specify what headers, if any, to add to a message without recipient headers. Accepted values are none, add-to, add-apparently-to, add-bcc, and add-to-undisclosed.

OldStyleHeaders, o

If set, this message may have old-style headers. If not set, this message is guaranteed to have new-style headers (i.e., commas instead of spaces between addresses).

PostmasterCopy=*user*, Puser

Send copies of all failed mail to *user* (usually postmaster).

PrivacyOptions=optionlist, poptionlist

Adjust the privacy of the SMTP daemon. The *optionlist* argument should be a comma-separated list of the following values:

public

Make SMTP fully public (the default).

needmailhelo

Require site to send HELO or ELHO before sending mail.

needexpnhelo

Require site to send HELO or ELHO before answering an address expansion request.

needvrfyhelo

Like preceding argument, but for verification requests.

noetrn

Deny requests to reverse the connection using extended TURN.

noexpn

Deny all expansion requests.

noverb

Deny requests for verbose mode.

novrfy

Deny all verification requests.

authwarnings

Insert special headers in mail messages advising recipients that the message may not be authentic.

goaway

Set all of the previous arguments (except public).

nobodyreturn

Don't return message body with a delivery status notification.

noreceipts

Turn off delivery status notification on success.

restrictexpand

Deny untrusted users access to aliases, forwards, or include files. Restrictsendmail -bv and disallow -v.

restrictmailq

Allow only users of the same group as the owner of the queue directory to examine the mail queue.

restrictqrun

Limit queue processing to root and the owner of the queue directory.

QueueDirectory=*dir*, Qdir

Select the directory in which to queue messages.

QueueFactor=factor, qfactor

Multiplier (factor) for high-load queuing. Default is 600000.

QueueLA=load, xload

Queue messages when load level is higher than*load*.

QueueTimeout=timeout, Ttimeout

Set the timeout on undelivered messages in the queue to the specified time (overridden by Timeout.queuereturn).

RecipientFactor=factor, yfactor

Penalize large recipient lists by*factor*.

RefuseLA=load, Xload

Refuse SMTP connections when load is higher than*load*.

ResolverOptions=arg, I *arg*

Use DNS lookups and tune them. Queue messages on connection refused. The*arg* arguments are identical to resolver flags without the RES_ prefix. Each flag can be preceded by a plus or minus sign to enable or disable the corresponding nameserver option. There must be whitespace between the I and the first flag.

RetryFactor=*inc*, Zinc

Increment priority of items remaining in queue by*inc* after each job is processed. sendmail uses 90,000 by default.

SaveFromLine, f

Save Unix-style From lines at the front of messages.

SendMimeErrors, j

Use MIME format for error messages.

SevenBitInput, 7

Format all incoming messages in seven bits.

StatusFile=*file*, Sfile

Save statistics in the named file.

SuperSafe, s

Always instantiate the queue file, even when it is not strictly necessary.

TempFileMode=mode, Fmode

Set default file permissions for temporary files. If this option is missing, default permissions are 0600.

Timeout.queuereturn=*timeout*

Return undelivered mail that has been in the queue longer than the specified*timeout*. The default is 5d (five days).

TimeZoneSpec=*timezone*, ttimezone

Set name of the time zone.

UseErrorsTo, l

Do not ignore Errors-To header.

UserDatabaseSpec=database, Udatabase

Consult the user *database* for forwarding information.

Verbose, v

Run in verbose mode.

sendmail support files

/usr/lib/sendmail

Traditional location of sendmail binary.

/usr/bin/newaliases

Link to */usr/lib/sendmail*; rebuilds the alias database from information in */etc/aliases*.

/usr/bin/mailq

Prints a listing of the mail queue.

/etc/mail/sendmail.cf

Configuration file, in text form.

/etc/mail/submit.cf

Configuration file used for local message submissions.

/etc/mail/helpfile

SMTP help file.

/etc/mail/statistics

Statistics file.

/etc/aliases

Alias file, in text form.

/etc/aliases.db

Alias file in dbm format. Created by newaliases

/var/spool/mqueue

Directory in which the mail queue and temporary files reside.

sensors

`sensors [options] [chips]`

Display current readings of all sensor chips and set limits as specified in the configuration file. The default configuration file is */etc/sensors.conf*.

Options

-A

Omit adapter and algorithm for each chipset.

-c [*config-file*]

Specify a configuration file. The default value is*sensor.conf*, and the default paths are searched in this order: */etc*, */usr/lib/sensors*, */usr/local/lib/sensors*, */usr/lib, /usr/local/lib*, and *.* (the current directory).

-f

Print temperatures in Fahrenheit, not Celsius.

-h

Display help information and exit.

`-s`

Evaluate all `set` statements in the configuration file. Requires superuser privileges.

`-u`

Treat all chips as unknown. Used for testing purposes. The output quality will be lower.

`-v`

Display version information and exit.

seq

```
seq [options] [first [increment]] last
```

Print the numbers from *first* through *last* by *increment*. The default is to print one number per line to standard output. Both *first* and *increment* can be omitted and default to 1, but if *first* is omitted then *increment* must also be omitted. In other words, if only two numbers are specified, they are taken to be the first and last numbers. The numbers are treated as floating-point.

Options

`-f` *format*, `--format=`*format*

Write the output using the specified `printf` floating-point format, which can be one of `%e`, `%f`, or `%g` (the default).

`--help`

Print help message and exit.

`-s` *string*, `--separator=`*string*

Use *string* to separate numbers in the output. Default is newline.

`-w`, `--equal-width`

Equalize the width of the numbers by padding with leading zeros. (Use `-f` for other types of padding.)

--version

Print version information and exit.

setfdprm

`setfdprm [options] device [name]`

Load disk parameters used when autoconfiguring floppy devices.

Options

-c *device*

Clear parameters of *device*.

-n *device*

Disable format-detection messages for *device*.

-p *device* [*name* | *parameters*]

Permanently reset parameters for *device*. You can use *name* to specify a configuration, or you can specify individual parameters. The parameters that can be specified are dev, size, sect, heads, tracks, stretch, gap, rate, spec1, or fmt_gap. Consult */etc/fdprm* for the original values.

-y *device*

Enable format-detection messages for *device*.

setkeycodes

`setkeycodes scancode keycode`

System administration command. Assign a *keycode* event to the specified keyboard *scancode*. The kernel matches these to its own keycodes. Scancodes in the range of 1-88 are hardwired in the kernel, but the remaining scancodes can be assigned to keycodes in the range of 1-127. Use `getkeycodes` to see current assignments. Use `showkey` to discover what scancode a key is sending.

setleds

`setleds [options]`

Display or change the LED flag settings (Num Lock, Caps Lock, and Scroll Lock) for the current virtual terminal. With no options, display the current settings for all three flags. Can be used in a startup script to set the initial state of the LEDs.

Options

`+num, -num`

Set or clear Num Lock.

`+caps, -caps`

Set or clear Caps Lock

`+scroll, -scroll`

Set or clear Scroll Lock.

`-D`

Change both the current and the default settings. Useful for always having NumLock set, for example.

`-F`

Only change the flags (and their settings may be reflected by the keyboard LEDs). The default behavior.

`-L`

Change the LEDs but not the flags, so the leds no longer reflect the virtual terminal (VT) flags. Run `setleds -L` with no other options to restore the default behavior.

`-v`

Report the settings before and after the change.

setmetamode

`setmetamode [options]`

Display or set Meta key handling for the current virtual terminal. With no option, print the current Meta key mode. Otherwise, set the mode and display the setting before and after the change.

Options

esc, prefix, escprefix

Set the Meta key to send an escape sequence.

meta, bit, metabit

Set the Meta key to set the high-order bit of the character.

setquota

`setquota [options] [name] [limits] filesystems`

System administration command. Set quotas from the command line. Provide limits in the format *soft-block-limit hard-block-limit soft-inode-limit hard-inode-limit*. To disable a quota, set it to 0. See also edquota, a vi editor interface for editing and setting quotas.

Options

-a

Apply settings to all filesystems listed in */etc/mtab* that support quotas.

-b

Read new settings from standard input. Provide as a list, each line in the form of "name limits.'

-F*format*

Specify filesystem quota *format* to use. See quota for a list of accepted values.

-g

Set group quotas instead of users.

-p*prototype*

Apply the same settings as used for the specified user or group:*prototype*.

-t*blockgrace inodegrace*

Specify overall grace times in seconds for block and inode quotas.

-T*name blockgrace inodegrace*

Specify grace times in seconds for individual user or group*name*. Use the string unset to remove existing grace times.

-u

Set user quotas. (This is the default.)

setsid

```
setsid command [arguments]
```

System administration command. Execute the named command and optional command*arguments* in a new session.

setterm

`setterm [`*`options`*`]`

Set terminal attributes by writing a character string to standard output to invoke the specified attributes.

Options

For Boolean options, the default value is on. Where 8-color is specified, the possible colors are black, red, green, yellow, blue, magenta, cyan, and white. Where 16-color is specified, the possible colors include the 8-color colors, plus grey, bright red, bright green, bright yellow, bright blue, bright magenta, bright cyan, and bright white.

-appcursorkeys [on|off]

Set cursor key application mode on or off. Virtual consoles only. Can cause problems withvi.

-append [*num*]

Write a snapshot of virtual console *num* to the file specified with the -file option, appending the snapshot to any existing contents. With no argument, write a snapshot of the current virtual terminal.

-background *8-color*|default

Set background color. Virtual consoles only.

-bfreq [*freq*]

Set the bell frequency in Hz (default 0).

-blank [*min*]

Set the delay before the screen blanks to the specified number of minutes. Virtual consoles only.

-blength [*millisec*]

Set the bell duration in milliseconds (default 0).

-blink [on|off]

Turn blinking mode on or off. If the terminal is not a virtual console,-blink off also turns off bold, half-bright, and reverse modes.

-bold [on|off]

Turn bold on or off. If the terminal is not a virtual console,-bold off also turns off blink, half-bright, and reverse modes.

-clear [all]

Clear the screen.

-clear rest

Clear from the current cursor position to the end of the screen.

-clrtabs [*tab1*...*tabn*]

With no arguments, clear all tab stops. Otherwise, clear the specified tab stops. Virtual consoles only.

-cursor [on|off]

Turn the cursor on or off.

-default

Set rendering options to defaults.

-dump [*num*]

Write a snapshot of virtual console *num* to the file specified with the -file option, overwriting any existing contents. With no argument, dump the current virtual console. Overrides-append.

-file *file*

Write output from the -dump or -append option to the specified file. If no filename is specified, write to the file *screen.dump* in the current directory.

-foreground *8-color*|default

Set foreground color. Virtual consoles only.

-half-bright [on|off]

Turn half-bright (dim) mode on or off. If the terminal is not a virtual console,-half-bright off also turns off bold, blink, and reverse modes.

-hbcolor *16-color*

Set color for half-bright characters. Virtual consoles only.

-initialize

Display the terminal initialization string to reset the rendering options and other attributes to their defaults.

-inversescreen [on|off]

Invert the screen colors, swapping foreground and background, and underline and half-bright. Virtual consoles only.

-linewrap [on|off]

Turn line-wrapping on or off. Virtual consoles only.

-msg [on|off]

Enable or disable the sending of kernel printk( ) messages to the console. Virtual consoles only.

-msglevel [*num*]

Set the console logging level for kernel printk( ) messages. The value of *num* can be in the range 0-8. Messages more important than the specified number are printed, with8 printing all kernel messages, and 0 equivalent to -msg on. Virtual consoles only.

-powerdown [*min*]

Set the VESA powerdown interval to the specified number of minutes, from 0-60. If no value is specified for *min*, defaults to 0, disabling powerdown.

-powersave [*mode*]

Put the monitor in the specified VESA powersave mode. Specifying no mode is equivalent to off. The possible values of *mode* are:

on, vsync

vsynch suspend mode.

hsync

hsync suspend mode.

powerdown

Powerdown mode.

off

off

Turn off VESA powersaving features.

-regtabs [*num*]

Clear all existing tab stops and set a regular tab stop pattern at every*num* number (default is 8). *num* is a number in the range 1-160. Virtual consoles only.

-repeat [on|off]

Turn keyboard repeat on or off. Virtual consoles only.

-reset

Display the terminal reset string to reset the terminal to its power-on state.

-reverse [on|off]

Turns reverse-video mode on or off. If the terminal is not a virtual console,-reverse off also turns off bold, half-bright, and blink modes.

-store

Store the current rendering options as the defaults. Virtual consoles only.

-tabs [*tab1*...*tabn*]

Set tab stops at the specified cursor positions, which can range from 1 to 160. Virtual consoles only.

-term *term*

Replace the value of the TERM environment variable with*term*.

-ulcolor *16-color*

Set color for underlining. Virtual consoles only.

-underline [on|off]

Turn underlining on or off.

sftp

`sftp [options] host`

An interactive file transfer program, similar to `ftp` except that it uses `ssh` to perform file transfers securely. `sftp` connects to *host* and logs in, prompting for a password if required. The host can be specified in the following ways:

host
[*user*@]*host*[:*file* [*file*] ...]
[*user*@]*host*[:*dir*[/]]

If *user* is specified, that username is used for the login. If any files are specified, the`sftp` client automatically retrieves them after the user has been authenticated, and then exits. If a directory*dir* is specified, the client starts in that directory on the remote host.`sftp` is part of the OpenSSH suite of network tools.

Options

-1

Use SSH1. The default is to use SSH2.

-b *file*

Run in batch mode, taking commands from the specified file. Requires the use of a

noninteractive authentication mechanism.

-B *bytes*

Specify the size of the buffer sftp uses for file transfers. Default is 32768 bytes.

-C

Enable compression (uses ssh -C).

-F *file*

Use *file* as the ssh configuration file instead of the default system configuration file. The systemwide file is usually */etc/ssh/ssh_config*, and per-user files are *$HOME/.ssh/config*.

-o*option*

Pass an option to ssh. The passed option is in the format used by ssh_config(5) (e.g., -oPORT=*nn*, where *nn* is the port number). -o can appear more than once to pass multiple options to ssh. This option is useful for passing options that don't have an equivalent sftp command-line option.

-P *server_path*

Connect directly to the local sftp server specified in *server_path*. Useful for debugging.

-R *num*

Specify the number of requests that may be outstanding at any time (default 16).

-s *subsys*|*server_path*

Specify the SSH2 subsystem or path to the sftp server on the remote system. Specifying the path is useful for using sftp via SSH1 or if the remote sshd does not have an sftp subsystem configured.

-S *program*

Specify the name of a program that understands ssh options and that you want to use for the encrypted connection.

-v

Raise the logging level.

sh

```
sh [options] [file [arguments]]
```

The standard Unix shell, a command interpreter into which all other commands are entered. On modern versions of Linux, this is just another name for the bash shell. For more information, see Chapter 6. For legacy Linux versions and other Unix flavors, be careful not to rely on sh and bash being equivalent.

sha1sum

```
sha1sum [option] [files]
sah1sum [option] --check [file]
```

Compute or check 160-bit SHA1 checksums to verify file integrity. If the file is not specified, or specified as -, read from standard input.

Options

-b, --binary

Read files in binary mode. The default on DOS or Windows.

-c, --check

Check the SHA1 sum and file information in the *file* argument (or standard input) against the corresponding files and verify that they are consistent. The input must have been generated by an earlier sha1sum command.

--help

Print usage information and exit.

--status

Don't generate output messages; the exit code indicates success or failure. Used only with--

check.

--string=*string*

Compute the SHA1 sum for the specified string. This option does not take a*file* argument. Put quotes around the string if it contains spaces.

-t, --text

Read files in text mode. The default.

--version

Print version information and exit.

-w, --warn

Warn about improperly formatted checksum lines. Used only with--check.

showkey

showkey [*options*]

Print keycodes, scancodes, or ASCII codes of keys pressed on the keyboard. The default is to show keycodes. In keycode and scancode mode, the program terminates 10 seconds after the last key is pressed. In ASCII mode, press Ctrl-D to exit. This command may not function properly under the X Window System, which also reads from the console device.

Options

-a, --ascii

Print the ASCII character, decimal, octal, and hexadecimal values of keys pressed.

-h, --help

Print version number and help message, then exit.

-k, --keycodes

Print keycodes associated with key-press events. This is the default mode.

-s, --scancodes

Print the keyboard scancodes associated with key-press events.

showmount

showmount [*options*] [*host*]

NFS/NIS command. Show information about an NFS server. This information is maintained by the mountd server on *host*. The default value for *host* is the value returned by hostname. With no options, show the clients that have mounted directories from the host.showmount is usually found in */usr/sbin*, which is not in the default search path.

Options

-a, --all

Print all remote mounts in the format *hostname:directory*, where *hostname* is the name of the client and *directory* is the root of the filesystem that has been mounted.

-d, --directories

List directories that have been remotely mounted by clients.

-e, --exports

Print the list of exported filesystems.

-h, --help

Provide a short help summary.

--no-headers

Do not print headers.

-v, --version

Report the current version of the program.

shred

`shred [options] files`

Overwrite a file to make the contents unrecoverable, and delete the file afterward if requested.

Options

-

Shred standard output.

-f, --force

Force permissions to allow writing to *files*.

--help

Print help message and exit.

-n*num*, --iterations=*num*

Overwrite files *num* times (default is 25).

-s*num*, --size=*num*

Shred *num* bytes. *num* can be expressed with suffixes (e.g., K, M, or G).

-u, --remove

Remove file after overwriting. shred does not remove the file unless this option is specified.

-v, --verbose

Verbose mode.

--version

Print version information and exit.

-x, --exact

Shred the exact file size; do not round up to the next full block.

-z, --zero

On the final pass, overwrite with zeros to hide the shredding.

shutdown

shutdown [*options*] *when* [*message*]

System administration command. Terminate all processing.*when* may be a specific time (in *hh*:*mm* format), a number of minutes to wait (in +*m* format), or now. A broadcast *message* notifies all users to log off the system. Processes are signaled withSIGTERM to allow them to exit gracefully. */etc/init* is called to perform the actual shutdown, which consists of placing the system in runlevel 1. Only privileged users can execute theshutdown command, although init may call shutdown with root privileges when the Ctrl-Alt-Del key combination is pressed from the console keyboard. Broadcast messages, default or defined, are displayed at regular intervals during the grace period; the closer the shutdown time, the more frequent the message.

Options

-a

When called from init, shut down only if one of the users listed in the file*/etc/shutdown.allow* is currently logged in.

-c

Cancel a shutdown that is in progress.

-f

Reboot fast, by suppressing the normal call tofsck when rebooting.

-F

Force a filesystem check (fsck) on reboot.

-h

Halt the system when shutdown is complete.

-k

Print the warning message, but suppress actual shutdown.

-r

Reboot the system when shutdown is complete.

-t *num*

Ensure a *num*-second delay between killing processes and changing the runlevel.

size

```
size [options] [objfile...]
```

Print the number of bytes of each section of *objfile* and its total size. If *objfile* is not specified, *a.out* is used.

Options

-d

Display the size in decimal and hexadecimal.

--format=*format*

Imitate the size command from either System V (--format sysv) or BSD (--format berkeley).

--help

Print help message, then exit.

-o

Display the size in octal and hexadecimal.

--radix=*num*

Specify how to display the size: in hexadecimal and decimal (if*num* is 10 or 16) or hexadecimal and octal (if *num* is 8).

-t, --totals

Show object totals. Works only with Berkeley format listings.

--target=*bfdname*

Specify object format by binary file descriptor name. Use-h for a list of supported object formats.

-x

Display the size in hexadecimal and decimal.

-A

Imitate System V's size command.

-B

Imitate BSD's size command.

-V, --version

Print version, then exit.

skill

```
skill [signal] [options] processes
snice [priority] [options] processes
```

Send a signal to *processes*, or reset the priority. The default signal for skill is TERM, and the default priority for snice is +4 but can be in the range +20 (slowest) to -20 (fastest). The selection options -c, -p, -t, and -u are not required, but can be specified to insure that *processes* are interpreted correctly.

Options

-c

The next argument is a command.

-i

Use interactive mode.

-l, -L

List available signals.

-n

Display the process ID, but take no other action.

-p

The next argument is a process ID.

-t

The next argument is a tty or pty.

-u

The next argument is a username.

-v

Verbose mode.

-V

Show version information and exit.

slabtop

`slabtop [`*`options`*`]`

Display kernel slab cache information in real time. `slabtop` displays a listing of the top caches as sorted by a given sort criteria.

Options

`-d n, --delay=`*`n`*

Refresh the display every *n* seconds. By default, the display is refreshed every three seconds.

`-s S, --sort=`*`S`*

Sort by *S*, where *S* is one of the following sort criteria:

a

Sort by the number of active objects in each cache.

b

Sort by the number of objects per slab.

c

Sort by cache size.

l

Sort by the number of slabs in each cache.

n

Sort by the name of each cache.

o

Sort by the number of objects in each cache (this is the default).

p

Sort by the number of pages per slab.

s

Sort by the size of objects in each cache.

u

Sort by cache utilization.

v

Sort by the number of active slabs.

-o, --once

Display once and then exit.

--help

Display usage information and then exit.

-V, --version

Display version information and then exit.

slattach

```
slattach [options] [tty]
```

TCP/IP command. Attach serial lines as network interfaces, thereby preparing them for use as point-to-point connections. Only a privileged user may attach or detach a network interface.

Options

-c *command*

Run *command* when the connection is severed.

-d

Debugging mode.

-e

Exit immediately after initializing the line.

-h

Exit when the connection is severed.

-l

Create UUCP-style lockfile in */var/spool/uucp*.

-L

Enable three-wire operation.

-m

Suppress initialization of the line to 8-bit raw mode.

-n

Similar to **mesg -n**.

-p *protocol*

Specify *protocol*, which may be **slip**, **adaptive**, **ppp**, or **kiss**.

-q

Quiet mode; suppress messages.

`-s` *speed*

Specify line speed.

sleep

```
sleep amount[units]
sleep option
```

Wait a specified *amount* of time before executing another command. *units* may be s (seconds), m (minutes), h (hours), or d (days). The default for *units* is seconds.

Options

`--help`

Print usage information and exit.

`--version`

Print version information and exit.

slocate

```
slocate [options] string
```

Securely search database(s) of filenames and print matches. Works like `locate`, but it also stores file permissions and ownership information so users cannot see files to which they don't have access. In some distributions, `locate` is actually a symbolic link to `slocate`.

Options

`-c`

Check the configuration file, */etc/updatedb.conf*, when updating the database.

-d *path*, --database=*path*

Specify the path to the database(s) to search.

-e *dirs*

Omit the specified directories from the database. Used with -u or -U.

-f *fstypes*

Omit the files on the specified filesystems from the database.

-h, --help

Display help information and exit.

-i

Perform a case-insensitive search.

-l *level*

Specify security level. If *level* is 0, turn off security checking to speed up searches. If *level* is 1, turn on checking. The default is 1.

-n *num*

Limit the number of results to *num*.

-o *file*, --output=*file*

Specify the database file to create with -u or -U.

-q

Run in quiet mode, suppressing error messages.

-r *regexp*, --regexp=*regexp*

Search the database using the specified POSIX regular expression.

-u

Create an slocate database starting at /.

-U *dir*

Create an slocate database starting at the specified directory.

-v, --verbose

Run in verbose mode, displaying the files when creating the database.

-V, --version

Print version information and exit.

snice

`snice [priority] [options] processes`

Reset the priority for *processes*. The default priority is +4. See skill for the possible options.

sort

`sort [options] [files]`

Sort the lines of the named *files*. Compare specified fields for each pair of lines; if no fields are specified, compare them by byte, in machine-collating sequence. If no files are specified or if the file is -, the input is taken from standard input. See also uniq, comm, and join.

Options

-b, --ignore-leading-blanks

Ignore leading spaces and tabs.

-c, --check

Check whether *files* are already sorted and, if so, produce no output.

-d, --dictionary-order

Sort in dictionary order.

-f, --ignore-case

Fold; ignore uppercase/lowercase differences.

-g, --general-numeric-sort

Sort in general numeric order.

--help

Print a help message and then exit.

-i, --ignore-nonprinting

Ignore nonprinting characters (those outside ASCII range 040-176).

-k *n*[,*m*], --key=*n*[,*m*]

Skip *n*-1 fields and stop at *m*-1 fields (i.e., start sorting at the *n*th field, where the fields are numbered beginning with 1).

-n

Sort in arithmetic order.

-ofile, --output=*file*

Put output in *file*.

-m, --merge

Merge already sorted input files.

-r, --reverse

Reverse the order of the sort.

-s, --stable

Stabilize sort by disabling last-resort comparison.

-t*c*, --field-separator=*c*

Separate fields with *c* (default is a tab).

-u, --unique

Identical lines in input file appear only one time in output.

-z, --zero-terminated

End lines with zero byte, not with newline.

--version

Print version information and then exit.

-M, --month-sort

Attempt to treat the first three characters as a month designation (JAN, FEB, etc.). In comparisons, treat JAN < FEB and any invalid name for a month as less than a valid month.

-S*size*, --buffer-size=*size*

Set the size of the main memory buffer to *size*, which may include a suffix e.g., K (1024, the default) or M.

-T *tempdir*, --temporary-directory=*dir*

Directory pathname to be used for temporary files.

Examples

List files by decreasing number of lines:

```
wc -l * | sort -r
```

Alphabetize a list of words, remove duplicates, and print the frequency of each word:

```
sort -fd wordlist | uniq -c
```

Sort the password file numerically by the third field (user ID):

```
sort -nk3,4 -t: /etc/passwd
```

split

```
split [options] [infile [prefix]]
```

Split *infile* into equal-sized segments. *infile* remains unchanged, and the results are written to *prefix*aa, *prefix*ab, and so on. The default prefix is x, giving the output files xaa, xab, etc. If *infile* is - or missing, standard input is read. See also csplit.

Options

-a *n*, --suffix-length=*n*

Use suffixes of length *n* (default is 2).

-b *n*[b|k|m], --bytes=*n*[b|k|m]

Split *infile* into *n*-byte segments. Alternate block sizes may be specified:

b

512 bytes.

k

1 kilobyte.

m

1 megabyte.

-C *bytes*[b|k|m], --line-bytes=*bytes*[b|k|m]

Put a maximum of *bytes* into file; insist on adding complete lines.

-d, --numeric-suffixes

Use numeric suffixes instead of alphabetic suffixes for the output filenames.

-*n*, -l *n*, --lines=*n*

Split *infile* into *n*-line segments (default is 1000).

--help

Print a help message and then exit.

--verbose

Print a message for each output file.

--version

Print version information and then exit.

Examples

Break *bigfile* into 1000-line segments:

```
split bigfile
```

Concatenate four files, then split them into 10-line files named*new.aa*, *new.ab*, and so on. Note that without the -, `new.` would be treated as a nonexistent input file:

```
cat list[1-4] | split -10 - new.
```

ssh

```
ssh [options] hostname [command]
```

Securely log a user into a remote system and run commands on that system. The version of ssh described here is the OpenSSH client. ssh can use either Version 1 (SSH1) or Version 2 (SSH2) of the SSH protocol. SSH2 is preferable, as it provides stronger encryption methods and greater connection integrity. The hostname can be specified either as *hostname* or as user@hostname. If a command is specified, the user is authenticated, the command is executed, and the connection is closed. Otherwise, a terminal session is opened on the remote system. See "Escape characters," later in this section, for functions that can be supported through an escape character. The default escape character is a tilde (~). The exit status returned from ssh is the exit status from the remote system, or 255 if there was an error.

Commonly, authentication is handled with standard username/password credentials, but it can also be useful to authenticate with a key exchange. This is done by generating a key on the client with ssh-keygen and populating the *known_hosts* file on the remote host.

Options

-1

Try only SSH1.

-2

Try only SSH2.

-4

Use only IPv4 addresses.

-6

Use only IPv6 addresses.

-a

Disable forwarding of the authentication agent connection.

-A

Allow forwarding of the authentication agent connection. Can also be specified on a per-host basis in a configuration file.

-b *bind_address*

Specify the interface to transmit from when there are multiple available interfaces or aliased addresses.

-c blowfish|3des|des|*ciphers*

Select the cipher for encrypting the session. The default is3des. For SSH2, a comma-separated list of *ciphers* can also be specified, with the ciphers listed in order of preference. des is supported only for legacy SSH1 compatibility and otherwise should not be used.

-C

Enable compression. Useful mainly for slow connections. The default compression level can be set on a per-host basis in the configuration file with theCompressionLevel option.

-D *port*

Enable dynamic application-level port forwarding using*port* on the local side. Can be specified in the configuration file. Only root can forward privileged ports.

-e *char*|^char|none

Set the escape character (default ~). The escape character must be the first character on a line. If none is specified, disable the use of an escape character.

-f

Run interactively for user authentication, then go into background mode for command execution. Implies -n.

-F *configfile*

Specify a per-user configuration file (default is*$HOME/.ssh/config*).

-g

Allow remote hosts to connect to local forwarded ports.

-i *idfile*

Use *idfile* to read identity (private key) for RSA or DSA authentication. Default is

$HOME/.ssh/id_rsa or *$HOME/.ssh/id_dsa* for SSH2, or *$HOME/.ssh/identity* for SSH1. You can specify more than one -i option on the command line or in the configuration file.

-I *device*

Specify a smartcard *device* from which to get the user's private RSA key.

-k

Disable Kerberos ticket and AFS token forwarding. Can be set on a per-host basis in the configuration file.

-l *user*

Log in as *user* on the remote system. Can be specified on a per-host basis in the configuration file.

-L *port:host:hostport*

Forward *port* on the local host to the specified remote host and port. Can be specified in the configuration file. Only root can forward privileged ports. For IPv6, an alternative syntax is *port/host/hostport*.

-m *macspec*

For SSH2, the contents of *macspec* specify message authentication code (MAC) algorithms to use. *macspec* is a comma-separated list of algorithms in order of preference.

-M

Put the ssh client into master mode for connection sharing.

-n

Get standard input as a redirection from */dev/null*. Used to prevent reading from standard input, which is required when running ssh in the background. Useful for running X programs or a remote host.

-N

Do not execute a remote command. Useful with SSH2 for port forwarding.

-o *option*

Specify options in configuration-file format. Useful for specifying options that have no

command-line equivalent.

-p *port*

Specify the port on the remote host to which ssh is to connect. Can be specified on a per-host basis in the configuration file.

-q

Run quietly, suppressing warnings and error messages.

-R *port:host:hostport*

Forward *port* on the remote host to the local *host:hostport*. Can be specified in the configuration file. You can forward privileged ports only if you are logged in as root on the remote host. For IPv6, an alternative syntax is *port/host/hostport*.

-s

For SSH2, request invocation of a subsystem on the remote host to be used for another application, such as sftp. The desired subsystem is specified as the remote command.

-S *ctl*

Specify the location of a control socket for connection sharing.

-t

Force pseudo-tty allocation. Multiple -t options can be specified to force tty allocation even when ssh has no local tty.

-T

Disable pseudo-tty allocation.

-v

Verbose mode. Useful for debugging. Specify multiple-v options to increase verbosity.

-V

Display version information and exit.

-x

Disable X11 forwarding.

-X

Enable X11 forwarding. Can be specified on a per-host basis in the configuration file.

-Y

Enable trusted X11 forwarding.

Escape characters

~.

Disconnect.

~~

Send a single ~.

~#

List forwarded connections.

~&

Run ssh in the background at logout, while waiting for a forwarded connection or X11 sessions to terminate.

~?

Display the available escape characters.

~B

Send a BREAK to the remote system. Only for SSH2 and if the remote system supports it.

~C

Open a command line. Useful for adding port forwardings when using the-L and -R options.

~R

Request rekeying of the connection. Useful only for SSH2 and if the peer supports it.

~ ^ Z

Suspend the connection.

Environment variables

DISPLAY

Set by SSH to *hostname:n* for forwarding X11 connections. *hostname* is the host where the shell is running, and *n* is an integer greater than zero.

HOME

The path to the user's home directory.

LOGNAME

The same as USER; set only for compatibility with systems that use LOGNAME.

MAIL

The path to the user's mailbox.

PATH

The default PATH as specified when SSH was compiled.

SSH_ASKPASS

Can be set to the name of a program to run to open an X11 window and read the user's passphrase if ssh does not have an associated terminal.

SSH_AUTH_SOCK

The path of a Unix-domain socket for communicating with the agent.

SSH_CONNECTION

Four space-separated values that contain the client IP address, the client port number, the server IP address, and the server port number.

SSH_ORIGINAL_COMMAND

The original command line, including arguments, if a forced command is executed.

SSH_TTY

The path to the tty device associated with the current shell or command. Not set if there is no associated tty.

TZ

The time zone, passed from the SSH daemon, if it was set when the daemon was started.

USER

The name of the user logging in.

Files

ssh uses the following files in the user's home directory:

$HOME/.rhosts

Lists host/user pairs allowed to log in. Used with rhosts authentication.

$HOME/.shosts

Like *.rhosts*, but allows *rhosts* authentication without permitting login with rlogin or rsh.

$HOME/.ssh/authorized_keys

Lists RSA/DSA public keys that can be used to log in as this user.

$HOME/.ssh/config

The user's configuration file.

$HOME/.ssh/environment

Additional environment variable definitions.

$HOME/.ssh/identity, *$HOME/.ssh/id_dsa*, *$HOME/.ssh/id_rsa*

The authentication identity of the user for SSH1 RSA, SSH2 DSA, and SSH2 RSA, respectively.

$HOME/.ssh/identity.pub, *$HOME/.ssh/id_dsa.pub*,

$HOME/.ssh/id_rsa.pub

The public key for user authentication for SSH1 RSA, SSH2 DSA, and SSH2 RSA, respectively.

$HOME/.ssh/known_hosts

Contains host keys for all hosts the user has logged into that are not already in the systemwide file at */etc/ssh/ssh_known_hosts*.

$HOME/.ssh/rc

Contains commands executed by ssh after the user has logged in but before the shell or command is started.

ssh-add

```
ssh-add [options] [files]
ssh-add -e|-s reader
```

Add RSA or DSA identities to the authentication agent (seessh-agent), which must be running and must be an ancestor of the current process. ssh-add reads the files created by ssh-keygen for private keys. It reads the information in these private keys to obtain RSA or DSA identities. With no arguments specified, ssh-add adds the files *$HOME/.ssh/id_rsa*, *$HOME/.ssh/id_dsa*, and *$HOME/.ssh/identity*. If any *files* are specified, it adds those instead, prompting for a passphrase if required.

Options

-c

Confirm identities being added, by running the program specified in the SSH_ASKPASS environment variable (see the ssh command). A 0 exit status from the program indicates successful confirmation.

-d

Remove an identity from the agent instead of adding one.

-D

Delete all identities from the agent.

-e *reader*

Remove key in specified smartcard reader.

-l

List fingerprints of all identities known to the agent.

-L

List public key parameters of all identities known to the agent.

-s *reader*

Add key in smartcard *reader*.

-t *life*

Set maximum lifetime when adding identities to an agent. The value of*life* can be in seconds or another time format specified in sshd.

-x

Lock the agent with a password.

-X

Unlock the agent.

ssh-agent

```
ssh-agent [options] [command [arguments]]
```

Hold private keys used for public key authentication. `ssh-agent` is usually executed at the beginning of an X or login session; then all other windows or programs given as *command* are run as clients of `ssh-agent`. When a command is specified, the command and any arguments are executed. The agent dies when the command completes. Use `ssh-add` to add keys (identities) to the agent. Operations that require a private key are performed by the agent, which returns the results to the requestor. When using `ssh-agent`, you must specify a shell for example:

```
$ ssh-agent /bin/bash
```

You can then use `ssh-add` to add identities.

Options

`-a` *bind_addr*

Bind the agent to the socket *bind_addr* (default is */tmp/ssh-nnnnnnnn/agent*, where *nnnnnnnn* is a generated number).

`-c`

Write `csh` commands to standard output. This is the default if the environment variable SHELL looks like a `csh`-type shell.

`-d`

Debug mode.

`-k`

Kill the current agent.

`-s`

Write Bourne shell commands to standard output. This is the default if the environment variable SHELL does not look like a `csh`-type command.

`-t` *life*

Set a default value for maximum identity lifetime for added identities. May be specified in seconds or in a format specified in `sshd(8)`. This value can be overridden by a lifetime

specified for an identity with `ssh-add`. The default maximum lifetime is forever.

ssh-keygen

`ssh-keygen [`*`options`*`]`

Generate, manage, and convert authentication keys for `ssh`. When using `ssh-keygen` to create a key, the `-t` option must be specified to identify the type of key to create.

Options

`-b` *bits*

Specify the number of bits in the key. The minimum is 512, and the default is 1024.

`-B`

Show the bubblebabble digest (a digest represented as a string that looks like real words) for the private or public keyfile specified with `-f`.

`-c`

Change the comment in the private and public keyfiles (for RSA1 keys only).

`-C` *comment*

Specify the new comment.

`-D` *reader*

Download the RSA public key from the smartcard in *reader*.

`-e`

Read an OpenSSH private or public keyfile and write it in SECSH Public Key File Format to standard output for exporting to a commercial SSH.

`-f` *file*

Specify the filename of the keyfile.

-i

Read an SSH2-compatible unencrypted private or public keyfile and write an OpenSSH-compatible key to standard output. Used to import keys from a commercial SSH.

-l

Show fingerprint of public or private RSA1 keyfile specified with-f.

-N *passphrase*

Specify the new passphrase.

-p

Change the passphrase for a private keyfile. Prompt for the file, the old passphrase, and twice for the new passphrase.

-P *passphrase*

Specify the old passphrase.

-q

Operate in quiet mode.

-t *type*

Specify the type of key to create. Possible values of*type* are rsa1 for SSH1, and rsa or dsa for SSH2.

-U *reader*

Upload an existing RSA private key to the smartcard in*reader*.

-y

Read a private OpenSSH-format file and print a public key to standard output.

ssh-keyscan

`ssh-keyscan [`*`options`*`]`

Gather public and private host keys from a number of hosts. Can be used in scripts.

Options

-4

Use IPv4 addresses only.

-6

Use IPv6 addresses only.

-f *file*

Read hostnames or *addrlist namelist* pairs from *file*. If - is specified instead of a filename, read hosts or *addrlist namelist* pairs from standard input.

-p *port*

Specify the port to connect to on the remote host.

-t *type*

Specify the type of key to get from the scanned hosts. Possible values arersa1 for SSH1 (default), or rsa or dsa for SSH2. Specify multiple values in a comma-separated list.

-T *timeout*

Specify the timeout for attempting a connection, in seconds.

-v

Verbose mode.

sshd

```
sshd [options]
```

TCP/IP command. Server for the ssh program, providing a secure remote-login and remote-execution facility equivalent to rlogin and rsh. Normally started at boot, sshd listens for incoming connections, forking a new daemon when one is detected. The forked daemon handles authentication, command execution, and encryption. Most implementations ofsshd support both SSH protocols 1 and 2. The following options are those used by OpenSSH, OpenBSD's Secure Shell implementation.

Options

-4

Use only IPv4 addresses.

-6

Use only IPv6 addresses.

-b *bits*

Use the specified number of *bits* in the server key. Default is 768.

-d

Run sshd in the foreground and send verbose debug information to the system log. Process only one connection. Use the specified number of*bits* in the server key. This option may be specified from one to three times. Each additional-d increases the level of information sent to the system log.

-D

Do not detach from the foreground process.

-e

Send output to standard error instead of the system log.

-f *file*

Read configuration information from *file* instead of the default configuration file */etc/ssh/sshd_config*.

-g *seconds*

Set the grace time a client has to authenticate itself before the server disconnects and exits. The default is 600 seconds. A value of 0 means there is no limit.

-h *keyfile*

Read the host's cryptographic key from the specified *keyfile* instead of from the default file */etc/ssh/ssh_host_key* for SSH protocol 1, and the default files */etc/ssh/ssh_host_rsa_key* and */etc/ssh/ssh_host_dsa_key* for SSH protocol 2. The -h option may be given more than once to specify multiple keyfiles.

-i

Use when running sshd from inetd.

-k *seconds*

Set how often the Version 1 server key should be regenerated. Default value is 3600 seconds. If set to 0 seconds, the key will never be regenerated.

-o *setting*

Pass a configuration file setting as an option.

-p *port*

Listen for connections on *port*. The default is 22. More than one -p option may be specified. This option overrides ports specified in a configuration file.

-q

Send no messages to the system log.

-t

Test configuration files and keys, then exit.

-u *namelength*

Specify the length of the remote hostname field in the UTMP structure as specifed in *utmp.h*. A *namelength* of 0 will cause sshd to write dotted decimal values instead of hostnames to the *utmp* file and prevent DNS requests unless required by the authentication mechanism.

stat

`stat [options] files`

Print out the contents of an inode as they appear to the `stat` system call in a human-readable format. The error messages "Can't stat file" and "Can't lstat file" usually mean the file doesn't exist. "Can't readlink file" generally indicates that something is wrong with a symbolic link.

Options

-c *format*, --format=*format*

Display the output as specified by *format*.

-f, --filesystem

Display information about the filesystem where the file is located, not about the file itself.

--help

Display help information and exit.

-L, --dereference

Follow links and display information about the files found.

-t

Print the output tersely, in a form suitable for parsing by other programs.

--version

Print version information and exit.

Output

`stat` and `stat -L` display the following:

- Device number
- Inode number
- Access rights
- Number of hard links
- Owner's user ID and name, if available
- Owner's group ID and name, if available
- Device type for inode device
- Total size, in bytes
- Number of blocks allocated
- I/O block size
- Last access time
- Last modification time
- Last change time
- Security context for SELinux

If -f is specified, stat displays the following information about the filesystem:

- Filesystem type
- Filesystem block size
- Total blocks in the filesystem
- Number of free blocks
- Number of free blocks for nonroot users
- Total number of inodes
- Number of free inodes
- Maximum filename length

Format

The printf(3) flag characters #, 0, -, +, and space can be used in *format*. In addition, the field width and precision options can be used.

If -c *format* is specified, the following sequences can be used for *format*:

%a

Access rights in octal.

%A

Access rights in human-readable form.

%b

Number of blocks allocated.

%B

Size in bytes of each block reported by %b.

%d

Device number in decimal.

%D

Device number in hex.

%f

Raw mode in hex.

%F

File type.

%g

Owner's group ID.

%G

Owner's group name.

%h

Number of hard links.

%i

Inode number.

%n

Filename.

%N

Quoted filename. If file is a symbolic link, include path to original.

%o

I/O block size.

%s

Total size, in bytes.

%t

Major device type in hex.

%T

Minor device type in hex.

%u

Owner's user ID.

%U

Owner's username.

%x

Last access time.

%X

Last access time as seconds since the Epoch.

%y

Last modification time (modification of the file contents).

%Y

Last modification time as seconds since the Epoch.

%z

Time of last change (modification of the inode).

%Z

Time of last change as seconds since the Epoch.

If both -c *format* and -f are specified, the following sequences can be used for*format*:

%a

Free blocks available to nonroot user.

%b

Total data blocks in filesystem.

%c

Total file nodes in filesystem.

%d

Free file nodes in filesystem.

%f

Free blocks in filesystem.

%i

Filesystem ID, in hex.

%l

Maximum filename length.

%n

Filename.

%s

Optimal transfer block size.

%t

Type in hex.

%T

Type in human-readable form.

Examples

Sample output from the command `stat /`:

```
stat /
  File: "/"
  Size: 4096              Blocks: 8          IO Block: 4096   Directory
Device: 303h/771d       Inode: 2           Links: 19
Access: (0755/drwxr-xr-x)  Uid: (    0/    root)   Gid: (    0/    root)
Access: Thu Jan  2 04:02:40 2003
Modify: Wed Jan  1 23:03:20 2003
Change: Wed Jan  1 23:03:20 2003
```

Sample output with `-f`, displaying information about the filesystem:

```
stat -f /
  File: "/"
    ID: 0        0        Namelen: 255     Type: ext2/ext3
Blocks: Total: 2612475    Free: 1869472    Available: 1736735    Size: 4096
Inodes: Total: 1329696    Free: 1150253
```

statd

`rpc.statd [options]`

System administration command. The NFS status server, `statd`, reports server status to clients like the `rup` command.

Options

`-d`

Debugging mode; log verbose information to standard error.

`-F`

Run `statd` in the foreground.

`-n` *hostname*, `--name` *hostname*

Specify a name to use for the local hostname. By default, this is read using the `gethostname` function.

`-o` *port*, `--outgoing-port` *port*

Specify the *port* that `statd` should use for its outgoing requests to other servers. When not specified, a port is assigned by `portmap`.

`-p` *port*, `--port` *port*

Specify the incoming *port* that `statd` should listen on. When not specified, a port is assigned by `portmap`.

`-P` *directory*, `--state-directory-path` *directory*

Store state information in *directory* instead of the default, */var/lib/nfs*.

`-V`

Print version information, then exit.

-?

Print help message, then exit.

strace

```
strace [options] command [arguments]
```

Trace the system calls and signals for *command* with optional *arguments*. strace shows you how data is passed between the program and the kernel. With no options, strace prints a line for each system call. It shows the call name, given arguments, return value, and any generated error messages. A signal is printed with both its signal symbol and a descriptive string. As it shows the data transfer between user and kernel-space, strace is very useful as both a diagnostic utility for system administrators and a debugging tool for programmers. By default, the output is written to standard error.

Options

-a *n*

Align the return values in column *n*. The default is 40.

-c

Count system calls, errors, signals, and time and provide a summary report when the program has ended.

-d

Debug mode. Print debugging information for strace on stderr.

-e [*keyword*=][!]*values*

Pass an expression to strace to limit the types of calls or signals that are traced or to change how they are displayed. If no *keyword* is given, trace is assumed. The *values* can be given as a comma-separated list. Preceding the list with an exclamation point (!) negates the list. The special *values* all and none are valid, as are the *values* listed with the following *keywords*.

abbrev=*names*

Abbreviate output from large structures for system calls listed in*names*.

read=*descriptors*

Print all data read from the given file*descriptors*.

signal=*symbols*

Trace the listed signal*symbols* (for example, signal=SIGIO,SIGHUP).

trace=*sets*

sets may be a list of system call names or one of the following:

file

Calls that take a filename as an argument.

ipc

Interprocess communication.

network

Network-related.

process

Process management.

signal

signal

Signal-related.

raw=*names*

Print arguments for the given system calls in hexadecimal.

verbose=*names*

Unabbreviate structures for the given system calls. Default isnone.

write=*descriptors*

Print all data written to the given file *descriptors*.

-f

Trace forked processes.

-ff

Write system calls for forked processes to separate files named *filename.pid* when using the -o option.

-h

Print help and exit.

-i

Print the current instruction pointer with each system call.

-o *filename*

Write output to *filename* instead of stderr. If *filename* starts with the pipe symbol |, treat the rest of the name as a command to which output should be piped.

-O *n*

Override strace's built-in timing estimates, and just subtract *n* microseconds from the timing of each system call to adjust for the time it takes to measure the call.

-p *pid*

Attach to the given process ID and begin tracking. strace can track more than one process if more than one option -p is given. Type Ctrl-C to end the trace.

-q

Quiet mode. Suppress attach and detach messages from strace.

-r

Relative timestamp. Print time in microseconds between system calls.

-s *n*

Print only the first *n* characters of a string. Default value is 32.

-S *value*

Sort output of -c option by the given *value*. *value* may be calls, name, time, or nothing. Default is time.

-T

Print time spent in each system call.

-t

Print time of day on each line of output.

-tt

Print time of day with microseconds on each line of output.

-ttt

Print timestamp on each line as the number of seconds and microseconds since the Epoch.

-u *username*

Run command as *username*. Needed when tracing setuid and setgid programs.

-V

Print version and exit.

-v

Verbose. Do not abbreviate structure information.

-x

Print all non-ASCII strings in hexadecimal.

-xx

Print all strings in hexadecimal.

strfile

`strfile [`*`options`*`] `*`input_file`*` [`*`output_file`*`]`
`unstr [-c `*`delimiter`*`] `*`input_file`*`[.`*`ext`*`] [`*`output_file`*`]`

strfile creates a random-access file for storing strings. The input file should be a file containing groups of lines separated by a line containing a single percent sign (or other specified delimiter character). strfile creates an output file that contains a header structure and a table of file offsets fo each group of lines, allowing random access of the strings. The output file, if not specified on the command line, is named *sourcefile.dat*. unstr undoes the work of strfile, printing out the strings contained in the input file in the order they are listed in the header file data. If no output file is specified, unstr prints to standard output; otherwise, it prints to the specified file. unstr can also globally change the delimiter character in a strings file.

Options

Of the following options, only -c can be used with unstr. All other options apply only to strfile.

-c *delimiter*

Change the delimiting character from the percent sign to *delimiter*. Valid for both strfile and unstr.

-i

Ignore case when ordering the strings.

-o

Order the strings alphabetically.

-r

Randomize access to the strings.

-s

Run silently; don't give a summary message when finished.

-x

Set the STR_ROTATED bit in the header `str_flags` field.

strings

`strings [options] files`

Search each *file* specified and print any printable character strings found that are at least four characters long and followed by an unprintable character. Often used to find human-readable content within binary files.

Options

-, -a, --all

Scan entire object files; default is to scan only the initialized and loaded sections for object files.

-e *encoding*, --encoding=*encoding*

Specify the character encoding of the strings to be found. Possible values are:

b

16-bit big-endian

B

32-bit big-endian

l

16-bit little-endian

L

32-bit little-endian

s

Single-7-bit-byte characters, such as ASCII, ISO-8859, etc. (the default)

S

Single-8-bit-byte characters.

-f, --print-file-name

Print the name of the file before each string.

-*min-len*, -n *min-len*, --bytes=min-len

Print only strings that are at least *min-len* characters.

-o

The same as -t o.

-t *base*, --radix=*base*

Print the offset within the file before each string, in the format specified by*base*:

d

Decimal

o

Octal

x

Hexadecimal

--target=*format*

Specify an alternative object code format to the system default. Valid targets includeelf32-i386, a.out-i386-linux, efi-app-ia32, elf32-little, elf32-big, srec, symbolsrec, tekhex, binary, ihex, and trad-core.

--help

Print help message and then exit. The help message includes a list of valid targets.

`-v`, `--version`

Print version information and then exit.

strip

`strip [`*`options`*`]` *`files`*

Remove symbols from object *files*, thereby reducing file sizes and freeing disk space.

Options

`-F`*bfdname*, `--target=`*bfdname*

Specify object format for both input and output by binary file descriptor name*bfdname*. Use option `-h` to see a list of supported formats.

`-I` *bfdname*, `--input-target=`*bfdname*

Expect object format *bfdname* for input.

`--help`

Print help message, then exit.

`-K` *symbol*, `--keep-symbol=`*symbol*

Delete all symbols except the specified*symbol*. This option may be used more than once.

`-N` *symbol*, `--strip-symbol=`*symbol*

Remove *symbol* from the source file.

`-O` *bfdname*, `--output-target=`*bfdname*

Use object format *bfdname* for output.

-o *file*

Write stripped object to *file* instead of replacing the original. Only one object file at a time may be stripped when using this option.

-p, --preserve-dates

Preserve access and modification times.

-R *section*, --remove-section=*section*

Delete *section*.

-S, -g, -d, --strip-debug

Strip debugging symbols.

-s, --strip-all

Strip all symbols.

--strip-unneeded

Remove symbols not needed for relocation processing.

-V, --version

Print version and exit.

-v, --verbose

Verbose mode.

-X, --discard-locals

Strip local symbols that were generated by the compiler.

-x, --discard-all

Strip nonglobal symbols.

stty

```
stty [options] [modes]
```

Set terminal I/O options for the current standard input device. Without options,stty reports the terminal settings that differ from those set by runningstty sane, where ^ indicates the Ctrl key and ^` indicates a null value. Most modes can be negated using an optional- (shown in brackets). The corresponding description is also shown in brackets. Some arguments use non-POSIX extensions; these are marked with *.

Options

-a, --all

Report all option settings.

-F *dev*, --device=*dev*

Open the specified device and use it instead of standard input.

-g, --save

Report settings in stty-readable form (i.e., hex).

--help

Print help message and exit.

--version

Print version information and exit.

Control modes

[-]clocal

[Enable] disable modem control.

[-]cread

[Disable] enable the receiver.

[-]crtscts*

[Disable] enable RTS/CTS handshaking.

cs*bits*

Set character size to *bits*, which must be 5, 6, 7, or 8.

[-]cstopb

[1] 2 stop bits per character.

[-]hup

[Do not] hang up connection on last close.

[-]hupcl

Same as previous.

[-]parenb

[Disable] enable parity generation and detection.

[-]parodd

Use [even] odd parity.

Input modes

[-]brkint

[Do not] signal INTR on break.

[-]icrnl

[Do not] map CR to NL on input.

[-]ignbrk

[Do not] ignore break on input.

[-]igncr

[Do not] ignore CR on input.

[-]ignpar

[Do not] ignore parity errors.

[-]imaxbel*

When input buffer is too full to accept a new character, [flush the input buffer] beep without flushing the input buffer.

[-]inlcr

[Do not] map NL to CR on input.

[-]inpck

[Disable] enable input parity checking.

[-]istrip

[Do not] strip input characters to 7 bits.

[-]iuclc*

[Do not] map uppercase to lowercase on input.

[-]ixany*

Allow [only XON] any character to restart output.

[-]ixoff, [-]tandem

[Enable] disable sending of START/STOP characters.

[-]ixon

[Disable] enable XON/XOFF flow control.

[-]parmrk

[Do not] mark parity errors.

Output modes

bs*n**

Select style of delay for backspaces (0 or 1).

cr*n**

Select style of delay for carriage returns (0-3).

ff*n**

Select style of delay for formfeeds (0 or 1).

nl*n**

Select style of delay for linefeeds (0 or 1).

tab*n*, [-]tabs*

Select style of delay for horizontal tabs (0-3). tabs is the same as tab0 and -tabs is the same as tab3.

vt*n**

Select style of delay for vertical tabs (0 or 1).

[-]ocrnl*

[Do not] map CR to NL on output.

[-]ofdel*

Set fill character to [NULL] DEL.

[-]ofill*

Delay output with [timing] fill characters.

[-]olcuc*

[Do not] map lowercase to uppercase on output.

[-]onlcr*

[Do not] map NL to CR-NL on output.

[-]onlret*

On the terminal, NL performs [does not perform] the CR function.

[-]onocr*

Do not [do] output CRs at column 0.

[-]opost

[Do not] postprocess output.

Local modes

[-]echo

[Do not] echo every character typed.

[-]echoe, [-]crterase

[Do not] echo ERASE character as BS-space-BS string.

[-]echok

[Do not] echo NL after KILL character.

[-]echonl

[Do not] echo NL.

[-]icanon

[Disable] enable canonical input (ERASE, KILL, WERASE, and RPRINT processing).

[-]iexten

[Disable] enable extended functions for input data.

[-]isig

[Disable] enable checking of characters against INTR, SUSPEND, and QUIT.

[-]noflsh

[Enable] disable flush after INTR or QUIT.

[-]tostop*

[Do not] send SIGTTOU when background processes write to the terminal.

[-]xcase*

[Do not] change case on local output.

[-]echoprt, [-]prterase*

When erasing characters, echo them backward, enclosed in \ and /.

[-]echoctl. [-]ctlecho*

Do not echo control characters literally. Use hat notation (e.g., ^Z).

[-]echoke [-]crtkill*

Erase characters as specified by the echoprt and echoe settings (default is echoctl and echok settings).

Control assignments

ctrl-char c

Set control character to *c*. *ctrl-char* is dsusp (flush input and then send stop), eof, eol, eol2 (alternate end-of-line), erase, intr, lnext (treat next character literally), kill, rprnt (redraw line), quit, start, stop, susp, swtch, or werase (erase previous word). *c* can be a literal control character, a character in hat notation (e.g., ^Z), in hex (must begin with 0x), in octal (must begin with 0), or in decimal. Disable the control character with values of^- or undef.

min *n*

Set the minimum number of characters that will satisfy a read until the time value has expired when -icanon is set.

time *n*

Set the number of tenths of a second before reads time out if the min number of characters has not been read when -icanon is set.

line *i**

Set line discipline to *i* (1-126).

Combination modes

[-]cooked

Same as [raw]-raw.

[-]evenp, [-]parity

Same as [-]parenb and cs[8]7.

ek

Reset ERASE and KILL characters to Ctrl-h and Ctrl-u, their defaults.

[-]lcase, [-]LCASE

[Unset] set xcase, iuclc, and olcuc.

[-]nl

[Unset] set icrnl and onlcr. -nl also unsets inlcr, igncr, ocrnl, and onlret, icrnl, onlcr.

[-]oddp

Same as [-]parenb, [-]parodd, and cs7[8].

[-]raw

[Disable] enable raw input and output (no ERASE, KILL, INTR, QUIT, EOT, SWITCH, or output

postprocessing).

sane

Reset all modes to reasonable values.

[-]cbreak

Same as [icanon]-icanon.

[-]pass8

Same as -parenb -istrip cs8.

[-]litout

Same as -parenb -istrip cs8.

[-]decctlq*

Same as -ixany.

crt

Same as echoe echoctl echoke.

dec

Same as echoe echoctl echoke -ixany. Additionally, set INTERRUPT to Ctrl-C, ERASE to Del, and KILL to Ctrl-U.

Special settings

n

Set terminal baud rate to *n* (e.g., 2400).

ispeed *speed*

Specify input speed.

ospeed *speed*

Specify output speed.

rows *rows**

Specify number of rows.

cols *columns*, columns *columns**

Specify number of columns.

size*

Display current row and column settings.

speed

Display terminal speed.

su

```
su [option] [user] [shell_args]
```

Create a shell with the effective user ID *user*. If no *user* is specified, create a shell for a privileged user (i.e., become a superuser). Enter EOF to terminate. You can run the shell with particular options by passing them as *shell_args* (e.g., if the shell runs `bash`, you can specify `-c` *command* to execute *command* via `bash`, or `-r` to create a restricted shell).

Options

-, -l, --login

Go through the entire login sequence (i.e., change to *user*'s environment).

-c *command*, --command=*command*

Execute *command* in the new shell and then exit immediately. If *command* is more than one word, it should be enclosed in quotes. For example:

```
su -c 'find / -name \*.c -print' nobody
```

-f, --fast

Start the shell with the -f option, which suppresses the reading of the *.cshrc* or *.tcshrc* file. Applies to csh and tcsh.

-m, -p, --preserve-environment

Do not reset environment variables.

-s *shell*, --shell=*shell*

Execute *shell*, not the shell specified in */etc/passwd*, unless *shell* is restricted.

--help

Print a help message and then exit.

--version

Print version information and then exit.

Examples

Become root and obtain all of root's user environment:

```
$ su -
```

Become root long enough to restart the Apache httpd web server, then revert to the current user:

```
$ su -c /etc/rc.d/init.d/httpd restart
```

sudo

```
sudo [options] [command]
```

If you are allowed, execute *command* as the superuser. Authorized users of sudo and the commands they are permitted to execute are listed in the sudo configuration file, */etc/sudoers*. If an unauthorized user attempts to run a command, sudo will inform an administrator via email. By default, it will send the message to the root account. Users attempting to run commands are prompted for their password. Once authenticated, sudo sets a timestamp for the user. For five minutes from the timestamp, the user may execute further commands without being prompted for her password. This grace period may be overriden by settings in the */etc/sudoers* file. Also see */etc/sudoers* for configuration examples.

Options

-b

Execute *command* in the background.

-h

Print help message, then exit.

-k

Revoke user's sudo permissions. Similar to -K, but changes user's timestamp to the Epoch instead of revoking it.

-l

List all allowed and forbidden commands for the user on the current host, then exit.

-p *promptstring*

Use the specified *promptstring* to prompt for a password. The string may contain the following escape codes, which will be replaced with the current user's login name and local hostname.

% h

Local hostname without the domain name.

% H

Local hostname with the domain name.

% u

Current user's login name

%U

Login name of the user the command will run under. The default is root.

%%

A single percent (%) character.

-s

Run the shell specified in the SHELL environment variable, or the default shell specified in */etc/passwd*. If a command is given, it should be a shell script and not a binary file.

-u *user*

Run command as the specified *user* instead of the root user. This may also be specified as a user ID number using #*uid*.

-v

Update timestamp for user. Prompt for password if necessary.

-H

Set the HOME environment variable to the home directory of the target user.

-K

Remove user's timestamp.

-L

List parameters that may be set as defaults for a user in the */etc/sudoers* file.

-P

Preserve initial user's group membership.

-S

Read password from standard input instead of from the console.

-V

Print version number, then exit. When run by the root user, printsudo's defaults and the local network address as well.

--

Stop reading command-line arguments.

sum

```
sum [options] files
```

Calculate and print a checksum and the number of (1 KB) blocks for*file*. If no files are specified, or *file* is -, read from standard input. Useful for verifying data transmission.

Options

-r

The default setting. Use the BSD checksum algorithm.

-s, --sysv

Use alternate checksum algorithm as used on System V. The block size is 512 bytes.

--help

Print a help message and then exit.

--version

Print the version number and then exit.

swapoff

`swapoff [options] [devicelist]`

System administration command. Stop making devices and files specified in*devicelist* available for swapping and paging.

Option

`-a`

Consult */etc/fstab* for devices marked `sw`. Use those in place of the *device* argument.

`-h`

Print help message and then exit.

`-V`

Display version number and then exit.

swapon

`swapon [options] devices`

System administration command. Make the listed*devices* available for swapping and paging.

Options

`-a`

Consult */etc/fstab* for devices marked `sw`. Use those in place of the *devices* argument.

`-e`

Used with `-a`. Don't complain about missing devices.

`-h`

Print help message, then exit.

`-p` *priority*

Specify a *priority* for the swap area. Higher priority areas will be used up before lower priority areas are used.

`-s`

Print swap usage summaries, then exit.

`-V`

Print version information, then exit.

sync

```
sync
```

System administration command. Write filesystem buffers to disk. `sync` executes the `sync( )` system call. If the system is to be stopped, `sync` must be called to ensure filesystem integrity. Note that `shutdown` automatically calls `sync` before shutting down the system. `sync` may take several seconds to complete, so the system should be told to `sleep` briefly if you are about to manually call `halt` or `reboot`. Note that `shutdown` is the preferred way to halt or reboot your system, as it takes care of `sync`-ing and other housekeeping for you.

sysctl

```
sysctl [options] [key]
```

System administration command. Examine or modify kernel parameters at runtime using the */proc/sys* filesystem. While many of these kernel keys can be altered by other utilities, `sysctl` provides a single interface to kernel settings.

Options

-a, -A

Display all available values.

-e

Ignore requests for unknown keys.

-n

Print values only, no keynames.

-p

Reset keys from information specified in */etc/sysctl.conf*.

-w *key=value*

Write a new value to the specified key.

sysklogd

`syslogd [options]`

System administration command. sysklogd provides both syslogd and klogd functionality. By default, it is meant to behave exactly like the BSD version ofsyslogd. While the difference should be completely transparent to the user, sysklogd supports an extended syntax. It is invoked as syslogd.

sysklogd logs system messages into a set of files described by the configuration file */etc/syslog.conf*. Each message is one line. A message can contain a priority code, marked by a number in angle brackets at the beginning of the line. Priorities are defined in<*sys/syslog.h*>. syslogd reads from an Internet domain socket specified in */etc/services*. To bring syslogd down, send it a terminate signal. See also klogd.

Options

-a *socket*

Add *socket* to the list of sockets syslogd listens to.

-d

Turn on debugging.

-f *configfile*

Specify alternate configuration file.

-h

Forward messages from remote hosts to forwarding hosts.

-l *hostlist*

Specify hostnames that should be logged with just the hostname, not the fully qualified domair name. Multiple hosts should be separated by a colon (:).

-m *markinterval*

Select number of minutes between mark messages.

-n

Avoid auto-backgrounding. This is needed when startingsyslogd from init.

-p *socket*

Send log to *socket* instead of */dev/log*.

-r

Receive messages from the network using an Internet domain socket with thesyslog service.

-s *domainlist*

Strip off domain names specified in *domainlist* before logging. Multiple domain names should be separated by a colon (:).

-v

Print version number, then exit.

`-x`

Disable domain name lookups for remote messages.

syslogd

`syslogd`

System administration command. See `sysklogd`.

tac

`tac [options] [file]`

Named for the common command `cat`, `tac` prints files in reverse to standard output. Without a filename or with `-`, it reads from standard input. By default, `tac` reverses the order of the lines, printing the last line first.

Options

`-b, --before`

Print separator (by default a newline) before the string it delimits.

`-r, --regex`

Expect separator to be a regular expression.

`-s` *string*, `--separator=`*string*

Specify alternate separator (default is newline).

`--help`

Print a help message and then exit.

--version

Print version information and then exit.

tail

```
tail [options] [files]
```

Print the last 10 lines of each named *file* (or standard input if - is specified) on standard output. If more than one file is specified, the output includes a header at the beginning of each file:

```
=  =>filename<=  =
```

For options that take the number of bytes or lines as an argument, you prepend a plus sign (+) to *num* to begin printing with the *num*th item. These options can also specify a block size:

b

512 bytes

k

1 kilobyte

m

1 megabyte

Options

-c *num*, --bytes *num*

Print the last *num* bytes.

-f, --follow[=name|descriptor]

Don't quit at the end of file; "follow" file as it grows and end when the user presses Ctrl-C. Following by file descriptor is the default, so -f, --follow, and --follow=descriptor are equivalent. Use --follow=name to track the actual name of a file even if the file is renamed, as with a rotated logfile.

-F

Identical to --follow=name --retry.

--help

Print a help message and exit.

-n *num*, --lines=*num*

Print the last *num* lines.

--max-unchanged-stats=*num*

Used with --follow=name to reopen a file whose size hasn't changed after *num* iterations (default 5), to see if it has been unlinked or renamed (as with rotated logfiles).

--pid=*pid*

Used with -f to end when process ID *pid* dies.

-q, --quiet, --silent

Suppress filename headers.

--retry

With -f, keep trying to open a file even if it isn't accessible whentail starts or if it becomes inaccessible later.

-s *sec*, --sleep-interval=*sec*

With -f, sleep approximately *sec* seconds between iterations. Default is 1 second.

-v, --verbose

With multiple files, always output the filename headers.

--version

Print version information and then exit.

Examples

Show the last 20 lines containing instances of .Ah:

```
grep '\.Ah ' file  | tail -20
```

Show the last 10 characters of variable name:

```
echo "$name" | tail -c
```

Print the last two blocks of bigfile:

```
tail -2b bigfile
```

tailf

```
tailf file
```

Print the last 10 lines of a file, then wait for the file to grow.tailf is similar to tail -f, but it does nothing when the file is not growing. Useful for following a logfile, particularly on a laptop when you want to conserve the battery power.

talk

```
talk person [ttyname]
```

Talk to another user. *person* is either the login name of someone on your own machine or user@host on another host. To talk to a user who is logged in more than once, use*ttyname* to indicate the appropriate terminal name. Once communication has been established, the two parties may type

simultaneously, with their output appearing in separate windows. To redraw the screen, type Ctrl-L. To exit, type your interrupt character; talk then moves the cursor to the bottom of the screen and restores the terminal.

talkd

```
talkd [options]
```

TCP/IP command. Remote user communication server. talkd notifies a user that somebody else wants to initiate a conversation. A talk client initiates a rendezvous by sending a CTL_MSG of type LOOK_UP to the server. This causes the server to search its invitation tables for an existing invitation for the client. If the lookup fails, the caller sends an ANNOUNCE message, causing the server to broadcast an announcement on the callee's login ports requesting contact. When the callee responds, the local server responds with the rendezvous address, and a stream connection is established through which the conversation takes place.

Options

-d

Write debugging information to the syslogd logfile.

-p

Log malformed packets to */var/log/talkd.packets*.

tar

```
tar [options] [tarfile] [other-files]
```

Copy *files* to or restore *files* from an archive medium. If any *files* are directories, tar acts on the entire subtree. Options need not be preceded by - (though they may be). The exception to this rule is when you are using a long-style option (such as --modification-time). In that case, the exact syntax is:

```
tar--long-option -function-options files
```

For example:

```
tar --modification-time -xvf tarfile.tar
```

Function options

You must use exactly one of these, and it must come before any other options:

-c, --create

Create a new archive.

-d, --diff, --compare

Compare the files stored in *tarfile* with *other-files*. Report any differences: missing files, different sizes, different file attributes (such as permissions or modification time).

--delete

Delete from the archive. This option cannot be used with magnetic tape.

-r, --append

Append *other-files* to the end of an existing archive.

-t, --list

Print the names of *other-files* if they are stored on the archive (if *other-files* are not specified, print names of all files).

-u, --update

Add files if not in the archive or if modified.

-x, --extract, --get

Extract *other-files* from an archive (if *other-files* are not specified, extract all files).

-A, --catenate, --concatenate

Concatenate a second tar file to the end of the first.

Options

[*drive*][*density*]

Set drive (0-7) and storage density (l, m, or h, corresponding to low, medium, or high). Not available in all versions of tar.

--anchored

Exclude patterns must match the start of the filename (the default).

--atime-preserve

Preserve original access time on extracted files.

-b *n*, --blocking-factor=*n*

Set block size to *n* x 512 bytes.

--backup[=*type*]

Back up files rather than deleting them. If no backup type is specified, a simple backup is made with ~ as the suffix. (See also --suffix.) The possible values of *type* are:

t, numbered

Make numbered backups.

nil, existing

Make numbered backups if there are already numbered backups; otherwise make simple backups.

never, simple

Always make simple backups.

--checkpoint

List directory names encountered.

--exclude=*pattern*

Remove files matching *pattern* from any list of files.

-f *file*, --file=*file*

Store files in or extract files from archive *file*. Note that *file* may take the form *hostname*:*filename*.

--force-local

Interpret filenames in the form *hostname*:*filename* as local files.

-g *file*, --listed-incremental=*file*

Create new-style incremental backup.

--group=*group*

Use *group* as the group for files added to the archive.

-h, --dereference

Dereference symbolic links, and archive the files they point to rather than the symbolic link.

--help

Print help message and exit.

-i, --ignore-zeros

Ignore zero-sized blocks (i.e., EOFs).

--ignore-case

Ignore case when excluding files.

--ignore-failed-read

Ignore unreadable files to be archived. Default behavior is to exit when encountering these.

-j, --I, --bzip

Compress files with bzip2 before archiving them, or uncompress them with bunzip2 before extracting them.

-l, --one-file-system

Do not archive files from other filesystems.

-k, --keep-old-files

When extracting files, do not overwrite files with similar names. Instead, print an error message.

-m, --modification-time, --touch

Do not restore file modification times; update them to the time of extraction.

--mode=*permissions*

Use *permissions* when adding files to an archive. The permissions are specified the same way as for the chmod command.

--newer-mtime=*date*

Add only files whose contents have changed since*date* to the archive.

--no-anchor

Exclude patterns may match anything following a slash.

--no-ignore-case

Do not ignore case when excluding files.

--no-same-permissions

Do not extract permissions information when extracting files from the archive. This is the default for users, and therefore affects only the superuser.

--no-recursion

Do not move recursively through directories.

--no-same-owner

When extracting, create files with yourself as owner.

--no-wildcards

Don't use wildcards when excluding files; treat patterns as strings.

--no-wildcards-match-slash

Wildcards do not match / when excluding files.

--null

Allow filenames to be null-terminated with -T. Override -C.

--numeric-owner

Use the numeric owner and group IDs rather than the names.

-o, --old-archive, --portability

Create old-style archive in Unix V7 rather than ANSI format.

--overwrite

Overwrite existing files and directory metadata when extracting from archive.

--overwrite-dir

Overwrite existing directory metadata when extracting from archive.

--owner=*owner*

Set *owner* as the owner of extracted files instead of the original owner. *owner* is first assumed to be a username, then, if there is no match, a numeric user ID.

-p, --same-permissions, --preserve-permissions

Keep permissions of extracted files the same as the originals.

--posix

Create a POSIX-compliant archive.

--preserve

Equivalent to invoking both the -p and -s options.

--record-size=*size*

Treat each record as having *size* bytes, where *size* is a multiple of 512.

--recursion

Move recursively through directories.

--recursive-unlink

Remove existing directory hierarchies before extracting directories with the same name.

--remove-files

Remove originals after inclusion in archive.

--rsh-command=*command*

Do not connect to remote host with rsh; instead, use *command*.

-s, --same-order, --preserve-order

When extracting, sort filenames to correspond to the order in the archive.

--same-owner

When extracting, create files with the same ownership as the originals.

--show-omitted-dirs

List directories being omitted when operating on an archive.

--suffix=*suffix*

Use *suffix* instead of the default ~ when creating a backup file.

--totals

Print byte totals.

--use-compress-program=*program*

Compress archived files with *program*, or uncompress extracted files with *program*.

-v, --verbose

Verbose. Print filenames as they are added or extracted.

--version

Print version information and exit.

--volno-file=*file*

Use/update the volume number in *file*.

-w, --interactive, --confirmation

Wait for user confirmation (y) before taking any actions.

--wildcards

Use wildcards when excluding files.

--wildcards-match-slash

Wildcards match / when excluding files.

-z, --gzip, --gunzip, --ungzip

Compress files with gzip before archiving them, or uncompress them with gunzip before extracting them.

-B, --read-full-records

Reblock while reading; used for reading from 4.2BSD pipes.

-C *directory*, --directory=*directory*

cd to *directory* before beginning tar operation.

-F *script*, --info-script=*script*, --new-volume-script=*script*

Implies -M (multiple archive files). Run *script* at the end of each file.

-G, --incremental

Create old-style incremental backup.

-K *file*, --starting-file=*file*

Begin tar operation at *file* in archive.

-L *length*, --tape-length=*length*

Write a maximum of *length* x 1024 bytes to each tape.

-M, --multivolume

Expect archive to be multivolume. With -c, create such an archive.

-N *date*, --newer=*date*, --after-date=*date*

Ignore files older than *date*.

-O, --to-stdout

Print extracted files to standard output.

-P, --absolute-names

Do not remove initial slashes (/) from input filenames.

-R, --block-number

Display archive's block number in messages.

-S, --sparse

Treat sparse files more efficiently when adding to archive.

-T *file*, --files-from=*file*

Consult *file* for files to extract or create.

-U, --unlink-first

Remove each existing file from the filesystem before extracting from the archive.

-V *name*, --label=*name*

Name this volume *name*.

-W, --verify

Check archive for corruption after creation.

-X *file*, --exclude-from *file*

Consult *file* for list of files to exclude.

-Z, --compress, --uncompress

Compress files with compress before archiving them, or uncompress them with uncompress before extracting them.

Examples

Create an archive of */bin* and */usr/bin* (c), show the command working (v), and store on the tape in */dev/rmt0*:

```
tar cvf /dev/rmt0 /bin /usr/bin
```

List the tape's contents in a format like ls -l:

```
tar tvf /dev/rmt0
```

Extract the */bin* directory:

```
tar xvf /dev/rmt0 /bin
```

Create an archive of the current directory and store it in a file *backup.tar*:

```
tar cvf - `find . -print` > backup.tar
```

(The - tells tar to store the archive on standard output, which is then redirected.)

Filter an archive through gzip, extracting the contents but leaving the original file compressed:

```
tar xvfz chapters.tar.gz
```

taskset

---

taskset [*options*] [*mask* |*list*] [*pid* |*command* [*args*]]

taskset is used to retrieve or set the processor affinity mask of either an existing process, given its PID, or to run a new a process, given its command name, with a specified affinity mask. The Linux scheduler will then honor the given affinity mask, ensuring that the process in question runs only on allowed processors.

Options

-c, --cpu-list

The affinity mask will be provided in list form, for example, "0,2,5-6," not as a bitmask.

-p, --pid

Set or retrieve the mask of the given PID. Do not start a new process.

-h, --help

Display usage information and then exit.

-V, --version

Display version information and then exit.

tcpd

`tcpd`

TCP/IP command. Monitor incoming TCP/IP requests (such as those for `telnet`, `ftp`, `finger`, `exec`, `rlogin`). Provide checking and logging services; then pass the request to the appropriate daemon.

tcpdump

`tcpdump [options] [expression]`

System administration command. Dump headers and packets of network traffic that match *expression*. The command continues to capture packets until it receives a SIGTERM or SIGINT signal (usually generated by typing the interrupt character `control-C`). When finished, it will generate a report on traffic captured, received, or dropped by the kernel.

Expressions

Create matching expressions using the following primitives followed by an ID or name.

direction

A qualifier indicating whether to match source or destination information. Accepted values are `src`, `dst`, `src or dst`, and `src and dst`. When not specified, the expression will match either source or destination traffic.

protocol

A qualifier restricting matches to a particular kind of packet. Accepted values are:`ether`, `fddi`, `tr`, `wlan`, `ip`, `ip6`, `arp`, `rarp`, `decnet`, `tcp`, and `udp`. If not specified, the match defaults to any appropriate protocol matching type.

type

A qualifier indicating what kind of thing the ID or name references, such as a part of a hostname (`host`), IP address (`net`) or port (`port`). When not specified, the match defaults to `host`.

Options

-A

Print packets in ASCII text.

-c *n*

Exit after receiving *n* packets.

-C *n*

When saving to a file, do not write files larger than*n* million bytes. Open a new file with the same basename appended by a number. Start with the number 1.

-d, -dd, -ddd

Compile and dump the packet-matching code for the given expression, then exit. Use the second form to dump it as a C programming fragment. Use the third form to dump the code in decimal.

-D

Print a list of the available interfaces, then exit.

-e

Print the link-level header on each line.

-F *file*

Read *expression* from the specified *file*.

-i *interface*

Listen on the specified *interface*. If not specified, tcpdump will listen on the lowest-numbered interface available, other than the loopback interface. Useany to listen to all available interfaces.

-l

Line buffer standard out.

-L

Print the data link types for an interface, then exit.

-n, -nn

Print IP addresses instead of converting them to hostnames. Use the second form to leave protocols and port numbers in numeric form, as well.

-N

Print hostnames instead of fully qualified domain names.

-q

Abbreviate output, printing less protocol information.

-r *file*

Read packets from the specified *file*. (You can create such a file with the -w option.)

-s *n*

Read *n* bytes of data from each packet. (The default is 68.)

-S

Print absolute TCP sequence numbers.

-T *n*

Read *n* bytes of data from each packet. (The default is 68.)

-t, -tt, -ttt, -tttt

Change display of timestamp. Use the first form to omit the timestamp from each line. Use the second form to print an unformatted timestamp. Use the third form to print the time in seconds between the current and the previous dump line. The final form prints the date before the timestamp on each dump line.

-u

Print undecoded NFS handles.

-v, -vv, -vvv

Increase the verbosity of the printout. Each additionalv increases the detail of the information printed.

-w *file*

Write the raw packet information to *file* without parsing or printing it. Specify - to write to standard output.

-x,-xx

Print packets in hex. Use the second form to print the packet's link level header in hex as well.

-X,-XX

Print packets in hex and ASCII text. Use the second form to print the packet's link level header in hex and ASCII as well.

-Z *user*

Drop root privileges and change to the specified user. Use the primary group of the specified user.

Examples

Place full packets into a file named *tcpdump.cap* for later analysis:

```
tcpdump -v -w tcpdump.cap -xX -s 0
```

Read all packet headers received on the eth0 interface, except for arp and SSH packets:

```
tcpdump -i eth0 not arp and not port ssh
```

tcpslice

`tcpslice [options] [start [end]] files`

System administration command. Reads and manipulates packet capture files created bytcpdump -

w. Based on timestamps, extract portions of or piece together *files.* Display all packets between the given *start* and *end* times. tcpslice understands most time and date formats. tcpslice also understands a relative time format specified as a unit of timee.g., +1h10m to specify the first hour and ten minutes of packets in the specified *files*. This format is named *ymdhmsu* after the letters it uses to denote units of time: years, months, days, hours, minutes, seconds, and microseconds. If no constraining dates are specified, the command will print out all packets contained in *files*.

Options

-d

Print the start and end time of the specified range, then exit.

-r

Print the time and date of the first and last packet in each file, then exit.

-R

Print the raw timestamp of the first and last packet in each file, then exit.

-t

Print times associated with the first and last packet in each file in *ymdhmsu* format.

-w *file*

Write output to *file* instead of standard output.

tee

```
tee [options] files
```

Accept output from another command and send it both to standard output and to *files* (like a T or fork in the road).

Options

-a, --append

Append to *files*; do not overwrite.

-i, --ignore-interrupts

Ignore interrupt signals.

--help

Print a help message and then exit.

--version

Print version information and then exit.

Example

```
ls -l | tee savefile      View listing and save for later
```

telinit

```
telinit [option] [runlevel]
```

System administration command. Signal `init` to change the system's runlevel. `telinit` is actually just a link to `init`, the ancestor of all processes.

Option

-t *seconds*

Send SIGKILL *seconds* after SIGTERM. Default is 20.

Runlevels

The default runlevels vary from distribution to distribution, but these are standard:

0

Halt the system.

1, s, S

Single user.

6

Reboot the system.

a, b, c

Process only entries in */etc/inittab* that are marked with runlevel a, b, or c.

q, Q

Reread */etc/inittab*.

Check the */etc/inittab* file for runlevels on your system.

telnet

```
telnet [options] [host [port]]
```

Access remote systems. telnet is the user interface that communicates with another host using the Telnet protocol. If telnet is invoked without *host*, it enters command mode, indicated by its prompt, `telnet>`, and accepts and executes commands. Type ? at the command prompt to see the available commands. If invoked with arguments, telnet performs an open command (shown in the following list) with those arguments. *host* indicates the host's official name, alias, or Internet address. *port* indicates a port number (default is the Telnet port).

The Telnet protocol is often criticized because it uses no encryption and makes it easy for snoopers to pick up user passwords. Most sites now use ssh instead.

Options

-a

Automatic login to the remote system.

-b *hostalias*

Use bind to bind the local socket to an aliased address or the address of an interface other than the one that would be chosen by connect.

-c

Disable reading of the user's *.telnetrc* file.

-d

Turn on socket-level debugging.

-e [*escape_char*]

Set initial telnet escape character to *escape_char*. If *escape_char* is omitted, no escape character is predefined.

-f

With Kerberos V5 authentication, allow forwarding of the local credentials to the remote system.

-k *realm*

With Kerberos authentication, obtain tickets for the remote host in*realm*, instead of in the remote host's realm.

-l *user*

When connecting to remote system and if remote system understands ENVIRON, send*user* to the remote system as the value for variable USER. Implies the-a option.

-n *tracefile*

Open *tracefile* for recording the trace information.

-r

Emulate rlogin. The default escape character for this mode is a tilde (~); an escape character followed by a dot causes telnet to disconnect from the remote host; a ^Z instead of a dot

suspends telnet; and a ^] (the default telnet escape character) generates a normal telnet prompt. These codes are accepted only at the beginning of a line.

-x

Turn on data-stream encryption if possible.

-8

Request 8-bit operation.

-E

Disable the escape character functionality.

-F

With Kerberos V5 authentication, allow local credentials to be forwarded to the remote system, including any that were already forwarded to the local environment.

-K

Do not allow automatic login to the remote system.

-L

Specify an 8-bit data path on output.

-X *atype*

Disable the *atype* type of authentication.

telnetd

`telnetd [options]`

TCP/IP command. Telnet protocol server. telnetd is invoked by the Internet server for requests to connect to the Telnet port (port 23 by default). telnetd allocates a pseudo-terminal device for a client, thereby creating a login process that has the slave side of the pseudo-terminal serving as stdin, stdout, and stderr. telnetd manipulates the master side of the pseudo-terminal by implementing the Telnet protocol and by passing characters between the remote client and the login

process.

The Telnet protocol is often criticized because it uses no encryption and makes it easy for snoopers to pick up user passwords. Most sites now use ssh instead.

Options

-a *type*

When compiled with authentication support, this option sets the authentication type. Accepted values are:

debug

Debug authentication code.

none

No authentication required, but accept it if offered. Use login for any further verification needed to access an account.

off

Disable authentication.

user

Allow only authenticated remote users with permission to access their accounts without giving a password.

valid

Allow only authenticated remote users. Use login for any additional verification needed to access an account.

-debug [*port*]

Start telnetd manually instead of through inetd. *port* may be specified as an alternate TCP port number on which to run telnetd.

-D *modifier(s)*

Debugging mode. This allows telnet to print out debugging information to the connection,

enabling the user to see what telnet is doing. Several modifiers are available for the debugging mode:

netdata

Display data stream received by telnetd.

options

Print information about the negotiation of the Telnet options.

ptydata

Display data written to the pseudo-terminal device.

report

Print options information, as well as some additional information about what processing is going on.

-edebug

When compiled with support for encryption, enable encryption debugging code.

-h

Don't print host-specific information until after login is complete.

-U

Refuse connections from IP addresses with no reverse DNS information.

-n

Disable checking for lost connections with TCP keep-alives.

-X *type*

Disable authentication *type*.

test

`test` *`expression`*
`[`*`expression`*`]`

Evaluate an *expression* and, if its value is true, return a zero exit status; otherwise, return a nonzero exit status. In shell scripts, you can use the alternate form [*expression*]. This command is generally used with conditional constructs in shell programs. Also exists as a built-in in most shells.

File testers

The syntax for all of these options is `test` *option file*. If the specified file does not exist, they return false. Otherwise, they test the file as specified in the option description.

`-b`

Is the file block special?

`-c`

Is the file character special?

`-d`

Is the file a directory?

`-e`

Does the file exist?

`-f`

Is the file a regular file?

`-g`

Does the file have the set-group-ID bit set?

`-k`

Does the file have the sticky bit set?

`-L, -h`

Is the file a symbolic link?

`-p`

Is the file a named pipe?

`-r`

Is the file readable by the current user?

`-s`

Is the file nonempty?

`-S`

Is the file a socket?

`-t` [*file-descriptor*]

Is the file associated with *file-descriptor* (or 1, standard output, by default) connected to a terminal?

`-u`

Does the file have the set-user-ID bit set?

`-w`

Is the file writable by the current user?

`-x`

Is the file executable?

`-O`

Is the file owned by the process's effective user ID?

`-G`

Is the file owned by the process's effective group ID?

File comparisons

The syntax for file comparisons is `test` *file1 option file2*. A string by itself, without options, returns true if it's at least one character long.

`-nt`

Is *file1* newer than *file2*? Check modification date, not creation date.

`-ot`

Is *file1* older than *file2*? Check modification date, not creation date.

`-ef`

Do the files have identical device and inode numbers?

String tests

The syntax for string tests is `test` *option string* or `test` *string1* [!]= *string2*.

`-z`

Is the string 0 characters long?

`-n`

Is the string at least 1 character long?

string1 = *string2*

Are the two strings equal?

string1 != *string2*

Are the strings unequal?

Expression tests

Note that an expression can consist of any of the previous tests.

(expression)

Is the expression true?

! *expression*

Is the expression false?

expression -a *expression*

Are the expressions both true?

expression -o *expression*

Is either expression true?

Integer tests

The syntax for integer tests is test *integer1 option integer2*. You may substitute -l *string* for an integer; this evaluates to *string*'s length.

-eq

Are the two integers equal?

-ne

Are the two integers unequal?

-lt

Is *integer1* less than *integer2*?

-le

Is *integer1* less than or equal to *integer2*?

-gt

Is *integer1* greater than *integer2*?

-ge

Is *integer1* greater than or equal to *integer2*?

tftp

```
tftp [options] [host [port]] [-c command]
```

User interface to TFTP (IPv4 Trivial File Transfer Protocol), which allows users to transfer files to and from a remote machine. The remote *host* may be specified, and optionally the *port*, in which case `tftp` uses *host* as the default host for future transfers. The version of `tftp` described here is `tftp-hpa`.

Options

`-c` *command*

Run *command* as though it had been entered at the `tftp` prompt. Must be last on the `tftp` command line.

`-m` *mode*

Set the default transfer mode. Usually used with `-c`.

`-v`

Verbose mode.

`-V`

Print version and configuration information and exit.

Commands

Once `tftp` is running, it issues the prompt:

```
tftp>
```

and recognizes the following commands:

? [*command*...]

help [*command*...]

Print help information. If no command is specified, list the commands and a brief usage message. With a command, list the usage message for that command.

ascii

Shorthand for mode ascii.

binary

Shorthand for mode binary.

connect *hostname* [*port*]

Set the *hostname*, and optionally the *port*, for transfers.

get *filename*

get *remotename localname*

get *filename1 filename2 filename3...filenameN*

Get a file or set of files from the specified remote sources. The filename can be specified as *host:filename* to set both host and filename at the same time. In that case, the last host specified becomes the default for future file transfers.

mode *transfer-mode*

Set the mode for transfers. *transfer-mode* may be ascii, netascii, binary, octet, or image. The default is ascii.

put *filename*

put *localfile remotefile*

put *filename1 filename2...filenameN remote-directory*

Transfer a file or set of files to the specified remote file or directory. The destination can be specified as *host:filename* to set both host and filename at the same time. In that case, the last host specified becomes the default for future file transfers. If*remote-directory* is specified, the remote host is assumed to be a Unix-style system that uses / as the directory path separator.

quit

Exit tftp.

rexmt *retransmission-timeout*

Set the per-packet retransmission timeout, in seconds.

status

Print status information: whether tftp is connected to a remote host (i.e., whether a host has been specified for the next connection), the current mode, whether verbose and tracing modes are on, and the values for *retransmission-timeout* and *total transmission-timeout*.

timeout *total-transmission-timeout*

Set the total transmission timeout, in seconds.

trace

Toggle packet tracing.

verbose

Toggle verbose mode.

tftpd

```
in.tftpd [options] [directories]
```

TCP/IP command. IPv4 Trivial File Transfer Protocol server. in.tftpd is normally started by inetd and operates at the port indicated in the tftp Internet service description in */etc/services*. Only publicly readable files may be accessed. By default, only files that already exist and are publicly writable can

be written. In addition, if any *directories* are specified, access is restricted to files in those directories. The version of tftp described here is tftp-hpa.

Options

-a [*address*][:*port*]

Specify the address and port to listen to when run in standalone mode with-l. By default, use the address and port in */etc/services*.

-B *size*

Do not transmit blocks larger than *size*, a number between 512 and 65464.

-c

Allow new files to be written. The default permissions allow anyone to read and write the files. Use -p or -U to set other permissions.

-l

Run tftpd in standalone mode, not from inetd. This mode ignores -t.

-m *file*

Remap filenames based on rules specified in *file*. Each line in this file should contain an operation, an egrep-style regular expression (regex), and, optionally, a replacement pattern. If the regex matches any part of a filename, the operation is performed. The operation is specified as any of the letters shown in the next section, alone or in combination. Comment lines begin with #. See filename remapping rules below.

-p

Use only normal system access controls for the user specified with-u (the tftpd username).

-r *option*

Never accept the specified RFC 2347 option. The possible options areblksize, blksize2 (not based on a standard; like blksize but the block size must be a power of 2), tsize (transfer size), and timeout.

-s

On startup, change root directory to the directory specified as*directory* on the command line. With -s, only one directory should be specified. Recommended for security and compatibility with certain boot ROMs.

-t *timeout*

Specify how long in seconds the server should wait for a new connection before terminating. Default timeout is 900 (15 minutes). If terminated, inetd spawns a new server when it receives a new request.

-T *timeout*

Wait *timeout* microseconds before retransmitting the first packet.

-u *username*

Specify the name of the tftpd user. The default user is nobody.

-U *umask*

Set the umask for newly created files. Without -p, the default is 0. With -p, it is inherited from the calling process.

-v

Increase verbosity. Specify multiple times for greater verbosity.

-V

Print version and configuration information, and exit.

Filename remapping rules

Use one or more of the following characters to create a single remapping operation.

a

If this rule matches, refuse the request and send an "access denied" error to the client.

e

If this rule matches, execute it and then end rule processing.

g

Repeat the rule until it no longer matches. Used with r.

G

Apply this rule to GET (RRQ) requests only.

i

Use case-insensitive regex matching. The default is for case-sensitive matching.

P

Apply this rule to PUT (WRQ) requests only.

r

Replace the matching substring with the replacement pattern.

s

If this rule matches, execute it and then restart rule processing with the first rule.

~

Invert the regular expression so operation affects filenames that do not match.

The replacement pattern can include the following escape sequences:

\0

The entire string matching the regex.

\1...\9

The strings matched by each of the first nine substrings in the regex.

\e

Cancel the effect of \U or \L.

\i

The IP address of the requesting host, in dotted-quad notation.

\L

Convert letters following this sequence to lowercase.

\U

Convert letters following this sequence to uppercase.

\x

The IP address of the requesting host, in hexadecimal notation.

\\

Literal backslash.

\whitespace

Literal whitespace.

\#

Literal hash mark.

time

```
time [options] command [arguments]
```

Run the specified command, passing it any *arguments*, and time the execution. Note that there is also a shell `time` command, so you might need to specify the full path, usually */usr/bin/time*, to run this version of `time`. `time` displays its results on standard error. The output includes elapsed time, user CPU time, system CPU time, and other information such as memory used and number of I/O operations. The output can be formatted using `printf` format strings specified with the `-f` option or the TIME environment variable.

Options

--

The end of the options. Anything after the -- is treated as the command or one of its arguments.

-a, --append

Used with -o to append the output to *file* instead of overwriting it.

-f *format*, --format=*format*

Specify the output format. Overrides any format specified in the TIME environment variable.

--help

Print help message and exit.

-o *file*, --output=*file*

Send the output from time to the specified file instead of to standard error. If *file* exists, it is overwritten.

-p, --portability

Use portable output format (POSIX).

-v, --verbose

Give verbose output, providing all available information.

-V, --version

Print version information and exit.

Resources

The following resources can be specified in format strings:

c

Number of involuntary context switches because of time slice expiring.

C

Name and arguments of command being timed.

D

Average size of unshared data area, in kilobytes.

e

Elapsed real time, in seconds.

E

Elapsed real time as *hours:minutes:seconds*.

F

Number of major (I/O-requiring) page faults.

I

Number of filesystem inputs.

k

Number of signals delivered to the process.

K

Average total (data+stack+text) memory use, in kilobytes.

M

Maximum resident set size, in kilobytes.

O

Number of filesystem outputs.

p

Average unshared stack size, in kilobytes.

P

Percent of CPU used.

r

Number of socket messages received.

R

Number of minor (recoverable) page faults.

s

Number of socket messages sent.

S

Total CPU seconds used by the system on behalf of the process.

t

Average resident set size, in kilobytes.

U

Total CPU seconds used directly by the process.

w

Number of voluntary context switches.

W

Number of times the process was swapped out of main memory.

x

Exit status of the command.

X

Average shared text size, in kilobytes.

Z

System page size, in bytes.

Example

Time the execution of the command ls -l and display the user time, system time, and exit status of the command:

```
/usr/bin/time -f "\t%U user,\t%S system,\t%x status" ls -Fs
```

tload

```
tload [options] [tty]
```

Display system load average in graph format. If *tty* is specified, print it to that terminal.

Options

-d *delay*

Specify the delay, in seconds, between updates.

-s *scale*

Specify scale (number of characters between each graph tick). A smaller number results in a larger scale.

-V

Print version information and exit.

tmpwatch

```
tmpwatch [options] hours directory
```

System administration command. Recursively remove regular files and directories in*directory* with access times older than *hours*. Specify the directory as an absolute path. This command is usually invoked by cron to remove old files in the */tmp* directory.

Options

-a, --all

Remove all file types.

-c, --ctime

Make decision on last inode change time for files and modification time for directories instead o access time

-d, --nodirs

Do not remove directories.

-f, --force

Force removal of read-only files (similar to rm -f).

-m, --mtime

Make decision on last modification time instead of access time.

-s, --fuser

Before deleting, attempt to use fuser to see if a file is in use.

-t, --test

Verbosely test command, but don't actually remove files.

-u, --atime

Make decision on access time. (This is the default.)

-v, --verbose

Print more details. Use two times to further increase the detail of the output.

`-x, --exclude=`*path*

Skip the specified *path*, the absolute path of a directory or file.

top

`top [`*options*`]`

Provide information (frequently refreshed) about the most CPU-intensive processes currently running You do not need to include a - before options. See ps for explanations of the field descriptors.

Options

`-b`

Run in batch mode; don't accept command-line input. Useful for sending output to another command or to a file.

`-c`

Show command line in display instead of just command name.

`-d` *delay*

Specify delay between refreshes.

`-f`

Add or remove fields or columns.

`-h`

Print a help message and exit.

`-i`

Suppress display of idle and zombie processes.-i is a toggle; top starts with the last

remembered setting.

-n *num*

Update display *num* times, then exit.

-p *pid*

Monitor only processes with the specified process ID.

-s

Secure mode. Disable some (dangerous) interactive commands.

-S

Cumulative mode. Print total CPU time of each process, including dead child processes.

-u *user*

Monitor only processes with the specified effective UID or username.

-U *user*

Monitor only processes with the specified UID or username, matching real, effective, saved, and filesystem ids.

-v

Print version information and exit.

Interactive commands

=

Remove restrictions on which tasks are shown. Reverses the effect of an activei or n command.

space, Enter

Update display immediately.

<, >

Move the sort field. Use < to move one column left and > to move one column to the right.

A

Toggle alternate display mode between a single window or multiple windows. See the following section Alternate display mode commands for the commands that work with A.

b

Toggle between bold and reverse display. Only works with x or y.

B

Globally toggle bold display.

c

Toggle display of command name or full command line.

d, s

Change delay between refreshes. Prompt for new delay time, which should be in seconds. Suppressed in secure mode.

f

Prompt to add fields to or remove fields from the display.

F, O

Select sort field.

G

Select another field group and make it current, or change by selecting a number from the following list:

1

Def

2

Job

3

Mem

4

Usr

h, ?

Display help about commands and the status of secure and cumulative modes.

I, 1

Toggle SMP view. Use I to toggle IRIX/Solaris mode, 1 to toggle single/separate states.

k

Prompt for process ID to kill, and signal to send (default is 15) to kill it.

i

Toggle suppression of idle and zombie processes.

l

Toggle display of load-average and uptime information.

m

Toggle display of memory information.

n, #

Prompt for maximum number of processes to show. If 0 is entered, show as many as will fit on the screen (default).

N

Sort numerically by process ID.

o

Prompt to change order of displayed fields.

P

Sort tasks by CPU usage (default).

q

Exit.

r

Apply renice to a process. Prompt for PID and renice value. Suppressed in secure mode.

R

Toggle normal or reverse sort.

S

Toggle cumulative mode. (See the -S option.)

t

Toggle display of processes and CPU states lines.

T

Sort tasks by time/cumulative time.

u

Prompt for specific user to show.

W

Write current setup to *~/.toprc*. This is the recommended way to write a top configuration file.

x

Toggle highlighting for sort field.

y

Toggle highlights for running tests.

z

Toggle between color and mono display.

Z

Globally change color mappings.

Alternate display mode commands

=

Rebalance tasks in the current window.

+

Rebalance tasks in every window.

-

Show or hide the current window.

_

Show all invisible windows or hide all visible windows.

a

Cycle forward through all four windows.

g

Change the name of the current window or group.

w

Cycle backward through all four windows.

Field descriptions

The first five entries in the following list describe the lines that appear at the top of thetop display. The rest are the fields that can be displayed for each task (sizes are in kilobytes). Use the interactive f command to add or remove fields.

top

Display the time the system has been up, the number of users, and three load averages consisting of the average number of processes ready to run in the last 1, 5, and 15 minutes.

Tasks

The total number of processes running when the last update was taken, shown as the number of running, sleeping, stopped, or undead tasks.

Cpu(s)

The percentage of CPU time spent in user mode, in system mode, on tasks with a negative nice value, and idle.

Mem

Memory statistics, including total available memory, free memory, memory used, shared memory, and memory used for buffers.

Swap

Swapspace statistics, including total, available, used, and cached.

PID

Process ID.

PPID

Parent process ID.

UID

Effective user ID of task's owner.

USER

Effective username of task's owner.

RUSER

Real username of task's owner.

GROUP

The effective group name of task's owner.

PR

Priority.

NI

Nice value.

nFLT

Page fault count.

CODE

Code size.

DATA

Data plus stack size.

RES

Resident task size.

SWAP

Size of swapped-out portion of task.

VIRT

The total amount of virtual memory used by the task.

nDRT

Size of pages marked dirty.

#C

Last-used processor, for multiprocessor systems.

SHR

Amount of shared memory used.

S

State of the task. Values are S (sleeping), D (uninterruptible sleep), R (running), Z (zombies), or T (stopped or traced), possibly followed by < (negative nice value), N (positive nice value), or W (swapped out).

WCHAN

Address or name of the kernel function in which the task is currently sleeping.

TIME

Total CPU time used by task and any children.

TIME+

Like TIME, but shows the time down to hundredths of a second.

%CPU

Share of CPU time since last update, as percentage of total CPU time.

%MEM

Share of physical memory.

TTY

Controlling tty.

COMMAND

Command line (truncated if too long) if task is in memory, or command name in parentheses if swapped out.

FLAGS

Task flags.

touch

`touch [options] files`

For one or more *files*, update the access time and modification time (and dates) to the current time and date. touch is useful in forcing other commands to handle files a certain way; for example, the operation of make, and sometimes find, relies on a file's access and modification time. If a file doesn't exist, touch creates it with a file size of 0.

Options

-a, --time=atime, --time=access, --time=use

Update only the access time.

-c, --no-create

Do not create any file that doesn't already exist.

-d *time*, --date *time*

Change the time value to the specified *time* instead of the current time. *time* can use several formats and may contain month names, time zones, a.m. and p.m. strings, etc.

-m, --time=mtime, --time=modify

Update only the modification time.

-r *file*, --reference *file*

Change times to be the same as those of the specified *file*, instead of the current time.

-t *time*

Use the time specified in *time* instead of the current time. This argument must be of the format [[*cc*]*yy*]*mmddhhmm*[.*ss*], indicating optional century and year, month, date, hours, minutes, and optional seconds.

--help

Print help message and then exit.

--version

Print the version number and then exit.

tr

`tr [options] [string1 [string2]]`

Translate characters. Copy standard input to standard output, substituting characters from *string1* to *string2*, or deleting characters in *string1*.

Options

-c, --complement

Complement characters in *string1* with respect to ASCII 001-377.

-d, --delete

Delete characters in *string1* from output.

-s, --squeeze-repeats

Squeeze out repeated output characters in *string2*.

-t, --truncate-set1

Truncate *string1* to the length of *string2* before translating.

--help

Print help message and then exit.

--version

Print the version number and then exit.

Special characters

Include brackets ([ ]) where shown.

\a

Ctrl-G (bell)

\b

Ctrl-H (backspace)

\f

Ctrl-L (form feed)

\n

Ctrl-J (newline)

\r

Ctrl-M (carriage return)

\t

Ctrl-I (tab)

\v

Ctrl-K (vertical tab)

nnn

Character with octal value *nnn*

\\

Literal backslash

char1-*char2*

All characters in the range *char1* through *char2*. If *char1* does not sort before *char2*, produce an error.

[*char**]

In *string2*, expand *char* to the length of *string1*.

[*char***number*]

Expand *char* to *number* occurrences. [x*4] expands to xxxx, for instance.

[:*class*:]

Expand to all characters in *class*, where *class* can be:

alnum

Letters and digits

alpha

Letters

blank

Whitespace

cntrl

Control characters

digit

Digits

graph

Printable characters except space

lower

Lowercase letters

print

Printable characters

punct

Punctuation

space

Whitespace (horizontal or vertical)

upper

Uppercase letters

xdigit

Hexadecimal digits

[=*char*=]

The class of characters to which *char* belongs.

Examples

Change uppercase to lowercase in a file:

```
cat file | tr 'A-Z' 'a-z'
```

Turn spaces into newlines (ASCII code 012):

```
tr ' ' '
' < file
```

Strip blank lines from file and save in new.file (or use 011 to change successive tabs into one tab):

```
cat file | tr -s "" "
" > new.file
```

Delete colons from file and save result in new.file:

```
tr -d : < file > new.file
```

tracepath

`tracepath` *host* [*port*]

TCP/IP command. Trace path to *host* and report the Maximum Transmission Unit (MTU.) A simplified version of `traceroute` without options meant for use by unprivileged users. If specified, it will use *port* to send UDP probe packets. *host* is the destination hostname or the IP number of the host to reach.

traceroute

`traceroute` [*options*] *host* [*packetsize*]

TCP/IP command. Trace route taken by packets to reach network host. `traceroute` attempts tracing by launching UDP probe packets with a small TTL (time-to-live), then listening for an ICMP "time exceeded" reply from a gateway. *host* is the destination hostname or the IP number of the host to reach. *packetsize* is the packet size in bytes of the probe datagram. Default is 40 bytes.

Options

-d

Turn on socket-level debugging.

-f *n*

Set the initial time-to-live to *n* hops.

-F

Set the "don't fragment" bit.

-g *addr*

Enable the IP LSRR (Loose Source Record Route) option in addition to the TTL tests, to ask hov someone at IP address *addr* can reach a particular target.

-i *interface*

Specify the network interface for getting the source IP address for outgoing probe packets. Useful with a multi-homed host. Also see the -s option.

-I

Use ICMP ECHO requests instead of UDP datagrams.

-m *max_ttl*

Set maximum time-to-live used in outgoing probe packets to *max-ttl* hops. Default is 30.

-n

Show numerical addresses; do not look up hostnames. (Useful if DNS is not functioning properly.)

-p *port*

Set base UDP port number used for probe packets to *port*. Default is (decimal) 33434.

-q *n*

Set number of probe packets for each time-to-live setting to the value *n*. Default is 3.

-r

Bypass normal routing tables and send directly to a host on an attached network.

-s *src_addr*

Use *src_addr* as the IP address that will serve as the source address in outgoing probe packets

-t *tos*

Set the type-of-service in probe packets to *tos* (default 0). The value must be a decimal integer in the range 0 to 255.

-v

Verbose; received ICMP packets (other than TIME_EXCEEDED and PORT_UNREACHABLE) will be listed.

-w *wait*

Set time to wait for a response to an outgoing probe packet to *wait* seconds (default is 5).

-x

Toggle IP checksums, usually to turn them off. IP checksums are always calculated if -I is specified.

-z *msecs*

Set the delay between probes, in milliseconds. The default is 0.

troff

`troff`

See groff.

true

`true`

A null command that returns a successful (0) exit status. See also false.

tset

```
tset [options] [terminal]
reset [options] [terminal]
```

Initialize a terminal. The terminal to be initialized is whichever is found first from the value of *terminal*, the value of the TERM environment variable, or the default terminal type. See also the reset command.

Options

-e*char*

Set the erase character to *char*.

-i*char*

Set the interrupt character to *char*.

-I

Do not send terminal or tab initialization strings to the terminal.

-k*char*

Set line-kill character to *char*.

-m *arg*

Specify a mapping from a port type to a terminal, where *arg* looks like this:

```
[port type][operator][baud rate][:]terminal_type
```

operator can be any combination of < (less than), > (greater than), @ (equal), and ! (not). The terminal type is a string (e.g., vt100 or xterm).

-q

Print the terminal type on standard output but do not initialize the terminal.

-Q

Don't display values for the erase, interrupt, and line kill characters.

-r

Print the terminal type to standard error.

-s

Print the shell commands that initialize the TERM environment variable on standard output.

-V

Print the version of ncurses used for this program and exit.

tsort

```
tsort [option] [file]
```

Perform a topological sort on partially ordered stringsin the specified file. Multiple strings on a line are separated by spaces, where each line indicates a partial ordering. The fully ordered results are written to standard output. See the tsort info page for an example of the use of tsort for sorting lists of functions into the order they are called.

Options

--help

Print help information and exit.

--version

Print version information and exit.

tty

```
tty [options]
```

Print the filename of the terminal connected to standard input.

Options

--help

Print help message and exit.

-s, --silent, --quiet

Print nothing to standard output, but return an exit status.

--version

Display version information and exit.

tune2fs

```
tune2fs [options] device
```

System administration command. Tune the parameters of a Linux Second Extended Filesystem by adjusting various parameters. You must specify the *device* on which the filesystem resides; it must not be mounted read/write when you change its parameters.

Options

-c *max-mount-counts*

Specify the maximum number of mount counts between two checks on the filesystem.

-C *mount-count*

Specify the mount count. For use with -c to force a check the next time the system boots.

-e *behavior*

Specify the kernel's behavior when encountering errors. *behavior* must be one of:

continue

Continue as usual.

remount-ro

Remount the offending filesystem in read-only mode.

panic

Cause a kernel panic.

-f

Force completion even if there are errors.

-g *group*

Allow *group* (a group ID or name) to use reserved blocks.

-i *interval*[d|w|m]

Specify the maximum interval between filesystem checks. Units may be in days (d), weeks (w), or months (m). If *interval* is 0, checking will not be time-dependent.

-j

Add an ext3 journal to the filesystem. If specified without -J, use the default journal parameters.

-J *jrnl-options*

Specify ext3 journal parameters as a comma-separated list of *option*=*value* pairs. The specified options override the default values. Only one size or device option can be specified for a

filesystem. Possible options are:

device=*ext-jrnl*

Attach to the journal block device on *ext-jrnl*, which must exist and must have the same block size as the filesystem to be journaled. *ext-jrnl* can be specified by its device name, by the volume label (LABEL=*label*), or by the Universal Unique Identifier (UUID) stored in the journal's ext2 superblock (UUID=*uuid*; see uuidgen). Create the external journal with:

mke2fs -O *jrnl-dev* *ext-jrnl*

size=*jrnl-size*

The size of the journal in megabytes. The size must be at least equivalent to 1024 blocks and not more than 102,400 blocks.

-I

Display a list of the superblock's contents.

-L *label*

Specify the volume label of filesystem. The label must be no more than 16 characters.

-m *percentage*

Specify the percentage of blocks that will be reserved for use by privileged users.

-M *dir*

Specify the filesystem's last-mounted directory.

-o *mount-options*

Set or clear the specified default *mount-options*. Mount options specified in */etc/fstab* or on the command line for mount will override these defaults. Specify multiple options as a comma-separated list. Prefixing an option with a caret (^) clears the option. No prefix or a plus sign (+) causes the option to be set. The following options can be cleared or set:

acl

Enable Posix Acess Control Lists.

bsdgroups

Assign new files the group-id of the directory in which they are created instead of the group-id of the process creating them.

debug

Enable debugging code.

journal_data

When journaling, commit all data to journal before writing to the filesystem.

journal_data_ordered

When journaling, force data to the filesystem before committing metadata to the journal.

journal_data_writeback

When journaling, force data to the filesystem after committing metadata to the journal.

-O *option*

Set or clear the specified filesystem options in the filesystem's superblock. Specify multiple options as a comma-separated list. Prefixing an option with a caret (^) clears the option. No prefix or a plus sign (+) causes the option to be set. Run e2fsck after changing filetype or sparse_super. The following options can be cleared or set:

dir_index

Use B-trees to speed up lookups on large directories.

filetype

Save file type information in directory entries.

has_journal

Create an ext3 journal. Same as the -j option.

sparse_super

Save space on large filesystems by limiting the number of backup superblocks. Same as -s.

-r *num*

Specify the number of blocks that will be reserved for use by privileged users.

-s [0|1]

Turn the sparse superblock feature on or off. Run e2fsck after changing this feature.

-T *time*

Set the time e2fsck was last run. The time specification is international date format, with the time optionali.e., *YYYYMMDD*[[*HHMM*]*SS*]. If *time* is specified as time-last-checked, the current time is used.

-u *user*

Allow *user* (a user ID or name) to use reserved blocks.

-U *uuid*

Set the UUID of the filesystem to a UUID generated by uuidgen or to one of the following:

clear

Clear the existing UUID.

random

Randomly generate a new UUID.

time

Generate a new time-based UUID.

tunelp

tunelp *device* [*options*]

System administration command. Control a line printer's device parameters. Without options, print information about device(s).

Options

-a [on|off]

Specify whether or not to abort if the printer encounters an error. By default, do not abort.

-c *n*

Retry device *n* times if it refuses a character. (Default is 250.) After exhausting *n*, sleep before retrying.

-i *irq*

Use *irq* for specified parallel port. Ignore -t and -c. If 0, restore noninterrupt-driven (polling) action.

-o [on|off]

Specify whether to abort if device is not online or is out of paper.

-q [on|off]

Specify whether to print current IRQ setting.

-r

Reset port.

-s

Display printer's current status.

-t *time*

Specify a delay of *time* in jiffies to sleep before resending a refused character to the device. A jiffy is defined as either one tick of the system clock or one AC cycle time; it should be approximately $^{1}/_{100}$ of a second.

-T [on|off]

Tell the lp driver whether it can trust the IRQ. Useful only if using with interrupts, to handle IRQ printing efficiently. Requires at least Linux 2.1.131.

-w *time*

Specify a delay of *time* in jiffies to sleep before resending a strobe signal.

ul

`ul [options] [names]`

Translate underscores to underlining. The process will vary by terminal type. Some terminals are unable to handle underlining.

Options

-i

When on a separate line, translate - to underline instead of translating underscores.

-t *terminal-type*

Specify terminal type. By default, TERM is consulted.

umount

`umount [options] [directory]`

System administration command. Unmount filesystem specified by directory. You may also specify the filesystem by device name. umount announces to the system that the removable file structure previously mounted on the specified directory is to be removed. Any pending I/O for the filesystem is completed, and the file structure is flagged as clean. A busy filesystem cannot be unmounted.

Options

-a

Unmount all filesystems listed in */etc/mtab* other than */proc*.

-d

If the unmounted device was a loop device, free the loop device too. See also the losetup command.

-f

Force the unmount. This option requires kernel 2.1.116 or later.

-h

Print help message and exit.

-l

Lazy unmount. Detach the filesystem from the hierarchy immediately, but don't clean up references until it is no longer busy. Requires kernel 2.4.11 or later.

-n

Unmount, but do not record changes in */etc/mtab*.

-O *options*

Unmount only filesystems with the specified options in */etc/fstab*. Specify multiple options as a comma-separated list. Add no as a prefix to an option to indicate filesystems that should not be unmounted.

-r

If unmounting fails, try to remount read-only.

-t *type*

Unmount only filesystems of type *type*. Multiple types can be specified as a comma-separated list, and any type can be prefixed with no to specify that filesystems of that type should not be unmounted.

-v

Verbose mode.

-V

Print version information and exit.

uname

```
uname [options]
```

Print information about the machine and operating system. Without options, print the name of the kernel (Linux).

Options

-a, --all

Combine all the system information from the other options.

-i, --hardware-platform

Print the system's hardware platform.

-m, --machine

Print the name of the hardware that the system is running on.

-n, --nodename

Print the machine's hostname.

-o, --operating-system

Print the operating system name.

-p, --processor

Print the type of processor.

-r, --kernel-release

Print the release number of the kernel.

-s, --kernel-name

Print the name of the kernel (Linux). This is the default action.

-v, --kernel-version

Print build information about the kernel.

--help

Display a help message and then exit.

--version

Print version information and then exit.

uncompress

uncompress [*options*] *files*

Uncompress files that were compressed (i.e., whose names end in *.Z*). uncompress takes all the same options as compress, except -b and -r.

unexpand

unexpand [*options*] [*files*]

Convert strings of initial whitespace, consisting of at least two spaces and/or tabs, to tabs. Read from standard input if given no file or a file named -.

Options

-a, --all

Convert all, not just leading, strings of spaces and tabs.

--first-only

Convert only leading spaces and tabs. Overrides -a.

-t *nums*, --tabs *nums*

nums is a comma-separated list of integers that specify the placement of tab stops. If a single integer is provided, the tab stops are set to every *integer* spaces. By default, tab stops are eight spaces apart. This option implies -a.

--help

Print help message and then exit.

--version

Print the version number and then exit.

unicode_start

`unicode_start [`*`font`*` [`*`umap`*`]]`

Put keyboard and console in Unicode mode, setting the font to *font* and the Unicode map to *umap* if the font doesn't have its own map. If no font is specified, use the default.

unicode_stop

`unicode_stop`

Take keyboard and console out of Unicode mode.

uniq

```
uniq [options] [file1 [file2]]
```

Remove duplicate adjacent lines from sorted *file1* or from standard input, sending one copy of each line to *file2* (or to standard output). Often used as a filter. Specify only one of `-d` or `-u`. See also `comm` and `sort`.

Options

`-c`, `--count`

Print each line once, prefixing number of instances.

`-d`, `--repeated`

Print duplicate lines once but no unique lines.

`-D`, `--all-repeated`[=*method*]

Print all duplicate lines. `-D` takes no delimiter method. The delimiter method *method* takes one of the following values: `none` (default), `prepend`, or `separate`. Blank lines are used as the delimiter.

`-f` *n*, `--skip-fields=`*n*

Ignore first *n* fields of a line. Fields are separated by spaces or by tabs.

`-i`, `--ignore-case`

Ignore case differences when checking for duplicates.

`-s` *n*, `--skip-chars=`*n*

Ignore first *n* characters of a field.

`-u`, `--unique`

Print only unique lines (no copy of duplicate entries is kept).

-w *n*, --check-chars=*n*

Compare only first *n* characters per line (beginning after skipped fields and characters).

--help

Print a help message and then exit.

--version

Print version information and then exit.

Examples

Send one copy of each line from list to output file list.new:

```
uniq list list.new
```

Show which names appear more than once:

```
sort names | uniq -d
```

uptime

uptime [*option*]

Print the current time, how long the system has been running, the number of users currently logged in (which may include the same user multiple times), and system load averages. This output is also produced by the first line of the w command.

Option

-V

Print version information and exit.

useradd

```
useradd [options] [user]
```

System administration command. Create new user accounts or update default account information. Unless invoked with the -D option, *user* must be given. useradd will create new entries in system files. Home directories and initial files may also be created as needed.

Options

-c *comment*

Comment field.

-d *dir*

Home directory. The default is to use *user* as the directory name under the *home* directory specified with the -D option.

-e *date*

Account expiration *date*. Use the format *MM*/*DD*/*YYYY*. Two-digit year fields are also accepted. The value is stored as the number of days since January 1, 1970. This option requires the use of shadow passwords.

-f *days*

Permanently disable account this many *days* after the password has expired. A value of -1 disables this feature. This option requires the use of shadow passwords.

-g *group*

Initial *group* name or ID number. If a different default group has not been specified using the-D option, the default group is 1.

-G *groups*

Supplementary *groups* given by name or number in a comma-separated list with no whitespace.

-k [*dir*]

Copy default files to the user's home directory. Meaningful only when used with the-m option. Default files are copied from */etc/skel/* unless an alternate *dir* is specified.

-m

Make user's home directory if it does not exist. The default is not to make the home directory.

-M

Do not create a home directory for the user, even if the system default in*/etc/login.defs* is to create one.

-n

Red Hat-specific option. Turn off the Red Hat default that creates a group with the same name as the username and puts the user in that group.

-o

Override. Accept a nonunique*uid* with the -u option. (Probably a bad idea.)

-p *passwd*

The encrypted password, as returned by crypt(3).

-r

Red Hat-specific option. Create a system account with a non-expiring password and a UID lower than the minimum defined in*/etc/login.defs*. Do not create a home directory for the account unless -m is also specified.

-s *shell*

Login *shell*.

-u *uid*

Numerical user ID. The value must be unique unless the-o option is used. The default value is the smallest ID value greater than 99 and greater than every other*uid*.

-D [*options*]

Set or display defaults. If *options* are specified, set them. If no options are specified, display current defaults. The options are:

-b *dir*

Home directory prefix to be used in creating home directories. If the -d option is not used when creating an account, the *user* name will be appended to *dir*.

-e *date*

Expire *date*. Requires the use of shadow passwords.

-f *days*

Number of *days* after a password expires to disable an account. Requires the use of shadow passwords.

-g *group*

Initial *group* name or ID number.

-s *shell*

Default login *shell*.

userdel

```
userdel [option] user
```

System administration command. Delete all entries for *user* in system account files.

Option

-r

Remove the home directory of *user* and any files contained in it.

usermod

```
usermod [options] user
```

System administration command. Modify *user* account information.

Options

-c *comment*

Comment field.

-d *dir*

Home directory.

-e *date*

Account expiration *date*. *date* is in the format *MM*/*DD*/*YYYY*; two-digit year fields are also accepted. The value is stored as the number of days since January 1, 1970. This option requires the use of shadow passwords.

-f *days*

Permanently disable account this many *days* after the password has expired. A value of -1 disables this feature. This option requires the use of shadow passwords.

-g *group*

Initial *group* name or number.

-G *groups*

Supplementary *groups* given by name or number in a comma-separated list with no whitespace. *user* will be removed from any groups to which it currently belongs that are not included in *groups*.

-l *name*

Login *name*. This cannot be changed while the user is logged in.

-L

Lock user's password by putting a ! in front of it. This option cannot be used with -p or -U.

-o

Override. Accept a nonunique *uid* with the -u option.

-p *pw*

Encrypted password, as returned from crypt(3).

-s *shell*

Login *shell*.

-u *uid*

Numerical user ID. The value must be unique unless the -o option is used. Any files owned by *user* in the user's home directory will have their user ID changed automatically. Files outside of the home directory will not be changed. *user* should not be executing any processes while this is changed.

-U

Unlock the user's password by removing the ! that -L put in front of it. This option cannot be used with -p or -L.

users

```
users [file]
users option
```

Print a space-separated list of each login session on the host. Note that this may include the same user multiple times. Consult *file* or, by default, */var/log/utmp* or */var/log/wtmp*.

Options

--help

Print usage information and exit.

--version

Print version information and exit.

usleep

```
usleep [microseconds]
usleep [options]
```

Sleep some number of microseconds (default is 1).

Options

-?, --help

Print help information and then exit.

--usage

Print usage message and then exit.

-v, --version

Print version information.

uudecode

```
uudecode [-o outfile] [file]
```

Read a uuencoded file and re-create the original file with the permissions and name set in the file (see uuencode). The -o option specifies an alternate output file.

uuencode

```
uuencode [-m] [file] name
```

Encode a binary *file*. The encoding uses only printable ASCII characters and includes the permissions and *name* of the file. When *file* is reconverted via uudecode, the output is saved as *name*. If the *file* argument is omitted, uuencode can take standard input, so a single argument is taken as the name to be given to the file when it is decoded. With the -m option, base64 encoding is used.

Examples

It's common to encode a file and save it with an identifying extension, such as *.uue*. This example encodes the binary file *flower12.jpg*, names it *rose.jpg*, and saves it to a *.uue* file:

```
$ uuencode flower12.jpg rose.jpg > rose.uue
```

Encode *flower12.jpg* and mail it:

```
$ uuencode flower12.jpg flower12.jpg | mail el@oreilly.com
```

uuidgen

```
uuidgen [option]
```

Create a new Universal Unique Identifier (UUID) and print it to standard output. The generated UUID consists of five hyphen-separated groups of hex digits (e.g., 3cdfc61d-87d3-41b5-ba50-32870b33dc67). The default is to generate a random-based UUID, but this requires that a high-quality random-number generator be available on the system.

Options

-r

Generate a random-based UUID.

-t

Generate a time-based UUID.

vdir

```
vdir [options] [files]
```

Verbosely list directory contents. Equivalent to `ls -lb`. By default, list the current directory. Directory entries are sorted alphabetically unless overridden by an option. `vdir` takes the same options as `ls`.

vi

```
vi [options] [files]
```

A screen-oriented text editor based on `ex`. `vi` is bi-modal, with a command mode and an insert mode. For more information on vi, see Chapter 9.

vidmode

```
vidmode [option] image [mode [offset]]
```

System administration command. Set the video mode for a kernel *image*. If no arguments are specified, print current *mode* value. *mode* is a 1-byte value located at offset 506 in a kernel image. You may change the *mode* by specifying the kernel *image* to change, the new *mode*, and the byte offset at which to place the new information (the default is 506). Note that `rdev -v` is a synonym for `vidmode`. If LILO is used, `vidmode` is not needed. The video mode can be set from the LILO prompt during a boot.

Modes

-3

Prompt

-2

Extended VGA

-1

Normal VGA

0

Same as entering 0 at the prompt

1

Same as entering 1 at the prompt

2

Same as entering 2 at the prompt

3

Same as entering 3 at the prompt

n

Same as entering n at the prompt

Option

-o *offset*

Same as specifying an *offset* as an argument.

vim

```
vim
```

An enhanced version of the `vi` screen editor. Both `vi` and `vim` are covered in Chapter 9.

vmstat

```
vmstat [options] [interval [count]]
```

System administration command. Print report on virtual memory statistics, including information on processes, memory, paging block I/O, traps, system and CPU usage. `vmstat` initially reports average values since the last system reboot. If given a sampling period *interval* in seconds, it prints additional statistics for each interval. If specified, `vmstat` exits when it has completed *count* reports. Otherwise, it continues until it receives a Ctrl-C, printing a new header line each time it fills the screen.

Options

`-a`

Display active and inactive memory.

`-d`

Display disk statistics.

`-f`

Display the number of forks since the system was booted.

`-m`

Display the names and sizes of various kernel objects stored in a cache known as the slab layer. Also see the `slabtop` command.

-n

Don't print new header lines when the screen is full.

-p *partition*

Display detailed statistics for the specified partition.

-s

Display various even counters and memory statistics.

-S *units*

Switch the output units. Possible values are k, K, m or M.

-V

Print version number, then exit.

VM mode fields

procs

r

Processes waiting for runtime.

b

Uninterruptible sleeping processes.

memory

swpd

Virtual memory used, in kilobytes.

free

Idle memory, in kilobytes.

buff

Memory used as buffers, in kilobytes.

cache

Cache memory, in kilobytes.

inactive

Inactive memory, in kilobytes, displayed with -a.

active

Active memory, in kilobytes; displayed with -a.

swap

si

Memory swapped in from disk each second, in kilobytes.

so

Memory swapped out to disk each second, in kilobytes.

io

bi

Blocks sent to block devices each second.

bo

Blocks received from block devices each second.

system

in

Interrupts per second, including clock interrupts.

cs

Context switches per second.

cpu

us

Percentage of CPU time consumed by user processes.

sy

Percentage of CPU time consumed by system processes.

id

Percentage of CPU time spent idle.

wa

Percentage of CPU time spent waiting for I/O.

Disk mode fields

Reads and Writes

total

Total reads or writes completed successfully.

merged

Reads or writes grouped into one I/O.

sectors

Sectors read or written successfully.

ms

Milliseconds spent reading or writing.

IO

cur

I/O in progress

s

Seconds spent doing I/O.

Disk partition mode fields

reads

Total reads issued to this partition.

read sectors

Total sectors read for this partition.

writes

Total writes issued to this partition.

requested writes

Total write requests for this partition.

Slab mode fields

cache

Cache name.

num

Number of currently active objects.

total

Total number of available objects.

size

Size of each object.

pages

Number of pages with at least one active object.

totpages

Total number of allocated pages.

pslab

Number of pages per slab.

volname

`volname [devfile]`

Return the volume name for a device such as a CD-ROM that was formatted with an ISO-9660 filesystem. The default device file *devfile* is */dev/cdrom*.

w

`w [options] [user]`

Print summaries of system usage, currently logged-in users, and what those users are doing.w is essentially a combination of `uptime`, `who`, and `ps -a`. Display output for one user by specifying*user*.

Options

-f

Toggle printing the from (remote hostname) field.

-h

Suppress headings and `uptime` information.

-s

Use the short format.

-u

Ignore the username while figuring out the current process and CPU times.

-V

Display version information.

File

/var/run/utmp

List of users currently logged in.

wall

```
wall [file]
wall [-n] [message]
```

Write to all users. Depending on your Linux distribution, wall uses one of the two syntaxes shown. In both versions, the default is for wall to read a message from standard input and send the message to all users currently logged in, preceded by "Broadcast Message from..." With the first syntax, which comes with Debian, for example, if *file* is specified, wall reads input from that file rather than from standard input, and only the superuser can write to a terminal if the user has disallowed messages. With the second syntax, distributed by Red Hat, for example, the text of the message can be included on the command line, and the message is limited to 20 lines. In this form, if -n is specified, the default banner message is replaced with "Remote broadcast message". -n can only be specified by the superuser, and only if wall was installed set-group-id.

Example

Send the message contained in the file *message.txt* to all users:

```
$ wall < message.txt
```

warnquota

```
warnquota [options] [filesystem]
```

System administration command. Mail warning messages to users that have exceeded their soft limit

Options

-a *file*

Read group administrator information from *file* instead of */etc/quotagrpadmins*.

-c *file*

Read configuration information from *file* instead of */etc/warnquota.conf*.

-C

Translate UIDs and GIDs individually. (Faster for database lookups.)

-d

Send messages without attaching quota reports.

-F *format*

Read quota information of the specified format. (See quota for valid formats.)

-g

Send messages for group quotas. Send the message to the user specified in */etc/quotagrpadmins*.

-i

Ignore automount mount points.

-q *file*

Read device description strings from *file* instead of */etc/quotagrpadmins*.

-s

Report sizes in more human-readable units.

-u

Send messages for user quotas. (This is the default.)

watch

```
watch [options] command [cmd_options]
```

Run the specified command repeatedly (by default, every two seconds) and display the output so you can watch it change over time. The command and any options are passed to `sh -c`, so you may need to use quotes to get correct results.

Options

-d, --differences[=cumulative]

Highlight changes between iterations. If cumulative is specified, the highlighting remains on the screen throughout, giving a cumulative picture of the changes.

-h, --help

Display help message and exit.

-n *secs*, --interval=*secs*

Run the command every *secs* seconds.

-t, --no-title

Do not display the header or the blank line following the header.

-v, --version

Print version information and exit.

wc

`wc [options] [files]`

Print byte, word, and line counts for each file. Print a total line for multiple *files*. If no *files* are given, read standard input. See other examples under ls and sort.

Options

-c, --bytes

Print byte count only.

-l, --lines

Print line count only.

-L, --max-line-length

Print length of longest line.

-m, --chars

Print character count only.

-w, --words

Print word count only.

--help

Print help message and then exit.

--version

Print the version number and then exit.

Examples

Count the number of users logged in:

```
who | wc -l
```

Count the words in three essay files:

```
wc -w essay.[123]
```

Count lines in the file named by variable $file (don't display filename):

```
wc -l < $file
```

wget

```
wget [options] [urls]
```

Perform non-interactive file downloads from the Web. `wget` works in the background and can be used to set up and run a download without the user having to remain logged on. `wget` supports HTTP, HTTPS, FTP, as well as downloads through HTTP proxies. `wget` uses a global startup file that you may find at */etc/wgetrc* or */usr/local/etc/wgetrc*. In addition, users can define their own *$HOME/.wgetrc* files.

Options

-a *logfile*, --append-output=*logfile*

Append output messages to *logfile*, instead of overwriting the contents. If *logfile* doesn't exist, create it.

-A *acclist*, --accept=*acclist*

Specify a comma-separated list of filename suffixes or patterns to accept.

-b, --background

Go into the background immediately after startup, writing output to the file specified with-o or to wget-log.

-B *url*, --base=*url*

Used with -F to prepend the specified URL to relative links in the input file specified with-i.

--bind-address=*address*

When making client TCP/IP connections, `bind( )` to the specified local address, which can be specified as a hostname or IP address. Useful if your system is bound to multiple IP addresses.

-c, --continue

Continue getting a partially downloaded file. Affects the restarting of downloads from an earlier invocation of `wget`. Works only with FTP servers and HTTP servers that support the Range header.

--connect-timeout=*seconds*

Set the timeout for a connection to be established in seconds. The default is never to time out, unless a timeout is implemented by system libraries.

--cut-dirs=*num*

Ignore the specified number of directory components when creating the local directory structure.

-d, --debug

Turn on debugging. wget must have been compiled with debug support.

-D *domainlist*, --domains=*domainlist*

Specify a comma-separated list of domains to be followed. Does not turn on-H.

--delete-after

Delete each retrieved file from the local machine after downloading it. Useful for prefetching pages through a proxy. -k is ignored if specified with --delete-after.

--dns-cache=off

Turn off DNS-lookup caching.

--dns-timeout=*seconds*

Set the DNS lookup timeout to *seconds*. The default is to never time out.

-e *command*, --execute=*command*

Execute the specified command after the commands in *.wgetrc*, overriding any *.wgetrc* commands. Can be included multiple times, once for each command to execute.

--exclude-domains=*domain-list*

Specify a comma-separated list of names that are never to be followed.

-F, --force-html

When reading input from a file, force the file to be treated as an HTML file.

--follow-ftp

Follow FTP links from HTML documents. The default is to ignore FTP links.

--follow-tags=*list*

Specify a comma-separated list of tags to be considered, overriding the internal table that wget normally uses during a recursive retrieval.

-h, --help

Display usage information and exit.

-H, --span-hosts

Enable spanning across hosts when doing recursive retrieval.

--header=*header*

Add an additional header to be passed to the HTTP server. The header must include a colon (:) preceded by at least one nonblank character, and with no newline characters. Can be specified multiple times. If *header* is an empty string, all user-defined headers are cleared.

--html-extension

Append the suffix *.html* to the filenames of downloaded files where the URL does not include it (for example, an *.asp* file).

--http-user=*user*, --http-password=*password*

Specify the username and password on an HTTP server.

-i *file*, --input-file=*file*

Read URLs from the specified file. URLs specified on the command line are accessed before URLs in the file.

-I *list*, --include-directories=*list*

Specify a comma-separated list of directories to follow when downloading. The list elements may contain wildcards.

--ignore-length

Ignore the "Content-Length" header on the HTTP server.

--ignore-tags=*list*

Specify a comma-separated list of tags to be ignored for recursive retrievals.

-k, --convert-links

Convert document links after the download is complete so they work locally.

-K, --backup-converted

When converting a file, back up the original and add a*.orig* suffix. Affects the behavior of -N.

--keep-session-cookies

Causes --save-cookies to also save session cookies.

-l *depth*, --level=*depths*

For recursive retrievals, specify the maximum recursion depth. The default depth is 5.

-L, --relative

Follow relative links only.

--limit-rate=*rate*

Set the maximum download speed, The default is to specify the rate in bytes, or add ak suffix for kilobytes or m for megabytes.

--load-cookies=*file*

Load cookies from the specified file before the first HTTP retrieval.

-m, --mirror

Turn on options suitable for mirroring a remote site. Equivalent to-r -N -l inf --no-remove-listing.

-N, --timestamping

Turn on timestamping.

-nc, --no-clobber

Do not download a file if there is already a copy on the disk. The default is to preserve the original copy and rename successive downloads, adding *.1*, *.2*, etc. to their name. May not be specified with -N.

-nd, --no-directories

Do not create a directory hierarchy when doing recursive retrievals.

-nH, --no-host-directories

Disable creation of directories prefixed by the name of the host. The default is to include the hostname.

--no-cache

Disable server-side cache for an HTTP retrieval. The default is for caching to be on.

--no-cookies

Disable the use of cookies.

--no-glob

Turn off FTP globbing to prevent the use of wildcards for multiple file retrievals.

--no-http-keep-alive

Turn off the keep-alive feature for HTTP retrievals.

--np, --no-parent

In recursive retrievals, do not ever go up to the parent directory.

--no-remove-listing

Do not remove the temporary *.listing* files generated by FTP retrievals.

-nv, --non-verbose

Turn off verbose mode, but don't run completely quietly. Displays error messages and basic information.

-o *logfile*, --output-file=*logfile*

Log output messages to *logfile*, instead of the default standard error.

-O *file*, --output-documents=*file*

Concatenate all documents into the specified file. If the file exists, it is overwritten. Specify the file as - to write to standard output.

-p, --page-requisites

Download all files necessary to display an HTML page.

-P *prefix*, --directory-prefix=*prefix*

Set the directory prefix to the specified value.

--passive-ftp

Perform a passive FTP retrieval.

--post-data=*string*, --post-file=*file*

Use POST as the method for HTTP requests and send the specified data in the request body. Use --post-data to send *string* as data and --post-file to send the *file* contents.

--progress=*type*[:style]

Set the progress indicator to *type*. Valid types are dot and bar; the default is bar. With --progress=dot, you can also set a style. The default style is for each dot to represent 1K, with 10 dots in a cluster and 50 dots per line. Alternatives are binary, with each dot representing 8K, 16-dot clusters, and 48 dots per line; mega, for downloading very large files, with each dot representing 64K, 8 dots per cluster, and 48 dots per line; and giga, with each dot representing 1M, 8 dots per cluster, and 4 clusters per line.

--protocol-directories

Use the protocol name as part of the local filename.

--proxy-user=*user*, --proxy-passwd=*password*

Specify the username and password for authentication on a proxy server.

-q, --quiet

Run quietly; don't produce output.

-Q *quota*, --quota=*quota*

Specify download quota for automatic retrievals. The default value is in bytes; addk suffix for kilobytes, or m for megabytes.

-r, --recursive

Turn on recursive retrieving.

-R *rejlist*, --reject=*rejlist*

Specify a comma-separated list of filename suffixes or patterns to reject.

--random-wait

Set a random wait time to prevent being identified by web sites that look for patterns in time between requests so they can block access.

--read-timeout=*seconds*

Set the read (and write) timeout to the specified number of seconds. The default is 900 seconds.

--referer=*url*

Include a "Referer: url" header in an HTTP request.

--restrict-file-names=*mode*[,nocontrol]

Restrict the characters found in remote URLs from appearing in local filenames. The value of mode is the operating systeme.g., unix or windows (use unix for Linux). Such characters are escaped with a percent sign (%). The default is to escape characters not valid on your operating system. Appending ,nocontrol turns off escaping of control characters.

--retr-symlinks

When retrieving FTP directories recursively, follow symbolic links and retrieve the linked-to files.

-S, --server-response

Print HTTP server headers and FTP server responses.

--save-cookies=*file*

Save cookies in the specified file before exiting. Does not save expired cookies, and only saves session cookies if --keep-session-cookies is also specified.

--save-headers

Save the headers sent by an HTTP server to the file, preceding the contents and separated by a blank line.

--spider

Behave like a web spider, checking that pages exist but not downloading them.

--strict-comments

Turn on strict parsing of HTML comments, instead of terminating comments at the first occurrence of -->.

-t *num*, --tries=*num*

Set the number of retries to the specified value of*num*. Set *num* to 0 or inf to keep trying forever (infinitely) (default is 20 retries), unless there is a fatal error such as "connection refused."

-T *seconds*, --timeout=*seconds*

Set network timeout to the specified number of seconds. Equivalent to specifying all of--dns-timeout,--connect-timeout, and --read-timeout.

-U *agent*,--user-agent=*agent*

Specify an agent string to the HTTP server to replace the default identification of Wget*/version*, where *version* is the current wget version. This string is used in the User-Agent header field.

-v, --verbose

Turn on verbose output, printing all available data. This is the default.

-V, --version

Display version information and exit.

-w *seconds*, --wait=*seconds*

Specify the wait in seconds between retrievals. Used to lighten server load. Use the suffixm to specify the wait in minutes, h for hours, or d for days.

--waitretry=*seconds*

Specify the number of seconds to wait between retries if the download fails. The default in the global configuration file is to not wait.

-x, --force-directories

Create a hierarchy of directories even if one wouldn't otherwise be created.

-X *list*, --exclude-directories=*list*

Specify a comma-separated list of directories to exclude from download. List elements may contain wildcards.

-Y on|off, --proxy=on|off

Turn proxy support on or off (default is on).

whatis

`whatis` *keywords*

Search the short manual page descriptions in the `whatis` database for each *keyword* and print a one-line description to standard output for each match. Like `apropos`, except that it searches only for complete words. Equivalent to `man -f`.

whereis

`whereis` [*options*] *files*

Locate the binary, source, and manual page files for specified commands/files. The supplied filename are first stripped of leading pathname components and any (single) trailing extension of the form *.ext* (for example, *.c*). Prefixes of *s.* resulting from use of source code control are also dealt with. `whereis` then attempts to locate the desired program in a list of standard Linux directories (*/bin*, */etc*, */usr/bin*, */usr/local/bin/*, etc.).

Options

-b

Search only for binaries.

-f

Terminate the last directory list and signal the start of filenames. Required when the-B, -M, or -S option is used.

-m

Search only for manual sections.

-s

Search only for sources.

-u

Search for unusual entriesthat is, files that do not have one entry of each requested type. Thus, the command `whereis -m -u *` asks for those files in the current directory that have no documentation.

-B *directories*

Change or otherwise limit the directories to search for binaries.

-M *directory*

Change or otherwise limit the directories to search for manual sections.

-S *directory*

Change or otherwise limit the directories to search for sources.

Example

Find all files in */usr/bin* that are not documented in */usr/share/man/man1* but that have source in */usr/src*:

```
$ cd /usr/bin
$ whereis -u -M /usr/share/man/man1 -S /usr/src -f *
```

which

```
which [options] [--] [commands]
```

List the full pathnames of the files that would be executed if the named*commands* had been run. which searches the user's $PATH environment variable.

Options

-a, --all

Print all matches, not just the first.

-i, --read-alias

Read aliases from standard input and write matches to standard output. Useful for using an alias for which.

--read-functions

Read shell functions from standard input and report matches to standard output. Useful for also using a shell function for which itself.

--skip-alias

Ignore --read-alias if present. Useful for finding normal binaries while using--read-alias in an alias for which.

--skip-dot

Skip directories that start with a dot.

--skip-functions

Ignore --read-functions if present. Useful when searching for normal binaries while using--

read-functions in an alias or function for which.

--skip-tilde

Skip directories that start with a tilde (~) and executables in $HOME.

--show-dot

If a matching command is found in a directory that starts with a dot, print *./cmdname* instead of the full pathname.

--show-tilde

Print a tilde (~) to indicate the user's home directory. Ignored if the user is root.

--tty-only

Stop processing options on the right if not on a terminal.

-v, -V, --version

Print version information and then exit.

--help

Print help information and then exit.

Example

```
$ which cc ls
/usr/bin/cc
ls:      aliased to ls -sFC
```

who

```
who [options] [file]
who am i
```

Show who is logged into the system. With no options, list the names of users currently logged in, their terminal, the time they have been logged in, and the name of the host from which they have logged in. An optional system *file* (default is */etc/utmp*) can be supplied to give additional information.

Options

-a, --all

Equivalent to -b -d --login -p -r -t -T -u.

am i

Print the username of the invoking user.

-b, --boot

Print time of last system boot.

-d, --dead

Print a list of dead processes.

--help

Print a help message and then exit.

-i, --idle

Include idle times. An idle time of . indicates activity within the last minute; one of old indicates no activity in more than a day.

-l, --login

Print list of system login processes.

--lookup

Attempt to include canonical hostnames via DNS.

-m

Same as who am i.

-p, --process

Print active processes spawned by init.

-q, --count

"Quick." Display only the usernames and total number of users.

-r, --runlevel

Print the current runlevel.

-s, --short

Print only name, line, and time. This is the default behaviour.

-t, --time

Print the last system clock change.

-u, --users

Print a list of the users who are logged in.

--version

Print version information and then exit.

-w, -T, --mesg, --message, --writable

Include user's message status in the output:

+

mesg y (write messages allowed)

-

mesg n (write messages refused)

?

Cannot find terminal device

-H, --heading

Print headings.

Example

This sample output was produced at 8 a.m. on April 17:

```
$ who -uH
NAME     LINE   TIME         IDLE   PID  COMMENTS
Earvin   ttyp3  Apr 16 08:14 16:25  2240
Larry    ttyp0  Apr 17 07:33   .   15182
```

Since Earvin has been idle since yesterday afternoon (16 hours), it appears that he isn't at work yet. He simply left himself logged in. Larry's terminal is currently in use.

whoami

`whoami`

Print current user ID. Equivalent to `id -un`.

whois

`whois[`*`options`*`] `*`query`*`[@`*`server`*`[:`*`port`*`]]`
`jwhois [`*`options`*`] `*`query`*`[@`*`server`*`[:`*`port`*`]]`

Search a `whois` database for a domain name, IP address, or NIC name. The information returned varies, but usually contains administrative and technical contacts so that you can find a person to handle problems at that domain. By default, the command returns information on *.com*, *.net*, and *.edu* domains, but other hosts can be queried for other domains using *host* or the `-h` option.

Options

--

Indicate the end of options. A subsequent string that begins with a hyphen on the command line is taken as a query string.

-a, --raw

Do not rewrite query according to configuration before sending to server.

-c *file*, --config=*file*

Specify a configuration file to use instead of the default */etc/jwhois.conf*.

-d, --disable-cache

Disable reading and writing to the cache.

-f, --force-lookup

Force the lookup query to go to the host, even if it is available from the cache.

-h *host,* --host=*host*

Query the whois server on the specified host. Same as *host* on the command line. By default, queries the server in the environment variable NICNAMESERVER or WHOISSERVER if either is set; otherwise queries *whois.internic.net*.

--help

Print help message and exit.

-i, --display-redirections

Display every step in a redirection. The default is to display only the last step.

-n, --no-redirect

Disable redirection from one server to the next.

-p *port*, --port=*port*

Connect to the specified port. Same as *port* on the command line. Default is 43.

-r, --rwhois

Force use of the rwhois protocol, instead of HTTP or whois.

--rwhois-display=*display*

Request receiving rwhois servers to display the results in the specified display instead of the default.

--rwhois-limit=*limit*

Request receiving rwhois servers to limit the number of matches to the specified limit.

-s, --no-whoisservers

Disable built-in support for *whois-servers.net*.

-v

Verbose. Display the query before sending it to the server.

--version

Print version information and exit.

write

```
write user [tty]
message
```

Initiate or respond to an interactive conversation with *user*. A write session is terminated with EOF. If the user is logged into more than one terminal, specify a *tty* number. See also talk; use mesg to keep other users from writing to your terminal.

xargs

```
xargs [options] [command]
```

Execute *command* (with any initial arguments), but read remaining arguments from standard input instead of specifying them directly. xargs passes these arguments in several bundles to *command*, allowing *command* to process more arguments than it could normally handle at once. The arguments are typically a long list of filenames (generated by ls or find, for example) that get passed to xargs via a pipe.

Options

-0, --null

Expect filenames to be terminated by NULL instead of whitespace. Do not treat quotes or backslashes specially.

-e[*string*], -E [*string*], --eof[=*string*]

Set EOF to _ or, if specified, to *string*.

--help

Print a summary of the options to xargs and then exit.

-i[*string*], -I [*string*], --replace[=*string*]

Replace all occurrences of { }, or *string*, with the names read from standard input. Unquoted blanks are not considered argument terminators. Implies -x and -L 1.

-l[*lines*], -L [*lines*], --max-lines[=*lines*]

Allow no more than *lines* nonblank input lines on the command line (default is 1). Implies -x.

-n *args*, --max-args=*args*

Allow no more than *args* arguments on the command line. Overridden by the maximum number of characters set with -s.

-p, --interactive

Prompt for confirmation before running each command line. Implies -t.

-P *max*, --max-procs=*max*

Allow no more than *max* processes to run at once. The default is 1. A maximum of 0 allows as many as possible to run at once.

-r, --no-run-if-empty

Do not run command if standard input contains only blanks.

-s *max*, --max-chars=*max*

Allow no more than *max* characters per command line.

-t, --verbose

Verbose mode. Print command line on standard error before executing.

-x, --exit

If the maximum size (as specified by -s) is exceeded, exit.

--version

Print the version number of xargs and then exit.

Examples

grep for *pattern* in all files on the system:

```
find / | xargs grep  pattern  > out &
```

Run diff on file pairs (e.g., f1.a and f1.b, f2.a and f2.b, etc.):

```
echo $* | xargs -n2 diff
```

The previous line would be invoked as a shell script, specifying filenames as arguments. Display*file*, one word per line (same as deroff -w):

```
cat  file  | xargs -n1
```

Move files in olddir to newdir, showing each command:

```
ls olddir | xargs -i -t mv olddir/{  } newdir/{  }
```

xinetd

---

xinetd [*options*]

TCP/IP command. The extended Internet services daemon. xinetd saves system resources by listening to multiple sockets on the behalf of other server programs, invoking necessary programs as requests are made for their services. Beyond this, xinetd provides better logging facilities, including remote user ID, access times, and server-specific information. It also provides access-control facilities. Not limited to system administration use, it can launch services that are not listed in */etc/services*. Unprivileged users can use this tool to start their own servers.

Options

-cc *num*

Perform an internal-state consistency check every *num* seconds.

-d

Turn on debugging support.

-dontfork

Execute in the foreground. This option automatically sets the -stayalive option.

-f *file*

Read configuration from the specified *file* instead of */etc/xinetd.conf*.

-filelog *file*

Write log messages to the specified *file*. Cannot be combined with -syslog or -d.

-inetd_compat

Read the */etc/inetd.conf* file after reading */etc/xinetd.conf*.

-limit *num*

Start no more than *num* concurrent processes.

-logprocs *num*

Limit processes used to look up remote user IDs to*num*.

-pidfile *file*

Write xinetd's process ID to *file*.

-stayalive

Keep running even when no services have been specified.

-syslog *facility*

Log messages to the specified syslogd facility. Accepted values are daemon, auth, user, and local*n*, where *n* can range from 0 to 7. Cannot be combined with -syslog or -d. The default behavior is to write messages to syslogd using the daemon facility.

-version

Print version information, then exit.

Configuration files

By default xinetd reads its configuration information from file */etc/xinetd.conf*. Lines in this file beginning with # are treated as comments. The entries for each service differ completely from */etc/inetd* entries. xinetd configuration entries for services follow the pattern:

```
service servicename
{
    attribute1 = valueset1
    attribute2 = valueset2
}
```

Some attributes allow assignment operators other than=. Other operators are +=, to add to a value

set, and -=, to remove a value from a value set. There are many attributes available to control services. The following are the most common:

cps

Limit incoming connection rate. Accepts two numeric arguments: the number of connections per second to allow and the number of seconds to wait to accept a new connection when the rate is exceeded. The default is 50 incoming connections and a 10-second wait.

disable

Accept a Boolean yes or no. When disabled, xinetd will ignore the entry.

flags

Accept a set of the following values defining xinetd's behavior:

IDONLY

Accept only connections when the remote user's ID can be verified by an identification server. Cannot be used with USERID logging.

INTERCEPT

Intercept packets to ensure they are coming from allowed locations. Cannot be used with internal or multithreaded services.

IPv4

Service is an IPv4 service.

IPv6

Service is an IPv6 service.

KEEPALIVE

Set flag on socket, enabling periodic checks to determine if the line is still receiving data.

NAMEINARGS

Expect the first argument for the server_args attribute to be the command to run. This flag is necessary to wrap services with tcpd.

NODELAY

Set socket's NODELAY flag.

NOLIBWRAP

Don't use xinetd's internal TCP wrapping facilities.

NORETRY

If service fails to fork, don't try to fork again.

SENSOR

Instead of launching a service, add IP addresses that attempt to access this service to a list of denied addresses for a time specified by thedeny_time attribute.

group

Specify a group ID for the server process. This may be used only whenxinetd runs as root.

nice

Set service priority. This attribute accepts the same values as therenice command.

id

Specify a unique identifier for the service. Useful when creating multiple entries with the *servicename*. For example, two versions of the echo service, one supporting UDP and the other TCP, might be given the identifiersecho-stream and echo-dgram.

log_on_failure

Specify values to log when a server cannot be started. Accepted values are HOST, USERID, or just ATTEMPT.

log_on_success

Specify values to log when a server is started. Accepted values are PID, HOST, USERID, EXIT, and DURATION.

no_access

Specify hosts that should not be allowed access to a service. May be given as an IP address, a netmask, a hostname, a network name from */etc/networks*, or a group of IP addresses like so: 192.168.1.{10,11,12,15,32}.

only_from

Restrict access to the service to the specified hosts. This attribute accepts the same values as no_access.

per_source

Specify the maximum number of instances allowed to a single source IP address. The default is "UNLIMITED".

port

Specify the service port to listen to. This attribute is required for non-RPC services not listed in */etc/services*. If the service is listed, the value of `port` cannot differ from what is listed.

protocol

Specify protocol to use, usually `tcp` or `udp`. The protocol must be listed in */etc/protocols*. This attribute is required for RPC services, as well as services not found in */etc/services*.

rpc_version

The RPC version used by the service. This can be a single number or a range of numbers from *x*-*y*. This attribute is required for RPC services.

rpc_number

Specify RPC ID number. This is required only for services not listed in */etc/rpc*; otherwise it's ignored.

server

The program to execute for the service. When using `tcpd` to wrap a service, also set the NAMEINARGS flag and use the server's program name as the first argument for server_args. This attribute is required for all non-internal services.

server_args

Arguments to pass to the server program.

socket_type

Specify the socket type to create. Accepted values are `stream`, `dgram`, `raw`, and `seqpacket`.

`type`

Describe the type of service. Accepted values are `RPC`, `INTERNAL`, and `UNLISTED`.

`user`

Specify a user ID for the server process. This may be used only when `xinetd` runs as root.

`wait`

Determine whether services should be treated as single-threaded (`yes`) and `xinetd` should wait until the server exits to resume listening for new connections, or multithreaded (`no`) and `xinetd` should not wait to resume listening. This attribute is required for all serices.

Files

/etc/xinetd.conf

Default configuration file.

/etc/xinetd.d

Common directory containing configuration files included from */etc/xinetd.conf*.

yacc

```
yacc [options] file
```

Given a *file* containing context-free grammar, convert *file* into tables for subsequent parsing, and send output to *y.tab.c*. This command name stands for yet another compiler-compiler. See also flex, bison, and *lex & yacc* (O'Reilly).

Options

-b *prefix*

Prepend *prefix*, instead of *y*, to the output file.

-d

Generate *y.tab.h*, producing #define statements that relate yacc's token codes to the token names declared by the user.

-g

Generate a VCG description.

-l

Exclude #line constructs from code produced in *y.tab.c*. (Use after debugging is complete.)

-o *outfile*

Write generated code to *outfile* instead of the default *y.tab.c*.

-p *prefix*

Change the symbol yacc uses for symbols it generates from the default yy to *prefix*.

-t

Compile runtime debugging code.

-v

Generate *y.output*, a file containing diagnostics and notes about the parsing tables.

yes

```
yes [strings]
yes [option]
```

Print the command-line arguments, separated by spaces and followed by a newline, until killed. If no arguments are given, print y followed by a newline until killed. Useful in scripts and in the background; its output can be piped to a program that issues prompts.

Options

--help

Print a help message and then exit.

--version

Print version information and then exit.

ypbind

`ypbind [options]`

NFS/NIS command. NIS binder process. `ypbind` is a daemon process typically activated at system startup time. Its function is to remember information that lets client processes on a single node communicate with some `ypserv` process. The information `ypbind` remembers is called a *binding*--the association of a domain name with the Internet address of the NIS server and the port on that host at which the `ypserv` process is listening for service requests. This information is cached in the file */var/yp/bindings/domainname.version*.

Options

-broadcast

Ignore configuration information in */etc/yp.conf* and directly request configuration information from a remote system using `ypset`.

-broken-server

Allow connections to servers using normally illegal port numbers. Sometimes needed for compatibility with other versions of `ypserv`.

-c

Check configuration file for syntax errors, then exit.

-debug

Run in the foreground process instead of detaching and running as a daemon.

-f *file*

Read configuration information from *file* instead of */etc/yp.conf*.

-no-ping

Don't ping remote servers to make sure they are alive.

--version

Print version information, then exit.

-ypset

Allow remote machine to change the local server's bindings. This option is very dangerous and should be used only for debugging the network from a remote machine.

-ypsetme

ypset requests may be issued from this machine only. Security is based on IP address checking, which can be defeated on networks on which untrusted individuals may inject packets. This option is not recommended.

ypcat

```
ypcat [options] map
```

NFS/NIS command. Print values in an NIS database specified by *map* name or nickname.

Options

-d *domain*

Specify *domain* other than the default domain.

-h *host*

Specify a ypbind *host* other than the default.

--help, -?

Print help message, then exit.

-k

Display keys for maps in which values are null or key is not part of value.

-t

Do not translate *mname* to map name.

--version, -?

Print version number, then exit.

-x

Display map nickname table listing the nicknames (*mname*s) known and map name associated with each nickname. Do not require an *mname* argument.

ypinit

ypinit [*options*]

NFS/NIS command. Build and install an NIS database on an NIS server. ypinit can be used to set up a master server, slave server, or slave copier. Only a privileged user can runypinit.

Options

-m

Indicate that the local host is to be the NIS master server.

-s *master_name*

Set up a slave server database. *master_name* should be the hostname of an NIS server, either

the master server for all the maps, or a server on which the database is up to date and stable.

ypmatch

```
ypmatch [options] key... mname
```

NFS/NIS command. Print value of one or more *key*s from an NIS map specified by *mname*. *mname* may be either a map name or a map nickname.

Options

-d *domain*

Specify *domain* other than default domain.

-k

Before printing value of a key, print the key itself, followed by a colon (:).

-t

Do not translate nickname to map name.

-x

Display map nickname table listing the nicknames (*mnames*) known, and the map name associated with each nickname. Do not require an *mname* argument.

yppasswd

```
yppasswd [options] [name]
```

NFS/NIS command. Change login password in Network Information Service. Create or change your password, and distribute the new password over NIS. The superuser can change the password for any *user*. This command may also be invoked as `ypchfn` and `ypchsh`.

Options

-f

Update the password information field (the GECOS field). Using this option is the same as `ypchfn`.

-l

Update the login shell. Using this option is the same as `ypchsh`.

-p

Update the password. This is the default behavior for `yppasswd`.

--help, -?

Print help message, then exit.

--version, -?

Print version number, then exit.

yppasswdd

`rpc.yppasswdd` [*options*]

NFS/NIS command. Server for modifying the NIS password file. `yppasswdd` handles password-change requests from `yppasswd`. It changes a password entry only if the password represented by `yppasswd` matches the encrypted password of that entry and if the user ID and group ID match those in the server's */etc/passwd* file. Then it updates */etc/passwd* and the password maps on the local server. If the server was compiled with the CHECKROOT=1 option, the password is also checked against the root password.

Options

-D *dir*

Specify a directory that contains the *passwd* and *shadow* files for rpc.yppasswdd to use instead of */etc/passwd* and */etc/shadow*. Useful to prevent all users in the NIS database from automatically gaining access to the NIS server.

-e chsh|chfn]

Permit users to change the shell or user information in the GECOS field of their *passwd* entry. By default, rpc.yppasswdd does not permit users to change these fields.

-E *program*

Specify a program to edit the *passwd* and *shadow* files instead of rpc.yppasswdd. The program should return 0 for successful completion; 1 for successful completion, but the pwupdate program should not be run to update the NIS server's maps; and anything else if the change failed.

-p *pwfile*

Specify an alternative *passwd* file to */etc/passwd*, to prevent all users in the NIS database from automatically gaining access to the NIS server.

--port *num*

Specify a port that rpc.yppasswdd will try to register itself, allowing a router to filter packets to the NIS ports.

-s *shadowfile*

Use *shadowfile* instead of */etc/passwd* for shadow password support.

-v

Print version information and whether the package was compiled withCHECKROOT.

-x *program*

Modify files using the specified *program* instead of using internal default functions. rpc.yppasswdd passes information to *program* in the following format:

```
username o:oldpassword p:password s:shell g:gcos
```

Any of the fields p, s, or g may be missing.

yppoll

`yppoll [options] map`

NFS/NIS command. Determine version of NIS map at NIS server. `yppoll` asks a `ypserv` process for the order number and the hostname of the master NIS server for the *map*.

Options

`-h` *host*

Ask the `ypserv` process at *host* about the map parameters. If *host* is not specified, the hostname of the NIS server for the local host (the one returned by `ypwhich`) is used.

`-d` *domain*

Use *domain* instead of the default domain.

yppush

`yppush [options] mapnames`

NFS/NIS command. Force propagation of changed NIS map. `yppush` copies a new version of an NIS map, *mapname*, from the master NIS server to the slave NIS servers. It first constructs a list of NIS server hosts by reading the NIS map `ypservers` with the `-d` option's *domain* argument. Keys within this map are the ASCII names of the machines on which the NIS servers run. A map transfer request is sent to the NIS server at each host, along with the information needed by the transfer agent to cal back to `yppush`. When the attempt has been completed and the transfer agent has sent`yppush` a status message, the results may be printed to standard error. Normally invoked by */var/yp/Makefile* after commenting out the `NOPUSH=true` line.

Options

`-d` *domain*

Specify a *domain*.

-h *host*

Specify one or a group of systems to which a map should be transferred instead of using the list of servers in the ypservers map. Multiple -h options can be specified to create a list of hosts.

-p *count*

Send maps to *count* NIS slaves simultaneously (in parallel). By default, yppush sends maps to one server at a time (serially).

--port *num*

Specify a port to listen on for callbacks. This will not work when sending maps in parallel. By default, the command chooses a random port.

-t *secs*

Specify a timeout value in seconds. The timeout determines how longyppush will wait for a response from a slave server before sending a map transfer request to the next server. The default timeout is 90 seconds, but for big maps a longer timeout may be needed.

-v

Verbose; print message when each server is called and for each response. Specify twice to make yppush even more verbose.

ypserv

`ypserv [options]`

NFS/NIS command. NIS server process. ypserv is a daemon process typically activated at system startup time. It runs only on NIS server machines with a complete NIS database. Its primary functior is to look up information in its local database of NIS maps. The operations performed byypserv are defined for the implementor by the NIS protocol specification, and for the programmer by the header file <*rpcvc/yp_prot.h*>. Communication to and from ypserv is by means of RPC calls. On startup or when receiving the signal SIGHUP, ypserv parses the file */etc/ypserv.conf*. ypserv supports securenets, which can be used to restrict access to a given set of hosts.

Options

-b, --dns

Query the DNS service for host information if not found in the hosts maps.

-d [*path*], --debug [*path*]

Run in debugging mode without going into background mode, and print extra status messages to standard error for each request. If *path* is specified, use it instead of */var/yp*.

-p *port*, --port *port*

Bind to the specified port. For use with a router to filter packets so that access from outside hosts can be restricted.

-v, --version

Print version information and exit.

Files and directories

/etc/yp.conf

Configuration file.

/var/yp/domainname

Location of NIS databases for *domainname*.

/var/yp/Makefile

Makefile that is responsible for creating NIS databases.

/var/yp/securenets

securenets information containing netmask/network pairs separated by whitespace.

ypset

```
ypset [options] server
```

NFS/NIS command. Point ypbind at a particular server. ypset tells ypbind to get NIS services for the specified domain from the ypserv process running on *server*. *server* indicates the NIS server to bind to and can be specified as a name or an IP address.

Options

-d *domain*

Use *domain* instead of the default domain.

-h *host*

Set ypbind's binding on *host* instead of the local host. *host* can be specified as a name or an IP address.

yptest

```
yptest [options]
```

NFS/NIS command. Check configuration of NIS services by calling various NIS functions. Without arguments, yptest queries the NIS server for the local machine.

Options

-d *domainname*

Use *domainname* instead of the current host's default domain. This option may cause some tests to fail.

-h *host*

Test ypserv on the specified *host* instead of the current host. This option may cause some tests to fail.

-m *map*

Use the specified *map* instead of the default map.

`-q`

Quiet mode. Print no messages.

`-u` *user*

Run tests as *user* instead of as nobody.

ypwhich

`ypwhich [`*`options`*`] [`*`host`*`]`

NFS/NIS command. Return hostname of NIS server or map master. Without arguments, `ypwhich` cites the NIS server for the local machine. If *host* is specified, that machine is queried to find out which NIS master it is using.

Options

`-d` *domain*

Use *domain* instead of the default domain.

`-m [`*map*`]`

Find master NIS server for a map. No host can be specified with `-m`. *map* may be a map name or a nickname for a map. If no map is specified, display a list of available maps.

`-t` *mapname*

Inhibit nickname translation.

`-V`*n*

Version of `ypbind` (default is v2).

`-x`

Display map nickname table. Do not allow any other options.

ypxfr

`ypxfr [options] mapname`

NFS/NIS command. Transfer an NIS map from the server to the local host by making use of normal NIS services. `ypxfr` creates a temporary map in the directory */var/yp/domain* (where *domain* is the default domain for the local host), fills it by enumerating the map's entries, and fetches the map parameters and loads them. If run interactively, `ypxfr` writes its output to the terminal. However, if it is invoked without a controlling terminal, its output is sent to `syslogd`.

Options

`-c`

Do not send a "Clear current map" request to the local `ypserv` process.

`-C` *tid prog ipadd port*

This option is for use only by `ypserv`. When `ypserv` invokes `ypxfr`, it specifies that `ypxfr` should call back a `yppush` process at the host with IP address *ipadd*, registered as program number *prog*, listening on port *port*, and waiting for a response to transaction *tid*.

`-d` *domain*

Specify a domain other than the default domain.

`-f`

Force the transfer to occur even if the version on the master server is older than the local version.

`-h` *host*

Get the map from *host* instead of querying NIS for the map's master server. *host* may be specified by name or IP address.

`-p` *dir*

Use *dir* as the path to the NIS map directory instead of */var/yp*.

`-s` *domain*

Specify a source *domain* from which to transfer a map that should be the same across domains (such as the *services.byname* map).

zcat

`zcat [options] [files]`

Read one or more *files* that have been compressed with `gzip` or `compress` and write them to standard output. Read standard input if no *files* are specified or if `-` is specified as one of the files; end input with EOF. `zcat` is identical to `gunzip -c` and takes the options described for `gzip`/`gunzip`.

zcmp

`zcmp [options] files`

Read compressed files and pass them uncompressed to the `cmp` command, along with any command-line options. If a second file is not specified for comparison, look for a file called *file.gz*.

zdiff

`zdiff [options] files`

Read compressed files and pass them, uncompressed, to the `diff` command, along with any command-line options. If a second file is not specified for comparison, look for a file called *file.gz*.

zdump

`zdump [options] [zones]`

System administration command. Dump a list of all known time zones or, if an argument is provided, a specific zone or list of zones. Include each zone's current time with its name.

Options

-c *year*

Specify a cutoff year to limit verbose output. Meaningful only with-v.

-v

Verbose mode. Include additional information about each zone.

zforce

```
zforce [names]
```

Rename all gzipped files to *filename.gz*, unless file already has a *.gz* extension.

zgrep

```
zgrep [options] [files]
```

Uncompress files and pass to grep, along with any command-line arguments. If no files are provided read from (and attempt to uncompress) standard input. May be invoked aszegrep or zfgrep and will in those cases invoke egrep or fgrep.

zic

```
zic [options] [files]
```

System administration command. Create time conversion information files from the file or files specified. If the specified file is-, read information from standard input.

Options

-d *directory*

Place the newly created files in*directory*. Default is */usr/local/etc/zoneinfo*.

-l *timezone*

Specify a *timezone* to use for local time. zic links the zone information for *timezone* with the zone localtime.

-p *timezone*

Set the default rules for handling POSIX-format environment variables to the zone name specified by *timezone*.

-s

Store time values only if they are the same when signed as when unsigned.

-v

Verbose mode. Include extra error checking and warnings.

-y *command*

Check year types with*command*. Default is yearistype.

-L *file*

Consult *file* for information about leap seconds.

The source files for zic should be formatted as a sequence of rule lines, zone lines, and link lines. An optional file containing leap-second rules can be specified on the command line. Rule lines describe how time should be calculated. They describe changes in time, daylight savings time, and any other changes that might affect a particular time zone. Zone lines specify which rules apply to a given zone Link lines link similar zones together. Leap lines describe the exact time when leap seconds should be added or subtracted. Each of these lines is made up of fields. Fields are separated from one another by any number of whitespace characters. Comment lines are preceded by#. The fields used in each

line are listed in the next section.

Rule line fields

The format of a rule line is:

```
Rule NAME FROM TO TYPE IN ON AT SAVE LETTERS
```

NAME

Name this set of rules.

FROM

Specify the first year to which this rule applies. Gregorian calendar dates are assumed. Instead of specifying an actual year, you may specify *minimum* or *maximum* for the minimum or maximum year, representable as an integer.

TO

Specify the last year to which this rule applies. Syntax is the same as for the *FROM* field.

TYPE

Specify the type of year to which this rule should be applied. The wildcard- instructs that all years be included. Any given year's type will be checked with the command given with the -y option or the default `yearistype` *year type*. An exit status of 0 is taken to mean the year is of the given type; an exit status of 1 means that it is not of the given type (see -y option).

IN

Specify month in which this rule should be applied.

ON

Specify day on which this rule should be applied. Whitespace is not allowed. For example:

1

The 1st.

firstSun

The first Sunday.

Sun>=3

The first Sunday to occur before or on the 3rd.

AT

Specify the time after which the rule is in effect. For example, you may use13, 13:00, or 13:00:00 for 1:00 p.m. You may include one of several suffixes (without whitespace between):

s

Local standard time.

u, g, z

Universal time.

w

Wall clock time (default).

SAVE

Add this amount of time to the local standard time. Formatted like*AT*, without suffixes.

LETTERS

Specify letter or letters to be used in time zone abbreviations (for example, S for EST). For no abbreviation, enter -.

Zone line fields

The format of a zone line is:

```
Zone NAME GMTOFF RULES/SAVE FORMAT [UNTIL]
```

NAME

Time zone name.

GMTOFF

The amount of hours by which this time zone differs from GMT. Formatted like*AT*. Negative times are subtracted from GMT; by default, times are added to it.

RULES/SAVE

Either the name of the rule to apply to this zone or the amount of time to add to local standard time. To make the zone the same as local standard time, specify-.

FORMAT

The format of time zone abbreviations. Specify the variable part with%s.

UNTIL

Change the rule for the zone at this date. The next line must specify the new zone information and therefore must omit the string "Zone" and the*NAME* field.

Link line fields

The format of a link line is:

```
Link LINK-FROM LINK-TO
```

LINK-FROM

The name of the zone that is being linked.

LINK-TO

An alternate name for the zone that was specified as*LINK-FROM*.

Leap line fields

The format of a leap line is:

```
Leap YEAR MONTH DAY HH:MM:SS CORR R|S
```

YEAR MONTH DAY HH:MM:SS

Specify when the leap second happened.

CORR

Uses + or - to show whether the second was added or skipped.

R|S

Rolling or Stationary. Describe whether the leap second should be applied to local wall-clock time or GMT, respectively.

zless

```
zless files
```

Uncompress files and allow paging through them. Equivalent to runningzmore with the environment variable PAGER set to less. See zmore for the available commands.

zmore

```
zmore [files]
```

Similar to more. Uncompress files and print them one screenful at a time. Works on files compressed with compress, gzip, or pack, and with uncompressed files.

Commands

space

Print next screenful.

*i*space

Print next *i* lines.

Return

Print one more line.

d, ^D

Print next *i*, or 11, lines.

iz

Print next *i* lines or a screenful. If *i* is specified, treat it as the new window size for the rest of the current file, then revert back to the default.

*i*s

Skip *i* lines. Print next screenful.

*i*f

Skip *i* screens. Print next screenful.

q, Q, :q, :Q

Go to next file or, if current file is the last, exit zmore.

e, q

Exit zmore when the prompt "--More--(Next file: *file*)" is displayed.

s

Skip next file and continue when the prompt "--More--(Next file: *file*)" is displayed.

=

Print line number.

i/expr

Search forward for *i*th occurrence (in all files) of *expr*, which should be a regular expression. Display occurrence, including the two previous lines of context.

*i*n

Search forward for the *i*th occurrence of the last regular expression searched for.

!*command*

Execute *command* in shell. If *command* is not specified, execute last shell command. To invoke a shell without passing it a command, enter \!.

.

Repeat the previous command.

znew

`znew [options] [files]`

Uncompress *.Z* files and recompress them in *.gz* format.

Options

-9

Optimal (and slowest) compression method.

-f

Recompress even if *filename.gz* already exists.

-K

If the original *.Z* file is smaller than the *.gz* file, keep it.

-P

Pipe data to conversion program. This saves disk space.

-t

Test new *.gz* files before removing *.Z* files.

-v

Verbose mode.

PREV

Chapter 4. Boot Methods

This chapter describes some techniques for booting your Linux system. Depending on your hardware and whether you want to run any other operating systems, you can configure the system to boot Linux automatically or to provide a choice between several operating systems. Choosing between operating systems is generally referred to as *dual booting*, although you can actually boot more than two.

Once your Linux system is installed, rebooting the system is generally straightforward. But with the wide variety of hardware and software in use, there are many possibilities for configuring your boot process. The most common choices are:

- Boot Linux from a floppy or bootable CD, leaving any other operating system to boot from the hard drive.
- Use the Linux Loader, LILO.[*] This is the traditional method of booting and lets you boot both Linux and other operating systems.

  [*] LILO is a boot program for i386-architecture machines. On the Alpha, the equivalent boot program is called MILO (Mini Loader), and on the SPARC, it's called SILO.

- Use the Grand Unified Bootloader (GRUB), the GNU graphical boot loader and command shell. Like LILO, GRUB lets you boot both Linux and other operating systems. For now, GRUB runs only on i386-based systems.
- Run Loadlin, which is an MS-DOS program that boots Linux from within DOS.

Other boot managers that can load Linux are available, but we don't discuss them here. We also won't talk further about booting from a floppy or CD or via Loadlin, except to say that whatever method you choose for booting, be sure to have a working boot disk available for emergency use. In particular, don't experiment with the files and options in this chapter unless you have a boot disk, because any error could leave you unable to boot from the hard disk. Note, though, that one of the advantages of using GRUB is that if there is a problem booting from the menu, it drops you down to the command-line interface so you can enter commands directly and try to recover. Also, see "Creating a GRUB boot floppy.," later in this chapter, for information on making a GRUB boot floppy.[*]

[*] Unfortunately, there is no standard set of instructions we can provide for making a bootable CD. Your best bet is to use a bootable installation CD for your distribution. Also, instructions and utilities are available online for making bootable CDs.

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4.1. The Boot Process

On an x86-based PC, the first sector of every hard disk is known as the *boot sector* and contains the partition table for that disk and possibly also code for booting an operating system. The boot sector of the first hard disk is known as the *master boot record* (MBR), because when you boot the system, the BIOS transfers control to a program that lives on that sector along with the partition table. That code is the *boot loader*, the code that initiates an operating system. When you add Linux to the system, you need to modify the boot loader, replace it, or boot from a floppy or CD to start Linux.

In Linux, each disk and each partition on the disk is treated as a device. For example, the entire first hard disk is known as */dev/hda*, and the entire second hard disk is */dev/hdb*. The first partition of the first hard drive is */dev/hda1*, and the second partition is */dev/hda2*. The first partition of the second hard drive is */dev/hdb1*, and so on. If your drives are SCSI instead of IDE, the naming works the same way, except that the devices are */dev/sda*, */dev/sda1*, and so on. Thus, if you want to specify that the Linux partition is the second partition of the first hard drive (as in the examples in this chapter), you refer to it as */dev/hda2*. Note, though, that GRUB has its own disk naming convention, described later in this chapter in "GRUB: The Grand Unified Bootloader.."

Once you've made the decision to install LILO or GRUB, you still need to decide how it should be configured. If you want your system to dual-boot Linux and Windows 95/98/ME, you can install LILO or GRUB on the MBR and set it up to let you select the system to boot. Dual-booting Linux and Windows NT/2000/XP is not quite as straightforward because these systems use the Windows NT loader, which is installed on the MBR and expects to be in charge. The standard solution described in this chapter is to add Linux as an option in the NT loader and install LILO or GRUB in the Linux partition as a secondary boot loader. The result is that the NT loader transfers control to the secondary loader, which then boots Linux. See "Dual-Booting Linux and Windows NT/2000/XP.," later in this chapter, for more information. You can also install one of the Linux boot loaders in the MBR and use it to boot Windows. (See the "Linux+WindowsNT" and the "Multiboot with GRUB" mini-HOWTOs if you're interested in doing that.)

When you install the boot loader (either LILO or GRUB) on the MBR, it replaces the MS-DOS boot loader or any other boot loader that may be there, such as the Windows NT loader. If you have problems with your installation or you simply want to restore the original boot loader, you can do one of the following:

- If you're running LILO, you can boot Linux from a floppy or CD and restore the boot sector, which LILO automatically backs up:

```
$ /sbin/lilo -u
```

- If you have the capability, boot to DOS and run the `fdisk` command with a special option that rebuilds the MBR:

```
C:> fdisk /mbr
```

- For Windows 2000 and Windows XP, which do not have an `fdisk` command, boot your computer from the Windows CD (or the Windows boot floppies if you can't boot from your CD drive). When you see "Welcome to Setup," press R (for repair) and, in Windows 2000, then press C. Select your Windows installation from the numbered list that is displayed (there may be only one entry) and enter the administrator password at the prompt. Enter the command `fixmbr` at the command-line prompt and confirm it with `y`. After the MBR has been restored, type `exit` to reboot.

The common element in all three methods is that they replace the boot loader on the MBR with the original Microsoft boot loader. The boot loader on the MBR is the one that will be used to boot the system. This means that if you want to switch from LILO to GRUB, say, or from GRUB to LILO, you don't need to uninstall the old loader; simply install the new one.

The rest of this chapter describes the various techniques for booting Linux and the options that you can specify to configure both the boot loader and the Linux kernel. Whether you use LILO or GRUB, you can pass options to the loader and specify options for the kernel.

PREV

4.2. LILO: The Linux Loader

In addition to booting Linux, LILO can boot other operating systems, such as MS-DOS, Windows 95/98/ME, or any of the BSD systems. During installation, the major Linux distributions provide the opportunity to install LILO; it can also be installed later if necessary. LILO can be installed on the MBR of your hard drive or as a secondary boot loader on the Linux partition. LILO consists of several pieces, including the boot loader itself, a configuration file(*/etc/lilo.conf*), a map file (*/boot/map*) containing the location of the kernel, and the`lilo` command (*/sbin/lilo*), which reads the configuration file and uses the information to create or update the map file and to install the files LILO needs.

One thing to remember about LILO is that it has two aspects: the boot loader and the`lilo` command. The `lilo` command configures and installs the boot loader and updates it as necessary. The boot loader is the code that executes at system boot time and boots Linux or another operating system.

4.2.1. The LILO Configuration File

The `lilo` command reads the LILO configuration file, */etc/lilo.conf*, to get the information it needs to install LILO. Among other things, it builds a map file containing the locations of all disk sectors needed for booting.

Note that any time you change */etc/lilo.conf* or rebuild or move a kernel image, you need to rerun `lilo` to rebuild the map file and update LILO.

The configuration file starts with a section of global options, described in the next section. Global options are those that apply to every system boot, regardless of the operating system you are booting. Here is an example of a global section (a hash sign,`#`, begins a comment):

```
boot=/dev/hda           # The boot device is /dev/hda
map=/boot/map           # Save the map file as /boot/map
install=/boot/boot.b    # The file to install as the new boot sector
prompt                  # Always display the boot prompt
timeout=30              # Set a 3-second (30 tenths of a second) timeout
```

Following the global section, there is one section of options for each Linux kernel and for each non-Linux operating system that you want LILO to be able to boot. Each of these sections is referred to as an *image* section because each boots a different kernel image (shorthand for a binary file containing a kernel) or another operating system. Each Linux image section begins with an`image=` line.

```
image=/boot/vmlinuz     # Linux image file
   label=linux          # Label that appears at the boot prompt
```

```
    root=/dev/hda2          # Location of the root filesystem
    vga=ask                 # Always prompt the user for VGA mode
    read-only               # Mount read-only to run fsck for a filesystem check
```

The equivalent section for a non-Linux operating system begins with `other=` instead of `image=`. For example:

```
other=/dev/hda1          # Location of the partition
   label=win98
   table=/dev/hda        # Location of the partition table
```

Put LILO configuration options that apply to all images into the global section of */etc/lilo.conf*, and options that apply to a particular image into the section for that image. If an option is specified in both the global section and an image section, the setting in the image section overrides the global setting for that image.

Here is an example of a complete */etc/lilo.conf* file for a system that has the Linux partition on */dev/hda2*:

```
## Global section
boot=/dev/hda2
map=/boot/map
delay=30
timeout=50
prompt
vga=ask

## Image section: For regular Linux
image=/boot/vmlinuz
  label=linux
  root=/dev/hda2
  install=/boot/boot.b
  map=/boot/map
  read-only
```

```
## Image section: For testing a new Linux kernel
image=/testvmlinuz
  label=testlinux
  root=/dev/hda2
  install=/boot/boot.b
  map=/boot/map
  read-only
  optional               # Omit image if not available when map is built

## Image section: For booting DOS
other=/dev/hda1
  label=dos
```

```
    loader=/boot/chain.b
    table=/dev/hda          # The current partition table

  ## Image section: For booting Windows 98
  other=/dev/hda1
    label=win98
    loader=/boot/chain.b
    table=/dev/hda
```

4.2.1.1 Global options

In addition to the options listed here, the kernel optionsappend, read-only, read-write, root, and vga (described later in Kernel options.) can also be set as global options.

backup=*backup-file*

Copy the original boot sector to *backup-file* instead of to */boot/boot.nnnn*, where *nnnn* is a number that depends on the disk device type.

boot=*boot-device*

Set the name of the device that contains the boot sector. boot defaults to the device currently mounted as root, such as */dev/hda2*. Specifying a device such as */dev/hda* (without a number) indicates that LILO should be installed in the master boot record; the alternative is to set it up on a particular partition, such as */dev/hda2*.

change-rules

Begin a section that redefines partition types at boot time for hiding and unhiding partitions. See the LILO User's Guide, which comes with the LILO distribution, for detailed information on using this option and creating a new rule set.

compact

Merge read requests for adjacent disk sectors to speed up booting. Use ofcompact is particularly recommended when booting from a floppy disk. Use ofcompact may conflict with linear.

default=*name*

Use the image *name* as the default boot image. If default is omitted, the first image specified in the configuration file is used.

delay=*tsecs*

Specify, in tenths of a second, how long the boot loader should wait before booting the default image. If `serial` is set, `delay` is set to a minimum of 20. The default is not to wait. See"Boot-Time Kernel Options." at the end of this chapter for ways to get the boot prompt if no delay is set.

`disk=`*device-name*

Define parameters for the disk specified by *device-name* if LILO can't figure them out. Normally, LILO can determine the disk parameters itself, and this option isn't needed. When `disk` is specified, it is followed by one or more parameter lines, such as:

```
disk=/dev/sda
  bios=0x80      # First disk is usually 0x80, second is usually 0x81
  sectors=...
  heads=...
```

Note that this option is not the same as the disk geometry parameters you can specify with the`hd` boot command-line option. With `disk`, the information is given to LILO; with `hd`, it is passed to the kernel. Note also that if either `heads` or `sectors` is specified, they must both be specified. The parameters that can be specified with `disk` are listed briefly here; they are described in detail in the LILO User's Guide.

`bios=`*bios-device-code*

The number the BIOS uses to refer to the device. See the previous example.

`cylinders=`*cylinders*

The number of cylinders on the disk.

`heads=`*heads*

The number of heads on the disk.

`inaccessible`

Tell LILO that the BIOS can't read the disk; used to prevent the system from becoming unbootable if LILO thinks the BIOS can read it. If this parameter is specified, it must be the only parameter.

`partition=`*partition-device*

Start a new section for a partition. The section contains one variable,`start=`*partition-offset*, which specifies the zero-based number of the first sector of the partition:

```
partition=/dev/sda1
```

```
start=2048
```

sectors=*sectors*

The number of sectors per track.

disktab=*disktab-file*

This option has been superseded by the disk= option.

fix-table

If set, allow lilo to adjust 3-D addresses (addresses specified as sector/head/cylinder) in partition tables. This is sometimes necessary if a partition isn't track-aligned and another operating system such as MS-DOS is on the same disk. See the*lilo.conf* manpage for details.

force-backup=*backup-file*

Like backup, but overwrite an old backup copy if one exists.

ignore-table

Tell lilo to ignore corrupt partition tables.

install=*boot-sector*

Install the specified file as the new boot sector. Ifinstall is omitted, the boot sector defaults to */boot/boot.b*.

lba32

Generate 32-bit Logical Block Addresses instead of sector/head/cylinder addresses, allowing booting from any partition on hard disks greater than 8.4 GB (i.e., remove the 1024-cylinder limit). Requires BIOS support for the EDD packet call interface[*] and at least LILO Version 21-4.

[*] If your BIOS is dated after 1998, it should include EDD packet call interface support.

linear

Generate linear sector addresses, which do not depend on disk geometry, instead of 3-D (sector/head/cylinder) addresses. If LILO can't determine your disk's geometry itself, you can try using linear; if that doesn't work, then you need to specify the geometry withdisk=. Note, however, that linear sometimes doesn't work with floppy disks, and it may conflict with

compact.

lock

Tell LILO to record the boot command line and use it as the default for future boots until it is overridden by a new boot command line. lock is useful if there are kernel options that you need to enter on the boot command line every time you boot the system.

map=*map-file*

Specify the location of the map file. Defaults to */boot/map*. The map file records the location of the kernel(s) used on the system.

message=*message-file*

Specify a file containing a message to be displayed before the boot prompt. The message can include a formfeed character (Ctrl-L) to clear the screen. The map file must be rebuilt by rerunning the lilo command if the message file is changed or moved. The maximum length of the file is 65,535 bytes.

nowarn

Disable warning messages.

optional

Specify that any image that is not available when the map is created should be omitted and no offered as an option at the boot prompt. Like the per-image optionoptional, but applies to all images.

password=*password*

Specify a password that the user is prompted to enter when trying to load an image. The password is not encrypted in the configuration file, so if passwords are used, permissions should be set so that only the superuser is able to read the file. This option is like the per-image version, except that all images are password-protected and they all have the same password.

prompt

Automatically display the boot prompt without waiting for the user to press the Shift, Alt, or Scroll Lock key. Note that setting prompt without also setting timeout prevents unattended reboots.

restricted

Can be used with `password` to indicate that a password needs to be entered only if the user specifies parameters on the command line. Like the per-image`restricted` option, but applies to all images.

`serial=`*parameters*

Allow the boot loader to accept input from a serial line as well as from the keyboard. Sending a break on the serial line corresponds to pressing a Shift key on the console to get the boot loader's attention. All boot images should be password-protected if serial access is insecure (e.g., if the line is connected to a modem). Setting`serial` automatically raises the value of `delay` to 20 (i.e., two seconds) if it is less than that. The parameter string*parameters* has the following syntax:

```
port[,bps[parity[bits]]]
```

For example, to initialize COM1 with the default parameters:

```
serial=0,2400n8
```

The parameters are:

port

The port number of the serial port. The default is 0, which corresponds to COM1 (*/dev/ttys0*). The value can be one of 0 through 3, for the four possible COM ports.

bps

The baud rate of the serial port. Possible values of*bps* are `110`, `300`, `1200`, `2400`, `4800`, `9600`, `19200`, and `38400`. The default is 2400 bps.

parity

The parity used on the serial line. Parity is specified asn or N for no parity, e or E for even parity, and o or O for odd parity. However, the boot loader ignores input parity and strips the 8th bit.

bits

Specify whether a character contains 7 or 8 bits. Default is 8 with no parity and 7 otherwise.

`timeout=`*tsecs*

Set a timeout (specified in tenths of a second) for keyboard input. If no key has been pressed after the specified time, the default image is booted automatically.timeout is also used to determine when to stop waiting for password input. The default timeout is infinite.

verbose=*level*

Turn on verbose output, where higher values of*level* produce more output. If -v is also specified on the lilo command line, the level is incremented by 1 for each occurrence of-v. The maximum verbosity level is 5.

4.2.1.2 Image options

The following options are specified in the image section for a particular boot image. The image can be a Linux kernel or a non-Linux operating system.

alias=*name*

Provide an alternate name for the image that can be used instead of the name specified with the label option.

image=*pathname*

Specify the file or device containing the boot image of a bootable Linux kernel. Each per-image section that specifies a bootable Linux kernel starts with animage option. See also the range option.

label=*name*

Specify the name that is used for the image at the boot prompt. Defaults to the filename of the image file (without the path).

loader=*chainloader*

For a non-Linux operating system, specify the chain loader to which LILO should pass control for booting that operating system. The default is*/boot/chain.b*. If the system will be booted from a drive that is neither the first hard disk or a floppy, the chainloader must be specified.

lock

Like lock, as described in the previous global options section; it can also be specified in an image section.

optional

Specify that the image should be omitted if it is not available when the map is created by the lilo command. Useful for specifying test kernels that are not always present.

other=*pathname*

Specify the path to a file that boots a non-Linux system. Each per-image section that specifies a bootable non-Linux system starts with another option.

password=*password*

Specify that the image is password-protected and provide the password that the user is prompted for when booting. The password is not encrypted in the configuration file, so if passwords are used, only the superuser should be able to read the file.

range=*sectors*

Used with the image option, when the image is specified as a device (e.g.,image=*/dev/fd0*), to indicate the range of sectors to be mapped into the map file.*sectors* can be given as the range *start-end* or as *start+number*, where *start* and *end* are zero-based sector numbers and *number* is the increment beyond *start* to include. If only *start* is specified, only that one sector is mapped. For example:

```
image=/dev/fd0
range=1+512   # take 512 sectors, starting with sector 1
```

restricted

Specify that a password is required for booting the image only if boot parameters are specified on the command line.

table=*device*

Specify, for a non-Linux operating system, the device that contains the partition table. Iftable is omitted, the boot loader does not pass partition information to the operating system being booted. Note that */sbin/lilo* must be rerun if the partition table is modified. This option cannot be used with unsafe.

unsafe

Can be used in the per-image section for a non-Linux operating system to indicate that the boot sector should not be accessed when the map is created. Ifunsafe is specified, then some checking isn't done, but the option can be useful for running thelilo command without having to insert a floppy disk when the boot sector is on a fixed-format floppy disk device. This option cannot be used with table.

4.2.1.3 Kernel options

The following kernel options can be specified in */etc/lilo.conf* as well as on the boot command line:

append=*string*

Append the options specified in *string* to the parameter line passed to the kernel. This typically is used to specify certain hardware parameters. For example, while BIOSes on newer systems can recognize more than 64 MB of memory, BIOSes on older systems are limited to 64 MB. If you are running Linux on such a system, you can use append:

```
append="mem=128M"
```

initrd=*filename*

Specify the file to load into */dev/initrd* when booting with a RAM disk. See also the options load_ramdisk (in Boot-Time Kernel Options.," later in this chapter) and prompt_ramdisk, ramdisk_size, and ramdisk_start in this section.

literal=*string*

Like append, but replace all other kernel boot options.

noinitrd

Preserve the contents of */dev/initrd* so they can be read after the kernel is booted.

prompt_ramdisk=*n*

Specify whether the kernel should prompt you to insert the floppy disk that contains the RAM disk image, for use during Linux installation. Values of*n* are:

0 Don't prompt. Usually used for an installation in which the kernel and the RAM disk image both fit on one floppy.

1 Prompt. This is the default.

ramdisk_size=*n*

Specify the amount of memory, in kilobytes, to be allocated for the RAM disk. The default is 4096, which allocates 4 MB.

ramdisk_start=*offset*

Used for a Linux installation in which both the kernel and the RAM disk image are on the same floppy. *offset* indicates the offset on the floppy where the RAM disk image begins; it is specified in kilobytes.

read-only

Specify that the root filesystem should be mounted read-only for filesystem checking (fsck), after which it is typically remounted read/write.

read-write

Specify that the root filesystem should be mounted read/write.

root=*root-device*

Specify the device that should be mounted as root. If the special namecurrent is used as the value, the root device is set to the device on which the root filesystem currently is mounted. Defaults to the root-device setting contained in the kernel image.

vga=*mode*

Specify the VGA text mode that should be selected when booting. The mode defaults to the VGA mode setting in the kernel image. The values are case-insensitive. They are:

ask

Prompt the user for the text mode. Pressing Enter in response to the prompt displays a list of the available modes.

extended (or ext)

Select 80x50 text mode.

normal

Select normal 80x25 text mode.

number

Use the text mode that corresponds to *number*. A list of available modes for your video card can be obtained by booting with vga=ask and pressing Enter.

4.2.2. The lilo Command

You need to run the lilo command to install the LILO boot loader and to update it whenever the kernel changes or to reflect changes to */etc/lilo.conf*. Note that if you replace your kernel image without rerunning lilo, your system may be unable to boot your system.

The path to the lilo command is usually */sbin/lilo*. The syntax of the command is:

```
lilo [options]
```

Some of the options correspond to */etc/lilo.conf* keywords:

Configuration keyword	Command option
boot=*bootdev*	-b *bootdev*
compact	-c
delay=*tsecs*	-d *tsecs*
default=*label*	-D *label*
disktab=*file*	-f *file*
install=*bootsector*	-i *bootsector*
lba32	-L
linear	-l
map=*mapfile*	-m *mapfile*
fix-table	-P fix
ignore-table	-P ignore
backup=*file*	-s *file*
force-backup=*file*	-S *file*
verbose=*level*	-v

These options should be put in the configuration file whenever possible; putting them on thelilo command line instead of in */etc/lilo.conf* is now deprecated. The next section describes those options that can be given only on the lilo command line; the others were described earlier.

4.2.3. lilo Command Options

The following list describes lilo command options that are available only on the command line. Multiple options are given separately; for example:

```
$ lilo -q -v
```

-C *config-file*

Specify an alternative to the default configuration file (*/etc/lilo.conf*). lilo uses the configuration file to determine which files to map when it installs LILO.

-I *label*

Print the path to the kernel specified by *label* to standard output, or an error message if no matching label is found. For example:

```
$ lilo -I linux
/boot/vmlinuz-2.0.34-0.6
```

-q

List the currently mapped files. lilo maintains a file (*/boot/map* by default) containing the name and location of the kernel(s) to boot. Running lilo with this option prints the names of the files in the map file to standard output, as in this example (the asterisk indicates that linux is the default):

```
$ lilo -q
linux     *
test
```

-r *root-directory*

Specify that before doing anything else, lilo should chroot to the indicated directory. Used for repairing a setup from a boot floppy; you can boot from a floppy but have lilo use the boot files from the hard drive. For example, if you issue the following commands, lilo will get the files it needs from the hard drive:

```
$ mount /dev/hda2 /mnt
$ lilo -r /mnt
```

-R *command-line*

Set the default command for the boot loader the next time it executes. The command executes once and then is removed by the boot loader. This option typically is used in reboot scripts, just before calling shutdown -r.

-t Indicate that this is a testdo not really write a new boot sector or map file. Can be used with -v to find out what lilo would do during a normal run.

-u *device-name*

Uninstall lilo by restoring the saved boot sector from */boot/boot.nnnn*, after validating it against a timestamp. *device-name* is the name of the device on which LILO is installed, such as */dev/hda2*.

-U *device-name*

Like -u, but do not check the timestamp.

-V

Print the lilo version number.

PREV

4.3. GRUB: The Grand Unified Bootloader

Like LILO, the GRUB boot loader can load other operating systems in addition to Linux. GRUB has become the default bootloader for many flavors of Linux. It was written by Erich Boleyn to boot operating systems on PC-based hardware and is now developed and maintained by the GNU project. GRUB was intended to boot operating systems that conform to the Multiboot Specification, which was designed to create one booting method that would work on any conforming PC-based operating system. In addition to multiboot-conforming systems, GRUB can boot directly to Linux, FreeBSD, OpenBSD, and NetBSD. It can also boot other operating systems such as Microsoft Windows indirectly, through the use of a *chainloader*. The chainloader loads an intermediate file, and that file loads the operating system's boot loader.

GRUB provides a graphical menu interface. It also provides a command interface that is accessible both while the system is booting (the native command environment) and from the command line once Linux is running.

While LILO works perfectly well, especially if you usually boot the default image, GRUB has some advantages. The graphical menu interface shows you exactly what your choices are for booting, so you don't have to remember them. It also lets you easily edit an entry on the fly, or drop down into the command interface. In addition, if you are using the menu interface and something goes wrong, GRUB automatically puts you into the command interface so you can attempt to recover and boot manually. Another advantage of GRUB is that if you install a new kernel or update the configuration file, that's all you have to do; with LILO, you also have to remember to rerun thelilo command to reinstall the boot loader. On the other hand, if you are used to LILO, don't need to see the prompts often, and have a stable system, LILO is quick and convenient.

A GRUB installation consists of at least two and sometimes three executables, known as stages. The stages are:

Stage 1

Stage 1 is the piece of GRUB that resides in the MBR or the boot sector of another partition or drive. Since the main portion of GRUB is too large to fit into the 512 bytes of a boot sector, Stage 1 is used to transfer control to the next stage, either Stage 1.5 or Stage 2.

Stage 1.5

Stage 1.5 is loaded by Stage 1 only if the hardware requires it. Stage 1.5 is filesystem-specific that is, there is a different version for each filesystem that GRUB can load. The name of the filesystem is part of the filename (*e2fs_stage1_5*, *fat_stage1_5*, etc.). Stage 1.5 loads Stage 2.

Stage 2

> Stage 2 runs the main body of the GRUB code. It displays the menu, lets you select the operating system to be run, and starts the system you've chosen.

If it was compiled with netboot support, GRUB can also be used to boot over a network. We don't describe that process here; see the file *netboot/README.netboot* in the GRUB source directory for detailed information.

One of the first things to understand about GRUB is that it uses its own naming conventions. Drives are numbered starting from 0; thus, the first hard drive is hd0, the second hard drive is hd1, the first floppy drive is fd0, and so on. Partitions are also numbered from 0, and the entire name is put in parentheses. For example, the first partition of the first drive, */dev/hda1*, is known as (hd0,0) to GRUB, and the third partition of the second drive is (hd1,2). GRUB makes no distinction between IDE drives and SCSI drives; thus the first drive is hd0 regardless of whether it is IDE or SCSI.

Files are specified either by the filename or by *blocklist*, which is used to specify files such as chainloaders that aren't part of a filesystem. A filename looks like a standard Unix path specification with the GRUB device name prepended; for example:

```
(hd0,0)/grub/grub.conf
```

If the device name is omitted, the GRUB root device is assumed. The GRUB root device is the disk or partition where the kernel image is stored, set with the `root` command. See GRUB Commands.," later in the chapter, for the command descriptions.

When you use blocklist notation, you tell GRUB which blocks on the disk contain the file you want. Each section of a file is specified as the offset on the partition where the block begins plus the number of blocks in the section. The offset starts at 0 for the first block on the partition. The syntax for blocklist notation is:

```
[device][offset]+length[,offset]+length...
```

In this case, too, the device name is optional for a file on the root device. With blocklist notation, you can also omit the offset if it is 0. A typical use of blocklist notation is when using a chainloader to boot Windows. If GRUB is installed in the MBR, you can chainload Windows by setting the root device to the partition that has the Windows boot loader, making it the active partition, and then using the `chainloader` command to read the Windows boot sector:

```
rootnoverify (hd0,0)
makeactive
chainloader +1
```

In this example, the blocklist notation (+1) does not include either the device name or the offset because we set the root device to the Windows partition, and the Windows loader begins at offset 0

of that partition.

GRUB also includes a *device map*. The device map is an ASCII file, usually */boot/grub/device.map*. Since the operating system isn't loaded yet when you use GRUB to boot Linux (or any other operating system), GRUB knows only the BIOS drive names. The purpose of the device map is to map the BIOS drives to Linux devices. For example:

```
(fd0)   /dev/fd0

(hd0)   /dev/hda
```

4.3.1. Installing GRUB

Installing GRUB involves two stages. First, you install the GRUB files on your system, either by compiling and installing the source tarball or from a package. That puts the GRUB files in the correct locations on your system. The second step is to install the GRUB software as your boot manager. This is the step we describe in this section.

If you installed GRUB as part of your Linux installation, the distribution's installation program took care of both stages of installing GRUB, and you'll most likely see the GRUB menu when you boot Linux. If you didn't install GRUB as part of your Linux installation, you have two choices. The easiest way to install GRUB is with the `grub-install` shell script that comes with GRUB. If `grub-install` doesn't work, or if you want to do the installation manually, you can run the `grub` command and issue the installation commands yourself.

The following sections describe how to create a GRUB boot floppy and how to install GRUB.

4.3.1.1 Creating a GRUB boot floppy

You can create a GRUB boot floppy for everyday use or to have for an emergency. The following instructions make a floppy that boots to the GRUB command line:

1. From the directory where GRUB was installed (e.g., */usr/share/grub/i386-pc*), use the `dd` command to write the file *stage1* to the floppy:

   ```
   $ dd if=stage1 of=/dev/fd0 bs=512 count=1
   ```

   This command writes one block, with a block size of 512, from the input file *stage1* to the floppy device */dev/fd0*.

2. Now write the file *stage2* to the floppy, skipping over the first block (`seek=1`) so you don't overwrite *stage1*:

```
$ dd if=stage2 of=/dev/fd0 bs=512 seek=1
```

Put together, the process looks like this

```
$ dd if=stage1 of=/dev/fd0 bs=512 count=1
1+0 records in
1+0 records out
$ dd if=stage2 of=/dev/fd0 bs=512 seek=1
254+1 records in
254+1 records out
```

The boot floppy is now ready to boot to the GRUB command line.

You can also make a boot floppy that boots to the GRUB menu:

1. Create a GRUB configuration file (*/boot/grub/grub.conf*) if you don't already have one. The configuration file is described later inThe GRUB Configuration File.."

2. Create a filesystem on your floppy disk. For example:

   ```
   $ mke2fs /dev/fd0
   ```

3. Mount the floppy drive and create the directory */boot/grub*:

   ```
   $ mount /mnt
   $ mkdir /mnt/boot
   $ mkdir /mnt/boot/grub
   ```

4. Copy the *stage1*, *stage2*, and *grub.conf* GRUB images from */boot/grub* on your Linux partition to */mnt/boot/grub*.

5. Run the `grub` command. This example assumes the command is in */sbin/grub*, but it might be in */usr/sbin/grub* on your system:

   ```
   $ /sbin/grub --batch <<EOT
   root (fd0)
   setup (fd0)
   quit
   EOT
   ```

You should now be able to boot to the GRUB menu from the floppy disk you just created.

4.3.1.2 Using grub-install

GRUB comes with a shell script, `grub-install`, which uses the GRUB shell to automate the installation. The command syntax is:

```
grub-install options install-device
```

where *install-device* is the name of the device on which you want to install GRUB, specified as either the GRUB device name (e.g., (hd0)) or the system device (e.g.,*/dev/hda*). For example, you might issue the following command (as root):

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

This command installs GRUB into the MBR of the first hard drive. The`grub-install` options are

`--force-lba`

Force GRUB to use LBA mode, to allow booting from partitions beyond cylinder 1024.

`--grub-shell=`*file*

Specify that *file* is to be used as the GRUB shell. You might want to use this option to append options to `grub`. For example:

```
$ grub-install --grub-shell="grub --read-only" /dev/fd0
```

`-h, help`

Print a help message on standard output and exit.

`--recheck`

Force probing of a device map. You should run`grub-install` with this option if you add or remove a disk from your system. The device map is found at */boot/grub/device.map*.

`--root-directory=`*dir*

Install GRUB images in the directory *dir* instead of the GRUB root directory.

`-v, --version`

Print the GRUB version number to standard output and exit.

4.3.1.3 Installing from the GRUB command line

To install GRUB from the native command environment, make a GRUB boot floppy as described previously. You will use that floppy to boot to the GRUB command line to do the installation. If you know which partition holds the GRUB files, you're all set. Otherwise, you can find the partition with the `find` command:

```
grub> find /boot/grub/stage1
(hd0,0)
```

Here, the files are on (hd0,0). Use that information to set the GRUB root device:

```
grub> root (hd0,0)
```

Run the `setup` command to install GRUB. To install GRUB on the MBR, run `setup` as follows:

```
grub> setup (hd0)
```

If you are going to chainload Linux and want to install GRUB on the boot sector of the Linux partition run `setup` like this:

```
grub> setup (hd0,0)
```

4.3.2. The GRUB Configuration File

GRUB uses a configuration file that sets up the menu interface. The configuration file is called *grub.conf* and is found with the other GRUB files in the */boot/grub* directory. *grub.conf* is also known as *menu.lst*, and at least on some distributions (e.g., Red Hat and SUSE), *menu.lst* is a symbolic link to *grub.conf*.

The configuration file begins with a section containing global commands that apply to all boot entries followed by an entry for each Linux image or other operating system that you want to be able to boot. Here is an example of a global section (a hash sign, `#`, begins a comment):

```
default=0                                # default to the first entry
timeout=20                               # set the timeout to 20 seconds
splashimage=(hd0,0)/grub/splash.xpm.gz   # the splash image displayed with
```

```
# the menu
```

Certain GRUB commands are available only in the global section of the configuration file, for use with the GRUB menu. These commands are described in the following list. All other commands can be used either in the configuration file or on the command line and are described later in GRUB Commands."

default *num*

Set the default menu entry to *num*. The default entry is started if the user does not make a selection before the timeout time. Menu entries are numbered from 0. If no default is specified the first entry (0) is used as the default.

fallback *num*

Specify the entry to be used if for any reason the default entry has errors. If this command is specified and the default doesn't work, GRUB boots the fallback entry automatically instead of waiting for user input.

hiddenmenu

Specify that the menu is not to be displayed. The user can press Esc before the end of the timeout period to have the menu displayed; otherwise the default entry is booted at the end of the timeout.

timeout *time*

Specify the timeout period, in seconds. The timeout is the amount of time GRUB waits for user input before booting the default entry.

title *name*

Start a new boot entry with specified *name*.

Following the global section, the configuration file includes an entry for each boot image. An entry begins with a title command that specifies the text that will appear on the menu for that entry when the system boots. A typical boot entry might look like this:

```
title Linux 2.6.10
root (hd0,1)
kernel /vmlinuz-2.6.10 ro root=LABEL=/
initrd /initrd-2.6.10
```

This entry provides the information GRUB needs to boot to Linux. When the menu is displayed, it will

include an entry that says:

```
Linux 2.6.10
```

The GRUB root is on the second partition of the first hard drive (hd0,1). The `kernel` command specifies which Linux kernel to run and passes some parameters to the kernel, and the `initrd` command sets up an initial RAM disk.

The configuration file also provides some security features, such as the ability to set passwords and to lock certain entries so only the root user can boot them. The configuration file can be set up so that a password is required to run interactively (i.e., for editing menu entries or using the command interface) or simply to protect certain menu entries while leaving other entries available to all users. See the explanation of the `password` and `lock` commands in GRUB Commands.," later in the chapter.

In addition to providing a password feature, GRUB provides the command `md5crypt` to encrypt passwords in MD5 format, and a corresponding Linux command, `grub-md5-crypt`. `grub-md5-crypt` is a shell script that acts as a frontend to the `grub` shell, calling `md5crypt`. Passwords encrypted either directly with `md5crypt` or with `grub-md5-crypt` can be used with the `password` command to set up a GRUB password. `grub-md5-crypt` has three possible options:

`--help`

Print help message and exit.

`--grub-shell=`*file*

Specify that *file* is to be used as the GRUB shell.

`--version`

Print version information and exit.

4.3.3. Using the Menu Interface

The most common way to use GRUB is with the menu interface. The Stage 2 loader reads the configuration file *grub.conf* and displays the menu. If a timeout is set in the configuration file, GRUB displays a countdown at the bottom of the window showing how much time is left before it boots to the default entry. Move the cursor to an entry and press Enter to boot; or, presse to edit the command line for that entry, a to modify the kernel arguments, or c to go to the command-line interface to issue commands manually.

If you go to the command line, you can return to the menu at any time by pressing Esc.

Selecting a and e are similar, except that a displays only the `kernel` command line and lets you

append options to it, while e displays the entire boot entry for you to edit. In either case, the available editing commands are similar to those available on the shell command line. When you are through editing, press Esc to return to the main menu. Your changes take effect for this session only the configuration file is not permanently changed.

One common use for editing a kernel command is to boot to single-user mode. To do that, selecta from the menu and append the word "single" to the end of thekernel command. Then press Esc to return to the menu and select the entry.

4.3.4. The GRUB Shell

In addition to using the command line from within the GRUB menu interface (or booting directly to the command line), you can run a GRUB shell directly from the Linux command line with thegrub command. For the most part, using the grub shell is the same as running in the native command-line environment. The major difference is that the shell uses operating system calls to emulate the BIOS calls that the native environment uses. That can lead to some differences in behavior.

The syntax of the grub command is:

```
grub [options]
```

For example:

```
$ grub --no-floppy
```

The grub command-line options are:

--batch

Turn on batch mode for noninteractive use. Equivalent togrub --no-config-file --no-curses --no-pager.

--boot-drive=*drive*

Use *drive* as the Stage 2 boot drive, specified as a decimal, hexadecimal, or octal integer. The default is hexadecimal 0x0.

--config-file=*file*

Use *file* as the GRUB configuration file. The default is */boot/grub/grub.conf*.

--device-map=*file*

Use *file* for the device map. The value of *file* is usually */boot/grub/device.map*.

--help

Display a help message to standard output and exit.

--hold

Wait for a debugger to attach before starting grub.

--install-partition=*partition*

Use *partition* as the Stage 2 installation partition, specified as a decimal, hexadecimal, or octal number. The default is hexadecimal 0x20000.

--no-config-file

Run without reading the configuration file.

--no-curses

Don't use the curses interface for managing the cursor on the screen.

--no-floppy

Don't probe for a floppy drive. This option is ignored if--device-map is also specified.

--no-pager

Don't use the internal pager.

--preset-menu

Use a preset menu, for example if your system has no console and you need to get a serial terminal set up to see messages. To use this option, compile GRUB with the--enable-preset-menu=*file* option and create a menu file. See the GRUB documentation for more information.

--probe-second-floppy

Probe the second floppy drive (which is not probed by default). This option is ignored if--device-map is also specified.

--read-only

Do not write to any disk drives.

--verbose

Print verbose messages.

--version

Print version information and exit.

When you run grub, you will see something like this:

```
   GRUB  version 0.94  (640K lower / 3072K upper memory)

 [ Minimal BASH-like line editing is supported.  For the first word, TAB
   lists possible command completions.  Anywhere else TAB lists the possible
   completions of a device/filename. ]

grub>
```

You can now enter commands at the *grub>* prompt. Press Tab to get a brief help message, listing all the commands:

```
grub>
Possible commands are: blocklist boot cat chainloader cmp color configfile
debug device displayapm displaymem dump embed find fstest geometry halt help
hide impsprobe initrd install ioprobe kernel lock makeactive map md5crypt
module modulenounzip pager partnew parttype password pause quit read reboot
root rootnoverify savedefault serial setkey setup terminal testload testvbe
unhide uppermem vbeprobe
```

Using Tab is a quick way to remind yourself of the commands, but it can be confusing to see them all run together and wrapping across lines. You can also run the help command, which lists the most frequently used commands and their syntax:

```
grub> help
blocklist FILE                                  boot
cat FILE                                        chainloader [--force] FILE
color NORMAL [HIGHLIGHT]                        configfile FILE
device DRIVE DEVICE                             displayapm
displaymem                                      find FILENAME
geometry DRIVE [CYLINDER HEAD SECTOR [          halt [--no-apm]
help [--all] [PATTERN ...]                      hide PARTITION
initrd FILE [ARG ...]                           kernel [--no-mem-option] [--type=TYPE]
makeactive                                      map TO_DRIVE FROM_DRIVE
md5crypt                                        module FILE [ARG ...]
```

```
modulenounzip FILE [ARG ...]          pager [FLAG]
partnew PART TYPE START LEN           parttype PART TYPE
quit                                  reboot
root [DEVICE [HDBIAS]]                rootnoverify [DEVICE [HDBIAS]]
serial [--unit=UNIT] [--port=PORT] [-- setkey [TO_KEY FROM_KEY]
setup [--prefix=DIR] [--stage2=STAGE2_ terminal [--dumb] [--timeout=SECS] [--
testvbe MODE                          unhide PARTITION
uppermem KBYTES                       vbeprobe [MODE]
```

You can add the --all option to see all the commands.

To get help for a specific command, add the command name (e.g.,help read). help treats the text you enter as a pattern; therefore, if you enter help find, you'll get help for the find command, but if you enter help module, you'll get help for both module and modulenounzip.

PREV

4.4. GRUB Commands

The following sections describe two sets of commands. Both can be used at the GRUB command line. In addition, the first set can be used in the global section of the menu, and the second can be used in individual menu entries. A few commands can be used only on the GRUB shell command line; this is noted in the command entry. The commands **default**, **fallback**, **hiddenmenu**, **timeout**, and **title** are available only in the configuration file, for use with the menu interface. They are described in "The GRUB Configuration File.", earlier in the chapter.

When running commands, if you find that you aren't sure how to complete a pathname, you can use the Tab key to find the possible completions. For example:

```
grub> blocklist (hd0,1)/grub/[Tab]
Possible files are: grub.conf splash.xpm.gz menu.lst device.map stage1
stage2 e2fs_stage1_5 fat_stage1_5 ffs_stage1_5 jfs_stage1_5 minix_stage1_5
reiserfs_stage1_5 vstafs_stage1_5 xfs_stage1_5
grub> blocklist (hd0,1)/grub/stage2
(hd0,1)33306+24,33332+231
```

4.4.1. Command-Line and Global Menu Commands

The commands available at the command line and in the global section of the configuration file are as follows.

bootp

```
bootp [--with-configfile]
```

Initialize a network device via the Bootstrap Protocol (BOOTP). This command is available only if GRUB was compiled with netboot support. If `--with-configfile` is specified, GRUB automatically loads a configuration file specified by your BOOTP server.

color

```
color normal [highlight]
```

Specify colors for the menu. *normal* represents the color used for normal menu text, while *highlight* represents the color used to highlight the line the cursor is on. Both *normal* and *highlight* are specified as two symbolic color names, for foreground and background color, separated by a slash. For example:

```
color light-gray/blue cyan/black
```

You can prefix the foreground color with `blink-` (e.g., `blink-cyan/red`) to get a blinking foreground. The colors `black`, `blue`, `green`, `cyan`, `red`, `magenta`, `brown`, and `light-gray` can be specified for foreground or background. Additional colors that can be used only for the foreground are `dark-gray`, `light-blue`, `light-green`, `light-cyan`, `light-red`, `light-magenta`, `yellow`, and `white`.

device

```
device drive file
```

Specify a file to be used as a BIOS drive. This command is useful for creating a disk image and/or for fixing the drives when GRUB fails to determine them correctly. The `device` command is available only from within the `grub` shell, not from the native command line. For example:

```
grub> device (fd0) /floppy-image
grub> device (hd0) /dev/sd0
```

dhcp

```
dhcp [--with-configfile]
```

Initialize a network device via the DHCP protocol. Currently, this command is just an alias for `bootp` and is available only if GRUB was compiled with netboot support. If specified with `--with-configfile`, GRUB will fetch and load a configuration file specified by your DHCP server.

hide

```
hide partition
```

Hide the specified partition. This is useful when you are booting DOS or Windows and there are multiple primary partitions on one disk. Hide all but the one you want to boot. Also see unhide.

ifconfig

```
ifconfig [--server=server] [--gateway=gateway] [--mask=mask]
[--address=address]
```

Configure a network device manually. If no options are specified, displays the current network configuration. With the server address, gateway, netmask, and IP address specified,ifconfig configures the device. The addresses must be in dotted decimal format (e.g., 192.168.0.4), and the options can be specified in any order.

pager

```
pager [flag]
```

Enable or disable the internal pager by setting *flag* to on (enable) or off (disable).

partnew

```
partnew part type from to
```

Make a new primary partition, *part*, specified in GRUB syntax. *type* is the partition type, specified as a number in the range 0-0xff. *from* and *to* are the starting and ending sectors, specified as absolute numbers. Some of the common partition types are:

Type	Number
None	0
FAT 16, lt 32M	4
FAT 16, gt 32M	6
FAT 32	0xb
FAT 32, with LBA	0xc

Type	Number
WIN 95, extended	0xf
EXT2FS	0x83
Linux extended	0x85
Linux RAID	0xfd
FreeBSD	0xa5
OpenBSD	0xa6
NetBSD	0xfd

parttype

`parttype` *`part type`*

Change the type of partition *part* to *type*. The type must be a number in the range 0-0xff. See `partnew` for a list of partition types.

password

`password [--md5]` *`passwd`* `[`*`file`*`]`

Set a password for the menu interface. If used in the global section of the configuration file, outside the menu entries, GRUB prompts for a password before processing an `a`, `e`, or `c` entered by the user. Once the password *passwd* has been entered, if no *file* was specified, GRUB allows the user to proceed. Otherwise, GRUB loads the file as a new configuration file and restarts Stage 2. If `password` appears in an individual menu entry, GRUB prompts for the password before continuing. Specify `--md5` to tell GRUB that the password was encrypted with the `md5crypt` command.

rarp

`rarp`

Initialize a network device via the Reverse Address Resolution Protocol (RARP). This command is available only if GRUB was compiled with netboot support. The use of RARP is deprecated.

serial

```
serial [options]
```

Initialize a serial device. The serial port is not used for communication unless `terminal` is also specified. This command is available only if GRUB was compiled with serial support.

Options

`--device=`*device*

Specify the tty device to be used in the host operating system. This option can be used only in the `grub` shell.

`--parity=`*parity*

Specify the parity. The possible values are `no`, `odd`, and `even`; the default is `no`.

`--port=`*port*

Specify the I/O port. The value of *port* overrides any value specified for `--unit`.

`--speed=`*speed*

Specify the transmission speed (default is 9600).

`--stop=`*num*

Specify the number of stop bits. The value of *num* is either 1 or 2 (default is 1).

`--unit=`*num*

Specify the serial port to use. The value of *num* is a number in the range 0-3; the default is 0, corresponding to COM1.

`--word=`*num*

Specify the number of data bits. The value of *num* is a number in the range 5-8 (default is 8).

setkey

```
setkey [to-key from-key]
```

Configure the keyboard map for GRUB by mapping the key *from-key* to the key *to-key*. With no mappings specified, reset the keyboard map. `setkey` is useful for setting up international keyboards. Possible key values are letters; digits; one of the strings `alt`, `backspace`, `capslock`, `control`, `delete`, `enter`, `escape`, F*n* (where *n* is one of the function key numbers), `shift`, `tab`; or one of the strings in the Key Value columns of the following table:

Key value	Character	Key value	Character
ampersand	&	asterisk	*
at	@	backquote	`
backslash	\	bar	|
braceleft	{	braceright	}
bracketleft	[	bracketright	]
caret	^	colon	:
comma	,	dollar	$
doublequote	"	equal	=
exclam	!	greater	>
less	<	minus	-
numbersign	#	parenleft	(
parenright	)	percent	%
period	.	plus	+
question	?	quote	`
semicolon	;	slash	/
space		tilde	~
underscore	_		

splashimage

```
splashimage file
```

Use the image in *file* as the background (splash) image. The file should be a gzipped *.xpm* (X pixmap) file, created with a 14-color palette at 640 x 480 resolution and specified with standard GRUB device syntax:

```
splashimage=(hd0,0)/grub/splash.xpm.gz
```

Programs that you can use to create *.xpm* files include the GIMP, `xv`, and `xpaint`.

terminal

`terminal [`*`options`*`] [console] [serial]`

Specify a terminal for user interaction. This command is available only if GRUBwas compiled with serial support. If both `console` and `serial` are specified, GRUB uses the first terminal where a key is pressed, or the first after the timeout has expired. If neither is specified, GRUB displays the current setting.

Options

`--dumb`

The terminal is a dumb terminal; if this option is not specified, the terminal is assumed to be VT100-compatible.

`--lines=`*`num`*

The terminal has *num* lines. The default is 24.

`--silent`

Suppress the prompt to hit any key (useful if your system does not have a terminal).

`--timeout=`*`secs`*

Specify the timeout in seconds.

tftpserver

`tftpserver` *`ipaddress`*

Specify a TFTP server, overriding the address returned by a BOOTP, DHCP, or RARP server. The IP address must be specified in dotted decimal format. This command is available only if GRUB was compiled with netboot support. This command is deprecated; use `ifconfig` instead.

unhide

`unhide` *`partition`*

Unhide the specified partition. This is useful when booting DOS or Windows when there are multiple primary partitions on one disk. You can `unhide` the partition you want to boot and `hide` the others.

4.4.2. Command-Line and Menu-Entry Commands

The commands available at the command line and in the individual menu entries of the configuration file are as follows.

blocklist

`blocklist` *`file`*

Print the specified file in blocklist notation, where *file* is an absolute pathname or a blocklist. For example:

```
grub> blocklist (hd0,1)/grub/grub.conf
(hd0,1)33746+2
```

boot

```
boot
```

Boot the operating system or chainloader that has been loaded. You need to run this command only i
you are in the interactive command-line mode.

cat

```
cat file
```

Display the contents of the specified file.

chainloader

```
chainloader [--force] file
```

Load *file* as a chainloader. You can use blocklist notation to specifiy the first sector of the current partition with `+1`. If `--force` is specified, the file is loaded forcibly.

cmp

```
cmp file1 file2
```

Compare the two files *file1* and *file2*. Report differences by printing nothing if the files are identical, the sizes if they are different, or the bytes at an offset if they differ at that offset.

configfile

```
configfile file
```

Load *file* as the configuration file.

debug

`debug`

Toggle debug mode, which prints extra messages to show disk activity. The default debug mode is off.

displayapm

`displayapm`

Display Advanced Power Management (APM) BIOS information.

displaymem

`displaymem`

Display the system address space map of the machine, including all regions of physical RAM installed For example:

```
grub> displaymem
 EISA Memory BIOS Interface is present
 Address Map BIOS Interface is present
 Lower memory: 640K, Upper memory (to first chipset hole): 3072K
 [Address Range Descriptor entries immediately follow (values are 64-bit)]
   Usable RAM:  Base Address:  0x0 X 4GB + 0x0,
      Length:   0x0 X 4GB + 0xa0000 bytes
   Reserved:  Base Address:  0x0 X 4GB + 0xa0000,
      Length:   0x0 X 4GB + 0x60000 bytes
   Usable RAM:  Base Address:  0x0 X 4GB + 0x100000,
      Length:   0x0 X 4GB + 0x300000 bytes
```

dump

dump *from to*

Dump the contents of one file into another. The file you're dumping*from* is a GRUB file, and the file you're dumping *to* is an operating system file.

embed

```
embed stage1.5 device
```

Embed the specified Stage 1.5 file in the sectors following the MBR if*device* is a drive, or in the boot loader area if it is an FFS (Berkeley Fast File System) partition (or, in the future, a ReiserFS partition). If successful, print the number of sectors the Stage 1.5 file occupies. You don't usually need to run this command directly.

find

```
find file
```

Search all partitions for the specified file and print the list of devices where it was found. The filenam specified should be an absolute filename, such as*/boot/grub/stage1*, or a blocklist.

fstest

```
fstest
```

Toggle the filesystem test mode, which prints data for device reads and the values being sent to the low-level routines. The `install` and `testload` commands turn off filesystem test mode. The test output is in the following format:

```
    <partition-offset-sector, byte-offset, byte-length>
```

for high-level reads in a partition, and:

```
    [disk-offset-sector]
```

for low-level sector requests from the disk.

geometry

```
geometry drive [cylinder head sector [total_sector]]
```

Print geometry information for *drive*. From the GRUB shell, you can specify the number of cylinders, heads, sectors, and total sectors to set the drive's geometry. If *total_sector* is omitted, it is calculated from the other values.

halt

```
halt [--no-apm]
```

Shut down the computer. The computer is halted with an APM BIOS call unless the option `--noapm` is specified.

help

```
help [--all] [patterns]
```

Provide help for built-in commands. With no options, show the command and any options or parameters for the most common commands. With `--all`, show the same information for all possible commands. If you specify a pattern (i.e., a partial command name) or a full command name, a more complete description of the command or commands matching the pattern is displayed.

impsprobe

```
impsprobe
```

Probe the Intel Multiprocessor Specification 1.1 or 1.4 configuration table and boot the CPUs that are found into a tight loop. This command can be used only in Stage 2.

initrd

`initrd` *`file`* [*`args`*]

Load an initial ramdisk *file* and pass any arguments.

install

`install` [*`options`*] *`stage1_file`* [d] *`dest_dev`* *`stage2_file`* [*`addr`*] [p] [*`config_file`*] [*`real_config_file`*]

Perform a full GRUB install. See also the setup command, which acts as a frontend to install and is easier to use. The Stage 2 or Stage 1.5 file (both referred to as*stage2_file* here because they are loaded the same way) must be in its final install location (e.g., in the*/boot/grub* directory). install loads and validates *stage1_file*, installs a blocklist in the Stage 1 file for loading*stage2_file* as Stage 2 or Stage 1.5, and writes the completed Stage 1 file to the first block of the device*dest_dev*.

Options

--force-lba

If the BIOS has LBA support but might return the incorrect LBA bitmap (which sometimes happens), --force-lba forces install to ignore the incorrect bitmap.

--stage2=*os_stage2_file*

This option is required to specify the operating system name of the Stage 2 file if the filesysten where it is located cannot be unmounted.

Parameters

addr

Specify the address at which Stage 1 is to load Stage 2 or Stage 1.5. The possible values are 0x8000 for Stage 2 and 0x2000 for Stage 1.5. If omitted, GRUB determines the address automatically.

config_file

Specify the location of the configuration file for Stage 2.

d

Tell Stage 1 to look for the actual disk on which *stage2_file* was installed if it's not on the boot drive.

dest_dev

Specify the destination device. The final Stage 1 file is written to this device.

p

If present, the partition where *stage2_file* is located is written into the first block of Stage 2.

real_config_file

If *stage2_file* is really a Stage 1.5 file, *real_config_file* specifies the real configuration filename and is written into the Stage 2 configuration file.

stage1_file

Specify the Stage 1 file to be written.

stage2_file

Specify the file that Stage 1 is to load for Stage 2.

ioprobe

```
ioprobe drive
```

Probe the I/O ports used for *drive* and write the results to standard output.

kernel

```
kernel [--non-mem-option] file [...]
```

Load the kernel image from *file*. Any text following *file* is passed on as the kernel command line. After running this command, you must reload any modules. The option `--type` specifies the kernel type and is required only for loading a NetBSD ELF kernel; GRUB automatically determines other types. The possible values of type are `linux`, `biglinux`, `freebsd`, `multiboot`, `netbsd`, and `openbsd`. For Linux, `--no-mem-option` tells GRUB not to pass the `mem=` option to the kernel.

lock

```
lock
```

Lock the entry until a valid password is entered. This is used in a menu entry immediately after`title` to prevent nonroot users from executing the entry. This command is most useful in conjunction with the `password` command.

makeactive

```
makeactive
```

Set the active partition on the root disk to GRUB's root device. Use only on primary PC hard disk partitions.

map

```
map to from
```

Map the *from* drive to the *to* drive. You need to do this when chainloading an operating system such as Windows, if it is not on the first drive. For example, if Windows is on (hd1):

```
grub> map (hd0) (hd1)
grub> map (hd1) (hd0)
```

This swaps the mappings of the first and second hard drives, tricking Windows into thinking it's on the first drive so it can boot.

md5crypt

`md5crypt`

Prompt for a password and encrypt it in MD5 format for use with the `password` command.

module

`module` *`file`* `[...]`

Load the boot module *file* for a multiboot format boot image. Anything after the filename is passed as the module command line.

modulenounzip

`modulenounzip` *`files`*

Like `module`, except that automatic decompression is disabled.

pause

`pause` *`messages`*

Print the specified message and wait for a key to be pressed before continuing.

quit

`quit`

Used only from within the `grub` shell to exit from the shell. In the native command environment, use `reboot` instead to reboot the computer.

read

`read` *`addr`*

Read a 32-bit value from memory at the specified address and display it in hex.

reboot

`reboot`

Reboot the system.

root

`root` *`device`* [*`hdbias`*]

Set the root device to the specified *device* and attempt to mount it to get the partition size (and some additional information for booting BSD kernels). If you are booting a BSD kernel, you can specify *hdbias* to tell the kernel how many BIOS drive numbers are before the current one.

rootnoverify

`rootnoverify` *`device`* [*`hdbias`*]

Similar to `root`, but don't attempt to mount the partition. Used when you are booting a non-GRUB-readable partition such as Windows.

savedefault

`savedefault`

Save the current menu entry as the default. GRUB will default to that entry the next time you boot the system.

setup

`setup [`*`options`*`] `*`install_device`*` [`*`image_device`*`]`

Set up installation of GRUB and run the `install` command to actually install GRUB onto the device *install_device*. Find the GRUB images on *image_device* if it is specified; otherwise use the current root device as set by the `root` command. If *install_device* is a hard disk, embed a Stage 1.5 file in the disk if possible.

Options

`--force-lba`

Force install to use LBA mode. Specify this option if your BIOS supports LBA mode but you find that GRUB isn't working in LBA mode without it.

`--prefix=`*`dir`*

Specify the directory where the GRUB images are located. If not specified, GRUB searches for them in */boot/grub* and */grub*.

`--stage2=`*`os_stage2_file`*

Passed to `install` to tell GRUB the operating system name of the Stage 2 file.

testload

`testload `*`file`*

Read the contents of a *file* in different ways and compare the results to test the filesystem code. If nc errors are reported and the final output reports an equal value for the reported variablesi and `filepos`, then the filesystem is consistent and you can try loading a kernel.

testvbe

`testvbe` *mode*

For a VBE (VESA BIOS Extension) BIOS, test the specified VESA BIOS extension mode. You should see an animation loop, which you can cancel by pressing any key.

uppermem

`uppermem` *kbytes*

Tell GRUB to assume that only the specified number of kilobytes of upper memory are installed. You should need to use this command only for old systems, where not all the memory may be recognized.

vbeprobe

`vbeprobe [`*mode*`]`

For a VBE BIOS, probe VESA BIOS extension information. If *mode* is specified, the output shows only information for that mode; otherwise, all available VBE modes are listed.

4.5. Dual-Booting Linux and Windows NT/2000/XP

As mentioned earlier, when you run Windows NT, its boot loader expects to be the one in charge; therefore, the standard way to dual-boot Windows NT and Linux is to add Linux as an option on the NT boot menu. This section describes how to do that. The information provided here also applies to Windows 2000 and Windows XP, which use the NT loader.

To set up dual booting with the NT loader, you need to provide the loader with a copy of the Linux boot sector. We'll describe how to do that on a computer running Windows NT with an NTFS filesystem (note that Windows NT should be installed on your system already). See the NT OS "Loader+Linux mini-HOWTO" for more information and other alternatives.

You should have a Linux boot floppy or CD available so that if necessary you can boot Linux before the NT boot loader has been modified. You should also have a DOS-formatted floppy to transfer the boot sector to the Windows NT partition. If you are running LILO and it is already installed, you may need to modify */etc/lilo.conf* as described later. Otherwise, install LILO or GRUB to the boot sector of the Linux partition; once the Linux boot manager is installed and you have a configuration file, you can set up the system for dual booting.

The following instructions assume your Linux partition is on */dev/hda2*. If Linux is on another partition in your system, be sure to replace */dev/hda2* in the following examples with the correct partition. The instructions also assume that you have a floppy drive to make a diskette for transferring the boot sector to your NTFS filesystem. If you don't have a floppy drive, you will have t use some other means of doing the transfer. If you have an NT FAT partition, you can mount that on Linux and transfer the file there. Other possibilities include putting it on a CD, transferring it over a network to another system while you reboot to NT, or even emailing it to yourself and reading it from the NT side.

1. If you are running LILO, specify the Linux root partition as your boot device in */etc/lilo.conf*. If you are editing */etc/lilo.conf* manually, your entry will look like this:

   ```
   boot=/dev/hda2
   ```

   and will be the same as the `root=` entry.

   If you are running GRUB, make sure your configuration file, */boot/grub/grub.conf*, includes a menu entry for booting Linux. The exact values of the entries in the menu depend on the filename of the kernel image that you wish to boot. For example:

   ```
   title Linux 2.6.10
   root (hd0,1)
   kernel /vmlinuz-2.6.10 ro root=LABEL=/
   ```

```
initrd /initrd-2.6.10
```

You can then skip to Step 3.

2. Run the lilo command to install LILO on the Linux root partition.

3. At this point, if you need to reboot Linux, you'll have to use the boot floppy or CD because the NT loader hasn't been set up yet to boot Linux.

4. From Linux, run the dd command to make a copy of the Linux boot sector:

```
$ dd if=/dev/hda2 of=/bootsect.lnx bs=512 count=1
```

This command copies one block, with a block size of 512 bytes, from the input file */dev/hda2* to the output file */bootsect.lnx*. Note that if you are running GRUB, the boot sector is actually the *stage1* file. (The output filename can be whatever makes sense to you; it doesn't have to be *bootsect.lnx*.)

5. Copy *bootsect.lnx* to a DOS-formatted floppy disk if that is how you are going to transfer it to NT:

```
$ mount -t msdos /dev/fd0 /mnt
$ cp /bootsect.lnx /mnt
$ umount /mnt
```

6. Reboot the system to Windows NT and copy the boot sector from the floppy disk to the hard disk. You can drag and drop the file to the hard drive, or use the command line to copy the file, as in the following example:

```
C:> copy a:\bootsect.lnx c:\bootsect.lnx
```

It doesn't matter where on the hard drive you put the file because you'll tell the NT loader where to find it in Step 8.

7. Modify the attributes of the file *boot.ini*[*] to remove the system and read-only attributes so you can edit it:

[*] *boot.ini* is the Windows NT counterpart to */etc/lilo.conf*. It defines what operating systems the NT loader can boot.

```
C:> attrib -s -r c:\boot.ini
```

8. Edit *boot.ini* with a text editor to add the line:

```
C:\bootsect.lnx="Linux"
```

This line adds Linux to the boot menu and tells the Windows NT boot loader where to find the Linux boot sector. You can insert the line anywhere in the `[operating systems]` section of the file. Its position in the file determines where it will show up on the boot menu when you reboot your computer. Adding it at the end, for example, results in a *boot.ini* file that looks something like this (the second `multi(0)` entry is wrapped to fit the margins of this page):

```
[boot loader]
timeout=30
default=multi(0)disk(0)rdisk(0)partition(1)\WINNT
[operating systems]
multi(0)disk(0)rdisk(0)partition(1)\WINNT="Windows NT Server Version 4.00"
multi(0)disk(0)rdisk(0)partition(1)\WINNT="Windows NT Server Version
4.00 [VGA mode]" /basevideo /sos
C:\bootsect.lnx="Linux"
```

If you want Linux to be the default operating system, modify the `default=` line:

```
default=C:\bootsect.lnx
```

9. Rerun `attrib` to restore the system and read-only attributes:

```
C:> attrib +s +r c:\boot.ini
```

Now you can shut down Windows NT and reboot. NT will prompt you with a menu that looks something like this:

```
OS Loader V4.00

Please select the operating system to start:

Windows NT Workstation Version 4.00
Windows NT Workstation Version 4.00 [VGA mode]
Linux
```

Select Linux, and the NT loader will read the Linux boot sector and transfer control to LILO or GRUB on the Linux partition.

If you are using LILO and you later modify */etc/lilo.conf* or rebuild the kernel, you need to rerun the `lilo` command, create a new *bootsect.lnx* file, and replace the version of *bootsect.lnx* on the Windows NT partition with the new version. In other words, you need to rerun Steps 2-6.

NOTE

If you have any problems or you simply want to remove LILO or GRUB later, you can reverse the installation procedure: boot to Windows NT, change the system and read-only attributes on *boot.ini*, re-edit *boot.ini* to remove the Linux entry, save the file, restore the system and read-only attributes, and remove the Linux boot sector from the NT partition.

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4.6. Boot-Time Kernel Options

The earlier sections of this chapter described some of the options you can specify when you boot Linux. There are many more options that can be specified. This section touches on the ways to pass options to the kernel and then describes some of the kinds of parameters you might want to use. The parameters in this section affect the kernel and therefore apply regardless of which boot loader you use.

As always with Unix systems, there are a number of choices for the boot process itself. If you are using Loadlin, you can pass parameters to the kernel on the command line or in a file.

If LILO is your boot loader, you can add to or override the parameters specified in*/etc/lilo.conf* during the boot process as follows:

- If `prompt` is set in */etc/lilo.conf*, LILO always presents the boot prompt and waits for input. At the prompt, you can choose the operating system to be booted. If you choose Linux, you can also specify parameters.
- If `prompt` isn't set, press Ctrl, Shift, or Alt when the word "LILO" appears. The boot prompt will then appear. You also can press the Scroll Lock key before LILO is printed and not have to wait poised over the keyboard for the right moment.
- At the boot prompt, specify the system you want to boot, or press Tab to get a list of the available choices. You then can enter the name of the image to boot. For example:

```
LILO boot: <press Tab>
linux   test   dos
boot: linux
```

  You also can add boot command options:

```
boot: linux single
```

- If you don't provide any input, LILO waits the amount of time specified in the`delay` parameter and then boots the default operating system with the default parameters, as set in */etc/lilo.conf*.

  If you are using GRUB, you can pass parameters to the kernel on the`kernel` command line, either in the configuration file or from the command-line interface. If you are booting from the GRUB menu, you can edit or add parameters by entering`e` or `a` when the menu appears.

  Some of the boot parameters have been mentioned earlier. Many of the others are hardware-specific and are too numerous to mention here. For a complete list of parameters and a

discussion of the booting process, see the "BootPrompt HOWTO." Some of the parameters not shown earlier that you might find useful are listed next; many more are covered in the HOWTO. Most of the following parameters are used to provide information or instructions to the kernel, rather than to LILO or GRUB.

acpi=off

Disable ACPI (Advanced Configuration and Power Interface) if it was to be enabled. This is useful for debugging possible hardware problems.

debug

Print all kernel messages to the console.

hd=*cylinders*,*heads*,*sectors*

Specify the hard drive geometry to the kernel. Useful if Linux has trouble recognizing the geometry of your drive, especially if it's an IDE drive with more than 1024 cylinders.

load_ramdisk=*n*

Tell the kernel whether to load a RAM disk image for use during Linux installation. Values of *n* are:

0 Don't try to load the image. This is the default.

1 Load the image from a floppy disk to the RAM disk.

mem=*size*

Specify the amount of system memory installed. Useful if your BIOS reports memory only up to 64 MB and your system has more memory installed. Specify as a number with M or k (case-insensitive) appended:

```
mem=128M
```

Because mem would have to be included on the command line for every boot, it often is specified on a command line saved with lock or with append to be added to the parameters passed to the kernel.

noinitrd

When set, disable the two-stage boot and preserve the contents of */dev/initrd* so the data is available after the kernel has booted. */dev/initrd* can be read only once, and then its contents are returned to the system.

number

Start Linux at the runlevel specified by *number*. A runlevel is an operating state that the system can be booted to, such as a multiuser system or a system configuration running the X Window System. A runlevel is generally one of the numbers from 1 to 6; the default is usually 3. The runlevels and their corresponding states are defined in the file */etc/inittab*. See the manpage for */etc/inittab* for more information.

ro Mount the root filesystem read-only. Used for doing system maintenance, such as checking the filesystem integrity, when you don't want anything written to the filesystem.

rw Mount the root filesystem read/write. If neither ro nor rw is specified, the default value (usually rw) stored in the kernel image is used.

single

Start Linux in single-user mode. This option is used for system administration and recovery. It gives you a root prompt as soon as the system boots, with minimal initialization. No other logins are allowed.

4.7. initrd: Using a RAM Disk

Modern Linux distributions use a modular kernel, which allows modules to be added without requiring that the kernel be rebuilt. If your root filesystem is on a device whose driver is a module (as is frequently true of SCSI disks), you can use the `initrd` facility, which provides a two-stage boot process, to first set up a temporary root filesystem in a RAM disk containing the modules you need to add (e.g., the SCSI driver) and then load the modules and mount the real root filesystem. The RAM disk containing the temporary filesystem is the special device file */dev/initrd*.

Similarly, you need to use a RAM disk if your root partition uses the ext3 filesystem and ext3 was not compiled into the kernel image. In that case, the ext3 module must be loaded with `initrd`.

Before you can use `initrd`, both RAM disk support (`CONFIG_BLK_DEV_RAM=y`) and initial RAM disk support (`CONFIG_BLK_DEV_INITRD=y`) must be compiled into the Linux kernel. Then you need to prepare the normal root filesystem and create the RAM disk image. Your Linux distribution may have utilities to do some of the setup for you; for example, the Red Hat distribution comes with the `mkinitrd` command, which builds the `initrd` image. For detailed information, see the `initrd` manpage and the file *initrd.txt* (the path may vary, but it is usually something like */usr/src/linux/Documentation/initrd.txt*).

Once your Linux system has been set up for `initrd`, you can do one of the following, depending on which boot loader you are using:

- If you are using LILO, add the `initrd` option to the appropriate image section:

  ```
  image=/vmlinuz
    initrd=/boot/initrd  # The file to load as the contents of /dev/initrd
    ...
  ```

  Run the `/sbin/lilo` command, and you can reboot with `initrd`.

- If you are using GRUB, add the `initrd` option to the kernel line of the configuration-file boot entry, or to the `kernel` command if you are booting from the command-line interface:

  ```
  kernel /vmlinuz-2.6.10 ro root=LABEL=/
  initrd /initrd-2.6.10
  ```

- If you are using Loadlin, add the `initrd` option to the command line:

  ```
  loadlin c:\linux\vmlinuz initrd=c:\linux\initrd
  ```

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Chapter 5. Package Management

This chapter describes the two major Linux packaging systems: the Red Hat Package Manager (RPM) and the Debian GNU/Linux Package Manager. It also describes the major frontend applications designed to simplify and automate package management: `yum` and `up2date` for RPM-based systems, `aptitude` and `synaptic` for Debian-based systems, and `apt`, which is a Debian package-management tool that is now also available for RPM-based systems.

When you install applications on your Linux system, most often you'll find a binary or a source package containing the application you want, instead of (or in addition to) a *.tar.gz* file. A package is a file containing the files necessary to install an application. However, while the package contains the files you need for installation, the application might require the presence of other files or packages that are not included, such as particular libraries (and even specific versions of the libraries), to actually be able to run. Such requirements are known as *dependencies*.

Package-management systems offer many benefits. As a user, you may want to query the package database to find out what packages are installed on the system and their versions. As a system administrator, you need tools to install and manage the packages on your system. And if you are a developer, you need to know how to build a package for distribution.

Among other things, package managers do the following:

- Provide tools for installing, updating, removing, and managing the software on your system.
- Allow you to install new or upgraded software directly across a network.
- Tell you what software package a particular file belongs to or what files a package contains.
- Maintain a database of packages on the system and their status, so you can determine what packages or versions are installed on your system.
- Provide dependency checking, so you don't mess up your system with incompatible software.
- Provide GPG, PGP, MD5, or other signature-verification tools.
- Provide tools for building packages.

Any user can list or query packages. However, installing, upgrading, or removing packages generally requires root privileges. This is because the packages normally are installed in system-wide directories that are writable only by root. Sometimes you can specify an alternate directory to install a package into your home directory or into a project directory where you have write permission, if you aren't running as root.

Signature verification is an important feature of package-management systems that helps maintain the security of your system. An MD5 checksum is used to check the integrity of a package, making sure, for example, that it was downloaded correctly and that it was not tampered with by a malicious user. GPG (and PGP) encrypt a digital signature into the package, which is used to verify the identity

of the package creator.

Most often you'll install a binary package, in which the source code has been compiled and the software is ready to run once it is installed. You may also want or need to install source packages, which provide the source code and instructions for compiling and installing it. Source code packages do not contain executable files. Packages follow certain naming conventions, and you can tell from the name whether it is a binary or source package. RPM and Debian package names contain the same information, but they are expressed slightly differently. An RPM package has the form:

```
package-version-release.architecture.rpm
```

A Debian package has the form:

```
package_version-revision_architecture.deb
```

In both cases, *package* is the name of the package, *version* is the version number of the software, *release* (RPM) and *revision* (Debian) indicate the revision number of the package for that version, and *architecture* shows what system architecture the software was packaged for (e.g., `i386` or `m68k`). The value of *architecture* may also be `noarch` for a package that is not hardware-specific or `src` for an RPM source package (Debian source packages come as `tar`red, `gz`ipped files).

All the package managers check for dependencies when you install a package. In the case of RPM, if there are missing dependencies, it prints an error and terminates without installing the package. To proceed, you need to first install the missing package (or packages). This can become an involved process if the missing package has its own dependencies. A major advantage of the high-level package managers described in this chapter (i.e., `apt`, `yum`, `up2date`, `synaptic`, and `aptitude`) is that they automatically resolve dependencies and install missing packages for you. Another advantage is that they locate and download the package automatically, based on information in configuration files specifying where to look for packages. With RPM, you first have to locate the package, then download it, and only then can you run RPM to do the install. On the other hand, if you already have the package file on your system or on a CD, RPM is quick and easy to run.

Both RPM and the `apt` system back up old files before installing an updated package. Not only does this let you go back if there is a problem, but it also ensures that you don't lose your changes (to configuration files, for example).

The following list shows the package-management programs described in the rest of this chapter. Which program to use is very much a matter of personal preference, and you can use more than one at different times. However, it's best to pick the program you prefer and use it consistently, so all your packages are maintained in a single database that you can query.

The Advanced Package Tool (APT)

APT is a modern, user-friendly package-management tool that consists of a number of commands. The most frequently used of these commands is`apt-get`, which is used to

download and install a Debian package. apt-get can be run from the command line or selected as a method from dselect. One of the features of apt-get is that you can use it to get and install packages across the Internet by specifying an FTP or HTTP URL. You can also use it to upgrade all packages currently installed on your system in a single operation.

Note that there are versions of the apt commands that can be used on an RPM-based system. If you plan to do that, it's best to install the version ofapt that comes with your Linux distribution.

aptitude

High-level text-based interface to APT. Runs either from the command line or in a visual mode inside a terminal window such as an xterm.

dpkg

The original Debian packaging tool. Used to install or uninstall packages, or as a frontend to dpkg-deb. Getting and installing packages is usually done withapt-get, but dpkg is still commonly used to install a package that is already on your system. In fact,apt-get calls dpkg to do the installation once it's gotten the package.

dpkg-deb

Lower-level packaging tool. Used to create and manage the Debian package archives. Accepts and executes commands from dpkg or can be called directly.

dselect

An interactive frontend to dpkg. With the advent of the newer tools and the increased number of packages, the use of dselect is deprecated.

RPM

The original command-line system for installing and managing RPM packages. RPM has two commands: rpm for installing and managing packages, and rpmbuild for creating packages.

synaptic

A graphical frontend to APT.

up2date

A graphical frontend to RPM.

yum

A frontend to RPM that runs from the command line.

If you want to update your system daily, to keep it current and to be sure you have the latest security fixes, you can set up a command that you can reissue every day, or you can set it up as a cron job to run overnight. (See the descriptions of the cron and crontab commands in Chapter 3 for more information on setting up a cron job.)

For example, with apt-get, you can set up the command:

```
apt-get update && apt-get -u dist-upgrade>
```

This command runs apt-get twice: first to update the local package lists, and then to actually do the upgrade. The dist-upgrade command handles all dependencies when it does the upgrade, and the -u option prints a list of the packages being upgraded.

yum, on the other hand, comes with a cron job that can be run daily. This job first updates yum itself, then updates all the remaining packages:

```
#!/bin/sh

if [ -f /var/lock/subsys/yum ]; then
        /usr/bin/yum -R 10 -e 0 -d 0 -y update yum
        /usr/bin/yum -R 120 -e 0 -d 0 -y update
fi
```

The -R option sets a maximum time, in minutes, for yum to wait before running the command, -e sets the error level to 0 to print only critical errors, -d specifies a debug level of 0 to print no debugging messages, and -y assumes "yes" as the answer to any questions.

5.1. The Red Hat Package Manager

The Red Hat Package Manager (RPM) is a freely available packaging system for software distribution and installation. In addition to the Red Hat Enterprise Linux and Fedora Core distributions, both SUSE and Mandrake are among the Linux distributions that use RPM.

Using RPM is straightforward. A single command, `rpm`, has options to perform all package-management functions except building packages.[*] For example, to find out if the Emacs editor is installed on your system, you could enter:

[*] In older versions of RPM, the build options were part of the **rpm** command.

```
$ rpm -q emacs
emacs-21.3-17
```

This command prints the full package name, confirming its presence.

The `rpmbuild` command is used to build both binary and source packages.

5.1.1. RPM Package Concepts

This section provides an overview of some of the parts of an RPM package. Much of the information is of primary use to developers, but because some of the terms are referenced in the RPM command descriptions, they are explained briefly here.

An RPM package has three primary components. The *header* contains all the information about the package, such as its name and version, a description, a list of included files, the copyright terms, and where the source file can be found. The *signature* contains information used to verify the integrity and authenticity of the package. The *archive* contains the actual files that make up the package.

When a package is being built, one of the requirements for its developers is to create a *spec* file. If you download the source `rpm` for a package, you can look at the spec file; it has a filename of *package.spec* (e.g., *yum.spec* for the `yum` spec file). The spec file contains all the information required to build a package, including a description of the software, instructions telling the `rpmbuild` command how to build the package, and a list of the files included and where they get installed. Some other features of spec files include the following:

Macros

Macros are sequences of commands stored together and executed by invoking the macro name. The RPM build process provides two standard macros: `%setup` to unpack the original

sources and %patch to apply patches. Other macros appear later in this chapter in the command descriptions and are described there.

Scripts

Scripts are used to control the build process. Some of the scripts RPM uses include%prep to begin the build process, %build primarily to run make and perhaps do some configuration, %install to do a make install and %clean to clean up afterward. Four additional scripts may be created to run when a package is actually installed on a system. These scripts are%pre for scripts run before package installation, %post for scripts run after package installation, %preun for scripts run before a package is uninstalled, and %postun for scripts run after a package is uninstalled.

Trigger scriptlets

Trigger scriptlets are extensions of the normal install and uninstall scripts. They provide for interaction between packages. A trigger scriptlet provided with one package will be triggered to run by the installation or removal of some other package. For example, a newly installed RPM package may cause an existing application to run or restart once installation is complete. In many cases, a newly installed package requires services to be restarted.

5.1.2. The rpm Command

RPM packages are built, installed, and queried with therpm command. RPM package filenames usually end with a *.rpm* extension. rpm has a set of modes, each with its own options. The format of the rpm command is:

```
rpm [options] [packages]
```

With a few exceptions, as noted in the lists of options that follow, the first option specifies therpm mode (install, query, update, etc.), and any remaining options affect that mode.

Options that refer to packages are sometimes specified as*package-name* and sometimes as *package-file*. The package name is the name of the program or application, such asxpdf. The package file is the name of the RPM file, such as*xpdf-3.00-10.1.i386.rpm*.

RPM provides a configuration file for specifying frequently used options. The default global configuration file is usually */usr/lib/rpm/rpmrc*, the local system configuration file is*/etc/rpmrc*, and users can set up their own *$HOME/.rpmrc* files. You can use the --showrc option to show the values RPM will use by default for all the options that may be set in an*rpmrc* file:

```
rpm --showrc
```

The rpm command includes FTP and HTTP clients, so you can specify an *ftp://* or *http://* URL to install or query a package across the Internet. You can use an FTP or HTTP URL wherever *package-file* is specified in the commands presented here. Be careful, however, when downloading packages from the Internet. Always verify package contents by checking MD5 hashes and signatures. Whenever possible, install from trusted media.

Any user can query the RPM database. Most of the other functions, such as installing and removing packages, require superuser privileges.

5.1.2.1 General options

The following options can be used with all modes:

--dbpath *path*

Use *path* as the path to the RPM database instead of the default */var/lib/rpm*.

-?, --help

Print a long usage message (running rpm with no options gives a shorter usage message).

--quiet

Display only error messages.

--rcfile *filelist*

Get configuration from the files in the colon-separated *filelist*. If --rcfile is specified, there must be at least one file in the list and the file must exist. *filelist* defaults to */usr/lib/rpm/rpmrc:/usr/lib/rpm/redhat/rpmrc:/etc/rpmrc:~/.rpmrc*. Use with --showrc to see what options will be used if alternate configuration files are specified.

--root *dir*

Perform all operations within the directory tree rooted at *dir*.

-v

Verbose. Print progress messages.

--version

Print the version number of rpm.

-vv

Print debugging information.

5.1.2.2 Install, upgrade, and freshen options

Use the install command to install or upgrade an RPM package. Upgrading withinstall leaves any existing versions on the system. Theinstall syntax is:

```
rpm -i [install-options] package_file ...
rpm --install [install-options] package_file ...
```

To install a new version of a package and remove an existing version at the same time, use the upgrade command instead:

```
rpm -U [install-options] package_file ...
rpm --upgrade [install-options] package_file ...
```

If the package doesn't already exist on the system, -U acts like -i and installs it. To prevent that behavior, you can freshen a package instead; in that case, rpm upgrades the package only if an earlier version is already installed. Thefreshen syntax is:

```
rpm -F [install-options] package_file ...
rpm --freshen [install-options] package_file ...
```

For all forms, *package-file* can be specified as an FTP or HTTP URL to download the file before installing it. See FTP/HTTP options.," later in this chapter.

The installation and upgrade options are:

--aid

If rpm suggests additional packages, add them to the list of package files.

--allfiles

Install or upgrade all files.

--badreloc

Used with --relocate to force relocation even if the package is not relocatable.

--excludedocs

Don't install any documentation files.

--excludepath *path*

Don't install any file whose filename begins with*path*.

--force

Force the installation. Equivalent to--replacepkgs --replacefiles --oldpackage.

-h, --hash

Print 50 hash marks as the package archive is unpacked. Use this option with-v or --verbose for a nicer display.

--ignorearch

Install even if the binary package is intended for a different architecture.

--ignoreos

Install binary package even if the operating systems don't match.

--ignoresize

Don't check disk space availability before installing.

--includedocs

Install documentation files. This is needed only ifexcludedocs: 1 is specified in an *rpmrc* file.

--justdb

Update the database only; don't change any files.

--nodeps

Don't check whether this package depends on the presence of other packages.

--nodigest

Don't verify package or header digests.

--noorder

Don't reorder packages to satisfy dependencies before installing.

--nopost

Don't execute any post-install script.

--nopostun

Don't execute any post-uninstall script.

--nopre

Don't execute any pre-install script.

--nopreun

Don't execute any pre-uninstall script.

--noscripts

Don't execute any pre-install or post-install scripts. Equivalent to specifying--nopre --nopost --nopreun --nopostun.

--nosignature

Don't verify package or header signatures.

--nosuggest

Don't suggest packages that provide a missing dependency.

--notriggerin

Don't execute any install trigger scriptlet.

--notriggerun

Don't execute any uninstall trigger scriptlet.

--notriggerpostun

Don't execute any post-uninstall trigger scriptlet.

--notriggers

Don't execute any scripts triggered by package installation. Equivalent to specifying--notriggerin --notriggerun --notriggerpostun.

--oldpackage

Allow an upgrade to replace a newer package with an older one.

--percent

Print percent-completion messages as files are unpacked. Useful for runningrpm from other tools.

--prefix *path*

Set the installation prefix to *path* for relocatable binary packages.

--relocate *oldpath*=newpath

For relocatable binary files, change all file paths from *oldpath* to *newpath*. Can be specified more than once to relocate multiple paths.

--repackage

Repackage the package files before erasing an older version, to save the package in case a transaction rollback is necessary. Rename the package as specified by the macro %_repackage_name_fmt, and save it in the directory specified by the macro %_repackage_dir (by default */var/spool/repackage*). The repackaged file is not identical to the original package.

--replacefiles

Install the packages even if they replace files from other installed packages.

--replacepkgs

Install the packages even if some of them are already installed.

--test

Go through the installation to see what it would do, but don't actually install the package. This option lets you test for problems before doing the installation.

5.1.2.3 Query options

The syntax for the query command is:

```
rpm -q [package-options] [information-options]
rpm --query [package-options] [information-options]
```

There are two subsets of query options. *Package-selection options* determine which packages to query, and *information-selection options* determine which information to provide.

5.1.2.4 Package-selection options

package_name

Query the installed package *package_name*.

-a, --all

Query all installed packages.

-f *file*, --file *file*

Find out which package owns *file*.

--fileid *md5*

Query package with the specified MD5 digest.

-g *group*, --group *group*

Find out which packages have group *group*.

--hdrid *sha1*

Query package with the specified SHA1 digest in the package header.

-p *package_file*, --package *package_file*

Query the uninstalled package *package_file*, which can be a URL. If *package_file* is not a binary package, it is treated as a text file containing a package manifest, with each line of the manifest containing a path or one or more whitespace-separated glob expressions to be expanded to paths. These paths are then used instead of *package_file* as the query arguments. The manifest can contain comments that begin with a hash mark (#).

--pkgid *md5*

Query the package with a package identifier that is the given MD5 digest of the combined header and contents.

--querybynumber *num*

Query the *num*th database entry. Useful for debugging.

-qf, --queryformat *string*

Specify the format for displaying the query output, using tags to represent different types of data (e.g., NAME, FILENAME, DISTRIBUTION). The format specification is a variation of the standard printf formatting, with the type specifier omitted and replaced by the name of the header tag inclosed in brackets ({ }). For example:

```
%{NAME}
```

The tag names are case-insensitive. Use --querytags (see Miscellaneous options.," later in this section) to view a list of available tags. The tag can be followed by *type* to get a different output format type. The possible types are:

:armor

Wrap a public key in ASCII armor.

:base64

Encode binary data as base64.

:date

Use %c format as in strftime(3)to display the preferred date and time format for this locale.

:day

Use %a %b %d %Y format as in the function strftime(3). This format displays the day, the month, the month as a decimal number, and the four-digit year.

:depflags

Format dependency flags.

:fflags

Format file flags.

:hex

Use hexadecimal format.

:octal

Use octal format.

:perms

Format file permissions.

:shescape

Escape single quotes for use in a script.

:triggertype

Display trigger suffix (i.e., in, un, or postun, indicating whether it's an install, uninstall, or post-uninstall trigger).

--specfile *specfile*

Query *specfile* as if it were a package. Useful for extracting information from a spec file.

--tid *tid*

List packages with the specified transaction identifier (*tid*). The tid is a Unix timestamp. All packages installed or erased in a single transaction have the same tid.

--triggeredby *pkg*

List packages containing triggers that are run when the installation status of package*pkg* changes. For example:

```
$ rpm -q --triggeredby glibc
redhat-lsb-1.3-4
```

In this example, the package redhat-lsb-1.3.4 contains a`triggerpostun` scriptlet that runs after `glibc` is uninstalled.

`--whatrequires` *capability*

List packages that require the given capability to function. For example:

```
$ rpm -q --whatrequires popt
rpm-4.3.2-21
gstreamer-0.8.7-3
librsvg2-2.8.1-1
planner-0.12.1-1
```

`--whatprovides` *capability*

List packages that provide the given capability. For example:

```
$ rpm -q --whatprovides popt
popt-1.9.1-21
```

5.1.2.5 Information-selection options

`-c, --configfiles`

List configuration files in the package. Implies-l.

`--changelog`

Display the log of change information for the package.

`-d, --docfiles`

List documentation files in the package. Implies-l.

`--dump`

Dump information for each file in the package. This option must be used with at least one of -l, -c, or -d. The output includes the following information in this order:

```
path size mtime md5sum mode owner group isconfig isdoc rdev symlink
```

--filesbypkg

List all files in each package.

-i, --info

Display package information, including the name, version, and description. Formats the results according to --queryformat if specified.

-l, --list

List all files in the package.

--last

List packages by install time, with the latest packages listed first.

--provides

List the capabilities this package provides.

-R, --requires

List any packages this package depends on.

-s, --state

List each file in the package and its state. The possible states arenormal, not installed, or replaced. Implies -l.

--scripts

List any package-specific shell scripts used during installation and uninstallation of the package

--triggers, --triggerscript

Display any trigger scripts in the package.

5.1.2.6 Uninstall options

The syntax for erase, the uninstall command, is:

```
rpm -e [uninstall-options ]package_name  ...
rpm --erase [uninstall-options ]package_name  ...
```

The uninstall options are:

--allmatches

Remove all versions of the package. Only one package should be specified; otherwise, an error results.

--nodeps

Don't check dependencies before uninstalling the package.

--nopostun

Don't run any post-uninstall scripts.

--nopreun

Don't run any pre-uninstall scripts.

--noscripts

Don't execute any pre-uninstall or post-uninstall scripts. This option is equivalent to--nopreun --nopostun.

--notriggerpostun

Don't execute any post-uninstall scripts triggered by the removal of this package.

--notriggers

Don't execute any scripts triggered by the removal of this package. Equivalent to--notriggerun --notriggerpostun.

--notriggerun

Don't execute any uninstall scripts triggered by the removal of this package.

--repackage

Repackage the files before uninstalling them, to save the package in case a transaction rollback is necessary. Rename the package as specified by the macro %_repackage_name_fmt and save it in the directory specified by the macro %_repackage_dir (by default, */var/spool/repackage*). The repackaged file is not identical to the original package file.

--test

Don't really uninstall anything; just go through the motions. Use with-vv for debugging.

5.1.2.7 Verify options

The syntax for the verify command is:

```
rpm -V|--verify [package-selection-options] [verify-options]
```

Verify mode compares information about the installed files in a package with information about the files that came in the original package and displays any discrepancies. The information compared includes the size, MD5 sum, permissions, type, owner, and group of each file. Uninstalled files are ignored.

The package selection options include those available for query mode. In addition, the following verify options are available:

--nodeps

Ignore package dependencies.

--nodigest

Ignore package or header digests.

--nofiles

Ignore attributes of package files.

--nogroup

Ignore group ownership errors.

--nolinkto

Ignore symbolic-link errors.

--nomd5

Ignore MD5 checksum errors.

--nomode

Ignore file mode (permissions) errors.

--nordev

Ignore major and minor device number errors.

--nomtime

Ignore modification time errors.

--noscripts

Ignore any verify script.

--nosignature

Ignore package or header signatures.

--nosize

Ignore file size errors.

--nouser

Ignore user ownership errors.

The output is formatted as an eight-character string, possibly followed by an attribute marker, and then the filename. Each of the eight characters in the string represents the result of comparing one file attribute to the value of that attribute from the RPM database. A period (.) indicates that the file passed that test. The following characters indicate failure of the corresponding test:

MD5 sum

D

Device

G

Group

L

Symlink

M

Mode (includes permissions and file type)

S

File size

T

Mtime

U

User

The possible attribute markers are:

c

Configuration file

d

Documentation file

g

Ghost file (contents not included in package)

l

License file

r

Readme file

5.1.2.8 Database rebuild options

The syntax of the command to rebuild the RPM database is:

```
rpm --rebuilddb [options]
```

You also can build a new database:

```
rpm --initdb [options]
```

The options available with the database rebuild mode are the`--dbpath`, `--root`, and `-v` options described earlier under General options.."

5.1.2.9 Signature-check options

RPM packages may have a GPG signature built into them. There are three types of digital signature options: you can check signatures, add signatures to packages, and import signatures.

The syntax of the signature check mode is:

```
rpm --checksig [options] package_file...
rpm -K [options] package_file...
```

The signature-checking options `-K` and `--checksig` check the digests and signatures contained in the specified packages to insure the integrity and origin of the packages. Note that RPM now automatically checks the signature of any package when it is read; these options are still useful, however, for checking all headers and signatures associated with a package.

The `--nosignature` and `--nodigest` options described earlier under Verify options. are available for use with signature check mode.

The syntax for adding signatures to binary packages is:

```
rpm --addsign binary-pkgfile ...
rpm --resign binary-pkgfile ...
```

Both `--addsign` and `--resign` generate and insert new signatures, replacing any that already exist in the specified binary packages.[*]

[*] In older versions of RPM, **--addsign** was used to add new signatures without replacing existing ones, but currently both options work the same way and replace any existing signatures.

The syntax for importing signatures is:

```
rpm --import public-key
```

The `--import` option is used to import an ASCII public key to the RPM database so that digital signatures for packages using that key can be verified. Imported public keys are carried in headers, and keys are kept in a ring, which can be queried and managed like any package file.

5.1.2.10 Miscellaneous options

Several additional `rpm` options are available:

`--querytags`

Print the tags available for use with the `--queryformat` option in query mode.

`--setperms` *packages*

Set file permissions of the specified packages to those in the database.

`--setugids` *packages*

Set file owner and group of the specified packages to those in the database.

`--showrc`

Show the values `rpm` will use for all options that can be set in an *rpmrc* file.

5.1.2.11 FTP/HTTP options

The following options are available for use with FTP and HTTP URLs in install, update, and query modes.

--ftpport *port*

Use *port* for making an FTP connection on the proxy FTP server instead of the default port. Same as specifying the macro %_ftpport.

--ftpproxy *host*

Use *host* as the proxy server for FTP transfers through a firewall that uses a proxy. Same as specifying the macro %_ftpproxy.

--httpport *port*

Use *port* for making an HTTP connection on the proxy HTTP server instead of the default port. Same as specifying the macro %_httpport.

--httpproxy *host*

Use *host* as the proxy server for HTTP transfers. Same as specifying the macro %_httpproxy.

5.1.3. RPM Examples

Query the RPM database to find Emacs-related packages:

```
$ rpm -q -a | grep emacs
```

Query an uninstalled package, printing information about the package and listing the files it contains:

```
$ rpm -qpil ~/downloads/bash2-doc-2.03-8.i386.rpm
```

Install a package (assumes superuser privileges):

```
$ rpm -i sudo-1.6.7p5-30.1.i386.rpm
```

Do the same thing, but report on the progress of the installation:

```
$ rpm -ivh sudo-1.6.7p5-30.1.i386.rpm
```

5.1.4. The rpmbuild Command

The `rpmbuild` command is used to build RPM packages. The syntax for `rpmbuild` is:

```
rpmbuild -[b|t]stage [build-options] spec-file ...
```

Specify `-b` to build a package directly from a spec file, or `-t` to open a tarred, gzipped file and use its spec file.

Both forms take the following single-character *stage* arguments, which specify the stages, or steps, required to build a package. The stages are listed in the order they would be performed:

p

Perform the prep stage, unpacking source files and applying patches.

l

Do a list check, expanding macros in the files section of the spec file and verifying that each file exists.

c

Perform the prep and build stages; generally equivalent to doing `amake`.

i

Perform the prep, build, and install stages; generally equivalent to doing `amake install`.

b

Perform the prep, build, and install stages, then build a binary package.

s

Build a source package.

a

Perform the prep, build, and install stages, then build both binary and source packages.

The difference between the build stage, which is one of the early steps, and building a binary packag

in b or a is the difference between building a working binary for the software and putting all the pieces together into a final rpm package.

5.1.4.1 rpmbuild options

The general rpm options described earlier under General options. can be used with rpmbuild.

The following additional options can also be used when building anrpm file with rpmbuild:

--buildroot *dir*

Override the BuildRoot tag with *dir* when building the package.

--clean

Clean up (remove) the build files after the package has been made.

--nobuild

Go through the motions, but don't execute any build stages. Used for testing spec files.

--rmsource

Remove the source files when the build is done. Can be used as a standalone option withrpm to clean up files separately from creating the packages.

--rmspec

Remove the spec file when the build is done. Like--rmsource, --rmspec can be used as a standalone option with rpmbuild.

--short-circuit

Can be used with -bc and -bi to skip previous stages that already ran successfully. With--short-circuit, -bc starts directly at the build stage and -bi starts with the install stage.

--sign

Add a GPG signature to the package for verifying its integrity and origin.

--target *platform*

When building the package, set the macros %_target, %_target_arch, and %_target_os to the value indicated by *platform*.

Two other options can be used standalone with `rpmbuild` to recompile or rebuild a package:

`--rebuild` *source-pkgfile*...

> Like `--recompile`, but also build a new binary package. Remove the build directory, the source files, and the spec file once the build is complete.

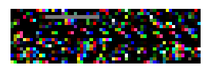
`--recompile` *source-pkgfile*...

> Install the named source package, and prep, compile, and install the package.

Finally, the `--showrc` option is used to show the current `rpmbuild` configuration:

```
rpmbuild --showrc
```

This option shows the values that will be used for all options that can be set in an*rpmrc* file.



5.2. Yum: Yellowdog Updater Modified

Yum is a system for managing RPM packages, including installing, updating, removing, and maintaining packages; it automatically handles dependencies between packages. Yum is derived from yup, an updating system written for Yellow Dog Linux, an RPM-based Macintosh distribution. Yum downloads the information in the package headers to a directory on your system, which it then uses to make decisions about what it needs to do. Yum obtains both the headers and the RPMs themselves from a collection of packages on a server, known as a*repository*.

A repository consists of a set of RPM packages and the package headers, which are on a server that can be accessed via FTP or HTTP, from an NFS server, or from a local filesystem. A single server can contain one or multiple repositories; repositories are often mirrored on many servers, and you can configure yum to use multiple repositories. When they are downloaded to your system, the header and package files are maintained in*/var/cache/yum.*

The configuration file,*/etc/yum.conf*, is where you customize yum. It consists of two section types. The first section, [main], sets configuration defaults for yum operation. This section is followed by [*server*] sections, where each server is named according to the repository it specifies. For example, for Fedora Core, you might have [base] for the base Fedora Core repository and [development] for the development repository.

The server sections can also be stored, one to a file, in*/etc/yum.repos.d*. yum comes with a default *yum.conf*file, which you can use as is or as a starting point from which to add additional repositories.

5.2.1. The yum Command

The yum command is an automated system for updating rpm-based packages, particularly on Fedora Core and Red Hat Enterprise Linux. Yum can automatically install, upgrade, and remove packages. In addition to individual packages or a list of packages,yum can operate on an entire group of packages at a time.

When you run yum, it first updates the cache (unless you tell it not to with the-C option); then it proceeds to perform the requested operation.

The format of the yum command is:

```
yum [options] [command] [package ...]
```

Any general options are specified first, followed by a command tellingyum what you want it to do, usually followed by a list of one or more packages. The*command* is always required, except with the --help, -h, and --version options.

Package names can be specified in various combinations of name, architecture, version, and release. For example, you could refer to the bash package as *bash*, *bash.i386*, *bash-3.0*, *bash-3.0-17*, or *bash-3.0-17.i386*.

5.2.1.1 General options

The following general options can be set on the command line. For those that can also be set in the [main] section of the *yum.conf* configuration file, the name of the configuration option is given.

-c [*config-file*]

Specify the location of the yum configuration file. The file can be specified as a path to a local file or as an HTTP or FTP URL. The default is */etc/yum.conf*.

-C

Run entirely from the local cache. Don't download or update headers unless required to complete the requested action.

-d [*num*]

Set the debug level to *num*, which is generally a number between 0 and 10, to specify how much debugging information to print. The configuration option is debuglevel.

--disablerepo=*repoid*

Disable the repository specified by *repoid* so yum won't use it for this operation. The configuration option is enabled.

-e [*num*]

Set the error level to *num*, where *num* is a number, generally between 0 and 10. If the value is 0, print only critical errors. If it is 1, print all errors. Values greater than 1 mean print more errors, if there are any.

--enablerepo=*repoid*

Enable the specified repository that is marked as disabled (enable=0) in the configuration file. This allows the repository to be used for this operation. The configuration option is enabled.

--exclude=*package*

Exclude the specified package from updates on all repositories. *package* can be given as a name or a glob. The configuration option is exclude.

-h, --help

Display a help message and exit.

--installroot=*root*

Specify an alternative root for package installation. All packages will be installed relative to root. The configuration option is installroot.

--obsoletes

Enable obsoletes processing logic, taking into consideration packages that are obsoleted by other packages in the repository. Meaningful only with the yum update command. The configuration option is obsoletes.

-R [*min*]

Set the maximum amount of time in minutes that yum will wait before performing a command.

--rss-filename=*filename*

Use *filename* as the output file for the generate-rss command. The configuration option is rss-filename.

-t, --tolerant

Keep going (be tolerant) if there are package errors on the command line. This allows yum to continue processing other packages even if there is a problem with one package (e.g., trying to install a package that is already installed). The configuration option is tolerant.

-y

Assume that the answer to any question is yes. The configuration option is assumeyes.

5.2.2. Yum Command Summary

The individual yum commands are listed here.

check-update

`check-update`

Determine if updates are available, without running `yum` interactively. If any package updates are available, returns an exit value of 100 and a list of packages. If there are no updates, returns 0.

clean

`clean [options]`

Clean up the `yum` cache directory.

Options

all

Clean everything: headers, packages, metadata, and the cache.

cache

Clean up the cache.

headers

Remove all header files, forcing `yum` to download new headers the next time it runs.

metadata

Remove the metadata files, which maintain information about the packages such as package name, file size, description, dependencies, etc.

packages

Remove cached packages.

generate-rss

`generate-rss [updates]`

Create an rss file that lists changelogs for all packages in the enabled repositories. If updates is specified, the rss file lists only updates that apply to your system.

groupinfo

```
groupinfo groups
```

Like info, but operates on package groups instead of individual packages.

groupinstall

```
groupinstall groups
```

Like install, but operates on package groups instead of individual packages.

grouplist

```
grouplist
```

Generate a list of installed and available groups to standard output. You can use these groups as input parameters to the other group commands, with their names in quotes (" ").

groupremove

```
groupremove groups
```

Like remove, but operates on package groups instead of individual packages.

groupupdate

`groupupdate` *groups*

Like `update`, but operates on package groups instead of individual packages.

info

`info` [*options*] [*packages*]

Display version information, a summary, and a description for each package, or for all packages if none is specified. See the list command for a description of the options.

install

`install` *packages*

Install the latest version of a package or packages, ensuring that all dependencies are met. If no package matches the name as specified, the name is treated as a shell glob and any matches are installed.

list

`list` [*options*] [*packages*]

Display a list of packages that match the *packages* specification and that are installed or available for installation.

Options

all

List all installed or available packages.

available

List packages on the repository that are available for installation.

extras

List packages on the system that are not available on any repository in the configuration file.

installed

List installed packages.

obsoletes

List installed packages that are made obsolete by any packages in any repository in the configuration file.

updates

List packages that have updates available for installation.

localinstall

`localinstall` *`packages`*

Install the specified packages, which reside on the local system, rather than downloading them from a repository.

localupdate

`localupdate` *`packages`*

Update the specified packages, which reside on the local system, rather than downloading them from a repository.

makecache

`makecache`

Download and cache the metadata files from the repository. Once the cache has been built, you can use the -C option to run the commands that use the metadata (check-update, info, list, provides, and search) directly from the cache.

provides

```
provides feature1 [feature2 ...]
whatprovides feature1 [feature2 ...]
```

List packages that are available or installed that provide the specified features. The features can be specified as a name or as a wildcard in file-glob syntax format, and Perl or Python regular expressions can be used.

remove

```
remove package1 [package2 ...]
erase package1 [package2 ...]
```

Remove the specified packages from the system. Also remove any packages that depend on the specified packages.

search

```
search string1 [string2 ...]
```

Find packages matching the specified string or strings in the description, summary, packager, or package name fields. Perl or Python regular expressions can be used for the strings. Useful for findin a package if you don't know the name.

update

```
update [packages]
```

With no packages specified, update all installed packages. Otherwise, update the specified packages. In either case, `yum` makes sure that all dependencies are satisfied. If no package matches, the names specified are assumed to be shell globs, and any matches are installed.

With the `--obsoletes` option, `yum` includes package obsoletes in its calculations.

upgrade

`upgrade [packages]`

Equivalent to `update --obsoletes`.

PREV

5.3. up2date: Red Hat Update Agent

The Red Hat Update Agent, `up2date`, installs and updates packages on RPM-based systems, primarily on Red Hat and Fedora Core Linux systems. Originally, `up2date` was intended for use with Red Hat Enterprise Linux and the Red Hat Network, but it has since been updated to work with `yum` and `apt` repositories as well. `up2date` operates on groupings of packages known as *channels*, based on the system architecture and Fedora Core or Red Hat Enterprise release. For example, a channel might be *fedora-core-3*, containing packages for that distribution; this type of channel is a base channel. Child channels are associated with a base channel and contain extra packages, such as for an application or a set of applications. Entries for the channels are found in */etc/sysconfig/rhn/sources.* This file contains an entry for each channel that associates the repository type (e.g., `up2date`, `yum`, or `apt`) with a channel name, and a URL in the case of a `yum` repository. For an `apt` repository, the URL is separated by spaces into parts: service:server, path, and repository name. You can also include entries for a local directory of packages, known as a `dir` repository.

`up2date` has both a command-line and a graphical interface; it is primarily the command-line interface that we describe in this section. If you are running GNOME or KDE and have the `rhn-applet` installed, clicking on the icon in the panel brings up the graphical `up2date` interface. The `rhn-applet` is the Red Hat Network Notification Tool, which runs in your desktop panel and notifies you when package updates are available. The panel icon is red with a blinking exclamation point if updates are available, and blue with a check mark if your system is up to date.

The format of the `up2date` command is:

```
up2date [options] [packages]
```

There are two additional commands:

```
up2date-nox [options] [packages]
up2date-config
```

Running `up2date-nox` is equivalent to running `up2date` with the `--nox` option; it runs without X (without the graphical interface). `up2date-config` runs a graphical tool for configuring `up2date`. You can also configure the program by editing the configuration file, */etc/sysconfig/rhn/up2date*, directly. These versions of the `up2date` command are not described further here.

Running `up2date` with no packages specified brings up the graphical interface. With packages, `up2date` updates or installs those packages, resolving dependencies as needed. Specify packages by name; `up2date` determines the appropriate version, release, and distribution.

5.3.1.

5.3.1.1 Options

--arch=*arch*

Install the package for the specified architecture. Not valid with-u, --list, or --dry-run.

--configure

Configure the Update Agent. Puts up a graphical window that lets you configure proxy and authentication information, retrieval options, and packages and files to skip.

--channel*channels*

Specify the channels to use.

-d, --download

Download the specified package, but do not install it.

--dbpath*path*

Specify the path to an alternate RPM database. The default path is*/var/lib/rpm*.

--dry-run

Go through the motions, but don't actually download and install any packages.

--exclude*packages*

Exclude packages in the comma-separated list of packages from being installed or updated.

-f, --force

Force package installation. Override file, package, and configuration skip lists.

--get

Download the packages, but don't resolve any dependencies.

--get-source

Download the source package. Don't resolve any dependencies.

--gpg-flags

List the flags that will be used when GPG is invoked. Useful for scripts that want to invoke GPG the way up2date does.

-h, --help

Print a help message and exit.

-i, --install

Download and install the package. Override configuration option. Cannot be used with--download.

--installall

Install all available packages on the channel specified by--channel.

--justdb

Add packages to the database, but do not install them to the filesystem.

-k, --packagedir*dirs*

Use the colon-separated list of directories to search for packages.

-l,--list

List packages available for update. Also shows packages marked to be skipped.

--list-rollbacks

Display a list of all RPM rollbacks available. A rollback lets you return to an earlier state before you installed a package.

--nodownload

Do not download any packages. Used for testing.

--nosig

Do not use GPG to check package signatures. If specified, overrides configuration option.

--nosrc

Do not download source packages. If specified, overrides configuration option.

--nox

Do not display the graphical interface.

--proxy*proxy*

Specify an HTTP proxy to use.

--proxyUser=username

Specify the username to use with an authenticated HTTP proxy.

--proxyPassword=password

Specify a password to use with an authenticated HTTP proxy.

--register

Register or reregister the system.

--showall

Display a list of all packages available for download, including both packages that are already installed and those that are not.

--show-available

Display a list of all packages available for download and not currently installed.

--show-channels

Show the channels associated with a package. If used alone, show the currently subscribed channels.

--show-groups

Display a list of package groups that are available for download.

--show-orphans

List any installed packages that are not in any of the subscribed-to channels.

--show-package-dialog

When running in GUI mode, show the package installation dialog.

--solve-deps=*dependencies*

Download and install packages needed to resolve the specified dependencies. The dependencie are given in a comma-separated list.

--src

Download source, as well as binary, RPMs.

--serverUrl=url

Specify the URL of the server to use.

--tmpdir=*directory*

Specify a temporary storage directory for files and packages, overriding the configured value.

-u, --update

Do a complete system update, downloading and installing all relevant packages.

--undo

Undo the last package set update.

--upgrade-to-release=*release-version*

Upgrade to the specified release, where *release-version* indicates the channel for that release.

-v, --verbose

Display additional output.

--version

Print version information and exit.

--what-provides=*dependencies*

List packages that solve the comma-separated list of dependencies.

PREV

PREV

5.4. The Debian Package Manager

Debian GNU/Linux provides several package-management tools, primarily intended to facilitate the building, installation, and management of binary packages. In addition to Debian GNU/Linux, the tools described here also work on other Debian-based systems such as Xandros, Knoppix, Ubuntu, and numerous others.

Debian package names generally end in *.deb*. The Debian package-management tools described here include apt, aptitude, dpkg, dpkg-deb, dselect, and synaptic.

Each of these tools is described later in detail inDebian Package Manager Command Summary.."

5.4.1. Files

Some important files used by the Debian package-management tools are described briefly here:

control

Comes with each package. Documents dependencies; contains the name and version of the package, a description, maintainer, installed size, the package priority, etc.

conffiles

Comes with each package. Contains a list of the configuration files associated with the package

preinst, *postinst*, *prerm*, *postrm*

Scripts developers can include in a package to be run before installation, after installation, before removal, or after removal of the package.

/var/lib/dpkg/available

Contains information about packages available on the system.

/var/lib/dpkg/status

Contains information about the status of packages available on the system.

/etc/apt/sources.list

A list for APT of package sources, used to locate packages. The sources are listed one per line, in order of preference.

/etc/apt/apt.conf

The main APT configuration file.

/etc/apt/apt_preferences

A preferences file that controls various aspects of APT, such as letting a user select the version or release of a package to install.

/etc/dpkg/dpkg.cfg

A configuration file containing default options for `dpkg`.

For a user, the important file is */etc/apt/sources.list*. This file is where you set up the paths to the package archives, telling `apt` where to go to find packages. `apt` is installed with a default file. You aren't required to modify the sources in the file, but you'll probably want to change some sources or add additional ones at some point. You might also want to change some of the options in the configuration files *apt.conf*, *apt_preferences*, and *dpkg.config* if you aren't satisfied with the defaults. The *control*, *conffiles*, and the pre- and post- install and removal script files are created by the package developers and used internally by the package-management system.

5.4.2. Package Priorities

Every Debian package has a priority associated with it, indicating how important the package is to the system. The priorities are:

required

The package is essential to the proper functioning of the system.

important

The package provides important functionality that enables the system to run well.

standard

The package is included in a standard system installation.

optional

The package is one that you might want to install, but you can omit it if you are short on disk space, for example.

extra

The package either conflicts with other packages that have a higher priority, has specialized requirements, or is one that you would want to install only if you need it.

The control file for dpkg, for example, shows that dpkg itself has a priority of required; dpkg-dev (which provides tools for building Debian packages) has a priority ofstandard; and dpkg-doc is optional.

5.4.3. Package and Selection States

The possible states that a package can be in are:

config-files

Only the configuration files for the package are present on the system.

half-configured

The package is unpacked, and configuration was started but not completed.

half-installed

Installation was started but not completed.

installed

The package is unpacked and configured.

not-installed

The package is not installed.

unpacked

The package is unpacked but not configured.

The possible package selection states are:

deinstall

The package has been selected for deinstallation (i.e., for removal of everything but the configuration files).

install

The package has been selected for installation.

purge

The package has been selected to be purged (i.e., for removal of everything including the configuration files).

5.4.4. Package Flags

Two possible package flags can be set for a package:

hold

The package should not be handled by dpkg unless forced with the --force-hold option. Holding a package keeps it at the current version, preventing it from being updated. You might hold a package, for example, if the latest version is broken and you want to stay with the version you have until a newer one is released.

reinst-required

The package is broken and needs to be reinstalled. Such a package cannot be removed unless forced with the --force-reinstreq option.

5.4.5. Scripts

In addition to the commands described in the next section, a number of shell and Perl scripts are included with the package manager for use in managing and building packages:

apt-file

Search for packages, specifying an action and a pattern to search for. (Perl script)

apt-rdepends

Recursively list dependencies. (Perl script)

apt-setup

An interactive script for adding download sources to the*sources.list* file. (Shell script)

dpkg-architecture

Determine and set the build and host architecture for package building. (Perl script)

dpkg-checkbuilddeps

Check installed packages against the build dependencies and build conflicts listed in the control file. (Perl script)

dpkg-buildpackage

A control script to help automate package building. (Shell script)

dpkg-distaddfile

Add an entry for a file to *debian/files*. (Perl script)

dpkg-divert

Create and manage the list of diversions, used to override the default location for installing files. (Perl script)

dpkg-genchanges

Generate an upload control file from the information in an unpacked, built source tree and the files it has generated. (Perl script)

dpkg-gencontrol

Read information from an unpacked source tree, generate a binary package control file (by default, *debian/tmp/DEBIAN/control*), and add an entry for the binary file to *debian/files*. (Perl script)

dpkg-name

Rename Debian packages to their full package names. (Shell script)

dpkg-parsechangelog

Read and parse the changelog from an unpacked source tree and write the information to standard output in machine-readable form. (Perl script)

dpkg-preconfigure

Let packages ask questions prior to installation. (Perl script)

dpkg-reconfigure

Reconfigure a package that is already installed. (Perl script)

dpkg-scanpackages

Create a *Packages* file from a tree of binary packages. The *Packages* file is used by dselect to provide a list of packages available for installation. (Perl script)

dpkg-shlibdeps

Calculate shared library dependencies for named executables. (Perl script)

dpkg-source

Pack and unpack Debian source archives. (Perl script)

dpkg-statoverride

Manage the list of stat overrides, which let dpkg override file ownership and mode when a package is installed. (Perl script)

5.4.6. Debian Package Manager Command Summary

For the apt- commands, options can be specified on the command line or set in the configuration file Boolean options set in the configuration file can be overridden on the command line in a number of different ways, such as --no-*opt* and -*opt*=no, where *opt* is the single-character or full name of the option.

apt-cache

```
apt-cache [options] command
```

Perform low-level operations on the APT binary cache, including the ability to perform searches and produce output reports from package metadata.

Commands

add *files*

Add the specified package index files to the source cache.

depends *pkgs*

For each specified package, show a list of dependencies and packages that can fulfill them.

dotty *pkgs*

Graph the relationships between the specified packages. The default is to trace out all dependent packages; turn this behavior off by setting theAPT::Cache::GivenOnly configuration option.

dump

List every package in the cache. Used for debugging.

dumpavail

Print a list of available packages to standard output, suitable for use withdpkg.

gencaches

Build source and package caches from the sources in the file s*ources.list* and from */var/lib/dpkg/status*. Equivalent to running apt-get check.

madison [*pkgs*]

Display a table showing the available versions of each specified package. Similar tomadison, a Debian tool that checks for package versions and reports their status. This option works locally and doesn't require access to the Debian project's internal archive.

pkgnames *[prefix*]

Print a list of packages in the system. If*prefix* is specified, print only packages whose names begin with that prefix. Most useful with the--generate option.

policy [*pkgs*]

Print detailed information about the priority selection of each specified package. With no

arguments, print the priorities of all sources. Useful for debugging issues related to the *preferences* file.

rdepends [*pkgs*]

Show a list of reverse dependencies for each specified packagei.e., list any packages that depend on the specified packages.

search *regex*

Search package names and descriptions of all available package files for the specified regular expression and print the name and short description of each matching package. With--full, the output is identical to that from the show command. With --names-only, only the package name is searched. Multiple regular expressions can be specified. Useful for finding packages when you don't know the actual package name.

show *pkgs*

Display the package records for each specified package. See the-a option for more details.

showpkg *pkgs*

Display information about the specified packages. For each package, the output includes the available versions, packages that depend on this package, and packages that this package depends on. Useful for debugging.

showsrc *pkgs*

Display source package records for each specified package.

stats

Display statistics about the cache.

unmet

Display the unmet dependencies in the package cache.

Options

-a, --all-versions

Print full records for all available versions. For use with theshow command. The default is to

show all versions; turn it off with --no-all-versions to display only the version that would be installed. The configuration option is APT::Cache::AllVersions.

--all-names

Cause pkgnames to print all names, including virtual packages and missing dependencies. The configuration option is APT::Cache::AllNames.

-c *file*, --config-file=*file*

Specify a configuration file to be read after the default configuration file.

-f, --full

Print full package records when searching. The configuration option is APT::Cache::ShowFull.

-g, --generate

Automatically regenerate the package cache rather than using the current cache. Default is to regenerate; turn it off with --no-generate. The configuration option is APT::Cache::Generate.

-h, --help

Print usage information and exit.

-i, --important

Print only important dependencies (Depends and Pre-Depends relations). For use with unmet. The configuration option is APT::Cache::Important.

--installed

Only produce output for currently installed packages. For use with depends and rdepends. The configuration option is APT::Cache::Installed.

-n, --names-only

Search only on package names, not long descriptions. The configuration option is APT::Cache::NamesOnly.

-o, --option

Set a configuration option. Syntax is -o *group*::*tool*=*option*.

-p *file*, --pkg-cache=*file*

Use the specified file for the package cache, the primary cache used by all operations. The configuration option is Dir::Cache::pkgcache.

-q, --quiet

Operate quietly, producing output for logging but no progress indicators. Use-qq for even quieter operation. The configuration option isquiet.

--recurse

Run depends or rdepends recursively, so all specified packages are printed once. The configuration option is APT::Cache::RecurseDepends.

-s *file*, --src-cache=*file*

Specify the source cache file used by gencaches. The configuration option is Dir::Cache::srcpkgcache.

-v, --version

Print version information and exit.

apt-cdrom

apt-cdrom [*options*] *command*

Add a new CD-ROM to APT's list of available sources. The database of CD-ROM IDs that APT maintains is */var/lib/apt/cdroms.list*.

Commands

add

Add a CD-ROM to the source list.

ident

Print the identity of the current CD-ROM and the stored filename. Used for debugging.

Options

-a, --thorough

Do a thorough package scan. May be needed with some old Debian CD-ROMs.

-c *file*, --config-file=*file*

Specify a configuration file to be read after the default configuration file.

-d *mount-point*, --cdrom=*mount-point*

Specify the CD-ROM mount point, which must be listed in*/etc/fstab*. The configuration option is Acquire::cdrom::mount.

-f, --fast

Do a fast copy, assuming the files are valid and don't all need checking. Specify this only if the disk has been run before without error. The configuration option isAPT::CDROM::Fast.

-h, --help

Print help message and exit.

-m, --no-mount

Don't mount or unmount the mount point. The configuration option is APT::CDROM::NoMount.

-n, --just-print, --recon, --no-act

Check everything, but don't actually make any changes. The configuration option is APT::CDROM::NoAct.

-o, --option

Set a configuration option. Syntax is-o *group*::*tool*=*option*.

-r, --rename

Prompt for a new label and rename the disk to the new value. The configuration option is APT::CDROM::Rename.

`-v, --version`

Print the version information and exit.

apt-config

```
apt-config [options] shell args
apt-config [options] dump
```

An internal program for querying configuration information.

Commands

`dump`

Display the contents of the configuration space.

`shell`

Access the configuration information from a shell script. The arguments are in pairs, specifying the name of a shell variable and a configuration value to query. The value may be postfixed with */x*, where *x* is one of the following letters:

`b`

Return true or false.

`d`

Return directories.

`f`

Return filenames.

`i`

Return an integer.

Options

-c *file*, --config-file=*file*

Specify a configuration file to be read after the default configuration file.

-h, --help

Print help message and exit.

-o, --option

Set a configuration option. Syntax is -o *group*::*tool*=*option*.

-v, --version

Print the version information and exit.

apt-extract-templates

`apt-extracttemplates [options] files`

Extract configuration scripts and templates from the specified Debian package files. For each specifie file, a line of output is generated with the following information:

`package version template-file config-script`

and the template files and configuration scripts are written to the directory specified with -t or --temp-dir, or by the configuration option APT::ExtractTemplates::TempDir. The filenames are in the form *package.template.xxxx* and *package.config.xxxx*.

Options

-c *file*, --config-file=*file*

Specify a configuration file to be read after the default configuration file.

-h, --help

Print help message and exit.

-o, --option

Set a configuration option. Syntax is -o *group*::*tool*=*option*.

-t *dir*, --tempdir=*dir*

Write the extracted template files and configuration scripts to the specified directory. The configuration option is APT::ExtractTemplates::TempDir.

-v, --version

Print the version information and exit.

apt-ftparchive

`apt-ftparchive [options] command`

Generate package and other index files used to access a distribution source. The files should be generated on the source's origin site.

Commands

clean *config-file*

Clean the databases used by the specified configuration file by removing obsolete records.

contents *path*

Search the specified directory tree recursively. For each *deb* file found, read the file list, sort the files by package, and write the results to standard output. Use with --db to specify a binary caching database.

generate *config-file sections*

Build indexes according to the specified configuration file.

packages *path* [*override* [*pathprefix*]]

Generate a package file from the specified directory tree. The optional override file contains information describing how the package fits into the distribution, and the optional path prefix is a string prepended to the filename fields. Similar todpkg-scanpackages. Use with --db to specify a binary caching database.

release *path*

Generate a release file from the specified directory tree.

sources *paths* [*override* [*pathprefix*]]

Generate a source index file from the specified directory tree. The optional override file contains information used to set priorities in the index file and to modify maintainer information. The optional path prefix is a string prepended to the directory field in the generated source index. Use --source-override to specify a different source override file. Similar to dpkg-scansources.

Options

-c *file*, --config-file=*file*

Specify a configuration file to be read after the default configuration file.

--contents

Perform contents generation. If set and if package indexes are being generated with a cache database, the file listing is extracted and stored in the database. If used withgenerate, allows the creation of any contents files. The default is on. The configuration option is APT::FTPArchive::Contents.

-d, --db

Use a binary caching database. This option has no effect ongenerate. The configuration option is APT::FTPArchive::DB.

--delink

Enable delinking of files when used with theExternal-Links setting. The default is on; turn off with --no-delink. The configuration option is APT::FTPArchive::DeLinkAct.

-h, --help

Print help message and exit.

--md5

Generate MD5 sums for the index files. The default is on. The configuration option is APT::FTPArchive::MD5.

-o, --option

Set a configuration option. Syntax is -o *group*::*tool*=*option*.

-q, --quiet

Run quietly, producing logging information but no progress indicators. Use -qq for quieter operation. The configuration option is quiet.

--read-only

Make the caching databases read-only. The configuration option is APT::FTPArchive::ReadOnlyDB.

-s *file*, --source-override=*file*

Specify a source override file. Use with the sources command. See the sources command description for more information. The configuration option is APT::FTPArchive::SourceOverride.

-v, --version

Print the version information and exit.

apt-get

apt-get [*options*] *command* [*package*...]

A command-line tool for handling packages. Also serves as a backend to other APT tools such as dselect, synaptic, and aptitude (all described later in this section). As described earlier in this chapter, the following command can be run every day to keep your system updated:

```
apt-get update && apt-get -u dist-upgrade
```

Commands

autoclean

Like clean, but remove only package files that can no longer be downloaded. Set the configuration option APT::Clean-Installed to off to prevent installed packages from being erased

build-dep

Install or remove packages to satisfy the build dependencies for a source package.

clean

Clear the local repository of retrieved package files. Useful for freeing up disk space.

check

Update the package cache and check for broken packages.

dist-upgrade

Like upgrade, but also handle dependencies intelligently. See the-f option for more information.

dselect-upgrade

Used with dselect. Track the changes made by dselect to the Status field of available packages and take actions necessary to realize that status.

install *packages*

Install one or more packages. Specify the package name, not the full filename. Other required packages are also retrieved and installed. With a hyphen appended to the package name, the package is removed if it is already installed. Select a version to install by appending an equals sign and the version.

remove *packages*

Remove one or more packages. Specify the package name, not the full filename. With a plus sign appended to the name, the package is installed.

source *packages*

Find source packages and download them into the current directory. If specified with--compile, the source packages are compiled into binary packages. With--download-only, the source packages are not unpacked. Select a specific version by appending an equals sign and the version.

update

Resynchronize the package overview files from their sources. Must be done before anupgrade or dist-upgrade.

upgrade

Install the latest versions of all packages currently installed. Runupdate first.

Options

--arch-only

Process only architecture-dependent build dependencies. Configuration option is APT::Get::Arch-Only.

-b, --compile, --build

Compile source packages after download. The configuration option isAPT::Get::Compile.

-c *file*, --config-file=*file*

Specify a configuration file to read after the default.

-d, --download-only

Retrieve package files, but don't unpack or install them. The configuration option is APT::Get::Download-only.

--diff-only

Download only the diff file from a source archive. The configuration option isAPT::Get::Diff-Only.

-f, --fix-broken

Try to fix a system with broken dependencies. Can be used alone or with a command. Run with the install command if you have problems installing packages. You can run the sequence:

```
apt-get -f install

apt-get dist-upgrade
```

several times to clean up interlocking dependency problems. The configuration option is APT::Get::Fix-Broken.

--force-yes

Force yes. Cause APT to continue without prompting if it is doing something that could damage your system. Use with great caution and only if absolutely necessary. The configuration option is APT::Get::force-yes.

-h, --help

Display a help message and exit.

--ignore-hold

Ignore a hold placed on a package, which would normally prevent the package form being upgraded. Use with dist-upgrade to override many undesired holds. The configuration option is APT::Get::Ignore-Hold.

--list-cleanup

Erase obsolete files from */var/lib/apt/lists*. The default is on; use --no-list-cleanup to turn it off, which you would normally do only if you frequently modify your list of sources. The configuration option is APT::Get::List-Cleanup.

-m, --ignore-missing, --fix-missing

Ignore missing or corrupted packages or packages that cannot be retrieved. Can cause problems when used with -f. The configuration option is APT::Get::Fix-Missing.

--no-download

Disable package downloading; use with --ignore-missing to force APT to use only the packages that have already been downloaded. The configuration option is APT::Get::Download.

--no-remove

Do not remove any packages; instead, abort without prompting. The configuration option is APT::Get::Remove.

--no-upgrade

Do not upgrade packages. Use with install to prevent upgrade of packages that are already installed. The configuration option is APT::Get::Upgrade.

-o, --option

Set a configuration option. Syntax is -o *group*::*tool*=*option*.

--only-source

Do not map the names specified with the source or build-dep commands through the binary table. With this option, only source package names can be specified. The configuration option is APT::Get::Only-Source.

--print-uris

Print Uniform Resource Indicators (URIs) of files instead of fetching them. Print path, destination filename, size, and expected MD5 hash. The configuration option is APT::Get::Print-URIs.

--purge

Tell dpkg to do a purge instead of a remove for items that would be removed. Purging removes packages completely, including any configuration files. The configuration option is APT::Get::Purge.

-q, --quiet

Quiet mode. Omit progress indicators and produce only logging output. Use -qq to make even quieter. The configuration option is quiet.

--reinstall

Reinstall packages that are already installed, upgrading them to the latest version. The configuration option is APT::Get::ReInstall.

-s, --simulate, --just-print, --dry-run, --recon, --no-act

Go through the motions, but don't actually make any changes to the system. The configuration option is APT::Get::Simulate.

-t *rel*, --target-release=rel, --default-release=*rel*

Retrieve packages only from the specified release. The value of *rel* can be a release number or a value such as "unstable." The configuration option is APT::Default-Release.

--tar-only

Download only the *tar* file from a source archive. The configuration option is APT::Get::Tar-Only.

--trivial-only

Perform only operations that are considered triviali.e., ones that won't harm your system, by, say, removing needed files. Unlike --assume-yes, which always answers "yes" to any prompts, --trivial-only always answers "no." The configuration option is APT::Get::Trivial-Only.

-u, --show-upgraded

Print a list of all packages to be upgraded. The configuration option is APT::Get::Show-Upgraded.

-v, --version

Display the version and exit.

-V, --verbose-versions

Show full versions for upgraded and installed packages. The configuration option is APT::Get::Show-Versions.

-y, --yes, --assume-yes

Automatically reply "yes" to prompts and run noninteractively. Abort if there is an error. The configuration option is APT::Get::Assume-Yes.

apt-sortpkgs

`apt-sortpkgs [options] indexfiles`

Sort the records in a source or package index file by package name and write the results to standard output. `apt-sortpkgs` also sorts the internal fields of each record.

Options

-c *file*, --config-file=*file*

Specify a configuration file to read after the default.

-h, --help

Display a help message and exit.

-o, --option

Set a configuration option. Syntax is-o *group*::*tool*=*option*.

-s, --source

Order by source index field. The configuration option isAPT::SortPkgs::Source.

-v, --version

Display the version and exit.

aptitude

aptitude [*options*] [*action*[*arguments*]]

A text-based frontend to apt, which can be run either directly from the command line or from a visual mode that runs in a terminal window.

Actions

The following actions are supported. Runningaptitude with no action invokes the visual mode. Package names can be entered individually or as search patterns. A search pattern consists of terms starting with a tilde (~), followed by a character indicating the type of term, followed by the text to be searched for. The most common usage is to use~n to search for a package name (e.g., ~nemacs, to search for packages that have *emacs* in their name). You can find the full list of term types in the *Aptitude User's Manual*. The manual can be found in */usr/share/doc/README*on a Debian system. On an RPM-based system with aptitude installed, the *README* file may be in */usr/share/aptitude* or */usr/share/doc/aptitude*.

autoclean

Clean out the cache by removing only packages that can no longer be downloaded.

clean

Clean out the cache by removing all previously downloaded *.deb* files.

dist-upgrade

Upgrade as many installed packages as possible, installing and removing packages as needed to satisfy dependencies.

download *packages*

Download the *.deb* file for each specified package to the current directory.

forbid-version *package*[=*version*]...

Don't allow aptitude to upgrade the package to a particular version. If no version is specified, it is assumed to be the version that would normally be used.

forget-new

Remove internal information about what packages are "new."

help

Display help information and exit.

hold *packages*

Place a hold on each specified package.

install [*package*[=*version*] ...]

Install the specified packages. With a version, install that version. With no arguments, install any stored or pending actions. You can also use install to perform different actions on multiple packages with a single command. Append - to the package name to remove, + to install, _ to purge, or = to hold a package.

markauto *packages*

Mark the specified packages as automatically installed.

purge [*package*[=*version*] ...]

Remove the specified packages and their configuration files.

remove [*package*[=*version*] ...]

Remove the specified packages.

search *patterns*

Search for packages matching each of the specified patterns and display a list of matches. The full list of search terms can be found in the*Aptitude User's Manual*.

show *patterns*

Search for packages matching each of the specified patterns and display detailed information for every match found.

unhold *packages*

Remove the hold on each specified package.

unmarkauto *packages*

Mark the specified packages as manually installed.

update

Update the list of available packages by downloading the names of new and upgradeable packages.

upgrade

Upgrade as many packages as possible; if a package has dependency problems, avoid upgrading that package (but don't remove it).

Options

Most of the aptitude options have corresponding configuration options that can be set in the configuration file.

-d, --download-only

Download packages to the cache but do not install them. Configuration option is

Aptitude::CmdLine::Download-Only.

-D, --show-deps

Show summaries of why packages will be automatically installed or removed. Configuration option is Aptitude::CmdLine::Show-Deps.

-f

Attempt to fix dependencies of broken packages. Configuration option is Aptitude::CmdLine::Fix-Broken.

-F *format*, --display-format *format*

Specify the output format for search. See the *Aptitude User's Manual* for details on specifying the format. Configuration option is Aptitude::CmdLine::Package-Display-Format.

-h, --help

Print help message and exit.

-O *order*, --sort *order*

Specify the sort order for search output. See the *Aptitude User's Manual* for details.

-P,--prompt

Always display a prompt even for actions that were explicitly requested. The corresponding configuration option is Aptitude::CmdLine::Always-Prompt.

-r, --with-recommends

Treat recommendations as dependencies when installing new packages. The corresponding configuration option is Aptitude::CmdLine::Recommends-Important.

-R, --without-recommends

Do not treat recommendations as dependencies when installing new packages. The corresponding configuration option is Aptitude::CmdLine::Recommends-Important.

-s, --simulate

Go through the motions, but do not actually perform the actions. Print the actions that would be performed. Configuration option is Aptitude::CmdLine::Simulate.

-t *release*, --target-release *release*

Specify the release to use for installing packages. Configuration option is Aptitude::CmdLine::Default-Release.

-v, --verbose

Operate verbosely, displaying additional information. Specify multiple times to get even more information displayed. Configuration option is Aptitude::CmdLine::Verbose.

-V, --show-versions

Display the version for packages being installed. Configuration option is Aptitude::CmdLine::Show-Versions.

--version

Display the version information for aptitude and exit.

--visual-preview

Start the visual interface and display the preview screen.

-w *width*, --width *width*

Specify the output display width for search. The default is the terminal width. The corresponding configuration option is Aptitude::CmdLine::Package-Display-Width.

-y, --assume-yes

Assume a yes response to a yes/no prompt and don't display the prompt. Prompts for dangerous actions are still shown. This option overrides-P. The corresponding configuration option is Aptitude::CmdLine::Assume-Yes.

-Z

Display the disk space that will be used or freed by the packages being acted upon. The corresponding configuration option is Aptitude::CmdLine::Show-Size-Changes.

Internal options

The following options are used internally for aptitude's visual mode. You shouldn't need to issue them directly.

-i

Display a download preview when the program starts. Cannot be used with-u.

-S *filename*

Load extended state information from the specified file, not the default state file.

-u

Begin updating the package lists as soon as the program starts. Cannot be used with-i.

dpkg

dpkg [*options*] *action*

A tool for installing, managing, and building packages. Also serves as a frontend todpkg-deb and dpkg-query.

dpkg actions

These actions are carried out by dpkg itself:

-A *pkgfile*, --record-avail *pkgfile*

Update the record of available files kept in */var/lib/dpkg/available* with information from *pkgfile*. This information is used by dpkg and dselect to determine which packages are available. With -R or --recursive, *pkgfile* must be a directory.

-C, --audit

Search for partially installed packages and suggest how to get them working.

--clear-avail

Remove existing information about which packages are available.

--command-fd *n*

Accept commands passed on the file descriptor given by*n*. Note that any additional options set through this file descriptor or on the command line are not reset, but remain for other

commands issued during the same session.

--compare-versions *ver1 op ver2*

Perform a binary comparison of two version numbers. The operators lt le eq ne ge gt treat a missing version as earlier. The operators lt-nl le-nl ge-nl gt-nl treat a missing version as later (where nl is "not later"). A third set of operators (< << <= = >= >> >) is provided for compatibility with control-file syntax. dpkg returns zero for success (i.e., the condition is satisfied) and nonzero otherwise.

--configure [*packages*|-a|--pending]

Reconfigure one or more unpacked *packages*. If -a or --pending is given instead of *packages*, configure all packages that are unpacked but not configured. Configuring a package involves unpacking the configuration files, backing up the old configuration files, and running the postinst script if one is present.

-Dh, --debug=help

Print debugging help message and exit.

--force-help

Print help message about the --force-*list* options and exit. See the --force-*list* option description for the possible values of *list*.

--forget-old-unavail

Forget about uninstalled, unavailable packages.

--get-selections [*pattern*]

Get list of package selections and write to standard output. With *pattern* specified, write selections that match the pattern.

--help

Print help message and exit.

-i *pkgfile*, --install *pkgfile*

Install the package specified as *pkgfile*. With -R or --recursive, *pkgfile* must be a directory.

--license, --licence

Print dpkg license information and exit.

--print-architecture

Print the target architecture.

--print-gnu-build-architecture

Print the GNU version of the target architecture.

--print-installation-architecture

Print the host architecture for installation.

-r, --remove [*packages*|-a|--pending]

--purge [*packages*|-a|--pending]

Remove or purge one or more installed *packages*. Removal gets rid of everything except the configuration files listed in *debian/conffiles*; purging also removes the configuration files. If -a or --pending is given instead of *packages*, dpkg removes or purges all packages that are unpacked and marked (in */var/lib/dpkg/status*) for removing or purging.

--set-selections

Set package selections based on input file read from standard input.

--unpack *pkgfile*

Unpack the package, but don't configure it. When used with -R or --recursive, *pkgfile* must be a directory.

--update-avail *pkgs-file*

--merge-avail *pkgs-file*

Update the record of available files kept in */var/lib/dpkg/available*. This information is used by dpkg and dselect to determine what packages are available. Update replaces the information with the contents of the *pkgs-file*, distributed as *Packages*. Merge combines the information from *Packages* with the existing information.

--version

Print dpkg version information and exit.

--yet-to-unpack

Search for uninstalled packages that have been selected for installation.

dpkg-deb actions

The following actions can be specified for dpkg and are passed to dpkg-deb for execution. Also see dpkg-deb.

-b *dir* [*archive*], --build *dir* [*archive*]

Build a package.

-c *archive*, --contents *archive*

List the contents of a package.

-e *archive [dir]*, --control *archive [dir]*

Extract control information from a package.

-f *archive* [*control-fields*], --field *archive* [*control-fields*]

Display the control field or fields of a package.

-I *archive* [*control-files*], --info *archive* [*control-files*]

Show information about a package.

--fsys-tarfile *archive*

Write the filesystem tree contained in a package to standard output in *tar* format.

-x *archive dir*, --extract *archive dir*

Extract the files from a package.

-X *archive dir*, --vextract *archive dir*

Extract the files and display the filenames from a package.

dpkg-query actions

The following actions can be specified for dpkg and are passed to dpkg-query for execution. Also see dpkg-query.

-l, --list [*pkg-name-pattern*]

List all packages whose names match the specified pattern. With no pattern, list all packages in */var/lib/dpkg/available*. The pattern can include standard shell wildcard characters and may have to be quoted to prevent the shell from doing filename expansion.

-L *packages*, --listfiles *packages*

List installed files that came from the specified package or packages.

-p, --print-avail *package*

Print the details about *package* from */var/lib/dpkg/available*.

-s *packages*, --status *packages*

Report the status of one or more *packages* by displaying the entry in the status database */var/lib/dpkg/status*.

-S *filename-pattern*, --search *filename-pattern*

Search installed packages for a filename. The pattern can include standard shell wildcard characters and may have to be quoted to prevent the shell from doing filename expansion.

Options

dpkg options can be specified on the command line or set in the configuration file. Each line in the configuration file contains a single option, specified without the leading dash (-).

--abort-after=*num*

Abort processing after *num* errors. Default is 50.

--admindir= *dir*, --instdir= *dir*, --root=*dir*

Change default directories. admindir contains administrative files with status and other information about packages; it defaults to */var/lib/dpkg*. instdir is the directory into which packages are installed; it defaults to /. Changing the root directory to *dir* automatically

changes instdir to *dir* and admindir to */dir/var/lib/dpkg*.

-B, --auto-deconfigure

When a package is removed, automatically deconfigure any other package that depended on it

-Doctal, --debug=*octal*

Turn on debugging, with the *octal* value specifying the desired level of debugging information. Use -Dh or --debug=help to display the possible values. You can OR the values to get the desired output.

-E, --skip-same-version

Don't install the package if this version is already installed.

--force-list, --no-force-list, --refuse-*list*

Force or refuse to force an operation. *list* is specified as a comma-separated list of options. With --force, a warning is printed, but processing continues. --refuse and --no-force cause processing to stop with an error. Use --force-help to display a message describing the options. The force/refuse options are:

all

Turn all force options on or off.

architecture

Process even if intended for a different architecture.

auto-select

Select or deselect packages to install or remove them. Forced by default.

bad-path

Some programs are missing from the path.

bad-verify

Install package even if it fails to verify.

confdef

Always choose the default action for modified configuration files. If there is no default and confnew or confold is also specified, use that to decide; otherwise, ask the user.

configure-any

Configure any unconfigured package that the package depends on.

conflicts

Permit installation of conflicting packages. Can result in problems from files being overwritten.

confmiss

Always install a missing configuration file. Be careful using this option, since it means overriding the removal of the file.

confnew

Always install the new version of a modified configuration file, unlessconfdef is also specified. In that case, use the default action if there is one.

confold

Keep the old version of a modified configuration file, unlessconfdef is also specified. In that case, use the default action if there is one.

depends

Turn dependency problems into warnings.

depends-version

Warn of version problems when checking dependencies, but otherwise ignore.

downgrade

Install even if a newer version is already installed. Forced by default.

hold

Process packages even if they are marked to be held.

not-root

Try to install or remove even when not logged on as root.

overwrite

Overwrite a file from one package with the same file from another package.

overwrite-dir

Overwrite one package's directory with a file from another package.

overwrite-diverted

Overwrite a diverted file with an undiverted version.

remove-essential

Remove a package even if it is essential. Note that this can cause your system to stop working.

remove-reinstreq

Remove a package even if it is broken and is marked to require reinstallation.

-G

Don't install a package if a newer version is already installed. Same as--refuse-downgrade.

--ignore-depends=*pkglist*

Dependency problems result only in a warning for the packages in*pkglist*.

--new

New binary package format. This is a dpkg-deb option.

--no-act,--dry-run,--simulate

Go through the motions, but don't actually write any changes. Used for testing. Be sure to specify before the action; otherwise, changes might be written.

--nocheck

Ignore the contents of the control file when building a package. This is a dpkg-deb option.

-O, --selected-only

Process only packages that are marked as selected for installation.

--old

Old binary package format. This is a dpkg-deb option.

-R, --recursive

Recursively handle *.deb* files found in the directories and their subdirectories specified with -A, -i, --install, --unpack, and --avail.

--status-fd *n*

Send the package status information to the specified file descriptor. Can be given more than once.

dpkg-deb

dpkg-deb *action* [*options*]

Backend command for building and managing Debian package archives. Also see dpkg; you'll often want to use dpkg to pass commands through to dpkg-deb, rather than call dpkg-deb directly.

Actions

-b *dir* [*archive*], --build *dir* [*archive*]

Create an *archive* from the filesystem tree starting with directory *dir*. The directory must have a *DEBIAN* subdirectory containing the control file and any other control information. If *archive* is specified and is a filename, the package is written to that file; if no *archive* is specified, the package is written to *dir.deb*. If the archive already exists, it is replaced. If *archive* is the name of a directory, dpkg-deb looks in the control file for the information it needs to generate the package name. (Note that for this reason, you cannot use --nocheck with a directory name.)

-c *archive*, --contents *archive*

List the filesystem-tree portion of *archive*.

-e *archive [dir]*, --control *archive [dir]*

Extract control information from *archive* into the directory *dir*, which is created if it doesn't exist. If *dir* is omitted, a *DEBIAN* subdirectory in the current directory is used.

-f *archive* [*control-fields*], --field *archive* [*control-fields*]

Extract information about one or more fields in the control file for *archive*. If no fields are provided, print the entire control file.

-h, --help

Print help information and exit.

-I *archive* [*control-files*], --info *archive* [*control-files*]

Write information about binary package *archive* to standard output. If no control files are provided, print a summary of the package contents; otherwise, print the control files in the order they were specified. An error message is printed to standard error for any missing components.

--fsys-tarfile *archive*

Extract the filesystem tree from *archive*, and send it to standard output in tar format. Can be used with tar to extract individual files from an archive.

--license, --licence

Print the license information and exit.

--version

Print the version number and exit.

-W *archive*, --show archive *archive*

Show information about the specified archive. The output can be customized with the--showformat option.

-x *archive dir*, --extract *archive dir*

-X *archive dir*, --vextract *archive dir*

Extract the filesystem tree from *archive* into the specified directory, creating *dir* if it doesn't already exist. -x (--extract) works silently, while -X (--vextract) lists the files as it extracts them. Do not use this action to install packages; use dpkg instead.

Options

-D, --debug

Turn on debugging.

--new

Build a new-style archive format (this is the default).

--nocheck

Don't check the control file before building an archive. This lets you build a broken archive.

--old

Build an old-style archive format.

--showformat=*format*

Specify the output format for -W/--show. The format can include the standard escape sequences \n (newline), \r (carriage return), or \\ (backslash). Specify package fields with the syntax ${*var*[;*width*]}. Fields are right-aligned by default, or left-aligned if *width* is negative.

-z#

Set the compression level to the value specified by #.

-Z *type*

Set the type of compression to use when building an archive. Possible values are: gzip, bzip2, and none.

dpkg-query

dpkg-query [*option*] *command*

Display information about packages listed in the `dpkg` database. You can also use `dpkg-query` as a backend for `dpkg`, instead of calling `dpkg-query` directly

Commands

--help

Print help information and exit.

-l [*patterns*], --list [*patterns*]

List packages whose names match any of the specified patterns. With no pattern specified, list all packages in */var/lib/dpkg/available*. The pattern may need to be in quotes to avoid expansion by the shell.

-L *packages*, --listfiles *packages*

List files installed on your system from each of the specified packages. This command does not list files created by package-specific installation scripts.

--license, --licence

Print the license information and exit.

-p *package*, --print-avail *package*

Display details for the specified package, as found in */var/lib/dpkg/available*.

-s *package*, --status *package*

Report on the status of the specified package.

-S *patterns*, --search *patterns*

Search the installed packages for filenames matching one of the specified patterns. At least one pattern must be specified.

-W [*patterns*], --show [*patterns*]

Like -l, but the output can be customized with the `--showformat` option.

--version

Print version information and exit.

Options

--admindir=*dir*

Use *dir* as the location of the dpkg database. The default is */var/lib/dpkg*.

--showformat=*format*

Specify the output format for -W/--show. The format can include the standard escape sequences \n (newline), \r (carriage return), or \\ (backslash). Specify package fields with the syntax ${*var*[;*width*]}. Fields are right-aligned by default, or left-aligned if *width* is negative.

dpkg-split

```
dpkg-split [action] [options]
```

Split a binary package into smaller pieces and reassemble the pieces, either manually or in automatic mode. The automatic mode maintains a queue of parts for reassembling. Useful for transferring to and from floppy disks on older systems.

Actions

-a -o *output part*, --auto -o *output part*

Add *part* to the queue for automatic reassembly, and if all the parts are available, reassemble the package as *output*. Requires the use of the -o (or --output) option, as shown.

-d [*packages*], --discard [*packages*]

Discard parts from the automatic-assembly queue. If any *packages* are specified, discard only parts from those packages. Otherwise, empty the queue.

-I *parts*, --info *parts*

Print information about the specified part file or files to standard output.

-j *parts*, --join *parts*

Join the parts of a package file together from the *parts* specified. The default output file is *package-version.deb*.

-l, --listq

List the contents of the queue of parts waiting for reassembly, giving the package name, the parts that are on the queue, and the number of bytes.

-s *full-package* [*prefix*], --split *full-package* [*prefix*]

Split the package *full-package* into parts *N* of *M*, named *prefixNofM.deb*. The prefix defaults to the *full-package* name without the *.deb* extension.

-h, --help

Print help message and exit.

--license, --licence

Print license information and exit.

--version

Print version information and exit.

Options

--depotdir *dir*

Specify an alternate directory *dir* for the queue of parts waiting for reassembly. Default is */var/lib/dpkg*.

--msdos

Force --split output filenames to be MS-DOS-compatible.

-Q, --npquiet

Do not print an error message for a part that doesn't belong to a binary package when doing

automatic queuing or reassembly.

-O *output*, --output *output*

Use *output* as the filename for a reassembled package.

-S *num*, --partsize *num*

When splitting, specify the maximum part size (*num*) in kilobytes. Default is 450 KB.

dselect

`dselect [options] [action]`

A screen-oriented user frontend to dpkg. One of the primary user interfaces for installing and managing packages. See dpkg and dpkg-deb for information on building packages.

Actions

If dselect is run with no action specified on the command line, it displays the following menu:

```
* 0. [A]ccess     Choose the access method to use.
  1. [U]pdate   Update list of available packages, if
                possible.
  2. [S]elect   Request which packages you want on your
                system.
  3. [I]nstall  Install and upgrade wanted packages.
  4. [C]onfig   Configure any packages that are
                unconfigured.
  5. [R]emove   Remove unwanted software.
  6. [Q]uit     Quit dselect.
```

The asterisk (on the first line) shows the currently selected option. Any of the menu items can be specified directly on the command line as an action (access, update, select, install, config, remove, quit) to go directly to the desired activity. For example:

```
$ dselect access
```

If you enter quit on the command line, dselect exits immediately without doing anything. An additional command-line action is menu, which displays the menu and is equivalent to running

dselect with no action.

Options

Options can be specified both on the command line and in thedselect configuration file, */etc/dpkg/dselect.cfg*.

--admindir *dir*

Change the directory that holds internal datafiles to*dir*. Default is */var/lib/dpkg*.

--color *colorspec*, --colour *colorspec*

Set colors for different parts of the screen, as specified by*colorspec* as follows:

```
screenpart:[fgcolor],[bgcolor][:attr[+attr+...]]
```

This option can be specified multiple times, to override the default colors for different*screenparts*. Rather than having to specify the colors on the command line each time you rundselect, you might prefer to set them in the configuration file. The possible screen parts (going from the top of the screen to the bottom) are:

title

The screen title.

listhead

The header line above the package list.

list

The scrolling list of packages and some help text.

listsel

The selected item in the list.

pkgstate

The text showing the current state of each package.

pkgstatesel

The text showing the current state of the selected package.

infohead

The header line showing the state of the selected package.

infodesc

The short description of the package.

info

The text that displays information such as the package description.

infofoot

The last line of the screen when selecting packages.

query

Query lines.

helpscreen

The color of help screens.

Either the foreground color, the background color, or both can be specified for each screen part. The colors are given as the standard curses colors. After the color specification, you can specify a list of attributes separated by plus signs (+). The possible attributes arenormal, standout, underline, reverse, blink, bright, dim, and bold. Not all attributes work on all terminals.

--expert

Run in expert mode; don't print help messages.

-D [*file*], --debug [*file*]

Turn on debugging. Send output to *file* if specified.

--help

Print help message and exit.

--license, licence

Print license information and exit.

--version

Print version information and exit.

synaptic

`synaptic [options]`

Graphical frontend for APT. Use in place of `apt-get` to install, upgrade, or remove packages from your system. With `synaptic`, you can view a list of all available packages, or you can break the list down in various ways to make it more manageable. From the `synaptic` window, you can select from a list of categories. The categories are section (e.g., view only development-related packages), package status, alphabetic (e.g., view only packages whose name starts with the letter A), search history, or filter.

If you choose to display by filter, there are a set of predefined filters, or you can define your own. The predefined filters include ones to display all packages, packages marked for a status change, packages that can be configured with `debconf` (Debian systems only), packages with broken dependencies, and packages that can be upgraded to a later version. You can edit the existing filters or define your own, by selecting Preferences Filters from the Edit menu.

Once you've used the selection criteria to find the list of packages, you can select a single package, or you can select multiple packages by holding down the Shift or Ctrl key. Like `apt-get`, first do an `update` to update the package lists, then you can do an `install` or `upgrade`.

To start `synaptic` from Gnome, select System tools Synaptic Package Manager from the Application menu. From the KDE menu, select Settings Extra Synaptic Package Manager. You can also start the graphical interface from the command line, with the command:

`synaptic` [*options*]

Options

In addition to the following options, `synaptic` accepts the standard GTK+ toolkit command-line options.

-f *filename*, --filter-file=*filename*

Use the specified file as an alternative filter settings file.

-h, --help

Print help message and exit.

-i *num*, --initial-filter=*num*

Start up with the filter numbered *num* as the initial filter.

--non-interactive

Run without prompting for user input.

-o*option*, --option=*option*

Set an internal option. Don't use this option unless you are sure you know what you are doing.

-r

Open with the file repository window displayed. This window lists the repositories and shows which are active.

Chapter 6. The Bash Shell and Korn Shell

The original Bourne shell distributed with V7 Unix in 1979 became the standard shell for writing shell scripts. The Bourne shell is still to be found in */bin/sh* on many commercial Unix systems. It hasn't changed that much since its initial release, although it has seen modest enhancements over the years. The most notable new features were the CDPATH variable and a built-in `test` command with System III (circa 1980), command hashing and shell functions for System V Release 2 (circa 1984), and the addition of job control features for System V Release 4 (1989).

Because the Berkeley C shell (`csh`) offered features that were more pleasant for interactive use, such as command history and job control, for a long time the standard practice in the Unix world was to use the Bourne shell for programming and the C shell for daily use. David Korn at Bell Labs was the first developer to enhance the Bourne shell by adding `csh`-like features to it: history, job control, and additional programmability. Eventually, the Korn shell's feature set surpassed both the Bourne shell and the C shell, while remaining compatible with the Bourne shell for shell programming. Today, the POSIX standard defines the "standard shell" language and behavior based on the System V Bourne shell, with a selected subset of features from the Korn shell.

The Free Software Foundation, in keeping with its goal to produce a complete Unix work-alike system, developed a clone of the Bourne shell, written from scratch, named "Bash," the Bourne-Again SHell. Over time, Bash has become a POSIX-compliant version of the shell, with many additional features. A large part of these additional features overlap the features of the Korn shell, but Bash is not an exact Korn shell clone.

This chapter covers Bash, which is the primary shell for GNU/Linux. It also covers the two main versions of the Korn shell, `ksh88` and `ksh93`. The following topics are presented:

- Overview of features
- Invoking the shell
- Syntax
- Functions
- Variables
- Arithmetic expressions
- Command history
- Job control
- Command execution
- Restricted shells

- Built-in commands

http://www.gnu.org/software/bash/bash.html provides information about the Bash shell, as does http://cswww.cns.cwru.edu/~chet/bash/bashtop.html. http://www.kornshell.com provides considerable information about the Korn shell. See also *Classic Shell Scripting*, *Learning the Korn Shell*, and *Learning the bash Shell* (all from O'Reilly).

All references in this chapter to the Bash shell are for Bash Version 3. Many of the features listed for ksh93 are found only in the version available from AT&T Research.

PREV

6.1. Overview of Features

The Bash and Korn shells provide the following features:

- Input/output redirection
- Wildcard characters (metacharacters) for filename abbreviation
- Shell variables and options for customizing your environment
- A built-in command set for writing shell programs
- Shell functions, for modularizing tasks within a shell program
- Job control
- Command-line editing (using the command syntax of either `vi` or `emacs`)
- Access to previous commands (command history)
- Integer arithmetic
- Arrays and arithmetic expressions
- Command-name abbreviation (aliasing)

`ksh93` and Bash (but not `ksh88`) have the following capabilities:

- Upward compliance with POSIX
- Internationalization facilities
- An arithmetic `for` loop
- More ways to substitute variables

`ksh93` adds the following capabilities:

- Floating-point arithmetic and built-in arithmetic functions
- Structured variable names and indirect variable references
- Associative arrays
- More ways to match patterns

6.2. Invoking the Shell

The command interpreter for the Bash shell (`bash`) or the Korn shell (`ksh`) can be invoked as follows:

```
bash [options] [arguments]

ksh  [options] [arguments]
```

`ksh` and Bash can execute commands from a terminal, from a file (when the first *argument* is an executable script), or from standard input (if no arguments remain or if `-s` is specified). Both shells automatically print prompts if standard input is a terminal, or if `-i` is given on the command line.

On Linux systems, */bin/sh* is generally a link to Bash. When invoked as `sh`, Bash acts more like the traditional Bourne shell: Login shells read */etc/profile* and *~/.profile*, and regular shells read $ENV, if it's set. Full details are available on the *bash*(1) manpage.

6.2.1. Options

6.2.1.1 Common options

`-c` *str*

Read commands from string *str*.

`-D`

Print all $"..." strings in the program. Not `ksh88`.

`-i`

Create an interactive shell (prompt for input).

`-p`

Start up as a privileged user. Bash: Don't read $ENV or $BASH_ENV, don't import functions from the environment, and ignore the value of $SHELLOPTS. Korn shell: Don't process *$HOME/.profile*, read */etc/suid_profile* instead of $ENV.

-r

Create a restricted shell.

-s

Read commands from standard input; output from built-in commands goes to file descriptor 1; all other shell output goes to file descriptor 2.

-, --

End option processing.

6.2.1.2 Bash options

-O *option*

Enable shopt option *option*.

--debugger

Read the debugging profile at startup, turn on the extdebug option to shopt, and enable function tracing. For use by the Bash debugger.

--dump-po-strings

Same as -D, but output in GNU gettext format.

--dump-strings

Same as -D.

--help

Print a usage message and exit successfully.

--init-file *file*

--rcfile *file*

Use *file* as the startup file instead of ~/*.bashrc* for interactive shells.

--login

Shell is a login shell.

--noediting

Do not use the *readline* library for input, even in an interactive shell.

--noprofile

Do not read */etc/profile* or any of the personal startup files.

--norc

Do not read ~/*.bashrc*. Enabled automatically when invoked as sh.

--posix

Turn on POSIX mode.

--restricted

Same as -r.

--verbose

Same as set -v; the shell prints lines as it reads them.

--version

Print a version message and exit.

The remaining options to Bash and ksh are listed under the set built-in command.

6.2.2. Arguments

Arguments are assigned in order to the positional parameters $1, $2, etc. If the first argument is an executable script, commands are read from it, and the remaining argumentsare assigned to $1, $2, etc. The name of the script is available as $0.

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6.3. Syntax

This section describes the many symbols peculiar to the Bash and Korn shells. The topics are arranged as follows:

- Special files
- Filename metacharacters
- Quoting
- Command forms
- Redirection forms
- Coprocesses (Korn shell only)

6.3.1. Special Files

Both shells read one or more startup files. Some of the files are read only when a shell is a login shell.

The Korn shell reads these files:

1. */etc/profile*. Executed automatically at login, first.
2. *~/.profile*. Executed automatically at login, second.
3. $ENV. Specifies the name of a file to read when a new Korn shell is created. (`ksh88`: all shells, `ksh93`: interactive shells only.) The value is a variable (`ksh93`: and command and arithmetic) substituted in order to determine the actual filename. Login shells read $ENV after processing */etc/profile* and *$HOME/.profile*.

Bash reads these files:

1. */etc/profile*. Executed automatically at login, first.
2. The first file found from this list: *~/.bash_profile*, *~/.bash_login*, or *~/.profile*. Executed automatically at login, second.
3. *~/.bashrc* is read by every shell, after the login files. However, if invoked assh, Bash instead reads $ENV, just as the Korn shell does.

For both shells, the `getpwnam( )` and `getpwuid( )` functions are are the sources of home directories for *~name* abbreviations. (On single-user systems, the user database is stored in */etc/passwd*. However on networked systems, this information may come from NIS, NIS+, or LDAPnot your workstation password file.)

6.3.2. Filename Metacharacters

Characters	Meaning
*	Match any string of zero or more characters.
?	Match any single character.
[*abc*...]	Match any one of the enclosed characters; a hyphen can specify a range (e.g.,a-z, A-Z, 0-9).
[!*abc*...]	Match any character *not* enclosed as above.
~	Home directory of the current user.
~*name*	Home directory of user *name*.
~+	Current working directory ($PWD).
~-	Previous working directory ($OLDPWD).

In the Korn shell, or Bash with the `extglob` option on:

Characters	Meaning
?(*pattern*)	Match zero or one instance of *pattern*.
*(*pattern*)	Match zero or more instances of *pattern*.
+(*pattern*)	Match one or more instances of *pattern*.
@(*pattern*)	Match exactly one instance of *pattern*.
!(*pattern*)	Match any strings that don't match *pattern*.
n	Match the text matched by the *n*th subpattern in (...). ksh93 only.

This *pattern* can be a sequence of patterns separated by |, meaning that the match applies to any of the patterns. This extended syntax resembles that available in `egrep` and `awk`. In the Korn shell, but not in Bash, if & is used instead of |, all the patterns must match. & has higher precedence than |.

ksh93 and Bash support the POSIX [[=*c*=]] notation for matching characters that have the same weight, and [[.*c*.]] for specifying collating sequences. In addition, character classes of the form [[:*class*:]], allow you to match the following classes of characters.

Class	Class	Class	Class
alnum	Alphanumeric characters	graph	Nonspace characters
alpha	Alphabetic characters	print	Printable characters
blank	Space or tab	punct	Punctuation characters
cntrl	Control characters	space	Whitespace characters
digit	Decimal digits	upper	Uppercase characters
lower	Lowercase characters	xdigit	Hexadecimal digits

Bash and ksh93 also accept the [:word:] character class, which is not in POSIX. [[:word:]] is equivalent to [[:alnum:]_].

6.3.2.1 Examples

```
$ ls new*       List new and new.1
$ cat ch?       Match ch9 but not ch10
$ vi [D-R]*     Match files that begin with uppercase D through R
$ pr !(*.o|core) | lp       Print files that are not object files or core dumps
```

NOTE

On modern systems, ranges such as [D-R] are not portable; the system's locale may include more than just the uppercase letters from D to R in the range.

6.3.3. Quoting

Quoting disables a character's special meaning and allows it to be used literally, as itself. The following table displays characters that have special meaning to the Bash and Korn shells.

Character	Meaning
;	Command separator
&	Background execution
( )	Command grouping
|	Pipe
< > &	Redirection symbols

Character	Meaning
* ? [ ] ~ + - @ !	Filename metacharacters
" ' \	Used in quoting other characters
'	Command substitution
$	Variable substitution (or command or arithmetic substitution)
space tab newline	Word separators

These characters can be used for quoting:

" "

Everything between " and " is taken literally, except for the following characters that keep their special meaning:

$

Variable (or command and arithmetic) substitution will occur.

'

Command substitution will occur.

"

This marks the end of the double quote.

' '

Everything between ' and ' is taken literally except for another '. You cannot embed another ' within such a quoted string.

\

The character following a \ is taken literally. Use within " " to escape ", $, and '. Often used to escape itself, spaces, or newlines.

$" "

Not ksh88. Just like " ", except that locale translation is done.

$' '

Not ksh88. Similar to ' ', but the quoted text is processed for the following escape sequences:

Sequence	Value	Sequence	Value
\a	Alert	\t	Tab
\b	Backspace	\v	Vertical tab
\c*X*	Control character *X*	*nnn*	Octal value *nnn*
\e	Escape	\x*nn*	Hexadecimal value *nn*
\E	Escape	\'	Single quote
\f	Form feed	\"	Double quote
\n	Newline	\\	Backslash
\r	Carriage return		

6.3.3.1 Examples

```
$ echo 'Single quotes "protect" double quotes'
Single quotes "protect" double quotes
$ echo "Well, isn't that \"special\"?"
Well, isn't that "special"?
$ echo "You have `ls | wc -l` files in `pwd`"
You have       43 files in /home/bob
$ echo "The value of \$x is $x"
The value of $x is 100
```

6.3.4. Command Forms

Syntax	Effect
cmd &	Execute *cmd* in background.
cmd1 ; *cmd2*	Command sequence; execute multiple *cmd*s on the same line.
{ *cmd1* ; *cmd2* ; }	Execute commands as a group in the current shell.
(*cmd1* ; *cmd2*)	Execute commands as a group in a subshell.
cmd1 | *cmd2*	Pipe; use output from *cmd1* as input to *cmd2*.
cmd1 '*cmd2*'	Command substitution; use *cmd2* output as arguments to *cmd1*.
cmd1 $(*cmd2*)	POSIX shell command substitution; nesting is allowed.

Syntax	Effect
cmd $((*expression*))	POSIX shell arithmetic substitution. Use the result of *expression* as argument to *cmd*.
cmd1 && *cmd2*	AND; execute *cmd1* and then (if *cmd1* succeeds) *cmd2*. This is a "short-circuit" operation; *cmd2* is never executed if *cmd1* fails.
cmd1 || *cmd2*	OR; execute either *cmd1* or (if *cmd1* fails) *cmd2*. This is a "short-circuit" operation; *cmd2* is never executed if *cmd1* succeeds.
! *cmd*	NOT; execute *cmd*, and produce a zero exit status if *cmd* exits with a nonzero status. Otherwise, produce a nonzero status when *cmd* exits with a zero status. Not ksh88.

6.3.4.1 Examples

```
$ nroff file > file.txt &  Format in the background
$ cd; ls                   Execute sequentially
$ (date; who; pwd) > logfile   All output is redirected
$ sort file | pr -3 | lp       Sort file, page output, then print
$ vi `grep -l ifdef *.c`       Edit files found by grep
$ egrep '(yes|no)' `cat list`  Specify a list of files to search
$ egrep '(yes|no)' $(cat list)    POSIX version of previous
$ egrep '(yes|no)' $(< list)   Faster, not in POSIX
$ grep XX file && lp file  Print file if it contains the pattern;
$ grep XX file || echo "XX not found"  Otherwise, echo an error message
```

6.3.5. Redirection Forms

File descriptor	Name	Common abbreviation	Typical default
0	Standard input	stdin	Keyboard
1	Standard output	stdout	Screen
2	Standard error	stderr	Screen

The usual input source or output destination can be changed, as seen in the following sections.

6.3.5.1 Simple redirection

cmd > *file*

Send output of *cmd* to *file* (overwrite).

cmd > > *file*

Send output of *cmd* to *file* (append).

cmd < *file*

Take input for *cmd* from *file*.

cmd < < *text*

The contents of the shell script up to a line identical to *text* become the standard input for *cmd* (*text* can be stored in a shell variable). This command form is sometimes called a *Here document*. Input is usually typed at the keyboard or in the shell program. Commands that typically use this syntax include cat, ex, and sed. (If < <- is used, leading tabs are stripped from the contents of the here document, and the tabs are ignored when comparing input with the end-of-input *text* marker.) If any part of *text* is quoted, the input is passed through verbatim. Otherwise, the contents are processed for variable, command, and arithmetic substitutions.

cmd < < < *word*

Supply text of *word*, with trailing newline, as input to *cmd*. (This is known as a *here string*, from the free version of the rc shell.) Not ksh88.

cmd < > *file*

Open *file* for reading *and* writing on the standard input. The contents are not destroyed.[*]

[*] With <, the file is opened read-only, and writes on the file descriptor will fail. With < >, the file is opened read-write; it is up to the application to actually take advantage of this.

cmd > | *file*

Send output of *cmd* to *file* (overwrite), even if the shell's noclobber option is set.

6.3.5.2 Redirection using file descriptors

Syntax	Effect
cmd > &*n*	Send *cmd* output to file descriptor *n*.

Syntax	Effect
cmd *m*>&*n*	Same, except that output that would normally go to file descriptor *m* is sent to file descriptor *n* instead.
cmd >&-	Close standard output.
cmd <&*n*	Take input for *cmd* from file descriptor *n*.
cmd *m*<&*n*	Same, except that input that would normally come from file descriptor *m* comes from file descriptor *n* instead.
cmd <&-	Close standard input.
cmd <&*n*-	Move input file descriptor *n* instead of duplicating it. Not ksh88.
cmd >&*n*-	Move output file descriptor *n* instead of duplicating it. Not ksh88.

6.3.5.3 Multiple redirection

Syntax	Effect
cmd 2>*file*	Send standard error to *file* ; standard output remains the same (e.g., the screen).
cmd > *file* 2>&1	Send both standard error and standard output to *file*.
cmd &> *file*	Same. Bash only, preferred form.
cmd >& *file*	Same. Bash only.
cmd > *f1* 2>*f2*	Send standard output to file *f1*, standard error to file *f2*.
cmd | tee *files*	Send output of *cmd* to standard output (usually the terminal) and to *files*. (See the Example in Chapter 3 under tee.)
cmd 2>&1 | tee *files*	Send standard output and error output of *cmd* to standard output (usually the terminal) and to *files*.

No space should appear between file descriptors and a redirection symbol; spacing is optional in the other cases.

Bash allows multi-digit file descriptor numbers. The other shells do not.

6.3.5.4 Examples

```
$ cat part1 > book
$ cat part2 part3 >> book
$ mail tim < report
$ sed 's/^/XX /g' << END_ARCHIVE
```

```
> This is often how a shell archive is "wrapped",
> bundling text for distribution.  You would normally
> run sed from a shell program, not from the command line.
> END_ARCHIVE
XX This is often how a shell archive is "wrapped",
XX bundling text for distribution.  You would normally
XX run sed from a shell program, not from the command line.
```

To redirect standard output to standard error:

```
$ echo "Usage error:  see administrator" 1>&2
```

The following command sends output (files found) to*filelist* and error messages (inaccessible files) to file *no_access*:

```
$ find / -print > filelist 2>no_access
```

6.3.6. Coprocesses

Coprocesses are a feature of the Korn shell only.

Syntax	Syntax
cmd1 | *cmd2* |&	Coprocess; execute the pipeline in the background. The shell sets up a two-way pipe, allowing redirection of both standard input and standard output.
read -p *var*	Read coprocess output into variable *var*.
print -p *string*	Write *string* to the coprocess.
cmd <&p	Take input for *cmd* from the coprocess.
cmd >&p	Send output of *cmd* to the coprocess.
exec *n*<&p	Move input from coprocess to file descriptor *n*.
exec *n*>&p	Move output for coprocess to file descriptor *n*.

Moving the coprocess input and output file descriptors to standard file descriptors allows you to open multiple coprocesses.

6.3.6.1 Examples

```
$ ed - memo |&          Start coprocess
$ print -p /word/           Send ed command to coprocess
$ read -p search            Read output of ed command into variable search
$ print "$search"           Show the line on standard output
A word to the wise.
```

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6.4. Functions

A shell *function* is a grouping of commands within a shell script. Shell functionslet you modularize your program by dividing it up into separate tasks. This way the code for each task need not be repeated every time you need to perform the task. The POSIX shell syntax for defining a function follows the Bourne shell:

```
name (  ) {
    function body's code come here
}
```

Functions are invoked just as are regular shell built-in commands or external commands. The command line parameters `$1`, `$2` and so on receive the function's arguments, temporarily hiding the global values of `$1`, etc. For example:

```
# fatal --- print an error message and die:

fatal (  ) {
    echo "$0: fatal error:" "$@" >&2     # messages to standard error
    exit 1
}
...
if [ $# = 0 ]    # not enough arguments
then
    fatal not enough arguments
fi
```

A function may use the `return` command to return an exit value to the calling shell program. Be careful *not* to use `exit` from within a function unless you really wish to terminate the entire program.

Bash and the Korn shell allow you to define functions using an additional keyword,`function`, as follows:

```
function fatal {
    echo "$0: fatal error:" "$@" >&2     # messages to standard error
    exit 1
}
```

When working with the different shells and defining functions, there are semantic differences that should be kept in mind:

- In Bash, all functions share traps with the "parent" shell (except the DEBUG trap, if function tracing has been turned on). With the `errtrace` option enabled (either `set -E` or `set -o errtrace`), functions also inherit the ERR trap. If function tracing has been enabled, functions inherit the RETURN trap. Functions may have local variables, and they may be recursive. The syntax used to define a function is irrelevant.
- In ksh88, all functions have their own traps and local variables, and may be recursive.
- In ksh93, *name* ( ) functions share traps with the "parent" shell and may not be recursive.
- In ksh93, `function` functions have their own traps and local variables, and may be recursive. Using the . command with a `function` function gives it POSIX shell semantics (i.e., shared traps and variables).

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6.5. Variables

This section describes the following:

- Variable substitution
- Built-in shell variables
- Other shell variables
- Arrays
- Discipline functions (ksh93 only)
- Special prompt strings

6.5.1. Variable Substitution

ksh93 provides structured variables, such as pos.x and pos.y . To create either one, pos must already exist, and braces must be used to retrieve their values. Names beginning with.sh are reserved for use b ksh .

No spaces should be used in the following expressions. The colon ( ) is optional; if it's included, *var* must be nonnull, as well as set.

Variable expression	Description
var = *value* ...	Set each variable *var* to a *value* .
${ *var* }	Use value of *var* ; braces are optional if *var* is separated from the following text. They are required for array variables, and in ksh93 if a variable name contains periods.
${ *var* :- *value* }	Use *var* if set; otherwise, use *value* .
${ *var* := *value* }	Use *var* if set; otherwise, use *value* and assign *value* to *var* .
${ *var* :? *value* }	Use *var* if set; otherwise, print *value* and exit (if not interactive). If *value* isn't supplied, print the phrase "parameter null or not set."
${ *var* :+ *value* }	Use *value* if *var* is set; otherwise, use nothing.
${# *var* }	Use the length of *var* .
${#*}	Use the number of positional parameters.

Variable expression	Description
${#@}	
${ *var* # *pattern* }	Use value of *var* after removing *pattern* from the left. Remove the shortest matching piece.
${ *var* ## *pattern* }	Same as # *pattern* , but remove the longest matching piece.
${ *var* % *pattern* }	Use value of *var* after removing *pattern* from the right. Remove the shortest matching piece.
${ *var* %% *pattern* }	Same as % *pattern* , but remove the longest matching piece.

In ksh93 and Bash:

Variable expression	Description
${! *prefix* * }	List of variables whose names begin with *prefix* .
${! *prefix* @}	
${ *var* : *pos* }	Starting at position *pos* (0-based) in variable *var* , extract *len* characters, or rest of string if no *len* . *pos* and *len* may be arithmetic expressions.
${ *var* : *pos* : *len* }	
${ *var* / *pat* / *repl* }	Use value of *var* , with first match of *pat* replaced with *repl* .
${ *var* / *pat* }	Use value of *var* , with first match of *pat* deleted.
${ *var* / / *pat* / *repl* }	Use value of *var* , with every match of *pat* replaced with *repl* .
${ *var* /# *pat* / *repl* }	Use value of *var* , with match of *pat* replaced with *repl* . Match must occur at beginning of the value.
${ *var* /% *pat* / *repl* }	Use value of *var* , with match of *pat* replaced with *repl* . Match must occur at end of the value.

In ksh93 , indirect variables allow you to "alias" one variable name to affect the value of another. This i accomplished using typeset -n :

```
$ greet="hello, world"                  Create initial variable
$ typeset -n friendly_message=greet           Set up alias
$ echo $friendly_message                Access old value through new name
```

```
hello, world
$ friendly_message="don't panic"            Change the value
$ echo $greet                    Old variable is changed
don't panic
```

Bash has a similar mechanism for indirect variable referencing:

```
$ greet="hello, world"                Create initial variable
$ friendly_message=greet              Aliasing variable
$ echo ${!friendly_message}           Use the alias
hello, world
```

6.5.1.1 Examples

```
$ u=up d=down blank=          Assign values to three variables (last is null)
$ echo ${u}root               Braces are needed here
uproot
$ echo ${u-$d}                Display value of u or d; since u is set, it's printed
up
$ echo ${tmp-`date`}          If tmp is not set, the date command is executed
Mon Aug 30 11:15:23 EDT 2004
$ echo ${blank="no data"}           blank is set, so it is printed (a blank line)
$ echo ${blank:="no data"}          blank is set but null, so the string is printed
no data
$ echo $blank                 blank now has a new value
no data
$ tail=${PWD##*/}           Take the current directory name and remove the
                             longest character string ending with /, which removes
                             the leading pathname and leaves the tail
```

6.5.2. Built-in Shell Variables

Built-in variables are automatically set by the shell and are typically used inside shell scripts. Built-in variables can make use of the variable substitution patterns shown previously. Note that the$S is not actually part of the variable name, although the variable is always referenced this way. The following ar available in any Bourne-compatible shell.

Variable	Variable
$#	Number of command-line arguments.

Variable	Variable
$-	Options currently in effect (arguments supplied on command line or toset).
$?	Exit value of last executed command.
$$	Process number of current process.
$!	Process number of last background command.
$0	First word; that is, command name. This will have the full pathname if it was found via a PATH search.
$ *n*	Individual arguments on command line (positional parameters). The Bourne shell allows only nine parameters to be referenced directly (*n* = 1-9); Bash and the Korn shell allow *n* to be greater than 9 if specified as ${ *n* } .
$* , $@	All arguments on command line ($1 $2 ...).
"$*"	All arguments on command line as one string ("$1 $2..."). The values are separated by the first character in IFS.
"$@"	All arguments on command line, individually quoted ("$1" "$2" ...).

Bash and the Korn shell automatically set these additional variables.

Variable	Variable
$_	Temporary variable; initialized to pathname of script or program being executed. Later, stores the last argument of previous command. Also stores name of matching MAIL file during mail checks.
HISTCMD	The history number of the current command.
LINENO	Current line number within the script or function.
OLDPWD	Previous working directory (set by cd).
OPTARG	Name of last option processed by getopts .
OPTIND	Numerical index of OPTARG.
PPID	Process number of this shell's parent.
PWD	Current working directory (set by cd).
RANDOM [= *n*]	Generate a new random number with each reference; start with integer *n* , if given.
REPLY	Default reply, used by select and read .
SECONDS [= *n*]	Number of seconds since the shell was started, or, if *n* is given, number of seconds + *n* since the shell started.

ksh93 automatically sets these additional variables. Variables whose names contain "." must be enclose in braces when referencede.g., ${.sh.edchar} .

Variable	Variable
.sh.edchar	The character(s) entered when processing a KEYBD trap. Changing it replaces the characters that caused the trap.
.sh.edcol	The position of the cursor in the most recent KEYBD trap.
.sh.edmode	Will be equal to Escape if in a KEYBD trap in vi mode; otherwise empty.
.sh.edtext	The characters in the input buffer during a KEYBD trap.
.sh.match	Array variable containing text matched during a variable substitution. Index0 is the entire value; the others correspond to parenthesized subexpressions.
.sh.name	The name of the variable running a discipline function.
.sh.subscript	The subscript of the variable running a discipline function.
.sh.value	The value of the variable inside the set and get discipline functions.
.sh.version	The version of ksh93 .

Bash automatically sets these additional variables. Many of these variables are for use by the Bash Debugger (see http://bashdb.sourceforge.net) or for providing programmable completion (see the section Programmable Completion (Bash only)," later in this chapter).

Variable	Variable
BASH	The full pathname used to invoke this instance of Bash.
BASH_ARGC	Array variable. Each element holds the number of arguments for the corresponding function or dot-script invocation. Set only in extended debug mode, with shopt -s extdebug .
BASH_ARGV	An array variable similar to BASH_ARGC. Each element is one of the arguments passed to a function or dot-script. It functions as a stack, with values being pushed on at each call. Thus, the last element is the last argument to the most recent function or script invocation. Set only in extended debug mode, with shopt -s extdebug .
BASH_COMMAND	The command currently executing or about to be executed. Inside a trap handler, it is the command running when the trap was invoked.
BASH_EXECUTION_STRING	The string argument passed to the -c option.
BASH_LINENO	Array variable, corresponding to BASH_SOURCE and FUNCNAME. For any given function number *i* (starting at 0), ${ FUNCNAME[*i*]} was invoked in file ${ BASH_SOURCE[*i*]} on line ${ BASH_LINENO[*i*]} . The information is stored with the most recent function invocation first.
BASH_REMATCH	Array variable, assigned by the =~ operator of the [[ ]] construct. Index 0 is the text that matched the entire pattern. The other indices are the text matched by parenthesized subexpressions. This variable is read-only.

Variable	Variable
BASH_SOURCE	Array variable, containing source filenames. Each element corresponds with those in FUNCNAME and BASH_LINENO.
BASH_SUBSHELL	This variable is incremented by one each time a subshell or subshell environment is created.
BASH_VERSINFO[0]	The major version number, or release, of Bash.
BASH_VERSINFO[1]	The minor version number, or version, of Bash.
BASH_VERSINFO[2]	The patch level.
BASH_VERSINFO[3]	The build version.
BASH_VERSINFO[4]	The release status.
BASH_VERSINFO[5]	The machine type; same value as in MACHTYPE.
BASH_VERSION	A string describing the version of Bash.
COMP_CWORD	For programmable completion. Index into COMP_WORDS, indicating the current cursor position.
COMP_LINE	For programmable completion. The current command line.
COMP_POINT	For programmable completion. The position of the cursor as a characte index in COMP_LINE.
COMP_WORDBREAKS	For programmable completion. The characters that the *readline* library treats as word separators when doing word completion.
COMP_WORDS	For programmable completion. Array variable containing the individual words on the command line.
DIRSTACK	Array variable, containing the contents of the directory stack as displayed by `dirs` . Changing existing elements modifies the stack, but only `pushd` and `popd` can add or remove elements from the stack.
EUID	Read-only variable with the numeric effective UID of the current user.
FUNCNAME	Array variable, containing function names. Each element corresponds with those in BASH_SOURCE and BASH_LINENO.
GROUPS	Array variable containing the list of numeric group IDs in which the current user is a member.
HISTCMD	The history number of the current command.
HOSTNAME	The name of the current host.
HOSTTYPE	A string that describes the host system.
MACHTYPE	A string that describes the host system in the GNU*cpu-company-system* format.
OSTYPE	A string that describes the operating system.

Variable	Variable
PIPESTATUS	An array variable containing the exit statuses of the commands in the most recent foreground pipeline.
SHELLOPTS	A colon-separated list of shell options (for `set -o`). If set in the environment at startup, Bash enables each option present in the list.
SHLVL	Incremented by one every time a new Bash starts up.
UID	Read-only variable with the numeric real UID of the current user.

6.5.3. Other Shell Variables

The following variables are not automatically set by the shell, although many of them can influence the shell's behavior. They are typically used in your *.profile* file, where you can define them to suit your needs. Variables can be assigned values by issuing commands of the form:

```
variable=value
```

This list includes the type of value expected when defining these variables. Those that are specific to the Bash shell are marked as (B). Those that are specific to the Korn shell are marked as (K). Those that are specific to `ksh93` are marked (K93).

Variable expression	Variable expression
CDPATH= *dirs*	Directories searched by `cd`; allows shortcuts in changing directories; unset by default.
COLUMNS= *n*	Screen's column width; used in line edit modes and `select` lists.
COMPREPLY=(*words ...*)	(B) Array variable from which Bash reads the possible completions generated by a completion function.
EDITOR= *file*	(K) Pathname of line-edit mode to turn on (can end in `emacs` or `vi`); used when VISUAL is not set.
EMACS	(B) If the value starts with `t`, Bash assumes it's running in an Emacs buffer and disables line editing.
ENV= *file*	Name of script that gets executed at startup; useful for storing alias and function definitions. For example, `ENV=$HOME/.kshrc`.
FCEDIT= *file*	Editor used by `fc` command (default is */bin/ed*). Obsoleted in `ksh93` by HISTEDIT.

Variable expression	Variable expression
FIGNORE= *pattern*	(K93) Pattern describing the set of filenames to ignore during pattern matching. (B) Similar: colon-separated list of patterns describing filenames tc ignore when doing filename completion.
FPATH= *dirs*	(K) Directories to search for function definitions; undefined functions are set via typeset -fu ; FPATH is searched when these functions are first referenced. (ksh93 also searches PATH.)
GLOBIGNORE= *patlist*	(B) Colon-separated list of patterns describing the set of filenames to ignore during pattern matching.
HISTCONTROL= *list*	(B) Colon-separated list of values controlling how commands are saved in the history file. Recognized values are: ignoredups , ignorespace , ignoreboth , and erasedups .
HISTEDIT= *file*	(K93) Editor used by hist command, if set. Overrides the setting of FCEDIT.
HISTFILE= *file*	File in which to store command history. For ksh , it must be set before ksh is started, and the default is *$HOME/.sh_history* . If you use both Bash and ksh , be sure to have different files for this value, as the format of the saved history file is *not* compatible between the two shells.
HISTFILESIZE= *n*	(B) Number of lines to be kept in the history file. This may be different than the number of commands.
HISTIGNORE= *list*	(B) A colon-separated list of patterns that must match the entire command line. Matching lines are *not* saved in the history file. An unescaped & in a pattern matches the previous history line.
HISTSIZE= *n*	Number of history commands to be kept in the history file.
HISTTIMEFORMAT= *string*	(B) A format string for *strftime* (3) to use for printing timestamps along with commands from the history command. If set (even if null), Bash saves timestamps in the history file along with the commands.
HOME= *dir*	Home directory; set by login (from */etc/passwd* file).
HOSTFILE= *file*	(B) Name of a file in the same format as */etc/hosts* that Bash should use to find hostnames for hostname completion.
IFS=' *chars* '	Input field separators; default is space, tab, and newline.
IGNOREEOF= *n*	(B) Numeric value indicating how many successive EOF characters must be typed before Bash exits. If null or nonnumeric value, default is 10.
INPUTRC= *file*	(B) Initialization file for the *readline* library. This overrides the default value of *~/.inputrc* .
LANG= *dir*	Default value for locale, used if no LC_* variables are set.
LC_ALL= *locale*	(B, K93) Current locale; overrides LANG and the other LC_* variables.
LC_COLLATE= *locale*	(B, K93) Locale to use for character collation (sorting order).
LC_CTYPE= *locale*	(B, K93) Locale to use for character class functions. (See the earlier section Filename Metacharacters .")

Variable expression	Variable expression
LC_MESSAGES= *locale*	(B) Locale to use for translating $"..." strings.
LC_NUMERIC= *locale*	(B, K93) Locale to use for the decimal-point character.
LINES= *n*	Screen's height; used for select lists.
MAIL= *file*	Default file to check for incoming mail; set by login .
MAILCHECK= *n*	Number of seconds between mail checks; default is 600 (10 minutes).
MAILPATH= *files*	One or more files, delimited by a colon, to check for incoming mail. Along wit each file, you may supply an optional message that the shell prints when the file increases in size. Messages are separated from the filename by a? character, and the default message is You have mail in $_ . $_ is replaced with the name of the file. For example, you might have: `MAILPATH="$MAIL?Ring! Candygram!:/etc/motd?New Login Message"`
OPTERR= *n*	(B) When set to 1 (the default value), Bash prints error messages from the built-in getopts command.
PATH= *dirlist*	One or more pathnames, delimited by colons, in which to search for commands to execute. Default for many systems is /bin:/usr/bin . On Solaris, the default is /usr/bin: . However, the standard start-up scripts change it to: `/usr/bin:/usr/ucb:/etc:.` ksh93 : PATH is also searched for function definitions for undefined functions
POSIXLY_CORRECT= *string*	(B) When set at startup or while running, Bash enters POSIX mode, disabling behavior and modifying features that conflict with the POSIX standard.
PROMPT_COMMAND= *command*	(B) If set, Bash executes this command each time before printing the primary prompt.
PS1= *string*	Primary prompt string; default is $.
PS2= *string*	Secondary prompt (used in multiline commands); default is > .
PS3= *string*	Prompt string in select loops; default is #? .
PS4= *string*	Prompt string for execution trace (ksh -x , bash -x , or set -x); default is + .
SHELL= *file*	Name of default shell (e.g., */bin/sh*). Bash sets this if it's not in the environment at startup.
TERM= *string*	Terminal type.

Variable expression	Variable expression
TIMEFORMAT= *string*	(B) A format string for the output for the time keyword.
TMOUT= *n*	If no command is typed after *n* seconds, exit the shell. Also affects the read command and the select loop.
VISUAL= *path*	(K) Same as EDITOR, but VISUAL is checked first.
auto_resume= *list*	(B) Enables the use of simple strings for resuming stopped jobs. With a value of exact , the string must match a command name exactly. With a value of substring , it can match a substring of the command name.
histchars= *chars*	(B) Two or three characters that control Bash's csh -style history expansion. The first character signals a history event. The second is the "quick substitution" character, and the third indicates the start of a comment. The default value is !^# .

6.5.4. Arrays

Both shells support one-dimensional arrays. The first element is numbered 0. Bash has no limit on the number of elements. ksh88 allowed up 1024 elements, early versions of ksh93 allowed at least 4096 elements, and modern versions allow up to 65,536 elements. Arrays are initialized with a special form o assignment:

```
message=(hi there how are you today)          Bash and ksh93
```

where the specified values become elements of the array. The Korn shellhas an additional syntax:

```
set -A message hi there how are you today     Ksh88 and ksh93
```

Individual elements may also be assigned to:

```
message[0]=hi             This is the hard way
message[1]=there
message[2]=how
message[3]=are
message[4]=you
message[5]=today
```

Declaring arrays is not required. Any valid reference to a subscripted variable can create an array.

When referencing arrays , use the ${ ... } syntax. This isn't needed when referencing arrays inside (( )) (the form of let that does automatic quoting). Note that [and] are typed literally (i.e., they don't stand for optional syntax).

Syntax	Effect
${ *name* [*i*]}	Use element *i* of array *name* . *i* can be any arithmetic expression as described under let .
${ *name* }	Use element 0 of array *name* .
${ *name* [*]}	Use all elements of array *name* .
${ *name* [@]}	
${# *name* [*]}	Use the number of elements in array *name* .
${# *name* [@]}	

ksh93 provides associative arrays , where the indices are strings instead of numbers (as in awk). In thi case, [and] act like double quotes. Associative arrays are created with typeset -A . A special syntax allows assigning to multiple elements at once:

```
data=([joe]=30 [mary]=25)
```

The values would be retrieved as ${data[joe]} and ${data[mary]} .

6.5.5. Discipline Functions (ksh93 only)

Along with structured variables, ksh93 introduces *discipline functions* . These are special functions that are called whenever a variable's value is accessed or changed. For a shell variable namedx , you can define the following functions:

x.get

Called when x 's value is retrieved ($x).

x.set

Called when x 's value is changed (x=2).

x.unset

Called when x is unset (unset x).

Within the discipline functions, special variables provide information about the variable being changed:

.sh.name

The name of the variable being changed.

.sh.subscript

The subscript of the array element being changed.

.sh.value

The value of the variable being assigned or returned. Changing it within the discipline function changes the value that is actually assigned or returned.

6.5.6. Special Prompt Strings

Both shells process the value of PS1 for special strings. The Korn shell expands a single ! into the curren command number. Use !! to get a literal ! . For example:

```
PS1='cmd !> '
```

Bash processes the values of PS1 , PS2 , and PS4 for the following special escape sequences.

Escape sequence	Description
\a	An ASCII BEL character (octal 07).
\A	The current time in 24-hour *HH:MM* format.
\d	The date in "weekday month day" format.
\D{ *format* }	The date as specified by the *strftime* (3) format *format* . The braces are required.
\e	An ASCII Escape character (octal 033).
\h	The hostname, up to the first period.
\H	The full hostname.
\j	The current number of jobs.
\l	The basename of the shell's terminal device.
\n	A newline character.
\r	A carriage-return character.

Escape sequence	Description
\s	The name of the shell (basename of $0).
\t	The current time in 24-hour *HH:MM:SS* format.
\T	The current time in 12-hour *HH:MM:SS* format.
\u	The current user's username.
\v	The version of Bash.
\V	The release (version plus patch level) of Bash.
\w	The current directory, with $HOME abbreviated as ~ .
\W	The basename of the current directory, with $HOME abbreviated as ~ .
\!	The history number of this command.
\#	The command number of this command.
\$	If the effective UID is 0, a # ; otherwise a $.
\@	The current time in 12-hour a.m./p.m. format.
\ *nnn*	The character represented by octal value *nnn* .
\ \	A literal backslash.
\ [	Start a sequence of nonprinting characters, such as for highlighting or changing colors on a terminal.
\ ]	End a sequence of nonprinting characters.

In addition, some or all of the PS1-PS4 variablesundergo different substitutions, as outlined in the following table.

Substitution	ksh88	ksh93	Bash
! for command number	PS1	PS1	
Escape sequences			PS1, PS2, PS4
Variable substitution	PS1	PS1	PS1, PS2, PS4
Command substitution		PS1	PS1, PS2, PS4
Arithmetic substitution		PS1	PS1, PS2, PS4

In Bash, the escape sequences are processed first, and then, if the`promptvars` shell option is enabled via the `shopt` command (the default), the substitutions are performed.

6.6. Arithmetic Expressions

The let command performs arithmetic. ksh88 and Bash are restricted to integer arithmetic. ksh93 can do floating-point arithmetic as well. Both shells provide a way to substitute arithmetic values (for use as command arguments or in variables); base conversion is also possible.

Expression	Meaning
$((*expr*))	Use the value of the enclosed arithmetic expression.
B#*n*	Interpret integer *n* in numeric base *B*. For example, 8#100 specifies the octal equivalent of decimal 64.

6.6.1. Operators

The shells use arithmetic operators from the C programming language; the following table listing is in decreasing order of precedence. ksh88 does not support the ++, --, unary +, ?:, comma or ** operators. Early versions of ksh93 do not have **.

Operator	Operator
++ --	Auto-increment and auto-decrement, both prefix and postfix.
+ - ! ~	Unary plus and minus, logical negation and binary inversion (one's complement).
**	Exponentiation.[a]
* / %	Multiplication; division; modulus (remainder).
+ -	Addition; subtraction.
<< >>	Bitwise left shift; bitwise right shift.
< <= > >=	Less than; less than or equal to; greater than; greater than or equal to.
== !=	Equality; inequality (both evaluated left to right).
&	Bitwise AND.
^	Bitwise exclusive OR.
|	Bitwise OR.
&&	Logical AND (short-circuit).
||	Logical OR (short-circuit).
?:	Inline conditional evaluation.

Operator	Operator
= += -=	Assignment.
*= /= %=	
< <= > >=	
&= ^= |=	
,	Sequential expression evaluation.

[a] In **ksh93**, the ****** operator is right associative. In **bash** versions prior to 3.1, it is left associative. It will be changed to right associative starting with version 3.1.

6.6.2. Built-in Mathematical Functions (ksh93 only)

ksh93 provides access to the standard set of mathematical functions. They are called using C function call syntax.

Name	Function	Name	Function
abs	Absolute value	hypot	Euclidean distance
acos	Arc cosine	int	Integer part of floating-point number
asin	Arc sine	log	Natural logarithm
atan	Arc tangent	pow	Exponentiation (*xy*)
atan2	Arc tangent of two variables	sin	Sine
cos	Cosine	sinh	Hyperbolic sine
cosh	Hyperbolic cosine	sqrt	Square root
exp	Exponential (*ex*)	tan	Tangent
fmod	Floating-point remainder	tanh	Hyperbolic tangent

6.6.3. Examples

See the let command for more information and examples:

```
let "count=0" "i = i + 1"      Assign i and count
let "num % 2"      Test for an even number
(( percent >= 0 && percent <= 100 ))      Test the range of a value
```

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6.7. Command History

Both shells let you display or modify previous commands. Commands in the history list can be modified using:

- Line-edit mode
- The fc and hist commands

Bash also supports a command-history mechanism very similar to that of the C shell. Because the interactive line-editing features are considerably superior, and because Bash's command historyis almost identical to that of the C shell, we have chosen not to cover those features here. See the Bash manpage for more information.

6.7.1. Line-Edit Mode

Line-edit mode emulates many features of the vi and emacs editors. The history list is treated like a file When the editor is invoked, you type editing keystrokes to move to the command line you want to execute. You can also change the line before executing it. When you're ready to issue the command, press the Enter key.

In ksh , line-edit mode can be started in several ways. For example, these are equivalent:

```
$ VISUAL=vi
$ EDITOR=vi
$ set -o vi          Overrides value of VISUAL or EDITOR
```

For Bash, you must use either set -o vi or set -o emacs ; assignment to the VISUAL or EDITOR variables has no effect.

Note that vi starts in input mode; to type a vi command, press the Escape key first.

Bash also provides a csh -style command-line editing mechanism, which we don't cover because the built-in vi and Emacs editing modes are easier to use.

6.7.1.1 Common editing keystrokes

vi	emacs	Result
k	Ctrl-P	Get previous command.
j	Ctrl-N	Get next command.

vi	emacs	Result
/ string	Ctrl-R *string*	Get previous command containing *string* .
h	Ctrl-B	Move back one character.
l	Ctrl-F	Move forward one character.
b	ESC-B	Move back one word.
w	ESC-F	Move forward one word.
X	DEL	Delete previous character.
x	Ctrl-D	Delete character under cursor.
dw	ESC-D	Delete word forward.
db	ESC-H	Delete word backward.
xp	Ctrl-R	Transpose two characters.

6.7.2. The fc and hist Commands

"fc " stands for either "find command" or "fix command," since it does both jobs. Usefc -l to list history commands and fc -e to edit them. See the fc entry in the later section See Built-in Commands (Bash an Korn Shells) for more information.

In ksh93 , the fc command has been renamed hist , and alias fc=hist is predefined.

6.7.2.1 Examples

```
$ history          List the last 16 commands
$ fc -l 20 30             List commands 20 through 30
$ fc -l -5         List the last five commands
$ fc -l cat       List all commands since the last command beginning with cat
$ fc -l 50         List all commands since command 50
$ fc -ln 5 > doit         Save command 5 to file doit
$ fc -e vi 5 20           Edit commands 5 through 20 using vi
$ fc -e emacs             Edit previous command using emacs
```

The following only work in the Korn shell, which predefines ther alias:

```
$ r              Reexecute previous command
$ r cat            Reexecute last cat command
$ r doc=Doc        Substitute, then reexecute last command
$ r chap=doc c       Reexecute last command that begins with c, but change string chap
                                    to doc
```

For both shells, the interactive line editing is easier to use thanfc , since you can move up and down in the saved command history using your favorite editor commands (as long as your favorite editor is eithe vi or Emacs!). Current versions of both shells also let you use the Up and Down arrow keys to traverse the command history.

6.7.3. Programmable Completion (Bash only)

Bash and the *readline* library provide *completion* facilities, whereby you can type part of a command name, press the Tab key, and have Bash fill in part or all of the rest of the command or filename. *Programmable completion* lets you, as a shell programmer, write code to customize the list of possible completions that Bash will present for a particular, partially entered word. This is accomplished through the combination of several facilities:

- The `complete` command allows you provide a completion specification, or*compspec* , for individual commands. You specify, via various options, how to tailor the list of possible completions for the particular command. This is simple, but adequate for many needs. (See the`complete` entry in the section See Built-in Commands (Bash and Korn Shells)," later in this chapter.)

- For more flexibility, you may use`complete -F` *funcname command* . This tells Bash to call *funcname* to provide the list of completions for*command* . You write the *funcname* function.

- Within the code for a `-F` function, the COMP* shell variables provide information about the current command line. COMPREPLY is an array into which the function places the final list of completion results.

- Also within the code for a `-F` function, you may use the `compgen` command to generate is a list of results, such as "usernames that begin witha " or "all set variables." The intent is that such results would be used with an array assignment:

```
...
COMPREPLY=( $( compgen options arguments ) )
...
```

Compspecs may be associated with either a full pathname for a command or, more commonly, with an unadorned command name (*/usr/bin/man* versus plain `man`). Completions are attempted in the following order, based on the options provided to the`complete` command:

1. Bash first identifies the command. If a pathname is used, Bash looks to see if a compspec exists fo the full pathname. Otherwise, it sets the the command name to the last component of the pathname, and searches for a compspec for the command name.

2. If a compspec exists, Bash uses it. If not, Bash falls back to the default built-in completions.

3. Bash performs the action indicated by the compspec to generate a list of possible matches. Of this

list, only those that have the word being completed as a prefix are used for the list of possible completions. For the -d and -f options, the variable FIGNORE is used to filter out undesirable matches.

4. Bash generates filenames as specified by the -G option. GLOBIGNORE is not used to filter the results, but FIGNORE is.

5. Bash processes the argument string provided to -W . The string is split using the characters in $IFS The resulting list provides the candidates for completion. This is often used to provide a list of options that a command accepts.

6. Bash runs functions and commands as specified by the -F and -C options. For both, Bash sets COMP_LINE and COMP_POINT as described previously. For a shell function, COMP_WORDS and COMP_CWORD are also set.

   Also for both, $1 is the name of the command whose arguments are being completed, $2 is the word being completed, and $3 is the word in front of the word being completed. Bash does*not* filte the results of the command or function.

   a. Functions named with -F are run first. The function should set the COMPREPLY array to the lis of possible completions. Bash retrieves the list from there.

   b. Commands provided with -C are run next, in an environment equivalent to command substitution. The command should print the list of possible completions, one per line. An embedded newline should be escaped with a backslash.

7. Once the list is generated, Bash filters the results according to the -X option. The argument to -X is a pattern specifying files to exclude. By prefixing the pattern with a! , the sense is reversed, and the pattern instead specifies that only matching files should be retained in the list.

   An & in the pattern is replaced with the text of the word being completed. Use \& to produce a literal & .

8. Finally, Bash prepends or appends any prefixes or suffixes supplied with -P or -S options.

9. In the case that no matches were generated, if -o dirnames was used, Bash will attempt directory name completion.

10. On the other hand, if -o plusdirs was provided, Bash *adds* the result of directory completion to the previously generated list.

11. Normally, when a compspec is provided, Bash's default completions are not attempted, nor are the *readline* library's default filename completions.

    a. If the compspec produces no results and -o bashdefault was provided, then Bash will attemp its default completions.

    b. If neither the compspec, nor the Bash default completions with -o bashdefault produced any results, and -o default was provided, then Bash has the *readline* library attempt its filename completions.

Ian Macdonald has collected a large set of useful compspecs, often distributed as the file */etc/bash_completion* . If your system does not have it, one location for downloading it is http://www.dreamind.de/files/bash-stuff/bash_completion . It is worth retrieving and reviewing.

6.7.3.1 Examples

Restrict files for the C compiler to C, C++ and assembler source files, and relocatable object files:

```
complete -f -X '!*.[Ccos]' gcc cc
```

For the man command, restrict expansions to things that have manpages:

```
# Simple example of programmable completion for manual pages.
# A more elaborate example appears in the bash_completion file.
# Assumes   man [num] command   command syntax.

shopt -s extglob              Enable extended pattern matching
_man (  ) {
    local dir mandir=/usr/share/man     Local variables

    COMPREPLY=(  )              Clear reply list
    if [[ ${COMP_WORDS[1]} = +([0-9]) ]]       Section number provided
    then
        # section provided: man 3 foo
        dir=$mandir/man${COMP_WORDS[COMP_CWORD-1]}    Look in that directory
    else
        # no section, default to commands
        dir=$mandir/'man[18]'           Look in command directories
    fi
    COMPREPLY=( $( find $dir -type f |          Generate raw file list
            sed 's;..*/;;' |            Remove leading directories
            sed 's/\.[0-9].*$//' |              Remove trailing suffixes
            grep "^${COMP_WORDS[$COMP_CWORD]}" |      Keep those that match
                                        given prefix
            sort          Sort final list
            ) )
}
complete -F _man man              Associate function with command
```

6.8. Job Control

Job control lets you place foreground jobs in the background, bring background jobs to the foreground, or suspend (temporarily stop) running jobs. All modern Unix systems, including Linux and BSD systems, support job control; thus the job-control features are automatically enabled. Many job-control commands take a *jobID* as an argument. This argument can be specified as follows:

%n

Job number *n*.

%s

Job whose command line starts with string *s*.

%?s

Job whose command line contains string *s*.

% %

Current job.

% +

Current job (same as above).

% -

Previous job.

Both shells provide the following job-control commands. For more information on these commands, see the Built-in Commands (Bash and Korn Shells)," later in this chapter.

bg

Put a job in the background.

fg

Put a job in the foreground.

jobs

List active jobs.

kill

Terminate a job.

stty tostop

Stop background jobs if they try to send output to the terminal. (Note thatstty is not a built-in command.)

suspend

Suspend a job-control shell (such as one created bysu).

wait

Wait for background jobs to finish.

Ctrl-Z

Suspend a foreground job. Then usebg or fg. (Your terminal may use something other than Ctrl-Z as the suspend character.)

6.9. Command Execution

When you type a command to Bash or ksh93, they look in the following places until they find a match:

1. Keywords such as `if` and `for`.
2. Aliases. You can't define an alias whose name is a shell keyword, but you can define an alias that expands to a keyword, e.g., `alias aslongas=while`. (Bash, when not in POSIX mode, does allow you to define an alias for a shell keyword.)
3. Special built-ins like `break` and `continue`. The list of POSIX special built-ins is `.` (dot), `:`, `break`, `continue`, `eval`, `exec`, `exit`, `export`, `readonly`, `return`, `set`, `shift`, `times`, `trap`, and `unset`. The Korn shell adds `alias`, `login`, `typeset`, and `unalias`, while Bash adds `source`.
4. Functions. When not in POSIX mode, Bash finds functions before built-in commands.
5. Nonspecial built-ins like `cd` and `test`.
6. Scripts and executable programs, for which the shell searches in the directories listed in the PATH environment variable.

The distinction between "special" built-in commands and nonspecialones comes from POSIX. This distinction, combined with the `command` command, makes it possible to write functions that override shell built-ins, such as `cd`. For example:

```
cd (  ) {          Shell function, found before built-in cd
    command cd "$@"    Use real cd to change directory
    echo now in $PWD           Other stuff we want to do
}
```

In ksh88, the search order is different; all built-ins are found before shell functions. Thus you have to do more work to override a built-in command with a function. You do so using a combination of functions and aliases:

```
_cd (  ) {         Shell function, note leading underscore
    cd "$@"              Use real cd to change directory
    echo now in $PWD           Other stuff we want to do
}
alias cd=_cd           Alias found first
```

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6.10. Restricted Shells

A *restricted shell* is one that disallows certain actions, such as changing directory, setting PATH, or running commands whose names contain a / character.

The original V7 Bourne shell had an undocumented restricted mode. Later versions of the Bourne shell clarified the code and documented the facility. Today, both Bash and the Korn shell supply a restricted mode, but with differing sets of items that get restricted. (See the respective manual pages for the details.)

Shell scripts can still be run, since in that case the restricted shell calls the unrestricted version of the shell to run the script. This includes */etc/profile*, *$HOME/.profile*, and other startup files.

Restricted shells are not used much in practice, as they are difficult to set up correctly.

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6.11. Built-in Commands (Bash and Korn Shells)

Examples to be entered as a command line are shown with the$ prompt. Otherwise, examples should be treated as code fragments that might be included in a shell script. For convenience, some of the reserved words used by multiline commands are also included.

!

```
! pipeline
```

Not ksh88. Negate the sense of a pipeline. Returns an exit status of 0 if the pipeline exited nonzero, and an exit status of 1 if the pipeline exited zero. Typically used inif and while statements.

Example

This code prints a message if user jane is not logged on:

```
if ! who | grep jane > /dev/null
then
        echo jane is not currently logged on
fi
```

#

```
#
```

Ignore all text that follows on the same line. # is used in shell scripts as the comment character and is not really a command.

#!shell

```
#!shell [option]
```

Used as the first line of a script to invoke the named*shell*. Anything given on the rest of the line is passed *as a single argument* to the named *shell*. This feature is typically implemented by the kernel, but may not be supported on some older systems. Some systems have a limit of approximately 32 characters on the maximum length of *shell*. For example:

```
#!/bin/sh
```

:

```
:
```

Null command. Returns an exit status of 0. The line is still processed for side effects, such as variable and command substitutions, or I/O redirection. See the following Example and the Example under [case](#).

Example

Check whether someone is logged in:

```
if who | grep $1 > /dev/null
then :   # Do nothing if user is found
else echo "User $1 is not logged in"
fi
```

.

```
. file [arguments]
```

Read and execute lines in *file*. *file* does not have to be executable, but must reside in a directory

searched by PATH. The *arguments* are stored in the positional parameters. If Bash is not in POSIX mode and *file* is not found in PATH, it will look in the current directory for*file*.

[[ ]]

```
[[ expression ]]
```

Same as test *expression* or [*expression*], except that [[ ]] allows additional operators. Word splitting and filename expansion are disabled. Note that the brackets ([ ]) are typed literally and that they must be surrounded by whitespace.

Additional Operators

&&

Logical AND of test expressions (short circuit).

||

Logical OR of test expressions (short circuit).

<

First string is lexically "less than" the second.

>

First string is lexically "greater than" the second.

alias

```
alias [options] [name[='cmd']]
```

Assign a shorthand *name* as a synonym for *cmd*. If ='*cmd*' is omitted, print the alias for*name* ; if *name* is also omitted, print all aliases. If the alias value contains a trailing space, the next word on the command line also becomes a candidate for alias expansion. See alsounalias.

These aliases are built into ksh88. Some use names of existing Bourne shell or C shell commands:

```
autoload='typeset -fu'
false='let 0'
functions='typeset -f'
hash='alias -t'
history='fc -l'
integer='typeset -i'
nohup='nohup '
r='fc -e -'
true=':'
type='whence -v'
```

The following aliases are built into ksh93:

```
autoload='typeset -fu'
command='command '
fc='hist'
float='typeset -E'
functions='typeset -f'
hash='alias -t --'
history='hist -l'
integer='typeset -i'
nameref='typeset -n'
nohup='nohup '
r='hist -s'
redirect='command exec'
stop='kill -s STOP'
times='{ {time;} 2>&1;}'
type='whence -v'
```

Options

-p

Print the word alias before each alias. Not ksh88.

-t

Create a tracked alias for a Unix command *name*. The Korn shell remembers the full pathname of the command, allowing it to be found more quickly and to be issued from any directory. If n name is supplied, current tracked aliases are listed. Tracked aliases are similar to hashed

commands in Bash. Korn shell only. ksh93 always does alias tracking.

-x

Export the alias; it can now be used in shell scripts and other subshells. If no name is supplied, current exported aliases are listed. Korn shell only. ksh93 accepts this option but ignores it.

Example

```
alias dir='echo ${PWD##*/}'
```

autoload

```
autoload [functions]
```

Korn shell alias for `typeset -fu`. Load (define) the *functions* only when they are first used.

bind

```
bind [-m map] [options]
bind [-m map] [-q function] [-r sequence] [-u function]
bind [-m map] -f file
bind [-m map] -x sequence:command
bind [-m map] sequence:function
bind readline-command
```

Bash only. Manage the *readline* library. Non-option arguments have the same form as in a *.inputrc* file.

Options

-f *file*

Read key bindings from *file*.

-l

List the names of all the *readline* functions.

-m *map*

Use *map* as the keymap. Available keymaps are: emacs, emacs-standard, emacs-meta, emacs-ctlx, vi, vi-move, vi-command, and vi-insert. vi is the same as vi-command, and emacs is the same emacs-standard.

-p

Print the current *readline* bindings such that they can be reread from a *.inputrc* file.

-P

Print the current *readline* bindings.

-q *function*

Query which keys invoke the *readline* function *function*.

-r *sequence*

Remove the binding for key sequence *sequence*.

-s

Print the current *readline* key sequence and macro bindings such that they can be reread from a *.inputrc* file.

-S

Print the current *readline* key sequence and macro bindings.

-u *function*

Unbind all keys that invoke the *readline* function *function*.

-v

Print the current *readline* variables such that they can be reread from a *.inputrc* file.

-V

Print the current *readline* variables.

-x *sequence*:*command*

Execute the shell command *command* whenever *sequence* is entered.

bg

```
bg [jobIDs]
```

Put current job or *jobIDs* in the background. See the earlier section Job Control."

break

```
break [n]
```

Exit from a for, while, select, or until loop (or break out of *n* loops).

builtin

```
builtin command [ arguments ... ]
```

Bash version. Run the shell built-in command *command* with the given arguments. This allows you to bypass any functions that redefine a built-in command's name. The command command is more portable.

Example

This function lets you do your own tasks when you change directory:

```
cd (  ) {
    builtin cd "$@"      Actually change directory
    pwd            Report location
}
```

builtin

```
builtin [ -ds ] [ -f library ] [ name ... ]
```

ksh93 version. This command allows you to load new built-in commands into the shell at runtime from shared library files.

If no arguments are given, builtin prints all the built-in command names. With arguments, builtin adds each *name* as a new built-in command (like cd or pwd). If the *name* contains a slash, the newly added built-in version is used only if a path search would otherwise have found a command of the same name. (This allows replacement of system commands with faster, built-in versions.) Otherwise, the built-in command is always found.

Options

-d

Delete the built-in command *name*.

-f

Load new built-in command from *library*.

-s

Only print "special" built-ins (those designated as special by POSIX).

case

```
case value in
 pattern1) cmds1;;
 pattern2) cmds2;;
  .
  .
  .
esac
```

Execute the first set of commands (*cmds1*) if *value* matches *pattern1*, execute the second set of commands (*cmds2*) if *value* matches *pattern2*, etc. Be sure the last command in each set ends with ;;. *value* is typically a positional parameter or other shell variable. *cmds* are typically Unix commands, shell programming commands, or variable assignments. Patterns can use file-generation metacharacters. Multiple patterns (separated by |) can be specified on the same line; in this case, the associated *cmds* are executed whenever *value* matches any of these patterns. See the Examples here and under eval.

The shells allow *pattern* to be preceded by an optional open parenthesis, as in (*pattern*). In Bash and ksh88, it's necessary for balancing parentheses inside a $( ) construct.

The Korn shell allows a case to end with ;& instead of ;;. In such cases, control "falls through" to the group of statements for the next *pattern*.

Examples

Check first command-line argument and take appropriate action:

```
case $1 in     # Match the first arg

    no|yes) response=1;;

    -[tT])  table=TRUE;;

    *)      echo "unknown option"; exit 1;;
esac
```

Read user-supplied lines until user exits:

```
while :         # Null command; always true
do
   printf "Type . to finish =  => "
   read line
```

```
    case "$line" in
        .) echo "Message done"
           break ;;
        *) echo "$line" >> $message ;;
    esac
done
```

caller

```
caller [expression]
```

Bash only. Print the line number and source file name of the current function call or dot file. With nonzero *expression*, prints that element from the call stack. The most recent is zero. This command is for use by the Bash debugger.

cd

```
cd [-LP] [dir]
cd [-LP] [-]
cd [-LP] [old new]
```

With no arguments, change to home directory of user. Otherwise, change working directory to*dir*. If *dir* is a relative pathname but is not in the current directory, the CDPATH variable is searched. A directory of - stands for the previous directory. The last syntax is specific to the Korn shell. It modifies the current directory name by replacing string*old* with *new* and then switches to the resulting directory.

Options

-L

Use the logical path (what the user typed, including any symbolic links) forcd .. and the value

of PWD. This is the default.

-P

Use the actual filesystem physical path for `cd ..` and the value of PWD.

Example

```
$ pwd
/var/spool/cron
$ cd cron uucp      Ksh: cd prints the new directory
/var/spool/uucp
```

command

```
command [-pvV] name [arg ...]
```

Not ksh88. Without `-v` or `-V`, execute *name* with given arguments. This command bypasses any aliases or functions that may be defined for *name*. When used with a special built-in, it prevents the built-in from exiting the script if it fails.

Options

-p

Use a predefined, default search path, not the current value of PATH.

-v

Print a description of how the shell interprets *name*.

-V

Print a more verbose description of how the shell interprets *name*.

Example

Create an alias for rm that will get the system's version, and run it with the -i option:

```
$ alias 'rm=command -p rm -i'
```

compgen

```
compgen [options] [string]
```

Bash only. Generate possible completions for *string* according to the options. Options are those accepted by complete, except for -p and -r. For more information, see the entry for complete.

complete

```
complete [options] command ...
```

Bash only. Specify the way to complete arguments for each *command*. This is discussed in See Programmable Completion (Bash only)," earlier in the chapter.

Options

-a

Same as -A alias.

-A *type*

Use *type* to specify a list of possible completions. The *type* may be one of the following.

alias

Alias names.

arrayvar

Array variable names.

binding

Bindings from the *readline* library.

builtin

Shell built-in command names.

directory

Directory names.

disabled

Names of disabled shell built-in commands.

enabled

Names of enabled shell built-in commands.

function

Names of shell functions.

group

Group names.

helptopic

Help topics as allowed by the help built-in command.

hostname

Hostnames, as found in the file named by $HOSTFILE.

job

Job names.

keyword

Shell reserved keywords.

running

Names of running jobs.

service

Service names (from */etc/services*).

setopt

Valid arguments for `set -o`.

shopt

Valid option names for the `shopt` built-in command.

signal

Signal names.

stopped

Names of stopped jobs.

user

Usernames.

variable

Shell variable names.

`-b`

Same as `-A builtin`.

`-c`

Same as `-A command`.

-C *command*

Run *command* in a subshell and use its output as the list of completions.

-d

Same as -A directory.

-e

Same as -A export.

-f

Same as -A file.

-F *function*

Run shell function *function* in the current shell. Upon its return, retrieve the list of completions from the COMPREPLY array.

-g

Same as -A group.

-G *pattern*

Expand *pattern* to generate completions.

-j

Same as -A job.

-k

Same as -A keyword.

-o *option*

Control the behavior of the completion specification. The value for*option* is one of the following.

bashdefault

Fall back to the normal Bash completions if no matches are produced.

default

Use the default *readline* completions if no matches are produced.

dirnames

Do directory name completion if no matches are produced.

filenames

Inform the *readline* library that the intended output is filenames, so that the library can do any filename-specific processing, such as adding a trailing slash for directories or removing trailing spaces.

nospace

Inform the *readline* library that it should not append a space to words completed at the end of a line.

plusdirs

Attempt directory completion and add any results to the list of completions already generated.

-p

With no commands, print all completion settings in a way that can be reread.

-P *prefix*

The *prefix* is added to each resulting string as a prefix after all the other options have been applied.

-r

Remove the completion settings for the given commands, or all settings if no commands.

-s

Save as -A service.

-S *suffix*

The *suffix* is added to each resulting string as a suffix after all the other options have been applied.

-u

Same as -A user.

-v

Same as -A variable.

-W *wordlist*

Split *wordlist* (a single shell word) using $IFS. The generated list contains the members of the split list that matched the word being completed. Each member is expanded using brace expansion, tilde expansion, parameter and variable expansion, command substitution, and arithmetic expansion. Shell quoting is respected.

-X *pattern*

Exclude filenames matching *pattern* from the filename completion list. With a leading !, the sense is reversed, and only filenames matching *pattern* are retained.

continue

```
continue [n]
```

Skip remaining commands in a for, while, select, or until loop, resuming with the next iteration of the loop (or skipping *n* loops).

declare

```
declare [options] [name[=value]]
```

Bash only. Declare variables and manage their attributes. In function bodies, variables are local, as if declared with the local command.

Options

-a

Each *name* is an array.

-f

Each *name* is a function.

-F

For functions, print just the functions' name and attributes, not the function definition (body).

-i

Each variable is an integer; in an assignment, the value is evaluated as an arithmetic expression.

-p

With no *names*, print all variables and their values. With *names*, print the names, attributes, and values of the given variables. This option causes all other options to be ignored.

-r

Mark *names* as read-only. Subsequent assignments will fail.

-t

Apply the *trace* attribute to each name. Traced functions inherit the DEBUG trap. This attribute has no meaning for variables.

-x

Mark *names* for export into the environment of child processes.

With a + instead of a -, the given attribute is disabled. With no variable names, all variables having the given attribute(s) are printed in a form that can be reread as input to the shell.

Examples

```
$ declare -i val       Make val an integer
    $ val=4+7          Evaluate value
    $ echo $val        Show result
    11

$ declare -r z=42         Make z read-only
    $ z=31             Try to assign to it
    bash: z: readonly variable     Assignment fails
    $ echo $z
    42

    $ declare -p val z        Show attributes and values
    declare -i val="11"
    declare -r z="42"
```

dirs

```
dirs [-clpv] [+n] [-n]
```

Bash only. Print the directory stack, which is managed with `pushd` and `popd`.

Options

+n

Print the *n*th entry from the left; first entry is zero.

-n

Print the *n*th entry from the right; first entry is zero.

-c

Remove all entries from (clear) the directory stack.

-l

Produce a longer listing, one that does not replace $HOME with ~.

`-p`

Print the directory stack, one entry per line.

`-v`

Print the directory stack, one entry per line, with each entry preceded by its index in the stack.

disown

```
disown [-ahr] [job ...]
```

Bash version. Remove *job* from the list of jobs managed by Bash.

Options

`-a`

Remove all jobs. With `-h`, mark all jobs.

`-h`

Instead of removing jobs from the list of known jobs, mark them to*not* receive SIGHUP when Bash exits.

`-r`

With no jobs, remove (or mark) only running jobs.

disown

```
disown [job ...]
```

ksh93 version. When a login shell exits, do not send aSIGHUP to the given jobs. If no jobs are listed, no background jobs will receiveSIGHUP.

do

do

Reserved word that precedes the command sequence in a for, while, until, or select statement.

done

done

Reserved word that ends a for, while, until, or select statement.

echo

```
echo [-eEn] [string]
```

Bash version, built into the shell. Write *string* to standard output. (See also echo in Chapter 3.)

Options

-e

Enable interpretation of the following escape sequences, which must be quoted (or escaped with a \) to prevent interpretation by the shell:

\a

Alert (ASCII BEL).

\b

Backspace.

\c

Suppress the terminating newline (same as -n).

\e

ASCII Escape character.

\f

Formfeed.

\n

Newline.

\r

Carriage return.

\t

Tab character.

\v

Vertical-tab character.

\\

Backslash.

\0*nnn*

ASCII character represented by octal number *nnn*, where *nnn* is zero, one, two, or three digits and is preceded by a 0.

nnn

ASCII character represented by octal number *nnn*, where *nnn* is one, two, or three digits.

\x*HH*

ASCII character represented by hexadecimal number *HH*, where *HH* is one or two hexadecimal digits.

-E

Do not interpret escape sequences, even on systems where the default behavior of the built-in `echo` is to interpret them.

-n

Do not print the terminating newline.

Examples

```
$ echo "testing printer" | lp
$ echo "Warning: ringing bell \a"
```

echo

```
echo [-n] [string]
```

Korn shell version. Write *string* to standard output; if `-n` is specified, the output is not terminated by a newline. If no *string* is supplied, echo a newline.

The Korn shell's `echo`, even though it is built into the shell, emulates the system's version of `echo`. Thus, if the version found by a path search supports `-n`, the built-in version does, too. Similarly, if the external version supports the escape sequences described below, the built-in version does, too; otherwise it does not.[*] (See also `echo` in Chapter 3.) `echo` understands special escape characters, which must be quoted (or escaped with a \) to prevent interpretation by the shell:

[*] The situation with **echo** is a mess; consider using **printf** instead.

\a

Alert (ASCII BEL).

\b

Backspace.

\c

Suppress the terminating newline (same as -n).

\f

Formfeed.

\n

Newline.

\r

Carriage return.

\t

Tab character.

\v

Vertical-tab character.

\\

Backslash.

\0*nnn*

ASCII character represented by octal number *nnn*, where *nnn* is one, two, or three digits and is preceded by a 0.

enable

```
enable [-adnps] [-f file] [command ...]
```

Bash only. Enable or disable shell built-in commands. Disabling a built-in lets you use an external

version of a command that would otherwise use a built-in version, such asecho or test.

Options

-a

For use with -p, print information about all built-in commands, disabled and enabled.

-d

Remove (delete) a built-in previously loaded with-f.

-f *file*

Load a new built-in command *command* from the shared library file *file*.

-n

Disable the named built-in commands.

-p

Print a list of enabled built-in commands.

-s

Print only the POSIX special built-in commands. When combined with-f, the new built-in command becomes a POSIX special built-in.

esac

```
esac
```

Reserved word that ends a case statement.

eval

```
eval args
```

Typically, eval is used in shell scripts, and *args* is a line of code that contains shell variables. eval forces variable expansion to happen first and then runs the resulting command. This "double-scanning" is useful any time shell variables contain input/output redirection symbols, aliases, or othe shell variables. (For example, redirection normally happens before variable expansion, so a variable containing redirection symbols must be expanded first using eval; otherwise, the redirection symbols remain uninterpreted.)

Example

This fragment of a shell script shows how eval constructs a command that is interpreted in the right order:

```
for option
do
    case "$option" in   Define where output goes
       save) out=' > $newfile' ;;
       show) out=' | more' ;;
    esac
 done

 eval sort $file $out
```

exec

```
exec [command args ...]
exec [-a name] [-cl] [command args ... ]
```

Execute *command* in place of the current process (instead of creating a new process). exec is also useful for opening, closing, or copying file descriptors. The second form is forksh93 and Bash.

Options

-a

Use *name* for the value of argv[0].

`-c`

Clear the environment before executing the program.

`-l`

Place a minus sign at the front of `argv[0]`, just as *login*(1) does. Bash only.

Examples

```
trap 'exec 2>&-' 0          Close standard error when
                            shell script exits (signal 0)

$ exec /bin/csh       Replace shell with C shell
$ exec < infile        Reassign standard input to infile
```

exit

```
exit [n]
```

Exit a shell script with status *n* (e.g., `exit 1`). *n* can be 0 (success) or nonzero (failure). If *n* is not given, exit status is that of the most recent command. `exit` can be issued at the command line to close a window (log out). Exit statuses can range in value from 0 to 255.

Example

```
if [ $# -eq 0 ]
then
   echo "Usage: $0 [-c] [-d] file(s)" 1>&2
   exit 1                  # Error status
fi
```

export

```
export [variables]
export [name=[value] ...]
export -p
export [-fn] [name=[value] ...]
```

Pass (export) the value of one or more shell *variables*, giving global meaning to the variables (which are local by default). For example, a variable defined in one shell script must be exported if its value is used in other programs called by the script. If no *variables* are given, `export` lists the variables exported by the current shell. The second form is the POSIX version, which is similar to the first form, except that you can set a variable *name* to a *value* before exporting it. The third form is not available in `ksh88`. The fourth form is specific to Bash.

Options

`-f`

Names refer to functions; the functions are exported in the environment. Bash only.

`-n`

Remove the named variables or functions from the environment. Bash only.

`-p`

Print `export` before printing the names and values of exported variables. This allows saving a list of exported variables for rereading later.

Example

In the original Bourne shell, you would type:

```
TERM=vt100
export TERM
```

In Bash and the Korn shell, you could type this instead:

```
export TERM=vt100
```

false

```
false
```

ksh88 alias for let 0. Built-in command in Bash and ksh93 that exits with a false return value.

fc

```
fc [options] [first [last]]
fc -e - [old=new] [command]
fc -s [old=new] [command]
```

ksh88 and Bash. Display or edit commands in the history list. (Use only one of -e, -l or -s.) *first* and *last* are numbers or strings specifying the range of commands to display or edit. If *last* is omitted, fc applies to a single command (specified by *first*). If both *first* and *last* are omitted, fc edits the previous command or lists the last 16. The second form of fc takes a history *command*, replaces *old* with *new*, and executes the modified command. If no strings are specified, *command* is just reexecuted. If no *command* is given either, the previous command is reexecuted. *command* is a number or string like *first*. See the examples in the earlier section Command History." The third form, available in Bash and ksh93, is equivalent to the second form.

Options

-e [*editor*]

Invoke *editor* to edit the specified history commands. The default *editor* is set by the shell variable FCEDIT. If that variable is not set, the default is */bin/ed*. (Bash defaults to vi; Version 3.1 and newer will default to */bin/ed* when in POSIX mode.) Bash tries FCEDIT, then EDITOR, and then */bin/ed*.

-e -

Execute (or redo) a history command; refer to second syntax line above.

-l

List the specified command or range of commands, or list the last 16.

-n

Suppress command numbering from the -l listing.

-r

Reverse the order of the -l listing.

-s

Equivalent to -e -. Not in ksh88.

fc

```
fc
```

ksh93 alias for hist.

fg

```
fg [jobIDs]
```

Bring current job or *jobIDs* to the foreground. See the earlier section Job Control."

fi

```
fi
```

Reserved word that ends an if statement. (Don't forget to use it!)

for

```
for x [in list]
do
 commands
done
```

For variable *x* (in optional *list* of values) do *commands*. If in *list* is omitted, "$@" (the positional parameters) is assumed.

Examples

Paginate files specified on the command line; save each result:

```
for file; do
     pr $file > $file.tmp
done
```

Search chapters for a list of words (like `fgrep -f`):

```
for item in `cat program_list`
do
     echo "Checking chapters for"
     echo "references to program $item..."
     grep -c "$item.[co]" chap*
done
```

Extract a one-word title from each file and use as new filename:

```
for file
do
     name=`sed -n 's/NAME: //p' $file`
     mv $file $name
done
```

for

```
for ((init; cond; incr))
do
 commands
done
```

Bash and ksh93. Arithmetic for loop, similar to C's. Evaluate *init*. While *cond* is true, execute the body of the loop. Evaluate *incr* before retesting *cond*. Any one of the expressions may be omitted; a missing *cond* is treated as being true.

Examples

Search for a phrase in each odd chapter:

```
for ((x=1; x <= 20; x += 2))
do
        grep $1 chap$x
done
```

function

```
function name { commands; }
function name (  ) { commands; }
```

Define *name* as a shell function. See the description of semantic issues in the earlier section Functions." The first form is for the Korn shell, although it may also be used with Bash. The second form is specific to Bash. Bash does not give different semantics to functions declared differently; all Bash functions behave the same way.

Example

Define a function to count files:

```
$ function fcount {
>     ls | wc -l
> }
```

functions

```
functions
```

Korn shell alias for `typeset -f`. (Note the "s" in the name; `function` is a Korn shell keyword.) See `typeset` later in this listing.

getconf

```
getconf [name [path]]
```

ksh93 only. Retrieve the values for parameters that can vary across systems. *name* is the parameter to retrieve; *path* is a filename to test for parameters that can vary on different filesystem types.

The parameters are defined by the POSIX 1003.1 standard. See the entry for `getconf` in Chapter 3.

Example

Print the maximum value that can be held in a `C int`:

```
$ getconf INT_MAX
2147483647
```

getopts

```
getopts [-a name] string name [args]
```

Process command-line arguments (or *args*, if specified) and check for legal options. `getopts` is used in shell-script loops and is intended to ensure standard syntax for command-line options. Standard syntax dictates that command-line options begin with a `-`. Options can be stacked: i.e., consecutive letters can follow a single `-`. End processing of options by specifying `--` on the command line. *string* contains the option letters to be recognized by `getopts` when running the shell script. Valid options

are processed in turn and stored in the shell variable *name*. If an option is followed by a colon, the option must be followed by one or more arguments. (Multiple arguments must be given to the command as one shell *word*. This is done by quoting the arguments or separating them with commas. The application must be written to expect multiple arguments in this format.)getopts uses the shell variables OPTARG and OPTIND. The Bash version also uses OPTERR.

Option

-a

Use *name* in error messages about invalid options. ksh93 only.

hash

```
hash [-dlrt] [-p file] [commands]
```

Bash version. As the shell finds commands along the search path ($PATH), it remembers the found location in an internal hash table. The next time you enter a command, the shell uses the value stored in its hash table.

With no arguments, hash lists the current hashed commands. The display shows *hits* (the number of times the command is called by the shell) and the command name.

With *commands*, the shell adds those commands to the hash table.

Options

-d

Remove (delete) just the specified commands from the hash table.

-l

Produce output in a format that can be reread to rebuild the hash table.

-p *file*

Associate *file* with *command* in the hash table.

-r

Remove all commands from the hash table.

-t

With one name, print the full pathname of the command. With more than one name, print the name and the full path, in two columns.

Besides the -r option, the hash table is also cleared when PATH is assigned. UsePATH=$PATH to clear the hash table without affecting your search path. This is most useful if you have installed a new version of a command in a directory that is earlier in $PATH than the current version of the command.

hash

```
hash
```

Korn shell alias for alias -t (alias -t -- in ksh93). Approximates the Bourne shell's hash.

help

```
help [-s] [pattern]
```

Bash only. Print usage information on standard output for each command that matches*pattern*. The information includes descriptions of each command's options. With the-s option, print only brief usage information.

Examples

```
$ help -s cd          Short help
cd: cd [-L|-P] [dir]

$ help true           Full help
true: true
    Return a successful result.
```

hist

```
hist [options] [first [last]]
hist -s [old=new] [command]
```

ksh93 only. Display or edit commands in the history list. (Use only one of-l or -s.) *first* and *last* are numbers or strings specifying the range of commands to display or edit. If*last* is omitted, hist applies to a single command (specified by*first*). If both *first* and *last* are omitted, hist edits the previous command or lists the last 16. The second form ofhist takes a history *command*, replaces *old* with *new*, and executes the modified command. If no strings are specified,*command* is just reexecuted. If no *command* is given either, the previous command is reexecuted.*command* is a number or string like *first*. See the examples in the earlier sectionCommand History."

Options

-e [*editor*]

Invoke *editor* to edit the specified history commands. The default*editor* is set by the shell variable HISTEDIT. If that variable is not set, FCEDIT is used. If neither is set, the default is */bin/ed*.

-l

List the specified command or range of commands, or list the last 16.

-n

Suppress command numbering from the -l listing.

-N *n*

Start with the command *n* commands before the current one.

-r

Reverse the order of the -l listing.

-s

Execute (or redo) a history command; refer to second syntax line above.

history

```
history [count]
history [options]
```

Bash version. Print commands in the history list or manage the history file. With no options or arguments, display the history list with command numbers. With a*count* argument, print only that many of the most recent commands.

Options

`-a`

Append new history lines (those executed since the beginning of the session) to the history file

`-c`

Clear the history list (remove all entries).

`-d` *position*

Delete the history item at position *position*.

`-n`

Read unread history lines from the history file into the history list.

`-p` *argument ...*

Perform csh-style history expansion on each *argument*, printing the results to standard output. The results are not saved in the history list.

`-r`

Read the history file and replace the history list with its contents.

`-s` *argument ...*

Store the *arguments* in the history list, as a single entry.

`-w`

Write the current history list to the history file, overwriting it entirely.

history

```
history
```

ksh88 alias for fc -l. ksh93 alias for hist -l. Show the last 16 commands.

if

```
if condition1then commands1
[ elif condition2 then commands2 ]
 .
 .
 .
[ else commands3 ]
fi
```

If *condition1* is met, do *commands1*; otherwise, if *condition2* is met, do *commands2* ; if neither is met, do *commands3*. Conditions are often specified with the`test` and `[[ ]]` commands. See test and `[[ ]]` for a full list of conditions, and see additional Examples under : andexit.

Examples

Insert a 0 before numbers less than 10:

```
if [ $counter -lt 10 ]
then number=0$counter
else number=$counter
fi
```

Make a directory if it doesn't exist:

```
if [ ! -d $dir ]; then
   mkdir $dir
   chmod 775 $dir
fi
```

integer

```
integer
```

Korn shell alias for `typeset -i`. Specify integer variables.

jobs

```
jobs [options] [jobIDs]
```

List all running or stopped jobs, or list those specified by*jobIDs*. For example, you can check whether a long compilation or text format is still running. Also useful before logging out. See the earlier section Job Control."

Options

-l

List job IDs and process group IDs.

-n

List only jobs whose status changed since last notification.

-p

List process group IDs only.

-r

List running jobs only. Bash only.

-x *cmd*

Replace each job ID found in *cmd* with the associated process ID and then execute *cmd*. Bash only.

kill

```
kill [options] IDs
```

Terminate each specified process *ID* or job *ID*. You must own the process or be a privileged user. This built-in command is similar to */usr/bin/kill*, described in Chapter 3. See the earlier section Job Control."

Options

-l

List the signal names. (Used by itself.)

-n *num*

Send the given signal number. Not ksh88.

-s *name*

Send the given signal name. Not ksh88.

-*signal*

The signal number (from */usr/include/sys/signal.h*) or name (from kill -l). With a signal number of 9, the kill is absolute.

Signals

Signals are defined in */usr/include/sys/signal.h* and are listed here without the SIG prefix. The correspondence between signal name and signal number shown in the following table is correct for Linux; many are different on other Unix-style operating systems.

Name	Number	Description
HUP	1	Hangup
INT	2	Interrupt (usually invoked by user through Ctrl-C)
QUIT	3	Quit
ILL	4	Illegal instruction
TRAP	5	Trace trap
ABRT	6	Abort
IOT	6	IOT trap
BUS	7	Bus error (a type of illegal address access)
FPE	8	Floating-point exception (example: division by 0)
KILL	9	Kill, unblockable (often used with INT fails to terminate process)
USR1	10	User-defined signal 1
SEGV	11	Segmentation violation (a type of illegal address access)
USR2	12	User-defined signal 2
PIPE	13	Broken pipe (generated when process on one side of pipe is aborted)
ALRM	14	Alarm clock (used for delivering timed alerts from a program)
TERM	15	Termination
STKFLT	16	Stack fault (a type of illegal address access)
CLD or CHLD	17	Child status has changed
CONT	18	Continue (issued after STOP or TSTP)
STOP	19	Stop, unblockable
TSTP	20	Stop (issued at terminal, usually through Ctrl-Z)
TTIN	21	Attempt to read from terminal while in background
TTOU	22	Unsuccessful attempt to write to terminal while in background
URG	23	Urgent condition on socket
XCPU	24	CPU usage limit exceeded
XFSZ	25	File size limit exceeded
VTALRM	26	Virtual alarm clock
PROF	27	Profiling alarm clock

Name	Number	Description
WINCH	28	Window size change
IO or POLL	29	Ready for I/O (used in applications for interrupts)
PWR	30	Power failure restart
SYS	31	Bad system call

let

```
let expressions or
((expressions))
```

Perform arithmetic as specified by one or more *expressions*. *expressions* consist of numbers, operators, and shell variables (which don't need a preceding $). Expressions must be quoted if they contain spaces or other special characters. The (( )) form does the quoting for you. For more information and examples, see "Arithmetic Expressions," earlier in this chapter. See also expr in Chapter 3.

Examples

Each of these examples adds 1 to variable i:

```
i=`expr $i + 1`          All Bourne shells
let i=i+1          Bash, ksh
let "i = i + 1"
(( i = i + 1 ))
(( i += 1 ))
(( i++ ))          Bash, ksh93
```

local

```
local [options] [name[=value]]
```

Bash only. Declares local variables for use inside functions. The *options* are the same as those accepted by declare; see declare for the full list. It is an error to use local outside a function body.

login

```
login [user]
```

Korn shell only. The shell does an *execve*(2) of the standard `login` program, allowing you to replace one login session with another, without having to logout first.

logout

```
logout
```

Bash only. Exit a login shell. The command fails if the current shell is not a login shell.

name ( )

```
name (  ) { commands; }
```

Define *name* as a function. POSIX syntax. The function definition can be written on one line or across many. Bash and the Korn shell provide the `function` keyword, alternate forms that work similarly. See the Functions section, earlier in the chapter.

Example

```
$ count (  ) {
> ls | wc -l
> }
```

When issued at the command line, `count` now displays the number of files in the current directory.

nameref

```
nameref newvar=oldvar ...
```

ksh93 alias for typeset -n. See the discussion of indirect variables in the Variables section, earlier in this chapter.

nohup

```
nohup command [arguments] &
```

Don't terminate a command after logout. nohup is a Korn shell alias:

```
nohup='nohup '
```

The embedded space at the end lets nohup interpret the following command as an alias, if needed.

popd

```
popd [-n] [+count] [-count]
```

Bash only. Pop the top directory off the directory stack (as shown by the dirs command), and change to the new top directory, or manage the directory stack.

Options

-n

Don't change to the new top directory; just manipulate the stack.

+count

Remove the item *count* entries from the left, as shown by dirs. Counting starts at zero. No directory change occurs.

-count

Remove the item *count* entries from the right, as shown by dirs. Counting starts at zero. No directory change occurs.

print

```
print [options] [string ...]
```

Korn shell only. Display *string* (on standard output by default). print includes the functions of echo and can be used in its place on most Unix systems.

Options

-

Ignore all subsequent options.

--

Same as -.

-e

Interpret escape sequences in argument strings. (This is the default, anyway.) Use it to undo an earlier -r in the same command line. ksh93 only.

-f *format*

Print like printf, using *format* as the format string. Ignores the -n, -r, and -R options. ksh93 only.

-n

Don't end output with a newline.

`-p`

Send *string* to the process created by `|&`, instead of to standard output.

`-r`

Ignore the escape sequences often used with `echo`.

`-R`

Same as `-r` and ignore subsequent options (except `-n`).

`-s`

Send *string* to the history file.

`-u[`*n*`]`

Send *string* to file descriptor *n* (default is 1).

printf

```
printf format [val ...]
```

Not ksh88. Formatted printing, like the ANSI C `printf` function.

Additional Format Letters

Both Bash and ksh93 accept additional format letters. Bash provides only `%b` and `%q`, while ksh93 provides all those in the following list:

`%b`

Expand escape sequences in strings (e.g., `\t` to tab, and so on).

`%B`

The corresponding argument is a variable name (typically created via `typeset -b`); its value is retrieved and printed.

%d

An additional period and the output base can follow the precision (e.g., %5.3.6d to produce output in base 6).

%H

Output strings in HTML/XML format. (Spaces become   and < and > become < and >.)

%n

Place the number of characters printed so far into the named variable.

%P

Translate egrep extended regular expression into ksh pattern.

%q

Print a quoted string that can be reread later on.

%R

Reverse of %P: translate ksh pattern into egrep extended regular expression.

%(*format*)T

Print a string representing a date and time according to the*strftime*(3) format *format*. The parentheses are entered literally. See the Examples.

%Z

Print an ASCII NUL (8 zero bits).

Examples

```
$ date                  Reformat date/time
Tue Sep  7 15:39:42 EDT 2004
$ printf "%(It is now %m/%d/%Y %H:%M:%S)T\n" "$(date)"
It is now 09/07/2004 15:40:10
```

```
$ printf "%H\n" "Here is a <string>"      Convert to HTML
Here is a &lt;string&gt;
```

pushd

```
pushd [-n] [directory]
pushd [-n] [+count] [-count]
```

Bash only. Add *directory* to the directory stack, or rotate the directory stack. With no arguments, swap the top two entries on the stack, and change to the new top entry.

Options

-n

Don't change to the new top directory, just manipulate the stack.

+*count*

Rotate the stack so that the *count*'th item from the left, as shown by dirs, is the new top of the stack. Counting starts at zero. The new top becomes the current directory.

-*count*

Rotate the stack so that the *count*'th item from the left, as shown by dirs, is the new top of the stack. Counting starts at zero. The new top becomes the current directory.

pwd

```
pwd [-LP]
```

Print your present working directory on standard output.

Options

Options give control over the use of logical versus physical treatment of the printed path. See also the entry for cd, earlier in this section.

-L

Use logical path (what the user typed, including any symbolic links) and the value of PWD for the current directory. This is the default.

-P

Use the actual filesystem physical path for the current directory.

r

r

ksh88 alias for fc -e -. ksh93 alias for hist -s. Reexecute previous command.

read

read [*options*] [*variable1*[*?string*]] [*variable2* ...]

Read one line of standard input and assign each word to the corresponding*variable*, with all leftover words assigned to the last variable. If only one variable is specified, the entire line is assigned to that variable. See the Examples here and under case. The return status is 0 unless *EOF* is reached. Both Bash and the Korn shell support options, as shown below. If no variables are given, input is stored in the REPLY variable.

Additionally, the Korn shell version supports the? syntax for prompting. If the first variable is followed by ?*string*, *string* is displayed as a user prompt.

Options

-a *array*

Read into indexed array *array*. Bash only.

-A *array*

Read into indexed array *array*. ksh93 only.

-d *delim*

Read up to first occurrence of *delim*, instead of newline. Not ksh88.

-e

Use the *readline* library if reading from a terminal. Bash only.

-n *count*

Read at most *count* bytes. Not ksh88.

-p *prompt*

Bash: print *prompt* before reading input.

-p

Korn shell: read from the output of a |& coprocess.

-r

Raw mode; ignore \ as a line-continuation character.

-s

Bash: read silently; characters are not echoed.

-s

Korn shell: save input as a command in the history file.

-t *timeout*

When reading from a terminal or pipe, if no data is entered after*timeout* seconds, return 1. This prevents an application from hanging forever, waiting for user input. Notksh88.

-u[*n*]

Read input from file descriptor *n* (default is 0).

Examples

Read three variables:

```
$ read first last address
Sarah Caldwell 123 Main Street

$ echo "$last, $first\n$address"
Caldwell, Sarah
123 Main Street
```

Prompt yourself to enter two temperatures, Korn shell version:

```
$ read n1?"High low: " n2
High low: 65 33
```

readonly

```
readonly [-afp] [variable[=value] ...]
```

Prevent the specified shell variables from being assigned new values. An initial value may be supplied using the assignment syntax, but that value may not be changed subsequently.

Options

ksh88 does not accept options for this command.

-a

Each *variable* must refer to an array. Bash only.

-f

Each *variable* must refer to an function. Bash only.

`-p`

Print `readonly` before printing the names and values of read-only variables. This allows saving a list of read-only variables for rereading later.

redirect

```
redirect i/o-redirection ...
```

ksh93 alias for `command exec`.

Example

Change the shell's standard error to the console:

```
$ redirect 2>/dev/console
```

return

```
return [n]
```

Use inside a function definition. Exit the function with status*n* or with the exit status of the previously executed command.

select

```
select x [in list]
do
 commandsdone
```

Display a list of menu items on standard error, numbered in the order they are specified in*list*. If no in *list* is given, items are taken from the command line (via "$@"). Following the menu is a prompt string (set by PS3). At the PS3 prompt, users select a menu item by typing its line number, or they redisplay the menu by pressing the Enter key. User input is stored in the shell variable REPLY. If a valid item number is typed, *commands* are executed. Typing EOF terminates the loop.

Example

```
PS3="Select the item number: "
select event in Format Page View Exit
do
   case "$event" in
     Format) nroff $file | lp;;
     Page)   pr $file | lp;;
     View)   more $file;;
     Exit)   exit 0;;
     *   )   echo "Invalid selection";;
   esac
done
```

The output of this script looks like this:

```
1. Format
2. Page
3. View
4. Exit
Select the item number:
```

set

```
set [options arg1 arg2 ...]
```

With no arguments, set prints the values of all variables known to the current shell. Options can be enabled (-*option*) or disabled (+*option*). Options can also be set when the shell is invoked. (See the earlier section Invoking the Shell.") Arguments are assigned in order to $1, $2, etc.

Options

There is a large set of overlapping options among ksh88, ksh93 and Bash. To minimize confusion, the following list includes every option. The table provided after the list summarizes which options ar available in which shells.

-a

From now on, automatically mark variables for export after defining or changing them.

+A *name*

Assign remaining arguments as elements of array *name*. Korn shell only.

-A *name*

Same as +A, but unset *name* before making assignments. Korn shell only.

-b

Print job completion messages as soon as jobs terminate; don't wait until the next prompt. Not ksh88.

-B

Enable brace expansion. On by default. Bash only.

-C

Prevent overwriting via > redirection; use >| to overwrite files. Not ksh88.

-e

Exit if a command yields a nonzero exit status. TheERR trap executes before the shell exits.

-E

Cause shell functions, command substitutions, and subshells to inherit theERR trap. Bash only.

-f

Ignore filename metacharacters (e.g., * ? [ ]).

-G

Cause ** to also match subdirectories during filename expansion. ksh93 only.

-h

Locate commands as they are defined. The Korn shell creates tracked aliases, whereas Bash hashes command names. On by default. See hash.

-H

Enable csh-style history substitution. On by default. Bash only.

-k

Assignment of environment variables (*var*=*value*) takes effect regardless of where they appear on the command line. Normally, assignments must precede the command name.

-m

Enable job control; background jobs execute in a separate process group. -m is usually set automatically.

-n

Read commands but don't execute; useful for checking syntax. Both shells ignore this option if is interactive.

+o [*mode*]

With *mode*, disable the given shell option. Plain set +o prints the settings of all the current options. For Bash and ksh93, this is in a form that can be reread by the shell later.

-o [*mode*]

List shell modes, or turn on mode *mode*. Many modes can be set by other options. Modes are:

allexport

Same as -a.

bgnice

Run background jobs at lower priority. Korn shell only.

braceexpand

Same as -B. Bash only.

emacs

Set command-line editor to emacs.

errexit

Same as -e.

errtrace

Same as -E. Bash only.

functrace

Same as -T. Bash only.

globstar

Same as -G. ksh93 only.

gmacs

Set command-line editor to gmacs (like GNU Emacs). Korn shell only.

hashall

Same as -h. Bash only.

histexpand

Same as -H. Bash only.

history

Enable command history. On by default. Bash only.

ignoreeof

Don't process *EOF* signals. To exit the shell, type exit.

keyword

Same as -k.

markdirs

Append / to directory names. Korn shell only.

monitor

Same as -m.

noclobber

Same as -C.

noexec

Same as -n.

noglob

Same as -f.

nolog

Omit function definitions from history file. Accepted but ignored by Bash.

notify

Same as -b.

nounset

Same as -u.

onecmd

Same as -t. Bash only.

physical

Same as -P. Bash only.

pipefail

Change pipeline exit status to be that of the rightmost command that failed, or zero if all exited successfully. Not ksh88.

posix

Change to POSIX mode. Bash only.

privileged

Same as -p.

trackall

Same as -h. Korn shell only.

verbose

Same as -v.

vi

Set command-line editor to vi.

viraw

Same as vi, but process each character when it's typed. Korn shell only.

xtrace

Same as -x.

+p

Reset effective UID to real UID.

-p

Start up as a privileged user. Bash: Don't read $ENV or $BASH_ENV, don't import functions from the environment, and ignore the value of $SHELLOPTS. Korn shell: Don't process *$HOME/.profile*, read */etc/suid_profile* instead of $ENV.

-P

Always use physical paths for `cd` and `pwd`. Bash only.

`-s`

Sort the positional parameters. Korn shell only.

`-t`

Exit after one command is executed.

`-T`

Cause shell functions, command substitutions, and subshells to inherit the`DEBUG` trap. Bash only.

`-u`

In substitutions, treat unset variables as errors.

`-v`

Show each shell command line when read.

`-x`

Show commands and arguments when executed, preceded by the value of `PS4`. This provides step-by-step tracing of shell scripts.

`-`

Turn off `-v` and `-x`, and turn off option processing. Included for compatibility with older versions of the Bourne shell.

`--`

Used as the last option; `--` turns off option processing so that arguments beginning with `-` are not misinterpreted as options. (For example, you can set `$1` to `-1`.) If no arguments are given after `--`, unset the positional parameters.

Option Availability Summary

Option	Same as	ksh88	ksh93	Bash
-a	-o allexport	.	.	.

Option	Same as	ksh88	ksh93	Bash
-A		.	.	
-b	-o notify		.	.
-B	-o braceexpand			.
-C	-o noclobber		.	.
-e	-o errexit	.	.	.
-E	-o errtrace			.
-f	-o noglob	.	.	.
-G	-o globstar		.	
-h	-o hashall			.
-h	-o trackall	.	.	
-H	-o histexpand			.
-k	-o keyword	.	.	.
-m	-o monitor	.	.	.
-n	-o noexec	.	.	.
-o allexport	-a	.	.	.
-o bgnice		.	.	
-o braceexpand	-B			.
-o emacs		.	.	.
-o errexit	-e	.	.	.
-o errtrace	-E			.
-o functrace	-T			.
-o globstar	-G		.	
-o gmacs		.	.	
-o hashall	-h			.
-o history				.
-o histexpand	-H			.
-o ignoreeof		.	.	.
-o keyword	-k	.	.	.
-o markdirs		.	.	

Option	Same as	ksh88	ksh93	Bash
-o monitor	-m	.	.	.
-o noclobber	-C	.	.	.
-o noexec	-n	.	.	.
-o noglob	-f	.	.	.
-o nolog		.	.	
-o notify	-b		.	.
-o nounset	-u			.
-o onecmd	-t			.
-o physical	-P			.
-o pipefail			.	.
-o posix				.
-o privileged	-p	.	.	.
-o trackall	-h	.	.	
-o verbose	-v	.	.	.
-o vi		.	.	.
-o viraw		.	.	
-o xtrace	-x	.	.	.
-p	-o privileged	.	.	.
-P	-o physical			.
-s		.	.	
-t	-o onecmd	.	.	.
-T	-o functrace			.
-u	-o nonunset	.	.	.
-v	-o verbose	.	.	.
-x	-o xtrace	.	.	.

Examples

```
set -- "$num" -20 -30   Set $1 to $num, $2 to -20, $3 to -30
set -vx                 Read each command line; show it;
```

```
                        execute it; show it again (with arguments)
set +x                  Stop command tracing
set -o noclobber        Prevent file overwriting
set +o noclobber        Allow file overwriting again
```

shopt

```
shopt [-opqsu] [option]
```

Bash only. Sets or unsets shell options. With no options or just `-p`, prints the names and settings of the options.

Options

`-o`

Each *option* must be one of the shell option names for `set -o`, instead of the options listed in the next section.

`-p`

Print the option settings as `shopt` commands that can be reread later.

`-q`

Quiet mode. The exit status is zero if the given option is set, nonzero otherwise. With multiple options, all of them must be set for a zero exit status.

`-s`

Set the given *options*. With no *options*, prints only those that are set.

`-u`

Unset the given *options*. With no *options*, prints only those that are unset.

Settable Shell Options

The following descriptions describe the behavior when set. Options marked with a dagger (|) are enabled by default.

cdable_vars

Treat a nondirectory argument to cd as a variable whose value is the directory to go to.

cdspell

Attempt spelling correction on each directory component of an argument tocd. Allowed in interactive shells only.

checkhash

Check that commands found in the hash table still exist before attempting to use them. If not, perform a normal PATH search.

checkwinsize

Check the window size after each command and update LINES and COLUMNS if the size has changed.

cmdhist |

Save all lines of a multiline command in one history entry. This permits easy re-editing of multiline commands.

dotglob

Include filenames starting with a period in the results of filename expansion.

execfail

Do not exit a noninteractive shell if the command given toexec cannot be executed. Interactive shells do not exit in such a case, no matter the setting of this option.

expand_aliases |

Expand aliases created with alias. Disabled in noninteractive shells.

extdebug

Enable behavior needed for debuggers:

- declare -F displays the source file name and line number for each function name argument.
- When a command run by the DEBUG trap fails, the next command is skipped.
- When a command run by the DEBUG trap inside a shell function or script sourced with . (dot) or source returns with an exit status of 2, the shell simulates a call to return.
- BASH_ARGC and BASH_ARGV are set as described earlier.
- Function tracing is enabled. Command substitutions, shell functions, and subshells invoked via (...) inherit the DEBUG and RETURN traps.
- Error tracing is enabled. Command substitutions, shell functions, and subshells invoked via (...) inherit the ERROR trap.

extglob

Enable extended pattern-matching facilities such as +(...). (These were not in the Bourne shell and are not in POSIX; thus Bash requires you to enable them if you want them.)

extquote |

Allow $'...' and $"..." within ${*variable*} expansions inside double quotes.

failglob

Cause patterns that do not match filenames to produce an error.

force_fignore |

When doing completion, ignore words matching the list of suffixes in FIGNORE, even if such words are the only possible completions.

gnu_errfmt

Print error messages in the standard GNU format.

histappend

Append the history list to the file named by HISTFILE upon exit, instead of overwriting the file.

histreedit

Allow a user to re-edit a failed csh-style history substitution with the *readline* library.

histverify

Place the results of csh-style history substitution into the *readline* library's editing buffer, in case the user wishes to modify it further, instead of executing it directly.

hostcomplete |

If using *readline*, attempt hostname completion when a word containing an@ is being completed.

huponexit

Send a SIGHUP to all running jobs upon exiting an interactive shell.

interactive_comments |

Allow words beginning with # to start a comment in an interactive shell.

lithist

If cmdhist is also set, save mutliline commands to the history file with newlines instead of semicolons.

login_shell

Set by the shell when it is a login shell. This is a read-only option.

mailwarn

Print the message "The mail in *mailfile* has been read" when a file being checked for mail has been accessed since the last time Bash checked it.

no_empty_cmd_completion

If using *readline*, do *not* search $PATH when a completion is attempted on an empty line.

nocaseglob

Ignore letter case when doing filename matching.

nullglob

Expand patterns that do not match any files to the null string, instead of using the literal pattern as an argument.

progcomp |

Enable programmable completion.

promptvars |

Perform variable, command, and arithmetic substitution on the values of PS1, PS2 and PS4.

restricted_shell

Set by the shell when it is a restricted shell. This is a read-only option.

shift_verbose

Causes shift to print an error message when the shift count is greater than the number of positional parameters.

sourcepath |

Causes the . (dot) and source commands to search $PATH in order to find the file to read and execute.

xpg_echo

Causes echo to expand escape sequences, even without the -e or -E options.

shift

```
shift [n]
```

Shift positional arguments (e.g., $2 becomes $1). If *n* is given, shift to the left *n* places. Used in while loops to iterate through command-line arguments. In the Korn shell, *n* can be an integer expression.

Examples

```
shift $1+$6          Korn shell: use expression result as shift count
shift $(($1 + $6))   Same, portable to any POSIX shell
```

sleep

```
sleep [n]
```

ksh93 only. Sleep for *n* seconds. *n* can have a fractional part.

source

```
source file [arguments]
```

Bash only. Identical to the . (dot) command; see that entry.

stop

```
stop [jobIDs]
```

ksh88 alias for kill -STOP. ksh93 alias for kill -s STOP. Suspend the background job specified by *jobIDs*; this is the complement of Ctrl-Z or suspend. See the earlier section Job Control."

suspend

```
suspend [-f]
```

Suspend the current shell. Often used to stop an su command. In ksh88, suspend is an alias for kill -STOP $$. In ksh93, it is an alias for kill -s STOP $$. In Bash, it is a built-in command.

Options

-f

Force the suspension, even if the shell is a login shell. Bash only.

test

```
test condition or
[ condition ]
 or
[[ condition ]]
```

Evaluate a *condition* and, if its value is true, return a zero exit status; otherwise, return a nonzero exit status. An alternate form of the command uses [] rather than the word test. An additional alternate form uses [[]], in which case word splitting and pathname expansion are not done. (See the [[ ]] entry.) *condition* is constructed using the following expressions. Conditions are true if the description holds true. Features that are specific to Bash are marked with a (B). Features that are specific to the Korn shell are marked with a (K). Features that are specific to ksh93 are marked with a (K93).

File Conditions

-a *file*

file exists.

-b *file*

file exists and is a block special file.

-c *file*

file exists and is a character special file.

-C *file*

file exists and is a contiguous file. This facility is not available on most Unix systems. (K)

-d *file*

file exists and is a directory.

-f *file*

file exists and is a regular file.

-g *file*

file exists, and its set-group-id bit is set.

-G *file*

file exists, and its group is the effective group ID.

-h *file*

file exists and is a symbolic link.

-k *file*

file exists, and its sticky bit is set.

-L *file*

file exists and is a symbolic link.

-N *file*

file exists and was modified after it was last read. (B)

-O *file*

file exists, and its owner is the effective user ID.

-p *file*

file exists and is a named pipe (fifo).

-r *file*

file exists and is readable.

-s *file*

file exists and has a size greater than zero.

-S *file*

file exists and is a socket.

-t [*n*]

The open file descriptor *n* is associated with a terminal device; default *n* is 1.

-u *file*

file exists, and its set-user-id bit is set.

-w *file*

file exists and is writable.

-x *file*

file exists and is executable.

f1 -ef *f2*

Files *f1* and *f2* are linked (refer to same file).

f1 -nt *f2*

File *f1* is newer than *f2*.

f1 -ot *f2*

File *f1* is older than *f2*.

String conditions

string

string is not null.

-n *s1*

String *s1* has nonzero length.

`-z` *s1*

String *s1* has zero length.

s1 `=` *s2*

Strings *s1* and *s2* are identical. *s2* can be a wildcard pattern. Quote *s2* to treat it literally. (See the Filename Metacharacters section, earlier in this chapter.) (K)

s1 `= =` *s2*

Strings *s1* and *s2* are identical. *s2* can be a wildcard pattern. Quote *s2* to treat it literally. Preferred over `=`. (B, K93)

s1 `!=` *s2*

Strings *s1* and *s2* are *not* identical. *s2* can be a wildcard pattern. Quote *s2* to treat it literally.

s1 `=~` *s2*

String *s1* matches extended regular expression *s2*. Quote *s2* to keep the shell from expanding embedded shell metacharacters. Strings matched by parenthesized subexpressions are placed into elements of the BASH_REMATCH array. See the description of BASH_REMATCH earlier in this chapter. (B)

s1 `<` *s2*

ASCII value of *s1* precedes that of *s2*. (Valid only within `[[ ]]` construct.)

s1 `>` *s2*

ASCII value of *s1* follows that of *s2*. (Valid only within `[[ ]]` construct.)

Internal shell conditions

`-o` *opt*

Option *opt* for `set -o` is on.

Integer comparisons

n1 -eq *n2*

n1 equals *n2*.

n1 -ge *n2*

n1 is greater than or equal to *n2*.

n1 -gt *n2*

n1 is greater than *n2*.

n1 -le *n2*

n1 is less than or equal to *n2*.

n1 -lt *n2*

n1 is less than *n2*.

n1 -ne *n2*

n1 does not equal *n2*.

Combined forms

(*condition*)

True if *condition* is true (used for grouping). For test and [ ], the ( )s should be quoted by a \. The form using [[ ]] doesn't require quoting the parentheses.

! *condition*

True if *condition* is false.

condition1 -a *condition2*

True if both conditions are true.

condition1 && *condition2*

True if both conditions are true. (Valid only within [[ ]] construct.)

condition1 -o *condition2*

True if either condition is true.

condition1 || *condition2*

True if either condition is true. (Valid only within [[ ]] construct.)

Examples

The following examples show the first line of various statements that might use a test condition:

```
while test $# -gt 0              While there are arguments...
while [ -n "$1" ]          While there are nonempty arguments...
if [ $count -lt 10 ]     If $count is less than 10...
if [ -d RCS ]                    If the RCS directory exists...
if [ "$answer" != "y" ]          If the answer is not y...
if [ ! -r "$1" -o ! -f "$1" ]    If the first argument is not a
                                 readable file or a regular file...
```

time

```
time command
```

Execute *command* and print the total elapsed time, user time, and system time (in seconds). Same as the Unix command time (see Chapter 3), except that the built-in version can also time other built-in commands as well as all commands in a pipeline.

The second form applies to ksh93; with no *command*, the total user and system times for the shell and all children are printed.

times

```
times
```

Print accumulated process times for user and system.

times

```
times
```

ksh93 alias for { {time;} 2>&1;}. See also time.

trap

```
trap [ [commands] signals]
trap -p
trap -l
```

Execute *commands* if any *signals* are received. The second form is specific to Bash and ksh93; it prints the current trap settings in a form suitable for rereading later. The third form is specific to Bash; it lists all signals and their numbers, like kill -l.

Common signals include EXIT (0), HUP (1), INT (2), and TERM (15). Multiple commands must be quoted as a group and separated by semicolons internally. If *commands* is the null string (i.e., trap "" *signals*), *signals* are ignored by the shell. If *commands* are omitted entirely, reset processing of specified signals to the default action. Bash and ksh93: if *commands* is "-", reset *signals* to their initial defaults.

If both *commands* and *signals* are omitted, list current trap assignments. See the Examples here and in exec.

Signals

A list of signal names, numbers, and meanings were given earlier in the kill entry; see the listing there. The shells allow you to use either the signal number or the signal name (without the SIG prefix). In addition, the shells support "pseudo-signals," signal names or numbers that aren't real operating system signals but which direct the shell to perform a specific action. These signals are:

DEBUG

Execution of any command.

ERR

Nonzero exit status.

EXIT

Exit from shell (usually when shell script finishes).

0

Same as EXIT, for historical compatibility with the Bourne shell.

KEYBD

A key has been read in emacs, gmacs, or vi editing mode. ksh93 only.

RETURN

A return is executed, or a script run with . (dot) or source finishes. Bash only.

Examples

```
trap "" INT        Ignore interrupts (signal 2)
trap INT           Obey interrupts again
```

Remove a $tmp file when the shell program exits, or if the user logs out, pressesCtrl-C, or does a kill:

```
trap "rm -f $tmp; exit" EXIT HUP INT TERM       POSIX style
trap "rm -f $tmp; exit" 0 1 2 15    Pre-POSIX Bourne shell style
```

Print a "clean up" message when the shell program receives signalsSIGHUP, SIGINT, or SIGTERM:

```
trap 'echo Interrupt!  Cleaning up...' HUP INT TERM
```

true

```
true
```

ksh88 alias for :. Bash and ksh93 built-in command that exits with a true return value.

type

```
type [-afpPt] commands
```

Bash version. Show whether each command name is a Unix command, a built-in command, an alias, a shell keyword, or a defined shell function.

Options

-a

Print all locations in $PATH that include *command*, including aliases and functions. Use -p together with -a to suppress aliases and functions.

-f

Suppress function lookup, as with command.

-p

If type -t would print file for a given *command*, this option prints the full pathname for the executable files. Otherwise, it prints nothing.

-P

Like -p, but force a PATH search, even if type -t would not print file.

-t

Print a word describing each *command*. The word is one of alias, builtin, file, function, or keyword, depending upon the type of each *command*.

Example

```
$ type mv read if
mv is /bin/mv
read is a shell builtin
if is a shell keyword
```

type

```
type commands
```

Korn shell alias for `whence -v`.

typeset

```
typeset [options] [variable[=value ...]]
typeset -p
```

In Bash, identical to `declare`. See declare.

In the Korn shell, assign a type to each variable (along with an optional initial*value*), or, if no variables are supplied, display all variables of a particular type (as determined by the options). When variables are specified, -*option* enables the type, and +*option* disables it. With no variables, -*option* prints variable names and values; +*option* prints only the names.

The second form shown is specific to `ksh93`.

Options

-A *arr*

arr is an associative array. ksh93 only.

-b

The variable can hold any data, including binary data. References retrieve the value printed in base-64 notation; The %B format with printf may be used to print the value. ksh93 only.

-E *d*

variable is a floating-point number. *d* is the number of decimal places. The value is printed using printf %g format. ksh93 only.

-f[*c*]

The named variable is a function; no assignment is allowed. If no variable is given, list current function names. Flag *c* can be t, u, or x. t turns on tracing (same as set -x). u marks the function as undefined, which causes autoloading of the function (i.e., a search of FPATH locates the function when it's first used. ksh93 also searches PATH). In ksh88, x exports the function. In ksh93, x is accepted but does nothing. Note the aliases autoload and functions.

-F *d*

variable is a floating-point number. *d* is the number of decimal places. The value is printed using printf %f format. ksh93 only.

-H

On non-Unix systems, map Unix filenames to host filenames.

-i[*n*]

Define variables as integers of base *n*. integer is an alias for typeset -i.

-L[*n*]

Define variables as left-justified strings, *n* characters long (truncate or pad with blanks on the right as needed). Leading blanks are stripped; leading zeroes are stripped if -Z is also specified. If no *n* is supplied, field width is that of the variable's first assigned value.

-l

Convert uppercase to lowercase.

-n

variable is an indirect reference to another variable (a *nameref*). ksh93 only. (See the Variables," section, earlier in this chapter.)

-p

Print typeset commands to re-create the types of all the current variables. ksh93 only.

-R[*n*]

Define variables as right-justified strings, *n* characters long (truncate or pad with blanks on the left as needed). Trailing blanks are stripped. If no *n* is supplied, field width is that of the variable's first assigned value.

-r

Mark variables as read-only. See also readonly.

-t

Mark variables with a user-definable tag.

-u

Convert lowercase to uppercase.

-ui[*n*]

Define variables as unsigned integers of base *n*. ksh93 only.

-x

Mark variables for automatic export.

-Z[*n*]

When used with -L, strip leading zeroes. When used alone, it's similar to -R, except that -Z pads numeric values with zeroes and pads text values with blanks.

Examples

```
typeset                 List name, value, and type of all set variables
typeset -x              List names and values of exported variables
typeset +r PWD          End read-only status of PWD
typeset -i n1 n2 n3     Three variables are integers
typeset -R5 zipcode     zipcode is flush right, five characters wide
```

ulimit

```
ulimit [options] [n]
```

Print the value of one or more resource limits, or, if *n* is specified, set a resource limit to *n*. Resource limits can be either hard (-H) or soft (-S). By default, ulimit sets both limits or prints the soft limit. The options determine which resource is acted on.

Options

-H

Hard limit. Anyone can lower a hard limit; only privileged users can raise it.

-S

Soft limit. Must be lower than the hard limit.

-a

Print all limits.

-b

Size of socket buffers. ksh93 only.

-c

Maximum size of core files.

-d

Maximum kilobytes of data segment or heap.

-f

Maximum size of files (the default option).

-l

Maximum size of address space that can be locked in memory. Notksh88.

-L

Maximum number of file locks. ksh93 only.

-m

Maximum kilobytes of physical memory. (Not effective on all Unix systems.)

-M

Maximum size of the address space. ksh93 only.

-n

Maximum number of file descriptors.

-p

Size of pipe buffers. (Not effective on all Unix systems.)

-s

Maximum kilobytes of stack segment.

-t

Maximum CPU seconds.

-T

Maximum number of threads. ksh93 only.

-u

Maximum number of processes a single user can have.

-v

Maximum kilobytes of virtual memory.

umask

```
umask [nnn]
umask [-pS] [mask]
```

Display file creation mask or set file creation mask to octal value*nnn*. The file creation mask determines which permission bits are turned off (e.g.,`umask 002` produces `rw-rw-r--`). See the entry in Chapter 3 for examples.

The second form is not in `ksh88`. A symbolic mask is permissions to keep.

Option

`-p`

Output is in a form that can be reread later by the shell. Bash only.

`-S`

Print the current mask using symbolic notation. Not `ksh88`.

unalias

```
unalias names
unalias -a
```

Remove *names* from the alias list. See also alias.

Option

`-a`

Remove all aliases. Not `ksh88`.

unset

```
unset [options] names
```

Erase definitions of functions or variables listed in*names*.

Options

-f

Unset functions *names*.

-n

Unset indirect variable (nameref) *name*, not the variable the nameref refers to. ksh93 only.

-v

Unset variables *names* (default). Not ksh88.

until

```
until conditiondo
 commandsdone
```

Until *condition* is met, do *commands*. *condition* is often specified with the test command. See the Examples under case and test.

wait

```
wait [ID]
```

Pause in execution until all background jobs complete (exit status 0 is returned), or pause until the specified background process *ID* or job *ID* completes (exit status of *ID* is returned). Note that the shell variable $! contains the process ID of the most recent background process.

Example

```
wait $!    Wait for most recent background process to finish
```

whence

```
whence [options] commands
```

Korn shell only. Show whether each command name is a Unix command, a built-in command, a defined shell function, or an alias.

Options

`-a`

Print all interpretations of *commands*. ksh93 only.

`-f`

Skip the search for shell functions. ksh93 only.

`-p`

Search for the pathname of *commands*.

`-v`

Verbose output.

while

```
while conditiondo
 commands
done
```

While *condition* is met, do *commands*. *condition* is often specified with the test command. See the Examples under case and test.

PREV

Chapter 7. Pattern Matching

A number of Linux text-processing utilities let you search for, and in some cases change, text patterns rather than fixed strings. These utilities include the editing programsed, ex, vi, and sed; the gawk programming language; and the commands grep and egrep. Text patterns (called *regular expressions* in computer science literature) contain normal characters mixed with special characters (called *metacharacters*).

This chapter presents the following topics:

- Filenames versus patterns
- Description of metacharacters
- List of metacharacters available to each program
- Examples

For more information on regular expressions, see the O'Reilly book Mastering Regular Expressions.

7.1. Filenames Versus Patterns

Metacharacters used in pattern matching are different from metacharacters used for filename expansion (see Chapter 6). However, several metacharacters have meaning for both regular expressions and for filename expansion. This can lead to a problem: the shell sees the command line first, and can potentially interpret an unquoted regular expression metacharacter as a filename expansion. For example, the command:

```
$ grep [A-Z]* chap[12]
```

could be transformed by the shell into:

```
$ grep Array.c Bug.c Comp.c chap1 chap2
```

and grep would then try to find the pattern *Array.c* in files *Bug.c*, *Comp.c*, *chap1*, and *chap2*. To bypass the shell and pass the special characters to grep, use quotes as follows:

```
$ grep "[A-Z]*" chap[12]
```

Double quotes suffice in most cases, but single quotes are the safest bet, since the shell does absolutely no expansions on single-quoted text.

Note also that in pattern matching, ? matches zero or one instance of a regular expression; in filename expansion, ? matches a single character.

7.2. Metacharacters

Different metacharacters have different meanings, depending upon where they are used. In particular, regular expressions used for searching through text (matching) have one set of metacharacters, while the metacharacters used when processing replacement text (such as in a text editor) have a different set. These sets also vary somewhat per program. This section covers the metacharacters used for searching and replacing, with descriptions of the variants in the different utilities.

7.2.1. Search Patterns

The characters in the following table have special meaning only in search patterns

Character	Pattern
.	Match any *single* character except newline. Can match newline in awk.
*	Match any number (or none) of the single character that immediately precedes it. The preceding character can also be a regular expression. For example, since. (dot) means any character, .* means "match any number of any character."
^	Match the following regular expression at the beginning of the line or string.
$	Match the preceding regular expression at the end of the line or string.
[ ]	Match any *one* of the enclosed characters.
	A hyphen (-) indicates a range of consecutive characters. A circumflex (^) as the first character in the brackets reverses the sense: it matches any one character *not* in the list. A hyphen or close bracket (]) as the first character is treated as a member of the list. All other metacharacters are treated as members of the list (i.e., literally).
{*n*,*m*}	Match a range of occurrences of the single character that immediately precedes it. The preceding character can also be a regular expression. {*n*} matches exactly *n* occurrences, {*n*,} matches at least *n* occurrences, and {*n*,*m*} matches any number of occurrences between *n* and *m*. *n* and *m* must be between 0 and 255, inclusive. (The GNU programs on Linux allow a range of 0 to 32767.)
\{*n*,*m*\}	Just like {*n*,*m*}, earlier, but with backslashes in front of the braces. (Historically, different utilities used different syntaxes for the same thing.)
\	Turn off the special meaning of the following character.
\(\)	Save the subpattern enclosed between \(and \) into a special holding space. Up to nine subpatterns can be saved on a single line. The text matched by the subpatterns can be "replayed" in substitutions by the escape sequences \1 to \9.

Character	Pattern
\n	Replay the *n*th subpattern enclosed in \(and \) into the pattern at this point. *n* is a number from 1 to 9, with 1 starting on the left. See the following Examples.
\< \>	Match characters at beginning (\<) or end (\>) of a word.
+	Match one or more instances of preceding regular expression.
?	Match zero or one instances of preceding regular expression.
|	Match the regular expression specified before or after the vertical bar (alternation).
( )	Apply a match to the enclosed group of regular expressions.

Linux allows the use of POSIX "character classes" within the square brackets that enclose a group of characters. They are typed enclosed in [: and :]. For example, [[:alnum:]] matches a single alphanumeric character.

Class	Characters matched	Class	Characters matched
alnum	Alphanumeric characters	lower	Lowercase characters
alpha	Alphabetic characters	print	Printable characters
blank	Space or Tab	punct	Punctuation characters
cntrl	Control characters	space	Whitespace characters
digit	Decimal digits	upper	Uppercase characters
graph	Non-space characters	xdigit	Hexadecimal digits

Finally, the GNU utilities on Linux accept additional escape sequences that act like metacharacters. (Because \b can also be interpreted as the sequence for the ASCII Backspace character, different utilities treat it differently. Check each utility's documentation.)

Sequence	Meaning
\b	Word boundary, either beginning or end of a word, as for the \< and \> metacharacters described earlier.
\B	Interword match; matches between two word-constituent characters.
\w	Matches any word-constituent character; equivalent to [[:alnum:]_].
\W	Matches any non-word-constituent character; equivalent to [^[:alnum:]_].
\`	Beginning of an Emacs buffer. Used by most other GNU utilities to mean unambiguously "beginning of string."
\'	End of an Emacs buffer. Used by most other GNU utilities to mean unambiguously "end of string."

7.2.2. Replacement Patterns

The characters in the following table have special meaning only in replacement patterns

Character	Pattern
\	Turn off the special meaning of the following character.
n	Reuse the text matched by the *n*th subpattern previously saved by \(and \) as part of the replacement pattern. *n* is a number from 1 to 9, with 1 starting on the left.
&	Reuse the text matched by the search pattern as part of the replacement pattern.
~	Reuse the previous replacement pattern in the current replacement pattern. Must be the only character in the replacement pattern (ex and vi).
%	Reuse the previous replacement pattern in the current replacement pattern. Must be the only character in the replacement pattern (ed).
\u	Convert first character of replacement pattern to uppercase.
\U	Convert entire replacement pattern to uppercase.
\l	Convert first character of replacement pattern to lowercase.
\L	Convert entire replacement pattern to lowercase.
\e	Turn off previous \u or \l.
\E	Turn off previous \U or \L.

7.3. Metacharacters, Listed by Program

Some metacharacters are valid for one program but not for another. Those that are available are marked by a bullet (•) in the following table. Items marked with a "P" are specified by POSIX. Full descriptions were provided in the previous section.

Symbol	ed	ex	vi	sed	awk	grep	egrep	Action
.	•	•	•	•	•	•	•	Match any character.
*	•	•	•	•	•	•	•	Match zero or more preceding characters.
^	•	•	•	•	•	•	•	Match beginning of line/string.
$	•	•	•	•	•	•	•	Match end of line/string.
\	•	•	•	•	•	•	•	Escape following character.
[ ]	•	•	•	•	•	•	•	Match one from a set.
\(\)	•	•	•	•		•		Store pattern for later replay.[a]
n	•	•	•	•		•		Replay subpattern in match.
{ }					• P		• P	Match a range of instances.
\{ \}	•			•		•		Match a range of instances.
\< \>	•	•	•					Match word's beginning or end.
+					•		•	Match one or more preceding characters.
?					•		•	Match zero or one preceding characters.
|					•		•	Separate choices to match.
( )					•		•	Group expressions to match.

[a] Stored subpatterns can be "replayed" during matching. See the following table.

Note that in ed, ex, vi, and sed, you specify both a search pattern (on the left) and a replacement pattern (on the right). The metacharacters listed above are meaningful only in a search pattern.

In ed, ex, vi, and sed, the metacharacters in the following table are valid only in a replacement pattern.

Symbol	ex	vi	sed	ed	Action

Symbol	ex	vi	sed	ed	Action
\	•	•	•	•	Escape following character.
n	•	•	•	•	Text matching pattern stored in \(\).
&	•	•	•	•	Text matching search pattern.
~	•	•			Reuse previous replacement pattern.
%				•	Reuse previous replacement pattern.
\u \U	•	•			Change character(s) to uppercase.
\l \L	•	•			Change character(s) to lowercase.
\e	•	•			Turn off previous \u or \l.
\E	•	•			Turn off previous \U or \L.

PREV

7.4. Examples of Searching

When used with grep or egrep, regular expressions should be surrounded by quotes. (If the pattern contains a $, you must use single quotes; e.g., '*pattern*'.) When used with ed, ex, sed, and awk, regular expressions are usually surrounded by /, although (except for awk) any delimiter works. The following tables show some sample patterns.

Pattern	What does it match?
bag	The string *bag*.
^bag	*bag* at the beginning of the line.
bag$	*bag* at the end of the line.
^bag$	*bag* as the only word on the line.
[Bb]ag	*Bag* or *bag*.
b[aeiou]g	Second letter is a vowel.
b[^aeiou]g	Second letter is a consonant (or uppercase or symbol).
b.g	Second letter is any character.
^...$	Any line containing exactly three characters.
^\.	Any line that begins with a dot.
^\.[a-z][a-z]	Same, followed by two lowercase letters (e.g., troff requests).
^\.[a-z]\{2\}	Same as previous; ed, grep, and sed only.
^[^.]	Any line that doesn't begin with a dot.
bugs*	*bug*, *bugs*, *bugss*, etc.
"word"	A word in quotes.
"*word"*	A word, with or without quotes.
[A-Z][A-Z]*	One or more uppercase letters.
[A-Z]+	Same; egrep or awk only.
[[:upper:]]+	Same as previous, egrep or awk.
[A-Z].*	An uppercase letter, followed by zero or more characters.
[A-Z]*	Zero or more uppercase letters.
[a-zA-Z]	Any letter, either lower- or uppercase.

Pattern	What does it match?
[^0-9A-Za-z]	Any symbol or space (not a letter or a number).
[^[:alnum:]]	Same, using POSIX character class.

egrep or awk pattern	What does it match?
[567]	One of the numbers *5*, *6*, or *7*.
five|six|seven	One of the words *five*, *six*, or *seven*.
80[2-4]?86	*8086*, *80286*, *80386*, or *80486*.
80[2-4]?86|(Pentium(-III?)?)	*8086*, *80286*, *80386*, *80486*, *Pentium*, *Pentium-II*, or *Pentium-III*.
compan(y|ies)	*company* or *companies*.

ex or vi pattern	What does it match?
\<the	Words like *theater* or *the*.
the\>	Words like *breathe* or *the*.
\<the\>	The word *the*.

ed, sed or grep pattern	What does it match?
0\{5,\}	Five or more zeros in a row.
[0-9]\{3\}-[0-9]\{2\}-[0-9]\{4\}	U.S. Social Security number (*nnn-nn-nnnn*).
\(why\).*\1	A line with two occurrences of *why*.
\([[:alpha:]_][[:alnum:]_.]*\) = \1;	C/C++ simple assignment statements.

7.4.1. Examples of Searching and Replacing

The examples in the following table show the metacharacters available tosed or ex. Note that ex commands begin with a colon. A space is marked by a ␣; a tab is marked by a *tab*.

Command	Result
s/.*/(&)/	Redo the entire line, but add spaces and parentheses.

Command	Result
s/.*/mv & &.old/	Change a wordlist (one word per line) into mv commands.
/^$/d	Delete blank lines.
:g/^$/d	Same as previous, in ex editor.
/^[␣*tab*]*$/d	Delete blank lines, plus lines containing only spaces or tabs.
:g/^[␣*tab*]*$/d	Same as previous, in ex editor.
s/␣␣*/␣/g	Turn one or more spaces into one space.
:%s/␣␣*/␣/g	Same as previous, in ex editor.
:s/[0-9]/Item &:/	Turn a number into an item label (on the current line).
:s	Repeat the substitution on the first occurrence.
:&	Same as previous.
:sg	Same as previous, but for all occurrences on the line.
:&g	Same as previous.
:%&g	Repeat the substitution globally (i.e., on all lines).
:.,$s/Fortran/\U&/g	On current line to last line, change word to uppercase.
:.,$s/\(F\)\(ORTRAN\)/\1\L\2/g	On current line to last line, change spelling of "FORTRAN" to correct, modern usage.
:%s/.*/\L&/	Lowercase entire file.
:s/\<./\u&/g	Uppercase first letter of each word on current line. (Useful for titles.)
:%s/yes/No/g	Globally change a word to *No*.
:%s/Yes/~/g	Globally change a different word to *No* (previous replacement).

Finally, some sed examples for transposing words. A simple transposition of two words might look like this:

```
s/die or do/do or die/      Transpose words
```

The real trick is to use hold buffers to transpose variable patterns. For example:

```
s/\([Dd]ie\) or \([Dd]o\)/\2 or \1/  Transpose, using hold buffers
```

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Chapter 8. The Emacs Editor

The Emacs editor is found on many Unix systems, including Linux, because it is a popular alternative to vi. Many versions are available, but this book documents the most popular one, GNU Emacs (Version 21.3), which is available from the Free Software Foundation (http://www.gnu.org/software/emacs).

Emacs is much more than "just an editor"--in fact, it provides a fully integrated user environment. From within Emacs, you can issue individual shell commands or open a window where you can work in the shell, read and send mail, read news, access the Internet, write and test programs, and maintain a calendar. To fully describe Emacs would require more space than we have available. In this chapter, therefore, we focus on the editing capabilities of Emacs.

This chapter presents the following topics:

- Conceptual overview
- Command-line syntax
- Summary of emacs commands by group
- Summary of emacs commands by key
- Summary of emacs commands by name

For more information about Emacs, see the O'Reilly book Learning GNU Emacs.

8.1. Conceptual Overview

This section describes some Emacs terminology that may be unfamiliar if you haven't used Emacs before.

8.1.1. Modes

One of the features that makes Emacs popular is its editing modes The modes set up an environment designed for the type of editing you are doing, with features such as having appropriate key bindings available and automatically indenting according to standard conventions for that type of document. There are two types of modes: major and minor. The major modes include modes for various programming languages such as C or Perl, for text processing (e.g., SGML or even straight text), and many more. One particularly useful major mode is Dired (Directory Editor), which has commands that let you manage directories. Minor modes set or unset features that are independent of the major mode, such as auto-fill (which controls word wrapping), insert versus overwrite, and auto-save. For a full discussion of modes, see Learning GNU Emacs(O'Reilly) or the Emacs Info documentation system (C-h i).

8.1.2. Buffer and Window

When you open a file in Emacs, the file is put into a*buffer* so you can edit it. If you open another file, that file goes into another buffer. The view of the buffer contents that you have at any point in time is called a *window*. For a small file, the window might show the entire file; for a large file, it shows only a portion of a file. Emacs allows multiple windowsto be open at the same time, to display the contents of different buffers or different portions of a single buffer.

8.1.3. Point and Mark

When you are editing in Emacs, the position of the cursor is known as*point*. You can set a *mark* at another place in the text to operate on the region between point and mark This is a very useful feature for such operations as deleting or moving an area of text.

8.1.4. Kill and Yank

Emacs uses the terms *kill* and *yank* for the concepts more commonly known today as*cut and paste*. You cut text in Emacs by killing it, and paste it by yanking it back. If you do multiple kills in a row, you can yank them back all at once.

8.1.5. Notes on the Tables

Emacs commands use the Ctrl key and the Meta key (Meta is usually the Alt key or the Escape key). In this chapter, the notation C- indicates that the Ctrl key is pressed at the same time as the character that follows. Similarly, M- indicates the use of the Meta key. When using Escape for Meta, press and release the Escape key, then type the next key. If you use Alt (or Option on the Mac) for Meta, it is just like Ctrl or Shift, and you should press it simultaneously with the other key(s).

In the command tables that follow, the first column lists the keystroke and the last column describes it. When there is a middle column, it lists the command name. If there are no keystrokes for a given command, you'll see (none) in the first column. Access these commands by typing M-x followed by the command name. If you're unsure of the name, you can type a tab or a carriage return, and Emacs lists possible completions of what you've typed so far.

Because Emacs is such a comprehensive editor, containing literally thousands of commands, some commands must be omitted for the sake of preserving a "quick" reference. You can browse the command set by typing C-h (for help) or M-x Tab (for command names).

8.1.6. Absolutely Essential Commands

If you're just getting started with Emacs, here's a short list of the most important commands:

Keystrokes	Description
C-h	Enter the online help system.
C-x C-s	Save the file.
C-x C-c	Exit Emacs.
C-_	Undo last edit (can be repeated).
C-g	Get out of current command operation.
C-p	Up/down/forward/back by line or character.
C-n	
C-f	
C-b	

Keystrokes	Description
C-v	Forward/backward by one screen.
M-v	
C-s	Search forward/backward for characters.
C-r	
C-d	Delete next/previous character.
Del	

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8.2. Command-Line Syntax

To start an Emacs editing session, type:

```
emacs  [file ]
```

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8.3. Summary of Commands by Group

Reminder: C- indicates the Ctrl key; M- indicates the Meta key.

8.3.1. File-Handling Commands

Keystrokes	Command name	Description
C-x C-f	find-file	Find file and read it.
C-x C-v	find-alternate-file	Read another file; replace the one read with C-x C-f.
C-x i	insert-file	Insert file at cursor position.
C-x C-s	save-buffer	Save file (may hang terminal; use C-q to restart).
C-x C-w	write-file	Write buffer contents to file.
C-x C-c	save-buffers-kill-emacs	Exit Emacs.
C-z	suspend-emacs	Suspend Emacs (use exit or fg to restart).

8.3.2. Cursor-Movement Commands

Keystrokes	Command name	Description
C-f	forward-char	Move *forward* one character (right).
C-b	backward-char	Move *backward* one character (left).
C-p	previous-line	Move to *previous* line (up).
C-n	next-line	Move to *next* line (down).
M-f	forward-word	Move one word *forward*.
M-b	backward-word	Move one word *backward*.
C-a	beginning-of-line	Move to beginning of line.
C-e	end-of-line	Move to *end* of line.
M-a	backward-sentence	Move backward one sentence.
M-e	forward-sentence	Move forward one sentence.
M-{	backward-paragraph	Move backward one paragraph.

Keystrokes	Command name	Description
M-}	forward-paragraph	Move forward one paragraph.
C-v	scroll-up	Move forward one screen.
M-v	scroll-down	Move backward one screen.
C-x [	backward-page	Move backward one page.
C-x]	forward-page	Move forward one page.
M->	end-of-buffer	Move to end of file.
M-<	beginning-of-buffer	Move to beginning of file.
(none)	goto-line	Go to line *n* of file.
(none)	goto-char	Go to character *n* of file.
C-l	recenter	Redraw screen with current line in the center.
M-*n*	digit-argument	Repeat the next command *n* times.
C-u *n*	universal-argument	Repeat the next command *n* times.

8.3.3. Deletion Commands

Keystrokes	Command name	Description
Del	backward-delete-char	Delete previous character.
C-d	delete-char	Delete character under cursor.
M-Del	backward-kill-word	Delete previous word.
M-d	kill-word	Delete the word the cursor is on.
C-k	kill-line	Delete from cursor to end of line.
M-k	kill-sentence	Delete sentence the cursor is on.
C-x Del	backward-kill-sentence	Delete previous sentence.
C-y	yank	Restore what you've deleted.
C-w	kill-region	Delete a marked region (see next section).
(none)	backward-kill-paragraph	Delete previous paragraph.
(none)	kill-paragraph	Delete from the cursor to the end of the paragraph.

8.3.4. Paragraphs and Regions

Keystrokes	Command name	Description
C-@	set-mark-command	Mark the beginning (or end) of a region.
C-Space	(same as above)	(same as above)
C-x C-p	mark-page	Mark page.
C-x C-x	exchange-point-and-mark	Exchange location of cursor and mark.
C-x h	mark-whole-buffer	Mark buffer.
M-q	fill-paragraph	Reformat paragraph.
(none)	fill-region	Reformat individual paragraphs within a region.
M-h	mark-paragraph	Mark paragraph.

8.3.5. Stopping and Undoing Commands

Keystrokes	Command name	Description
C-g	keyboard-quit	Abort current command.
C-_	advertised-undo	Undo last edit (can be done repeatedly).
(none)	revert-buffer	Restore buffer to the state it was in when the file was last saved (or auto-saved).

8.3.6. Transposition Commands

Keystrokes	Command name	Description
C-t	transpose-chars	Transpose two letters.
M-t	transpose-words	Transpose two words.
C-x C-t	transpose-lines	Transpose two lines.
(none)	transpose-sentences	Transpose two sentences.
(none)	transpose-paragraphs	Transpose two paragraphs.

8.3.7. Search Commands

Keystrokes	Command name	Description
C-s	isearch-forward	Incremental search forward.

Keystrokes	Command name	Description
C-r	isearch-backward	Incremental search backward
M-%	query-replace	Search and replace.
C-M-s Enter	re-search-forward	Regular expression search forward.
C-M-r Enter	re-search-backward	Regular expression search backward

8.3.8. Capitalization Commands

Keystrokes	Command name	Description
M-c	capitalize-word	Capitalize first letter of word.
M-u	upcase-word	Uppercase word.
M-l	downcase-word	Lowercase word.
M- - M-c	negative-argument; capitalize-word	Capitalize previous word.
M- - M-u	negative-argument; upcase-word	Uppercase previous word.
M- - M-l	negative-argument; downcase-word	Lowercase previous word.
(none)	capitalize-region	Capitalize region.
C-x C-u	upcase-region	Uppercase region
C-x C-l	downcase-region	Lowercase region.

8.3.9. Word-Abbreviation Commands

Keystrokes	Command name	Description
(none)	abbrev-mode	Enter (or exit) word abbreviation mode.
C-x a i g	inverse-add-global-abbrev	Type global abbreviation, then definition.
C-x a i l	inverse-add-local-abbrev	Type local abbreviation, then definition.
(none)	unexpand-abbrev	Undo the last word abbreviation.
(none)	write-abbrev-file	Write the word abbreviation file.
(none)	edit-abbrevs	Edit the word abbreviations.
(none)	list-abbrevs	View the word abbreviations.
(none)	kill-all-abbrevs	Kill abbreviations for this session.

8.3.10. Buffer-Manipulation Commands

Keystrokes	Command name	Description
C-x b	switch-to-buffer	Move to specified buffer.
C-x C-b	list-buffers	Display buffer list.
C-x k	kill-buffer	Delete specified buffer.
(none)	kill-some-buffers	Ask about deleting each buffer.
(none)	rename-buffer	Change buffer name to specified name.
C-x s	save-some-buffers	Ask whether to save each modified buffer.

8.3.11. Window Commands

Keystrokes	Command name	Description
C-x 2	split-window-vertically	Divide the current window into two, one on top of the other.
C-x 3	split-window-horizontally	Divide the current window into two, side by side.
C-x >	scroll-right	Scroll the window right.
C-x <	scroll-left	Scroll the window left.
C-x o	other-window	Move to the other window.
C-x 0	delete-window	Delete current window.
C-x 1	delete-other-windows	Delete all windows but this one.
(none)	delete-windows-on	Delete all windows on a given buffer.
C-x ^	enlarge-window	Make window taller.
(none)	shrink-window	Make window shorter.
C-x }	enlarge-window-horizontally	Make window wider.
C-x {	shrink-window-horizontally	Make window narrower.
C-M-v	scroll-other-window	Scroll other window.
C-x 4 f	find-file-other-window	Find a file in the other window.
C-x 4 b	switch-to-buffer-other-window	Select a buffer in the other window.
C-x 5 f	find-file-other-frame	Find a file in a new frame.
C-x 5 b	switch-to-buffer-other-frame	Select a buffer in another frame.

Keystrokes	Command name	Description
(none)	compare-windows	Compare two buffers; show first difference.

8.3.12. Special Shell Characters

Keystrokes	Command Name	Description
(none)	shell	Start a shell buffer.
C-c C-c	comint-interrupt-subjob	Terminate the current job.
C-c C-d	comint-send-eof	End of file character.
C-c C-u	comint-kill-input	Erase current line.
C-c C-w	backward-kill-word	Erase the previous word.
C-c C-z	comint-stop-subjob	Suspend the current job.

8.3.13. Indentation Commands

Keystrokes	Command name	Description
C-x .	set-fill-prefix	Use characters from the beginning of the line up to the cursor column as the "fill prefix." This prefix is prepended to each line in the paragraph. Cancel the prefix by typing this command in column 1.
(none)	indented-text-mode	Major mode: each tab defines a new indent for subsequent lines.
(none)	text-mode	Exit indented text mode; return to text mode.
C-M-\	indent-region	Indent a region to match first line in region.
M-m	back-to-indentation	Move cursor to first character on line.
C-M-o	split-line	Split line at cursor; indent to column of cursor.
(none)	fill-individual-paragraphs	Reformat indented paragraphs, keeping indentation.

8.3.14. Centering Commands

Keystrokes	Command name	Description
M-s	center-line	Center line that cursor is on.
(none)	center-paragraph	Center paragraph that cursor is on.
(none)	center-region	Center currently defined region.

8.3.15. Macro Commands

Keystrokes	Command name	Description
C-x (	start-kbd-macro	Start macro definition.
C-x)	end-kbd-macro	End macro definition.
C-x e	call-last-kbd-macro	Execute last macro defined.
M-*n* C-x e	digit-argument and call-last-kbd-macro	Execute last macro defined *n* times.
C-u C-x (	universal-argument and start-kbd-macro	Execute last macro defined, then add keystrokes.
(none)	name-last-kbd-macro	Name last macro you created (before saving it).
(none)	insert-keyboard-macro	Insert the macro you named into a file.
(none)	load-file	Load macro files you've saved and loaded.
(none)	*macroname*	Execute a keyboard macro you've saved.
C-x q	kbd-macro-query	Insert a query in a macro definition.
C-u C-x q	(none)	Insert a recursive edit in a macro definition.
C-M-c	exit-recursive-edit	Exit a recursive edit.

8.3.16. Basic Indentation Commands

Keystrokes	Command name	Description
C-M-\	indent-region	Indent a region to match first line in region.
M-m	back-to-indentation	Move to first nonblank character on line.
M-^	delete-indentation	Join this line to the previous one.

8.3.17. Detail Information Help Commands

Keystrokes	Command name	Description
C-h a	command-apropos	What commands involve this concept?
(none)	apropos	What functions and variables involve this concept?
C-h c	describe-key-briefly	What command does this keystroke sequence run?
C-h b	describe-bindings	What are all the key bindings for this buffer?
C-h k	describe-key	What command does this keystroke sequence run, and what does it do?
C-h l	view-lossage	What are the last 100 characters I typed?
C-h w	where-is	What is the key binding for this command?
C-h f	describe-function	What does this function do?
C-h v	describe-variable	What does this variable mean, and what is its value?
C-h m	describe-mode	Tell me about the mode the current buffer is in.
C-h s	describe-syntax	What is the syntax table for this buffer?

8.3.18. Help Commands

Keystrokes	Command name	Description
C-h t	help-with-tutorial	Run the Emacs tutorial.
C-h i	info	Start the Info documentation reader.
C-h n	view-emacs-news	View news about updates to Emacs.
C-h C-c	describe-copying	View the Emacs General Public License.
C-h C-d	describe-distribution	View information on ordering Emacs from the FSF.
C-h C-w	describe-no-warranty	View the (non-)warranty for Emacs.

8.4. Summary of Commands by Key

Emacs commands are presented below in two alphabetical lists. Reminder: C- indicates the Ctrl key; M- indicates the Meta key.

8.4.1. Control-Key Sequences

Keystrokes	Command name	Description
C-@	set-mark-command	Mark the beginning (or end) of a region.
C-Space	(same as previous)	
C-]	(none)	Exit recursive edit and exit query-replace.
C-a	beginning-of-line	Move to beginning of line.
C-b	backward-char	Move *backward* one character (left).
C-c C-c	comint-interrupt-subjob	Terminate the current job.
C-c C-d	comint-send-eof	End-of-file character.
C-c C-u	comint-kill-input	Erase current line.
C-c C-w	backward-kill-word	Erase the previous word.
C-c C-z	comint-stop-subjob	Suspend the current job.
C-d	delete-char	Delete character under cursor.
C-e	end-of-line	Move to *end* of line.
C-f	forward-char	Move *forward* one character (right).
C-g	keyboard-quit	Abort current command.
C-h	help-command	Enter the online help system.
C-h a	command-apropos	What commands involve this concept?
C-h b	describe-bindings	What are all the key bindings for this buffer?
C-h C-c	describe-copying	View the Emacs General Public License.
C-h C-d	describe-distribution	View information on ordering Emacs from FSF.

Keystrokes	Command name	Description
C-h C-w	describe-no-warranty	View the (non-)warranty for Emacs.
C-h c	describe-key-briefly	What command does this keystroke sequence run?
C-h f	describe-function	What does this function do?
C-h i	info	Start the Info documentation reader.
C-h k	describe-key	What command does this keystroke sequence run, and what does it do?
C-h l	view-lossage	What are the last 100 characters I typed?
C-h m	describe-mode	Tell me about the mode the current buffer is in.
C-h n	view-emacs-news	View news about updates to Emacs.
C-h s	describe-syntax	What is the syntax table for this buffer?
C-h t	help-with-tutorial	Run the Emacs tutorial.
C-h v	describe-variable	What does this variable mean, and what is its value?
C-h w	where-is	What is the key binding for this command?
C-k	kill-line	Delete from cursor to end of line.
C-l	recenter	Redraw screen with current line in the center.
C-M-\	indent-region	Indent a region to match first line in region.
C-M-c	exit-recursive-edit	Exit a recursive edit.
C-M-o	split-line	Split line at cursor; indent to column of cursor.
C-M-v	scroll-other-window	Scroll other window.
C-n	next-line	Move to *next* line (down).
C-p	previous-line	Move to *previous* line (up).
C-r	isearch-backward	Start incremental search backward.
C-s	isearch-forward	Start incremental search forward.
C-t	transpose-chars	Transpose two letters.
C-u *n*	universal-argument	Repeat the next command *n* times.
C-u C-x (	universal-argument and start-kbd-macro	Execute last macro defined, then add keystrokes.
C-u C-x q	(none)	Insert recursive edit in a macro definition.

Keystrokes	Command name	Description
C-v	scroll-up	Move forward one screen.
C-w	kill-region	Delete a marked region.
C-x (	start-kbd-macro	Start macro definition.
C-x)	end-kbd-macro	End macro definition.
C-x [	backward-page	Move backward one page.
C-x]	forward-page	Move forward one page.
C-x ^	enlarge-window	Make window taller.
C-x {	shrink-window-horizontally	Make window narrower.
C-x }	enlarge-window-horizontally	Make window wider.
C-x <	scroll-left	Scroll the window left.
C-x >	scroll-right	Scroll the window right.
C-x .	set-fill-prefix	Use characters from the beginning of the line up to the cursor column as the "fill prefix." This prefix is prepended to each line in the paragraph. Cancel the prefix by typing this command in column 1.
C-x 0	delete-window	Delete current window.
C-x 1	delete-other-windows	Delete all windows but this one.
C-x 2	split-window-vertically	Divide the current window into two, one on top of the other.
C-x 3	split-window-horizontally	Divide the current window into two, side by side.
C-x 4 b	switch-to-buffer-other-window	Select a buffer in the other window.
C-x 4 f	find-file-other-window	Find a file in the other window.
C-x 5 b	switch-to-buffer-other-frame	Select a buffer in another frame.
C-x 5 f	find-file-other-frame	Find a file in a new frame.
C-x C-b	list-buffers	Display the buffer list.
C-x C-c	save-buffers-kill-emacs	Exit Emacs.
C-x C-f	find-file	Find file and read it.

Keystrokes	Command name	Description
C-x C-l	downcase-region	Lowercase region.
C-x C-p	mark-page	Mark page.
C-x C-q	(none)	Toggle read-only status of buffer.
C-x C-s	save-buffer	Save file (may hang terminal; use C-q to restart).
C-x C-t	transpose-lines	Transpose two lines.
C-x C-u	upcase-region	Uppercase region
C-x C-v	find-alternate-file	Read an alternate file, replacing the one read with C-x C-f.
C-x C-w	write-file	Write buffer contents to file.
C-x C-x	exchange-point-and-mark	Exchange location of cursor and mark.
C-x DEL	backward-kill-sentence	Delete previous sentence.
C-x a i g	inverse-add-global-abbrev	Type global abbreviation, then definition.
C-x a i l	inverse-add-local-abbrev	Type local abbreviation, then definition.
C-x b	switch-to-buffer	Move to the buffer specified.
C-x e	call-last-kbd-macro	Execute last macro defined.
C-x h	mark-whole-buffer	Mark buffer.
C-x i	insert-file	Insert file at cursor position.
C-x k	kill-buffer	Delete the buffer specified.
C-x o	other-window	Move to the other window.
C-x q	kbd-macro-query	Insert a query in a macro definition.
C-x s	save-some-buffers	Ask whether to save each modified buffer.
C-_	advertised-undo	Undo last edit (can be done repeatedly).
C-y	yank	Restore what you've deleted.
C-z	suspend-emacs	Suspend Emacs (use exit or fg to restart).

8.4.2. Meta-Key Sequences

Keystrokes	Command name	Description

Keystrokes	Command name	Description
Meta	(none)	Exit a query-replace or successful search.
M- - M-c	negative-argument; capitalize-word	Capitalize previous word.
M- - M-l	negative-argument; downcase-word	Lowercase previous word.
M- - M-u	negative-argument; upcase-word	Uppercase previous word.
M-$	spell-word	Check spelling of word after cursor.
M-<	beginning-of-buffer	Move to beginning of file.
M->	end-of-buffer	Move to end of file.
M-{	backward-paragraph	Move backward one paragraph.
M-}	forward-paragraph	Move forward one paragraph.
M-^	delete-indentation	Join this line to the previous one.
M-*n*	digit-argument	Repeat the next command *n* times.
M-*n* C-x e	digit-argument and call-last-kbd-macro	Execute the last defined macro *n* times.
M-a	backward-sentence	Move backward one sentence.
M-b	backward-word	Move one word *backward*.
M-c	capitalize-word	Capitalize first letter of word.
M-d	kill-word	Delete word that cursor is on.
M-DEL	backward-kill-word	Delete previous word.
M-e	forward-sentence	Move forward one sentence.
M-f	forward-word	Move one word *forward*.
(none)	fill-region	Reformat individual paragraphs within a region.
M-h	mark-paragraph	Mark paragraph.
M-k	kill-sentence	Delete sentence the cursor is on.
M-l	downcase-word	Lowercase word.
M-m	back-to-indentation	Move cursor to first nonblank character on line.
M-q	fill-paragraph	Reformat paragraph.
M-s	center-line	Center line that cursor is on.
M-t	transpose-words	Transpose two words.
M-u	upcase-word	Uppercase word.
M-v	scroll-down	Move backward one screen.

Keystrokes	Command name	Description
M-x	(none)	Access command by command name.

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8.5. Summary of Commands by Name

The Emacs commands below are presented alphabetically by command name. UseM-x to access the command name. Reminder: C- indicates the Ctrl key; M- indicates the Meta key.

Command name	Keystrokes	Description
macroname	(none)	Execute a keyboard macro you've saved.
abbrev-mode	(none)	Enter (or exit) word abbreviation mode.
advertised-undo	C-_	Undo last edit (can be done repeatedly).
apropos	(none)	What functions and variables involve this concept?
back-to-indentation	M-m	Move cursor to first nonblank character on line.
backward-char	C-b	Move *backward* one character (left).
backward-delete-char	Del	Delete previous character.
backward-kill-paragraph	(none)	Delete previous paragraph.
backward-kill-sentence	C-x Del	Delete previous sentence.
backward-kill-word	C-c C-w	Erase previous word.
backward-kill-word	M-Del	Delete previous word.
backward-page	C-x [	Move backward one page.
backward-paragraph	M-{	Move backward one paragraph.
backward-sentence	M-a	Move backward one sentence.
backward-word	M-b	Move backward one word.
beginning-of-buffer	M-<	Move to beginning of file.
beginning-of-line	C-a	Move to beginning of line.
call-last-kbd-macro	C-x e	Execute last macro defined.
capitalize-region	(none)	Capitalize region.
capitalize-word	M-c	Capitalize first letter of word.
center-line	M-s	Center line that cursor is on.

Command name	Keystrokes	Description
center-paragraph	(none)	Center paragraph that cursor is on.
center-region	(none)	Center currently defined region.
comint-interrupt-subjob	C-c C-c	Terminate the current job.
comint-kill-input	C-c C-u	Erase current line.
comint-send-eof	C-c C-d	End of file character.
comint-stop-subjob	C-c C-z	Suspend current job.
command-apropos	C-h a	What commands involve this concept?
compare-windows	(none)	Compare two buffers; show first difference.
delete-char	C-d	Delete character under cursor.
delete-indentation	M-^	Join this line to previous one.
delete-other-windows	C-x 1	Delete all windows but this one.
delete-window	C-x 0	Delete current window.
delete-windows-on	(none)	Delete all windows on a given buffer.
describe-bindings	C-h b	What are all the key bindings for in this buffer?
describe-copying	C-h C-c	View the Emacs General Public License.
describe-distribution	C-h C-d	View information on ordering Emacs from the FSF.
describe-function	C-h f	What does this function do?
describe-key	C-h k	What command does this keystroke sequence run, and what does it do?
describe-key-briefly	C-h c	What command does this keystroke sequence run?
describe-mode	C-h m	Tell me about the mode the current buffer is in.
describe-no-warranty	C-h C-w	View the (non-)warranty for Emacs.
describe-syntax	C-h s	What is the syntax table for this buffer?
describe-variable	C-h v	What does this variable mean, and what is its value?
digit-argument and call-last-kbd-macro	M-*n* C-x e	Execute the last defined macro *n* times.
digit-argument	M-*n*	Repeat next command *n* times.
downcase-region	C-x C-l	Lowercase region.

Command name	Keystrokes	Description
downcase-word	M-l	Lowercase word.
edit-abbrevs	(none)	Edit word abbreviations.
end-kbd-macro	C-x)	End macro definition.
end-of-buffer	M->	Move to end of file.
end-of-line	C-e	Move to end of line.
enlarge-window	C-x ^	Make window taller.
enlarge-window-horizontally	C-x }	Make window wider.
exchange-point-and-mark	C-x C-x	Exchange location of cursor and mark.
exit-recursive-edit	C-M-c	Exit a recursive edit.
fill-individual-paragraphs	(none)	Reformat indented paragraphs, keeping indentation.
fill-paragraph	M-q	Reformat paragraph.
fill-region	(none)	Reformat individual paragraphs within a region.
find-alternate-file	C-x C-v	Read an alternate file, replacing the one read with C-x C-f.
find-file	C-x C-f	Find file and read it.
find-file-other-frame	C-x 5 f	Find a file in a new frame.
find-file-other-window	C-x 4 f	Find a file in the other window.
forward-char	C-f	Move *forward* one character (right).
forward-page	C-x]	Move forward one page.
forward-paragraph	M-}	Move forward one paragraph.
forward-sentence	M-e	Move forward one sentence.
forward-word	M-f	Move forward one word.
goto-char	(none)	Go to character *n* of file.
goto-line	(none)	Go to line *n* of file.
help-command	C-h	Enter the online help system.
help-with-tutorial	C-h t	Run the Emacs tutorial.
indent-region	C-M-\	Indent a region to match first line in region.
indented-text-mode	(none)	Major mode: each tab defines a new indent for subsequent lines.

Command name	Keystrokes	Description
info	C-h i	Start the Info documentation reader.
insert-file	C-x i	Insert file at cursor position.
insert-keyboard-macro	(none)	Insert the macro you named into a file.
inverse-add-global-abbrev	C-x a i g	Type global abbreviation, then definition.
inverse-add-local-abbrev	C-x a i l	Type local abbreviation, then definition.
isearch-backward	C-r	Start incremental search backward.
isearch-backward-regexp	C-r	Same, but search for regular expression.
isearch-forward	C-s	Start incremental search forward.
isearch-forward-regexp	C-r	Same, but search for regular expression.
kbd-macro-query	C-x q	Insert a query in a macro definition.
keyboard-quit	C-g	Abort current command.
kill-all-abbrevs	(none)	Kill abbreviations for this session.
kill-buffer	C-x k	Delete the buffer specified.
kill-line	C-k	Delete from cursor to end of line.
kill-paragraph	(none)	Delete from cursor to end of paragraph.
kill-region	C-w	Delete a marked region.
kill-sentence	M-k	Delete sentence the cursor is on.
kill-some-buffers	(none)	Ask about deleting each buffer.
kill-word	M-d	Delete word the cursor is on.
list-abbrevs	(none)	View word abbreviations.
list-buffers	C-x C-b	Display buffer list.
load-file	(none)	Load macro files you've saved.
mark-page	C-x C-p	Mark page.
mark-paragraph	M-h	Mark paragraph.
mark-whole-buffer	C-x h	Mark buffer.
name-last-kbd-macro	(none)	Name last macro you created (before saving it).

Command name	Keystrokes	Description
negative-argument; capitalize-word	M- - M-c	Capitalize previous word.
negative-argument; downcase-word	M- - M-l	Lowercase previous word.
negative-argument; upcase-word	M- - M-u	Uppercase previous word.
next-line	C-n	Move to *next* line (down).
other-window	C-x o	Move to the other window.
previous-line	C-p	Move to *previous* line (up).
query-replace-regexp	C-% Meta	Query-replace a regular expression.
recenter	C-l	Redraw screen, with current line in center.
rename-buffer	(none)	Change buffer name to specified name.
replace-regexp	(none)	Replace a regular expression unconditionally.
re-search-backward	(none)	Simple regular expression search backward.
re-search-forward	(none)	Simple regular expression search forward.
revert-buffer	(none)	Restore buffer to the state it was in when the file was last saved (or auto-saved).
save-buffer	C-x C-s	Save file (may hang terminal; use C-q to restart).
save-buffers-kill-emacs	C-x C-c	Exit Emacs.
save-some-buffers	C-x s	Ask whether to save each modified buffer.
scroll-down	M-v	Move backward one screen.
scroll-left	C-x <	Scroll the window left.
scroll-other-window	C-M-v	Scroll other window.
scroll-right	C-x >	Scroll the window right.
scroll-up	C-v	Move forward one screen.
set-fill-prefix	C-x .	Use characters from the beginning of the line up to the cursor column as the "fill prefix." This prefix is prepended to each line in the paragraph. Cancel the prefix by typing this command in column 1.

Command name	Keystrokes	Description
set-mark-command	C-@ or C-Space	Mark the beginning (or end) of a region.
shell	(none)	Start a shell buffer.
shrink-window	(none)	Make window shorter.
shrink-window-horizontally	C-x {	Make window narrower.
spell-buffer	(none)	Check spelling of current buffer.
spell-region	(none)	Check spelling of current region.
spell-string	(none)	Check spelling of string typed in minibuffer.
spell-word	M-$	Check spelling of word after cursor.
split-line	C-M-o	Split line at cursor; indent to column of cursor.
split-window-vertically	C-x 2	Divide the current window into two, one on top of the other.
split-window-horizontally	C-x 3	Divide the current window into two, side by side.
start-kbd-macro	C-x (	Start macro definition.
suspend-emacs	C-z	Suspend Emacs (use exit or fg to restart).
switch-to-buffer	C-x b	Move to the buffer specified.
switch-to-buffer-other-frame	C-x 5 b	Select a buffer in another frame.
switch-to-buffer-other-window	C-x 4 b	Select a buffer in the other window.
text-mode	(none)	Exit indented text mode; return to text mode.
transpose-chars	C-t	Transpose two letters.
transpose-lines	C-x C-t	Transpose two lines.
transpose-paragraphs	(none)	Transpose two paragraphs.
transpose-sentences	(none)	Transpose two sentences.
transpose-words	M-t	Transpose two words.
unexpand-abbrev	(none)	Undo the last word abbreviation.
universal-argument	C-u *n*	Repeat the next command *n* times.
universal-argument and start-kbd-macro	C-u C-x (	Execute last macro defined, then add keystrokes to it.

Command name	Keystrokes	Description
upcase-region	C-x C-u	Uppercase region.
upcase-word	M-u	Uppercase word.
view-emacs-news	C-h n	View news about updates to Emacs.
view-lossage	C-h l	What are the last 100 characters I typed?
where-is	C-h w	What is the key binding for this command?
write-abbrev-file	(none)	Write the word abbreviation file.
write-file	C-x C-w	Write buffer contents to file.
yank	C-y	Restore what you've deleted.

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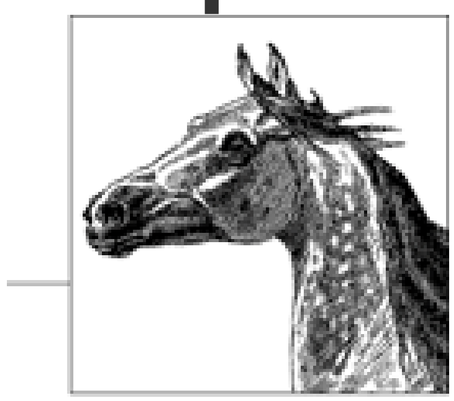
Chapter 9. The vi, ex, and vim Editors



The vi and ex editors are the "standard" editors on Unix systems. You can count on there being some version of them, no matter what Unix flavor you are using. The two editors are in fact the same program; based on how it was invoked, the editor enters full-screen mode or line mode.

vim is a popular extended version of vi. On some Linux distributions, the vi command invokes vim in a vi-compatible mode.

This chapter presents the following topics:

- Conceptual overview
- Command-line syntax
- Review of vi operations
- Alphabetical list of keys in command mode
- vi commands
- vi configuration
- ex basics
- Alphabetical summary of ex commands

vi is pronounced "vee eye."

Besides the original Unix vi, there are a number of freely available vi clones (including vim). Both the original vi and the clones are covered in Learning the vi Editor (O'Reilly).

9.1. Conceptual Overview

vi is the classic screen-editing program for Unix. A number of enhanced versions exist, including nvi, vim, vile, and elvis. On GNU/Linux systems, the vi command is usually one of these programs (either a copy or a link). The Emacs editor, covered in Chapter 8, has several vi modes that allow you to use many of the same commands covered in this chapter.

The vi editor operates in two modes: command mode and insert mode. The dual modes make vi an attractive editor for users who separate text entry from editing. For users who edit as they type, the modeless editing of Emacs can be more comfortable. However, vim supports both ways of editing, through the insertmode option.

vi is based on an older line editor called ex. (ex, in turn, was developed by Bill Joy at the University of California, Berkeley, from the primordial Unix line editor, ed.) A user can invoke powerful editing capabilities within vi by typing a colon (:), entering an ex command, and pressing the Enter key. Furthermore, you can place ex commands in a startup file called *~/.exrc*, which vi reads at the beginning of your editing session. Because ex commands are such an important part of vi, they are also described in this chapter.

One of the most common versions of vi found on Linux systems is Bram Moolenaar's Vi IMproved, or vim. On some Linux distributions, vim is the default version of vi and runs when you invoke vi. vim offers many extra features, and optionally changes some of the basic features of vi, most notoriously changing the undo key to support multiple levels of undo.

Fully documenting vim is beyond the scope of this chapter, but we do cover some of its most commonly used options and features. Beyond what we cover here, vim offers enhanced support to programmers through an integrated build and debugging process, syntax highlighting, extended ctags support, and support for Perl and Python, as well as GUI fonts and menus, function-key mapping, independent mapping for each mode, and more. Fortunately, vim comes with a powerful internal help system that you can use to learn more about the things we just couldn't fit into this chapter. See http://www.vim.org for more information.

9.2. Command-Line Syntax

The three most common ways of starting a vi session are:

```
vi [options] file
vi [options] +num file
vi [options] +/pattern file
```

You can open *file* for editing, optionally at line *num* or at the first line matching *pattern*. If no *file* is specified, vi opens with an empty buffer.

9.2.1. Command-Line Options

Because vi and ex are the same program, they share the same options. However, some options only make sense for one version of the program. Options specific to vim are so marked.

+[*num*]

Start editing at line number *num*, or the last line of the file if *num* is omitted.

+/*pattern*

Start editing at the first line matching *pattern*. (For ex, fails if nowrapscan is set in your *.exrc* startup file, since ex starts editing at the last line of a file.)

-b

Edit the file in binary mode. {vim}

-c *command*

Run the given ex command upon startup. Only one -c option is permitted for vi; vim accepts up to 10. An older form of this option, +*command*, is still supported.

--cmd *command*

Like -c, but execute the command before any resource files are read. {vim}

-C

vim: Start the editor in vi-compatible mode.

-d

Run in diff mode. Can also be invoked by running the commandvimdiff. {vim}

-D

Debugging mode for use with scripts. {vim}

-e

Run as ex (line editing rather than full-screen mode).

-h

Print help message, then exit. {vim}

-i *file*

Use the specified *file* instead of the default (~/*.viminfo*) to save or restore vim's state. {vim}

-l

Enter Lisp mode for running Lisp programs (not supported in all versions).

-L

List files that were saved due to an aborted editor session or system crash (not supported in al versions). For vim, this option is the same as -r.

-m

Start the editor with the write option turned off so the user cannot write to files. {vim}

-M

Do not allow text in files to be modified. {vim}

-n

Do not use a swapfile; record changes in memory only. {vim}

--noplugin

Do not load any plug-ins. {vim}

-N

Run vim in a non-vi-compatible mode. {vim}

-o[*num*]

Start vim with *num* open windows. The default is to open one window for each file. {vim}

-O[*num*]

Start vim with *num* open windows arranged horizontally (split vertically) on the screen. {vim}

-r [*file*]

Recovery mode; recover and resume editing on *file* after an aborted editor session or system crash. Without *file*, list files available for recovery.

-R

Edit files read-only.

-s

Silent; do not display prompts. Useful when running a script. This behavior also can be set through the older - option. For vim, only applies when used together with -e.

-s *scriptfile*

Read and execute commands given in the specified *scriptfile* as if they were typed in from the keyboard. {vim}

-S *commandfile*

Read and execute commands given in *commandfile* after loading any files for editing specified on the command line. Shorthand for the option vim -c 'source *commandfile*'. {vim}

-t *tag*

Edit the file containing *tag* and position the cursor at its definition. (See `ctags` in Chapter 3 for more information.)

-T *type*

Set the terminal type. This value overrides the $TERM environment variable. {vim}

-u *file*

Read configuration information from the specified resource file instead of default *.vimrc* resource file. If the *file* argument is NONE, `vim` will read no resource files, load no plug-ins, and run in compatible mode. If the argument is NORC, it will read no resource files, but it will load plug-ins. {vim}

-v

Run in full-screen mode (default for `vi`).

--version

Print version information, then exit. {vim}

-V[*num*]

Verbose mode; print messages about what options are being set and what files are being read or written. You can set a level of verbosity to increase or decrease the number of messages received. The default value is 10 for high verbosity. {vim}

-w *rows*

Set the window size so *rows* lines at a time are displayed; useful when editing over a slow dial-up line (or long distance Internet connection). Older versions of `vi` do not permit a space between the option and its argument. `vim` does not support this option.

-W *scriptfile*

Write all typed commands from the current session to the specified *scriptfile*. The file created can be used with the `-s` command. {vim}

-x

Prompt for a key that will be used to try to encrypt or decrypt a file using `crypt` (not supported in all versions).[*]

[*] The crypt command's encryption is weak. Don't use it for serious secrets.

-y

Modeless vi; run vim in insert mode only, without a command mode. {vim}

-Z

Start vim in restricted mode. Do not allow shell commands or suspension of the editor. {vim}

While most people know ex commands only by their use within vi, the editor also exists as a separate program and can be invoked from the shell (for instance, to edit files as part of a script). Within ex, you can enter the vi or visual command to start vi. Similarly, within vi, you can enter Q to quit the vi editor and enter ex.

You can exit ex in several ways:

:x

Exit (save changes and quit).

:q!

Quit without saving changes.

:vi

Enter the vi editor.

9.3. Review of vi Operations

This section provides a review of the following:

- vi modes
- Syntax of vi commands
- Status-line commands

9.3.1. Command Mode

Once the file is opened, you are in command mode. From command mode, you can:

- Invoke insert mode
- Issue editing commands
- Move the cursor to a different position in the file
- Invoke ex commands
- Invoke a Unix shell
- Save the current version of the file
- Exit vi

9.3.2. Insert Mode

In insert mode, you can enter new text in the file. You normally enter insert mode with thei command. Press the Escape key to exit insert mode and return to command mode. The full list of commands that enter insert mode is provided later, in the sectionInsert Commands."

9.3.4. Syntax of vi Commands

In vi, editing commands have the following general form:

```
[n] operator[m] motion
```

The basic editing *operators* are:

c

Begin a change.

d

Begin a edeletion.

y

Begin a yank (or copy).

If the current line is the object of the operation, the *motion* is the same as the operator: cc, dd, yy. Otherwise, the editing operators act on objects specified by cursor-movement commands or pattern-matching commands. (For example, cf. changes up to the next period.) *n* and *m* are the number of times the operation is performed, or the number of objects the operation is performed on. If both *n* and *m* are specified, the effect is *n* x *m*.

An object of operation can be any of the following text blocks:

word

Includes characters up to a whitespace character (space or tab) or punctuation mark. A capitalized object is a variant form that recognizes only whitespace.

sentence

Is up to ., !, or ?, followed by two spaces.

paragraph

Is up to the next blank line or paragraph macro defined by the `para=` option.

section

Is up to the next `nroff/troff` section heading defined by the `sect=` option.

motion

Is up to the character or other text object as specified by a motion specifier, including pattern

searches.

9.3.4.1 Examples

2cw

Change the next two words.

d}

Delete up to next paragraph.

d^

Delete back to beginning of line.

5yy

Copy the next five lines.

y]]

Copy up to the next section.

cG

Change to the end of the edit buffer.

More commands and examples may be found in the section Changing and Deleting Text," later in this chapter

9.3.4.2 Visual mode (vim only)

vim provides an additional facility, "visual mode." This allows you to highlight blocks of text which then become the object of edit commands such as deletion or saving (yanking). Graphical versions of vim allow you to use the mouse to highlight text in a similar fashion. See thevim help file *visual.txt* for the full story.

v

Select text in visual mode one character at a time.

V

Select text in visual mode one line at a time.

Ctrl-V

Select text in visual mode in blocks.

9.3.5. Status-Line Commands

Most commands are not echoed on the screen as you input them. However, the status line at the bottom of the screen is used to edit these commands:

/

Search forward for a pattern.

?

Search backward for a pattern.

:

Invoke an ex command.

!

Invoke a Unix command that takes as its input an object in the buffer and replaces it with output from the command. You type a motion command after the ! to describe what should be passed to the Unix command. The command itself is entered on the status line.

Commands that are entered on the status line must be entered by pressing the Enter key. In addition, error messages and output from the Ctrl-G command are displayed on the status line.

9.4. vi Commands

vi supplies a large set of single-key commands when in command mode.vim supplies additional multi-key commands.

9.4.1. Movement Commands

Some versions of vi do not recognize extended keyboard keys (e.g., arrow keys, Page Up, Page Down, Home, Insert, and Delete); some do. All, however, recognize the keys in this section. Many users of vi prefer to use these keys, as it helps them keep their fingers on the home row of the keyboard. A number preceding a command repeats the movement. Movement commands are also used after an operator. The operator works on the text that is moved.

9.4.1.1 Character

Command	Action
h, j, k, l	Left, down, up, right (, , ,)
Space	Right
Backspace	Left
Ctrl-H	Left

9.4.1.2 Text

Command	Action
w, b	Forward, backward by "word" (letters, numbers, and underscore make up words).
W, B	Forward, backward by "WORD" (only whitespace separates items).
e	End of word.
E	End of WORD.
ge	End of previous word. {vim}
gE	End of previous WORD. {vim}
), (	Beginning of next, current sentence.

Command	Action
}, {	Beginning of next, current paragraph.
]], [[	Beginning of next, current section.
][, [ ]	End of next, current section. {vim}

9.4.1.3 Lines

Long lines in a file may show up on the screen as multiple lines. (They *wrap* around from one screen line to the next.) While most commands work on the lines as defined in the file, a few commands work on lines as they appear on the screen. The vim option wrap allows you to control how long lines are displayed.

Command	Action
0, $	First, last position of current line.
^, _	First nonblank character of current line.
+, -	First nonblank character of next, previous line.
Enter	First nonblank character of next line.
num|	Column *num* of current line.
g0, g$	First, last position of screen line. {vim}
g^	First nonblank character of screen line. {vim}
gm	Middle of screen line. {vim}
gk, gj	Move up, down one screen line. {vim}
H	Top line of screen (Home position).
M	Middle line of screen.
L	Last line of screen.
*num*H	*num* lines after top line.
*num*L	*num* lines before last line.

9.4.1.4 Screens

Command	Action
Ctrl-F, Ctrl-B	Scroll forward, backward one screen.

Command	Action
Ctrl-D, Ctrl-U	Scroll down, up one-half screen.
Ctrl-E, Ctrl-Y	Show one more line at bottom, top of screen.
z Enter	Reposition line with cursor to top of screen.
z.	Reposition line with cursor to middle of screen.
z-	Reposition line with cursor to bottom of screen.
Ctrl-L	Redraw screen (without scrolling).
Ctrl-R	vi: Redraw screen (without scrolling).
	vim: Redo last undone change.

9.4.1.5 Searches

Command	Action
/*pattern*	Search forward for *pattern*. End with Enter.
/*pattern*/ +*num*	Go to line *num* after *pattern*.
?*pattern*	Search backward for *pattern*. End with Enter.
?*pattern*?-*num*	Go to line *num* before *pattern*.
:noh	Suspend search highlighting until next search. {vim}.
n	Repeat previous search.
N	Repeat search in opposite direction.
/	Repeat previous search forward.
?	Repeat previous search backward.
*	Search forward for word under cursor. Matches only exact words. {vim}
#	Search backward for word under cursor. Matches only exact words. {vim}
g*	Search backward for word under cursor. Matches the characters of this word when embedded in a longer word. {vim}
g#	Search backward for word under cursor. Matches the characters of this word when embedded in a longer word. {vim}
%	Find match of current parenthesis, brace, or bracket.
f*x*	Move cursor forward to *x* on current line.
F*x*	Move cursor backward to *x* on current line.

Command	Action
t*x*	Move cursor forward to character before *x* in current line.
T*x*	Move cursor backward to character after *x* in current line.
,	Reverse search direction of last f, F, t, or T.
;	Repeat last f, F, t, or T.

9.4.1.6 Line Numbering

Command	Action
Ctrl-G	Display current line number.
gg	Move to first line in file. {vim}
*num*G	Move to line number *num*.
G	Move to last line in file.
:*num*	Move to line number *num*.

9.4.1.7 Marks

Command	Action
m*x*	Place mark *x* at current position.
`*x*	(backquote) Move cursor to mark *x*.
'*x*	(apostrophe) Move to start of line containing *x*.
``	(backquotes) Return to position before most recent jump.
''	(apostrophes) Like preceding, but return to start of line.
'"	(apostrophe quote) Move to position when last editing the file. {vim}
`[, `]	(backquote bracket) Move to beginning/end of previous text operation. {vim}
'[, ']	(apostrophe bracket) Like preceding, but return to start of line where operation occurred. {vim}
`.	(backquote period) Move to last change in file. {vim}
'.	(apostrophe period) Like preceding, but return to start of line. {vim}
`0	Position where you last exited vim. {vim}
:marks	List active marks. {vim}

9.4.2. Insert Commands

Command	Action
a	Append after cursor.
A	Append to end of line.
c	Begin change operation.
C	Change to end of line.
gI	Insert at beginning of line. {vim}
i	Insert before cursor.
I	Insert at beginning of line.
o	Open a line below cursor.
O	Open a line above cursor.
R	Begin overwriting text.
s	Substitute a character.
S	Substitute entire line.
ESC	Terminate insert mode.

The following commands work in insert mode.

Command	Action
Backspace	Delete previous character.
Delete	Delete current character.
Tab	Insert a tab.
Ctrl-A	Repeat last insertion. {vim}
Ctrl-D	Shift line left to previous shift width. {vim}
Ctrl-E	Insert character found just below cursor. {vim}
Ctrl-H	Delete previous character (same as Backspace).
Ctrl-I	Insert a tab.
Ctrl-K	Begin insertion of multi-keystroke character.
Ctrl-N	Insert next completion of the pattern to the left of the cursor. {vim}
Ctrl-P	Insert previous completion of the pattern to the left of the cursor. {vim}

Command	Action
Ctrl-T	Shift line right to next shift width. {vim}
Ctrl-U	Delete current line.
Ctrl-V	Insert next character verbatim.
Ctrl-W	Delete previous word.
Ctrl-Y	Insert character found just above cursor. {vim}
Ctrl-[	(Escape) Terminate insert mode.

Some of the control characters listed in the previous table are set bystty. Your terminal settings may differ.

9.4.3. Edit Commands

Recall that c, d, and y are the basic editing operators.

9.4.3.1 Changing and Deleting Text

The following table is not exhaustive, but it illustrates the most common operations.

Command	Action
cw	Change word.
cc	Change line.
c$	Change text from current position to end of line.
C	Same as c$.
dd	Delete current line.
*num*dd	Delete *num* lines.
d$	Delete text from current position to end of line.
D	Same as d$.
dw	Delete a word.
d}	Delete up to next paragraph.
d^	Delete back to beginning of line.
d/*pat*	Delete up to first occurrence of pattern.

Command	Action
dn	Delete up to next occurrence of pattern.
df*a*	Delete up to and including *a* on current line.
dt*a*	Delete up to (but not including) *a* on current line.
dL	Delete up to last line on screen.
dG	Delete to end of file.
gqap	Reformat current paragraph to textwidth. {vim}
g~w	Switch case of word. {vim}
guw	Change word to lowercase. {vim}
gUw	Change word to uppercase. {vim}
p	Insert last deleted or yanked text after cursor.
gp	Same as p, but leave cursor at end of inserted text. {vim}
]p	Same as p, but match current indention. {vim}
[p	Same as P, but match current indention. {vim}
P	Insert last deleted or yanked text before cursor.
gP	Same as P, but leave cursor at end of inserted text. {vim}
r*x*	Replace character with *x*.
R*text*	Replace with new *text* (overwrite), beginning at cursor. Escape ends replace mode.
s	Substitute character.
4s	Substitute four characters.
S	Substitute entire line.
u	Undo last change.
Ctrl-R	Redo last change. {vim}
U	Restore current line.
x	Delete current cursor position.
X	Delete back one character.
5X	Delete previous five characters.
.	Repeat last change.
~	Reverse case and move cursor right.
Ctrl-A	Increment number under cursor. {vim}
Ctrl-X	Decrement number under cursor. {vim}

9.4.3.2 Copying and Moving

Register names are the letters a-z. Uppercase names append text to the corresponding register.

Command	Action
Y	Copy current line.
yy	Copy current line.
"*x*yy	Copy current line to register *x*.
ye	Copy text to end of word.
yw	Like ye, but include the whitespace after the word.
y$	Copy rest of line.
"*x*dd	Delete current line into register *x*.
"*x*d	Delete into register *x*.
"*x*p	Put contents of register *x*.
y]]	Copy up to next section heading.
ye	Copy to end of word.
"*x*p	Put contents of register *x*.
J	Join current line to next line.
gJ	Same as J, but without inserting a space. {vim}
:j	Same as J.
:j!	Same as gJ.

9.4.4. Saving and Exiting

Writing a file means overwriting the file with the current text.

Command	Action
ZZ	Quit vi, writing the file only if changes were made.
:x	Same as ZZ.
:wq	Write file and quit.
:w	Write file.
:w *file*	Save copy to *file*.
:*n*,*m*w *file*	Write lines *n* to *m* to new *file*.

Command	Action
:*n*,*m*w >> *file*	Append lines *n* to *m* to existing *file*.
:w!	Write file (overriding protection).
:w! *file*	Overwrite *file* with current text.
:w %.*new*	Write current buffer named *file* as *file.new*.
:q	Quit vi (fails if changes were made).
:q!	Quit vi (discarding edits).
Q	Quit vi and invoke ex.
:vi	Return to vi after Q command.
%	Replaced with current filename in editing commands.
#	Replaced with alternate filename in editing commands.

9.4.5. Accessing Multiple Files

Command	Action
:e *file*	Edit another *file*; current file becomes alternate.
:e!	Return to version of current file at time of last write.
:e + *file*	Begin editing at end of *file*.
:e +*num file*	Open *file* at line *num*.
:e #	Open to previous position in alternate file.
:ta *tag*	Edit file at location *tag*.
:n	Edit next file in the list of files.
:n!	Force next file.
:n *files*	Specify new list of *files*.
:rewind	Edit first file in the list.
Ctrl-G	Show current file and line number.
:args	Display list of files to be edited.
:prev	Edit previous file in the list of files.

9.4.6. Window Commands

The following table lists common commands for controlling windows in vim. See also the split, vsplit, and resize commands in the section Alphabetical Summary of ex Commands," later in this chapter. For brevity, control characters are marked in the following list by ^.

Command	Action
:new	Open a new window.
:new *file*	Open *file* in a new window.
:sp [*file*]	Split the current window. With *file*, edit that file in the new window.
:sv [*file*]	Same as :sp, but make new window read-only.
:sn [*file*]	Edit next file in file list in new window.
:vsp [*file*]	Like :sp, but split vertically instead of horizontally.
:clo	Close current window.
:hid	Hide current window, unless it is the only visible window.
:on	Make current window the only visible one.
:res *num*	Resize window to *num* lines.
:wa	Write all changed buffers to file.
:qa	Close all buffers and exit.
^W s	Same as :sp.
^W n	Same as :new.
^W ^	Open new window with alternate (previously edited) file.
^W c	Same as :clo.
^W o	Same as :only.
^W j, ^W k	Move cursor to next/previous window.
^W p	Move cursor to previous window.
^W h, ^W l	Move cursor to window on left/right.
^W t, ^W b	Move cursor to window on top/bottom of screen.
^W K, ^W B	Move current window to top/bottom of screen.
^W H, ^W L	Move current window to far left/right of screen.
^W r, ^W R	Rotate windows down/up.
^W +, ^W -	Increase/decrease current window size.
^W =	Make all windows same height.

9.4.7. Interacting with the System

Command	Action
:r *file*	Read in contents of *file* after cursor.
:r !*command*	Read in output from *command* after current line.
:*num*r !*command*	Like above, but place after line *num* (0 for top of file).
:!*command*	Run *command*, then return.
!*motion command*	Send the text covered by *motion* to Unix *command*; replace with output.
:*n*,*m*! *command*	Send lines *n*-*m* to *command*; replace with output.
num!!*command*	Send *num* lines to Unix *command*; replace with output.
:!!	Repeat last system command.
:sh	Create subshell; return to file with *EOF*.
Ctrl-Z	Suspend editor, resume with fg.
:so *file*	Read and execute ex commands from *file*.

9.4.8. Macros

Command	Action
:ab *in out*	Use *in* as abbreviation for *out* in insert mode.
:unab *in*	Remove abbreviation for *in*.
:ab	List abbreviations.
:map *string sequence*	Map characters *string* as *sequence* of commands. Use #1, #2, etc., for the function keys.
:unmap *string*	Remove map for characters *string*.
:map	List character strings that are mapped.
:map! *string sequence*	Map characters *string* to input mode *sequence*.
:unmap! *string*	Remove input mode map (you may need to quote the character withCtrl-V).
:map!	List character strings that are mapped for input mode.
q*x*	Record typed characters into register specified by letter *x*. If letter is uppercase, append to register. {vim}
q	Stop recording. {vim}
@*x*	Execute the register specified by letter *x*. Use @@ to repeat the last @ command.

In vi, the following characters are unused in command mode and can be mapped as user-defined commands:

Letters

g K q V v

Control keys

^A ^K ^O ^W ^X ^_ ^\

Symbols

_ * \ = #

NOTE

The = is used by vi if Lisp mode is set. Different versions of vi may use some of these characters, so test them before using.

vim does not use ^K, ^_, _, or \.

9.4.9. Miscellaneous Commands

Command	Action
<	Shift text described by following motion command left by one shiftwidth. {vim}
>	Shift text described by following motion command right by one shiftwidth. {vim}
<<	Shift line left one shift width (default is eight spaces).
>>	Shift line right one shift width (default is eight spaces).
>}	Shift right to end of paragraph.
<%	Shift left until matching parenthesis, brace, or bracket. (Cursor must be on the matching symbol.)
= =	Indent line in C-style, or using program specified inequalprg option. {vim}
g	Start many multiple character commands in vim.
K	Look up word under cursor in manpages (or program defined inkeywordprg). {vim}

Command	Action
^O	Return to previous jump. {vim}
q	Record keystrokes. {vim}
^Q	Same as ^V. {vim} (On some terminals, resume data flow.)
^T	Return to the previous location in the tag stack. (vim)
^]	Perform a tag lookup on the text under the cursor.
^\	Enter ex line-editing mode.
^^	(Caret key with Ctrl key pressed) Return to previously edited file.

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9.5. vi Configuration

This section describes the following:

- The :set command
- Options available with :set
- Sample *.exrc* file

9.5.1. The :set Command

The :set command allows you to specify options that change characteristics of your editing environment. Options may be put in the *~/.exrc* file or set during a vi session.

The colon does not need to be typed if the command is put in *.exrc*:

Command	Action
:set *x*	Enable boolean option *x*, show value of other options.
:set no*x*	Disable option *x*.
:set *x*=*value*	Give *value* to option *x*.
:set	Show changed options.
:set all	Show all options.
:set *x*?	Show value of option *x*.

9.5.2. Options Used by :set

Table 9-1 contains brief descriptions of the important set command options. In the first column, options are listed in alphabetical order; if the option can be abbreviated, that abbreviation is shown in parentheses. The second column shows the default setting. The last column describes what the option does, when enabled.

This table lists set options for vi, with the addition of important vim options. Other versions of vi may have more or fewer or different options. See your local documentation, or use:set all to see the full list. Options that receive a value are marked with an =.

Table 9-1. :set Options

Option	Default	Description
autoindent (ai)	noai	In insert mode, indent each line to the same level as the line above or below. Use with the `shiftwidth` option.
autoprint (ap)	ap	Display changes after each editor command. (For global replacement, display last replacement.)
autowrite (aw)	noaw	Automatically write (save) the file if changed before opening another file with a command such as `:n`, or before giving Unix command with `:!`.
background (bg)		Describe the background so the editor can choose appropriate highlighting colors. Default value of `dark` or `light` depends on the environment in which the editor is invoked. {vim}
backup (bk)	nobackup	Create a backup file when overwriting an existing file. {vim}
backupdir= (bdir)	.,~/tmp/,~/	Name directories in which to store backup files if possible. The list of directories is comma-separated and in order of preference. {vim}
beautify (bf)	nobf	Ignore all control characters during input (except tab, newline, or formfeed).
backupext= (bex)	~	String to append to filenames for backup files. {vim}
cindent (cin)	nocindent	In insert mode, indent each line relative to the one above it, as is appropriate for C or C++ code. {vim}
compatible (cp)	cp	Make `vim` behave more like `vi`. Default is `nocp` when a *~/.vimrc* file is found. {vim}
directory (dir)	*/tmp*	Name of directory in which `ex`/`vi` stores buffer files. (Directory must be writable.) This can be a comma-separated list for `vim`.
edcompatible	noedcompatible	Remember the flags used with the most recent substitute command (global, confirming) and use them for the next substitute command. Despite the name, no version of `ed` actually does this.
equalprg= (ep)		Use the specified program for the = command. When the option is blank (the default), the key invokes the internal C indention function or the value of the `indentexpr` option. {vim}
errorbells (eb)	errorbells	Sound bell when an error occurs.
exrc (ex)	noexrc	Allow the execution of *.exrc* files that reside outside the user's home directory.

Option	Default	Description
formatprg= (fp)		The gq command will invoke the named external program to format text. It will call internal formatting functions when this option is empty (the default). {vim}
gdefault (gd)	nogdefault	Set the g flag on for substitutions by default. {vim}
hardtabs= (ht)	8	Define boundaries for terminal hardware tabs.
hidden (hid)	nohidden	Hide buffers rather than unload them when they are abandoned. {vim}
hlsearch (hls)	hlsearch	Highlight all matches of most recent search pattern. Use :nohlsearch to remove highlighting. {vim}
history= (hi)	20	Number of ex commands to store in the history table. {vim}
ignorecase (ic)	noic	Disregard case during a search.
incsearch (is)	noincsearch	Highlight matches to a search pattern as it is typed. {vim}
lisp	nolisp	Insert indents in appropriate Lisp format. ( ), { }, [[, and]] are modified to have meaning for Lisp.
list	nolist	Print tabs as ^I; mark ends of lines with $. (Use list to tell if end character is a tab or a space.)
magic	magic	Wildcard characters; . (dot), * (asterisk), and [ ] (brackets) have special meaning in patterns.
mesg	mesg	Permit system messages to display on terminal while editing in vi.
mousehide (mh)	mousehide	When characters are typed, hide the mouse pointer. {vim}
novice	nonovice	Require the use of long ex command names, such as copy or read.
number (nu)	nonu	Display line numbers on left of screen during editing session.
open	open	Allow entry to *open* or *visual* mode from ex. Although not in vim, this option has traditionally been in vi, and may be in your version of vi.
optimize (opt)	noopt	Abolish carriage returns at the end of lines when printing multiple lines; speed output on dumb terminals when printing lines with leading whitespace (spaces or tabs).
paragraphs (para)	IPLPPPQPP LIpplpipnpbp	Define paragraph delimiters for movement by { or }. The pairs of characters in the value are the names of troff macros that begin paragraphs.
paste	nopaste	Change the defaults of various options to make pasting text into a terminal window work better. All options are returned to their original value when the paste option is reset. {vim}
prompt	prompt	Display the ex prompt (:) when vi 's Q command is given.

Option	Default	Description
readonly (ro)	noro	Any writes (saves) of a file fail unless you use! after the write (works with w, ZZ, or autowrite).
redraw (re)		vi redraws the screen whenever edits are made. noredraw is useful at slow speeds on a dumb terminal: the screen isn't fully updated until you press Escape. Default depends on line speed and terminal type.
remap	remap	Allow nested map sequences.
report=	5	Display a message on the status line whenever you make an edit that affects at least a certain number of lines. For example, 6dd reports the message "6 lines deleted."
ruler (ru)	ruler	Show line and column numbers for the current cursor position. {vim}
scroll=	[1/2 *window*]	Number of lines to scroll with ^D and ^U commands.
sections= (sect)	SHNHH HUnhsh+c	Define section delimiters for [[and]] movement. The pairs of characters in the value are the names of troff macros that begin sections.
shell= (sh)	/bin/sh	Pathname of shell used for shell escape (:!) and shell command (:sh). Default value is derived from shell environment, which varies on different systems.
shiftwidth= (sw)	8	Define number of spaces used when the indent in increased or decreased.
showmatch (sm)	nosm	In vi, when) or } is entered, cursor moves briefly to matching (or {. (If no match, rings the error message bell.) Very useful for programming.
showmode	noshowmode	In insert mode, display a message on the prompt line indicating the type of insert you are making. For example, "OPEN MODE" or "APPEND MODE."
slowopen (slow)		Hold off display during insert. Default depends on line speed and terminal type.
smartcase (scs)	nosmartcase	Override the ignorecase option when a search pattern contains uppercase characters. {vim}
tabstop= (ts)	8	Define number of spaces a tab indents during editing session. (Printer still uses system tab of 8.)
taglength= (tl)	0	Define number of characters that are significant for tags. Default (zero) means that all characters are significant.
tags=	*tags /usr/lib/tags*	Define pathname of files containing tags. (See the Unix ctags command.) (By default, vi searches the file *tags* in the current directory and */usr/lib/tags*.)
tagstack	tagstack	Enable stacking of tag locations on a stack. (Solaris vi and vim.)
term=		Set terminal type.

Option	Default	Description
terse	noterse	Display shorter error messages.
textwidth= (tw)	0	The maximum width of text to be inserted; longer lines are broken after whitespace. Default (zero) disables this feature, in which case wrapmargin is used. {vim}
timeout (to)	timeout	Keyboard maps timeout after 1 second.[a]
timeoutlen= (tm)	1000	Number of milliseconds after which keyboard maps timeout. Default value of 1000 provides traditional vi behavior. {vim}
ttytype=		Set terminal type. This is just another name for term.
undolevels= (ul)	1000	Number of changes that can be undone. {vim}
warn	warn	Display the warning message, "No write since last change."
window (w)		Show a certain number of lines of the file on the screen. Default depends on line speed and terminal type.
wrap		When on, long lines wrap on the screen. When off, only the first part of the line is displayed. {vim}
wrapmargin (wm)	0	Define right margin. If greater than zero, vi automatically inserts carriage returns to break lines.
wrapscan (ws)	ws	Searches wrap around either end of file.
writeany (wa)	nowa	Allow saving to any file.
writebackup (wb)	wb	Back up files before attempting to overwrite them. Remove the backup when the file has been successfully written, unless the backup option is set. {vim}

[a] When you have mappings of several keys (for example, **:map zzz 3dw**), you probably want to use **notimeout**. Otherwise, you need to type **zzz** within 1 second. When you have an insert mode mapping for a cursor key (for example, **:map! ^[OB ^[ja**), you should use **timeout**. Otherwise, **vi** won't react to Escape until you type another key.

9.5.3. Sample .exrc File

The following lines of code are an example of a customized *.exrc* file:

```
set nowrapscan                          " Searches don't wrap at end of file
set wrapmargin=7                        " Wrap text at 7 columns from right margin
set sections=SeAhBhChDh nomesg          " Set troff macros, disallow message
map q :w^M:n^M                          " Alias to move to next file
map v dwElp                             " Move a word
ab ORA O'Reilly Media, Inc.             " Input shortcut
```

NOTE

The q alias isn't needed for vim, which has the :wn command. The v alias would hide the vim command v, which enters character-at-a-time visual-mode operation.

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9.6. ex Basics

The ex line editor serves as the foundation for the screen editor vi. Commands in ex work on the current line or on a range of lines in a file. Most often, you use ex from within vi. In vi, ex commands are preceded by a colon and entered by pressing Enter.

You can also invoke ex on its own from the command line just as you would invoke vi. (You could execute an ex script this way.) You can also use the vi command Q to quit the vi editor and enter ex.

9.6.1. Syntax of ex Commands

To enter an ex command from vi, type:

```
: [address ] command [options ]
```

An initial : indicates an ex command. As you type the command, it is echoed on the status line. Execute the command by pressing the Enter key. *address* is the line number or range of lines that are the object of *command*. *options* and *addresses* are described below. ex commands are described in the next section Alphabetical Summary of ex Commands."

You can exit ex in several ways:

:x

Exit (save changes and quit).

:q!

Quit without saving changes.

:vi

Switch to the vi editor on the current file.

9.6.2. Addresses

If no address is given, the current line is the object of the command. If the address specifies a range of lines, the format is:

```
x,y
```

where *x* and *y* are the first and last addressed lines (*x* must precede *y* in the buffer). *x* and *y* may each be a line number or a symbol. Using ; instead of , sets the current line to *x* before interpreting *y*. The notation 1,$ addresses all lines in the file, as does %.

9.6.3. Address Symbols

Symbol	Meaning
1,$	All lines in the file.
x,*y*	Lines *x* through *y*.
x;*y*	Lines *x* through *y*, with current line reset to *x*.
0	Top of file.
.	Current line.
num	Absolute line number *num*.
$	Last line.
%	All lines; same as 1,$.
x-*n*	*n* lines before *x*.
x+*n*	*n* lines after *x*.
-[*num*]	One or *num* lines previous.
+[*num*]	One or *num* lines ahead.
'*x*	Line marked with *x*.
''	Previous mark.
/*pattern*/	Forward to line matching *pattern*.
?*pattern*?	Backward to line matching *pattern*.

See Chapter 7 for more information on using patterns.

9.6.4. Options

!

Indicates a variant form of the command, overriding the normal behavior. The! must come immediately after the command.

count

The number of times the command is to be repeated. Unlike invi commands, *count* cannot precede the command, because a number preceding an ex command is treated as a line address. For example, d3 deletes three lines beginning with the current line; 3d deletes line 3.

file

The name of a file that is affected by the command. % stands for the current file; # stands for the previous file.

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9.7. Alphabetical Summary of ex Commands

ex commands can be entered by specifying any unique abbreviation. In this listing, the full name appears in the margin, and the shortest possible abbreviation is used in the syntax line. Examples ar assumed to be typed from vi, so they include the : prompt.

abbreviate

```
ab [string text]
```

Define *string* when typed to be translated into *text*. If *string* and *text* are not specified, list all current abbreviations.

Examples

Note: ^M appears when you type ^V followed by Enter.

```
:ab ora O'Reilly Media, Inc.
:ab id Name:^MRank:^MPhone:
```

append

```
[address] a[!]
text
.
```

Append new *text* at specified *address*, or at present address if none is specified. Add a! to toggle the autoindent setting that is used during input. That is, if autoindent was enabled, ! disables it. Enter new text after entering the command. Terminate input of new text by entering a line consisting of just a period.

Example

```
:a                    Begin appending to current line.
Append this line
and this line too.
.                    Terminate input of text to append.
```

args

```
ar
args file ...
```

Print the members of the argument list (files named on the command line), with the current argument printed in brackets ([ ]).

The second syntax is for vim, which allows you to reset the list of files to be edited.

bdelete

```
[num] bd[!] [num]
```

Unload buffer *num* and remove it from the buffer list. Add a ! to force removal of an unsaved buffer. The buffer may also be specified by filename. If no buffer is specified, remove the current buffer. {vim}

buffer

```
[num] b[!] [num]
```

Begin editing buffer *num* in the buffer list. Add a ! to force a switch from an unsaved buffer. The buffer may also be specified by filename. If no buffer is specified, continue editing the current buffer. {vim}

buffers

```
buffers[!]
```

Print the members of the buffer list. Some buffers (e.g., deleted buffers) will not be listed. Add! to show unlisted buffers. ls is another abbreviation for this command. {vim}

cd

```
cd dir
chdir dir
```

Change current directory within the editor to *dir*.

center

```
[address] ce [width]
```

Center line within the specified *width*. If *width* is not specified, use textwidth. {vim}

change

```
[address] c[!]
text
.
```

Replace the specified lines with *text*. Add a ! to switch the autoindent setting during input of *text*. Terminate input by entering a line consisting of just a period.

close

```
clo[!]
```

Close current window unless it is the last window. If buffer in window is not open in another window, unload it from memory. This command will not close a buffer with unsaved changes, but you may add ! to hide it instead. {vim}

copy

```
[address] co destination
```

Copy the lines included in *address* to the specified *destination* address. The command t (short for "to") is a synonym for copy.

Example

```
:1,10 co 50         Copy first 10 lines to just after line 50
```

delete

```
[address] d [register]
```

Delete the lines included in *address*. If *register* is specified, save or append the text to the named register. Register names are the lowercase letters a-z. Uppercase names append text to the corresponding register.

Examples

```
:/Part I/,/Part II/-1d      Delete to line above "Part II"
:/main/+d     Delete line below "main"
:.,$d x       Delete from this line to last line into
                                    register x
```

edit

```
e[!] [+num] [filename]
```

Begin editing on *filename*. If no *filename* is given, start over with a copy of the current file. Add a ! to edit the new file even if the current file has not been saved since the last change. With the +*num* argument, begin editing on line *num*. Or *num* may be a pattern, of the form /*pattern*.

Examples

```
:e file           Edit file in current editing buffer
:e +/^Index #     Edit alternate file at pattern match
:e!               Start over again on current file
```

file

```
f [filename]
```

Change the filename for the current buffer to *filename*. The next time the buffer is written, it will be written to file *filename*. When the name is changed, the buffer's "not edited" flag is set, to indicate you are not editing an existing file. If the new filename is the same as a file that already exists on the disk, you will need to use :w! to overwrite the existing file. When specifying a filename, the % character can be used to indicate the current filename. A # can be used to indicate the alternate filename. If no *filename* is specified, print the current name and status of the buffer.

Example

```
:f%.new
```

fold

```
address fo
```

Fold the lines specified by *address*. A fold collapses several lines on the screen into one line, which later can be unfolded. It doesn't affect the text of the file. {vim}

foldclose

```
[address] foldc[!]
```

Close folds in specified *address*, or at present address if none is specified. Add a! to close more than one level of folds. {vim}

foldopen

```
[address] foldo[!]
```

Open folds in specified *address*, or at present address if none is specified. Add a! to open more than one level of folds. {vim}

global

```
[address] g[!]/pattern/[commands]
```

Execute *commands* on all lines which contain *pattern* or, if *address* is specified, on all lines within that

range. If *commands* are not specified, print all such lines. Add a ! to execute *commands* on all lines *not* containing *pattern*. See also v.

Examples

```
:g/Unix/p              Print all lines containing "Unix"
:g/Name:/s/tom/Tom/    Change "tom" to "Tom" on all lines
                                containing "Name:"
```

hide

```
hid
```

Close current window unless it is the last window, but do not remove the buffer from memory. This is a safe command to use on an unsaved buffer. {vim}

insert

```
[address] i[!]
text
.
```

Insert *text* at line before the specified *address*, or at present address if none is specified. Add a ! to switch the autoindent setting during input of *text*. Terminate input of new text by entering a line consisting of just a period.

join

```
[address] j[!] [count]
```

Place the text in the specified range on one line, with whitespace adjusted to provide two space characters after a period (.), no space characters before a), and one space character otherwise. Add

a ! to prevent whitespace adjustment.

Example

```
:1,5j!   Join first five lines, preserving whitespace
```

jumps

```
ju
```

Print jump list used with Ctrl-I and Ctrl-O commands. The jump list is a record of most movement commands that skip over multiple lines. It records the position of the cursor before each jump. {vim}

k

```
[address] k char
```

Same as mark; see mark, later in this list.

left

```
[address] le [count]
```

Left-align lines specified by *address*, or current line if no address is specified. Indent lines by *count* spaces. {vim}

list

```
[address] l [count]
```

Print the specified lines so that tabs display as ^I, and the ends of lines display as $. l is like a temporary version of :set list.

map

```
map[!] [string commands]
```

Define a keyboard macro named *string* as the specified sequence of *commands*. *string* is usually a single character, or the sequence #*num*, representing a function key on the keyboard. Use a ! to create a macro for input mode. With no arguments, list the currently defined macros.

Examples

```
:map K dwwP          Transpose two words
:map q :w^M:n^M        Write current file; go to next
:map! + ^[bi(^[ea)    Enclose previous word in parentheses
```

NOTE

vim has K and q commands, which the above aliases would hide.

mark

```
[address] ma char
```

Mark the specified line with *char*, a single lowercase letter. Return later to the line with 'x (where *x* is the same as *char*). vim also uses uppercase and numeric characters for marks. Lowercase letters work the same as in vi. Uppercase letters are associated with filenames and can be used between multiple files. Numbered marks, however, are maintained in a special *viminfo* file and cannot be set using this command. Same as k.

marks

```
marks [chars]
```

Print list of marks specified by *chars*, or all current marks if no chars specified. {vim}

Example

```
:marks abc      Print marks a, b and c.
```

mkexrc

```
mk[!] file
```

Create an *.exrc* file containing set commands for changed ex options and key mappings. This saves the current option settings, allowing you to restore them later.

move

```
[address] m destination
```

Move the lines specified by *address* to the *destination* address.

Example

```
:.,/Note/m /END/        Move text block to after line containing "END"
```

new

```
[count] new
```

Create a new window *count* lines high with an empty buffer. {vim}

next

```
num[!] [[+num] filelist]
```

Edit the next file from the command-line argument list. Use `args` to list these files. If *filelist* is provided, replace the current argument list with *filelist* and begin editing on the first file. With the *+num* argument, begin editing on line *num*. Or *num* may be a pattern, of the form */pattern*.

Example

```
:n chap*      Start editing all "chapter" files
```

nohlsearch

```
noh
```

Temporarily stop highlighting all matches to a search when using the `hlsearch` option. Highlighting is resumed with the next search. {vim}

number

```
[address] nu [count]
```

Print each line specified by *address*, preceded by its buffer line number. Use # as an alternate abbreviation for number. *count* specifies the number of lines to show, starting with *address*.

only

```
on [!]
```

Make the current window be the only one on the screen. Windows open on modified buffers are not removed from the screen (hidden), unless you also use the ! character. {vim}

open

```
[address] o [/pattern/]
```

Enter open mode (vi) at the lines specified by *address*, or at the lines matching *pattern*. Exit open mode with Q. Open mode lets you use the regular vi commands, but only one line at a time. It can be useful on slow dial-up lines (or on very distant Internetssh connections).

preserve

```
pre
```

Save the current editor buffer as though the system were about to crash.

previous

```
prev[!]
```

Edit the previous file from the command-line argument list. {vim}

print

```
[address] p [count]
```

Print the lines specified by *address*. *count* specifies the number of lines to print, starting with *address*. P is another abbreviation.

Example

```
:100;+5p        Show line 100 and the next five lines
```

put

```
[address] pu [char]
```

Restore previously deleted or yanked lines from named register specified by *char*, to the line specified by *address*. If *char* is not specified, the last deleted or yanked text is restored.

qall

```
qa[!]
```

Close all windows and terminate current editing session. Use! to discard changes made since the last save. {vim}

quit

```
q[!]
```

Terminate current editing session. Use ! to discard changes made since the last save. If the editing session includes additional files in the argument list that were never accessed, quit by typingq! or by typing q twice. vim only closes the editing window if there are still other windows open on the screen.

read

```
[address] r filename
```

Copy the text of *filename* after the line specified by *address*. If *filename* is not specified, the current filename is used.

Example

```
:0r $HOME/data          Read file in at top of current file
```

read

```
[address] r !command
```

Read the output of shell *command* into the text after the line specified by *address*.

Example

```
:$r !spell %            Place results of spell checking at end of file
```

recover

```
rec [file]
```

Recover *file* from the system save area.

redo

```
red
```

Restore last undone change. Same as Ctrl-R. {vim}

resize

```
res [[±]num]
```

Resize current window to be *num* lines high. If + or - is specified, increase or decrease the current window height by *num* lines. {vim}

rewind

```
rew[!]
```

Rewind argument list and begin editing the first file in the list. Add a! to rewind even if the current file has not been saved since the last change.

right

```
[address] ri [width]
```

Right-align lines specified by *address*, or current line if no address is specified, to column *width*. Use `textwidth` option if no *width* is specified. {vim}

sbnext

```
[count] sbn [count]
```

Split the current window and begin editing the *count*'th next buffer from the buffer list. If no count is specified, edit the next buffer in the buffer list. {vim}

sbuffer

```
[num] sb [num]
```

Split the current window and begin editing buffer *num* from the buffer list in the new window. The buffer to be edited may also be specified by filename. If no buffer is specified, open the current buffe in the new window. {vim}

set

```
se parameter1
parameter2 ...
```

Set a value to an option with each *parameter*, or, if no *parameter* is supplied, print all options that have been changed from their defaults. For boolean options, each *parameter* can be phrased as *option* or no*option*; other options can be assigned with the syntax *option*=*value*. Specify all to list current settings. The form set *option*? displays the value of *option*. See the list of set options in the section The :set Command," earlier in this chapter.

Examples

```
:set nows wm=10
:set all
```

shell

```
sh
```

Create a new shell. Resume editing when the shell terminates.

snext

```
[count] sn [[+num] filelist]
```

Split the current window and begin editing the next file from the command-line argument list. If *count* is provided, edit the *count'th* next file. If *filelist* is provided, replace the current argument list with *filelist* and begin editing the first file. With the *+n* argument, begin editing on line *num*. Alternately, *num* may be a pattern of the form */pattern*. {vim}

source

```
so file
```

Read (source) and execute ex commands from *file*.

Example

```
:so $HOME/.exrc
```

split

```
[count] sp [+num] [filename]
```

Split the current window and load *filename* in the new window, or the same buffer in both windows if no file is specified. Make the new window *count* lines high, or, if *count* is not specified, split the window into equal parts. With the +*n* argument, begin editing on line *num*. *num* may also be a pattern of the form */pattern*. {vim}

sprevious

```
[count] spr [+num]
```

Split the current window and begin editing the previous file from the command-line argument list in the new window. If *count* is specified, edit the *count*'th previous file. With the +*num* argument, begin editing on line *num*. *num* may also be a pattern of the form */pattern*. {vim}

stop

```
st
```

Suspend the editing session. Same as Ctrl-Z. Use the shell fg command to resume the session.

substitute

```
[address] s [/pattern/replacement/] [options] [count]
```

Replace the first instance of *pattern* on each of the specified lines with *replacement*. If *pattern* and *replacement* are omitted, repeat last substitution. *count* specifies the number of lines on which to substitute, starting with *address*. See additional examples in Chapter 7.

Options

c

Prompt for confirmation before each change.

g

Substitute all instances of *pattern* on each line (global).

p

Print the last line on which a substitution was made.

Examples

```
:1,10s/yes/no/g      Substitute on first 10 lines
:%s/[Hh]ello/Hi/gc   Confirm global substitutions
:s/Fortran/\U&/ 3    Uppercase "Fortran" on next three lines
:g/^[0-9][0-9]*/s//Line &:/   For every line beginning with one or
                                        more digits, add "Line" and a colon
```

suspend

```
su
```

Suspend the editing session. Same as Ctrl-Z. Use the shell fg command to resume the session.

sview

```
[count] sv [+num] [filename]
```

Same as the split command, but set the readonly option for the new buffer. {vim}

t

```
[address] t destination
```

Copy the lines included in *address* to the specified *destination* address. t is equivalent to copy.

Example

```
:%t$        Copy the file and add it to the end
```

tag

```
[address] ta tag
```

In the *tags* file, locate the file and line matching *tag*, and start editing there.

Example

Run ctags, then switch to the file containing *myfunction*:

```
:!ctags *.c
:tag myfunction
```

tags

```
tags
```

Print list of tags in the tag stack. {vim}

unabbreviate

```
una word
```

Remove *word* from the list of abbreviations.

undo

```
u
```

Reverse the changes made by the last editing command. In vi, the undo command will undo itself, redoing what you undid. vim supports multiple levels of undo. Use redo to redo an undone change in vim.

unhide

```
[count] unh
```

Split screen to show one window for each active buffer in the buffer list. If specified, limit the number of windows to *count*. {vim}

unmap

```
unm[!] string
```

Remove *string* from the list of keyboard macros. Use ! to remove a macro for input mode.

v

```
[address] v/pattern/[command]
```

Execute *command* on all lines *not* containing *pattern*. If *command* is not specified, print all such lines. v is equivalent to g!. See global.

Example

```
:v/#include/d          Delete all lines except "#include" lines
```

version

```
ve
```

Print the editor's current version number and date of last change.

view

```
vie[[+num] filename]
```

Same as edit, but set file to readonly. When executed in ex mode, return to normal or visual mode. {vim}

visual

```
[address] vi [type] [count]
```

Enter visual mode (vi) at the line specified by *address*. Return to ex mode with Q. *type* can be one of -, ^, or . (See the z command). *count* specifies an initial window size.

visual

```
vi [+ num] file
```

Begin editing *file* in visual mode (vi), optionally at line *num*.

vsplit

```
[count] vs [+num] [filename]
```

Same as the split command, but split the screen vertically. The *count* argument can be used to specify a width for the new window. {vim}

wall

```
wa[!]
```

Write all changed buffers with filenames. Add! to force writing of any buffers marked readonly. {vim}

wnext

```
[count] wn[!] [[+num] filename]
```

Write current buffer and open next file in argument list, or the *count'th* next file if specified. If

filename is specified, edit it next. With the +*num* argument, begin editing on line *num*. *num* may also be a pattern of the form */pattern*. {vim}

write

```
[address] w[!] [[>>] file]
```

Write lines specified by *address* to *file*, or write full contents of buffer if *address* is not specified. If *file* is also omitted, save the contents of the buffer to the current filename. If > > *file* is used, append lines to the end of the specified *file*. Add a ! to force the editor to write over any current contents of *file*.

Examples

```
:1,10w name_list      Copy first 10 lines to file name_list
:50w >> name_list       Now append line 50
```

write

```
[address] w !command
```

Write lines specified by *address* to *command*.

Example

```
:1,66w !pr -h myfile | lp          Print first page of file
```

wq

```
wq[!]
```

Write and quit the file in one movement. The file is always written. The! flag forces the editor to write over any current contents of *file*.

wqall

```
wqa[!]
```

Write all changed buffers and quit the editor. Add! to force writing of any buffers marked readonly. xall is another alias for this command. {vim}

X

```
X
```

Prompt for an encryption key. This command can be preferable to:set key, as typing the key is not echoed to the console. To remove an encryption key, just reset thekey option to an empty value. {vim}

xit

```
x
```

Write the file if it was changed since the last write, then quit.

yank

```
[address] y [char] [count]
```

Place lines specified by *address* in named register *char*. Register names are the lowercase letters a-z. Uppercase names append text to the corresponding register. If no *char* is given, place lines in general register. *count* specifies the number of lines to yank, starting with *address*.

Example

```
:101,200 ya a       Copy lines 100-200 to register "a"
```

z

```
[address] z [type] [count]
```

Print a window of text with the line specified by *address* at the top. *count* specifies the number of lines to be displayed.

Type

+

Place specified line at the top of the window (default).

-

Place specified line at the bottom of the window.

.

Place specified line in the center of the window.

^

Print the previous window.

=

Place specified line in the center of the window and leave the current line at this line.

!

```
[address] !command
```

Execute Unix *command* in a shell. If *address* is specified, use the lines contained in *address* as standard input to *command*, and replace the lines with the output and error output. (This is called *filtering* the text through the *command*.)

Examples

```
:!ls              List files in the current directory
:11,20!sort -f    Sort lines 11-20 of current file
```

=

```
[address] =
```

Print the line number of the line indicated by *address*. Default is line number of the last line.

< >

```
[address] < [count]
[address] > [count]
```

Shift lines specified by *address* either left (<) or right (>). Only leading spaces and tabs are added or removed when shifting lines. *count* specifies the number of lines to shift, starting with *address*. The `shiftwidth` option controls the number of columns that are shifted. Repeating the < or > increases the shift amount. For example, :>>> shifts three times as much as :>.

address

address

Print the lines specified in *address*.

Enter

Print the next line in the file. (For ex only; not from the : prompt in vi.)

@

[*address*] @ [*char*]

Execute contents of register specified by *char*. If *address* is given, move cursor to the specified address first. If *char* is @, repeat the last @ command.

&

[*address*] & [*options*] [*count*]

Repeat the previous substitute (s) command. *count* specifies the number of lines on which to substitute, starting with *address*. *options* are the same as for the substitute command.

Examples

```
:s/Overdue/Paid/          Substitute once on current line
:g/Status/&           Redo substitution on all "Status" lines
```

~

```
[address] ~ [count]
```

Replace the last-used regular expression (even if from a search, and not from ans command) with the replacement pattern from the most recent s (substitute) command. This is rather obscure; see Chapter 6 of Learning the vi Editor (O'Reilly) for details.

PREV

Chapter 10. The sed Editor

The sed "stream editor" is one of the most prominent text-processing tools on Unix and Linux. It is most often used for performing simple substitutions on data streams going through pipelines, butsed scripts can be written to do much more.

This chapter presents the following topics:

- Conceptual overview of sed
- Command-line syntax
- Syntax of sed commands
- Group summary of sed commands
- Alphabetical summary of sed commands

The version of sed provided with Linux systems is the GNU version written by the Free Software Foundation; its home page is http://www.gnu.org/software/sed/sed.html. For more information on sed, see sed & awk (O'Reilly).

10.1. Conceptual Overview

The stream editor, sed, is a non-interactive editor. It interprets a script and performs the actions in the script. sed is stream-oriented because, like many Unix programs, input flows through the program and is directed to standard output. For example, sort is stream-oriented; vi is not. sed's input typically comes from a file or pipe, but it can also be taken from the keyboard. Output goes to the screen by default, but it can be captured in a file or sent through a pipe instead. GNUsed can edit files that use multibyte character sets.

10.1.1. Typical Uses of sed

- Editing one or more files automatically.
- Simplifying repetitive edits to multiple files.
- Writing conversion programs.

10.1.2. sed Operation

sed operates as follows:

- Each line of input is copied into a*pattern space*, an internal buffer where editing operations are performed.
- All editing commands in a sed script are applied, in order, to each line of input.
- Editing commands are applied to all lines (globally) unless line addressing restricts the lines affected.
- If a command changes the input, subsequent commands and address tests are applied to the current line in the pattern space, not the original input line.
- The original input file is unchanged because the editing commands modify an in-memory copy of each original input line. The copy is sent to standard output (but can be redirected to a file).
- sed also maintains the *hold space*, a separate buffer that can be used to save data for later retrieval.

10.2. Command-Line Syntax

The syntax for invoking sed has two forms:

```
sed [-n] [-e] 'command' file(s)
sed [-n]  -f  scriptfile file(s)
```

The first form allows you to specify an editing command on the command line, surrounded by single quotes. The second form allows you to specify a*scriptfile*, a file containing sed commands. Both forms may be used together, and they may be used multiple times. If no*file (s)* is specified, sed reads from standard input.

10.2.1. Standard Options

The following options are recognized:

-n

Suppress the default output; sed displays only those lines specified with the p command or with the p flag of the s command.

-e *cmd*

Next argument is an editing command. Necessary if multiple scripts or commands are specified.

-f *file*

Next argument is a file containing editing commands.

If the first line of the script is #n, sed behaves as if -n had been specified.

Multiple -e and -f options may be provided, and they may be mixed. The final script consists of the concatenation of all the *script* and *file* arguments.

10.2.2. GNU sed Options

GNU sed accepts a number of additional command-line options, as well as long-option equivalents for the standard options. The GNU sed options are:

-e *cmd*, --expression *cmd*

Use *cmd* as editing commands.

-f *file*, --file *file*

Obtain editing commands from *file*.

--help

Print a usage message and exit.

-i[*suffix*], --in-place[=*suffix*]

Edit files in place, overwriting the original file. If optional *suffix* is supplied, use it for renaming the original file as a backup file. See the GNU sed online Info documentation for the details.

-l *len*, --line-length *len*

Set the line length for the l command to *len* characters.

-n, --quiet, --silent

Suppress the default output; sed displays only those lines specified with the p command or with the p flag of the s command.

--posix

Disable *all* GNU extensions. Setting POSIXLY_CORRECT in the environment merely disables those extensions that are incompatible with the POSIX standard.

-r, --regex-extended

Use Extended Regular Expressions instead of Basic Regular Expressions. See Chapter 7 for more information.

-s, --separate

Instead of considering the input to be one long stream consisting of the concatenation of all the input files, treat each file separately. Line numbers start over with each file, the address $ refers to the last line of each file, files read by the R command are rewound, and range

addresses (/x/,/y/) may not cross file boundaries.

-u, --unbuffered

Buffer input and output as little as possible. Useful for editing the output oftail -f when you don't want to wait for the output.

--version

Print the version of GNU sed and a copyright notice, and then exit.

PREV

10.3. Syntax of sed Commands

sed commands have the general form:

```
[address[,address ]][!]command[arguments]
```

commands consist of a single letter or symbol; they are described later, by group and alphabetically. *arguments* include the label supplied to b or t, the filename supplied to r or w, and the substitution flags for s. *addresses* are described next.

10.3.1. Pattern Addressing

A sed command can specify zero, one, or two addresses. In POSIX sed, an address has one of the forms in the following table. Regular expressions are described in Chapter 7. Additionally, \n can be used to match any newline in the pattern space (resulting from the N command), but not the newline at the end of the pattern space.

Address	Meaning
/*pattern*/	Lines that match *pattern*.
\;*pattern*;	Like previous, but use semicolon as the delimiter instead of slash. Any character may be used. This is useful if *pattern* contains multiple slash characters.
n	Line number *n*.
$	The last input line.

If the command specifies:	Then the command is applied to:
No address	Each input line.
One address	Any line matching the address. Some commands accept only one address: a, i, r, q, and =.
Two comma-separated addresses	First matching line and all succeeding lines up to and including a line matching the second address.
An address followed by !	All lines that do *not* match the address.

GNU sed allows additional address forms:

Address	Meaning
/*pattern*/i	Match pattern, ignoring case. I may be used instead of i.
/*pattern*/m	Match pattern, allowing ^ and $ to match around an embedded newline. M may be used instead of m.
0,/*pattern*/	Similar to 1,/*pattern*/, but if line 1 matches *pattern*, it will end the range.
address,+*n*	Matches line matching *address*, and the *n* following lines.
address~*incr*	Matches line matching *address* and every *incr* lines after it. For example, 42~3 matches 42, 45, 48, and so on.

10.3.2. Pattern Addressing Examples

Command	Action performed
s/xx/yy/g	Substitute on all lines (all occurrences).
/BSD/d	Delete lines containing BSD.
/^BEGIN/,/^END/p	Print between BEGIN and END, inclusive.
/SAVE/!d	Delete any line that doesn't contain SAVE.
/BEGIN/,/END/!s/xx/yy/g	Substitute on all lines, except between BEGIN and END.

Braces ({ }) are used in sed to nest one address inside another or to apply multiple commands at a single matched address:

```
[/pattern/[,/pattern/]]{
command1

command2
}
```

The opening curly brace must end its line, and the closing curly brace must be on a line by itself. Be sure there are no spaces after the braces.

10.3.3. GNU sed Regular Expression Extensions

With the -r option, GNU sed uses Extended Regular Expressions instead of Basic Regular

expressions. (See Chapter 7 for more information.) However, even without `-r`, you can use additional escape sequences for more powerful text matching. The following escape sequences are valid only in regular expressions:

`\b`

Matches on a word boundary, where of the two surrounding characters (*x*`\b`*y*), one is a word-constituent character and the other is not.

`\B`

Matches on a non-word boundary, where both of the two surrounding characters (*x*`\b`*y*) are either word-constituent or not word-constituent.

`\w`

Matches any word-constituent character (i.e., a letter, digit, or underscore).

`\W`

Matches any non-word-constituent character (i.e., anything that is *not* a letter, digit, or underscore).

`\``

Matches the beginning of the pattern space. This is different from `^` when the `m` modifier is used for a pattern or the `s` command.

`\'`

Matches the end of the pattern space. This is different from `$` when the `m` modifier is used for a pattern or the `s` command.

The following escape sequences may be used anywhere.

`\a`

The ASCII BEL character.

`\f`

The ASCII formfeed character.

\n

The ASCII newline character.

\r

The ASCII carriage-return character.

\v

The ASCII vertical tab character.

\d*nn*

The character whose ASCII decimal value is *nn*.

\o*nn*

The character whose ASCII octal value is *nn*.

\x*nn*

The character whose ASCII hexadecimal value is *nn*.

10.4. Group Summary of sed Commands

In the lists that follow, the sed commands are grouped by function and are described tersely. Full descriptions, including syntax and examples, can be found afterward in the Alphabetical Summary section. Commands marked with a | are specific to GNU sed.

10.4.1. Basic Editing

Command	Action
a\	Append text after a line.
c\	Replace text (usually a text block).
i\	Insert text before a line.
d	Delete lines.
s	Make substitutions.
y	Translate characters (like Unix tr).

10.4.2. Line Information

Command	Action
=	Display line number of a line.
l	Display control characters in ASCII.
p	Display the line.

10.4.3. Input/Output Processing

Command	Action
e	Execute commands.
n	Skip current line and go to the next line.
r	Read another file's contents into the output stream.

Command	Action
R †	Read one line from a file into the output.
w	Write input lines to another file.
W †	Write first line in pattern space to another file.
q	Quit the sed script (no further output).
Q †	Quit without printing the pattern space.
v †	Require a specific version of GNU sed to run the script.

10.4.4. Yanking and Putting

Command	Action
h	Copy into hold space; wipe out what's there.
H	Copy into hold space; append to what's there.
g	Get the hold space back; wipe out the destination line.
G	Get the hold space back; append to the pattern space.
x	Exchange contents of the hold and pattern spaces.

10.4.5. Branching Commands

Command	Action
b	Branch to *label* or to end of script.
t	Same as b, but branch only after substitution.
T	Same as t, but branch only if no successful substitutions.
:*label*	Label branched to by t or b.

10.4.6. Multiline Input Processing

Command	Action
N	Read another line of input (creates embedded newline).

Command	Action
D	Delete up to the embedded newline.
P	Print up to the embedded newline.

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10.5. Alphabetical Summary of sed Commands

GNU sed lets you use the filenames */dev/stdin*, */dev/stdout* and */dev/stderr* to refer to standard input, output, and error, respectively, for the r, R, w, and W commands and the w flag to the s command.

GNU-specific commands or extensions are noted with {G} in the command synopsis. When the GNU version allows a command to have two addresses, the command is performed for each input line within the range.

#

```
#
```

Begin a comment in a sed script. Valid only as the first character of the first line. (Some versions, including GNU sed, allow comments anywhere, but it is better not to rely on this.) If the first line of the script is #n, sed behaves as if -n had been specified.

:

```
:label
```

Label a line in the script for the transfer of control by b or t. According to POSIX, sed must support labels that are unique in the first eight characters. GNU sed has no limit, but some older versions support up to only seven characters.

=

```
[/pattern/]=
[address1[,address2]]= {G}
```

Write to standard output the line number of each line addressed by*pattern*.

a

```
[address]a\
text
[address1[,address2]]a \ {G}

text
```

Append *text* following each line matched by *address*. If *text* goes over more than one line, newlines must be "hidden" by preceding them with a backslash. The*text* is terminated by the first newline that is not hidden in this way. The*text* is not available in the pattern space, and subsequent commands cannot be applied to it. The results of this command are sent to standard output when the list of editing commands is finished, regardless of what happens to the current line in the pattern space.

The GNU version accepts two addresses and allows you to put the first line of*text* on the same line as the a command.

Example

```
$a\
This goes after the last line in the file\
(marked by $).  This text is escaped at the\
end of each line, except for the last one.
```

b

```
[address1[,address2]]b[label]
```

Unconditionally transfer control to *:label* elsewhere in script. That is, the command following the*label* is the next command applied to the current line. If no*label* is specified, control falls through to the end of the script, so no more commands are applied to the current line.

Example

```
# Ignore HTML tables; resume script after </table>:
/<table/,/<\/table>/b
```

c

```
[address1[,address2]]c\
text
```

Replace (change) the lines selected by the address(es) with *text*. (See a for details on *text*.) When a range of lines is specified, all lines are replaced as a group by a single copy of *text*. The contents of the pattern space are, in effect, deleted, and no subsequent editing commands can be applied to the pattern space (or to *text*).

Example

```
# Replace first 100 lines in a file:
1,100c\
\
<First 100 names to be supplied>
```

d

```
[address1[,address2]]d
```

Delete the addressed line (or lines) from the pattern space. Thus, the line is not passed to standard output. A new line of input is read, and editing resumes with the first command in the script.

Example

```
# Delete all empty lines, including lines with just
whitespace:
/^[#tab]*$/d
```

D

```
[address1[,address2]]D
```

Delete the first part (up to embedded newline) of a multiline pattern space created by theN command, and resume editing with the first command in the script. If this command empties the pattern space, then a new line of input is read, as if thed command had been executed.

Example

```
# Strip multiple blank lines, leaving only one:
/^$/{
N
/^\n$/D
}
```

e

```
[address1[,address2]]e [command] {G}
```

With *command*, execute the command and send the result to standard output. Without*command*, execute the contents of the pattern space as a command, and replace the pattern space with the results.

g

```
[address1[,address2]]g
```

Paste the contents of the hold space (see h and H) back into the pattern space, wiping out the previous contents of the pattern space. The Example shows a simple way to copy lines.

Example

This script collects all lines containing the word *Item:* and copies them to a place marker later in the file. The place marker is overwritten:

```
/Item:/H
/<Replace this line with the item list>/g
```

G

```
[address1[,address2]]G
```

Same as g, except that a newline and the hold space are pasted to the end of the pattern space instead of overwriting it. The Example shows a simple way to "cut and paste" lines.

Example

This script collects all lines containing the word *Item:* and moves them after a place marker later in the file. The original *Item:* lines are deleted.

```
/Item:/{
H
d
}
/Summary of items:/G
```

h

```
[address1[,address2]]h
```

Copy the pattern space into the hold space, a special temporary buffer. The previous contents of the hold space are obliterated. You can use h to save a line before editing it.

Example

```
# Edit a line; print the change; replay the original
/Linux/{
h
s/.* Linux \(.*\) .*/\1:/
p
x
}
```

Sample input:

```
This describes the Linux ls command.
This describes the Linux cp command.
```

Sample output:

```
ls:
This describes the Linux ls command.
cp:
This describes the Linux cp command.
```

H

```
[address1[,address2]]H
```

Append a newline and then the contents of the pattern space to the contents of the hold space. Even if the hold space is empty, H still appends a newline. H is like an incremental copy. See Examples under g and G.

i

```
[address]i\
text
[address1[,address2]]i \ {G}
```

```
text
```

Insert *text* before each line matched by *address*. (See a for details on *text*.)

The GNU version accepts two addresses and allows you to put the first line of*text* on the same line as the i command.

Example

```
/Item 1/i\
The five items are listed below:
```

l

```
[address1[,address2]]l
[address1[,address2]]l [len] {G}
```

List the contents of the pattern space, showing nonprinting characters as ASCII codes. Long lines are wrapped. With GNU sed, *len* is the character position at which to wrap long lines. A value of0 means to never break lines.

n

```
[address1[,address2]]n
```

Read the next line of input into pattern space. The current line is sent to standard output, and the next line becomes the current line. Control passes to the command followingn instead of resuming at the top of the script.

Example

In DocBook/XML, titles follow section tags. Suppose you are using a convention where each opening section tag is on a line by itself, with the title on the following line. To print all the section titles,

invoke this script with `sed -n`:

```
/<sect[1-4]/{
n
p
}
```

N

`[address1[,address2]]N`

Append the next input line to contents of pattern space; the new line is separated from the previous contents of the pattern space by a newline. (This command is designed to allow pattern matches across two lines.) By using `\n` to match the embedded newline, you can match patterns across multiple lines. See the Example under D.

Examples

Like the Example in n, but print the section tag line as well as header title:

```
/<sect[1-4]/{
N
p
}
```

Join two lines (replace newline with space):

```
/<sect[1-4]/{
N
s/\n/ /
p
}
```

p

```
[address1[,address2]]p
```

Print the addressed line(s). Note that this can result in duplicate output unless default output is suppressed by using #n or the -n command-line option. Typically used before commands that change control flow (d, n, b), which might prevent the current line from being output. See the Examples under h, n, and N.

P

```
[address1[,address2]]P
```

Print first part (up to embedded newline) of multiline pattern space created byN command. Same as p if N has not been applied to a line.

Example

Suppose you have function references in two formats:

```
function(arg1, arg2)
function(arg1,
         arg2)
```

The following script changes argument arg2, regardless of whether it appears on the same line as the function name:

```
s/function(arg1, arg2)/function(arg1, XX)/
/function(/{
N
s/arg2/XX/
P
D
}
```

q

```
[address]q
[address]q [value] {G}
```

Quit when *address* is encountered. The addressed line is first written to the output (if default output is not suppressed), along with any text appended to it by previousa or r commands. GNU sed allows you to provide *value*, which is used as the exit status.

Examples

Delete everything after the addressed line:

```
/Garbled text follows:/q
```

Print only the first 50 lines of a file:

```
50q
```

Q

```
[address]Q [value] {G}
```

Quits processing, but without printing the pattern space. If*value* is provided, it is used as sed's exit status.

r

```
[address]r file
[address1[,address2]]r file {G}
```

Read contents of *file* and append to the output after the contents of the pattern space. There must be exactly one space between the r and the filename. The GNU version accepts two addresses.

Example

```
/The list of items follows:/r item_file
```

R

```
[address1[,address2]]R file {G}
```

Read one line of *file* and append to the output after the contents of the pattern space. Successive R commands read successive lines from *file*.

s

```
[address1[,address2]]s/pattern/replacement/[flags]
```

Substitute *replacement* for *pattern* on each addressed line. If pattern addresses are used, the patterr / / represents the last pattern address specified. Any delimiter may be used. Use \ within *pattern* or *replacement* to escape the delimiter. The following flags can be specified (those marked with a | are specific to GNU sed):

n

Replace *n*th instance of *pattern* on each addressed line. *n* is any number in the range 1 to 512, and the default is 1.

e

If the substitution was made, execute the contents of the pattern space as a shell command and replaces the pattern space with the results.

g

Replace all instances of *pattern* on each addressed line, not just the first instance.

i or I †

Do a case-insensitive regular expression match.

m or M †

Allow ^ and $ to match around a newline embedded in the pattern space.

p

Print the line if the substitution is successful. If several successful substitutions are successful, sed prints multiple copies of the line.

w *file*

Write the line to *file* if a replacement was done. In the traditional Unix sed, a maximum of 10 different *files* can be opened.

GNU sed allows you to use the special filenames /dev/stdout and /dev/stderr to write to standard output or standard error, respectively.

Within the *replacement*, GNU sed accepts special escape sequences, with the following meanings:

\L

Lowercase the replacement text until a terminating \E or \U.

\l

Lowercase the following character only.

\U

Uppercase the replacement text until a terminating \E or \L.

\u

Uppercase the following character only.

\E

Terminate case conversion from \L or \U.

Examples

Here are some short, commented scripts:

```
# Change third and fourth quote to ( and ):
/function/{
s/")/4
s/"/(/3
}

# Remove all quotes on a given line:
/Title/s/"//g

# Remove first colon and all quotes; print resulting lines:
s/://p
s/"//gp

# Change first "if" but leave "ifdef" alone:
/ifdef/!s/if/   if/
```

t

```
[address1[,address2]]t [label]
```

Test if successful substitutions have been made on addressed lines, and if so, branch to the line marked by :*label*. (See b and *:*.) If *label* is not specified, control branches to the bottom of the script The t command is like a case statement in the C programming language or the various shell programming languages. You test each case; when it's true, you exit the construct.

Example

Suppose you want to fill empty fields of a database. You have this:

```
ID: 1   Name: greg   Rate: 45
ID: 2   Name: dale
ID: 3
```

You want this:

```
ID: 1   Name: greg   Rate: 45   Phone: ??
```

```
ID: 2   Name: dale   Rate: ??   Phone: ??
ID: 3   Name: ????   Rate: ??   Phone: ??
```

You need to test the number of fields already there. Here's the script (fields are tab-separated):

```
#n
/ID/{
s/ID: .* Name: .* Rate: .*/&   Phone: ??/p
t
s/ID: .* Name: .*/&   Rate: ??   Phone: ??/p
t
s/ID: .*/&   Name: ????   Rate: ??   Phone: ??/p
}
```

T

[*address1*[,*address2*]]T [*label*] **{G}**

Like t, but only branches to *label* if there *not* any successful substitutions. (see b, t, and *:*). If *label* is not specified, control branches to the bottom of the script.

v

[*address1*[,*address2*]]v [*version*] **{G}**

This command doesn't do anything. You use it to require GNU sed for your script. This works, because non-GNU versions of sed don't implement the command at all, and will therefore fail. If you supply a specific *version*, GNU sed fails if the required version is newer than the one executing the script.

w

[*address1*[,*address2*]]w *file*

Append contents of pattern space to *file*. This action occurs when the command is encountered rather than when the pattern space is output. Exactly one space must separate the w and the filename. This command will create the file if it does not exist; if the file exists, its contents will be overwritten each time the script is executed. Multiple write commands that direct output to the same file append to the end of the file.

GNU sed allows you to use the special filenames /dev/stdout and /dev/stderr to write to standard output or standard error, respectively.

Example

```
# Store HTML tables in  a file
/<table/,/<\/table>/w tables.html
```

W

```
[address1[,address2]]W file
```

Like w, but only writes the contents of the first line in the pattern space to the file.

x

```
[address1[,address2]]x
```

Exchange the contents of the pattern space with the contents of the hold space. See h for an example.

y

```
[address1[,address2]]y/abc/xyz/
```

Translate characters. Change every instance of *a* to *x*, *b* to *y*, *c* to *z*, etc.

Example

```
# Change item 1, 2, 3 to Item A, B, C ...
/^item [1-9]/y/i123456789/IABCDEFGHI/
```

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Chapter 11. The gawk Programming Language

gawk is the GNU version of awk, a powerful utility often used for text and string manipulation within shell scripts, particularly when input data can be viewed as records and fields.awk is also an elegant and capable programming language that allows you to accomplish a lot with very little work.

This chapter presents the following topics:

- Conceptual overview
- Command-line syntax
- Patterns and procedures
- Built-in variables
- Operators
- Variables and array assignment
- User-defined functions
- gawk-specific facilities
- Implementation limits
- Group listing of awk functions and commands
- Alphabetical summary of awk functions and commands
- Source code

For more information, see sed & awk and the Free Software Foundation book Effective awk Programming, both published by O'Reilly.

11.1. Conceptual Overview

awk is a pattern-matching program for processing files, especially when each line has a simple field-oriented layout. Linux provides the GNU version ofawk, called gawk, which provides a number of additional features. This utility can be invoked either through the standard nameawk or through gawk.

Items described here as "common extensions" are available ingawk and most versions of awk offered on other operating systems (often callednawk for "new awk"), but should not be used if strict portability of your programs is important to you.

With gawk, you can:

- Think of a text file as made up of records and fields in a textual database.
- Perform arithmetic and string operations.
- Use programming constructs, such as loops and conditionals.
- Produce formatted reports.
- Define your own functions.
- Execute Unix commands from a script.
- Process the results of Unix commands.
- Process command-line arguments gracefully.
- Work easily with multiple input streams.
- Flush open output files and pipes.
- Sort arrays.
- Retrieve and format system time values.
- Do bit manipulation.
- Internationalize your gawk programs, allowing strings to be translated into a local language at runtime.
- Perform two-way I/O to a coprocess.
- Open a two-way TCP/IP connection to a socket.
- Dynamically add built-in functions.

- Profile your gawk programs.

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11.2. Command-Line Syntax

The syntax for invoking awk has two forms:

```
awk [options] 'script' var=value file(s)
awk [options] -f scriptfile var=value file(s)
```

You can specify a *script* directly on the command line, or you can store a script in a *scriptfile* and specify it with -f. gawk allows multiple -f scripts. Variables can be assigned a value on the command line. The value can be a string or numeric constant, a shell variable ($*name*), or a command substitution ('*cmd*'), but the value is available only after the BEGIN statement is executed.

awk operates on one or more *files*. If none are specified (or if - is specified), awk reads from standard input.

11.2.1. Standard Options

The standard options are:

-F*fs*

Set the field separator to *fs*. This is the same as setting the built-in variable FS. gawk allows *fs* to be a regular expression. Each input line, or *record*, is divided into fields by whitespace (spaces or tabs) or by some other user-definable field separator. Fields are referred to by the variables $1, $2,..., $*n*. $0 refers to the entire record.

-v *var*=*value*

Assign a *value* to variable *var*. This allows assignment before the script begins execution.

For example, to print the first three (colon-separated) fields of each record on separate lines:

```
awk -F: '{ print $1; print $2; print $3 }' /etc/passwd
```

Numerous examples are shown later in Simple Pattern-Procedure Examples."

11.2.2. Important gawk Options

Besides the standard command line options, gawk has a large number of additional options. This section lists those of most value in day-to-day use. Any unique abbreviation of these options is acceptable.

--dump-variables[=*file*]

When the program has finished running, print a sorted list of global variables, their types, and their final values to *file*. The default file is *awkvars.out*.

--gen-po

Read the awk program and print all strings marked as translatable to standard output in the form of a GNU gettext Portable Object file. See the section "Internationalization," later in this chapter, for more information.

--help

Print a usage message to standard error and exit.

--lint[=fatal]

Enable checking of nonportable or dubious constructs, both when the program is read and as it runs. With an argument of fatal, lint warnings become fatal errors.

--non-decimal-data

Allow octal and hexadecimal data in the input to be recognized as such. This option is not recommended; use strtonum( ) in your program, instead.

--profile[=*file*]

With gawk, put a "prettyprinted" version of the program in *file*. Default is *awkprof.out*. With pgawk (see "Profiling," later in this chapter), put the profiled listing of the program in *file*.

--posix

Turn on strict POSIX compatibility, in which all common and gawk-specific extensions are disabled.

--source='*program text*'

Use *program text* as the awk source code. Use this option with -f to mix command-line programs with awk library files.

--traditional

Disable all gawk-specific extensions, but allow common extensions (e.g., the** operator for exponentiation).

--version

Print the version of gawk on standard error and exit.

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11.3. Patterns and Procedures

awk scripts consist of patterns and procedures:

```
pattern  { procedure }
```

Both *pattern* and { *procedure* } are optional. If *pattern* is missing, { *procedure* } is applied to all lines. If { *procedure* } is missing, the matched line is printed.

11.3.1. Patterns

A pattern can be any of the following:

```
general expression
/regular expression/
relational expression

pattern-matching expression
BEGIN
END
```

- General expressions can be composed of quoted strings, numbers, operators, function calls, user-defined variables, or any of the predefined variables described later in this chapter inBuilt-in Variables."
- Regular expressions use the extended set of metacharacters, as described inChapter 7.
- The ^ and $ metacharacters refer to the beginning and end of a string (such as the fields), respectively, rather than the beginning and end of a line. In particular, these metacharacters will *not* match at a newline embedded in the middle of a string.
- Relational expressions use the relational operators listed in theOperators," section, later in this chapter. For example, $2 > $1 selects lines for which the second field is greater than the first. Comparisons can be either string or numeric. Thus, depending upon the types of data in$1 and $2, awk will do either a numeric or a string comparison. This can change from one record to the next.

- Pattern-matching expressions use the operators ~ (match) and !~ (don't match). See Operators," later in this chapter.
- The BEGIN pattern lets you specify procedures that will take place *before* the first input line is processed. (Generally, you process the command line and set global variables here.)
- The END pattern lets you specify procedures that will take place *after* the last input record is read.
- BEGIN and END patterns may appear multiple times. The procedures are merged as if there had been one large procedure.

Except for BEGIN and END, patterns can be combined with the Boolean operators || (or), && (and), and ! (not). A range of lines can also be specified using comma-separated patterns:

```
pattern,pattern
```

11.3.2. Procedures

Procedures consist of one or more commands, function calls, or variable assignments, separated by newlines or semicolons, and are contained within curly braces. Commands fall into five groups:

- Variable or array assignments
- Input/Output commands
- Built-in functions
- Control-flow commands
- User-defined functions

11.3.3. Simple Pattern-Procedure Examples

Print first field of each line:

```
{ print $1 }
```

Print all lines that contain *pattern*:

```
/pattern/
```

Print first field of lines that contain *pattern*:

```
/pattern/ { print $1 }
```

Select records containing more than two fields:

```
NF > 2
```

Interpret input records as a group of lines up to a blank line. Each line is a single field:

```
BEGIN { FS = "\n"; RS = "" }
```

Print fields 2 and 3 in switched order, but only on lines whose first field matches the stringURGENT:

```
$1 ~ /URGENT/ { print $3, $2 }
```

Count and print the number of *pattern* found:

```
/pattern/ { ++x }
END { print x }
```

Add numbers in second column and print the total:

```
{ total += $2 }
END { print "column total is", total}
```

Print lines that contain less than 20 characters:

```
length($0) < 20
```

Print each line that begins with `Name:` and that contains exactly seven fields:

```
NF =  = 7 && /^Name:/
```

Print the fields of each record in reverse order, one per line:

```
 {
        for (i = NF; i >= 1; i--)
                print $i
}
```

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11.4. Built-in Variables

All awk variables are included in gawk.

Version	Variable	Description
awk	ARGC	Number of arguments on the command line.
	ARGV	An array containing the command-line arguments, indexed from 0 to ARGC - 1.
	ENVIRON	An associative array of environment variables.
	FILENAME	Current filename.
	FNR	Like NR, but relative to the current file.
	FS	Field separator (a space).
	NF	Number of fields in current record.
	NR	Number of the current record.
	OFMT	Output format for numbers ("%.6g").
	OFS	Output field separator (a space).
	ORS	Output record separator (a newline).
	RLENGTH	Length of the string matched by match( ) function.
	RS	Record separator (a newline).
	RSTART	First position in the string matched by match( ) function.
	SUBSEP	Separator character for array subscripts ("\034").
	$0	Entire input record.
	$*n*	*n*th field in current record; fields are separated by FS.
gawk	ARGIND	Index in ARGV of current input file.
	BINMODE	Controls binary I/O for input and output files. Use values of 1, 2, or 3 for input, output, or both kinds of files, respectively. Set it on the command line to affect standard input, standard output, and standard error.
	ERRNO	A string indicating the error when a redirection fails for getline or if close( ) fails.

Version	Variable	Description
	FIELDWIDTHS	A space-separated list of field widths to use for splitting up the record, instead of FS.
	IGNORECASE	When true, all regular expression matches, string comparisons, and index( ) ignore case.
	LINT	Dynamically controls production of "lint" warnings. With a value of "fatal", lint warnings become fatal errors.
	PROCINFO	An array containing information about the process, such as real and effective UID numbers, process ID number, and so on.
	RT	The text matched by RS, which can be a regular expression in gawk.
	TEXTDOMAIN	The text domain (application name) for internationalized messages ("messages").

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11.5. Operators

The following table lists the operators, in order of increasing precedence, that are available in awk.

Symbol	Meaning
= += -= *= /= %= ^= **=	Assignment.
?:	C conditional expression.
||	Logical OR (short-circuit).
&&	Logical AND (short-circuit).
in	Array membership.
~ !~	Match regular expression and negation.
< <= > >= != ==	Relational operators.
(blank)	Concatenation.
+ -	Addition, subtraction.
* / %	Multiplication, division, and modulus (remainder).
+ - !	Unary plus and minus, and logical negation.
^ **	Exponentiation.
++ --	Increment and decrement, either prefix or postfix.
$	Field reference.

NOTE

While ** and **= are common extensions, they are not part of POSIX awk.

11.6. Variable and Array Assignment

Variables can be assigned a value with an = sign. For example:

```
FS = ","
```

Expressions using the operators +, -, /, and % (modulo) can be assigned to variables.

Arrays can be created with the `split( )` function (described later), or they can simply be named in an assignment statement. Array elements can be subscripted with numbers (*array*[1], ..., *array*[*n*]) or with strings. Arrays subscripted by strings are called *associative arrays*.[*] For example, to count the number of widgets you have, you could use the following script:

[*] In fact, all arrays in **awk** are associative; numeric subscripts are converted to strings before being used as array subscripts. Associative arrays are one of **awk**'s most powerful features.

```
/widget/ { count["widget"]++ }       Count widgets
END      { print count["widget"] }   Print the count
```

You can use the special `for` loop to read all the elements of an associative array:

```
for (item in array)
        process array[item]
```

The index of the array is available as `item`, while the value of an element of the array can be referenced as `array[item]`.

You can use the operator `in` to test that an element exists by testing to see if its index exists. For example:

```
if (index in array)
        ...
```

tests that `array[index]` exists, but you cannot use it to test the value of the element referenced by `array[index]`.

You can also delete individual elements of the array using thedelete statement. (See also the delete entry in Alphabetical Summary of awk Functions and Commands," later in this chapter.)

11.6.1. Escape sequences

Within string and regular-expression constants, the following escape sequences may be used.

Sequence	Meaning	Sequence	Meaning
\a	Alert (bell)	\v	Vertical tab
\b	Backspace	\\	Literal backslash
\f	Form feed	*nnn*	Octal value *nnn*
\n	Newline	\x*nn*	Hexadecimal value *nn*
\r	Carriage return	\"	Literal double quote (in strings)
\t	Tab	\/	Literal slash (in regular expressions)

NOTE

The \x escape sequence is a common extension; it is not part of POSIXawk.

11.6.2. Octal and Hexadecimal Constants in gawk

gawk allows you to use octal and hexadecimal constantsin your program source code. The form is as in C: octal constants start with a leading 0, and hexadecimal constants with a leading 0x or 0X. The hexadecimal digits a-f may be in either uppercase or lowercase.

```
$ gawk 'BEGIN { print 042, 42, 0x42 }'
34 42 66
```

Use the strtonum( ) function to convert octal or hexadecimal input data into numerical values.

11.7. User-Defined Functions

gawk allows you to define your own functions. This makes it easy to encapsulate sequences of steps that need to be repeated into a single place and reuse the code from anywhere in your program.

The following function capitalizes each word in a string. It has one parameter, namedinput, and five local variables, which are written as extra parameters:

```
# capitalize each word in a string
function capitalize(input, result, words, n, i, w)
{
   result = ""
   n = split(input, words, " ")
   for (i = 1; i <= n; i++) {
        w = words[i]
        w = toupper(substr(w, 1, 1)) substr(w, 2)
        if (i > 1)
                 result = result " "
        result = result w
   }
   return result
}

# main program, for testing
{ print capitalize($0) }
```

With this input data:

```
A test line with words and numbers like 12 on it.
```

This program produces:

```
A Test Line With Words And Numbers Like 12 On It.
```

NOTE

For user-defined functions, no space is allowed between the function name and the left parenthesis when the function is called.

PREV

11.8. Gawk-specific Features

This section describes features unique to gawk.

11.8.1. Coprocesses and Sockets

gawk allows you to open a two-way pipe to another process, called a *coprocess*. This is done with the |& operator used with getline and print or printf.

```
print database command |& "db_server"
"db_server" |& getline response
```

If the *command* used with |& is a filename beginning with /inet/, gawk opens a TCP/IP connection. The filename should be of the following form:

```
/inet/protocol/lport/hostname/rport
```

The parts of the filename are:

protocol

One of tcp, udp or raw, for TCP, UDP, or raw IP sockets, respectively. Note: raw is currently reserved but unsupported.

lport

The local TCP or UPD port number to use. Use 0 to let the operating system pick a port.

hostname

The name or IP address of the remote host to connect to.

rport

The port (application) on the remote host to connect to. A service name (e.g., tftp) is looked

up using the C `getservbyname( )` function.

11.8.2. Profiling

When `gawk` is built and installed, a separate program named `pgawk` (*profiling* `gawk`) is built and installed with it. The two programs behave identically; however, `pgawk` runs more slowly because it keeps execution counts for each statement as it runs. When it is done, it automatically places an execution profile of your program in a file named *awkprof.out*. (You can change the filename with the `--profile` option.)

The execution profile is a "prettyprinted" version of your program, with execution counts listed in the left margin. For example, after running this program:

```
$ pgawk '/bash$/ { nusers++ }
> END { print nusers, "users use Bash." }' /etc/passwd
16 users use Bash.
```

the execution profile looks like this:

```
    # gawk profile, created Mon Nov  1 14:34:38 2004

    # Rule(s)

35  /bash$/ { # 16
16          nusers++
    }

    # END block(s)

    END {
 1          print nusers, "users use Bash."
    }
```

If sent SIGUSR1, `pgawk` prints the profile and an `awk` function call stack trace, and then keeps going. Multiple SIGUSR1 signals may be sent; the profile and trace will be printed each time. This facility is useful if your `awk` program appears to be looping and you want to see if something unexpected is being executed.

If sent SIGHUP, `pgawk` prints the profile and stack trace, and then exits.

11.8.3. File Inclusion

The igawk program provides a file-inclusion facility for gawk. You invoke it the same way you do gawk: it passes all command line arguments on to gawk. However, igawk processes source files and command-line programs for special statements of the form:

```
@include file.awk
```

Such files are searched for along the list of directories specified by the AWKPATH environment variable. When found, the @include line is replaced with the text of the corresponding file. Included files may themselves include other files with@include.

The combination of the AWKPATH environment variable andigawk makes it easy to have and use libraries of awk functions.

11.8.4. Internationalization

You can *internationalize* your programs if you use gawk. This consists of choosing a text domain for your program, marking strings that are to be translated, and, if necessary, using the bindtextdomain( ), dcgettext( ), and dcngettext( ) functions.

Localizing your program consists of extracting the marked strings, creating translations, and compiling and installing the translations in the proper place. Full details are given in Effective awk Programming (O'Reilly).

The internationalization features in gawk use GNU gettext. You may need to install the GNU gettext tools to create translations if your system doesn't already have them. Here is a very brief outline of the steps involved:

1. Set TEXTDOMAIN to your text domain in a BEGIN block:

```
BEGIN { TEXTDOMAIN = "whizprog" }
```

2. Mark all strings to be translated by prepending a leading underscore:

```
printf(_"whizprog: can't open /dev/telepath (%s)\n",
                   dcgettext(ERRNO)) > "/dev/stderr"
```

3. Extract the strings with the --gen-po option:

```
$ gawk --gen-po -f whizprog.awk > whizprog.pot
```

4. Copy the file for translating, and make the translations:

```
$ cp whizprog.pot esperanto.po
$ ed esperanto.po
```

5. Use the `msgfmt` program from GNU `gettext` to compile the translations. The binary format allows fast lookup of the translations at runtime. The default output is a file named *messages*:

```
$ msgfmt esperanto.po
$ mv messages esperanto.mo
```

6. Install the file in the standard location. This is usually done at program installation. The location can vary from system to system.

That's it! `gawk` will automatically find and use the translated messages, if they exist.

11.9. Implementation Limits

Many versions of awk have various implementation limits, on things such as:

- Number of fields per record
- Number of characters per input record
- Number of characters per output record
- Number of characters per field
- Number of characters per printf string
- Number of characters in literal string
- Number of characters in character class
- Number of files open
- Number of pipes open
- The ability to handle 8-bit characters and characters that are all zero (ASCII NUL)

gawk does not have limits on any of the above items, other than those imposed by the machine architecture and/or the operating system.

11.10. Group Listing of awk Functions and Commands

The following table classifies awk functions and commands.

Function type			Functions or commands		
Arithmetic	atan2	cos	exp	int	log
	rand	sin	sqrt	srand	
String	asort[a]	asorti[a]	gensub[a]	gsub	index
	length	match	split	sprintf	strtonum[a]
	sub	substr	tolower	toupper	
Control flow	break	continue	do/while	exit	for
	if/else	return	while		
I/O	close	fflush[b]	getline	next	nextfile[b]
	print	printf			
Programming	extension[a]	delete	function	system	

[a] Available in **gawk**.

[b] Available in Bell Labs **awk** and **gawk**.

The following functions are specific to gawk.

Function type			Functions or commands		
Bit manipulation	and	compl	lshift	or	rshift
	xor				
Time	mktime	strftime	systime		
Translation	bindtextdomain	dcgettext	dcngettext		

11.11. Alphabetical Summary of awk Functions and Commands

The following alphabetical list of keywords and functions includes all that are available in POSIX awk and gawk. Extensions that aren't part of POSIX awk but that are in both gawk and the Bell Laboratories awk are marked as {E}. Cases where gawk has extensions are marked as {G}. Items that aren't marked with a symbol are available in all versions.

#

```
#
```

Ignore all text that follows on the same line. # is used in awk scripts as the comment character and is not really a command.

and

```
and(expr1, expr2) {G}
```

Return the bitwise AND of *expr1* and *expr2*, which should be values that fit in a C unsigned long.

asort

```
asort(src [,dest]) {G}
```

Sort the array *src* based on the element values, destructively replacing the indices with values from one to the number of elements in the array. If *dest* is supplied, copy *src* to *dest* and sort *dest*, leaving *src* unchanged. Returns the number of elements in *src*.

asorti

```
asorti(src [,dest]) {G}
```

Like asort( ), but the sorting is done based on the indices in the array, not based on the element values. For gawk 3.1.2 and later.

atan2

```
atan2(y, x)
```

Return the arctangent of *y*/*x* in radians.

bindtextdomain

```
bindtextdomain(dir [,domain]) {G}
```

Look in directory *dir* for message translation files for text domain *domain* (default: value of TEXTDOMAIN). Returns the directory where *domain* is bound.

break

```
break
```

Exit from a while, for, or do loop.

close

```
close(expr)
close(expr, how) {G}
```

In most implementations of awk, you can only have up to ten files and one pipe open simultaneously. Therefore, POSIX awk provides a close( ) function that allows you to close a file or a pipe. It takes the same expression that opened the pipe or file as an argument. This expression must be identical, character by character, to the one that opened the file or pipeeven whitespace is significant.

In the second form, close one end of either a TCP/IP socket or a two-way pipe to a coprocess.*how* is a string, either "from" or "to". Case does not matter.

compl

```
compl(expr) {G}
```

Return the bitwise complement of *expr*, which should be a value that fits in a C unsigned long.

continue

```
continue
```

Begin next iteration of while, for, or do loop.

cos

```
cos(x)
```

Return the cosine of *x*, an angle in radians.

dcgettext

```
dcgettext(str [, dom [,cat]]) {G}
```

Return the translation of *str* for the text domain *dom* in message category *cat*. Default text domain is value of TEXTDOMAIN. Default category is "LC_MESSAGES".

dcngettext

```
dcngettext(str1, str2, num [, dom [,cat]]) {G}
```

If *num* is one, return the translation of *str1* for the text domain *dom* in message category *cat*. Otherwise, return the translation of *str2*. Default text domain is value of TEXTDOMAIN. Default category is "LC_MESSAGES". For `gawk` 3.1.1 and later.

delete

```
delete array[element]
delete array {E}
```

Delete *element* from *array*. The brackets are typed literally. The second form is a common extension, which deletes *all* elements of the array in one shot.

do

```
do
 statement
while (expr)
```

Looping statement. Execute *statement*, then evaluate *expr* and if true, execute *statement* again. A series of statements must be put within braces.

exit

```
exit [expr]
```

Exit from script, reading no new input. The END procedure, if it exists, will be executed. An optional *expr* becomes awk's return value.

exp

```
exp(x)
```

Return exponential of *x* (*ex*).

extension

```
extension(lib, init) {G}
```

Dynamically load the shared object file *lib*, calling the function *init* to initialize it. Return the value returned by the *init* function. This function allows you to add new built-in functions to gawk. See Effective awk Programming (O'Reilly) for the details.

fflush

```
fflush([output-expr]) {E}
```

Flush any buffers associated with open output file or pipe *output-expr*.

gawk extends this function. If no *output-expr* is supplied, it flushes standard output. If *output-expr* is the null string (""), it flushes all open files and pipes.

for

```
for (init-expr; test-expr; incr-expr)
 statement
```

C-style looping construct. *init-expr* assigns the initial value of a counter variable. *test-expr* is a relational expression that is evaluated each time before executing the*statement*. When *test-expr* is false, the loop is exited. *incr-expr* is used to increment the counter variable after each pass. All of the expressions are optional. A missing *test-expr* is considered to be true. A series of statements must be put within braces.

for

```
for (item in array)
 statement
```

Special loop designed for reading associative arrays. For each element of the array, the*statement* is executed; the element can be referenced by *array* [*item*]. A series of statements must be put within braces.

function

```
function name(parameter-list) {
 statements
}
```

Create *name* as a user-defined function consisting of awk *statements* that apply to the specified list of parameters. No space is allowed between *name* and the left parenthesis when the function is called.

gensub

```
gensub(regex, str, how [, target]) {G}
```

General substitution function. Substitute *str* for matches of the regular expression *regex* in the string *target*. If *how* is a number, replace the *how*th match. If it is "g" or "G", substitute globally. If *target* is not supplied, $0 is used. Return the new string value. The original *target* is *not* modified. (Compare with gsub and sub.) Use & in the replacement string to stand for the text matched by the pattern.

getline

```
getline
getline [var] [< file]
command | getline [var]
command |& getline [var] {G}
```

Read next line of input.

The second form reads input from *file*, and the third form reads the output of *command*. All forms read one record at a time, and each time the statement is executed, it gets the next record of input. The record is assigned to $0 and is parsed into fields, setting NF, NR and FNR. If *var* is specified, the result is assigned to *var* and $0 and NF are not changed. Thus, if the result is assigned to a variable, the current record does not change. getline is actually a function, and it returns 1 if it reads a record successfully, 0 if end-of-file is encountered, and -1 if for some reason it is otherwise unsuccessful.

The fourth form reads the output from coprocess *command*. See the section Coprocesses and Sockets," for more information.

gsub

```
gsub(regex, str [, target])
```

Globally substitute *str* for each match of the regular expression *regex* in the string *target*. If *target* is not supplied, defaults to $0. Return the number of substitutions. Use & in the replacement string to stand for the text matched by the pattern.

if

```
if (condition)
 statement1
[else
 statement2]
```

If *condition* is true, do *statement1*; otherwise do *statement2* in optional else clause. The *condition* can be an expression using any of the relational operators <, <=, ==, !=, >=, or >, as well as the array membership operator in, and the pattern-matching operators ~ and !~ (e.g., if ($1 ~ /[Aa].*/)). A series of statements must be put within braces. Anotherif can directly follow an else in order to produce a chain of tests or decisions.

index

```
index(str, substr)
```

Return the position (starting at 1) of *substr* in *str*, or zero if *substr* is not present in *str*.

int

```
int(x)
```

Return integer value of *x* by truncating any fractional part.

length

```
length([arg])
```

Return length of *arg*, or the length of $0 if no argument.

log

```
log(x)
```

Return the natural logarithm (base *e*) of *x*.

lshift

```
lshift(expr, count) {G}
```

Return the result of shifting *expr* left by *count* bits. Both *expr* and *count* should be values that fit in a C unsigned long.

match

```
match(str, regex)
match(str, regex [, array]) {G}
```

Function that matches the pattern, specified by the regular expression *regex*, in the string *str* and returns either the position in *str* where the match begins, or 0 if no occurrences are found. Sets the values of RSTART and RLENGTH to the start and length of the match, respectively.

If *array* is provided, gawk puts the text that matched the entire regular expression in *array*[0], the text that matched the first parenthesized subexpression in *array*[1], the second in *array*[2], and so on.

mktime

```
mktime(timespec) {G}
```

Turns *timespec* (a string of the form *YYYY MM DD HH MM SS*[*DST*] representing a local time) into a time-of-day value in seconds since midnight, January 1, 1970, UTC.

next

`next`

Read next input line and start new cycle through pattern/procedures statements.

nextfile

`nextfile {E}`

Stop processing the current input file and start new cycle through pattern/procedures statements, beginning with the first record of the next file.

or

`or(`*`expr1, expr2`*`) {G}`

Return the bitwise OR of *expr1* and *expr2*, which should be values that fit in a C unsigned long.

print

`print [ `*`output-expr`*`[ , ...]] [ `*`dest-expr`*` ]`

Evaluate the *output-expr* and direct it to standard output followed by the value of ORS. Each comma-separated *output-expr* is separated in the output by the value of OFS. With no *output-expr*, print $0. The output may be redirected to a file or pipe via the *dest-expr*, which is described in Output Redirections," later in this chapter.

printf

```
printf(format [, expr-list ]) [ dest-expr ]
```

An alternative output statement borrowed from the C language. It has the ability to produce formatted output. It can also be used to output data without automatically producing a newline. *format* is a string of format specifications and constants. *expr-list* is a list of arguments corresponding to format specifiers. As for `print`, output may be redirected to a file or pipe. See printf Formats," later in this chapter, for a description of allowed format specifiers.

Like any string, *format* can also contain embedded escape sequences: `\n` (newline) or `\t` (tab) being the most common. Spaces and literal text can be placed in the *format* argument by quoting the entire argument. If there are multiple expressions to be printed, there should be multiple formats specified.

Examples

Using the script:

```
{ printf("The sum on line %d is %.0f.\n", NR, $1+$2) }
```

The following input line:

```
5   5
```

produces this output, followed by a newline:

```
The sum on line 1 is 10.
```

rand

```
rand(   )
```

Generate a random number between 0 and 1. This function returns the same series of numbers each

time the script is executed, unless the random number generator is seeded using`srand( )`.

return

```
return [expr]
```

Used within a user-defined function to exit the function, returning the value of*expr*. The return value of a function is undefined if *expr* is not provided.

rshift

```
rshift(expr, count) {G}
```

Return the result of shifting *expr* right by *count* bits. Both *expr* and *count* should be values that fit in a C `unsigned long`.

sin

```
sin(x)
```

Return the sine of *x*, an angle in radians.

split

```
split(string, array [, sep])
```

Split *string* into elements of array *array*[1],...,*array*[*n*]. Return the number of array elements created. The string is split at each occurrence of separator*sep*. If *sep* is not specified, FS is used.

sprintf

```
sprintf(format [, expressions])
```

Return the formatted value of one or more *expressions*, using the specified *format*. Data is formatted but not printed. See printf Formats," later in this chapter, for a description of allowed format specifiers.

sqrt

```
sqrt(arg)
```

Return the square root of *arg*.

srand

```
srand([expr])
```

Use optional *expr* to set a new seed for the random number generator. Default is the time of day. Return value is the old seed.

strftime

```
strftime([format [,timestamp]]) {G}
```

Format *timestamp* according to *format*. Return the formatted string. The *timestamp* is a time-of-day value in seconds since midnight, January 1, 1970, UTC. The *format* string is similar to that of sprintf. If *timestamp* is omitted, it defaults to the current time. If *format* is omitted, it defaults to a value that produces output similar to that of the Unix date command. See the date entry in Chapter 3 for a list.

strtonum

```
strtonum(expr) {G}
```

Return the numeric value of *expr*, which is a string representing an octal, decimal, or hexadecimal number in the usual C notations. Use this function for processing nondecimal input data.

sub

```
sub(regex, str [, target])
```

Substitute *str* for first match of the regular expression *regex* in the string *target*. If *target* is not supplied, defaults to $0. Returns 1 if successful, 0 otherwise. Use & in the replacement string to stand for the text matched by the pattern.

substr

```
substr(string, beg [, len])
```

Return substring of *string* at beginning position *beg* (counting from 1), and the characters that follow to maximum specified length *len*. If no length is given, use the rest of the string.

system

```
system(command)
```

Function that executes the specified *command* and returns its exit status. The status of the executed command typically indicates success or failure. A value of 0 means that the command executed successfully. A nonzero value indicates a failure of some sort. The documentation for the command you're running will give you the details.

awk does *not* make the output of the command available for processing within theawk script. Use *command* | getline to read the output of a command into the script.

systime

```
systime(  ) {G}
```

Return a time-of-day value in seconds since midnight, January 1, 1970, UTC.

Examples

Log the start and end times of a data-processing program:

```
BEGIN {
        now = systime(  )
        mesg = strftime("Started at %m/%d/%Y %H:%M:%S",
now)
        print mesg
}
process data ...
END {
        now = systime(  )
        mesg = strftime("Ended at %m/%d/%Y %H:%M:%S", now)
        print mesg
}
```

tolower

```
tolower(str)
```

Translate all uppercase characters in *str* to lowercase and return the new string.[*]

[*] Very early versions of **nawk** don't support **tolower( )** and **toupper( )**. However, they are now part of the POSIX specification for **awk**.

toupper

```
toupper(str)
```

Translate all lowercase characters in *str* to uppercase and return the new string.

while

```
while (condition)
 statement
```

Do *statement* while *condition* is true (see if for a description of allowable conditions). A series of statements must be put within braces.

xor

```
xor(expr1, expr2) {G}
```

Return the bitwise XOR of *expr1* and *expr2*, which should be values that fit in a C unsigned long.

11.12.1. Output Redirections

For print and printf, *dest-expr* is an optional expression that directs the output to a file or pipe.

> *file*

Direct the output to a file, overwriting its previous contents.

>> *file*

Append the output to a file, preserving its previous contents. In both this case and the> *file* case, the file will be created if it does not already exist.

| *command*

Direct the output as the input to a system command.

|& *command*

Direct the output as the input to a coprocess. gawk only.

Be careful not to mix > and >> for the same file. Once a file has been opened with >, subsequent output statements continue to append to the file until it is closed.

Remember to call close( ) when you have finished with a file, pipe, or coprocess. If you don't, eventually you will hit the system limit on the number of simultaneously open files.

11.12.2. printf Formats

Format specifiers for printf and sprintf have the following form:

```
%[posn$][flag][width][.precision]letter
```

The control letter is required. The format-conversion control letters are given in the following table.

Character	Description
c	ASCII character.
d	Decimal integer.
i	Decimal integer. (Added in POSIX)
e	Floating-point format ([-]*d*.*precision*e[+-]*dd*).
E	Floating-point format ([-]*d*.*precision*E[+-]*dd*).
f	Floating-point format ([-]*ddd*.*precision*).
g	e or f conversion, whichever is shortest, with trailing zeros removed.
G	E or f conversion, whichever is shortest, with trailing zeros removed.
o	Unsigned octal value.
s	String.
u	Unsigned decimal value.
x	Unsigned hexadecimal number. Uses a-f for 10 to 15.
X	Unsigned hexadecimal number. Uses A-F for 10 to 15.
%	Literal %.

gawk allows you to provide a *positional specifier* after the % (*posn*$). A positional specifier is an integer count followed by a $. The count indicates which argument to use at that point. Counts start at one and don't include the format string. This feature is primarily for use in producing translations of format strings. For example:

```
$ gawk 'BEGIN { printf "%2$s, %1$s\n", "world", "hello" }'
hello, world
```

The optional *flag* is one of the following:

Character	Description
-	Left-justify the formatted value within the field.
space	Prefix positive values with a space and negative values with a minus.
+	Always prefix numeric values with a sign, even if the value is positive.
#	Use an alternate form: %o has a preceding 0; %x and %X are prefixed with 0x and 0X, respectively; %e, %E and %f always have a decimal point in the result; and %g and %G do not have trailing zeros removed.
0	Pad output with zeros, not spaces. This only happens when the field width is wider than the converted result. This flag applies to all output formats, even nonnumeric ones.
'	gawk 3.1.4 and later only. For numeric formats, in locales that support it, supply a thousands-separator charater.

The optional *width* is the minimum number of characters to output. The result will be padded to this size if it is smaller. The 0 flag causes padding with zeros; otherwise, padding is with spaces.

The *precision* is optional. Its meaning varies by control letter, as shown in the following table:

Conversion	Precision means
%d, %i, %o, %u, %x, %X	The minimum number of digits to print.
%e, %E, %f	The number of digits to the right of the decimal point.
%g, %G	The maximum number of significant digits.
%s	The maximum number of characters to print.

11.13. Source Code

The following URLs indicate where to get source code for four freely available versions of awk and GNU gettext.

http://cm.bell-labs.com/~bwk

Brian Kernighan's home page, with links to the source code for the latest version of awk from Bell Laboratories.

ftp://ftp.whidbey.net/pub/brennan/mawk1.3.3.tar.gz

Michael Brennan's mawk. A very fast, very robust version of awk.

ftp://ftp.gnu.org/gnu/gawk/

The Free Software Foundation's version of awk, called gawk.

http://www.gnu.org/software/gawk/gawk.html

The Free Software Foundation's home page for gawk.

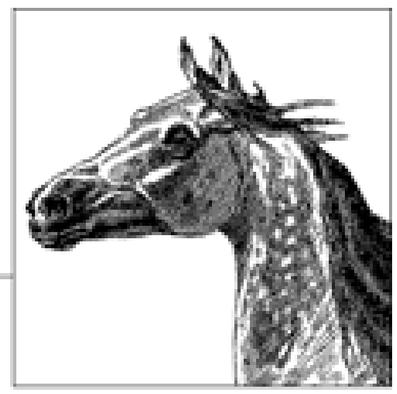
http://awka.sourceforge.net

The home page for awka, a translator that turns awk programs into C, compiles the generated C, and then links the object code with a library that performs the core awk functions.

ftp://ftp.gnu.org/gnu/gettext/

The source code for GNU gettext. Get this if you need to produce translations for your awk programs that use gawk.

Chapter 12. Source Code Management: An Overview



Chapters 13 and 14 describe two popular source code management systemsfor Linux: CVS and Subversion (SVN). This chapter introduces the major concepts involved with using these systems for users who may never have used one. If you're already familiar with source code management, feel free to skip ahead to the particular software suite that interests you. See also the O'Reilly books Essential CVS, CVS Pocket Reference, and Version Control with Subversion.

This chapter covers the following topics:

- Introduction and terminology
- Usage models
- Source code management systems
- Other source code management systems

12.1. Introduction and Terminology

Source code management systems let you store and retrieve multiple versions of a file. While originally designed for program source code, they can be used for any kind of file: source code, documentation, configuration files, and so on. Modern systems allow you to store binary files as well, such as image or audio data.

Source code management systems let you compare different versions of a file, as well as do "parallel development." In other words, you can work on two different versions of a file at the same time, with the source code management system storing both versions. You can then merge changes from two versions into a third version. This will become more clear shortly. We'll start by defining some terms.

Repository

A *repository* is where the source code management system stores its copy of your file. Usually one file in the source code management system is used to hold all the different versions of a source file. Each source code management system uses its own format to allow it to retrieve different versions easily and to track who made what changes, and when.

Sandbox

A *sandbox* is your personal, so-called "working copy" of the program or set of documents under development. You edit your private copy of the file in your own sandbox, returning changes to the source code management system when you're satisfied with the new version.

Check in, *check out*

You "check out" files from the repository, edit them, and then "check them in" when you're satisfied with your changes. Other developers working against the same repository will not see your changes until after you check them back in. Another term used for check-in is*commit*.

Log message

Every time you check in a file, you are prompted for a message describing the changes you made. You should do so in a concise fashion. If your software development practices include the use of a bug tracking system, you might also wish to include the bug number or problem report (PR) number that your change resolves.

Keyword substitutions

When you check out a file, the source code management system can replace special*keywords*

with values representing such things as the file's version number, the name of the user who made the most recent change, the date and time the file was last changed, the file's name, and so on. Each of the systems described in this book uses an overlapping set of keywords. Some systems always do keyword substitution, while others require that you explicitly enable the feature for each file.

Branch

A *branch* is a separate development path. For example, once you've released version 1.0 of whizprog, you will wish to proceed with the development for version 2.0. The main line of development is often called the *trunk*.

Now consider what happens when you wish to make a bug-fix release to whizprog 1.0, to be named version 1.1. You create a separate branch, based on the original 1.0 code, in a new sandbox. You perform all your development *there*, without disturbing the development being done for the 2.0 release.

Tag

A *tag* is a name you give to a whole group of files at once, at whatever version each individual file may be, in order to identify those files as being part of a particular group. For example, you might create tags WHIZPROG-1_0-ALPHA, WHIZPROG-1_0-BETA, WHIZPROG-1_0-RELEASE and so on. This is a powerful facility that should be used well, since it allows you to retrieve a "snapshot" of your entire development tree as it existed at different points in time.

Merging

Most typically, when development along a branch is completed, it becomes necessary to *merge* the changes from that branch back into the main line of development. In our hypothetical example, all the bugs fixed in whizprog 1.0 to create version 1.1 should also be fixed in the ongoing 2.0 development. Source code management systems can help you automate the process of merging.

Conflict

A *conflict* occurs when two developers make inconsistent changes to the same part of a source file. Modern source code management systems detect the conflict, usually marking the conflicting parts of the file in your working copy using special markers. You first discuss the conflict with the other developer, in order to arrive at a correct resolution of the conflict. Once that's done, you then resolve the conflict manually (by making the appropriate changes) and check in the new version of the file.

Client/Server

As with other "client/server" networking models, the idea here is that the repository is stored on one machine, the *server*, and that different developers may access the repository from multiple *client* systems. This powerful feature facilitates distributed development, allowing developers to work easily on their local systems, with the repository kept in a central place

where it can be easily accessed and administered.

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12.2. Usage Models

Different systems have different conceptual "models" as to how they're used.

Older systems such as SCCS and RCS use a "check out with locking" model. These systems were developed before client/server computing, when software development was done on centralized minicomputers and mainframes. In this model, the repository is a central directory on the same machine where the developers work, and each developer checks out a private copy into their own sandbox. In order to avoid two developer's making conflicting changes to a file, the file must be *locked* when it's checked out. Only one user may lock a particular version of a file at a time. When that user has checked in their changes, they *unlock* the file so that the next user can check in changes. If necessary, the second user may "break" the first user's lock, in which case the first user is notified via electronic mail.

This model works well for small projects where developers are co-located and can communicate easily. As long as one developer locks a file when she checks it out, another developer wishing to work with the file will know that he can't until the first one is done. The drawback is that such locking can slow down development significantly.

Newer systems, such as CVS and Subversion, use an "copy, modify, merge" model. In practice, when two developers wish to work on the same file, they usually end up changing different, unrelated parts of the file. Most of the time, each developer can make changes without adversely affecting the other. Thus, files are not locked upon checkout into a sandbox. Instead, the source code management system detects conflicts and disallows a check-in when conflicts exist.

For example, consider two developers, *dangermouse* and *penfold*, who are both working on *whizprog.c*. They each start with version 1.4 of the file. *dangermouse* commits his changes, creating version 1.5. Before *penfold* can commit his changes, the source code management system notices that the file has changed in the repository. *penfold* must first merge *dangermouse*'s changes into his working copy. If there are no conflicts, he can then commit his changes, creating version 1.6. On the other hand, if there are conflicts, he must first resolve them (they'll be marked in the working copy), and only then may he commit his version.

The combination of the "copy, modify, merge" model with a networked client/server facility creates a powerful environment for doing distributed development. Developers no longer have to worry about file locks. Because the source code management system enforces serialization (making sure that new changes are based on the latest version in the repository), development can move more smoothly, with little danger of miscommunication or that successive changes will be lost.

12.3. Source Code Management Systems

There are several source code management systems used in the Unix community:

SCCS

The Source Code Control System. SCCS is the original Unix source code management system. It was developed in the late 1970s for the Programmer's Workbench (PWB) Unix systems within Bell Labs. It is still in use at a few large longtime Unix sites. However, for a long time it was not available as a standard part of most commercial or BSD Unix systems, and it did not achieve the widespread popularity of other, later systems. (It is still available with Solaris.) SCCS uses a file storage format that allows it to retrieve any version of a source file in constan time.

RCS

The Revision Control System. RCS was developed in the early 1980s at Purdue University by Walter F. Tichy. It became popular in the Unix world when it was shipped with 4.2 BSD in 1983. At the time, Berkeley Unix was the most widely used Unix variant, even though to get it, a site had to have a Unix license from AT&T.

RCS is easier to use than SCCS. Although it has a number of related commands, only three or four are needed for day-to-day use, and they are quickly mastered. A central repository is easy to use: you first create a directory for the sandbox. In the sandbox, you make a symbolic link to the repository named *RCS*, and then all the developers can share the repository. RCS uses a file format that is optimized for retrieving the most recent version of a file.

CVS

The Concurrent Versions System. CVS was initially built as a series of shell scripts sitting atop RCS. Later it was rewritten in C for robustness, although still using RCS commands to manage the storage of files. However, for quite some time, CVS has had the RCS functionality built into it, and it no longer requires that RCS be available. The file format continues to be the same. CVS was the first distributed source code management system and is currently the standard one for Unix systemsin particular for collaborative, distributed, Free and open source development projects.

The repository is named when you create a sandbox and is then stored in the files in the sandbox, so that it need not be provided every time you run a CVS command. Unlike SCCS and RCS, which provide multiple commands, CVS has one main command (namedcvs), which you use for just about every operation.

Subversion

> With increasing use, it became clear that CVS lacked some fundamental capabilities. The Subversion project was started by several longtime CVS users and developers with the explicit goal to "build a better CVS," not necessarily to explore uncharted territory in source code management systems. Subversion is thus intentionally easy to learn for CVS users. Subversion uses its own format for data storage, based on the Berkeley DB in-process data library. Distributed use was designed in from day one, providing useful facilities that leverage the capabilities of the well-known Apache HTTP server.

RCS, CVS, and Subversion represent a progression, each one building on the features of its predecessors. For example, all three share a large subset of the same keyword substitutions, and command names are similar or identical in all three. They also demonstrate the progression from centralized, locking-based development to distributed, conflict-resolution-based development.

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12.4. Other Source Code Management Systems

Besides the source code management systems covered in this book, several other systems are worth knowing about. The following list, though, is by no means exhaustive:

Arch

GNU Arch is a distributed source code management system similar to CVS and Subversion. One of its significant strengths is that you can do offline development with it, working on multiple versions even on systems that are not connected to the Internet and that cannot communicate with the central repository. For more information, see http://www.gnu.org/software/gnu-arch/.

Codeville

Codeville is a distributed version-control system in the early stages of development. It is written in Python, is easy to set up and use, and shows a lot of promise. For more information, see http://codeville.org/.

CSSC

CSSC is a free clone of SCCS. It intends to provide full compatibility with SCCS, including file format, command names and options, and "bug for bug" compatible behavior. If you have an existing SCCS repository, you should be able to drop CSSC into your environment, in place of SCCS. CSSC can be used to migrate from a commercial Unix system to a freely available clone such as GNU/Linux or a BSD system. For more information, see http://directory.fsf.org/GNU/CSSC.html.

Monotone

The web page for `monotone` describes it well:

> monotone is a free distributed version control system. It provides a simple, single-file transactional version store, with fully disconnected operation and an efficient peer-to-pee synchronization protocol. It understands history-sensitive merging, lightweight branches, integrated code review, and third party testing. It uses cryptographic version naming and client-side RSA certificates. It has good internationalization support, has no external dependencies, runs on [Linux, Solaris, Mac OS X, NetBSD, and Windows], and is licensed under the GNU GPL.

For more information, see http://www.venge.net/monotone/.

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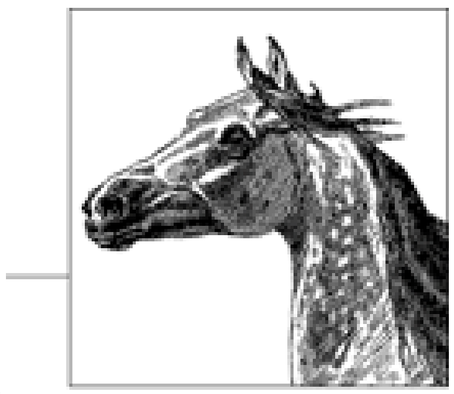
Chapter 13. The Concurrent Versions



System (CVS)

This chapter is a comprehensive reference of all CVS commands, with a brief summary of what each does. It is intended to be useful as a quick reference, not a tutorial.

This chapter covers the following topics:

- Conceptual overview
- Command-line syntax and options
- CVS dot files
- Environment variables
- Keywords and keyword modes
- Dates
- CVSROOT variables
- Alphabetical summary of commands

Most of the material in this chapter is adapted from the O'Reilly book Essential CVS. The Internet starting point for CVS is http://www.cvshome.org/.

Conceptual Overview

The basic concepts for source code management systems were presented in Chapter 12. As described there, CVS is a distributed source code management system based on the "copy, modify, merge" model. It uses RCS format files for storing data in its repository and is currently the most popular source code management suite for Unix and Unix-like systems.

Table 13-1 is a quick-start guide to using CVS. You can use the commands in the order shown to create and start using a CVS repository. (The basic steps for using CVS are similar to those for the Subversion source code management system, described in detail in Chapter 14.)

Table 13-1. CVS commands quick start guide

Command	Purpose
mkdir */path/to/repos*	Make the repository directory.
cvs init */path/to/repos*	Initialize the repository.
cvs import ...	Import the initial version of a project into the repository.
cvs checkout ...	Create a sandbox.
cvs diff ...	Compare the sandbox to the repository, or different versions in the repository.
cvs status	Check if files have changed in the sandbox or the repository.
cvs update	Download changes from the repository to the sandbox.
cvs commit	Upload changes from the sandbox to the repository.

CVS Wrappers

When resolving conflicts, the usual method CVS uses isMERGE, which means that CVS puts both versions of the conflicting group of lines into the file, surrounded by special markers. However, this method doesn't work for binary files. Thus, the second conflict-resolution method isCOPY, which presents both versions of the file to the user for manual resolution.

You can manually specify the conflict resolution method and keyword expansion method when a file i added to a repository, as well as later, after the file is already there. However, doing so manually for lots of files is painful and error-prone. Wrappers allow you to specify the conflict resolution method and keyword expansion method for groups of files, based on filename patterns. You may do this on

the command line or, more conveniently, by placing the wrappers into a *.cvswrappers* file. Each line has the following format:

```
        wildcard
option
'value'
[option
'value'...]
```

The *wildcard* is a shell-style wildcard pattern. If *option* is `-m`, it indicates the conflict resolution method. In this case, *value* should be either MERGE or COPY. If *option* is `-k`, then *value* is one of the keyword resolution modes (b, k, o, etc.).

Stickiness

When some aspect of the persistent state of a file in a sandbox is different from that of the file in the repository, that aspect is said to be *sticky*. For example, when a file is retrieved based on a specific date, tag, or revision, those attributes are sticky. Similarly, when a file in a sandbox belongs to a branch, the branch is said to be sticky, and if the keyword expansion mode is set on a file, that mode is also sticky. Entire directories may be marked as sticky, not just individual files.

These attributes are termed "sticky" because the state of the file becomes persistent. In particular, a `cvs update` does *not* update such files to the latest revision in the repository. Similarly, you cannot use `cvs commit` to make such a file become the head of a branch or the trunk in the repository. Finally, when a file is on a sticky branch, it can only be committed on that branch.`cvs status` shows the stickiness of various attributes.

This all makes sense: work on a branch should be done only on that branch. When work on the branch is finished, the branch's changes should be merged into the files on the trunk, instead of checking the files into the head of the trunk directly.

Stickiness is created or changed using the `-D`, `-k` or `-r` options to `cvs checkout` and `cvs update`. Use `cvs update -A` to remove stickiness. You must use this command on a sticky directory directly; applying it just to all the contained files in the directory is not enough.

See Chapter 4 in Essential CVS (O'Reilly) for more details.

Command-Line Syntax and Options

CVS supports a number of command-line options that you can use to control various aspects of CVS behavior. Each CVS subcommand has its own options, as well.

The syntax of any CVS command is as follows:

```
        cvs
[cvs-options]
[command]
[command-options-and-arguments]
```

The *cvs-options* modify the behavior of the main CVS code, rather than the code for a specific command.

cvs Options

Options to the cvs command are supplied *before* the particular subcommand to be executed. This section focuses on options that you pass to the cvs executable itself, not to any specific CVS command. The following options are valid:

-a

Authenticate all network traffic. Without this option, the initial connection for the command is authenticated, but later traffic along the same data stream is assumed to be from the same source.

This option is available only with GSS-API connections, but if you usessh as your rsh replacement in the ext connection mode, ssh authenticates the data stream.

This option is supported if it is listed incvs --help-options. The command-line client can be compiled to support it by using the --enable-client option to the configure script.

-allow-root=*directory*

Used as part of the inetd command string for the server, kserver, and pserver connection methods. The *directory* is the repository root directory to which the server allows connections. Using --allow-root more than once in a command allows users to connect to any of the specified repositories.

d *repository_path*

Use *repository_path* as the path to the repository root directory. This option overrides both the CVSROOT environment variable and the contents of the *Root* file in the sandbox's *CVS* subdirectory. It also overrides the contents of the *.cvsrc* file.

The syntax for the repository path is:

`[:`*`method`*`:][[[`*`user`*`][:`*`password`*`]@]`*`hostname`*`[:[`*`port`*`]]]/`*`path`*

See Essential CVS (O'Reilly) for a full explanation of each element of the repository path.

e *editor*

Use the specified *editor* when CVS calls an editor for log information during the `commit` or `import` process. This option overrides the EDITOR, CVSEDITOR, and VISUAL environment variables, and the contents of the *.cvsrc* file.

-f

Prevent CVS from reading the *~/.cvsrc* file and using the options in it.

H, --help

If called as `cvs -H` or `cvs --help`, CVS displays a general CVS help message.

If called as `cvs -H` *command* or `cvs --help` *command*, CVS displays the available options and help information for the specified *command*.

-help-commands

List the available CVS commands with brief descriptions of their purposes.

-help-options

List the available *cvs-options* with brief descriptions of their purposes.

-help-synonyms

List the valid synonyms (short names) for the CVS commands.

-l

Do not log the current command to the *history* file in the repository's *CVSROOT* directory. The command will not show in subsequent `cvs history` output.

-n

Execute only commands that do not change the repository. Using this option withcvs update can provide a status report on the current sandbox.

-q

Run in *quiet mode*. This option causes CVS to display only some of the informational messages

-Q

Run in *very quiet mode*. This option causes CVS to display only the most critical information.

-r

Set files checked out to the sandbox as read-only. This option only sets newly checked-out files. If a file is being watched withcvs watch, read-only is the default. This option overrides settings in the *.cvsrc* file.

s *variable*=*value*

Set a user variable for use with one of the scripting files in*CVSROOT*. The user variables are explained in CVSROOT Variables," later in this chapter.

-t

Display messages that trace the execution of the command. This option can be used with-n to determine precisely what a command does.

T *directory*

Use the named *directory* to store temporary files. This option overrides environment variables or settings in the *.cvsrc* file.

v, --version

Display CVS version and copyright information.

-w

Set files checked out to the sandbox as readable and writable. This option sets only the permissions of newly checked-out files. This option overrides the CVSREAD environment variable, and it overrides settings in the*.cvsrc* file.

-x

Encrypt all data that travels across the network between the client and the server. This option is currently available in GSS-API or Kerberos mode only, but if you usessh as your rsh replacement in the ext connection mode, ssh encrypts the data stream.

This option is available only if the client supports it. It is supported if it is listed incvs --help-options. You can compile the command-line client to support it by using the--enable-client and --enable-encryption options to the configure script.

z *n*

Compress all network traffic by using the specifiedgzip compression level *n*. The compression levels range from 0 (no compression) to 9 (maximum compression). This option overrides settings in the *.cvsrc* file.

This option is available only if the client supports it. It is supported if it is listed incvs --help-options. You can compile the command-line client to support it by using the--enable-client option to the configure script.

Common Subcommand Options

Many of the CVS subcommands (add, commit, and so on) share a large number of common options They are described here.

d *directory-name*

Check out or update a sandbox out into a directory called*directory-name* instead of using the repository directory name or the name designated in the*modules* file in the repository's *CVSROOT* directory. This is particularly useful when creating a second sandbox for a project.

CVS usually creates the same directory structure that the repository uses. However, if the checkout parameter contains only one file or directory and the-d option is used, CVS does not create any intervening directories. Use-N to prevent CVS from shortening the path.

D *date*

Run the subcommand on the latest revision of a file that is as old as or older than the date or time specified by date.

-f

Use the latest (HEAD) revision of a file that is on the current branch or trunk if no revision matches a specified date or revision number. This option applies only if-r or -D is used.

k *mode*

Specify the keyword expansion *mode*. For `cvs add`, this option also sets the default keyword mode for the file. If you forget to set the default keyword mode with`cvs add`, you can do so later with `cvs admin`. The keyword-expansion modes are listed in "Keywords and Keyword Modes," later in this chapter

`-l`

Run the subcommand on the files in the local directory only. (Do not recurse into subdirectories.) See also `-R`.

`m` *message*

Use the specified *message* as the description of the newly added file or as the description of the change made.

`-n`

Do not run any program listed in the *modules* file for this directory.

`-N`

Do not shorten the path. CVS usually creates the same directory structure that the repository uses. However, if the checkout contains only one file and the `-d` option is used, CVS does not create any intervening directories unless `-N` is also specified.

`r` *revision*

Run the subcommand on the specified *revision* or tag of a file. If this option refers to a branch, run the command on the latest (HEAD) revision of the branch.

`-R`

Run the subcommand on the files in the local directory and all subdirectories and recurse down the subdirectories. This option is generally the default. See also `-l`.

Dot Files

In client/server mode, all the dot filesother than *.rhosts* should be on the client computer. The *.rhosts* file should be in the user's home directory on the server computer.

These are the dot files in the sandbox directory:

.cvsignore

Contains a list of files CVS should not process. The format is one or more lines, with whitespace-separated filenames or shell wildcard patterns matching files that CVS should ignore when producing informational messages and duringcommit, update, or status operations. A single ! causes CVS to empty out its ignore list and start over again with subsequent filenames or patterns. The file may be checked into CVS.

.#filename.revision

If a project file that is not fully synchronized with the repository is overwritten by CVS, the original file is stored as *.#filename.revision*, where *revision* is the BASE revision of the file.

These are the dot files in a user's home directory:

.cvsignore

Contains a list of files CVS should not process. See the earlier description.

.cvspass

Used in pserver remote-access mode. This file contains the user's password for each repository they are logged into, stored in a simple form of encoding. Be aware that the file is human-readable and that the passwords are easy to decrypt.

.cvsrc

Contains a list of CVS commands and the options the user wants as default options for those commands.

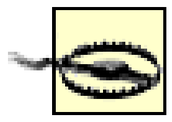
.cvswrappers

Contains a list of wrappers that affect how a file is stored. The wrappers include a pattern that

CVS matches against filenames and a keyword-expansion mode that CVS applies to any file whose name matches the pattern.

.rhosts

Used when connecting with rsh. This file should be in the user's home directory on the server machine, and it should contain the client's computer and username.



The rsh command is unacceptably insecure. You should avoid it completely; use ssh instead.

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Environment Variables

Several environment variables affect CVS. Some are read-only when CVS is the client, and some are read-only when CVS is the server. When the repository resides on the local machine, both sets are read.

Client Environment Variables

The environment variables in the following list are read and used by the process that runs on the client computer and must be in the calling user's environment:

CVS_CLIENT_LOG

Used for debugging CVS in client/server mode. If set, everything sent to the server is stored in the *$CVS_CLIENT_LOG.in* file, and everything received by the client is stored in *$CVS_CLIENT_LOG.out*.

CVS_CLIENT_PORT

Used to set the port the client uses to connect to the CVS server inkserver, gserver, and pserver modes. By default, the client uses port 2401 (gserver and pserver) or port 1999 (kserver) to connect to the server.

CVSIGNORE

A whitespace-separated list of filename patterns that should be ignored. See the description of the *.cvsignore* file, earlier in this chapter.

CVSEDITOR, EDITOR, VISUAL

Used to set the editor CVS calls when it opens an editor for log messages. On Unix and GNU/Linux systems, the default editor is vi. Using CVSEDITOR is preferred over EDITOR and VISUAL, as other variables may be used by other programs.

CVS_PASSFILE

Used to change the file CVS uses to store and retrieve the password inpserver remote-access mode. The default file is *$HOME/.cvspass*.

CVSREAD

If set to 1, CVS tries to check out your sandbox in read-only mode. (CVS actually checks whether this variable is nonnull, so it works regardless of the setting. This behavior may change in the future.)

CVSROOT

Contains the full pathname of the CVS repository. When you're working in a sandbox, this variable is not needed. If you're working outside a sandbox, either this variable must be present or the `-d` *repository_path* option must be used.

CVS_RSH

Used to set the program CVS calls to connect to a remote repository in `ext` mode. The default program is `rsh`.

The `rsh` command is unacceptably insecure. You should avoid it completely; use `ssh` instead.

CVS_SERVER

If connecting to a CVS server using `rsh`, this variable is used to determine which program is started on the server side. In `ext` and `server` modes, this defaults to `cvs`. When the repository is on the local system, this defaults to the path to the CVS client program.

CVSWRAPPERS

May contain no more than one *wrapper*, as explained in CVS Wrappers," earlier in this chapter.

HOME, HOMEPATH, HOMEDRIVE

Used to determine where the user's home directory is, to enable CVS to locate its files. On Unix, GNU/Linux, and related systems, only HOME is used. On Windows systems, HOMEDRIVE and HOMEPATH are used. Some Windows operating systems (Windows NT, 2000, and XP) set these variables automatically. If yours doesn't, HOMEDRIVE should be set to the drive letter (e.g., *C:*), and HOMEPATH should be set to the path (e.g., *\home\arnold*).

PATH

Used to locate any programs whose path is not compiled with the CVS program. This variable is still used, but it is less important now that the `rcs`, `diff`, and `patch` programs CVS uses are all distributed with CVS.

Server Environment Variables

The following variables are read when CVS is operating as the server (or when the repository is on the local system). They must be in the calling user's environment on the server computer.

CVS_SERVER_SLEEP

Used only when debugging the server in client/server mode. This variable delays the start of the server client process by CVS_SERVER_SLEEP seconds to allow the debugger to be attached to it.

CVSUMASK

Used to set the default permissions of files in the repository. This variable may be added to the client code in a later version of CVS.

PATH

Used to locate any programs whose path is not compiled with the CVS program. This variable is still used, but it is less important now that the `rcs`, `diff`, and `patch` programs CVS uses are all distributed with CVS.

TMPDIR

Sets the temporary directory CVS stores data in. This variable defaults to */tmp*.

CVS creates temporary files with `mkstemp` (BSD 4.3), if possible. If `mkstemp` is not available when CVS is compiled, it tries `tempnam` (SVID 3), `mktemp` (BSD 4.3), or `tmpnam` (POSIX), in that order. If it uses `tmpnam`, it cannot use the TMPDIR environment variable, and files are created in */tmp*.

Keywords and Keyword Modes

CVS contains keywords that can be included in nonbinary project files. When CVS finds a keyword in a file it is checking out, it expands the keyword to provide metadata about the latest revision of the file. You can set keyword-expansion modes on a file to tell CVS whether (and how) to expand the keywords it finds.

Keyword-expansion modes also control line-ending conversion. Unix, Macintosh, and Windows operating systems use different sets of codes to signal the ends of lines. (GNU/Linux uses the same codes as Unix.) When you commit a file from an operating system that doesn't use Unix line endings, CVS converts the line endings to Unix style. If you are storing binary files, this conversion can corrup the file. Use the `-kb` keyword-expansion mode to tell CVS not to convert line endings.

CVS keywords take the form:

```
$Keyword$
```

All keywords except Log expand to the format:

```
    $Keyword:
value$
```

These are the keywords and the information they show about the file they are in:

Author

: The username of the user who committed the last revision.

Date

: The date on which the last revision was committed, in UTC.

Header

: A header containing information about the file, including the author, date and revision number, path and filename of the RCS file (project file in the repository), file status, and whether the fil is locked.

Id

A header like the one given by the Header keyword, without the path of the RCS file.

Locker

The username of the user who locked the file with cvs admin -l (empty if the file is not locked).

Log

The commit messages, dates, and authors for the file. This keyword instructs CVS to store this information in the file itself. Any characters that prefix the keyword are also used to prefix log lines; this enables comment markers to be included automatically. Unlike most keywords, existing log expansions are not overwritten with the new ones; the new log expansions are merely prepended to the list.

The Log keyword is best used at the end of a file, to avoid users having to go through all the log messages to get to the important parts of the file.

This feature was inherited from RCS. As such, the log created by the Log keyword does not merge neatly when CVS merges a branch back to the trunk. If your file is likely to be branched and remerged, it is better to use the cvs log command than to store a log within the file.

NOTE

The cvs log command displays all the information that the Log keyword provides.

Name

The tag name the file was checked out with. This keyword can display a branch or provide a more meaningful identification of a revision than the revision number alone.

RCSfile

The name of the RCS file (the project file in the repository).

Revision

The CVS internal revision number of the file. This number is specific to the individual file and does not identify a stage within the project.

Source

The name and path of the RCS file (the project file in the repository).

State

The current state assigned to the current revision, set with `cvs admin -s`. See Chapter 7 in Essential CVS (O'Reilly).

The keyword-expansion modes in the following list are used in commands and CVS wrappers to control keyword expansion and line-ending conversion. The syntax differs slightly for each use. In commands, you use the mode without a space between the option and the mode (e.g., `-kb`). In wrappers, you need a space and may need to quote (e.g., `-k 'b'`).

b

Inhibit keyword expansion and line-ending conversion. Use this keyword-expansion mode to signal that a file is binary. This option is needed because CVS can convert line endings from the form appropriate to the server to the form appropriate to the client. This causes obvious problems when working with binary files.

k

Generate only a keyword name, not a name and value. Use this option when merging different (nonbinary) versions of a file to prevent keyword substitution from creating spurious merge errors. This option can corrupt binary files.

o

Generate the version of a keyword string that was present just before the current file was last committed, rather than generating a version with the modifications of the last commit. This option is similar to `-kb`, but with line-ending conversion.

v

Generate only the value of a keyword, rather than the name and value. This is most useful with `cvs export`, but do not use it for binary files. Once any keyword is removed from a file, further expansions are not possible unless the word is replaced.

kv

Generate the name and value of a keyword. This is the default mode.

kvl

Generate the name and value of a keyword and add the name of the locking user if the revision is locked with `cvs admin -l`.

Dates

In CVS, all dates and times are processed by a version of the GNU `getdate` function, which can translate dates and times given in several different formats. Case is always irrelevant when interpreting dates. Spaces are permitted in date strings, but in the command-line client, a string with spaces should be surrounded by quotes. If a year is 0 to 99, it is considered to be in the twentieth century.

If a time is not given, midnight at the start of the date is assumed. If a time zone is not specified, the date is interpreted as being in the client's local time zone.

Legal Date Formats

The legal time and date formats for CVS are defined by the ISO 8601 standard and RFC 822 as amended by RFC 1123. Other formats can be interpreted, but CVS is designed to handle only these standards.

ISO 8601

The basic ISO 8601 date format is as follows:

```
year-month-day
hours:minutes:seconds
```

All values are numbers with leading zeros to ensure that the correct number of digits are used. Hours are given in 24-hour time. This produces the structure *YYYY-MM-DD HH:MM:SS*, which is internationally acceptable and can be sorted easily. You can use a date, a time, or both.

If you're using ISO 8601 format with the hyphens, the full date is required in CVS. The *YYYYMMDD* date format is also acceptable and can be abbreviated to *YYYYMM* or *YYYY*.

The *HH* and *HH:MM* time formats are acceptable. Times can also be specified without the colon, so *HHMMSS* or *HHMM* are usable.

> Be aware that *HHMM* may be misinterpreted as *YYYY*. Get into the habit of using separators.

In strict ISO 8601 format, a T is required between the date and the time, but CVS understands this

format with or without the T. The ISO 8601 standard also states that a Z at the end of the string designates UTC (Universal Coordinated Time), but CVS does not recognize the use ofZ.

RFC 822 and RFC 1123

RFCs 822 and 1123 define a precise time format:

```
    [DDD ,]
DD MMM
YYYY
HH:MM[:SS]
ZZZ
```

These are the terms in the format:

DDD

A three-letter day of the week.

DD

A two-digit date of the month.

MMM

A three-letter month.

YYYY

The year (it must be a four-digit year).

HH

Hours.

MM

Minutes.

SS

Seconds.

ZZZ

The time zone (can be the text abbreviation, a military time zone, or an offset from UTC in hours and minutes).

Legal Date Keywords

CVS also allows short English phrases such as "last Wednesday" and "a month ago" to be used in place of actual dates. Case is not significant, and CVS can understand plurals. These are the keywords it understands:

Month names

January, February, March, April, May, June, July, August, September, October, November, and December.

Month abbreviations

Jan, Feb, Mar, Apr, Jun, Jul, Aug, Sep, Sept, Oct, Nov, and Dec.

Days of the week

Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday.

Day abbreviations

Sun, Mon, Tue, Tues, Wed, Wednes, Thu, Thur, Thurs, Fri, and Sat.

Units of time

year, month, fortnight, week, day, hour, minute, min, second, and sec.

Relative times

tomorrow, yesterday, today, and now.

Meridian qualifiers

am, pm, a.m., and p.m.

Modifiers

a, last, this, next, and ago.

Sequences

first, third, fourth, fifth, sixth, seventh, eighth, ninth, tenth, eleventh, and twelfth. (second can't be used as a sequence term, because it is used as a time unit.)

Time Zones

CVS understands time zones expressed in offsets from UTC, such as +0700 (7 hours ahead) and -1130 (11 hours, 30 minutes behind). The format for these time zones is +*HHMM* or -*HHMM*, where + means ahead of UTC and - means behind UTC. CVS also understands time-zone abbreviations and ignores case and punctuation when interpreting them.

NOTE

Some of the time-zone abbreviations CVS recognizes are ambiguous. CVS recognizes only one meaning for each of the ambiguous time zones. However, the meaning that is recognized may vary depending on your operating system, and on how CVS was configured when it was compiled.

Table 13-2 shows the valid civilian time-zone abbreviations for CVS. Table 13-3 shows military time-zone abbreviations that CVS recognizes.

Table 13-2. Civilian time-zone abbreviations

Abbrev.	Offset / Name	Abbrev.	Offset / Name
gmt	+0000 Greenwich Mean	met	-0100 Middle European
ut	+0000 Coordinated Universal Time	mewt	-0100 Middle European Winter
utc	+0000 Coordinated Universal Time	mest	Middle European Summer
wet	+0000 Western European	swt	-0100 Swedish Winter
bst	+0000 British Summer (ambiguous with Brazil Standard)	sst	Swedish Summer (ambiguous with South Sumatra)
wat	+0100 West Africa	fwt	-0100 French Winter
at	+0200 Azores	fst	French Summer
bst	+0300 Brazil Standard (ambiguous with British Summer)	eet	-0200 Eastern Europe, USSR Zone 1

Abbrev.	Offset / Name	Abbrev.	Offset / Name
gst	+0300 Greenland Standard (ambiguous with Guam Standard)	bt	-0300 Baghdad, USSR Zone 2
nft	+0330 Newfoundland	it	-0330 Iran
nst	+0330 Newfoundland Standard (ambiguous with North Sumatra)	zp4	-0400 USSR Zone 3
ndt	Newfoundland Daylight	zp5	-0500 USSR Zone 4
ast	+0400 Atlantic Standard	ist	-0530 Indian Standard
adt	Atlantic Daylight	zp6	-0600 USSR Zone 5
est	+0500 Eastern Standard	nst	-0630 North Sumatra (ambiguous with Newfoundland Summer)
edt	Eastern Daylight	sst	-0700 South Sumatra, USSR Zone 6 (ambiguous with Swedish Summer)
cst	+0600 Central Standard	wast	-0700 West Australian Standard
cdt	Central Daylight	wadt	West Australian Daylight
mst	+0700 Mountain Standard	jt	-0730 Java
mdt	Mountain Daylight	cct	-0800 China Coast, USSR Zone 7
pst	+0800 Pacific Standard	jst	-0900 Japan Standard, USSR Zone 8
pdt	Pacific Daylight	cast	-0930 Central Australian Standard
yst	+0900 Yukon Standard	cadt	Central Australian Daylight
ydt	Yukon Daylight	east	-1000 Eastern Australian Standard
hst	+1000 Hawaii Standard	eadt	Eastern Australian Daylight
hdt	Hawaii Daylight	gst	-1000 Guam Standard, USSR Zone 9 (ambiguous with Greenland Standard)
cat	+1000 Central Alaska	nzt	-1200 New Zealand
ahst	+1000 Alaska-Hawaii Standard	nzst	-1200 New Zealand Standard
nt	+1100 Nome	nzdt	New Zealand Daylight
idlw	+1200 International Date Line West	idle	-1200 International Date Line East
cet	-0100 Central European		

Table 13-3. Military time-zone abbreviations

Name	Offset	Name	Offset	Name	Offset	Name	Offset	Name	Offset
a	+0100	f	+0600	l	+1100	q	-0400	v	-0900

Name	Offset	Name	Offset	Name	Offset	Name	Offset	Name	Offset
b	+0200	g	+0700	m	+1200	r	-0500	w	-1000
c	+0300	h	+0800	n	-0100	s	-0600	x	-1100
d	+0400	i	+0900	o	-0200	t	-0700	y	-1200
e	+0500	k	+1000	p	-0300	u	-0800	z	+0000

PREV

CVSROOT Variables

The administrative files in *CVSROOT* can use several types of variables: internal, environment, and shell variables. You can use these variables to pass parameters to the scripts in the scripting files, or you can use them as part of command-line templates.

The internal variables allow you to use information CVS stores about the currently running command The environment variables are used to access information from the environment the command is running in, and the shell variables are used to access information about the shell.

Environment Variables in CVSROOT Files

Three environment variables are set when CVS runs commands or scripts from CVS administrative files:

CVS_USER

This variable is meaningful only with the `pserver` access method. It refers to the CVS username provided in the leftmost field of the appropriate line in *CVSROOT/passwd*. If this username does not exist, the variable expands to an empty string.

LOGNAME, USER

Both of these variables contain the username of the user calling the CVS process.

In the `pserver` access method, the username is the third field of the line in *passwd*. If no username is there, the CVS_USER value is used.

Internal Variables in CVSROOT Files

The syntax for referencing a CVS internal variable is ${*VARIABLE*}. The $*VARIABLE* syntax can also be used if the character immediately following the variable is neither alphanumeric nor an underscore (_).

These are the internal CVS variables:

CVSROOT

The path to the repository root directory (not the path to the *CVSROOT* directory within the repository). This variable contains the path only, not any access method or host information.

CVSEDITOR, EDITOR, VISUAL

The editor CVS is using. If you use the -e *editor* CVS option, CVS uses the editor you specify on the command line. If you don't use -e, CVS reads the environment variables and uses the first editor it finds. CVS uses CVSEDITOR by preference, then EDITOR, then VISUAL.

USER

The username (on the server machine in client/server mode) of the user running CVS.

With the pserver access method, this is the third field of the appropriate line in *passwd*. If no username is there, it is the name in the leftmost field.

CVS permits user-defined variables that can be passed to administrative files from the client. In the administrative files, reference such a variable with the syntax ${=*VARIABLE*}. On the command line, use the -s *variable*=*value* CVS option to pass the variable to CVS. All strings that contain the $ symbol, other than the variable references, are reserved for CVS internal use. There is no way to escape the $ symbol.

Shell Variables in CVSROOT Files

Two shell variables are also used in the administrative files:

~/

The home directory of the user calling the CVS process.

~*username*

The home directory of the user identified as *username*.

Alphabetical Summary of Commands

Most of your interaction with CVS is through the various CVS subcommands. Even if you use a graphical client, most of the functions the client uses call the CVS subcommands.

Most subcommands have a shortened nickname that you can type instead of the longer subcommand name. These are called *command synonyms* in CVS jargon.

add

```
cvs [cvs-options] add [-k mode] [-m message] files
```

Add a file or directory to the repository. This command can also be used to undo an uncommitted file deletion or to restore a deleted file. You must commit any added files in order for the addition to fully take effect.

Synonyms: `ad`, `new`

Standard subcommand options: `-k`, `-m`

Examples

```
$ cvs add Design.rtf
    cvs server: scheduling file `Design.rtf' for addition
    cvs server: use 'cvs commit' to add this file permanently
```

admin

```
cvs [cvs-options] admin [options] [files ...]
```

Use RCS commands on the repository copy of project files. This command is is a frontend for a range of useful (though sometimes useless to CVS) RCS-based commands. Project files are stored in the repository in RCS format, so it is useful to have a way to use some of the RCS commands on the files directly.

Synonyms: `adm`, `rcs`

Standard subcommand options: -k

Options

-a*usernames*

Append the comma-separated list of *usernames* to the RCS access list in the repository (RCS-format) copy of a file. This change to an RCS file has no effect on CVS. See also -A and -e.

-A*filename*

Append the RCS access list in *filename* to the access list of the files being operated on. This change to an RCS file has no effect on CVS. See also -a and -e.

-b[*revision*]

Set the default branch of a file to the named branch revision; if no revision is named, set the default branch to the highest branch revision on the trunk. This option should be used very rarely in CVS; it is better to check out a sandbox as a branch sandbox with the -r option to checkout or update.

-c*string*

Set the RCS comment leader of a file to the specified *string*. This option is not used in CVS.

-e[*usernames*]

Remove the comma-separated list of *usernames* from the RCS access list in the repository (RCS-format) copy of a file. If no list of *usernames* is provided, remove all names. This change to an RCS file has no effect on CVS. See also -a and -A.

-i

Create and initialize an RCS file. This option is not used in CVS (use cvs add instead), and it is not available in CVS 1.9.14 and later.

-l

Run interactively. This option does not work in client/server-mode CVS and may be removed from later versions of CVS.

-l[*revision*]

Lock the specified *revision* of a file so that another user cannot commit to it. If *revision* is omitted, CVS locks the latest revision on the current sandbox's branch or the trunk. To work with CVS, the lock requires a script such as the `rcslock` script in the *contrib* directory of the source. See Essential CVS (O'Reilly) for how to use this option. See also `-u`.

`-L`

Set RCS locking for a file to strict, which means that the owner of the file must lock the file before committing. (This locking is done by the CVS code, and need not be done manually.) Fil locking must be set to strict for CVS to work properly. See also `-U`.

`-m`*revision*`:`*message*

Replace the log message of the designated *revision* of a file with the specified *message*.

`-n`*tagname*`[:[`*revision*`]]`

Tag the designated *revision* or branch of a file with the *tagname*. If there is no *revision* and no colon, delete the tag; if there is a colon but no *revision*, tag the latest revision on the default branch, usually the trunk. If the *tagname* is already present in the file (and the operation isn't "delete"), this option prints an error and exits. See also `-N`.

Generally, it is better to use `cvs tag` and `cvs rtag` to manipulate tags.

`-N`*tagname*`[:[`*revision*`]]`

Tag the designated *revision* or branch of a file with the *tagname*. If there is no *revision* and no colon, delete the tag; if there is a colon but no revision, tag the latest revision on the default branch, usually the trunk. If the *tagname* is already present in the file (and the operation isn't "delete"), this option moves the tag to the new revision. See also `-n`.

Generally, it is better to use `cvs tag` and `cvs rtag` to manipulate tags.

`-o`*range*

Delete the revisions specified in the *range*. The revisions given in the range can be revision numbers or tags, but be wary of using tags if multiple tags in a file denote the same revision.

There is no way to undo a `cvs admin -o` command.

The *range* can be any of the following:

revision1`:`*revision2*

Delete revisions between *revision1* and *revision2*, including *revision1* and *revision2*.

revision1::*revision2*

Delete revisions between *revision1* and *revision2*, excluding *revision1* and *revision2*.

revision:

Delete *revision* and all newer revisions on the same branch (or the trunk).

revision::

Delete all revisions newer than *revision* on the same branch (or the trunk).

:*revision*

Delete *revision* and all older revisions on the same branch (or the trunk). This range does not delete the base revision of the branch or revision 1.1.

::*revision*

Delete all revisions older then *revision* on the same branch (or the trunk). This range does not delete the base revision of the branch or revision 1.1.

revision

Delete *revision*.

`-q`

Run quietly, without printing diagnostics (redundant with `cvs -q admin`).

`-s`*state*[:*revision*]

Set the *state* of the designated *revision* of a file, or set the last revision on the trunk or the current branch if no *revision* is listed. The *state* should be a string and is shown in the output of `cvs log` and by the `Log` and `State` keywords. The `dead` state is reserved for CVS internal use.

`-t`[*filename*]

Write the contents of the file specified by *filename* to the description of each file listed in the command. The description is an RCS field, shown in `cvs log` output. This option deletes any existing description. If the *filename* is omitted, CVS seeks input from standard input, ending with a period (.) on a line by itself. See also `-t`-*string*.

-t-*string*

Write the contents of the *string* to the description of each file listed in the command. The description is an RCS field, shown in `cvs log` output. This option deletes any existing description. See also `-t`.

-u[*revision*]

Unlock the specified *revision* of a file so that another user can commit from that revision. If the *revision* is omitted, this option unlocks the latest revision on the current sandbox's branch or the trunk. This option requires a script, such as the `rcslock` script in the *contrib* directory of the source. See Essential CVS (O'Reilly) for how to use this option. See also `-l`.

-U

Set RCS locking for a file to nonstrict, which means that the owner of the file does not need to lock the file before committing. (This locking is done by the CVS code and need not be done manually.)

File locking must be set to strict for CVS to work properly. This option should never be used on CVS-stored files. See also `-L`.

-V*n*

Write an RCS file compatible with RCS version *n*. This option is not used in CVS anymore, and it is not available in CVS 1.9.20 and later.

-x*suffix*

Specify the *suffix* for the RCS file. This option is not used or available in CVS (all CVS files use ,v as the suffix).

Examples

```
$ cvs admin -kb AcceptanceTest.doc
RCS file: /var/lib/cvs/wizzard/doc/design/AcceptanceTest.
doc,v
done
```

annotate

```
cvs [cvs-options] annotate [options] [files ...]
```

Display a file or files with annotations showing the last editor and revision that changed each line of the file. If no files are used in the argument, the files in the current sandbox are shown. See also rannotate.

Synonym: ann

Standard subcommand options: -D, -f, -l, -r, -R

Options

-F

Show annotations for binary files.

Examples

```
$ cvs annotate Makefile

Annotations for Makefile
***************
1.2  (arnold     01-Sep-02): #
1.2 (arnold     01-Sep-02): # Makefile for the Wizzard
project
1.2 (arnold     01-Sep-02): # Created by A Robbins, 1
September 2002
```

checkout

cvs [*cvs-options*] checkout [*options*] *projects* ...

Create a new sandbox in the current working directory. This command can also be used to update an existing sandbox. See also export and update.

The *projects* argument to checkout may be one or more paths to directories within the repository, paths to files within the repository, or module names as specified in the*modules* file in the repository's *CVSROOT* directory. These paths must be separated by spaces.

When creating a new sandbox, the repository path must be specified by using the-d *repository_path* CVS option or the CVSROOT environment variable.

If you are creating a new sandbox inside an existing sandbox, the*CVS/Root* file of the current

directory in the existing sandbox can provide a repository path. In most cases, having a sandbox inside a sandbox is needlessly confusing.

Synonyms: co, get

Standard subcommand options: -d, -D, -f, -k, -l, -n, -N, -r, -R

Options

-A

Clear sticky tags, dates, and keyword-expansion modes from a project and replace the current files with the head of the trunk.

-c

Display the contents of the *modules* file in the repository's *CVSROOT* directory. This option lists the modules in the current repository and the options applicable to those modules. See also-s.

> NOTE
>
> checkout -c lists only those projects that have entries in the *modules* file.

-j *revision*[:*date*]

Determine the changes between the revision the files in the sandbox are based on and the specified *revision* and merge those changes to the sandbox.

If two -j options are used, determine the changes between the first-j revision and the second -j revision and merge those changes to the sandbox.

The *date* can be used only if the revision designates a branch. *date* specifies the latest revision on that date.

-p

Check out the listed files to standard output, rather than to the filesystem.

-P

Do not include empty directories in the sandbox.

-s

Display the contents of the *modules* file in the repository's *CVSROOT* directory. This option lists the modules in the current repository and their status. See also `-c`.

Examples

```
$ cvs -d cvs:/var/lib/cvs checkout wizzard
cvs server: Updating wizzard
U wizzard/Changelog
U wizzard/INSTALL
U wizzard/Makefile
```

commit

```
cvs [cvs-options] commit [options] [files ...]
```

Commit changes in a sandbox to the repository. Until a `commit` is run, changes such as modified, new, or removed files are not reflected in the repository. If no files are listed as arguments, CVS uploads all changes in the current sandbox.

Unless you use either the `-m` or `-F` options, `commit` calls an editor to request a log message.

If there have been changes in the repository version of a file since it was last synchronized with the repository, and the local version has also changed, you have a *conflict* and the file cannot be committed. You can try to commit the file again once you have updated it using `cvs update` or `cvs checkout`. The update will include an attempt to merge the file.

Synonyms: `ci`, `com`

Standard subcommand options: `-l`, `-m`, `-n`, `-r`, `-R`

Options

`-f`

Force CVS to commit a file even if there have been no changes to the file. This option implies the `-l` option.

`-F` *logfile*

Read a log message from the specified *logfile* rather than calling an editor.

Examples

```
/home/arnold/cvs/wizzard$ cvs commit
cvs commit: Examining .
cvs commit: Examining doc
cvs commit: Examining lib
...
RCS file: /var/lib/cvs/wizzard/doc/design/Design.rtf,v
done
Checking in doc/design/Design.rtf;
/var/lib/cvs/wizzard/doc/design/Design.rtf,v <--  Design.
rtf
initial revision: 1.1
done
```

diff

```
cvs [cvs-options] diff [format-options] [options] [files ...]
```

Display the differences between two revisions of a file or files. By default,diff checks the sandbox copy against the revision in the repository that the sandbox copy was last synchronized with. If the *files* argument is a directory, all files under that directory are compared, and files in subdirectories are also compared recursively. See also rdiff.

Synonyms: di, dif

Standard subcommand options: -D, -k, -l, -r, -R

The *format-options* determine how cvs diff displays any differences it finds. They operate in the same way as the options to the GNU diff program. See the entry for diff in Chapter 3.

Line and group format options

Line and group formats allow you to modify the way diff displays line changes. The group format options control the markers that surround the change, and the line format options control the marks on the changed lines themselves. Group format options are often used to create*if-then-else* structures for automated parsers to use.

The format options have a format string as a parameter and display the lines they affect according tc the rule provided in the format string. The format string usually contains characters that are interpreted by your operating system's shell, so the string usually needs to be surrounded by your shell's quote character.

Following are the group format options, which affect the markers surrounding changed lines:

--changed-group-format=*format-string*

Display the text defined by the format string for each group of lines that are different between files, usually a concatenation of the old and new group format strings.

--new-group-format=*format-string*

Display the text defined by the format string for each group of lines from the second file that are different or missing in the first file.

--old-group-format=*format-string*

Display the text defined by the format string for each group of lines from the first file that are different or missing in the second file.

--unchanged-group-format=*format-string*

Display the text defined by the format string for each group of lines that are the same in both files.

Here are the line format options, which affect the lines themselves:

--line-format=*format-string*

Display the text defined by the format string for all lines.

--new-line-format=*format-string*

Display the text defined by the format string for each line from the second file that is different or missing in the first file.

--old-line-format=*format-string*

Display the text defined by the format string for each line from the first file that is different or missing in the second file.

--unchanged-line-format=*format-string*

Display the text defined by the format string for each line that is the same in both files.

The *format-string* for both group and line formats uses the percent (%) character as a special token, denoting a string to be evaluated by `cvs diff`. The string `% %` represents a single percent character. You also need to know your shell's quoting rules if you wish to include your shell's quote marks in the format string.

These are the special characters for a line *format-string*:

%c'*C*'

The character *C*, which cannot be a quote or a backslash.

%c'*O*'

The character represented by the octal string *O*.

%l

The contents of the line to be formatted, not including the newline character.

%L

The contents of the line to be formatted, including the newline character. If a line does not contain a newline character, this character does not add it.

%[-][*width*][.[*digits*]][doxX]n

A printf-style *format-string* that displays the line number of the current line. The hyphen (-) signals that the number should be left-justified. The*width* specifies the minimum field width, and *digits* specifies the minimum number of digits. The other options ared (for decimal), o (for octal), and x or X (for lowercase or uppercase hexadecimal).

%%

The percent character.

These are the special characters for a group *format-string*:

%<

The lines from the first file.

%>

The lines from the second file.

%=

Lines common to both files.

%[-][*width*][.[*digits*]][doxX]*symbol*

A printf-style *format-string* that displays the number denoted by *symbol*. The hyphen (-) signals that the number should be left-justified. The*width* specifies the minimum field width, and *digits* specifies the minimum number of digits. The other options ared (for decimal) o (for octal), and x or X (for lowercase or uppercase hexadecimal).

Lowercase *symbols* denote the first file. Uppercase symbols denote the second file. The *symbols* are:

E, e

The line number of the line just before the group.

F, f

The line number of the first line in the group.

L, l

The line number of the last line in the group.

M, m

The line number of the line just after the group.

N, n

The number of lines in the group.

%*(A=B?C:D)*

If *A* is equal to *B*, display *C*; otherwise, display *D*. *A* and *B* must be decimal constants or a single letter that is one of the symbols provided.

% %

The percent character.

% c'*C*'

The character *C*, which cannot be a quote or a backslash.

%c'*O*'

The character represented by the octal string *O*.

Examples

This is a simple example to show how CVS displays the difference between the current and repository revisions of the *Makefile*.

```
$ cvs diff Makefile
Index: Makefile
=  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==
RCS file: /var/lib/cvs/wizzard/Makefile,v
retrieving revision 1.6
diff -r1.6 Makefile
25a26
>       rm -f lib/*.o
```

edit

```
cvs [cvs-options] edit [options] [files ...]
```

Mark a file as being edited by the current user. This command is used as part of the `cvs watch` family of commands. If a file is being watched, it is checked out to the sandbox with read permissions but not write permissions. The `edit` command sets the sandbox file as writable, notifies any watchers that the file is being edited, and sets the user as a temporary watcher to be notified if certain actions are performed on the file by other users. See also `editors`, `unedit`, `watch`, and `watchers`.

NOTE

CVS does not notify you of your own changes.

You can unedit (set read-only and clear the temporary watch) a file with `cvs unedit` or `cvs release`, or by removing the file and re-creating it with `cvs update` or `cvs checkout`.

CVS uses any script in the *notify* file in the repository's *CVSROOT* directory to notify the user of changes.

Synonyms: none

Standard subcommand options: -l, -R

Options

-a *action*

Notify the user when the specified *action* occurs to the file. This setting acts as a temporary watch (see watch) on the file and is removed when the file is no longer being edited. Each -a designates one of the possible actions. The -a option can be repeated to designate multiple actions.

The *action* may be any of the following:

commit

Notify the user when someone else commits changes to the file.

edit

Notify the user if someone else has run cvs edit on the file.

unedit

Notify the user when the file is no longer being edited by someone else. This notification is triggered by the user running cvs unedit or cvs release, or by the file being deleted and re-created with cvs update or cvs checkout.

all

Notify the user of all of the previous actions.

none

Notify the user of none of the previous actions.

editors

```
cvs [cvs-options] editors [-lR] [files ...]
```

Displays the list of people who have a current edit command for the file or files listed as parameters. If no files are listed, this command lists the editors for the files in the current directory and subdirectories. See also edit, unedit, watch, and watchers.

Synonyms: none

Standard subcommand options: -l, -R

Examples

```
$ cvs editors Makefile
Makefile arnold Sat Oct 26 01:51:02 2002 GMT helit /home/
arnold/cvs/wizzard
```

export

`cvs [cvs-options] export [options] project`

Create a directory containing all directories and files belonging to a specified release of a project, wit
no CVS administrative files. It acts like a `checkout` or `update` for that specific point, but it does not produce the CVS administrative files. `export` requires the `-r` or `-D` command options. When exporting, the repository path must be specified by using the `-d` *repository_path* CVS option or the CVSROOT environment variable. See also `checkout` and `update`.

The argument to `export` can be a directory name or path within the repository, a filename or path within the repository, or a module name as specified in the *modules* file in the repository's *CVSROOT* directory.

> NOTE
>
> You can imply the repository path by being in a sandbox, but exporting into a sandbox is not recommended.

Synonyms: `exp`, `ex`

Standard subcommand options: `-d`, `-D`, `-f`, `-k`, `-l`, `-n`, `-N`, `-r`, `-R`

Examples

```
$ cvs -d cvs:/var/lib/cvs export -D now wizzard
cvs server: Updating wizzard
U wizzard/Changelog
U wizzard/INSTALL
```

```
U wizzard/Makefile
```

history

```
cvs [cvs-options] history [options] [files ...]
```

Display the information stored in the *history* file in the repository's *CVSROOT* directory. If that file does not exist or is not writable, the history command fails with an error. CVS writes to the *history* file during checkout, export, commit, rtag, update, and release operations.

Synonyms: hi, his

Standard subcommand options: -D, -r

> NOTE
>
> The -f, -l, -n, and -p options for cvs history act differently than their normal uses in CVS.

Options

-a

> Show history data for all users. By default, CVS shows only the data for the calling user.

-b *string*

> Show data more recent than the newest record that contains the given*string* in the module name, filename, or repository path.

-c

> Report only commits: times when the repository was modified (equivalent to-xAMR).

-e

> Report on every record type. This option is equivalent to-x with every type specified.

-f *file*

Show data for the specified *file*. This option can be repeated to show data for multiple files.

-l

Show only the most recent commit to the repository.

-m *module*

Show data for a particular *module*. CVS checks the *modules* file in the repository's *CVSROOT* directory and then searches the *history* file for files and directories that belong to the *module*.

-n *module*

Like -m, but CVS searches only the *history* file for the specified *module* name.

-o

Report on records of checkouts (equivalent to -xO).

-p *directory*

Show records for a particular project *directory*. This option can be repeated to show records for several projects.

-r *revision*

Show data as of, or more recent than, the *revision* or tag. CVS searches the repository's project files to determine the timestamp of the *revision*.

-t *tagname*

Show data as of, or more recent than, the latest time a tag record with this *tagname* was stored in the *history* file by any user.

-T

Report on records of tags (equivalent to -xT).

-u *username*

Report on records for the specified *username*. This option can be repeated to search for multiple users.

-w

Report on records of actions that match the current working directory.

-x *flag(s)*

Extract records that match the given *flag* or *flags*. Any number of flags can be used with the -x option. cvs history extracts all records in the *history* file that match this option and all other options. The flags may be any of the following:

A

Report on records of files added to the repository.

C

Report on records of files that would have been updated in a sandbox, but where the files needed to be merged and there were conflicts in the merge.

E

Report on records of files exported from the repository.

F

Report on records of files that were released.

G

Report on records of files updated in a sandbox with a successful merge.

M

Report on records of files that were modified (a sandbox revision added to the repository).

O

Report on records of files that were checked out.

R

Report on records of files that were removed from the repository.

T

Report on records of files that were rtagged.

U

Report on records of files updated in a sandbox file with no merge required.

W

Report on records of files deleted from a sandbox during an update because they were no longer active in the repository.

-z *timezone*

Produce output and convert times to the specified *timezone*. The time zone can be a recognized abbreviation such as EST, or it can be given as an offset of UTC. Time zones are listed in the earlier section Time Zones."

Examples

```
$ cvs history
O 2002-10-03 08:33 +0000 arnold wizzard/src =wizmain=
<remote>/*
O 2002-10-03 09:12 +0000 arnold wizzard     =wizmake=
<remote>/*
O 2002-10-03 09:12 +0000 arnold wizzard/src =wiztest=
<remote>/*
O 2002-10-25 08:58 +0000 arnold wizzard     =wizzard=
<remote>/*
```

import

```
cvs [cvs-options] import [options] project-name vendor-tag
release-tag
```

Create a new project in the repository, or manage *vendor branches*. To create a new project, lay out the project structure and any initial files. You can do this in a temporary directory, as CVS does not need the initial structure or files once the project has been imported. Change directories into the root directory of the new project; then run cvs import. You need to specify the repository path and provide a project name and two tags: a vendor tag and a release tag.

The *project-name* will become the project's root directory name. The tags are less critical; if you do not intend to use a vendor branch, a meaningless pair of tags such asa1 b2 is sufficient. The tag

names must conform to all the normal requirements for tags: they must start with a letter and can contain only alphanumeric characters, underscores (_), and hyphens (-). The HEAD and BASE tag names are reserved.

A *vendor branch* is a special branch that CVS provides to track third-party code that contributes to a project. If you use vendor branches, CVS uses the *vendor-tag* as a branch tag for the vendor branch, and it uses the *release-tag* to mark the current revisions of the vendor branch files.

Create a vendor branch by using cvs import to create the project. When you want to update to a new release from the vendor, use cvs import on the same project with the same vendor tag and a new release tag.

NOTE

Test that you can cvs checkout the new project before removing the original files.

Synonyms: im, imp

Standard subcommand options: -k, -m

Options

-b *branch*

Import to the specified vendor *branch*. If you have more than one external supplier for a project, you may need to use two or more distinct vendor branches to manage the project. If you are using multiple vendor branches, use the -b option to specify which branch you are importing to. *branch* must be the branch number, not a tag, and CVS does not check that the branch number given with the option and the symbolic tag provided as the *vendor-tag* argument to the command correspond to the same branch.

-d

When setting the timestamp on each imported file, use each file's last modification time rather than the current time.

-I *file*

Ignore the named file when updating. -I can be used more than once. Use -I ! to clear the list of ignored files.

-W *wrapper*

Modify the import based on elements of each filename.

Examples

```
$ cvs -d cvs:/var/lib/cvs import wizzard wizproject ver_0-
1
...
No conflicts created by this import
```

init

```
cvs [cvs-options] init
```

Convert an existing directory into a CVS repository, and create and populate the*CVSROOT* directory that contains the administrative files for a CVS repository.

CVS creates the final directory in the path if it does not already exist. Previous directories in the path must exist.

Synonyms: none

Examples

```
$ cvs -d /var/lib/cvsroot init
```

kserver

```
cvs [cvs-options] kserver
```

Run the repository-server end of a Kerberos 4 connection. The`cvs kserver` command must be called from `inetd` or an equivalent server daemon. See also `pserver`.

Synonyms: none

log

```
cvs [cvs-options] log [options] [files ...]
```

Display information about the files in the current sandbox or the files specified as parameters. The information this command provides is part of the header section of the files in the repository. This command also provides information from the log messages created when files are imported or changes are committed.

With no options, cvs log displays all the information it has available. See also rlog.

Synonym: lo

Standard subcommand options: -l

Options

`-b`

Display information about only the revisions on the default branch, normally the trunk.

`-d` *dates*

Display information only on revisions checked in on or between the dates or times provided. Date and time formats are listed in the earlier section "Dates." More than one date range can be given; ranges must be separated by semicolons. Date ranges can be specified according to the following list:

date1`>`*date2*, *date2*`<`*date1*

Select all revisions between the two dates.

date1`>=`*date2*, *date2*`<=`*date1*

Select all revisions on or between the two dates.

date`>`, `<`*date*

Select all revisions earlier than *date*.

date`>=`, `<=`*date*

Select all revisions on or earlier than *date*.

date<, >*date*

Select all revisions later than *date*.

date<=, >=*date*

Select all revisions on or later than *date*.

date

Select all revisions on *date*.

-h

Print only the header information for a file, not the description, the log messages, or revision information.

-N

Do not list the tags (the symbolic names).

-r[*revisions*]

Provide information only on *revisions* in the ranges provided. More than one range can be given; ranges must be separated by commas. There must be no space between the-r and its argument. If no range is provided, the latest revision on the default branch, normally the trunk, is used.

Ranges can be specified according to the following list:

revision1:*revision2*, *revision1*::*revision2*

Select all revisions between *revision1* and *revision2*. The revisions must be on the same branch. With the double colon, CVS excludes *revision1*.

:*revision*, ::*revision*

Select revisions from the start of the branch or trunk the *revision* is on, up to and including the *revision*.

revision:, *revision*::

Select revisions from *revision* to the end of the branch or trunk the *revision* is on. With the double colon, CVS excludes the *revision*.

branch

Select all revisions on *branch*.

branch1:*branch2*, *branch1*::*branch2*

Select all revisions on both branches and any branches that split off from the two branches.

branch.

Select the latest revision on *branch*. Note the trailing period.

-R

Display the name of the repository copy of a file only.

-s *states*

Display only revisions with states that match one of the*states* in the comma-separated list.

-S

Do not display header information if there are no revisions to display.

-t

Print only the header information and description, not the log messages or revision information

-w[*usernames*]

Display only revisions committed by the specified list of users. Provide the list of users as a comma-separated list. If no usernames are listed, the revisions committed by the current user are displayed. There can be no space between -w and its argument.

Examples

```
$ cvs log
cvs server: Logging .


RCS file: /var/lib/cvs/wizzard/Changelog,v
Working file: Changelog
head: 1.1
```

```
branch:
locks: strict
access list:
symbolic names:
beta_0-1_branch: 1.1.0.2
beta_0-1_branch_root: 1.1
pre_beta_0-1: 1.1
keyword substitution: kv
total revisions: 1;
selected revisions: 1
description:
----------------------------
revision 1.1    da
te: 2002/08/31 13:37:56;   author: arnold;  state: Exp;
Creating a structure.
...
```

login

`cvs [cvs-options] login`

Log into a CVS `pserver` session. This command is needed only with the `pserver` connection mode. See also logout.

Synonyms: none

Examples

```
$ cvs -d :pserver:arnold:password:@cvs.nosuch.net:/var/
lib/cvs login
Logging in to :pserver:arnold@cvs:2401/var/lib/cvs
```

logout

`cvs [cvs-options] logout`

Log out of a CVS `pserver` session. This command is needed only with the `pserver` connection mode. See also login.

Synonyms: none

Examples

```
$ cvs -d :pserver:arnold@cvs:/var/lib/cvs logout
Logging out of :pserver:arnold@cvs:2401/var/lib/cvs
```

pserver

```
cvs [cvs-options] pserver
```

Run the repository-server end of a password server or Kerberos 5 (via the GSS-API) connection. This command must be called from `inetd` or an equivalent server daemon. See also `kserver`.

Synonyms: none

rannotate

```
cvs [cvs-options] rannotate [options] files
...
```

Display files with annotations showing the last editor and revision that changed each line of each specified file. You can run `rannotate` without a sandbox, but you must have a repository specified if you do so. `rannotate` requires at least one filename, directory name, or module name from within the repository as an argument. See also `annotate`.

Synonyms: `ra`, `rann`

Standard subcommand options: `-D`, `-f`, `-l`, `-r`, `-R`

Options

-F

Show annotations for binary files.

Examples

```
$ cvs rannotate wizzard/Makefile


Annotations for wizzard/Makefile
***************
1.2  (arnold 01-Sep-02): #
1.2  (arnold     01-Sep-02): # Makefile for the Wizzard
project
1.2  (arnold     01-Sep-02): # Created by A Robbins, 1
September 2002
```

rdiff

---

cvs [*cvs-options*] rdiff [*options*] *projects* ...

Create output that can be redirected into a file and used with the GNU (or equivalent)`patch` program. The output goes to the standard output. `rdiff` operates directly from the repository and does not need to be used from a sandbox. It does, however, require a filename, directory name, or module name as an argument, and you must specify one or two revisions or dates. If you specify one revision or date, `rdiff` calculates the differences between that date and the current (HEAD) revision. If two dates are specified, `rdiff` calculates the differences between the two. See also `diff`.

Synonyms: `pa`, `patch`

NOTE

Most people use `rdiff` to make a file to use with `patch`. If you're using a `patch` file that was created over more than one directory, you may need to use the `-p` option to `patch`, so that it can find all the appropriate directories.

Standard subcommand options: -D, -f, -l, -r, -R

Options

`-c`

Use `context` output format, with three lines of context around each change. This is the default format.

`-s`

Create a summary change report rather than a patch, showing which files have changed with one line per file.

-t

Produce a report on the two most recent revisions in a file. Do not use-r or -D with the -t option.

-u

Use unidiff format instead of context format.

-V *version*

This option is now obsolete, but it used to allow you to expand keywords according to the rules of the specified RCS *version*.

Examples

```
$ cvs rdiff -r 1.5 wizzard/Makefile
Index: wizzard/Makefile
diff -c wizzard/Makefile:1.5 wizzard/Makefile:1.6
*** wizzard/Makefile:1.5     Thu Oct 17 08:50:14 2002
--- wizzard/Makefile         Thu Oct 17 10:01:12 2002
***************
*** 2,17 ****
    # Makefile for the Wizzard project
    # First created by A Robbins, 1 September 2002
    #
  ! # Current revision $Revision: 1.4 $
    # On branch $Name:  $ (not expanded if this is the trunk)
  ! # Latest change by $Author: sanders $ on $Date: 2005/05/
    03 19:07:12 $
    #
    ##

    # Initial declarations
    #
    CC=gcc
  ! SUBDIRS = man doc src lib


    # Declaring phony targets
  --- 2,17 ----
    # Makefile for the Wizzard project
    # First created by A Robbins, 1 September 2002
    #    ! # Current revision $Revision: 1.4 $
```

```
  # On branch $Name:  $ (not expanded if this is the trunk)
! # Latest change by $Author: sanders $ on $Date: 2005/05/
03 19:07:12 $
  #
  ##

  # Initial declarations
  #
  CC=gcc
! SUBDIRS = man doc src lib test


  # Declaring phony targets
***************

...
```

release

`cvs [cvs-options] release [-d] directories ...`

Make a sandbox inactive. This command checks for uncommitted changes, removing any existing edi flags, and writes to the *CVSROOT/history* file that the sandbox has been released. You can use release on an entire sandbox or on one or more subdirectories.

Synonyms: re, rel

Option

`-d`

Delete the sandbox after it has been released.

Examples

```
$ cvs -d cvs:/var/lib/cvs release wizzard
You have [0] altered files in this repository.
Are you sure you want to release directory `wizzard': y
```

remove

```
cvs [cvs-options] remove [-flR] [files ...]
```

The remove command removes a file or directory from the repository. It can also be used to undo an uncommitted file addition.

Synonyms: rm, delete.

Standard subcommand options: -l, -R.

Options

-f

Delete the files from the sandbox before removing them from the repository.

Examples

```
$ cvs remove server.cc
cvs server: scheduling `server.cc' for removal
cvs server: use 'cvs commit' to remove this file
permanently
```

rlog

```
cvs [cvs-options] rlog [options] files ...
```

The rlog command is a remote version of the log command. rlog works without a sandbox and requires a file, directory, or module name from the repository. See also log.

Synonym: rl.

Standard subcommand options: -l.

Options

`-b`

Provide information about only the revisions or a file on the default branch, normally the highest branch on the trunk.

`-d` *dates*

Provide information on only revisions of a file that were checked in on or between the dates or times provided. Date formats are listed in the earlier sectionDates." More than one date range can be given; ranges must be separated by semicolons. Date ranges are the same as for the `log` command (see log).

`-h`

Print only the header information, not the description, log messages, or revision information.

`-N`

Do not list the tags (the symbolic names).

`-r`[*revisions*]

Provide information on only *revisions* in the ranges provided. More than one revision range can be given; ranges must be separated by commas. There must be no space between the `-r` and its argument. If no range is provided, the latest revision on the default branch, normally the trunk, is used. The possible values for *revisions* are the same as for `log` (see log).

`-R`

Display the name of the repository copy of the file only.

`-s` *states*

Display only revisions with states that match one of the*states* in the comma-separated list.

`-S`

Do not display header information of a file if there are no revisions to display.

`-t`

Print only the header information of a file and its description, not the log messages or revision information.

`-w`[*usernames*]

Display only revisions committed by the *usernames* in the comma-separated list. If there are no usernames listed, the revisions committed by the current user are displayed. There can be no space between -w and its argument.

rtag

```
cvs [cvs-options] rtag [options] tagname files ...
```

Mark a revision of a single file with a meaningful name, or mark a set of revisions of multiple files so that they can all be retrieved easily as a group. *Tagname*s must begin with a letter and may contain only alphanumeric characters, underscores (_), and hyphens (-). There are two tags reserved for CVS: the BASE and HEAD tags. See also tag.

The tag and rtag commands are also used to create branches.

The rtag command does not need to run from a sandbox, but it does need to have a revision or date specified. It also requires a filename, directory name, or module name given as a parameter.

Synonyms: rt, rfreeze

Standard subcommand options: -D, -f, -l, -n, -r, -R

Options

-a

Clear a tag from files that have been removed from active development. Normally, removed files are not searched when tags are removed. This option works with the -d and -F options.

-b

Create a branch off the designated *revision* (provided with -r), using the designated *tagname* as the branch name.

-B

Allow -F and -d to act on branch tags. Back up the repository before you use this option, and be extremely careful. See Chapter 4 in Essential CVS (O'Reilly) before using this option.

-d

Delete the specified tag.

-F

Move the tag from the revision it currently refers to, to the revision specified in thertag command.

Examples

```
$ cvs -d cvs:/var/lib/cvs rtag -D now alpha_1-6 wizzard
cvs rtag: Tagging wizzard
cvs rtag: Tagging wizzard/doc
cvs rtag: Tagging wizzard/doc/design
cvs rtag: Tagging wizzard/doc/plan
...
```

server

```
cvs server
```

Runs the repository end of the CVSserver using an internal version of the rsh program. The CVS client must also be able to use this internal version. This is used for theserver access method. See also kserver and pserver.

Synonyms: none

status

```
cvs [cvs-options] status [-vlR] [files ...]
```

Display information about files, such as the current working or base revision, the current revision in the repository, and whether the files are currently synchronized with the repository. With the-v option, status also shows the files' tags.

Synonyms: st, stat

Standard subcommand options: -l, -R

Options

-v

Include information about tags.

Examples

```
$ cvs status Makefile
=  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==  ==
File: Makefile                          Status: Locally Modified


Working revision:    1.6
Repository revision: 1.6     /var/lib/cvs/wizzard/Makefile,v
Sticky Tag:          (none)
Sticky Date:         (none)
Sticky Options:      (none)
```

tag

```
cvs [cvs-options] tag [options]\ tagname [files ...]
```

Mark a revision of a single file with a meaningful name, or mark a set of revisions of multiple files so that they can all be retrieved easily as a group. *Tagname*s must begin with a letter and may contain only alphanumeric characters, underscores (_), and hyphens (-). There are two tags reserved for CVS: the BASE and HEAD tags. See also rtag.

The tag and rtag commands are also used to create branches.

If no revision number or date is given to the tag command, this command tags based on the most recent revision in the repository that was synchronized with the current sandbox directory (i.e., the most recently updated, checked-out, or committed revision). This revision can be seen as the working revision in the cvs status command.

Synonyms: ta, freeze

Standard subcommand options: -D, -f, -l, -r, -R

Options

-b

Create a branch off the specified *revision*, using the specified *tagname* as the branch name.

`-c`

Check whether the sandbox copies of the specified *files* have been modified since they were last synchronized with the repository. If they have been modified, do not tag them and display an error. If they are unmodified, tag them with the specified *tagname*. This option is useful when tagging the current sandbox revisions.

`-d`

Delete the specified *tagname* from a file.

`-F`

Move the *tagname* from the revision it currently refers to, to the revision specified in the `tag` command.

Examples

```
$ cvs tag alpha_1-5
cvs server: Tagging .
T Changelog
T INSTALL
T Makefile
T README
T TODO
...
```

unedit

`cvs [cvs-options] unedit [-lR] [files ...]`

Unmark a file as being edited by the current user. The `cvs unedit` command is used as part of the `cvs watch` family of commands. If a file is being watched, CVS writes it (when it is checked out) to the sandbox with read permissions but not write permissions. The `unedit` command notifies watchers that the file is no longer being edited, clears the temporary watch, sets the file as read-only, and restores the file to the repository revision that the sandbox copy was based on. See also `edit`, `editors`, `watch`, and `watchers`.

The script in the *notify* file in the repository's *CVSROOT* directory is used to notify the user of changes.

Synonyms: none

Standard subcommand options: -l, -R

update

```
cvs [cvs-options] update [options] [files ...]
```

Download changes from the repository to an existing sandbox. While doing this,`update` merges changes from the repository into changed files in the sandbox. See also`checkout` and `export`.

If `update` cannot merge repository changes with sandbox changes without losing data, it reports a conflict.

If `update` is not given any filenames or directory names as parameters, it acts on the current sandbox.

Synonyms: `up`, `upd`

Standard subcommand options: -D, -f, -k, -l, -r, -R

Options

-A

Clear sticky tags, dates, and keyword-expansion modes and replace the current files in the sandbox with the head of the trunk.

-C

Replace any file that has been changed locally with the revision from the repository that the local file was based on. The modified local file is saved as.#*file*.*revision* in its local sandbox directory.

-d

Create any directories that are in the repository but not in the sandbox. By default,`update` works only on the directories that are currently in the sandbox and ignores any new directories

-I *file*

Ignore the named file when updating. -I can be used more than once. Use -I ! to clear the list of ignored files.

-j *revision*[:*date*]

Determine the changes between the revision the files in the sandbox are based on and the specified *revision*, and merge the changes to the sandbox.

If two -j options are used, determine the changes between the first -j *revision* and the second -j *revision*, and merge those changes to the sandbox.

The *date* can be used only if the *revision* designates a branch. If *date* is used, it specifies the latest revision on (not before) that date.

-p

Update the listed files, but write them to standard output rather than to the filesystem. Do not change the sandbox.

-P

Do not include empty directories in the sandbox.

-W *wrapper*

Modify the `update` based on elements of each filename.

Examples

```
$ cvs update
cvs server: Updating .
U wizzard/Changelog
U wizzard/INSTALL
U wizzard/Makefile
```

version

```
cvs [cvs-options] version
```

Display the version information for the current installation of CVS

Synonyms: ve, ver

Examples

```
$ cvs version
Concurrent Versions System (CVS) 1.11.15 (client/server)
```

watch

```
cvs [cvs-options] watch command [options] [files ...]
```

Set files to be watched, or add users to the file-watch list. Users who are watching a file are notified via the script in the *notify* file in the repository's *CVSROOT* directory when other users perform specific actions. Essential CVS (O'Reilly) explains uses of the `cvs watch` family of commands. See also edit, editors, unedit, and watchers.

> NOTE
>
> CVS does not notify you of your own changes.

Synonyms: none

Standard subcommand options: -l, -R

Commands

on and off

The `on` and `off` subcommands control whether the file or files are marked as being watched. If a file is marked as being watched, CVS sets it as read-only when it is checked out of the repository. Without this read-only setting, developers might forget to use `cvs edit` when editing a file.

If the argument is a directory, all current files in the directory and all new files added to that directory in the future are set as being watched.

The `on` and `off` subcommands set whether a file is watchable, but they do not set who is watching it; the `add` and `remove` subcommands set whether or not you are watching a file.

add and remove

Use the add and remove subcommands to set or remove files you want to watch. Use the -a option to specify which actions you want to be notified of.

Options

-a *action*

Notify the user when the designated actions occur to the file. Each -a designates one possible action. The -a option can be repeated to designate multiple actions. The -a option is usable only with the add and remove subcommands.

These are the possible actions:

commit

Notify the user when someone else commits changes to the file.

edit

Notify the user if someone else has run cvs edit on the file.

unedit

Notify the user when the file is no longer being edited by someone else. Notification occurs when cvs unedit or cvs release runs, or when the file is deleted and re-created with cvs update or cvs checkout.

all

Notify the user in all of the previous cases.

none

Notify the user in none of the previous cases.

Example

```
$ cvs watch on Makefile          Enable watching
$ cvs watch add Makefile         Add me to list of watchers
```

watchers

```
cvs [cvs-options] watchers [-lR] [files ...]
```

Display the list of users who are watching the files listed as parameters. If no files are listed, this command lists the watchers for the files in the current directory and its subdirectories. See also edit, editors, unedit, and watch.

Standard subcommand options: -l, -R

Examples

```
$ cvs watchers Makefile
Makefile doppel edit unedit commit
arnold edit unedit commit
```

Chapter 14. The Subversion Version Control System

The Subversion version control system is a powerful, open source system for management of file and directory versions. Designed from the ground up to support distributed development, it offers many leading-edge features.

This chapter covers the following topics:

- Conceptual overview
- Obtaining Subversion
- Using Subversion: a quick tour
- The Subversion command line client: svn
- Repository administration: svnadmin
- Examining the repository: svnlook
- Providing remote access: svnserve
- Other Subversion components

Version control was introduced in Chapter 12, which contained a comparison of Subversion, CVS, and other popular systems. Most of the material in the current chapter is adapted from Version Control with Subversion (O'Reilly). See that book for much more information on Subversion.

14.1. Conceptual Overview

Subversion is a version-control system. It lets you track changes to an entire project directory tree. Every change made to the tree is recorded and can be retrieved.

Subversion is intended to be "a better CVS"; this is discussed in detail shortly. Subversion is purposely an open source project. If you want to participate, you can!

14.1.1. Basic Version-Control Operations

Actual data is kept in a *repository*, a set of directories and files managed by Subversion. Users use the `svn` client program to access the repository and make changes to it.

Subversion uses the *copy-modify-merge* development model. You make a private copy of a given project in a *sandbox*. (This is often called *checking out* a copy.) Like CVS, this private copy is not locked in the repository. You then make all the changes you like to the copy within the sandbox, without having to worry about what other developers are doing. As you work, you can compare your changes to the version you started with, as well as the version currently in the repository. Once you're satisfied with the changes, you *commit* them, sometimes referred to as a *check-in*. (These terms come from RCS and CVS.)

In the event that another developer has modified part of a file that you were working on and checked it in, when you commit your changes, Subversion notices and indicates that a *conflict* exists. Conflicts are marked as such in the file, and Subversion creates pristine copies of the file as it exists in the repository and of the file as you modified it, so that you can do full comparisons. Once you have resolved the conflict, you tell Subversion about it, and then commit the final version.

Like CVS, Subversion lets you create a development *branch*, a separate stream of development versions. You can periodically merge changes from the main development stream (the *trunk*) into your branch, and also merge changes from your branch back into the trunk.

Finally, you can *tag* a particular copy of the project. For instance, when a project is ready for a release, you can create a snapshot of the project and give it a descriptive tag that allows you to re-create the project tree exactly as it was for the release. This is particularly valuable when you need to produce a bug fix for an older version of the project, or when you have to attempt to retrofit a fix or feature from current development into an older version.

14.1.2. Building a Better CVS

When discussing Subversion's features, it is often helpful to speak of them in terms of how they improve upon CVS's design. Subversion provides:

Directory versioning

CVS only tracks the history of individual files, but Subversion implements a virtual versioned filesystem that tracks changes to whole directory trees over time. Files*and* directories are versioned.

True version history

Since CVS is limited to file versioning, operations such as copies and renameswhich might happen to files, but which are really changes to the contents of some containing directoryaren't supported in CVS. In CVS, you cannot delete a versioned file and then create a new file of the same name with different contents without inheriting the history of the oldperhaps completely unrelatedfile. With Subversion, you can add, delete, copy, and rename both files and directories. And every newly added file begins with a fresh, clean history all its own, even if the filename was previously used.

Atomic commits

A collection of modifications either goes into the repository completely, or not at all. This allows developers to construct and commit changes as logical chunks, and prevents problems that can occur when only a portion of a set of changes is successfully sent to the repository.

Versioned metadata

Each file and directory has a set of propertieskeys and their valuesassociated with it. You can create and store any arbitrary key/value pairs. Properties are versioned over time, just like file contents.

Choice of network layers

Subversion has an abstracted notion of repository access, making it easy for people to implement new network mechanisms. Subversion can plug into the Apache HTTP Server as an extension module. This gives Subversion a big advantage in stability and interoperability, and instant access to existing features provided by that serverauthentication, authorization, wire compression, and so on. A more lightweight, standalone Subversion server process is also available. This server speaks a custom protocol that can be easily tunneled over SSH.

Consistent data handling

Subversion expresses file differences using a binary differencing algorithm, which works identically on both text (human-readable) and binary (human-unreadable) files. Both types of files are stored equally compressed in the repository, and only the differences are transmitted in both directions across the network.

Efficient branching and tagging

The cost of branching and tagging need not be proportional to the project size. Subversion creates branches and tags by simply copying the project, using a mechanism similar to a hard link. Thus these operations take only a very small, constant amount of time.

Hackability

Subversion has no historical baggage; it is implemented as a collection of shared C libraries with well-defined APIs. This makes Subversion extremely maintainable and usable by other applications and languages.

Optimized around the network

Disk storage continues to increase in size and speed, and decrease in cost: disk space is cheap on today's systems. However, network connectivity has not kept pace; access to remote repositories is several orders of magnitude slower than local access. Thus the Subversion design is optimized to avoid connecting to the repository when possible. For example, in the working copy's administrative directory, *.svn*, Subversion maintains a pristine copy of each file as it was checked out of the repository. This makes it possible to produce the differences very quickly, with no need to contact the repository.

In addition, Subversion uses similar commands to those of CVS, making it straightforward to transfer your CVS habits to Subversion.

14.1.3. Converting a Repository from CVS to Subversion

A very effective way to learn Subversion if you already know CVS is to move your project from CVS to Subversion. The minimal way to accomplish this is to do a flat import into a Subversion repository from an exported CVS repository. However, this only gives you a "snapshot" of your repository; the revision history (changes, logs, tags, branches, etc.) are not kept.

Copying a repository while maintaining history is a difficult problem to solve. Nevertheless, a few tools exist that at least partially convert existing CVS repositories into new Subversion ones, such as `cvs2svn`, a Python script originally created by members of Subversion's own development community (see http://cvs2svn.tigris.org/), and Lev Serebryakov's RefineCVS (see http://lev.serebryakov.spb.ru/refinecvs/).

For an updated collection of links to known converter tools, visit the Links page of the Subversion web site (http://subversion.tigris.org/project_links.html).

14.1.4. Special File Properties

Subversion allows you to associate *properties* with files or directories. A property is just a keyword/value pair associated with the file. Subversion reserves property names starting with`svn:` for its own use. The special properties in Subversion 1.0 are:

svn:author

The username of the person who committed a particular revision.

svn:date

The date when the transaction for a revision was created.

svn:eol-style

Different operating systems use different conventions to mark the end of lines in text files. Unix and its workalikes use a single ASCII line-feed character (LF) to end lines. MS Windows systems use a Carriage Return + Line Feed combination (CRLF), and older Macintosh systems use a single Carriage Return (CR). This can cause problems when a Windows user stores a new revision of the file: suddenly a Unix user who does a checkout sees a file with extraneous Carriage Return characters at the end of every line. The svn:eol-style attribute solves this problem. It should be set to one of the following values:

CR

Clients should always use CR line terminators, no matter what the native format is.

CRLF

Clients should always use CR-LF line terminators, no matter what the native format is.

LF

Clients should always use LF line terminators, no matter what the native format is.

native

Clients should use the native format when checking out files.

Subversion always stores files in normalized, LF-only format in the repository.

svn:executable

Valid only for files, the mere presence of this property indicates that the file should be made executable when it's checked out or updated from the repository. It has no effect on filesystems, such as FAT-32 or NTFS, that don't have the concept of an execute bit.

svn:externals

This property, when set on a directory under version control, allows you to specify other,

external repositories to use for particular local subdirectories. You set this property withsvn propset or svn propedit (see svn Subcommands," later in this chapter). The value is a multiline table of directories and fully qualified Subversion URLs. For example:

```
$ svn propget svn:externals calc
third-party/sounds              http://sounds.red-bean.com/repos
third-party/skins               http://skins.red-bean.com/repositories/
skinproj
third-party/skins/toolkit -r21 http://svn.red-bean.com/repos/skin-maker
```

Once set, anyone else who checks out a working copy will also get the third party files checked out automatically.

svn:ignore

A property containing a list of file patterns that certain Subversion operations will ignore. It should be set on directories, as needed. It works to filter unversioned files and directories out of commands like svn status, svn add, and svn import. It is similar to the *.cvsignore* file in CVS, and you can often import your *.cvsignore* with this command:

```
$ svn propset svn:ignore -F .cvsignore .
property 'svn:ignore' set on '.'
```

svn:keywords

A list of keywords for which Subversion should perform *keyword expansion* when checking out the file. This is purposely similar to the same feature in RCS and CVS. However, Subversion does keyword expansion only when this property is set, and only for the keywords listed in the property's value. The list of recognized keywords is provided shortly.

svn:log

The log message associated with the commit of a particular revision.

svn:mime-type

An indication of the type of data stored in the file. In general, if it does not begin withtext/, Subversion assumes that the file contains binary data. For updates, this causes Subversion to rename a modified working copy of the file with a.orig extension and replace the file with the current version from the repository. This prevents an attempt to perform a "merge" on data that can't be merged. This property also influences how the Subversion Apache module sets the HTTP Content-type: header.

svn:realmstring

A specialized property that describes the "authentication realm" for a file in Subversion's cached copy of the authentication credentials. See Chapter 6 of Version Control with Subversion (O'Reilly) for more information.

Subversion defines the list of keywords available for substitution. That list contains the following five keywords, some of which have shorter aliases that you can also use:

$LastChangedDate$

This keyword describes the last time the file was changed in the repository and looks like $LastChangedDate: 2002-07-22 21:42:37 -0700 (Mon, 22 Jul 2002) $. It may be abbreviated as Date.

$LastChangedRevision$

This keyword describes the last revision in which this file changed in the repository and looks like $LastChangedRevision: 144 $. It may be abbreviated as Revision or Rev.

$LastChangedBy$

This keyword describes the last user to change this file in the repository, and looks like $LastChangedBy: harry $. It may be abbreviated as Author.

$HeadURL$

This keyword describes the full URL to the latest version of the file in the repository. It looks like $HeadURL: http://svn.collab.net/repos/trunk/README $. It may be abbreviated as URL.

$Id: ch14.xml,v 1.5 2005/08/12 21:21:32 sally Exp sally $

This keyword is a compressed combination of the other keywords. Its substitution looks like $Id: ch14.xml,v 1.5 2005/08/12 21:21:32 sally Exp sally $, and is interpreted to mean that the file *calc.c* was last changed in revision 148 on the evening of July 28, 2005 by the user *sally*.

14.2. Obtaining Subversion

The Subversion project web site is http://subversion.tigris.org. It contains links to project documentation, Frequently Asked Questions (FAQs), and project source code.

Some GNU/Linux systems come with Subversion available on the installation CDs. Thus, you may be able to install a prebuilt binary for your system or use a package manager to download and install it.

14.2.1. Subversion Releases

Subversion uses the "even / odd" release model. Even numbered point releases(1.0, 1.2, etc.) are considered to be *stable* releases. Such releases undergo change only to fix problems. New features are not added, and users can expect to use the software without problems. Odd numbered point releases (1.1, 1.3, etc.), on the other hand, are *development* versions. New features are added in such versions, they tend to undergo rapid change and evolution, and such releases may have bugs o problems that could cause loss of data. You should use an even-numbered release if stability and data preservation are important to you. Use an odd-numbered release only if it has a critical, must-have feature *and* if you are willing to live with the risks involved.

14.2.2. A View Down The Road

The one constant in the open source world is *change*. At the time of writing, Subversion 1.0 is the current released stable version. The first development release of Subversion 1.1 is also available. Along with a host of fixes and several new command-line options, the next version has the following interesting features:

Symbolic links may be versioned

Unix-style symbolic links are stored in the repository as a regular file with a special attribute. The svn client knows how to store and extract symbolic links correctly on Unix-style systems.

Nondatabase repository backend

Repositories can be set up to store data in regular files, instead of requiring the use of Berkeley DB.

Better localization support

The framework for localization of the Subversion code has been improved, with at least eight

translations already available.

The Subversion web site's Roadmap page (http://subversion.tigris.org/roadmap.html) lists the following future development goals. (You should recheck the website, things will undoubtedly have changed.)

Subversion 1.2 goals

- Optional locking (reserved checkouts).

Medium-term goals

- True rename support (not based on copy/delete).
- Merge tracking (describes a whole class of problems).
- Repository-level Access Control Lists (ACLs).[*]

[*] ACLs provide finer-grained access controls than the regular Unix user/group/other permissions mechanism. Many Unix systems support some form of ACLs, but in incompatible ways.

Long-term goals

- SQL repository backend.
- Rewrite of working-copy library.
- Broader WebDAV/DeltaV compatibility.[ ]

[ ] WebDAV is short for "Web-based Distributed Authoring and Versioning," an extension to HTTP that makes read/write file resources available over the Web. Despite the "V" in the name, the original specification (RFC 2518) does not provide a model for version control, Such a model is provided by DeltaV, described in RFC 3253. See http://www.webdav.org for more information.

- Pluggable client-side diff programs.
- Progressive multilingual support.

14.2.3. Source Code

The latest Subversion source is kept in a Subversion archive available from the main Subversion site. This leads to a so-called *bootstrapping* problem; you can't get Subversion unless you already have it. Fortunately, the developers make Subversion releases available as standalone `tar` archives, which you can use to build your initial Subversion client. You can get these from the main web site, http://subversion.tigris.org. Once there, select the "Downloads" link. You may choose to download a binary distribution (Red Hat RPM file, Debian package, etc.), if one is available. This is the easiest

road to take. Or you may choose to download source code and build your own.

PREV

14.3. Using Subversion: A Quick Tour

This section provides a very quick tour of using Subversion for version control. We start with the initial version of a project for importing into Subversion:

```
$ find /tmp/hello -print                    Show directory layout
/tmp/hello
/tmp/hello/branches                         Directory for branch development
/tmp/hello/tags                             Directory for tagged releases
/tmp/hello/trunk
/tmp/hello/trunk/hello.c                    Mainline development is done on the trunk
/tmp/hello/trunk/Makefile
/tmp/hello/trunk/README
```

The next steps are to create the repository and then to import the project into it:

```
$ svnadmin create /path/to/svnrepos
$ svn import /tmp/hello file:///path/to/svnrepos -m "initial import"
Adding         /tmp/hello/trunk
Adding         /tmp/hello/trunk/hello.c
Adding         /tmp/hello/trunk/Makefile
Adding         /tmp/hello/trunk/README
Adding         /tmp/hello/branches
Adding         /tmp/hello/tags

Committed revision 1.
```

Now that the project exists in Subversion, we check out a working copy into a sandbox underneath our home directory and start making changes:

```
$ cd                                                Move to home directory
$ svn checkout file:///path/to/svnrepos hello       Check out working copy
A  hello/trunk
A  hello/trunk/hello.c
A  hello/trunk/README
A  hello/trunk/Makefile
A  hello/branches
A  hello/tags
Checked out revision 1.
```

```
$ cd hello/trunk                                    Change to sandbox
$ vi message.c hello.c Makefile                     Make changes
3 files to edit

$ cat message.c                                     Show newly created file
const char message[  ] = "hello, world!";
$ make                                              Compile program and test it
cc    -c -o hello.o hello.c
cc    -c -o message.o message.c
cc -O hello.o message.o -o hello
$ hello
hello, world!
```

One of the most common operations is to compare the changed copy with the original. The result is in *unified diff* format, the equivalent of the regular `diff -u` command:

```
$ svn diff hello.c
Index: hello.c
===================================================================
====
--- hello.c     (revision 1)
+++ hello.c     (working copy)
@@ -1,7 +1,9 @@
 #include <stdio.h>

+extern const char message[  ];
+
 int main(void)
 {
-       printf("hello, world!\n");
+       printf("%s\n", message);
        return 0;
 }
```

Now that we're comfortable with the changes, we schedule the new file,*message.c* , for addition to the repository, and then we actually commit our changes:

```
$ svn add message.c                                 Schedule message.c for addition
A         message.c
$ svn commit                                        Commit all the changes
Sending        trunk/Makefile
Sending        trunk/hello.c
Adding         trunk/message.c
Transmitting file data ...
Committed revision 2.
```

Finally, we can view *all* our changes relative to the initial revision:

```
$ svn diff -r 1
Index: hello.c
===================================================================
--- hello.c     (revision 1)
+++ hello.c     (working copy)
@@ -1,7 +1,9 @@
 #include <stdio.h>

+extern const char message[  ];
+
 int main(void)
 {
-       printf("hello, world!\n");
+       printf("%s\n", message);
        return 0;
 }
Index: Makefile
===================================================================
--- Makefile    (revision 1)
+++ Makefile    (working copy)
@@ -1,2 +1,2 @@
-hello: hello.c
-       $(CC) -O $< -o $@
+hello: hello.o message.o
+       $(CC) -O hello.o message.o -o $@
Index: message.c
===================================================================
--- message.c   (revision 0)
+++ message.c   (revision 2)
@@ -0,0 +1 @@
+const char message[  ] = "hello, world!";
```

14.4. The Subversion Command Line Client: svn

The syntax for the Subversion command line client, `svn`, is:

The *options* and *subcommand* may be provided in any order.

14.4.1. svn Options

While Subversion has different options for its subcommands, all options are globalthat is, each option is guaranteed to mean the same thing regardless of the subcommand you use it with. For example, `--verbose` (`-v`) always means verbose output, regardless of the subcommand you use it with.

`--auto-props`

Enable auto-props, overriding the `enable-auto-props` directive in the *config* file.

`--config-dir` *dir*

Read configuration information from the specified directory instead of the default location (*.subversion* in the user's home directory).

`--diff-cmd` *cmd*

Use *cmd* as the external program to show differences between files. By default, `svn diff` uses Subversion's internal `diff` engine, which provides unified diffs by default. To use an external `diff` program, use `--diff-cmd`. You can pass options to the `diff` program with the `--extensions` option (discussed later in this list).

`--diff3-cmd` *cmd*

Use *cmd* as the external program to merge files.

`--dry-run`

Pretend to run a command, but make no actual changeseither on disk or in the repository.

`--editor-cmd` *cmd*

Use *cmd* as the program for editing a log message or a property value. If not set, Subversion checks the environment variables SVN_EDITOR, VISUAL, and EDITOR, in that order, for the name of the editor to use.

--encoding *enc*

Use *enc* as the encoding for the commit message. The default encoding is your operating system's native locale, and you should specify the encoding if your commit message is in any other encoding.

--extensions *args*, -x *args*

Pass *args* to an external diff command when providing differences between files. To pass multiple arguments, enclose all of them in quotes (for example,svn diff --diff-cmd /usr/bin/diff -x "-b -E"). This option can be used *only* if you also pass the --diff-cmd option.

--file *filename*, -F *filename*

Use the contents of *filename* for the specified subcommand.

--force

Force a particular command or operation to run. There are some operations that Subversion prevents you from doing in normal usage, but you can pass this option to tell Subversion that you know what you're doing, as well as the possible repercussions of doing it, so do it anyway. Use with caution.

--force-log

Force a suspicious parameter passed to the --message (-m) or --file (-F) options to be accepted as valid. By default, Subversion produces an error if parameters to these options look like they might instead be targets of the subcommand. For example, if you pass a versioned file's path to the --file (-F) option, Subversion assumes you've made a mistake, that the path was instead intended as the target of the operation, and that you simply failed to provide some otherunversioned--file as the source of your log message. To assert your intent and override these types of errors, pass the --force-log option to commands that accept log messages.

--help, -h, -?

If used with one or more subcommands, show the built-in help text for each subcommand. If used alone, display the general client help text.

--ignore-ancestry

Ignore ancestry when calculating differences (i.e., rely on path contents alone).

--incremental

Print output in a format suitable for concatenation.

--message *message*, -m *message*

Use *message* as the commit message. For example:

```
$ svn commit -m "They don't make Sunday."
```

--new *arg*

Use *arg* as the newer target when producing a diff.

--no-auth-cache

Do not cache authentication information (e.g., username and password) in the Subversion administrative directories.

--no-auto-props

Disable auto-props, overriding the enable-auto-props directive in the *config* file.

--no-diff-deleted

Do not print differences for deleted files. The default behavior when you remove a file is forsvn diff to print the same differences that you would see if you had left the file but removed all the content.

--no-ignore

Show files in the status listing that would normally be omitted because they match a pattern in the svn:ignore property.

--non-interactive

In the case of an authentication failure, or insufficient credentials, do not prompt for credential (e.g., username or password). This is useful if you're running Subversion inside of an automated script where it's better to have Subversion fail instead of trying to prompt for more information.

--non-recursive, -N

Stop a subcommand from recursing into subdirectories. Most subcommands recurse by default but some subcommandsusually those that have the potential to remove or undo your local modificationsdo not.

--notice-ancestry

Pay attention to ancestry when calculating differences.

--old *arg*

Use *arg* as the older target when producing a diff.

--password *pass*

Use *pass* as the password for authentication on the command line; otherwise, if it is needed, Subversion prompts you for it.

--quiet, -q

Print only essential information while performing an operation.

--recursive, -R

Make a subcommand recurse into subdirectories. Most subcommands recurse by default.

--relocate *from to* [*path* ...]

Used with the svn switch subcommand to change the location of the repository that your working copy references. This is useful if the location of your repository changes and you have an existing working copy that you'd like to continue to use. Seesvn switch in the svn Subcommands section, later in this chapter, for an example.

--revision *rev*, -r *rev*

Use *rev* as the revision (or range of revisions) for a particular operation. You can provide revision numbers, revision keywords, or dates (in curly braces) as arguments to the revision option. To provide a range of revisions, provide two revisions separated by a colon. For example:

```
$ svn log -r 1729
$ svn log -r 1729:HEAD
$ svn log -r 1729:1744
$ svn log -r {2001-12-04}:{2002-02-17}
$ svn log -r 1729:{2002-02-17}
```

The acceptable revision keywords for --revision are:

BASE

The original, unmodified version of the working copy. This keyword cannot refer to a URL.

COMMITTED

The last revision, before or at BASE, at which an item actually changed. This keyword cannot refer to a URL.

HEAD

The most recent revision in the repository.

PREV

The revision just before that at which an item changed. Equivalent toCOMMITED - 1. This keyword cannot refer to a URL.

Revision Date

A date specification enclosed in curly braces, { and }, such as {2002-02-17}, {15:30}, {"2002-02-17 15:30"}, {2002-02-17T15:30}, or {20020217T1530-0500}. See Version Control with Subversion (O'Reilly) for full details.

--revprop

Operate on a revision property instead of a Subversion property specific to a file or directory. This option requires that you also pass a revision with the--revision (-r) option.

--show-updates, -u

Display information about which files in your working copy are out of date. This doesn't actually update any of your files; it just shows you which files will be updated if you runsvn update.

--stop-on-copy

Cause a Subversion subcommand that is traversing the history of a versioned resource to stop harvesting that historical information when it encounters a copythat is, a location in history where that resource was copied from another location in the repository.

--strict

Use strict semantics, a notion that is rather vague unless talking about specific subcommands. See Version Control with Subversion (O'Reilly) for more information.

--targets *filename*

Retrieve the list of files to operate on from *filename* instead of listing all the files on the command line.

--username *name*

Use *name* as the username for authentication; otherwise, if it is needed, Subversion prompts you for it.

--verbose, -v

Print out as much information as possible while running any subcommand. This may result in Subversion printing out additional fields, detailed information about every file, or additional information regarding its actions.

--version

Print the client version info. This information not only includes the version number of the client but also a listing of all repository access modules that the client can use to access a Subversior repository.

--xml

Prints output in XML format.

14.4.2. svn Subcommands

The svn command is the main user interface to Subversion. It works by accepting subcommands with arguments. The general form is:

```
svn subcommand[options] arguments
```

add

```
svn add path ...
```

Add files and directories to your working copy and schedule them for addition to the repository. They

will be uploaded and added to the repository on your next commit. If you add something and change your mind before committing, you can unschedule the addition usingsvn revert.

Alternate names: none

Changes: working copy

Accesses repository: no

Options

--auto-props
--config-dir *dir*
--no-auto-props
--non-recursive (-N)
--quiet (-q)
--targets *filename*

Examples

To add a file to your working copy:

```
$ svn add foo.c
A         foo.c
```

You can add a directory without adding its contents:

```
$ svn add --non-recursive otherdir
A         otherdir
```

blame

```
svn blame target ...
```

Show author and revision information inline for the specified files or URLs. Each line of text is annotated at the beginning with the author (username) and the revision number for the last change to that line.

Alternate names: praise, annotate, ann

Changes: nothing

Accesses repository: yes

Options

--config-dir *dir*
--no-auth-cache
--non-interactive
--password *pass*
--revision *rev*, -r *rev*
--username *user*

cat

```
svn cat target ...
```

Output the contents of the specified files or URLs. For listing the contents of directories, seesvn list.

Alternate names: none

Changes: nothing

Accesses repository: yes

Options

--config-dir *dir*
--no-auth-cache
--non-interactive
--password *pass*
--revision *rev*, -r *rev*
--username *user*

Examples

To view *readme.txt* in your repository without checking it out:

```
$ svn cat http://svn.red-bean.com/repos/test/readme.txt
This is a README file.
You should read this.
```

NOTE

If your working copy is out of date (or if you have local modifications) and you want to see the HEAD revision of a file in your working copy, svn cat automatically fetches the HEAD revision when you give it a path:

```
$ cat foo.c
This file is in my local working copy
and has changes that I've made.

$ svn cat foo.c
Latest revision fresh from the repository!
```

checkout

```
svn checkout URL ... [path]
```

Check out a working copy from a repository. If *path* is omitted, the basename of the URL is used as the destination. If multiple URLs are given, each one is checked out into a subdirectory of *path*, with the name of the subdirectory being the basename of the URL.

Alternate names: co

Changes: creates a working copy

Accesses repository: yes

Options

--config-dir *dir*
--no-auth-cache
--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--username *user*

Examples

Check out a working copy into a directory called *mine*:

```
$ svn checkout file:///tmp/repos/test mine
A  mine/a
A  mine/b
Checked out revision 2.
$ ls
mine
```

If you interrupt a checkout (or something else interrupts your checkout, such as loss of connectivity, etc.), you can restart it either by issuing the identical checkout command again or by updating the incomplete working copy:

```
$ svn checkout file:///tmp/repos/test test
A  test/a
A  test/b
^C
svn: The operation was interrupted
svn: caught SIGINT

$ svn checkout file:///tmp/repos/test test
A  test/c
A  test/d
^C
svn: The operation was interrupted
svn: caught SIGINT

$ cd test
$ svn update
A  test/e
A  test/f
Updated to revision 3.
```

cleanup

```
svn cleanup [path ...]
```

Recursively clean up the working copy, removing locks and resuming unfinished operations. If you ever get a working-copy-locked error, run this command to remove stale locks and get your working copy into a usable state again.

If, for some reason, an `svn update` fails due to a problem running an external `diff` program (e.g., user input or network failure), pass the `--diff3-cmd` option to allow cleanup to complete any

merging with your external diff program. You can also specify any configuration directory with the --config-dir option, but you should need these options extremely infrequently.

Alternate names: none

Changes: working copy

Accesses repository: no

Options:

--config-dir *dir*
--diff3-cmd *cmd*

commit

```
svn commit [path ...]
```

Send changes from your working copy to the repository. If you do not supply a log message with your commit by using either the --file or --message option, svn starts your editor for you to compose a commit message.

> NOTE
>
> If you begin a commit and Subversion starts your editor to compose the commit message, you can still abort without committing your changes. To cancel your commit, just quit your editor without saving your commit message and Subversion prompts you to abort the commit, continue with no message, or edit the message again.

Alternate names: ci (short for check innot co, which is short for checkout)

Changes: working copy, repository

Accesses repository: yes

Options

--config-dir *dir*
--encoding *enc*
--file *file*, -F *file*
--force-log
--message *text*, -m *text*

--no-auth-cache
--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--targets *filename*
--username *user*

Examples

Commit a simple modification to a file with the commit message on the command line and an implicit target of your current directory (.):

```
$ svn commit -m "added howto section."
Sending        a
Transmitting file data .
Committed revision 3.
```

To commit a file scheduled for deletion:

```
$ svn commit -m "removed file 'c'."
Deleting       c
Committed revision 7.
```

copy

```
svn copy src dst
```

Copy a file in a working copy or in the repository.*src* and *dst* can each be either a working-copy (WC) path or a URL:

WC *WC*

Copy and schedule an item for addition (with history).

WC *URL*

Immediately commit a copy of WC to URL.

URL ⟶ *WC*

Check out URL into WC, and schedule it for addition.

URL ⟶ *URL*

Complete server-side copy. This is usually used to branch and tag.

NOTE

You can only copy files within a single repository. Subversion does not support cross-repository copying.

Alternate names: cp

Changes: repository if destination is a URL; working copy if destination is a WC path

Accesses repository: if source or destination is in the repository, or if needed to lookup the source revision number

Options

--config-dir *dir*
--editor-cmd *editor*
--encoding *enc*
--file *file*, -F *file*
--force-log
--message *text*, -m *text*
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--username *user*

Examples

Copy an item within your working copy (just schedules the copy; nothing goes into the repository until you commit):

```
$ svn copy foo.txt bar.txt
A         bar.txt
$ svn status
```

```
A  +   bar.txt
```

Copy an item from the repository to your working copy (just schedules the copy; nothing goes into the repository until you commit):

NOTE

This is the recommended way to resurrect a dead file in your repository!

```
$ svn copy file:///tmp/repos/test/far-away near-here
A         near-here
```

And finally, copying between two URLs:

```
$ svn copy file:///tmp/repos/test/far-away \
> file:///tmp/repos/test/over-there -m "remote copy."
Committed revision 9.
```

NOTE

This is the easiest way to tag a revision in your repository; just `svn copy` that revision (usually HEAD) into your tags directory.

```
$ svn copy file:///tmp/repos/test/trunk \
>          file:///tmp/repos/test/tags/0.6.32-prerelease \
>          -m "tag tree"
Committed revision 12.
```

delete

```
svn delete path ...
svn delete URL ...
```

Items specified by *path* are scheduled for deletion upon the next commit. Files (and directories that have not been committed) are *immediately* removed from the working copy. The command will not remove any unversioned or modified items; use the--force option to override this behavior.

Items specified by URL are deleted from the repository via an immediate commit. Multiple URLs are committed atomically.

Alternate names: del, remove, rm

Changes: working copy if operating on files; repository if operating on URLs

Accesses repository: only if operating on URLs

Options

--config-dir *dir*
--editor-cmd *editor*
--encoding *enc*
--file *file*, -F *file*
--force-log
--force
--message *text*, -m *text*
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--targets *filename*
--username *user*

diff

```
svn diff [-r N[:M]] [--old old-tgt] [--new new-tgt] [path ...]
svn diff -r N:M URL
svn diff [-r N[:M]] URL1[@N] URL2[@M]
```

Display the differences between two paths. The three different ways you can usesvn diff are:

svn diff [-r *N*[:*M*]] [--old *old-tgt*] [--new *new-tgt*] [*path* ...]

Display the differences between*old-tgt* and *new-tgt*. If *path*s are given, they are treated as relative to *old-tgt* and *new-tgt*, and the output is restricted to differences in only those paths. *old-tgt* and *new-tgt* may be working copy paths or *URL*[@*rev*]. *old-tgt* defaults to the current working directory, and *new-tgt* defaults to *old-tgt*. *N* defaults to BASE or, if *old-tgt* is a URL, to

HEAD. *M* defaults to the current working version or, if *new-tgt* is a URL, to HEAD. svn diff -r *N* sets the revision of *old-tgt* to *N*, whereas svn diff -r *N*:*M* also sets the revision of *new-tgt* to *M*.

svn diff -r *N*:*M URL*

A shorthand for svn diff -r *N*:*M* --old=*URL* --new=*URL*.

svn diff [-r *N*[:*M*]] *URL1*[@*N*] *URL2*[@*M*]

A shorthand for svn diff [-r *N*[:*M*]] --old=*URL1* --new=*URL2*.

If *target* is a URL, then revisions *N* and *M* can be given either via the --revision option or by using @ notation as described earlier.

If *target* is a working copy path, then the --revision option means:

--revision *N*:*M*

The server compares *target@N* and *target@M*.

--revision *N*

The client compares *target@N* against the working copy.

No --revision option

The client compares the base and working copies of *target*.

If the alternate syntax is used, the server compares *URL1* and *URL2* at revisions *N* and *M* respectively. If either *N* or *M* are omitted, a value of HEAD is assumed.

By default, svn diff ignores the ancestry of files and merely compares the contents of the two files being compared. If you use --notice-ancestry, the ancestry of the paths in question is taken into consideration when comparing revisions. (That is, if you runsvn diff on two files with identical contents but different ancestry you will see the entire contents of the file as having been removed and added again.)

Alternate names: di

Changes: nothing

Accesses repository: for obtaining differences against anything but theBASE revision in your working copy

Options

--config-dir *dir*
--diff-cmd *cmd*
--extensions *args*, -x *args*
--new *new-target*
--no-auth-cache
--no-diff-deleted
--non-interactive
--non-recursive (-N)
--notice-ancestry
--old *old-target*
--password *pass*
--revision *rev*, -r *rev*
--username *user*

Examples

Compare BASE and your working copy:

```
$ svn diff COMMITTERS
Index: COMMITTERS
===================================================================
--- COMMITTERS  (revision 4404)
+++ COMMITTERS  (working copy)
...
```

See how your working copy's modifications compare against an older revision:

```
$ svn diff -r 3900 COMMITTERS
Index: COMMITTERS
===================================================================
--- COMMITTERS  (revision 3900)
+++ COMMITTERS  (working copy)
...
```

Use --diff-cmd *cmd* and -x to pass arguments directly to the external diff program:

```
$ svn diff --diff-cmd /usr/bin/diff -x "-i -b" COMMITTERS
Index: COMMITTERS
===================================================================
0a1,2
> This is a test
>
```

export

```
svn export [-r rev] URL [path]
svn export path1 path2
```

The first form exports a clean directory tree into *path* from the repository specified by URL, at revision *rev* if it is givenotherwise at HEAD. If *path* is omitted, the last component of the *URL* is used for the local directory name.

The second form exports a clean directory tree from the working copy specified by *path1* into *path2*. All local changes are preserved, but files not under version control are not copied.

Alternate names: none

Changes: local disk

Accesses repository: only if exporting from a URL

Options

--config-dir *dir*
--force
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--username *user*

help

```
svn help [subcommand ...]
```

Provide a quick usage summary. With *subcommand*, provide information about the given subcommand.

Alternate names: ?, h

Changes: nothing

Accesses repository: no

Options

--quiet (-q)
--version

import

```
svn import [path] URL
```

Recursively commit a copy of *path* to *URL*. If *path* is omitted, . is assumed. Parent directories are created in the repository as necessary.

Alternate names: none

Changes: repository

Accesses repository: yes

Options

--auto-props
--config-dir *dir*
--editor-cmd *editor*
--encoding *enc*
--file *file*, -F *file*
--force-log
--message *text*, -m *text*
--no-auth-cache
--no-auto-props
--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--username *user*

Examples

Import the local directory *myproj* into the root of your repository:

```
$ svn import -m "New import" myproj \
> http://svn.red-bean.com/repos/test
```

```
Adding         myproj/sample.txt
...
Transmitting file data .........
Committed revision 16.
```

Import the local directory *myproj* into *trunk/vendors* in your repository. The directory *trunk/vendors* need not exist before you import into it; `svn import` will recursively create directories for you:

```
$ svn import -m "New import" myproj \
> http://svn.red-bean.com/repos/test/trunk/vendors/myproj
Adding         myproj/sample.txt
...
Transmitting file data .........
Committed revision 19.
```

After importing data, note that the original tree is *not* under version control. To start working, you still need to `svn checkout` a fresh working copy of the tree.

info

```
svn info [path ...]
```

Print information about paths in your working copy, including:

- Path
- Name
- URL
- Revision
- Node kind
- Last changed author
- Last changed revision
- Last changed date
- Text last updated

- Properties last updated
- Checksum

Alternate names: none

Changes: nothing

Accesses repository: no

Options

--config-dir *dir*
--recursive (-R)
--targets *filename*

list

```
svn list [target ...]
```

List each *target* file and the contents of each *target* directory as they exist in the repository. If *target* is a working copy path, the corresponding repository URL is used. The default *target* is `.`, meaning the repository URL of the current working-copy directory.

With `--verbose`, the following fields show the status of the item:

- Revision number of the last commit
- Author of the last commit
- Size (in bytes)
- Date and time of the last commit

Alternate names: ls

Changes: nothing

Accesses repository: yes

Options

--config-dir *dir*
--no-auth-cache
--non-interactive

--password *pass*
--recursive (-R)
--revision *rev*, -r *rev*
--username *user*
--verbose (-v)

Examples

To see what files a repository has without downloading a working copy:

```
$ svn list http://svn.red-bean.com/repos/test/support
README.txt
INSTALL
examples/
...
```

Pass the --verbose option for additional information:

```
$ svn list --verbose file:///tmp/repos
     16 sally         28361 Jan 16 23:18 README.txt
     27 sally             0 Jan 18 15:27 INSTALL
     24 harry               Jan 18 11:27 examples/
```

log

```
svn log [path]
svn log URL [path ...]
```

The default target is the path of your current directory. If no arguments are supplied,svn log shows the log messages for all files and directories inside of (and including) the current working directory of your working copy. You can refine the results by specifying a path, one or more revisions, or any combination of the two. The default revision range for a local path isBASE:1.

If you specify a URL alone, the command prints log messages for everything that the URL contains. I you add paths past the URL, only messages for those paths under that URL are printed. The default revision range for a URL is HEAD:1.

With --verbose, svn log also prints all affected paths with each log message. With--quiet, svn log does not print the log message body itself (this is compatible with--verbose).

Each log message is printed just once, even if more than one of the affected paths for that revision

were explicitly requested. Logs follow copy history by default. Use--stop-on-copy to disable this behavior, which can be useful for determining branch points.

Alternate names: none

Changes: nothing

Accesses repository: yes

Options

--config-dir *dir*
--incremental
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--stop-on-copy
--targets *filename*
--username *user*
--verbose (-v)
--xml

Examples

To see the log messages for all the paths that changed in your working copy, runsvn log from the top:

```
$ svn log
------------------------------------------------------------------------
r20 | harry | 2003-01-17 22:56:19 -0600 (Fri, 17 Jan 2003)
| 1 line

Tweak.
------------------------------------------------------------------------
r17 | sally | 2003-01-16 23:21:19 -0600 (Thu, 16 Jan 2003)
| 2 lines
...
```

If you don't have a working copy handy, you can log a URL:

```
$ svn log http://svn.red-bean.com/repos/test/foo.c
------------------------------------------------------------------------
r32 | sally | 2003-01-13 00:43:13 -0600 (Mon, 13 Jan 2003)
| 1 line
```

```
Added defines.
------------------------------------------------------------------------
r28 | sally | 2003-01-07 21:48:33 -0600 (Tue, 07 Jan 2003)
| 3 lines
...
```

If you run svn log on a specific path and provide a specific revision and get no output at all:

```
$ svn log -r 20 http://svn.red-bean.com/untouched.txt
------------------------------------------------------------------------
```

That just means that the path was not modified in that revision. If you log from the top of the repository, or know the file that changed in that revision, you can specify it explicitly:

```
$ svn log -r 20 touched.txt
------------------------------------------------------------------------
r20 | sally | 2003-01-17 22:56:19 -0600 (Fri, 17 Jan 2003)
| 1 line

Made a change.
------------------------------------------------------------------------
```

merge

```
svn merge sourceURL1[@N] sourceURL2[@M] [wcpath]
svn merge -r N:M source [path]
```

In the first form, the source URLs are specified at revisions *N* and *M*. These are the two sources to be compared. The revisions default to HEAD if omitted.

In the second form, *source* can be a URL or working-copy item, in which case the corresponding URL is used. This URL, at revisions *N* and *M*, defines the two sources to be compared.

wcpath is the working-copy path that will receive the changes. If *wcpath* is omitted, a default value of "." is assumed, unless the sources have identical basenames that match a file within ".", in which case, the differences are applied to that file.

Unlike svn diff, this command takes the ancestry of a file into consideration when performing a merge operation. This is very important when you're merging changes from one branch into another and you've renamed a file on one branch but not the other.

Alternate names: none

Changes: working copy

Accesses repository: only if working with URLs

Options

--config-dir *dir*
--diff3-cmd *cmd*
--dry-run
--force
--ignore-ancestry
--no-auth-cache
--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--username *user*

Examples

Merge a branch back into the trunk (assuming that you have a working copy of the trunk and that the branch was created in revision 250):

```
$ svn merge -r 250:HEAD \
> http://svn.red-bean.com/repos/branches/my-branch
U  myproj/tiny.txt
U  myproj/thhgttg.txt
U  myproj/win.txt
U  myproj/flo.txt
```

If you branched at revision 23, and you want to merge changes from the trunk into your branch, you could do this from inside the working copy of your branch:

```
$ svn merge -r 23:30 file:///tmp/repos/trunk/vendors
U  myproj/thhgttg.txt
...
```

To merge changes to a single file:

```
$ cd myproj
```

```
$ svn merge -r 30:31 thhgttg.txt
U  thhgttg.txt
```

mkdir

```
svn mkdir path ...
svn mkdir URL ...
```

Create a directory with a name given by the final component of the*path* or URL. A directory specified by a working copy *path* is scheduled for addition in the working copy. A directory specified by a URL is created in the repository via an immediate commit. Multiple directory URLs are committed atomically. In both cases, all the intermediate directories must already exist.

Alternate names: none

Changes: working copy; repository if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--editor-cmd *editor*
--encoding *enc*
--file *file*, -F *file*
--force-log
--message *text*, -m *text*
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--username *user*

move

```
svn move src dst
```

This command moves (renames) a file or directory in your working copy or in the repository.

> NOTE
>
> This command is equivalent to an svn copy followed by svn delete.

WC ⟶ *WC*

> Move and schedule a file or directory for addition (with history).

URL ⟶ *URL*

> Complete server-side rename.

> NOTE
>
> Subversion does not support moving between working copies and URLs. In addition, you can move files only within a single repository; Subversion does not support cross-repository moving.

Alternate names: mv, rename, ren

Changes: working copy; repository if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--editor-cmd *editor*
--encoding *enc*
--file *file*, -F *file*
--force-log
--force
--message *text*, -m *text*
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--username *user*

propdel

```
svn propdel propname [path ...]
svn propdel propname --revprop -r rev [URL]
```

This removes properties from files, directories, or revisions. The first form removes versioned properties in your working copy, while the second removes unversioned remote properties on a repository revision.

Alternate names: pdel, pd

Changes: working copy; repository only if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--recursive (-R)
--revision *rev*, -r *rev*
--revprop
--username *user*

Examples

Delete a property from a file in your working copy:

```
$ svn propdel svn:mime-type some-script
property 'svn:mime-type' deleted from 'some-script'.
```

Delete a revision property:

```
$ svn propdel --revprop -r 26 release-date
property 'release-date' deleted from repository revision
'26'
```

propedit

```
svn propedit propname path ...
svn propedit propname --revprop -r rev [URL]
```

Edit one or more properties using your favorite editor. The first form edits versioned properties in your working copy, while the second edits unversioned remote properties on a repository revision.

Alternate names: pedit, pe

Changes: working copy; repository only if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--editor-cmd *editor*
--encoding *enc*
--no-auth-cache
--non-interactive
--password *pass*
--revision *rev*, -r *rev*
--revprop
--username *user*

propget

```
svn propget propname [path ...]
svn propget propname --revprop -r rev [URL]
```

Print the value of a property on files, directories, or revisions. The first form prints the versioned property of an item or items in your working copy, while the second prints the unversioned remote property on a repository revision.

Alternate names: pget, pg

Changes: working copy; repository only if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--no-auth-cache

--non-interactive
--password *pass*
--recursive (-R)
--revision *rev*, -r *rev*
--revprop
--strict
--username *user*

proplist

```
svn proplist propname [path ...]
svn proplist propname --revprop -r rev [URL]
```

List all properties on files, directories, or revisions. The first form lists versioned properties in your working copy, while the second lists unversioned remote properties on a repository revision.

Alternate names: plist, pl

Changes: working copy; repository only if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--recursive (-R)
--revision *rev*, -r *rev*
--revprop
--username *user*
--verbose (-v)

Examples

You can use svn proplist to see the properties on an item in your working copy:

```
$ svn proplist foo.c
Properties on 'foo.c':
  svn:mime-type
  svn:keywords
  owner
```

But with the --verbose flag, svn proplist is extremely handy, as it also shows you the values for the properties:

```
$ svn proplist --verbose foo.c
Properties on 'foo.c':
  svn:mime-type : text/plain
  svn:keywords : Author Date Rev
  owner : sally
```

propset

```
svn propset propname [propval] path ...
svn propset propname --revprop -r rev [propval] [URL]
```

Set *propname* to *propval* on files, directories, or revisions. The first example creates a versioned, local property change in the working copy, and the second creates an unversioned, remote property change on a repository revision. The new property value,*propval*, may be provided literally, or using the -F *valfile* option.

Alternate names: pset, ps

Changes: working copy; repository only if operating on a URL

Accesses repository: only if operating on a URL

Options

--config-dir *dir*
--encoding *enc*
--file *file*, -F *file*
--force
--no-auth-cache
--non-interactive
--password *pass*
--quiet (-q)
--recursive (-R)
--revision *rev*, -r *rev*
--revprop
--targets *filename*
--username *user*

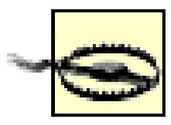
Examples

Set the mimetype on a file:

```
$ svn propset svn:mime-type image/jpeg foo.jpg
property 'svn:mime-type' set on 'foo.jpg'
```

On a Unix system, if you want a file to have the executable permission set:

```
$ svn propset svn:executable ON somescript
property 'svn:executable' set on 'somescript'
```



By default, you cannot modify revision properties in a Subversion repository. Your repository administrator must explicitly enable revision property modifications by creating a hook named `pre-revprop-change`.

resolved

```
svn resolved path ...
```

Remove the conflicted state on working-copy files or directories. This command does not semantically resolve conflict markers; it merely removes conflict-related artifact files and allows *path* to be committed again; that is, it tells Subversion that the conflicts have been resolved. Use it after you have resolved the conflict in the file.

Alternate names: none

Changes: working copy

Accesses repository: no

Options

--config-dir *dir*
--quiet (-q)
--recursive (-R)
--targets *filename*

Example

If you get a conflict on an update, your working copy will contain three additional files:

```
$ svn update
C  foo.c
Updated to revision 31.
$ ls
foo.c                   Merged version with conflict markers
foo.c.mine              Original working copy version
foo.c.r30               Unmodified BASE version
foo.c.r31               Unmodified HEAD version
```

Once you've resolved the conflict and *foo.c* is ready to be committed, run `svn resolved` to let your working copy know you've taken care of everything.

> **NOTE**
>
> You *can* just remove the conflict files and commit, but `svn resolved` fixes up some bookkeeping data in the working-copy administrative area in addition to removing the conflict files, so you should use this command.

revert

```
svn revert path ...
```

Revert any local changes to a file or directory, and resolve any conflicted states. `svn revert` reverts not only the contents of an item in your working copy, but also any property changes. Finally, you can use it to undo any scheduling operations that you may have done (e.g., files scheduled for addition or deletion can be unscheduled).

Alternate names: none

Changes: working copy

Accesses repository: no

Options

--config-dir *dir*
--quiet (-q)
--recursive (-R)
--targets *filename*

Examples

Discard changes to a file:

```
$ svn revert foo.c
Reverted foo.c
```

If you want to revert a whole directory of files, use the--recursive flag:

```
$ svn revert --recursive .
Reverted newdir/afile
Reverted foo.c
Reverted bar.txt
```

If you provide no targets to svn revert, it does nothing; to protect you from accidentally losing changes in your working copy,svn revert requires you to provide at least one target.

status

```
svn status [path ...]
```

Print the status of working-copy files and directories. With no arguments, it prints only locally modified items (no repository access). With --show-updates, add working revision and server out-of-date information. With --verbose, print full revision information on every item.

The first five columns in the output are each one character wide, and each column gives you information about different aspects of each working-copy item.

The first column indicates that an item was added, deleted, or otherwise changed:

space

No modifications.

A

Item is scheduled for addition.

D

Item is scheduled for deletion.

M

Item has been modified.

C

Item is in conflict with updates received from the repository.

X

Item is related to an externals definition.

I

Item is being ignored (e.g., with the`svn:ignore` property).

?

Item is not under version control.

!

Item is missing (e.g., you moved or deleted it without using`svn`). This also indicates that a directory is incomplete (a checkout or update was interrupted).

~

Item is versioned as a directory but has been replaced by a file, or vice versa.

The second column tells the status of a file's or directory's properties:

space

No modifications.

M

Properties for this item have been modified.

C

Properties for this item are in conflict with property updates received from the repository.

The third column is populated only if the working copy directory is locked:

space

Item is not locked.

L

Item is locked.

The fourth column is populated only if the item is scheduled for addition-with-history:

space

No history scheduled with commit.

+

History scheduled with commit.

The fifth column is populated only if the item is switched relative to its parent:

space

space

Item is a child of its parent directory.

S

Item is switched.

If you pass the --show-updates option, the out-of-date information appears in the eighth column:

space

The item in your working copy is up to date.

*

A newer revision of the item exists on the server.

The remaining fields are variable width and delimited by spaces. The working revision is the next field if the --show-updates or --verbose options are passed.

If the --verbose option is passed, the last committed revision and last committed author are displayed next.

The working-copy path is always the final field, so it can include spaces.

Alternate names: stat, st

Changes: nothing

Accesses repository: only if using --show-updates

Options

--config-dir
--no-auth-cache
--no-ignore
--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--show-updates (-u)
--username *user*
--verbose (-v)

Examples

To find out what changes you have made to your working copy:

```
$ svn status wc
 M     wc/bar.c
A  +   wc/qax.c
```

To find out what files in your working copy are out of date, pass the --show-updates option (this does *not* make any changes to your working copy). Here you can see that *wc/foo.c* has changed in the repository since we last updated our working copy:

```
$ svn status --show-updates wc
```

```
 M           965    wc/bar.c
       *     965    wc/foo.c
A  +         965    wc/qax.c
Status against revision:    981
```

NOTE

--show-updates places an asterisk *only* next to items that are out of date (that is, items that will be updated from the repository if you runsvn update). --show-updates does *not* cause the status listing to reflect the repository's version of the item.

And finally, the most information you can get out of the status subcommand:

```
$ svn status --show-updates --verbose wc
 M           965       938 sally        wc/bar.c
       *     965       922 harry        wc/foo.c
A  +         965       687 harry        wc/qax.c
             965       687 harry        wc/zig.c
Head revision:   981
```

switch

```
svn switch URL [path]
```

This subcommand updates your working copy to mirror a new URLusually a URL that shares a common ancestor with your working copy, although not necessarily. This is the Subversion way to move a working copy to a new branch.

Alternate names: sw

Changes: working copy

Accesses repository: yes

Options

--config-dir *dir*
--diff3-cmd *cmd*
--no-auth-cache

--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--relocate
--revision *rev*, -r *rev*
--username *user*

Examples

If you're currently inside the directory *vendors*, which was branched to *vendors-with-fix*, and you'd like to switch your working copy to that branch:

```
$ svn switch http://svn.red-bean.com/repos/branches/ \
> vendors-with-fix .
U  myproj/foo.txt
U  myproj/bar.txt
U  myproj/baz.c
U  myproj/qux.c
Updated to revision 31.
```

And to switch back, just provide the URL to the location in the repository from which you originally checked out your working copy:

```
$ svn switch http://svn.red-bean.com/repos/trunk/vendors .
U  myproj/foo.txt
U  myproj/bar.txt
U  myproj/baz.c
U  myproj/qux.c
Updated to revision 31.
```

NOTE

You can just switch part of your working copy to a branch if you don't want to switch your entire working copy.

Sometimes an administrator might change the "base location" of your repository; in other words, the contents of the repository doesn't change, but the main URL used to reach the root of the repository does. For example, the hostname may change, or the URL schema, or perhaps just the path that leads to the repository. Rather than checking out a new working copy, you can have thesvn switch command "rewrite" the beginnings of all the URLs in your working copy. Use the--relocate command to do the substitution. No file contents are changed, nor is the repository contacted. It's similar to running a sed script over your working copy *.svn/* directories, which runs s/*OldRoot*/*NewRoot*/ :

```
$ cd /tmp
$ svn checkout file:///tmp/repos test
A  test/a
A  test/b
...

$ mv repos newlocation
$ cd test/

$ svn update
svn: Unable to open an ra_local session to URL
svn: Unable to open repository 'file:///tmp/repos'

$ svn switch --relocate file:///tmp/repos file:///tmp/newlocation .
$ svn update
At revision 3.
```

update

```
svn update [PATH ...]
```

svn update brings changes from the repository into your working copy. If no revision is given, it brings your working copy up to date with the HEAD revision. Otherwise, it synchronizes the working copy to the revision given by the --revision option.

For each updated item Subversion prints a line starting with a specific character reporting the action taken. These characters have the following meaning:

A

Added

D

Deleted

U

Updated

C

Conflict

G

Merged

A character in the first column signifies an update to the actual file, while updates to the file's properties are shown in the second column.

NOTE

If you want to examine an older revision of a single file, you may want to usesvn cat.

Alternate names: up

Changes: working copy

Accesses repository: yes

Options

--config-dir *dir*
--diff3-cmd *cmd*
--no-auth-cache
--non-interactive
--non-recursive (-N)
--password *pass*
--quiet (-q)
--revision *rev*, -r *rev*
--username *user*

14.5. Repository Administration: svnadmin

svnadmin is the administrative tool for monitoring and repairing your Subversion repository.

14.5.1. svnadmin Options

--bdb-log-keep

(Berkeley DB specific) Disable automatic log removal of database logfiles.

--bdb-txn-nosync

(Berkeley DB specific) Disable use of fsync( ) when committing database transactions.

--bypass-hooks

Bypass the repository hook system.

--clean-logs

Remove unused Berkeley DB logs.

--force-uuid

By default, when loading data into a repository that already contains revisions,svnadmin ignores the UUID from the dump stream. This option causes the repository's UUID to be set to the UUID from the stream.

--ignore-uuid

By default, when loading an empty repository, svnadmin uses the UUID from the dump stream. This option causes that UUID to be ignored.

--incremental

Dump a revision only as a diff against the previous revision, instead of the usual full text.

--parent-dir *dir*

When loading a dumpfile, root paths at *dir* instead of /.

--quiet

Do not show normal progress; show only errors.

--revision *rev*, -r *rev*

Specify a particular revision to operate on.

14.5.2. svnadmin Subcommands

The svnadmin command creates and administers the repository. As such, it always operates on loca paths, not on URLs.

create

```
svnadmin create repos_path
```

Create a new, empty repository at the path provided. If the provided directory does not exist, it is created for you.

Options

```
--bdb-log-keep
--bdb-txn-nosync
```

Example

Creating a new repository is just this easy:

```
$ svnadmin create /usr/local/svn/repos
```

deltify

```
svnadmin deltify [-r lower[:upper]] repos_path
```

svnadmin deltify only exists in 1.0.x due to historical reasons. This command is deprecated and no longer needed.

It dates from a time when Subversion offered administrators greater control over compression strategies in the repository. This turned out to be a lot of complexity for*very* little gain, and the feature was deprecated.

Options

--quiet
--revision *rev*, -r *rev*

dump

```
svnadmin dump repos_path [-r lower[:upper]] [--incremental]
```

Dump the contents of filesystem to standard output in a dumpfile portable format, sending feedback to standard error. Dump revisions *lower* rev through *upper* rev. If no revisions are given, dump all revision trees. If only *lower* is given, dump that one revision tree.

Options

--incremental
--quiet
--revision *rev*, -r *rev*

Examples

Dump your whole repository:

```
$ svnadmin dump /usr/local/svn/repos
SVN-fs-dump-format-version: 1
Revision-number: 0
* Dumped revision 0.
Prop-content-length: 56
Content-length: 56
...
```

Incrementally dump a single transaction from your repository:

```
$ svnadmin dump /usr/local/svn/repos -r 21 --incremental
* Dumped revision 21.
SVN-fs-dump-format-version: 1
Revision-number: 21
Prop-content-length: 101
Content-length: 101
...
```

help

```
svnadmin help [subcommand ...]
```

Provide a quick usage summary. With *subcommand*, provide information about the given subcommand.

Alternate names: ?, h

hotcopy

```
svnadmin hotcopy old_repos_path new_repos_path
```

This subcommand makes a full hot backup of your repository, including all hooks, configuration files, and, of course, database files. If you pass the --clean-logs option, svnadmin performs a hotcopy of your repository, and then removes unused Berkeley DB logs from the original repository. You can rur this command at any time and make a safe copy of the repository, regardless of whether other processes are using the repository.

Option

--clean-logs

list-dblogs

```
svnadmin list-dblogs repos_path
```

List Berkeley DB logfiles. Berkeley DB creates logs of all changes to the repository, which allow it to recover in the face of catastrophe. Unless you enable DB_LOGS_AUTOREMOVE, the logfiles accumulate, although most are no longer used and can be deleted to reclaim disk space.

list-unused-dblogs

```
svnadmin list-unused-dblogs repos_path
```

Remove unused Berkeley DB logfiles (see `svnlook list-dblogs`).

Example

Remove all unused logfiles from a repository:

```
$ svnadmin list-unused-dblogs /path/to/repos | xargs rm
## disk space reclaimed!
```

load

```
svnadmin load repos_path
```

Read a dumpfile-formatted stream from standard input, committing new revisions into the repository's filesystem. Send progress feedback to standard output.

Options

--force-uuid
--ignore-uuid
--parent-dir
--quiet (-q)

Examples

This shows the beginning of loading a repository from a backup file (made, of course, withsvn dump):

```
$ svnadmin load /usr/local/svn/restored < repos-backup
<<< Started new txn, based on original revision 1
     * adding path : test ... done.
     * adding path : test/a ... done.
...
```

Or, to load into a subdirectory:

```
$ svnadmin load --parent-dir new/subdir/for/project \
>   /usr/local/svn/restored < repos-backup
<<< Started new txn, based on original revision 1
     * adding path : test ... done.
     * adding path : test/a ... done.
...
```

lstxns

```
svnadmin lstxns repos_path
```

Print the names of all uncommitted transactions.

recover

```
svnadmin recover repos_path
```

Run this command if you get an error indicating that your repository needs to be recovered.

rmtxns

```
svnadmin rmtxns repos_path txn_name ...
```

Delete outstanding transactions from a repository.

Options

--quiet (-q)

Examples

Remove all uncommitted transactions from your repository, using*svn lstxns* to provide the list of transactions to remove:

```
$ svnadmin rmtxns /usr/local/svn/repos/ \
>           `svnadmin lstxns /usr/local/svn/repos/`
```

setlog

```
svnadmin setlog repos_path -r revision file
```

Set the log message on revision *revision* to the contents of *file*.

This is similar to using svn propset --revprop to set the svn:log property on a revision, except that you can also use the option --bypass-hooks to avoid running any pre- or post-commit hooks, which is useful if the modification of revision properties has not been enabled in the pre-revprop-change hook.

> Revision properties are not under version control, so this command permanently overwrites the previous log message.

Options

--bypass-hooks
--revision *rev*, -r *rev*

Example

Set the log message for revision 19 to the contents of the file *msg*:

```
$ svnadmin setlog /usr/local/svn/repos/ -r 19 msg
```

verify

```
svnadmin verify repos_path
```

Run this command to verify the integrity of your repository. This iterates through all revisions in the repository by internally dumping all revisions and discarding the output.

14.6. Examining the Repository: svnlook

svnlook is a command-line utility for examining different aspects of a Subversion repository. It does not make any changes to the repository. svnlook is typically used by the repository hooks, but a repository administrator might find it useful for diagnostic purposes.

Since svnlook works via direct repository access (and thus can only be used on the machine that holds the repository), it refers to the repository with a path, not a URL.

If no revision or transaction is specified, svnlook defaults to the youngest (most recent) revision of the repository.

14.6.1. svnlook Options

Options in svnlook are global, just as in svn and svnadmin; however, most options apply to only one subcommand because the functionality of svnlook is (intentionally) limited in scope.

--no-diff-deleted

Do not print differences for deleted files. The default behavior when a file is deleted in a transaction/revision is to print the same differences that you would see if you had left the file but removed all the content.

--revision rev, -r rev

Examine revision number *rev*.

--show-ids

Show the filesystem node revision IDs for each path in the filesystem tree.

--transaction tid, -t tid

Examine transaction ID *tid*.

--verbose

Show property values for the property-related commands, too.

--version

Display version and copyright information.

14.6.2. svnlook Subcommands

author

```
svnlook author repos_path
```

Print the author of a revision or transaction in the repository.

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

cat

```
svnlook cat repos_path path_in_repos
```

Print the contents of a file.

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

changed

```
svnlook changed repos_path
```

Print the paths that were changed in a particular revision or transaction, as well as ansvn update-style status letter in the first column: A for added, D for deleted, and U for updated (modified).

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

Example

Show a list of all the changed files in revision 39 of a test repository:

```
$ svnlook changed -r 39 /usr/local/svn/repos
A   trunk/vendors/deli/
A   trunk/vendors/deli/chips.txt
A   trunk/vendors/deli/sandwich.txt
A   trunk/vendors/deli/pickle.txt
```

date

```
svnlook date repos_path
```

Print the datestamp of a revision or transaction in a repository.

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

diff

```
svnlook diff repos_path
```

Print GNU-style differences of changed files and properties in a repository. If a file has a nontextual svn:mime-type property, the differences are explicitly not shown.

Options

--no-diff-deleted
--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

dirs-changed

```
svnlook dirs-changed repos_path
```

Print the directories that were themselves changed (property edits) or whose file children were changed.

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

help

```
svnlook help
svnlook -h
svnlook -?
```

Provide a quick usage summary. With *subcommand*, provide information about the given subcommand.

Alternate names: ?, h

history

```
svnlook history repos_path [path_in_repos]
```

Print information about the history of a path in the repository (or the root directory if no path is supplied).

Options

--revision *rev*, -r *rev*
--show-ids

Example

This shows the history output for the path */tags/1.0*, as of revision 20 in our sample repository.

```
$ svnlook history -r 20 /usr/local/svn/repos /tags/1.0 \
> --show-ids
REVISION   PATH <ID>
--------   ---------
      19   /tags/1.0 <1.2.12>
      17   /branches/1.0-rc2 <1.1.10>
      16   /branches/1.0-rc2 <1.1.x>
      14   /trunk <1.0.q>
...
```

info

```
svnlook info repos_path
```

Print the author, datestamp, log message size, and log message.

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

log

```
svnlook log repos_path
```

Print the log message.

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

propget

```
svnlook propget repos_path propname path_in_repos
```

List the value of a property on a path in the repository.

Alternate names: pg, pget

Options

--revision *rev*, -r *rev*
--transaction *tid*, -t *tid*

Example

Show the value of the seasonings property on the file */trunk/sandwich* in the HEAD revision:

```
$ svnlook pg /usr/local/svn/repos seasonings /trunk/sandwich
mustard
```

proplist

```
svnlook proplist repos_path path_in_repos
```

List the properties of a path in the repository. With --verbose, show the property values too.

Alternate names: pl, plist

Options

--revision *rev*, -r *rev*

--transaction *tid*, -t *tid*
--verbose (-v)

Examples

Show the names of properties set on the file */trunk/README* in the HEAD revision:

```
$ svnlook proplist /usr/local/svn/repos /trunk/README
original-author
svn:mime-type
```

This is the same command as in the previous example, but this time it shows the property values as well:

```
$ svnlook proplist --verbose /usr/local/svn/repos \
> /trunk/README
original-author : fitz
svn:mime-type : text/plain
```

tree

```
svnlook tree repos_path[path_in_repos]
```

Print the tree, starting at *path_in_repos* (if supplied; at the root of the tree otherwise), optionally showing node revision IDs.

Options

--revision *rev*, -r *rev*
--show-ids
--transaction *tid*, -t *tid*

Example

This shows the tree output (with node IDs) for revision 40 in our sample repository:

```
$ svnlook tree -r 40 /usr/local/svn/repos --show-ids
/ <0.0.2j>
```

```
trunk/ <p.0.2j>
 vendors/ <q.0.2j>
  deli/ <1g.0.2j>
   egg.txt <1i.e.2j>
   soda.txt <1k.0.2j>
   sandwich.txt <1j.0.2j>
```

uuid

```
svnlook uuid repos_path
```

Print the UUID for the repository. The UUID is the repository's*U*niversal *U*nique *ID*entifier. The Subversion client uses this identifier to differentiate between one repository and another.

youngest

```
svnlook youngest repos_path
```

Print the youngest revision number of a repository.

14.7. Providing Remote Access: svnserve

svnserve allows access to Subversion repositories using the svn network protocol. You can run svnserve either as a standalone server process, or by having another processsuch asinetd, xinetd, or sshd--start it for you.

Once the client has selected a repository by transmitting its URL,svnserve reads a file named *conf/svnserve.conf* in the repository directory to determine repository-specific settings, such as what authentication database to use and what authorization policies to apply. The details are provided in Version Control with Subversion (O'Reilly).

14.7.1. svnserve Options

Unlike the previous commands we've described, svnserve has no subcommands; svnserve is controlled exclusively by options.

--daemon, -d

Run in daemon mode. svnserve backgrounds itself, and accepts and serves TCP/IP connections on the svn port (3690, by default).

--foreground

When used together with -d, this option causes svnserve to stay in the foreground. This option is mainly useful for debugging.

--help, -h

Display a usage summary and exit.

--inetd, -i

Use the standard input/standard output file descriptors, as appropriate for a server running out of inetd.

--listen-host=host

Listen on the interface specified by*host*, which may be either a hostname or an IP address.

--listen-once, -X

Accept one connection on the svn port, serve it, and exit. This option is mainly useful for debugging.

--listen-port=port

Listen on *port* when run in daemon mode.

--root=root, -r=root

Set the virtual root for repositories served by svnserve to *root*. The pathname in URLs provided by the client are interpreted relative to this root and are not allowed to escape this root.

--threads, -T

When running in daemon mode, spawn a thread instead of a process for each connection. The svnserve process still backgrounds itself at startup time.

--tunnel, -t

Run in tunnel mode, which is just like the inetd mode of operation (serve one connection over standard input/standard output), except that the connection is considered to be pre-authenticated with the username of the current UID. This flag is selected by the client when running over a tunnelling agent such as ssh.

14.8. Other Subversion Components

Subversion creates the mod_dav_svn plug-in for use with the Apache 2.0 httpd web server. By running Apache 2.0 with mod_dav_svn, you can make your repository available via the HTTP protocol. Full details are provided in Version Control with Subversion (O'Reilly). Two other commands are supplied with Subversion.

svndumpfilter

```
svndumpfilter subcommand [options] paths ...
```

Filter out files from a repository dump for use in later repository restoration (seesvnadmin dump and svnadmin load).

Subcommands

exclude

Exclude from the dump the files and directories named by*paths*. Everything else is left in the dump.

help, h, ?

Print a help message and exit.

include

Include in the dump only the files and directories named by*paths*. Everything else is excluded.

Options

--drop-empty-revs

Remove empty revisions. Such revisions can be created when the original revision contained paths that were filtered out. This option removes empty revisions from the dump.

--preserve-revprops

If empty revisions are being kept, preserve their revision properties (such as log message, author, date, etc.). Otherwise, empty revisions contain only the original datestamp and a generated log message that the revision was dropped.

--renumber-revs

If empty revisions are being dropped, renumber subsequent revisions, so that all revision numbers are contiguous.

Example

Dump the repository, and then separate out its two components:

```
$ svnadmin dump /path/to/repos > dumpfile
* Dumped revision 0.
* Dumped revision 1.
* Dumped revision 2.
...

$ svndumpfilter include client < dumpfile > client-dumpfile
$ svndumpfilter include server < dumpfile > server-dumpfile
```

svnversion

svnversion [*options*] *path* [*URL*]

Produce a version number for the working copy in *path*. The *URL* is the pathname part of a Subversion URL used to tell if the *path* was switched (see svn switch).

The output is a single number if the working copy represents an unmodified, nonswitched revision whose URL matches the supplied *URL*.

Options

`-c`

Report "last changed" revision instead of the current revision.

`-n`

Do not print the final newline.

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About the Authors

Ellen Siever is a writer and editor specializing in Linux and other open source topics. In addition to *Linux in a Nutshell*, she coauthored O'Reilly's *Perl in a Nutshell*. She is a longtime Linux and Unix user and was a programmer for many years until she decided that writing about computers was more fun.

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Our look is the result of reader comments, our own experimentation, and feedback from distribution channels.Distinctive covers complement our distinctive approach to technical topics, breathing personality and life into potentially dry subjects.

The animal featured on the cover of *Linux in a Nutshell*, Fifth Edition is an Arabian horse. Known for its grace and intelligence, the Arabian is one of the oldest breeds of horse, with evidence of its existence dating back 5000 years. The Arabian was instrumental as an ancestor to other popular breeds, most notably the Thoroughbred in the 17th and 18th centuries. Possibly one of the more distinctive horse breeds, the typical Arabian has large, expressive eyes and nostrils, small ears, and a short, sturdy back. Its stamina suits it particularly well for endurance riding, a sport dominated by the Arabian breed. Its wonderful temperament makes the Arabian an all-around favorite riding horse in North America, although it also can be found in more specialized competitions such as dressage, jumping, and reining.

Sanders Kleinfeld was the production editor and proofreader for *Linux in a Nutshell*, Fifth Edition. Adam Witwer and Claire Cloutier provided quality control. Ellen Troutman-Zaig wrote the index.

Edie Freedman designed the cover of this book, using a 19th-century engraving from the Dover Pictorial Archive. Karen Montgomery produced the cover layout with Adobe InDesign CS using Adobe's ITC Garamond font.

David Futato designed the interior layout.This book was converted by Keith Fahlgren to FrameMaker 5.5.6 with a format conversion tool created by Erik Ray, Jason McIntosh, Neil Walls, and Mike Sierra that uses Perl and XML technologies. The text font is Linotype Birka; the heading font is Adobe Myriad Condensed; and the code font is LucasFont's TheSans Mono Condensed. The illustrations that appear in the book were produced by Robert Romano, Jessamyn Read, and Lesley Borash using Macromedia FreeHand MX and Adobe Photoshop CS. The tip and warning icons were drawn by Christopher Bing.

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