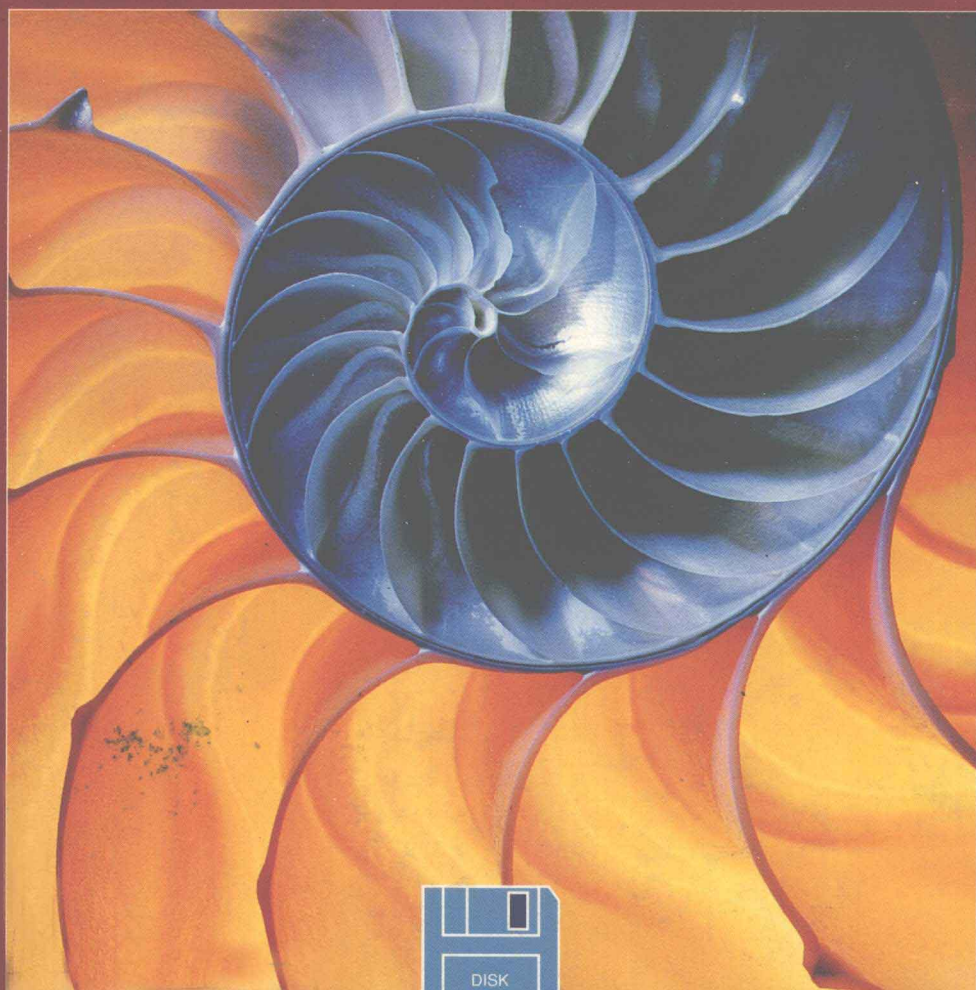


SYSTEM V

# HANDS-ON UNIX

A PRACTICAL GUIDE WITH  
THE ESSENTIALS OF COHERENT



MARK G. SOBELL

# **HANDS-ON UNIX:<sup>®</sup>**

## **A PRACTICAL GUIDE WITH THE ESSENTIALS OF COHERENT<sup>®</sup>**

**Mark G. Sobell**



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*for Laura  
Max  
Zachary  
and the B*

See, the human mind is kind of like . . .  
a piñata. When it breaks open,  
there's a lot of surprises inside.  
Once you get the piñata perspective,  
you see that losing your mind  
can be a peak experience.

Jane Wagner

*The Search for Signs of Intelligent Life in the Universe*



# Preface

---

This book is *practical* because it uses tutorial examples that show you what you will see on your terminal screen each step of the way. It is a *guide* because it takes you from logging in on your system (Chapter 2) through writing complex shell programs (Chapters 10, 11, 12), using sophisticated software development tools (Chapter 13), and administrating a system (Chapter 14). Part II is a *reference guide* to 78 UNIX utilities. This *Practical Guide* is intended for people with some computer experience but little or no experience with the UNIX system. However, more experienced UNIX system users will find the later chapters and Part II to be useful sources of information on such subjects as basic and advanced shell programming, C programming, networks, graphical user interfaces, and system administration.

This book covers System V Release 4, which is the foundation for most UNIX systems manufactured today, including Sun's Solaris environment. The following list highlights some of the features of this book.

## Networking

A new chapter (Chapter 7) is devoted to explaining what a network is, how it works, and how you can use it. It tells you about types of networks, various network implementations, distributed computing, how to use the network for communicating with other users via **talk** and **mailx**, and using various networking utilities (such as **telnet**, **ftp**).

## Internet and the World Wide Web

Chapter 7 also discusses the use of the Internet and shows, with examples, how to use **archie** and **gopher**, two user-friendly interfaces to the Internet.

It also details the World Wide Web and its use of hypertext, and explains how to use the powerful browser named **Mosaic**.

## Graphical User Interfaces (GUIs)

Chapter 6, another new chapter, discusses various graphical user interfaces, including Motif and OPEN LOOK. It explains the X Window system, how to open and control windows, how to customize your X work environment, and how to customize the Motif window manager.

## The Korn Shell and Advanced Shell Programming

The newest of the three major shells, the Korn Shell, is becoming more popular. Chapter 12 covers the latest version of this shell (ksh93) as well as older versions. This chapter extends the concepts of shell programming introduced in Chapter 10 into more advanced areas, including more information on the locality of variables, recursion, and the coprocess.

## The vi Editor

The screen-oriented **vi** editor, which was originally a part of Berkeley UNIX, is still one of the most widely used text editors. Chapter 8 continues from the introduction in Chapter 2 and goes on to explain how to use many of the advanced features of **vi**, including special characters in search strings, the general-purpose and named buffers, parameters, markers, and executing commands from **vi**. The chapter concludes with a summary of **vi** commands.

## The emacs Editor

Produced and distributed (for minimal cost) by the Free Software Foundation, the **emacs** editor has grown in popularity and is now available on many UNIX machines. Chapter 9 explains how to use many of the features of this versatile editor, from a basic orientation to the use of the (META), (ALT), and (ESCAPE) keys; key bindings, buffers, the concept of Point, the cursor, Mark, and Region, incremental and complete searching for both character strings and regular expressions; using the on-line help facilities, cutting and pasting, using multiple windows; and C Mode, which is designed to aid a programmer in writing and debugging C code. The chapter concludes with a summary of **emacs** commands.

## Job Control

The job control commands, which originated on Berkeley UNIX, allow a user to work on many jobs at once from a single window, and switch back and forth between the jobs as desired. On SVR4, the C Shell, Bourne Shell, and Korn Shell include support for job control.

## Shell Functions

A new feature of the Bourne and Korn Shells, shell functions, enables users to write their own commands that are similar to the aliases provided by the C Shell, only more powerful.

## Source Code Management: SCCS and RCS

The Source Code Control System (SCCS) and Revision Control System (RCS) are convenient sets of tools that enable programmers to track multiple versions of files on a number of different types of projects.

## POSIX

The IEEE POSIX committees have developed standards for programming and user interfaces based on historical UNIX practice, and new standards are under development. Appendix C describes these standards and their direction and effect on the UNIX industry.

## Part I and Part II

*UNIX System V: A Practical Guide* shows you how to use the UNIX system from your terminal. Part I comprises the first fourteen chapters, which contains step-by-step tutorials covering the most important aspects of the UNIX operating system. (If you have used a UNIX system before, you may want to skim over Chapters 2 and 3.) The more advanced material in each chapter is

presented in sections marked “Optional,” which you are encouraged to return to after mastering the more basic material presented in the chapter. Review exercises are included at the end of each chapter for readers who want to hone their skills. Some of the exercises test the reader’s understanding of material covered in the chapter, while others challenge the reader to go beyond the material presented to develop a more thorough understanding.

Part II offers a comprehensive, detailed reference to the major UNIX utilities, with numerous examples. If you are already familiar with the UNIX system, this part of the book will be a valuable, easy-to-use reference. If you are not an experienced user, you will find Part II a useful supplement while you are mastering the tutorials in Part I.

## Organizing Information

In Chapters 2, 3, and 4, you will learn how to create, delete, copy, move, and search for information using your system. You will also learn how to use the UNIX system file structure to organize the information you store on your computer.

## Electronic Mail and Telecommunications

Chapters 2 and 3 and Part II include information on how to use the UNIX system utilities (**mailx**, **talk**, and **write**) to communicate with users on your system and other systems. Chapter 7 details how to address electronic mail to users on remote, networked systems.

## Using the Shell

In Chapter 5 you will learn how to redirect output from a program to the printer, to your terminal, or to a file—just by changing a command. You will also see how you can use pipes to combine UNIX utilities to solve problems right from the command line.

## Shell Programming

Once you have mastered the basics of the UNIX system, you can use your knowledge to build more complex and specialized programs (shell scripts), using a shell programming language. Chapter 10 shows you how to use the Bourne Shell to write your own scripts composed of UNIX system commands. Chapter 11 covers the C Shell. Chapter 12 covers the Korn Shell, which combines many of the popular features of the C Shell (such as history and aliases) with a programming language similar to that of the Bourne Shell. This chapter also covers many concepts of advanced shell programming. The examples in Part II also demonstrate many features of the UNIX utilities that you can use in shell scripts.

## Using Programming Tools

Chapter 13 introduces you to the C compiler and the UNIX system’s exceptional programming environment. This chapter describes how to use some of the most useful software development tools: **make**, the Source Code Control System (SCCS), and the Revision Control System (RCS). The **make** utility automates much of the drudgery involved in ensuring that a program you



compile contains the latest versions of all program modules. SCCS and RCS help you to track the versions of files involved in a project.

## System Administration

Chapter 14 explains the inner workings of the UNIX system. It details the responsibilities of the superuser and explains how to bring up and shut down a UNIX system, add users to the system, back up files, set up new devices, check the integrity of a filesystem, and more. This chapter goes into detail about the structure of a filesystem and explains what administrative information is kept in the various files.

## Using UNIX Utilities

The UNIX system includes hundreds of utilities. Part II contains extensive examples of how to use many of these utilities to solve problems without resorting to programming in C (or another language). The example sections of **awk** (over 20 pages, starting on page 447), and **sort** (page 603), give real-life examples that demonstrate how to use these utilities alone and with other utilities to generate reports, summarize data, and extract information.

## Regular Expressions

Many UNIX utilities allow you to use regular expressions to make your job easier. Appendix A explains how to use regular expressions, so that you can take advantage of some of the hidden power of your UNIX system.

## Perspective

This book is now in its third edition. Over ten years ago when I went peddling my UNIX manuscript, most publishers were polite, but I had the feeling that they had a good chuckle when I left after trying to explain what UNIX was, and how it was going to catch on. UNIX? Never heard of it.

Silicon Valley was hot, the Santa Cruz Operation was starting to sell Xenix, which was Microsoft's version of UNIX, and I worked for Cromemco, a small microprocessor manufacturer. Those were the days of the Z-80 and 8086 chips; 16KB was a lot of memory, and a 10MB hard disk was really special. CP/M was the operating system, and Osborne made a splash with its "portable" computer. UNIX really didn't fit in.

At that time I chose some names to use throughout the book—notably those of my 15-year-old nephew Alex and his younger sister, Jenny. Cute. Now Jenny has a son, and Alex helped me work on this edition of the book (he did the illustrations using FrameMaker).

In producing the first edition of the book, I used Cromemco's text editor. I had limited, 1200-baud dial-up access to a UNIX system—an Onyx machine (the first commercial attempt at a UNIX box) at RDS (later to become Informix). I was bold enough to send the files from my computer to the typesetter via a modem—we had no common medium for exchanging information. Translation from my text files into galleys was marginal at best.

I wrote the second edition on a 386-based computer running UNIX. I used **vi** and **troff** for editing and formatting, a 300 dpi PostScript printer for proofing, generating final output on a Linotronic phototypesetter. Illustrations were hand-drawn, and photos were stripped in at the printer's.

For this edition I decided it was time to join the real world: desktop publishing, scanning, and so on. Although many people said it would be easier to use a Macintosh, I wanted to see if UNIX had matured to the point where I could produce a what-you-see-is-what-you-get book on a UNIX machine. It almost has. I chose to use a Mac for scanning, but that is all. And I access the Mac over a TCP/IP network as a window in a graphical user interface on my X terminal. Now I use an 80486-based computer running Santa Cruz Operation's Open Desktop. A 1,000-megabyte hard disk is no big deal—almost as small as a deck of cards. Screen shots are mostly dumps (using **xwd**) of X windows. Illustrations and all text were produced using FrameMaker. On my screen I saw what I was going to get before I ever put a piece of paper in the printer. Proofing was still done on a PostScript laser printer (now at 600 dpi), and I used an 88MB Syquest removable hard disk to ship the PostScript file to the printer. The printer took the file and produced negatives, eliminating the paste-up and camera-ready-copy stages of book production.

I miss writing and debugging **troff** macros. Somehow that seemed real—you didn't just click on a button that said "superscript" to get a superscript—you had to tell **troff** how high up to raise the type with a series of arcane commands. Osanna's **troff** manual is a work of art—so dense that even years after reading it for the first time, I could still find new information in it. Quite a challenge and obviously not suitable for most commercial offices. I still use **vi** for writing code. It, too, is dense—even after more than ten years I still learn a new command every once in a while.

## Thanks

As times have changed, so the book and the way it is produced have changed. Many people have helped write, edit, proof, and produce this, the third edition of *UNIX System V: A Practical Guide*.

First, a big *THANKS* to my Production Editor at B/C, Teri Holden, for her gentle yet firm hand in dealing with major procrastination, for her continued support and understanding, and for her being there during the hard part. My Editor, Carter Shanklin, also gets a big *Thank You* for standing behind the project even when things looked pretty dim. Unfortunately, he is the one who takes the flak from both sides, so here's a little de-flacking: Carter, I wouldn't have finished the project without your help and support. Thanks to the many others at B/C who remain mostly invisible to me, but who are an integral part of this project.

Pat Parseghian researched, wrote, analyzed reviews, and coordinated all of the efforts that went into this edition. From her large-scale system-administration experience at Princeton and her interest in data networks, she brings a breadth to this book that ties together the technobabble of computers and their use in the real world. Pat is responsible for much of the work on the Networking and GUI chapters.

Thanks to the Texan, JFP (Dr. John Frank Peters), for his many hours on the **emacs** chapter. His understanding of this editor gives this chapter a depth and breadth that makes you want to dive right in. Fred Zlotnick, author of *The POSIX.1 Standard*, did a lot of work on the Korn Shell chapter and the POSIX Appendix.

Also, many thanks to those whose time and energy went into improving the quality of the third edition through the process of review: Arnold Robbins, Georgia Tech. University (Ksh & POSIX); Behrouz Forouzan, DeAnza

College (Ksh & GUI); Mike Keenan, Virginia Polytechnic Institute and State University (GUI); Mike Johnson, Oregon State University (GUI); Jandelyn Plane, University of Maryland (Networking & **emacs**); Sathis Menon, Georgia Tech. University (Networking); Cliff Shaffer, Virginia Polytechnic Institute and State University (**emacs**); and Steven Stepanek, California State University, Northridge.

I continue to be grateful to the many people who helped with the first and second editions. This book would not have been possible without the help and support of everyone at Informix Software, Inc. Special thanks to Roger Sippl, Laura King, and Roy Harrington for introducing me to the UNIX system. My mother, Dr. Helen Sobell, provided invaluable comments on the manuscript at several junctures.

Isaac Rabinovitch provided a very thorough review of the system administration chapter. Prof. Raphael Finkel and Prof. Randolph Bentson each reviewed the manuscript several times, making many significant improvements. Bob Greenberg, Prof. Udo Pooch, Judy Ross, and Dr. Robert Veroff also reviewed the manuscript and made useful suggestions. In addition, the following people provided critical reviews and were generally helpful during the long haul: Dr. Mike Denny, Joe DiMartino, Dr. John Mashey, Diane Schulz, Robert Jung, and Charles Whitaker.

I am also deeply indebted to many people whose help with different parts of the revision process greatly improved the second edition. Darlene Hawkins and Diane Blass handled countless administrative details. Numerous people helped by providing technical information about of the UNIX system: Don Cragun, Brian Dougherty, Dr. Robert Fish, Guy Harris, Ping Liao, Gary Lindgren, Dr. Jarrett Rosenberg, Dr. Peter Smith, Bill Weber, Mike Bianchi, and Scooter Morris. Brian Reid provided the USENET map of site locations and news exchange paths shown on page 9. Clarke Echols, Oliver Grillmeyer, and Dr. Stephen Wampler reviewed a draft of the manuscript.

Dr. David Korn and Dr. Scott Weikart's reviews of the Bourne Shell chapter and the original Korn Shell appendix caused me to step back and rethink my approach to shell programming, and finally to make significant revisions, particularly to Chapter 10.

Dr. Brian Kernighan and Rob Pike graciously allowed me to reprint the **bundle** script from their book, "The UNIX Programming Environment," and Dr. Richard Curtis provided several other shell scripts used in Chapter 10.

Dr. Kathleen Hemenway researched, wrote, analyzed reviews, and generally coordinated all the efforts that went into the second edition. From her work on the UNIX system at Bell Labs and her teaching experience, she brought a breadth to this book that greatly increases its value as a learning tool. Of course I must take responsibility for any errors or omissions. If you find one, or just have a comment, let me know (at [sobell!mark@igc.org](mailto:sobell!mark@igc.org) or c/o the publisher), and I'll fix it in the next printing.

Finally, I must also thank the black cat without a tail who harassed me during the preparation of the initial manuscript and who is now sitting upstairs somewhere laughing at us mortals who work all day in front of CRTs instead of stretching out in the sun. This book is for you too, Odie.

Mark G. Sobell  
Menlo Park, California

## The Essentials of COHERENT

The next few pages introduce The Essentials of COHERENT, a special introductory version of COHERENT®, an operating system designed for use on machines capable of running MS-DOS. The COHERENT Operating System provides the features and functionality of UNIX, and is the creation of the Mark Williams Company of Northbrook, Illinois. The Essentials of COHERENT is a carefully selected subset of the complete operating system. It is designed

- to allow both readers who are new to, as well as those who are familiar with the UNIX operating system, to explore and experiment with an operating system that has the look and feel of UNIX, and can be run on a PC.
- to provide an easy way for newcomers to experiment with some of the more frequently-used UNIX utilities.

The result is an impressive selection of UNIX utilities which enable the reader to gain hands-on experience with UNIX while reading this book. While a full UNIX operating system can cost from several hundred to many thousands of dollars, this collection of utilities offers a low cost educational alternative with high value and real functionality.

### Hardware Requirements

The 3.5" and 5.25" diskettes will run on IBM PC-AT, (and compatible) 286-, 386-, 486-, and Pentium-based machines. At least 640K of RAM is required. The software will only function through the **A:** floppy drive. It will not function through the **B:** drive or on microchannel-based machines. By design, the Essentials of COHERENT diskettes do not support hard disk devices.

### Contents of the Essentials of COHERENT

The following is a listing of all of the utilities and commands found in the Essentials of COHERENT. The same list can be generated by using the command `find / -type f -print` which prints a list of all files on the diskette. The files marked with a dagger (†) are only on the 3.5" diskette.

<b>/ (root)</b>	phone	mount
.profile	pr	mount.all
autoboot	ps	mtab
coherent	pwd	newusr
tboot	qfind	passwd
	rm	profile
<b>/bin</b>	rmail	ramdisk
[	rmdir	rc
at	scat	reboot
bc†	sed	shutdown
awk	sh	termcap
cal	shutdown	timezone
cat	size	ttys
chgrp	sleep	umount
chmod	smail†	umount.all

chown	sort	update
clear	stty	uucpname
cmp	su	wall
cp	sync	
cpdir	tail	<b>/usr/bin</b>
date	tee	elvis
dd	test	emacs
df	time	ex
diff	touch	input
dos	tr	ksh
du	true	me
echo	umount	more
ed	uniq	pg
egrep	units	vi
expr	wc	view
false	who	
file		<b>/usr/games</b>
find	<b>/etc</b>	chase
grep	.profile	.profile
head	ATclock	
help	brc	<b>/usr/lib</b>
kill	checklist	atrun
lc	coh_intro	binunits†
lmail†	cron	copyright
ln	domain	crontab
login	drvld.all	lib.b
lpr	fdformat	lpd
ls	fsck	more.help
mail†	getty	units†
man	group	
mkdir	helpfile	<b>/usr/pub</b>
mount	helpindex	ascii
mv	init	phonebook
newgrp	logmsg	
od	lpr_config	<b>/usr/spool/mail</b>
passwd	mkfs	guest
phone	mknod	root
	mnttab	

## Getting Started

The first step is to make a backup copy of the appropriate size diskette. Choose the size disk that fits in your **A:** drive.

## Making a Backup Copy of the Essentials of COHERENT Diskette

The Essentials of COHERENT diskette will not function correctly if it is write protected; running the operating system will write to the diskette. Therefore, before you start using the Essentials of COHERENT diskette, you should make a backup copy of it. While your system is running DOS, give the command **diskcopy a: a:**. Then insert the Essentials of COHERENT diskette as the *Source* diskette and a blank diskette as the *Target* diskette. For safety, you can write-protect the Essentials of COHERENT diskette before making the copy, but remember to remove the write protection before you try to boot from it.

## Starting up the Essentials of COHERENT

To start the Essentials of COHERENT operating system, turn your computer off, insert the diskette into drive **A:**, and turn the computer on.

### CAUTION

**DO NOT WARM BOOT.** A warm boot (typing **CONTROL ALT DEL**) can cause problems with some implementations of the PC's BIOS.

### CAUTION

The Essentials of COHERENT diskette is *not* a DOS diskette. It is a boot diskette that contains a complete operating system. It will not run under DOS like an application program using DOS will. The system needs to be turned on with the diskette in the **A:** drive in order for it to function as the operating system for your PC.

When you turn your computer on, it will search drive **A:** for instructions while initializing itself. The Essentials of COHERENT will then boot up from the **A:** drive as the operating system for your computer. Once the diskette is booted, a short guided tour to the Essentials of COHERENT will begin automatically. When you are prompted to login as a user of the system, type **guest** and press the **RETURN** key.

### CAUTION

In order to work properly, the diskette must not be write protected.

## Single user

While the Essentials of COHERENT will run in a multiuser format, as a floppy disk-based version, only one user can be logged on at one time. As a result, few of the utilities that support multiple users are available on the Essentials of COHERENT diskette. One exception is **who**, a command for finding out who is using the system. Users of the Essentials of COHERENT will get a response from **who** indicating that they are the only user logged in.

```
$ who
guest console Jul 27 20:39
```

## Floppy Drive Device Names

Depending on the size and density of the **B:** floppy drive, you can address it as shown in the following table.

Device	Disk Size, Capacity, and Density
/dev/f9a1	5.25" 720K low density
/dev/fha1	5.25" 1.2M high density
/dev/fqa1	3.5" 720K low density
/dev/fva1	3.5" 1.44M high density

## Saving Files

Files created using the Essentials of COHERENT can be saved on the Essentials of COHERENT diskette or on another floppy but not on a hard drive. With most of the floppy disk space occupied by the operating system utilities, the total space available for file storage is limited to 30KB on the 5.25" diskette and 140KB on the 3.5" diskette. If you have a **B:** floppy disk drive, you can save your files to that drive instead. Consult Part II of this book for more information about using the utilities involved in copying disks before giving the following commands. To use a floppy disk filesystem with the Essentials of COHERENT, you must:

1. format the diskette with **/etc/fdformat**,
2. build an empty filesystem on it with **/etc/mkfs**,
3. mount it with **mount**,
4. copy files to, or from, it with **cp** or **cpdir**, and
5. unmount it with **umount**.

You could give the following commands to copy a directory named **/dir** to a 5.25" 1.2M diskette in drive **B:**. The **fdformat** utility uses the raw form of the device. Precede the last part of the device name from the table above with the letter **r** (**/dev/fva1** becomes **/dev/rfva1**). All subsequent uses use the device name from the table.

```
$ /etc/fdformat -a /dev/rfha1
$ /etc/mkfs /dev/fha1 2400
$ mount /dev/fha1 /f1
$ cpdir -vd /dir /f1/dir
$ umount /dev/fha1
```

Substitute the appropriate device name (from the preceeding table) in the example above. The Essentials of COHERENT requires that you use a legal filename to store information. Filenames are generally made up of uppercase or lowercase letters but unlike DOS, the Essentials of COHERENT distinguishes between uppercase and lowercase when identifying a file. Examples of legal names include **.profile**, **File01**, **cmd.sh**, **file01**.

## Saving Files to a DOS Diskette

The Essentials of COHERENT allows you to save files to a DOS diskette in floppy drive **B:**. To use a DOS floppy disk with the Essentials of COHERENT, you must first format the diskette under DOS using the **format** command (or you can format it under the Essentials of COHERENT using **/etc/fdformat** and then build a DOS filesystem on it with a **/bin/dos F** command). Then you can copy files to or from it using the Essentials of COHERENT's **dos** utility. For example, you could use the following command to copy **File1** to a preformatted 5.25" high-density DOS diskette in drive **B:**.

```
$ dos r /dev/fha1 File1
```

## Printing

The Essentials of COHERENT supports a serial or parallel PCL printer. It does not support Postscript printers. For most readers, this is not an issue since PCL is the standard for most currently available printers. To print a file you

must run a script to specify your printer port before you can print a file. If you log in as **guest**, the **.login** file will run this script automatically. If you do not log in as **guest**, give the command **/etc/lpr\_config** and follow its instructions to specify and test a printer port. After configuration is successful, you can type **pr File1 | lpr -B** to process **File1** with the pagination program **pr** and spool the output to the line printer. The **-B** option causes **lpr** not to print the banner page. Although this book discusses the **lp** utility, you can use **lpr** in a similar manner. Only the options differ.

## Exiting From Essentials of COHERENT

Exiting from a UNIX System is not as simple as turning off the computer. To turn off a PC running the Essentials of COHERENT, give the command **shutdown**, and follow the instructions. When you see the single-user prompt (**#**), type **sync** several times and wait for floppy disk activity to stop, remove the Essentials of COHERENT diskette, and turn off or reset the computer.

### CAUTION

Improperly exiting from the Essentials of COHERENT can cause damage to the files on the diskette. Follow the instructions above when you want to shut down the system. For more information, refer to Chapter 14 and to the following explanation.

## Why Not Just Turn the Power Off?

For efficiency, the COHERENT system keeps some file information in memory and writes it to the disk periodically. Shutting down the system improperly can result in damage to the filesystem on the disk when the information in memory does not get written to the disk. This results in inconsistencies in the disk filesystem. The **fsck** utility detects and repairs filesystem damage. When the Essentials of COHERENT system starts up, it runs **fsck** automatically from the **/etc/brc** startup file. If **fsck** detects filesystem damage, it prompts you and attempts to repair the damage, placing disconnected files in the **/lost+found** directory. Follow the instructions given by **fsck** to repair any filesystem damage.

## On-line Help

Due to space limitations, the complete manual pages for commands, normally displayed by the **man** utility, are not available on the Essentials of COHERENT diskette. However, a brief summary of command options is available using **help**. Give the command **help cpdir** to see the options of the **cpdir** utility. For the Essentials of COHERENT, the **man** command provides the same information as **help**.

## Technical Support

Given the low cost and educational nature of the Essentials of COHERENT, technical support is quite limited in scope and is accessible only to instructors of courses that have adopted *Hands-On UNIX* as a required textbook for their course. Instructors should contact their Benjamin/Cummings Sales Representative for information on technical support.



## Limitations of the Essentials of COHERENT

While the number of utilities included is large, the Essentials of COHERENT does have specific limitations.

- Not every utility discussed in this book is included on the Essentials of COHERENT diskette and, conversely, not every utility on the Essentials of COHERENT diskette is covered by the this book.
- By design, the Essentials of COHERENT does not support hard disk devices. You cannot install the Essentials of COHERENT on your hard drive, it must run from your **A:** floppy drive.
- Limitations exist on the ability to save files. With most of the diskette space occupied by the operating system utilities, total space available for file storage on the Essentials of COHERENT diskettes is limited to 30KB for the 5.25" diskette and 140KB for the 3.5" diskette. For users with dual floppy drive systems other options exist, (page xvi).
- By design the Essentials of COHERENT is single-user oriented. For multiuser capabilities an upgrade path to the full version of COHERENT is provided. See details below.
- Technical Support is limited in scope and accessible only to instructors of courses that have adopted *Hands-On UNIX* as a required textbook for their course.

## Upgrading to the full version of COHERENT

The Essentials of COHERENT gives you just a taste of the full spectrum UNIX-power of COHERENT which you can purchase for \$149.95. The makers of COHERENT are pleased to offer purchasers of this book the option of upgrading to the full COHERENT Operating System. The full version of COHERENT gives your computer multi-tasking, multiuser capabilities without the overhead in both hardware and money required by current editions of UNIX.

The COHERENT System consists of the following:

- a fully, multi-tasking, multiuser kernel,
- choice of Bourne or Korn shells,
- a suite of commands, including editors, languages, tools, and utilities,
- drivers for peripheral devices, including terminals, ASCII printers, the HP LaserJet printer, and tape backup,
- complete professional C development environment, including the standard C library and the mathematics library,
- sample programs, including full source code for the MicroEMACS editor,
- X Windows . . . and much more.

For more information you can call the Mark Williams Company at 1-800-636-6700 Prices and features subject to change without notice.