START HERE!

This binder contains everything you need to know about installing XENIX and running XENIX programs.

• Before You Begin:

1 - Check the Compatible Hardware section of the *Release Notes* in this binder before making any hardware modifications to your system.

2 - Read the "Installation Notes" in the *Release Notes*.

3 - Glance through Chapter 2, "Installation Procedure," in the *Installation Guide*, also in this binder. Then, use that chapter to help you install XENIX.

4 - Refer to the appropriate section in the Release Notes on any question you might have. The Release Notes are made up of different sections grouped by topic.

• If you've never used XENIX, refer to the *Introduction To XENIX* in this binder. It shows you how to use some of the basic XENIX commands.

• The *Release Notes* contain important information about your system. Refer to them if you have any questions.

• For information on operating your system, including how to add terminals, line printers and other devices, and perform system backups, see the *Operations Guide*. 
The XENIX® System V
Operating System

Release Notes

Version 2.2.3

The Santa Cruz Operation, Inc.
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Contents

1. Preface
   1.1 Contents of the Distribution  3
   1.2 Packages In This Set  3
   1.3 Software Support  4

2. Notes About Installing Your Software
   2.1 Keeping Consistent Systems  7
   2.2 Memory Requirements  8
   2.3 Swap Space Allocation on 386 Machines -- 10
   2.4 80386 32-bit Multiply Bug  11
   2.5 Deciding Whether to Have a Separate /u Filesystem  12
   2.6 Installing terminfo(M)  14
   2.7 Installing on a Serial Console  14
   2.8 Include Files and Utilities  15
   2.9 Games Support  15
   2.10 Restoring Lost Files  15

3. Using Your System
   3.1 csh(C) - sh(C) Conflicts  16
   3.2 Using csh(C) Under Heavy Load  16
   3.3 vsh(C)  16
   3.4 shV(C)  17
   3.5 vi(C)  17
   3.6 mapkey(M)  17
   3.7 fnsname(M)  17
   3.8 Introduction to XENIX, “Listing Directory Contents”  17
   3.9 pack(C)  17
   3.10 crypt(C)  17
   3.11 cpio(C): -l Option  18
   3.12 sort(C): -u Option  18
   3.13 Using Raw Devices  18

4. System Configuration and Link Kit Notes
   4.1 Buffer Overflow  18
   4.2 Using 286 Device Drivers on 386 Machines  19
   4.3 vmstat(C)  19
   4.4 master(F) Manual Page  19
   4.5 configure(C)  19
   4.6 uname(S)  20
5. Administering Your System

5.1 badtrk(C) 21
5.2 Intel 387 Co-Processor Problems 22
5.3 Using an NEC Businessmate or Powermate 286 in 10Mhz Mode 22
5.4 Using an Intel Inboard in High Speed Mode 22
5.5 autoboott(M) and System Console 22
5.6 mkdev(C) 23
5.7 termio(M) and stty(C) 23
5.8 /etc/passwd Ownership 23
5.9 fsck(C) and 386 Core Files 23
5.10 Clockrate Adjustment 23
5.11 swapctl(C) 24
5.12 /etc/init 24
5.13 /dev/tty[11,12,13,14] 24
5.14 Additional Multiscreens - tty11, tty12 24
5.15 shl(C) Notes 25
5.16 dtype(C) 25
5.17 Creating Boot and Root Floppies 25
5.18 ULIMIT 26
5.19 shutdown(C) and Shell Layers 26
5.20 Using backup(C) and restore(C) with floppies 26
5.21 Software Reboot 26
5.22 Using Altos 386 Binaries with XENIX 27
5.23 Large Model restore 27
5.24 Loading adb(CP) Without the Development System 28

6. Using DOS

6.1 DOS Utilities and /tmp files 28
6.2 format(C) and DOS 28
6.3 DOS/XENIX Coexistence 29

7. Using Communications and Networks

7.1 uucp(C) and cu(C) Notes 29
7.2 Using XENIX-NET 31

8. Using Printers

8.1 imprint(C) 31
8.2 parallel(HW) 31
8.3 lp(C) and lpr(C) 32
8.4 lpstat(C); -p Option 32
8.5 IMAGEN printers - 1ps(M) 32
8.6 Slow Parallel Printers 32

9. Using Hard Disks

9.1 Olivetti Computers and Hard Disks 35
9.2 Adding a 2.1 Hard Disk to 2.2 35

10. Using Keyboards

10.1 setkey(C) and console(HW) 37
10.2 Keyboard Lock-up 37

11. Using Video Display Hardware

11.1 Hercules Graphics Card Support 39
11.2 screen(HW) - HPA 40
11.3 screen(HW) - Control Modes 41
11.4 Display Adapter CMOS Note 41
11.5 mapchan(M) and mapscrn(M) 41

12. Using Tape Drives

12.1 The Irwin Tape Drive 42
12.2 Tape Support in XENIX 86 Release 2.2 44
12.3 Spurious Tape Driver Error Messages 44

13. Special Documentation Notes

13.1 Manual Page Permuted Indexes 44
13.2 Terminals (M) 44
13.3 Replacement Manual Pages 45

14. SVID Conformance Notes

A.1 Compatible Hardware

1.1 Using this Appendix A-2
1.2 General Compatibility Guidelines A-2
1.3 XENIX 286AT Operating System A-20
1.4 XENIX 386AT Operating System A-24
1.5 XENIX 286PS Operating System A-27
1.6 XENIX 386PS Operating System A-28
1.7 XENIX 286HP Operating System A-29
1.8 XENIX 286/386AT ESDI Operating System A-33
1.9 XENIX 6300+ Operating System A-48
1.10 XENIX 86XT Operating System A-50

- iii -
B.1 Common Questions and Answers
SCO XENIX System V
Operating System Release Notes

1. Preface 1
   1.1 Contents of the Distribution 3
   1.2 Packages In This Set 3
   1.3 Software Support 4

2. Notes About Installing Your Software 5
   2.1 Keeping Consistent Systems 7
   2.2 Memory Requirements 8
      2.2.1 vi(C) and vsh(C) 9
      2.2.2 Display Adapters 9
      2.2.3 Running Out of Swap Space 9
   2.3 Swap Space Allocation on 386 Machines 10
   2.4 80386 32-bit Multiply Bug 11
   2.5 Deciding Whether to Have a Separate /u Filesystem 12
   2.6 Installing terminfo(M) 14
   2.7 Installing on a Serial Console 14
   2.8 Include Files and Utilities 15
   2.9 Games Support 15
   2.10 Restoring Lost Files 15

3. Using Your System 16
   3.1 csh(C) - sh(C) Conflicts 16
   3.2 Using csh(C) Under Heavy Load 16
   3.3 vsh(C) 16
   3.4 shV(C) 17
   3.5 vi(C) 17
   3.6 mapkey(M) 17
   3.7 fname(M) 17
   3.8 Introduction to XENIX, “Listing Directory Contents” 17
   3.9 pack(C) 17
   3.10 crypt(C) 17
   3.11 cpio(C): -l Option 18
   3.12 sort(C): -u Option 18
   3.13 Using Raw Devices 18

XG-2-29-88-4.1.1/2.2.3  - i -  The Santa Cruz Operation
4. System Configuration and Link Kit Notes  18
   4.1 Buffer Overflow  18
      4.1.1 tty Buffer  18
      4.1.2 Function Key Buffer  19
   4.2 Using 286 Device Drivers on 386 Machines  19
   4.3 vmstat(C)  19
   4.4 master(F) Manual Page  19
   4.5 configure(C)  19
   4.6 uname(S)  20
   4.7 NOFILE - Number of Open Files  20

5. Administering Your System  21
   5.1 badtrk(C)  21
   5.2 Intel 387 Co-Processor Problems  21
   5.3 Using an NEC Businessmate or Powermate 286 in 10Mhz Mode  22
   5.4 Using an Intel Inboard in High Speed Mode  22
   5.5 autoboot(M) and System Console  22
   5.6 mkdev(C)  23
   5.7 termio(M) and stty(C)  23
   5.8 /etc/passwd Ownership  23
   5.9 fsck(C) and 386 Core Files  23
   5.10 Clockrate Adjustment  23
   5.11 swapctl(C)  24
   5.12 /etc/init  24
   5.13 /dev/tty[11,12,13,14]  24
   5.14 Additional Multiscreens - tty11, tty12  24
   5.15 shl(C) Notes  25
   5.16 dtye(C)  25
   5.17 Creating Boot and Root Floppies  25
   5.18 ULIMIT  26
   5.19 shutdown(C) and Shell Layers  26
   5.20 Using backup(C) and restore(C) with floppies  26
   5.21 Software Reboot  26
   5.22 Using Altos 386 Binaries with XENIX386  27
   5.23 Large Model restor  27
   5.24 Loading adb(CP) Without the Development System  28

6. Using DOS  28
   6.1 DOS Utilities and /tmp files  28
6.2 format(C) and DOS 28
6.3 DOS/XENIX Coexistence 29

7. Using Communications and Networks 29
7.1 uucp(C) and cu(C) Notes 29
   7.1.1 Autodialing 29
   7.1.2 Communicating with 3.0 XENIX Systems 30
   7.1.3 L-devices and L.sys 30
   7.1.4 Using Modems with XENIX 30
   7.1.5 Restriction in the USERFILE 30
   7.1.6 uuninstall(C) 31
7.2 Using XENIX-NET 31

8. Using Printers 31
8.1 imprint(CT) 31
8.2 parallel(HW) 31
8.3 lp(C) and lpr(C) 32
8.4 lpsat(C): -p Option 32
8.5 IMAGEN printers - ips(M) 32
8.6 Slow Parallel Printers 32
   8.6.1 Polling Operation 32
   8.6.2 Ignore Deselect Operation 33

9. Using Hard Disks 35
9.1 Olivetti Computers and Hard Disks 35
9.2 Adding a 2.1 Hard Disk to 2.2 35

10. Using Keyboards 37
10.1 setkey(C) and console(HW) 37
10.2 Keyboard Lock-up 37

11. Using Video Display Hardware 39
   11.1 Hercules Graphics Card Support 39
   11.2 screen(HW) - HPA 40
   11.3 screen(HW) - Control Modes 41
   11.4 Display Adapter CMOS Note 41
   11.5 mapchan(M) and mapscrn(M) 41

12. Using Tape Drives 42
   12.1 The Irwin Tape Drive 42
   12.2 Tape Support in XENIX 86 Release 2.2 44
Release Notes

12.3 Spurious Tape Driver Error Messages 44

13. Special Documentation Notes 44
   13.1 Manual Page Permuted Indexes 44
   13.2 Terminals (M) 44
   13.3 Replacement Manual Pages 45

14. SVID Conformance Notes 45
1. Preface

This document contains important information about the SCO XENIX System V Operating System Release 2.2:

- Installation Notes
- Software Notes
- Documentation Notes
- Compatible Hardware
- Common Questions and Answers
- Updated replacement manual pages.

These notes are organized into sections by topic. There is a section for notes about system installation, a section for system user's notes that should be read by every user on the system, a section of notes of interest to the System Administrator, and sections on using various tools and peripherals such as DOS, networks, printers, tape drives, hard disks, etc.
Release Notes

Note

Please read through the Notes About Installing Your Software section of these Release Notes before installing the XENIX System V Operating System. Also, please read the sections of these notes pertaining to any peripheral devices such as printers, tape drives or any other hardware you are installing.

Also, please note that certain hardware configuration information included in Appendix A of these notes may be required for successful XENIX installation. Please refer to those sections of Appendix A that apply to the hardware in your configuration if you have difficulty.

We are always pleased to hear of users' experiences with our product, and recommendations of how it can be made even more useful. All written suggestions are given serious consideration.

The manual pages fd(HW), diskp(C), dos(C), dtye(C), and mkdev(C) have been updated and replacement pages are included with these notes. Please replace the existing pages with these updated ones.
1.1 Contents of the Distribution

The XENIX System V Operating System Release 2.2 is distributed on the following 96tpi floppies:

- Volumes N1-N3 (N1-N2 on 286 machines)
- Volume B1
- Volumes X1-X3
- Games (Optional) - Volume 1

The XENIX System V Operating System Release 2.2 is also available on the following 48tpi floppies:

- Volumes N1-N7
- Volumes B1-B3
- Volumes X1-X10
- Games (Optional) - Volume 1

The XENIX System V Operating System Release 2.2 is also available on the following 135tpi 3.5 inch floppies:

- Volumes N1-N6
- Volumes B1-B2
- Volumes X1-X5
- Games (Optional) - Volume 1

The software is grouped into *packages* that are listed in the next section, “Packages In This Set.”

1.2 Packages In This Set

The XENIX System V Operating System software is grouped into *packages*. This makes customizing your system easier, since you can use the `custom(C)` utility to add or delete groups of programs that have related functions.

For example, if you do not want to use your system for communications, you would not install the UUCP package. If you install a package, then change your mind later, use `custom` to remove that package. `custom` can locate all the files that belong in a certain package and delete them, thus removing the package.
Release Notes

These are the packages in the XENIX System V Operating System: (the numbers are the approximate sizes of the individual packages in 512 byte blocks)

<table>
<thead>
<tr>
<th>Package</th>
<th>Size (in blocks)</th>
<th>Use/contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>13028</td>
<td>Entire Operating System set</td>
</tr>
<tr>
<td>RTS</td>
<td>3648</td>
<td>XENIX run time system</td>
</tr>
<tr>
<td>LINK</td>
<td>1686</td>
<td>The link kit</td>
</tr>
<tr>
<td>BACKUP</td>
<td>282</td>
<td>System backup and recovery tools</td>
</tr>
<tr>
<td>BASE</td>
<td>926</td>
<td>Basic extended utility set</td>
</tr>
<tr>
<td>CSH</td>
<td>106</td>
<td>The C-shell</td>
</tr>
<tr>
<td>DOS</td>
<td>346</td>
<td>DOS utilities</td>
</tr>
<tr>
<td>EX</td>
<td>336</td>
<td>The ex and vi editors</td>
</tr>
<tr>
<td>FILE</td>
<td>436</td>
<td>File manipulation tools</td>
</tr>
<tr>
<td>IMAGEN</td>
<td>272</td>
<td>Imagen Laser Printer Support</td>
</tr>
<tr>
<td>INITTAB</td>
<td>10</td>
<td>Terminal initialization</td>
</tr>
<tr>
<td>LPR</td>
<td>462</td>
<td>Multiple line printer spooler</td>
</tr>
<tr>
<td>MAIL</td>
<td>628</td>
<td>Electronic mail and local area networking</td>
</tr>
<tr>
<td>MAPCHAN</td>
<td>630</td>
<td>International character set mapping</td>
</tr>
<tr>
<td>PERM</td>
<td>52</td>
<td>XENIX contents and permissions lists</td>
</tr>
<tr>
<td>SYSADM</td>
<td>1024</td>
<td>System administration tools</td>
</tr>
<tr>
<td>TERMINF</td>
<td>440</td>
<td>Terminfo Database</td>
</tr>
<tr>
<td>UUCP</td>
<td>792</td>
<td>Uucp and cu communications utilities</td>
</tr>
<tr>
<td>VSH</td>
<td>256</td>
<td>The visual shell</td>
</tr>
</tbody>
</table>

1.3 Software Support

Software support is available to customers who purchased XENIX for use in the United States and Canada. If you purchased XENIX for use outside of the US or Canada, contact your distributor or retailer for support information.

Software support is described on an insert in the back of the XBNIX documentation.
2. Notes About Installing Your Software

Please refer to the *Installation Guide* in the binder marked "XENIX Operating System Run Time Environment" to install the XENIX System V Operating System. Chapter 2, "Installation Procedure," describes the actual installation steps.

If you have all three systems, (the XENIX Operating System, Development System and Text Processing System) you can use the XENIX *Installation Guide* to install them all at once. If you wish to install the Development System and/or the Text Processing System at a later time, refer to the *Release Notes* at the beginning of the appropriate guide (XENIX Programmer's Guide Volume I or XENIX Text Processing Guide). See also the manual page for `custom(C)`. With `custom` you can install all or portions of the XENIX System.

This installation is not an update, and it will overwrite the present contents of the hard disk drive 0. If you wish to update from an earlier release or version of XENIX, and you have not yet obtained an update, contact your sales/support center.

If you are upgrading your 286 AT to 2.2, you can continue to use a pre-2.2 XENIX filesystem on a second hard disk by following the instructions in the section "Adding a 2.1 Hard Disk to 2.2" later in these *Release Notes*.

Read the *Release Notes* and *Installation Guide* and make sure you completely understand the installation process before installing the product.

There are some specific points to be aware of before you start:

- Do not abort the installation process by using the `DEL` or `Ctrl-\` keys. If you need to stop because you enter incorrect information or for some other reason, press the computer "reset" button or power cycle your system and start the process again from the beginning rather than trying to proceed from the stopping point.

- Users upgrading their XENIX 3.0 system to XENIX System V should refer to Appendix A, "Upgrading Your System" in the *XENIX Installation Guide*. Users installing XENIX for the first time can ignore Appendix A of the *Installation

- XENIX and DOS must boot from the physical drive 0 (hard disk or diskette). Keep this in mind when planning for extra hardware.

- XENIX installs with a minimum of screen prompts and typing, and is set up with ample defaults for most uses and sites. However, you can customize the operating system during installation to meet a wide variety of needs.

If you know that you need to customize your installation, go over this next list and decide if any of the items apply to you. If they do, read any suggested sections and make sure you understand the procedures involved before installing XENIX:

- Install all or only parts of the operating system.
  This is described during the installation process, but the section of these Notes "Contents of the Distribution" can help you decide what software you need, and what software you may not need.

- Create additional filesystems, besides the root.
  This is described in Chapter 2 of the Installation Guide, "Installation Procedure" and in the section "Deciding Whether to Have a Separate /u Filesystem" later in these Notes.

- Add a second hard disk that contains filesystems created under XENIX 2.1.
You can continue to use the filesystems on a second hard disk that you created under XENIX 2.1 or later.

Do not install XENIX 2.2 right away. Instead, you should read the subsequent section of these Release Notes "Adding a 2.1 Hard Disk to 2.2" before installing XENIX.

If you intend to preserve and use 2.1 filesystems on drive 0 after installing 2.2, you must obtain the 2.1 to 2.2 update from your sales/support center. The XENIX 2.2 installation will completely replace a 2.1 installation on drive 0.

- Set up your hard disk to accommodate other operating systems, such as DOS.

This is discussed in Chapter 2 and Chapter 3 of the Installation Guide, "Installation Procedure" and "Using DOS and XENIX on the Same Disk."

As stated before, most users and sites do not need to extensively customize their installations since the defaults satisfy most requirements. If you need to customize your installation, though, make sure you have a clear idea of what you want before you start the actual installation process.

- If you plan to use DOS and XENIX on the same hard disk, install DOS first, then install XENIX. This is not required by XENIX but by some versions of DOS.

2.1 Keeping Consistent Systems

We do not recommend using mismatched portions of XENIX Releases. For example, we do not recommend installing a 2.2.2 Link Kit on a 2.2.1 XENIX Operating System. Note that you can use different releases of different systems, for example a 2.2.2 Operating System with a 2.2.0 Development System. This warning only applies to mismatched releases of the same system.

This warning applies to both the Operating System and the Development System.
Release Notes

To make sure that all of the pieces of the XENIX System work together properly, either reinstall a new release over a previous one, or use standard update software available from your dealer. Any other approach may cause system errors and other problems.

Information on performing updates is furnished with the appropriate update software. Also, general information on upgrading your system to a new release is described in Appendix A, "Upgrading Your System" in the XENIX Installation Guide.

2.2 Memory Requirements

Please use the following table to determine the amount of memory you need to run the XENIX System V Operating System and Development System:

<table>
<thead>
<tr>
<th>System</th>
<th>Requirements</th>
</tr>
</thead>
</table>
| XENIX 86/286 Operating System | minimum: 512K  
recommended: 640K  
multiuser: 1-2MB, or  
more for optimum performance |
| XENIX 386 Operating System  | minimum: 1MB  
recommended: 2MB  
multiuser: 2MB or  
more for optimum performance |
| XENIX 86/286 Development System | minimum: 640K  
recommended: 1MB |
| XENIX 386 Development System | minimum: 1MB  
recommended: 2MB |

When you invoke a utility that needs more memory than is available, the message "Killed" or "too big" displays on your screen.
Note

"Hidden" Memory on 386 Machines

Certain manufacturers reserve memory, such as the upper 384K of the first megabyte of memory, for DOS. On some machines, XENIX cannot access this “shadow” RAM. One megabyte of “visible” RAM is required in order to install the Operating System. Should the upper RAM be inaccessible on your machine, you will have to install additional memory to compensate for this loss. If you install a second megabyte of RAM in this example, you would have 1.6 megabytes of usable memory.

2.2.1 vi(C) and vsh(C)

vi(C) and vsh(C) are not supported for 8086 or 80286 machines with 512 Kilobytes(K) or less of main memory. If you have only 512K of main memory installed, use of any medium model program may severely impair system performance.

2.2.2 Display Adapters

If you have two display adapters on a machine running with less than 640K of RAM, you see the following message at boot time:

Insufficient memory for second display adapter

In that case, the second adapter is not used by the XENIX System V Operating System.

2.2.3 Running Out of Swap Space

On 286 machines, running out of swap space causes an immediate panic and total system halt. On 386 machines, the system can recover. If you see the kernel warning: “out of swap” on a 386 machine, you must kill some processes quickly. A 386 machine will panic and halt if it runs out of both memory and swap space. Refer to “Killing a Process” in Chapter 4 of Introduction to XENIX for instructions.
Release Notes

Be sure to allocate plenty of swap space during installation, as the only way to add more swap space is to reinstall.

2.3 Swap Space Allocation on 386 Machines

The virtual memory feature of 386 machines allows the maximum size of a user process to be much larger than physical memory. The default formula for this release is that “a process may occupy all of user memory plus 30 percent of the swap area.” You can alter these limits with configure(C) by changing the parameters MEMLIM and SWPLIM, which have default values of 100 and 30, respectively.

The maximum user process size is displayed at boot time. If you intend to run very large applications, you should allocate swap space according to the formula below. For typical multiuser operation, other considerations apply.

Ideally, all processes should fit in memory. For best results, swap space should be at least as large as memory. If it is smaller, you may occasionally see the message: “warning: out of swap”. This is a warning, not a panic. It means that the paging mechanism is not operating efficiently due to lack of swap space.

To calculate multiuser swap size (286 or 386):

1. Multiply the number of users on the machine by the size of the largest process normally run on the machine, in K bytes. If no unusual processes apply, use 512K.

2. Take the amount of memory installed in your machine and add the figure 256K. Compare this result with the result from step 1. Use whichever number is larger as your multiuser swap size.

3. Adjust this number upward a bit if multiple users are running different large applications. (Try adding 512K per different large application.)

For example, for an 8-user machine with 4Mb of memory and a typical departmental computing mix of a spreadsheet, database, word processor, and graphics package:
1. 8 users x 512K = 4096K.

2. 4096K memory installed + 256K = 4352K, which is greater than the number above.

3. Add 4 x 512K, which yields a swap space allocation of 6400K.

2.4 80386 32-bit Multiply Bug

There is a serious, but not immediately apparent problem that affects some 386 CPU chips. Although the computer and operating system appear to function normally, this hardware problem can cause damage to data and programs.

According to Intel, the microprocessor may incorrectly multiply very large numbers during 32-bit operations. The hardware fix requires a new CPU chip or motherboard.

The kernel will not boot if it detects this hardware error, and this message is displayed:

**HARDWARE FAILURE:**

386 incorrectly multiplies 32 bit numbers

In addition, the system will *panic*. At your own risk, you may override this protection mechanism by adding the keyword *mulbug* to the boot line:

```
Boot:
: xenix mulbug
```

We do NOT recommend using a machine with this hardware problem and systems with this hardware problem are not supported.

80386 chips marked "16 bit only" might not present the multiply bug but might also fail with XENIX 386. Chips marked "Σ Σ" have been tested by Intel to function correctly.

For more information about this problem, refer to the "Administering Your System" section of these *Release Notes*.
2.5 Deciding Whether to Have a Separate /u Filesystem

If you install XENIX on a hard disk that is larger than 20 Mb, you may be prompted to decide if you wish to divide the XENIX partition into two filesystems. Traditionally, the second filesystem is called /u, although you can name it anything you like, and it is typically used for user accounts and files. Throughout these Release Notes the second filesystem is referred to as /u.

Note that any figures given are rough guidelines, since XENIX installations vary widely depending upon their use.

The advantages to having more than one filesystem are:

- It can make system backups easier.
- It is faster to clean smaller filesystems (using fsck(C)).
- Your system is easier to manage.

The only disadvantage is that once you make the division it is time consuming to change the size of each of the filesystems. If you discover that you have made a filesystem too small, or that you no longer want multiple filesystems, you must backup your entire XENIX partition, change the filesystems with the divvy(C) utility, then restore the entire system from the backups.

If you have a large hard disk, it might be a good idea to create a /u filesystem if:

- You are running a typical multiuser system where user files change often but system files remain fairly static.

Most users create and modify files in their home accounts frequently and as a result, user accounts must be backed up often. However, once XENIX and your applications are installed, most of the utilities and system files remain unchanged, or do not change as often. Thus, it can make sense to put all the user accounts together on a separate filesystem.

If you have a separate /u filesystem, less media (e.g. fewer floppies, fewer tapes, smaller tape size, etc.) is required to make backups because you can tailor your backup schedule.
more closely to your system needs.

- There is more than 10 Mb left on the root filesystem after you account for all of the system utilities and applications you plan to install.

The exact amount of extra room you should allow varies depending upon what the system is used for and what applications you plan to install. While some applications programs can be installed on any file system, others might not be so flexible.

You should leave the XENIX system files in the relative locations in which they are installed. Be sure to leave enough space on your root filesystem for the system's temporary directory /tmp. Many XENIX programs and applications use this directory for temporary storage, so, depending upon the number of users you have and how active they are, the amount of temporary space you need can vary. A comfortable margin is half a megabyte for each user who will be logged in at any time. Add more to this figure depending upon how many of those users are likely to use large databases, edit large files, or work on software development.

Databases that are maintained on the root filesystem can grow very large. If you plan to use a database, allow extra room to store them.

Finally, you should allow several megabytes of room "just in case." Systems always grow, so plan for that growth.

Check the section "Packages In The Distribution" in these Release Notes to see how much room is required for the entire Operating System and how much for individual parts. Disk space requirements are usually furnished with most applications.

- There is adequate room on the /u filesystem.

Allow a minimum of 1.5 - 2 Mb disk space per user on the /u file system. If you have a database that uses home accounts for file storage, more room is required, depending upon the
number of people who will use the database, and how large
the files typically become.

- If your disk is so large that it would be difficult to manage as
  a single file system.

If your system is equipped with a very large disk, such as an
80 Mb or larger disk with most or all of it used for XENIX, it
may become difficult to manage. The larger the disk, the
more media is required to perform system backups, and the
longer that process takes. Also, cleaning the filesystem
after crashes takes longer with large filesystems. Finally,
maintaining enough free space on the filesystem takes more
work with very large disks.

We do not recommend a separate filesystem if:

- Your system is a runtime system, with a dedicated
  application or with little user file storage.

- The root filesystem cannot be kept large enough to maintain
  10-20% of its size as free space.

2.6 Installing terminfo (M)

If you choose to install terminfo, which is in the TERMINF package,
you see some messages that describe the installation process. You
are prompted as to whether you want the terminfo database
compiled at this time (a lengthy process). If you choose to defer this
to a later time, you are given instructions for doing so.

2.7 Installing on a Serial Console

If you are installing the XENIX System V Operating System on a
system that does not have a video display adapter, and you are using a
serial console, you will see this message:

    No display adapter present

This is a normal part of the installation.
2.8 Include Files and Utilities

Machine dependent Development System include files and utilities are included on the XENIX System V Operating System N Volumes. If you do not install the Link Kit package or the XENIX System V Development System set, you may not be prompted to extract any files off some of the N volumes.

2.9 Games Support

Games are supplied, as is, for your pleasure and enjoyment. They are not supported. On line documentation is supplied for some of the games in the directory /usr/games/doc. Use custom(C) to install the Games floppy:

1. Enter custom.

2. Select the option to “Add a Supported Product.”

3. Insert Games Volume 1 when prompted, then follow the screen prompts as they appear.

Refer to the custom(C) manual page in the XENIX Reference for more information on installing all or parts of a package.

Note

/usr/games/doc/rogue contains control characters on line 20 that may affect terminals or printers when this file is displayed or printed. Edit the file to remove the characters if they cause a problem.

2.10 Restoring Lost Files

If you accidentally erase one or more of the files included with the distribution after you have installed the XENIX System V Operating System, you can use custom(C) to restore the file, or files. The custom(C) utility can list, install, or remove individual files, sets within the XENIX System packages, or entire packages of the XENIX
System V complete system.

Refer to custom(C) in the XENIX Reference for information on using custom. You cannot use custom to restore any special modifications you made to a file between the time when you first installed it and the time when the file is lost. It is wise to perform regular backups of your system to prevent such losses.

3. Using Your System

3.1 csh(C) - sh(C) Conflicts

The C-shell, csh(C), has many built-in commands with the same name and functionality, but different syntax, than those used by the sh(C) shell. The sh(C) commands are those documented in the XENIX Reference. An example of two commands that exhibit this behavior are echo and nice. Refer to the manual page csh(C) for information on built-in C-shell commands.

An /etc/cshrc file is included with this release. You can customize the C-shell environment for all csh(C) users by using this file, which is similar to /etc/profile for sh(C) users.

3.2 Using csh(C) Under Heavy Load

During intervals of heavy system load on a 386 machine, repeatedly pressing the delete key while at a C-shell prompt (%) may cause the shell to exit. If csh is the login shell, the user is logged out.

3.3 vsh(C)

The visual shell, vsh(C), does not currently support the use of special characters when specifying file names. The use of these special characters (*, [I], [J], and ?) is explained in the chapter “Basic Concepts” in the Introduction to XENIX.

vsh(C) resets the switch character. It is not possible to switch to the session manager, shl(C), while running vsh. However, switching from vi(C) or sysadmsh(C) works. Note however, that the default switch character (control-Z) is a command to sysadmsh, so you may experience difficulty in running sysadmsh under shell layers.

In addition, it is necessary to run vsh as superuser and select “help” in order to initialize the help files.
3.4 shV(C)

If the shV(C) manual page is present, remove it from your User's Reference. The functionality of shV has been merged with sh(C).

3.5 vi(C)

On page 10 of the vi(C) man page, the page and scroll command descriptions are reversed.

3.6 mapkey(M)

The following list of files replaces the list on the current mapkey(M) manual page:

<table>
<thead>
<tr>
<th>keys</th>
<th>keys.chw</th>
<th>keys.fra</th>
</tr>
</thead>
<tbody>
<tr>
<td>keys.ger</td>
<td>keys.ita</td>
<td>keys.nor</td>
</tr>
<tr>
<td>keys.spa</td>
<td>keys.swe</td>
<td>keys.ukd</td>
</tr>
<tr>
<td>keys.usa</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.7 fsname(M)

The "Syntax" line of the fsname(M) manual page is incomplete. It should read:

```
fsname [-p] [-s name] /dev/device
```

3.8 Introduction to XENIX, "Listing Directory Contents"

On page 4–13, the explanation of the -F option of lc(C) is incorrect. "...with a backslash (\)" should read "...with a slash (/)."

3.9 pack(C)

The description of the "-" option on the pack(C) manual page is incorrect. It should read: "If the - argument is used, an internal flag is set that causes packing statistics to be printed on the standard output."

3.10 crypt(C)

The crypt(C) command is not distributed with the XENIX System V Operating System. If you want the crypt(C) utility and associated crypt(S) libraries, and you live in the United States, contact the support center listed on the support information card included with the software.
3.11 epio(C): -l Option

The -l flag is intended to link files wherever possible. If the link cannot be done, (e.g. the file already exists) the command will abort.

3.12 sort(C): -u Option

Using the -u option can result in random meaningless characters at the end of the sorted file.

3.13 Using Raw Devices

When using dd(C) or tar(C) with a raw device, specify the block size as a multiple of 1K, which is equivalent to 2 "b." This is recommended because dd(C) and tar(C) use 512 byte blocks while the XENIX filesystem uses 1024 byte blocks. For example, for dd (C) using a 9K (system) block size use:

    dd if=-/dev/rfd0 bs=18b conv=sync

You could also use:

    dd if=-/dev/rfd0 bs=9k conv=sync

Specify an even blocking factor with tar(C):

    tar cvfb /dev/rfd0 18 file

You can also use the default tar settings. (See tar(C) in the XENIX Reference).

4. System Configuration and Link Kit Notes

4.1 Buffer Overflow

4.1.1 tty Buffer

The XENIX kernel buffers for unread tty input hold up to 256 characters. Overflow of a buffer causes it to be flushed and the 257th character is not echoed. If this 257th character is dropped during the output of an escape sequence, the output of that sequence is other than expected.

For example, if a function key is programmed to send "[154g" and the function key is held down so that the output of this string on the screen repeats, the 257th string character, "4", is dropped and the string interpreted would instead be "[15g" that one time.
4.1.2 Function Key Buffer

If setkey(C) is used to assign more than 512 characters to function key strings, the character buffer limit in the function key buffer is overflowed. The arrow keys are the first to stop working. To reduce unnecessary character assignments, remove the characters within quotes in the file /usr/lib/keyboard/strings. Use the mapstr utility (see mapkey(M)) to make the string changes. Once the buffer has overflowed, you must reboot the system to reestablish the integrity of the system (i.e. invoking mapstr will not make the arrow keys work again).

4.2 Using 286 Device Drivers on 386 Machines

New vendor supplied device drivers are required for XENIX 386. 86 and 286 device drivers will not link into the 386 kernel. All the device drivers included in the XENIX 286 Operating System are included in the XENIX 386 Operating System. Third party supplied drivers must at least be recompiled to work with the 386 kernel. Contact the IHV/ISV who supplied you with the 286 device driver and direct them to your Support center so that we can help them support their device in the 386 kernel.

4.3 vmstat(C)

The command vmstat(C) has been added on 386 systems only. vmstat reports system statistics on processes, demand paging, plus cpu and trap activity. The vmstat manual page is distributed in the set of updated documentation included with these Release Notes. Place it in the correct section of the XENIX Reference.

4.4 master(F) Manual Page

The master(F) manual page states that the 000200 line in field 3 is "Not used." The manual page should state that 000200 is used for the Halt routine.

4.5 configure(C)

configure has three additional options as described here:

- j prefix prints out the major device number for the driver using prefix.
-j NEXTMAJOR prints out the smallest available major device number.

-r forces a rewrite of the configuration files whether or not the command changed the configuration.

4.6 uname(S)

No XENIX utilities currently use the node name in the `uname` structure. XENIX utilities use the entry in `/etc/systemid`. However, some sites may want to set the node name in the `uname` structure. The node name can be up to 9 characters long. You can set the node name by using the Link Kit to relink a new XENIX kernel. Refer to Chapter 4 of the XENIX Installation Guide "Using the Link Kit".

To create the node entry in the `uname` structure, first install the Link Kit with `custom(C)`, then:

```
# cd /usr/sys/conf
# ./configure
select "System Name"
enter name
quit from configure
# ./link_xenix
# mv xenix /xenix.new
reboot specifying xenix.new
# uname -a
verify node name appears as desired
# mv /xenix.new /xenix
reboot as usual
```

4.7 NOFILE - Number of Open Files

The XENIX System V Operating System Release 2.2 kernel allows up to 60 open files per process, rather than the previous limit of 20 open files. Note that this increase is in the kernel limit only, and that standard I/O routines other than those in the XENIX System V Development System Release 2.2 have the previous limit. The `open(S)` system call has the new limit of 60 since it depends only on the kernel.

You may have to reconfigure your kernel to increase certain parameters if you use programs that take advantage of this increased
limit. For example, you may have to increase NINODES to raise the
limit to the number of inodes open on the system at one time. See
configure(C).

Use the Link Kit to raise any required limits. See Chapter 4 of the
Installation Guide, "Using The Link Kit."

5. Administering Your System

5.1 badtrk(C)

If you run badtrk(C) on a disk that contains existing XENIX
filesystems, (such as during a XENIX reinstallation) you may see an
extra prompt before you see the badtrk(C) main menu. The message
you see reads as follows:

This device contains a valid division table. Additional (non-root)
filesystems can be preserved across this reinstallation.

If you wish to be able to preserve these file systems later,
you must not change the current limit of the bad track table, which
is number bad tracks. Do you wish to leave it unchanged? <y/n>:

If you elect to leave the limit of the bad track table unchanged, you
are not prompted to change the number of reserved replacement
tracks during this process. If you wish to change the number of
replacement tracks, you cannot preserve existing file systems.

5.2 Intel 387 Co-Processor Problems

Because of manufacturing defects, some Intel 387 math co-
processors will not operate correctly under XENIX-386. If your
processor does not operate correctly, you have several options. You
may remove the 387 chip and replace it with one that is known to
work correctly, you may remove it and elect not to replace it, or you
may bypass the chip by adding the ignorefpu keyword in your boot
command as follows:

Boot
:xenix ignorefpu

To automatically bypass the 387 chip every time you boot your
system, add the ignorefpu keyword to the /etc/default/boot file. See
boot(HW) for more information.
5.3 Using an NEC Businessmate or Powermate 286 in 10Mhz Mode

The default power-up cpu speed of the NEC Businessmate and Powermate computers is 8MHz. To use the 10MHz cpu speed of these machines, add the keyword nec10mhz to the boot command as follows:

```
Boot
:xenix nec10mhz
```

To automatically use the 10MHz speed every time you boot your system, add the nec10mhz keyword to the `/etc/default/boot` file. See `boot(HW)` for more information.

5.4 Using an Intel Inboard in High Speed Mode

The Intel Inboard is a plug-in card for a 286 AT that replaces the 286 cpu with a 386 cpu. To utilize the high-speed, cache mode of the Intel Inboard, add the keyword inboard to the boot line:

```
Boot
:xenix inboard
```

To automatically use this mode of the inboard every time you boot the system, add the "inboard" keyword to the `/etc/default/boot` file. See `boot(HW)` for more information.

5.5 autoboot(M) and System Console

The text describing the SYSTTY=x entry for `/etc/default/boot` is incorrect and should read:

```
SYSTTY=x
```

If x is zero (0), the system console device is set to the main display adapter. If x is one (1), the system console is set to the serial adapter at COM1.

Note that the serial console must be on a standard COM1 card, not a multiport card or one that requires the installation of special drivers.
5.6 mkdev(C)

In the first paragraph of the “Description” section of the `mkdev(C)` manual page, the sentence: “`mkdev` may call `lpinit(C), hdinit, serinit, fdinit, fsinit, tapeinit, ominit, or shlnit`” should read: “`mkdev` may call `lpinit(C), or any script in the directory `/usr/lib/mkdev`.”

5.7 termio(M) and stty(C)

There are two new extensions to the `c_cflag` field which is documented on the `termio(M)` manual page:

- `CTSFLOW` 0020000
- `RTSFLOW` 0040000

`CTSFLOW` and `RTSFLOW` enable CTS/RTS flow control. You should also set `-ixon` and `-ixany` so that these two types of flow control do not interfere with each other.

On the `stty(C)` manual page, the following two `stty` settings should have been included in the list of “Common Control Modes”:

- `ctsfow (-ctsfow)`
  Enables CTS protocol for a modem line.

- `rtsflow (-rtsflow)`
  Enables RTS signaling for a modem line.

5.8 /etc/passwd Ownership

The ownership of `/etc/passwd` file is set to the group ID of the last user to change their password.

5.9 fsck(C) and 386 Core Files

If there are 386 core files present when fsck is run, the message “POSSIBLE FILESIZE ERROR” is displayed. This is normal and should be ignored.

5.10 Clockrate Adjustment

If you have an AT&T 6300, you may need to reset your clockrate, since these computers operate at a different frequency than the default setting.

You can check the accuracy of your clock rate using the `date(C)` command over a period of days. If the system clock gains or loses time excessively, refer to the manual page `clockrate(HW)` for
information on setting the clock rate.

The correct clock rate for an AT&T 6300 is 1.22878.

5.11 swapctl(C)

The `swapctl` utility listed in Contents and Indexes in the XENIX User's Reference is not supported in this release and there is no `swapctl` page.

5.12 /etc/init

`/etc/init` can only be executed by the kernel as process 1. It cannot be invoked from a shell prompt.

For information on changing init states, see `disable(C)`, `enable(C)`, and `init(M)`. Another method of changing init states is provided in release 2.2 by `telinit(C)`. See `telinit(C)` in the XENIX Reference for more information.

`init2tab(M)` is provided for users more familiar with the `telinit` approach to terminal administration, as opposed to the standard XENIX `enable(C)` and `disable(C)` approach. It is intended that a full integration of these two approaches will be provided in a future version of XENIX.

5.13 /dev/tty[11,12,13,14]

Serial lines `/dev/tty11`, `/dev/tty12`, `/dev/tty13`, and `/dev/tty14` are no longer linked to the serial I/O devices `/dev/tty1a`, `/dev/tty1A`, `/dev/tty2a`, and `/dev/tty2A` respectively. These links were maintained for backwards compatibility with `uuep(C)` and shell scripts. Please note that if you use older versions of `uuep(C)`, you may have to alter certain files because of this change.

`/dev/tty11` and `/dev/tty12` are now multiscrren. The next section describes these new multiscrren.

5.14 Additional Multiscrren - tty11, tty12

The maximum number of multiscrren has been increased to twelve. If your system has enough memory, it is automatically configured for up to twelve multiscrren. You can also reconfigure the system with the Link Kit as described in Chapter 4 of the XENIX Installation Guide, “Using The Link Kit.”
You can use these new multiscreens just like the other ten if your keyboard has the additional function keys F11 and F12, and they are compatible with the standard enhanced keyboard F11 and F12. If you have fewer function keys than the number of multiscreens enabled, or a "non-compatible" keyboard, you can access the other screens by stepping past the last multiscreen with the Ctrl-PrtScr key.

For example, if your keyboard has ten function keys, but you have twelve multiscreens enabled, you can access the eleventh and twelfth screens by first going to the tenth screen, by pressing Alt-F10, then pressing Ctrl-PrtScr to step to the eleventh screen. If you press Ctrl-PrtScr again, you can access the twelfth screen, and if you press it once more, you are back to the first screen.

For general information on multiscreens, see multiscreen(M) in the XENIX Reference.

5.15 shl(C) Notes

If you have problems with shell layers, shl(C), on some terminals, but not on others, or shl works on your console, but not on another terminal, you may have to set istrip for that terminal line:

```
stty istrip
```

XENIX 286 and XENIX 386 are initially configured for one shell layer session at a time. This means that XENIX defaults to allow only one user to access shell layers. You can use mkdev shl to change this single session limit. The script will prompt for the number of sessions desired and will relink the kernel. The new limits will become effective after rebooting, as the script instructs.

5.16 dtype(C)

The dtype(C) utility reports incorrect filesystem versions (e.g., System 3.x versus System V).

5.17 Creating Boot and Root Floppies

You can now create boot and root floppies with the mkdev(C) utility. To do this, use the following command:

```
mkdev fd
```
You can create bootable or root file system floppies with 48tpi drives. With 96tpi 5.25 inch and 3.5inch 720KB drives, you can create combined boot/root floppies.

5.18 ULIMIT

The default ULIMIT has been raised for the XENIX System V Operating System Release 2.2. It is now 2,097,152 blocks (1 gigabyte).

5.19 shutdown(C) and Shell Layers

shutdown(C) does not work if ps and who am I do not report the same tty name, for example from within shell layers (shl(C)). Do not run shutdown(C) from within shell layers.

5.20 Using backup(C) and restore(C) with floppies

If the default archive medium specified in /etc/default/backup or /etc/default/restore is block structured, (i.e. floppy disk) then the volume size in Kbytes must be specified on the command line. Neither utility works correctly without this information. For example, using the default device (below) with the backup command, enter the following:

backup k 360

The default device entry for /etc/default/backup (tape=/dev/xxx) and /etc/default/restore (archive=/dev/xxx) is /dev/rfd0 in your distribution.

5.21 Software Reboot

The XENIX System V Operating System Release 2.2 allows software rebooting, so you do not need to power off to reboot. The following message is displayed after a system shutdown (using shutdown(C) or haltsys(C)):

** Safe to Power Off **
--or--
** Hit Any Key to Reboot **

Fixed disk heads are “parked” (locked) when this message is displayed.
A new command, `reboot`, causes the system to automatically reboot after shutting down, without waiting for any keyboard input.

**Note**

Note that not all hardware supports this software reboot. Some machines must be powered off and on again for all the device controllers to be properly initialized.

**Note**

When the floppy drive door is closed, the computer attempts to boot from a floppy. The floppy drive door must be open to boot off the hard disk.

### 5.22 Using Altos 386 Binaries with XENIX 386

Altos XENIX 386 binaries are *not* compatible with SCO XENIX 386. This is because Altos did not use the latest compiler from Microsoft, and they do not use the same system call interface that has been adopted to ensure binary compatibility with future versions of XENIX. In most cases the binaries run but there are situations where alignment of structures and system call arguments are not the same between Altos XENIX 386 and all other XENIX 386 systems. Altos plans to correct this problem.

### 5.23 Large Model `restor`

A large model version of `restor(C)`, `restorL`, is now included for 286 machines as part of the BACKUP package. This allows the use of the `X` key option of the `restor` command, which enables operations on large directory trees without running out of memory. The `restorL` utility is a 286-specific command; 8086 and 80386 machines should use `restor` only.
5.24 Loading adb(CP) Without the Development System

adbL (for the 286) and adb (for the 386) are provided as part of the Operating System distribution in order to apply kernel patches as described in “Keyboard Lockup.” To load adb or adbL on your system, insert the N1 floppy into your drive and enter the following commands (substitute adb for adbL if your machine is a 386):

```
# mount -r /dev/fd096 /mnt
# cp /mnt/bin/adbL /bin
# umount /dev/fd096
```

If your system is an IBM PS/2 (286 or 386), adb is distributed on the N4 floppy in tar format. To load adb on a PS/2 system, insert the N4 floppy into your drive and enter the following commands:

```
# cd /
# tar x ./*bin/adb*
```

Please note that adb and adbL are not supported for general programming and debugging unless you have purchased the Development System.

6. Using DOS

6.1 DOS Utilities and /tmp files

All DOS utilities leave temporary files in /tmp, regardless of whether or not the utility executed successfully. These files are removed at the next reboot.

6.2 format(C) and DOS

The format(C) command is a low-level formatter for XENIX, and does not format floppies for use under DOS. To format DOS floppies, use the dosformat command. See dos(C) in the XENIX Reference.

Note that neither format nor dosformat can be used to format the hard disk.

The XENIX System V Operating System requires error-free floppy disks.

XG-2-29-88-4.1.1/2.2.3 - 28 - The Santa Cruz Operation
6.3 DOS/XENIX Coexistence

The XENIX System V Operating System supports the coexistence of MS\textsuperscript{TM}-DOS and XENIX on the same hard disk. Some versions of DOS have restrictions, for example, ITT DOS releases previous to 3.10 cannot share the disk with XENIX or MS-DOS. For these releases, XENIX must occupy the whole disk.

As another example, an ITT MS-DOS+ release 3.20 hard disk partition should not be made larger than 32 Mbytes. Activating a larger partition will corrupt the MS-DOS+ ending cylinder. XENIX \texttt{dos(C)} commands may not work when accessing an ITT MS-DOS+ release 3.20 hard disk partition that is 32 Mbytes or larger.

Likewise, some versions of NCR DOS only recognizes 32MB partitions, you see the message “No operating system on fixed disk” when attempting to boot a DOS partition larger than 32MB.

Some versions of DOS (for example, Olivetti DOS) put the boot block in track 0 very close to the end of the masterboot block when installed starting in cylinder 0. If you have a problem with the DOS partition not being accessible after installation, start the DOS partition on cylinder 1 instead of cylinder 0.

Whenever you use DOS and XENIX on the same disk, if in doubt, install DOS first, then install XENIX.

7. Using Communications and Networks

7.1 \texttt{uucp(C) and cu(C) Notes}

This section answers questions you may have about \texttt{uucp(C) and cu(C). The installation of the uucp programs and utilities is optional. Refer to the chapter “Building a Micnet Network” in the XENIX Operations Guide and the chapter on “Building a Communications System” in the XENIX User’s Guide. Also refer to \texttt{custom(C)} to install (or remove) communications files.

7.1.1 Autodialing

In addition to the program on the \texttt{dial(M)} manual page, 
\texttt{/usr/lib/uucp/dial.c}, the C language program for the distributed 
\texttt{/usr/lib/uucp/dial} is included in this release. You can copy and modify \texttt{dial.c} or you can use this as an example to write programs to use other kinds of modems. The makefile distributed in
Release Notes

`/usr/lib/uucp` should be modified to reflect your own dialer program. You must have the XENIX Development System in order to compile C programs. Dial programs cannot be shell scripts.

If you create a `dial` program for another modem, please send us the source. User-written `dial` programs will be considered for inclusion in future releases.

**7.1.2 Communicating with 3.0 XENIX Systems**

If you have trouble connecting to a computer running XENIX System 3.0 with `uuep(C)`, try making that system “active” and the computer running XENIX System V the “slave”.

**7.1.3 L-devices and L.sys**

We recommend running `uuep(C)` direct connections at 2400 or 4800 baud so that the system’s performance is not impaired. These baud rates are specified in the files `/usr/lib/uucp/L-devices` and `/usr/lib/uucp/L.sys`. This can be done by specifying the `dialer program` instead of the `call unit device features`.

Do not use tabs as field separators in the `L.sys` file.

**7.1.4 Using Modems with XENIX**

Refer to the XENIX Operations Guide chapter “Using Peripheral Devices” for information on modem settings, modem control, aliasing alphabetic characters and dialing with your computer.

**7.1.5 Restriction in the USERFILE**

`USERFILE` used in this release must start with the line:

```
uucp, /
```

followed by at least one other line.

Because the `uucp` login can be accessed by many users, some of whom may be undesirable, you should not use “`uucp`” as the `uucp` account. To ensure proper security, create a different account with `uucico` as its login shell. Many systems use the `uumachine_name` convention as the user login, where `machine_name` represents the system’s machine name.
7.1.6 uuninstall(C)

uuninstall(C) may not allow certain features such as variable baud rate to be configured. Note that the L.sys and L-devices files may have to be edited with a text editor to use new features.

7.2 Using XENIX-NET

On 286 machines, you cannot use versions of XENIX-NET previous to 1.1.1 with the XENIX System V Operating System Release 2.2. On 386 machines you must have XENIX-NET 1.2.0.

8. Using Printers

8.1 imprint(CT)

References to imprint(CT) are incorrect. The imprint command is in the (C) commands group.

8.2 parallel(HW)

The parallel man page currently indicates that some machines allow the use of two parallel devices, "/dev/lp0 and either /dev/lp1 or /dev/lp2." This is only half-correct, as the devices available vary from machine to machine, and may instead allow "either /dev/lp0 or /dev/lp1 and /dev/lp2." Check the boot message for the devices recognized on your system.

The parallel page also includes the stty command:

    stty eol "\"J" < /dev/lp0

This should read:

    stty time 10 < /dev/lp0

In addition, when given from a prompt, this command will only work if the port is open. It is recommended that a variation of this command be placed in the interface script used with the parallel device to achieve the same results:

    stty time 10 0 < &1
8.3 \texttt{lp(C) and lpr(C)}

\texttt{lp(C) and lpr(C)} will only print files that are publically readable, even when printed by the file’s owner. The file’s directory and all directories in the path must also be publically readable. The following are two possible workarounds:

\begin{verbatim}
pr filename | lpr
\end{verbatim}

\begin{verbatim}
cat filename | lpr
\end{verbatim}

8.4 \texttt{lpstat(C): -p Option}

The command \texttt{lpstat -p list} fails to display status of printers.

8.5 \texttt{IMAGEN printers - ips(M)}

When using an IMAGEN printer in parallel printer mode (using \texttt{lpbs}, see \texttt{ips(M)}) you must specify the quote character as hex 2 (0x02 or control-b) and the EOF character as hex 4 (0x04 or control-d). Control characters must be “taken as is”. Refer to the IMAGEN system manuals provided with the printer, for information on specifying these characters in the printer configuration.

8.6 \texttt{Slow Parallel Printers}

If you have a parallel printer that prints abnormally slow, check your configuration according to the procedure described in Appendix B: “Common Installation/Configuration Questions and Answers.” If it still prints slowly, there are two options for adapting the driver to suit your printer: “Polling Operation” and “Ignore Deselect Operation.”

8.6.1 Polling Operation

If your printer is slow, the parallel port hardware may be missing interrupts. A solution is to alter the way that the hardware and the printer driver communicate. The parallel printer driver can be made to “poll” a parallel port. This way the driver does not rely on interrupts from the parallel port, but this may cause a drain on system resources.

To set up polling for a parallel port/parallel printer, create what is known as a “special device node.” Log in as \texttt{root} (super-user) and enter one of the following sets of commands. (Note which printer ports are recognized during the boot up message.)
For lp0:

mknod /dev/lp0p c 6 64
chown bin /dev/lp0p
chgrp bin /dev/lp0p
chmod 222 /dev/lp0p

For lp1:

mknod /dev/lp1p c 6 65
chown bin /dev/lp1p
chgrp bin /dev/lp1p
chmod 222 /dev/lp1p

For lp2:

mknod /dev/lp2p c 6 66
chown bin /dev/lp2p
chgrp bin /dev/lp2p
chmod 222 /dev/lp2p

If you are using the print spooler, run mkdev lp to inform the spooler of the new parallel poll device. You can choose to add a new printer or re-configure an existing printer. When you are asked to choose a device for the printer, do not use the standard parallel devices that are displayed. Instead, use: "/dev/lp0p", "/dev/lp1p", or "/dev/lp2p".

If this does not solve the problem, try the solution described in the next section.

8.6.2 Ignore Deselect Operation

If your printing speed is unusually slow, about 4 seconds per line, your printer may be deselecting itself after receiving a line of text. An adb(CP) patch is provided to adapt your printer driver to this type of printer. Note that there is one patch for the 286 kernel and another for the 386 kernel, and that these patches work only with the 2.2.2 release of XENIX. Instructions on how to load adbL (286) or adb (386) appear in the section, "Loading adb Without the Development System."

This behavior has been seen on some models of Tandy printers, but is not exclusively found on Tandy printers.
Note

The application of these patches can cause other classes of parallel printers to hang.

Before using a patch, you should make a copy of your original kernel. Enter single-user mode and type in the following commands:

```
# cd /
# cp xenix xenix.00
```

This patch can be used with either the polled or standard lp devices.

The pound signs (#) and asterisks (*) are prompts from the system shell and from adb; do not type them in.

286 release 2.2.2 patch

```
# adbL -w /xenix
* $x
* patime+9b?xxx
  _patime+0x9b: 0x46f6 0x10fc 0xe74
* patime+9b?w 9090
  _patime+0x9b: 0x46f6= 0x9090
* patime+9d?w 9090
  _patime+0x9d: 0x10fc= 0x9090
* patime+9f?w 9090
  _patime+0x9f: 0xe74= 0x9090
* $q
#
```
386 release 2.2.2 patch

# adb -w /xenix
* patime+b1?xxx
  _patime+0xb1:  0x45f6  0x10f8  0xe74
* patime+b1?w 9090
  _patime+0xb1:  0x45f6= 0x9090
* patime+b3?w 9090
  _patime+0xb3:  0x10f8= 0x9090
* patime+b5?w 9090
  _patime+0xb5:  0xe74= 0x9090
* $q
#

9. Using Hard Disks

9.1 Olivetti Computers and Hard Disks

Olivetti computers use the last cylinder of the Hard Disk to write User diagnostics. Therefore, allocating the last cylinder of a drive to be used with an Olivetti computer will result in the corruption of any data stored in that cylinder. Do not allocate the last cylinder of your hard disk if you have an Olivetti computer.

9.2 Adding a 2.1 Hard Disk to 2.2

Follow these steps to add an existing XENIX 286 System V Operating System Release 2.1 hard disk to your XENIX 286 System V Operating System Release 2.2 system:

- Enter single user mode.
- Use the fixperm utility to create the necessary device nodes:

```
  cd /
  fixperm -c -dHD1 /etc/inst.perms
```

If you do not know what fdisk partitions you have your XENIX filesystems in, run fdisk:

```
  fdisk -f /dev/rhd10
```

Enter "1" at the main fdisk menu to display the partition table. Write down the numbers of the partitions that
contain XENIX, then exit from fdisk.

- Invoke divvy with the following command line:

  `divvy -b 1 -c 1 -p 1 -v partition-number`

  In the above command line, substitute the actual partition numbers that you copied from the fdisk table. Follow this divvy procedure for all of the possible fdisk partitions.

  Examine your divvy table. You should see a list of divvy divisions, which may contain valid filesystems, that do not have names. Only the divvy division number and sizes are displayed.

  Next, create names for all the divisions you want to preserve. You can call them anything you want, such as u, user2, etc.

  When you have named all of the potential divvy divisions, enter "q" to quit from divvy, then "i" to install the partition table.

- When you have named all of the likely candidates in all the possible fdisk partitions, mount each of the filesystems in turn. For example, to mount a filesystem named /u, enter:

  `mount /dev/u /mnt`

  If the divvy partition is not valid, the mount command should refuse to mount the filesystem. If the filesystem mounts, change directories to it and examine it.

  If it is not the filesystem you want to preserve, unmount it, remove it from /dev, and try another filesystem.

  Do this until you find the filesystem(s) you want to preserve.

  Use this command for each filesystem you want to preserve:

  `mkdev fs /dev/devicename /directory`

  In the above command, substitute the name of the actual device and the mount directory. For example:

  `mkdev fs /dev/u /u`

XG-2-29-88-4.1.1/2.2.3 - 36 - The Santa Cruz Operation
10. Using Keyboards

10.1 setkey(C) and console(HW)

Assigning more than 512 characters to function keys on a per screen basis fills the allotted string key buffer. The sequences sent by the arrow keys are overwritten, and the arrow keys do not work, most recognizably in vi(C). Although the size of the setkey string mapping table has been increased to 512 bytes, there is a limit of 30 characters assigned to an individual key. This limit also applies when defining function keys as described on the console manual page. However, when using mapstr(C), there is no 30 character per key limit, only the total 512 byte limit.

10.2 Keyboard Lock-up

A very small number of systems experience a problem known as “keyboard lockup,” where the system does not respond to keyboard input from the console keyboard. This has been investigated thoroughly and should be quite rare. This particular condition only affects keyboards that are attached to the video display adapter, not standard terminals that are attached to serial lines.

Your keyboard may be “locked up” if:

- The system console keyboard cannot be used to enter data or perform any tasks

- You cannot flip Multiscreens and the CAPS LOCK key does not turn the caps lock light on or off

- Other terminals on the system continue to work

- Printers or other devices continue to work

- The system is still running.

Keyboard lockup is similar to other circumstances, so before trying to fix a “locked” keyboard, make sure that:

- You did not accidentally enter Ctrl-S
Release Notes

- The “Keyboard Lock” key is not in the lock position
- The keyboard is still plugged in
- The system itself is still running.

First, make sure you did not enter Ctrl-S accidentally. Press Ctrl-Q several times and check to see if you can enter characters on the screen. Press RETURN a few times, or enter DEL.

Next, check the Keyboard Lock key, if your computer has one. It should be turned to the “unlocked” position. Also, make sure the keyboard is still plugged in to the correct socket.

Make sure the system is still running. Check a terminal to see if it is still working and that you can perform system tasks, such as logging in and checking the date. If you do not have a terminal, watch the hard disk access light, if your computer has one. If it flashes periodically, at least once every thirty seconds or so, the system is still running and is using the hard disk. Note that you cannot use other terminals and that the hard disk access light may not flash if you are in single user mode.

If you check all of the suggestions, but you still cannot use your console keyboard, try unplugging the console keyboard then plugging it in again. If this fixes the problem, it is definitely a case of keyboard lockup. If this last step does not fix the problem, you may still have keyboard lockup.

You can prevent keyboard lockup with the following fix. Note that it disables the keyboard lights (LEDs), so you should do this only if you have tried all other approaches:

1. Get the system console working, if it is not. Reboot the system if you have to and bring it up to single-user mode.

2. If you didn’t reboot, log in as root on the system console and shut the system down to single user mode with shutdown(C):

   
   # /etc/shutdown su

See shutdown(C) in the XENIX “Reference” for more information.
3. Once the system is in single user mode, back up the kernel:

   # cd /
   # mv xenix xenix.00
   # cp xenix.00 xenlx

4. Enter this command (on 386 machines, omit the "L"):

   # adbl -w /xenix
   * ledspresent/w 0
   * $q

   This patches your kernel with the necessary fix. Again, note that it permanently disables the console keyboard lights (LEDs).

5. Shut down the system:

   # /etc/shutdown 0

6. When you see the "Normal System Shutdown" message, press any key to reboot the system. You have now fixed the keyboard lockup problem.

7. Finally, call your support center and report your problem.

11. Using Video Display Hardware

11.1 Hercules Graphics Card Support

Monochrome graphics are now supported using the Hercules Graphics Card. Most all functions and features of the new support are identical and/or supersets of those currently available with the Monochrome Adapter. The adapter device interface to the Hercules is still /dev/mono or /dev/monochrome.

- Control Modes - continue to use the SWAPMONO ioctl to select the Hercules as the output device.

- Display Modes - Two new ioctls have been added to support the possible Hercules adapters graphics modes.
Release Notes

SW_HGC_P0 - Instructs the Hercules to display page 0 at frame buffer address 0xB0000 (length of 32K) in 720x348 graphics mode. This mode is legal whenever the Hercules is installed regardless of the existence of either a CGA, PGA or EGA. Note that the frame buffer is zeroed to clear pre-existing text information.

SW_HGC_P1 - Instructs the Hercules to display page 1 at frame buffer address 0xB8000 (length of 32K) in 720x348 graphics mode. This mode is only legal whenever the Hercules is installed and there is not a CGA, PGA or EGA display adapter installed. Note that the frame buffer is NOT zeroed so as to allow applications the option of multiple text and graphics environments.

- Getting Display Modes - MCA_GET still returns all standard monochrome modes with the addition of the two new Hercules modes previously mentioned.

- Memory Mapping Modes - MAPMONO still maps the frame buffer with the following exceptions. When the Hercules is installed with an additional CGA, PGA or EGA, the standard 32K frame buffer starting at 0xB0000 is mapped, whereas when there is no additional CGA, PGA or EGA, the entire Hercules frame buffer of 64K at frame buffer 0xB0000 is mapped.

- Graphics Adapter Port I/O - MCAIO should still be used for Hercules port I/O. Three new ports are supported including 0x3b9 for configuration, and 0x3b9 / 0x3bb for a light pen.

11.2 screen(HW) - HPA

Any sequence sent to Horizontal Position Absolute (HPA) will position the cursor at column zero.
11.3 screen(HW) - Control Modes

This note is primarily for software developers.

The screen(HW) manual page for XENIX System V Operating System Release 2.2 lists the following commands under "Control Modes":

```
SWAPMONO
SWAPCGA
SWAPPGA
SWAPEGA
```

In the current release, these ioctl commands behave just as if a "change multiscreen" sequence were issued. For compatibility, we recommend that you do not use the commands listed above and that programs should swap to other adapter types by opening the devices associated with the desired adapter.

For example, if a program, started on a multiscreen associated with a monochrome adapter, is to display output on an installed CGA, the program should open /dev/color and use the mode changing and selector mapping ioctl's on the resulting file descriptor. This maintains greater compatibility.

11.4 Display Adapter CMOS Note

CMOS location 0x2d is read at boot time to initialize the display adapter. If that register is non-zero, the adapter may be initialized differently than would normally be expected (i.e. the screen may be filled with random meaningless characters). Some older Compaq 286 machines may exhibit a problem with high resolution monochrome monitors due to this.

11.5 mapchan(M) and mapscren(M)

Using 7-bit terminals with mapchan mapping, where the ‘[’ (left bracket) character is mapped to some other character, can cause escape sequence processing by termcap and other applications to fail. If you must map the ‘[’ character, termcap entries (and applications programs) can be modified to look for the mapped value instead of ‘[’.

The functionality of mapscren from release 2.1.3 has been restored to XENIX 286 and XENIX 386 to alleviate problems with emulating 7-bit
terminals on the video screen.

12. Using Tape Drives

12.1 The Irwin Tape Drive

The following subsection should have appeared at the end of Section 7.3 of the XENIX Operations Guide, "Using a Cartridge Tape Drive."

A tape cartridge drive is a mass storage device that uses 1/4 inch tape. XENIX System V Operating System Release 2.2 supports the following Irwin mini-cartridge tape drives:

- Model 110 (10 megabyte)
- Model 125 (20 megabyte)
- Model 145 (40 megabyte)

Memory and Irwin Usage. Irwin use is directly related to the amount of physical memory installed on your computer. The more memory you have, the better the driver performs. This is because of the normal memory fragmentation that occurs in multiuser operating systems.

The Model 110 works with a minimum of 1 megabyte of physical memory. Since some 386 machines have memory which cannot be accessed by XENIX, it is possible to have 1 megabyte installed and still have insufficient memory for the Irwin drive. The amount of memory available to XENIX is displayed at boot time; take note of it and install additional memory if it is less than 1024K.

Note that the tape drive must be configured as drive 2.

We recommend that you always use the Irwin tape drive in single-user mode because there is more memory available and less memory fragmentation. Also, the system is typically less active when running in single user mode. Therefore, Irwin format and I/O operations are faster and there are fewer bad blocks on tapes formatted when running on a quiet system.

When excess memory fragmentation occurs, you see this error message on the console:

<ir>: Not enough memory for mini-cartridge; retrying...

The driver tries to access the tape drive for one minute. During this time you can either wait for processes to exit or kill processes that are
using up memory. If memory fragmentation still exists after one minute, the tape command fails and you see,

<ir>: Not enough memory for mini-cartridge; open failed.

Formatting the Irwin Tape Media. You must format blank, unused, Irwin mini-cartridge tapes with the `format(C)` utility before you can use them to store data. Use this command on blank, unformatted tapes:

```
format /dev/rctmini
```

The `rctmini` device verifies the format on the tape. You should also use the verification device when making backups tapes.

The Irwin drive cannot reformat 10 or 20-megabyte tapes. These cartridges may be bulk erased and formatted normally, but the drive itself cannot reformat them. 40-megabyte tapes can be reformatted by the drive. Generally, once the format is written, it is good for the life of the media. The format only needs to be re-written if a failure occurs while formatting is in progress.

To reformat a 40-megabyte tape use the `format` command with the `-e` option:

```
format -e /dev/rctmini
```

This erases the tape completely, including all previous format information, then reformats the tape. Note that this is a lengthy process (often taking more than 90 minutes for a 40MB tape) and it cannot be interrupted once it has been started.

The `tape(C)` utility does not yet work with the Irwin (`ctmini`) device.

When using an Irwin mini-cartridge tape drive to write large amounts of data, you may see this error message after the last file has been written on the tape:

```
Tape uncorrectable ECC error
```

If this occurs after the last file has been written, the message is erroneous and can be ignored. You can check to make sure the last file was successfully written to tape.

If you see this message in the middle of writing, it is probably a valid error message. Try to read the data off of the tape to make sure the error is valid, and if it is, you should reformat the tape with the
format(C) command. Specify the -e option. See format(C) for information on formatting irwin tapes.

12.2 Tape Support in XENIX 86 Release 2.2
There is no tape support in the XENIX 86 Operating System Release 2.2.

12.3 Spurious Tape Driver Error Messages
Whenever the tape driver finishes writing to a tape, it prints an error message on the system console such as “ct cmd error (1,60)” or “ct cmd error (2,21)”. This has been observed on irwin tape drives as well, but with different messages. These messages are spurious and should be ignored.

13. Special Documentation Notes
In order to make the documentation as complete as possible, this section describes errors in the documentation as well as some new features of the XENIX System V Operating System Release 2.2 that are not documented elsewhere.

13.1 Manual Page Permutated Indexes
The following manual pages are mentioned in the Alphabetized list and Permutated index but are not included in this distribution:

- catimp(CT)
- charmap(CT)
- deco(CT)
- enco(CT)
- dviimp(CT)
- itroff(CT)

13.2 Terminals (M)
The following terminals are among those supported under XENIX:

- Tandy DT1
- Tandy DT100
13.3 Replacement Manual Pages

Replacement manual pages:

- diskcp(C)
- dos(C)
- dtype(C)
- mkdev(C)
- vmstat(C)
- fd(HW)

are included at the back of these Release Notes. Please substitute these replacement pages for the pages in your reference books.

14. SVID Conformance Notes

The SCO XENIX System V Operating System meets the single volume System V Interface Definition (SVID) published in 1985 by AT&T (Select Code 307-127). SCO XENIX System V Operating System has been subjected to a stringent set of tests for the purpose of verifying conformance to SVID, and conforms to SVID functionality with the following exceptions:
<table>
<thead>
<tr>
<th>Function</th>
<th>SVID Specification</th>
<th>SCO XENIX Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>shmat</td>
<td>Allows non-zero arguments.</td>
<td>shmaddr argument must be zero. The SVID states that shmat() should allow a non-zero shmaddr argument. The architecture of the 86 family precludes allowing attachment of shared memory at specific physical addresses. Because of this, XENIX System V requires that the shmaddr argument be zero to allow the system to choose the first available address.</td>
</tr>
<tr>
<td>shmop</td>
<td>Shared memory operations.</td>
<td>Because of the architecture of the 86 and 286 family of chips, XENIX System V for the 86/286 utilizes shared memory by using far pointers. The SVID &quot;char *shmaddr&quot; is replaced with &quot;char far *shmaddr.&quot; XENIX 386 returns &quot;char *shmaddr.&quot;</td>
</tr>
<tr>
<td>shmtct1</td>
<td>Return &quot;char *shmaddr&quot;</td>
<td></td>
</tr>
<tr>
<td>shmget</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ptrace</td>
<td>Address specified as (int*).</td>
<td>Address specified as structure. The SVID states that ptrace() calls should fail if the &quot;addr&quot; argument is not the start address of a word. Because of word alignment conventions in the 86 family of chips this failure will not occur.</td>
</tr>
</tbody>
</table>
These exceptions are found on the *termio* manual pages *(termio(dev) for SVID and termio(M) for XENIX) System V:*

<table>
<thead>
<tr>
<th>Termio Characters/values</th>
<th>SVID Specification</th>
<th>SCO XENIX V Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUIT</td>
<td>Ctrl-\</td>
<td>Ctrl-\</td>
</tr>
<tr>
<td>ERASE</td>
<td>#</td>
<td>Ctrl-H</td>
</tr>
<tr>
<td>KILL</td>
<td>@</td>
<td>Ctrl-U</td>
</tr>
<tr>
<td>38400 baud</td>
<td>B38400</td>
<td>not included</td>
</tr>
<tr>
<td>default initial baud rate</td>
<td>B300</td>
<td>B9600</td>
</tr>
</tbody>
</table>
Appendix A
Compatible Hardware

A.1 Compatible Hardware A-1

1.1 Using this Appendix A-2

1.2 General Compatibility Guidelines A-2

1.2.1 Machines A-3

1.2.2 Math Chips A-4

1.2.3 Memory Cards A-5

1.2.4 Multi-Function Cards A-5

1.2.5 Serial I/O Boards A-5

1.2.6 Tape Drive/Controller Combinations A-13

1.2.7 Typical Device Interrupts A-15

1.2.8 Video Adapters and Monitors A-15

1.2.9 Add-On Hard Disks A-17

1.2.10 Compatible Hard Disk Controllers A-18

1.2.11 Modems and Autodialing A-19

1.3 XENIX 286AT Operating System A-20

1.3.1 Machines A-20

1.3.2 Math Chips A-21

1.3.3 Memory Cards A-21

1.3.4 Add-On Hard Disks A-21

1.3.5 Compatible Hard Disk Controllers A-23

1.4 XENIX 386AT Operating System A-24

1.4.1 Machines A-24

1.4.2 General Guidelines for 386AT Peripherals A-25

1.4.3 Video Cards A-25

1.4.4 Memory Cards A-25

1.4.5 Add-On Hard Disks A-25

1.4.6 Serial Cards A-25

1.4.7 Compatible Hard Disk Controllers A-26

1.4.8 Floppy Drives A-26

1.5 XENIX 286PS Operating System A-27

1.5.1 Machines A-27

1.5.2 Serial Cards A-27

1.5.3 Video Cards and Monitors A-27
Release Notes

1.5.4 Tape Drives A-27
1.5.5 Other Hardware A-27

1.6 XENIX 386PS Operating System A-28
  1.6.1 Machines A-28
  1.6.2 Serial Cards A-28
  1.6.3 Video Cards and Monitors A-28
  1.6.4 Tape Drives A-28
  1.6.5 Other Hardware A-28

1.7 XENIX 286HP Operating System A-29
  1.7.1 Machines A-29
  1.7.2 Memory Cards A-29
  1.7.3 Serial I/O boards A-29
  1.7.4 Video Cards and Monitors A-29
  1.7.5 Other HP Hardware A-30
  1.7.6 Compatible Hard Disk Controllers A-30
  1.7.7 Add-On Hard Disks A-31

1.8 XENIX 286/386AT ESDI Operating System A-33
  1.8.1 Introduction A-33
  1.8.2 General Notes A-33
  1.8.3 Standard Installation A-34
  1.8.4 Hardware Installation and Initialization A-37
  1.8.5 DMA/Programmed I/O Considerations A-37
  1.8.6 Interleave Factors A-38
  1.8.7 Drive Size Limits A-38
  1.8.8 Drive Tables A-43

1.9 XENIX 6300+ Operating System A-48
  1.9.1 Memory Cards A-48
  1.9.2 Hard Disks A-48

1.10 XENIX 86XT Operating System A-50
  1.10.1 Machines A-50
  1.10.2 Math Chips A-51
  1.10.3 Memory Cards A-51
  1.10.4 Accelerator Boards A-51
  1.10.5 Add-On Hard Disks A-51
  1.10.6 Compatible Hard Disk Controllers A-53
A.1 Compatible Hardware

The XENIX System V Operating System is available for many configurations of Personal Computer hardware. In general, your hardware configuration must have the original settings and boards before you install the XENIX System V Operating System. If you have added any boards, make sure that all switches are set as recommended in the manufacturer's hardware manual for that board.

This Appendix is divided into several sections. "General Compatibility Guidelines" contains general guidelines for hardware compatibility, including charts of compatible peripherals, serial cards, video adapters monitors, hard disks and controllers. System parameters necessary for these devices also appear in this section. These guidelines must be followed to ensure proper system performance.

The remaining sections include exceptions and special notes for each type of machine supported.

Note

The specific hardware that is listed in these Notes should work with the XENIX System V Operating System. However, not every machine and configuration has been tested by us and proven to work. Also, because compatible machine or add-on peripheral manufacturers may change configuration, functionality, or firmware at any time, no guarantee is implied. Please write us with accurate hardware information for possible inclusion on our lists.
1.1 Using this Appendix

To find a listing of compatible hardware for your machine, you must know your machine type. You must know the processor your machine uses and if it follows the Industry Standard format. You should also know if there are enhancements to your system, such as an ESDI interface. To find the available types of machines, check the section titled "Machines" in the "General Compatibility Guidelines" section of this appendix. There is a specific section of compatible hardware in this appendix for each version of SCO XENIX. There is also a section called "General Compatibility Guidelines" that discusses general compatibility issues with SCO XENIX. Read through this section before you install any extra hardware on your system.

1.2 General Compatibility Guidelines

This section describes what hardware can be used with the standard XENIX Operating System Release 2.2 distribution. There are many other devices that you can use, which require additional vendor supplied software, that are available from independent hardware vendors. Call your dealer or software support center and ask for the third-party IHV/ISV catalogue.

If your computer is listed as a supported machine in this Appendix, it should run XENIX without adding any hardware or changing any jumper or switch settings. This appendix is provided as a reference so that you can check the compatibility of any piece of hardware you own or may wish to buy in the future.
1.2.1 Machines

The XENIX System V Operating System Release 2.2 is available for several machine configurations. Find your machine configuration in the right hand column and match it with the corresponding version of SCO XENIX in the left hand column. The XENIX kernel runs in one of three modes:

<table>
<thead>
<tr>
<th>Processor</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>8086</td>
<td>Real mode (unprotected)</td>
</tr>
<tr>
<td>80286</td>
<td>Segmented mode (protected)</td>
</tr>
<tr>
<td>80386</td>
<td>Demand paged virtual memory mode (protected)</td>
</tr>
</tbody>
</table>

Your version of XENIX is for one of the following machines:

<table>
<thead>
<tr>
<th>XENIX version</th>
<th>Hardware Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>286AT</td>
<td>Industry Standard 286 based personal computer.</td>
</tr>
<tr>
<td>386AT</td>
<td>Industry Standard 386 based personal computer.</td>
</tr>
<tr>
<td>286PS</td>
<td>IBM Personal System/2 Model 50 or Model 60.</td>
</tr>
<tr>
<td>386PS</td>
<td>IBM Personal System/2 Model 80.</td>
</tr>
<tr>
<td>286HP</td>
<td>HP Vectra 286 based personal computer.</td>
</tr>
<tr>
<td>286ESDI</td>
<td>Industry Standard 286 based personal computer with an SMS 8620 or 8627 ESDI disk controller.</td>
</tr>
<tr>
<td>386ESDI</td>
<td>Industry Standard 386 based personal computer with an SMS 8620 or 8627 ESDI disk controller.</td>
</tr>
<tr>
<td>6300+</td>
<td>AT&amp;T 6300+ 286 based personal computer.</td>
</tr>
<tr>
<td>86XT</td>
<td>Industry Standard 8086 based personal computer.</td>
</tr>
</tbody>
</table>
Note

For machines with bus or processor speeds greater than 6 MHz, check with your peripheral vendor to verify that their hardware will run under your configuration. Malfunctions with slow hardware are especially noticeable in a 386 environment.

Some computers arrive with the hard disk only partially formatted. If you have such a machine, use the DOS hard disk format command or Diagnostics diskette to format the entire disk before installing the XENIX System V Operating System.

Some computers require specific switch settings to run the XENIX System V Operating System. If your computer does not run the XENIX System V Operating System with the settings as shipped, contact your computer hardware representative for the proper settings.

1.2.2 Math Chips

Your personal computer may include the 8087, 80287 or 80387 math co-processor, which is automatically detected and supported by XENIX 86, XENIX 286, and XENIX 386 System V Operating Systems. These co-processors will improve floating point efficiency.

Use math co-processors matching your machine's CPU speed. Follow the manufacturer's recommendations.

At boot time, the XENIX System V Operating System announces the presence of a math coprocessor with the message "math coprocessor present" if an 8087, 80287 or 80387 is detected. Please note that switches on the main system board must be set properly to enable 8087, 80287 or 80387 interrupts or your system must be set up with the manufacturer's setup disk to expect the chip. Insure that the system diagnostics recognize the co-processor presence and check your hardware manual for the proper switch settings.

Please note that on some motherboards, XENIX 386 incorrectly recognizes the presence of an 80387 co-processor even if the chip is
not installed. This problem is prevalent on machines that use the Intel motherboard. If your computer incorrectly recognizes the presence of an 80387 chip, make sure that blocks E48 and E49 are not connected with a jumper connection.

XENIX 386 supports both the 287 and 387 math coprocessors. Support for the Weitek 1167 is not yet available.

Some 8087, 80287 and 80387 exceptions have been masked. Refer to the manual page for 8087(HW).

1.2.3 Memory Cards

In general, most memory cards work with XENIX. If you experience “panic: parity” errors it is often because of low quality memory chips or cards. This problem is especially prevalent with the 32-bit static RAM chips used in 386 machines.

With memory cards, check the switch settings on both the card and motherboard. Refer to the hardware manuals for your computer and for the memory card to find the correct switch settings. The XENIX 86 Operating System supports up to 640K of main memory. The XENIX 286 and XENIX 386 Operating Systems support up to 16MB of main memory.

1.2.4 Multi-Function Cards

The serial ports on many multi-function cards function as expected if COM1 and COM2 are fully compatible with the standard specifications for these serial ports. These specifications are explained in the “Serial I/O Boards” section of these Notes.

1.2.5 Serial I/O Boards

This section describes the conditions and results of using various serial I/O boards with the XENIX System V Operating System. Standard single port serial I/O boards function as expected if COM1 and COM2 are fully compatible with the standard specifications for these serial ports.

To configure the Operating System for the serial board you are installing, you must run the mkdev serial command. See “Using Peripheral Devices” of the XENIX Operations Guide for more information on /usr/lib/mkdev/serial, the script called by mkdev serial.
Each multiport serial I/O board is unique; the XENIX System V Operating System has special driver code for each card listed. Only those with status poll registers can work with the high performance driver scheme chosen, and new boards require additional driver support. The following serial I/O boards are supported by the XENIX System V Operating System for personal computers:

AMI lamb 4 and 8 port  
Arnet Controls 2, 4 and 8 port  
(clock option not supported)  
Arnet Twin port  
AST FourPORT/XN  
Computone ATvantage-X 8 port board  
Control Systems Hostess 4 and 8 port versions  
CTC Versanet 4AT (4 port) and 8AT (8 port)  
Digiboard 4 and 8 port  
IBM standard COM1 and COM2  
Kimtron Quartet 4 port*  
Olivetti RS232C Multiport Board  
Quadram QuadPort™ 1 and 5 port  
Stargate Technologies OC4400 (4 port) and  
OC8000 (8 port) versions  
Tandon Quad Serial Card

* The Kimtron board does not work with all 386 machines.

The following serial I/O boards are supported by the XENIX System V Operating System for the Personal System/2:

IBM 2 port cards (up to 3 per system)  
Control Systems MC 8 port cards

Refer to the serial(HW) and mkdev(C) manual pages for more information on compatible serial I/O cards and on adding and enabling serial lines.

8250a Serial I/O Chip Notes

Some computers or add-on serial I/O cards use the 8250a serial I/O chip. Some revisions of this chip do not handle interrupts properly. DOS does not use interrupts, so the use of this chip with DOS causes no problems. The XENIX System V Operating System does make use of interrupts, as it is a multi-tasking operating system.
The problem with the serial I/O chip shows up when using uuep(C) or cu(C). Indications that your computer contains a bad revision 8250a chip are that uuep(C) may lose characters constantly and generate unkillable uucico processes, and that cu(C) at high baud rates stops executing and does not exit.

The problem rarely shows up when using the serial port with a terminal. It is associated with high-speed serial input. If you want to use uuep(C) or cu(C) and your computer has one of these chips, we recommend you replace the 8250a chip with an 8250b serial I/O chip or use a multi-function card containing a serial port and configure it as COM1 or COM2. Disable the built-in serial port or avoid high-speed input on that port.

All COM1 boards should be strapped at interrupt vector 4. All COM2 boards should be strapped at interrupt vector 3. Check your serial card hardware manual or call the hardware manufacturer for the switch settings that implement these addresses.

---

**Note**

SCO uniPATH SNA-3270 uses interrupt vector 3, which can interfere with the use of a serial card on COM2.

---

**Serial Card Addresses and Notes**

The following table lists supported serial cards and their addresses. Note that if you install two serial cards on COM1 and COM2 that are incompatible, you may see this message at boot time:

**WARNING:** Serial boards are installed at conflicting addresses

The message indicates the boards do not have the correct switch settings. This check does not occur for cards installed on additional COM ports and you may not see this message even if the boards are actually incompatible.

Refer to the following serial address table to resolve conflicts and check the "Notes" following the table for more information.
Release Notes

When using a 286 or 386 IBM Personal System/2, configure additional serial cards at the standard addresses given by the reference diskette.

<table>
<thead>
<tr>
<th>Physical Port</th>
<th>Board Type</th>
<th>Primary I/O Address</th>
<th>Primary Status Address</th>
<th>Alternate I/O Address</th>
<th>Alternate Status Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM1</td>
<td>AMIlamb**</td>
<td>0x540</td>
<td>0x210</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Arnet</td>
<td>0x100</td>
<td>0x142</td>
<td>0x280</td>
<td>0x2C2</td>
</tr>
<tr>
<td></td>
<td>AST*</td>
<td>0x2A.0</td>
<td>0x2BF</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>CTC†</td>
<td>0x160</td>
<td>n/a</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Digiboard††</td>
<td>0x110</td>
<td>0x151</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Hostess</td>
<td>0x500</td>
<td>0x507</td>
<td>0x680</td>
<td>0x687</td>
</tr>
<tr>
<td></td>
<td>Kimtron</td>
<td>0x120</td>
<td>0x8120</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Olivetti†††</td>
<td>0x2A.0</td>
<td>0x2BF</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Quadram***</td>
<td>0x280</td>
<td>0x2D3</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Stargate</td>
<td>0x290</td>
<td>0x2D0</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Tandon***</td>
<td>0x2A.0</td>
<td>n/a</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>COM2</td>
<td>AMIlamb**</td>
<td>0x2C0</td>
<td>0x212</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Arnet</td>
<td>0x180</td>
<td>0x1C2</td>
<td>0x300</td>
<td>0x342</td>
</tr>
<tr>
<td></td>
<td>AST*</td>
<td>0x1A.0</td>
<td>0x1BF</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>CTC†</td>
<td>0x218</td>
<td>n/a</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Hostess</td>
<td>0x580</td>
<td>0x587</td>
<td>0x700</td>
<td>0x707</td>
</tr>
<tr>
<td></td>
<td>Digiboard††</td>
<td>0x210</td>
<td>0x250</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Kimtron</td>
<td>0x2EO</td>
<td>0x82EO</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Olivetti†††</td>
<td>0x1A.0</td>
<td>0x1BF</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Quadram***</td>
<td>0x288</td>
<td>0x2DB</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Stargate</td>
<td>0x190</td>
<td>0x1D0</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Tandon***</td>
<td>0x280</td>
<td>n/a</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>OTHER1</td>
<td>UNISYS****</td>
<td>0x400</td>
<td>n/a</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>OTHER2</td>
<td>UNISYS****</td>
<td>0x408</td>
<td>n/a</td>
<td>none</td>
<td>n/a</td>
</tr>
</tbody>
</table>
* Only enhanced mode is supported. Do not use the AST driver.

** Only continuous mode is supported.

*** Tandon is the only card whose I/O addresses are potentially identical with other supported cards, such as the AST and Quadram serial cards.

Since card addresses must not overlap in the same systems, if you have both a Tandon and a Quadram, the Tandon must be on COM1 and the Quadram must be on COM2.

You can use the following Quadram serial expansion cards in these configurations under the standard XENIX Operating System:

<table>
<thead>
<tr>
<th>COM1</th>
<th>COM2</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-port</td>
<td>-</td>
</tr>
<tr>
<td>1-port</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>5-port</td>
</tr>
<tr>
<td>-</td>
<td>1-port</td>
</tr>
<tr>
<td>5-port</td>
<td>1-port</td>
</tr>
</tbody>
</table>

If you need to use any other configuration of Quadram cards, you must relink the kernel using the Link Kit. You also need the SCO XENIX “Software Development System” to recompile siocnf.c. Edit siocnf.c as follows:

1. This file contains several groupings of serial card descriptions. Each group is identified by the first number on the description line.

   Find the descriptions for the Quadram cards in each group and move that descriptor line to the front of the group.

2. Remake and boot the new kernel. Refer to “Using the Link Kit” in the Installation Guide for information on the Link Kit. Use config -i.
These serial cards only work on the UNI*SYS PC/TT.

† Notes for the CTC Versanet serial cards:

1. The correct switch settings for the 8AT and 4AT are:

As a COM1 (strapped at addr 0x160, using irq4) the 8AT has:

switches 33, 35, 36, 38, 39 & 40 OFF
switches 34, 37 ON (i.e.: shunted)

on the DIPSWITCH selection:

5, 6 & 8 should be OFF
all the others should be ON

As a COM2 (strapped at addr 0x218, using irq3) the 8AT has:

switches 33, 35-40 OFF
switch 34 ON (i.e.: shunted)

on the DIPSWITCH selection:

1, 2 & 7 should be OFF
all the others should be ON.

The 4AT is the same as the 8AT in both the above cases, with the following common exception:

switches 39 & 40 MUST BE ON (shunted)

2. These boards come in both 8250 and 16450 versions, you must have the 16450 version if you intend to run on 386. The 8250 should run on the 286.

3. The original CTC Versanet boards used different addresses. Please ask your hardware vendor for versanet boards strapping at the above addresses (0x160 and 0x218).

4. The CTC "Maomao-4" serial board is not supported.
†† Notes on the Digiboard serial card:

1. Ports for switches DS2 to DS5 (DS9 for 8 port version) must be strapped starting at the boards base address as given in the table and incrementing by 8 for each port.

The following example is for COM1 at 110:

<table>
<thead>
<tr>
<th>DS2</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS3</td>
<td>118</td>
</tr>
<tr>
<td>DS4</td>
<td>120</td>
</tr>
<tr>
<td>DS5</td>
<td>128</td>
</tr>
<tr>
<td>DS6</td>
<td>130</td>
</tr>
<tr>
<td>DS7</td>
<td>138</td>
</tr>
<tr>
<td>DS8</td>
<td>140</td>
</tr>
<tr>
<td>DS9</td>
<td>148</td>
</tr>
<tr>
<td>DS1</td>
<td>150</td>
</tr>
</tbody>
</table>

2. If COM1 is used then all the ports must be strapped as "EVEN" to interrupt request line 4 (see Digiboard documentation). If COM2 is used then all the ports must be strapped as "ODD" to interrupt request line 3 (same notation).

3. Only rev. 3 and later boards are supported.

††† Notes for the Olivetti RS232C Multiport board:

1. The factory settings will not function properly – you must alter the existing switch positions to reflect those listed in Item 4 below.

2. If you are using a single Olivetti board, you must configure it as COM2.

3. If you are using two Olivetti boards, one must be configured as COM2 and the other configured as COM1, with the COM1 port built into the M380 disabled. To disable the COM1 port built into the
4. The correct switch settings:

As a COM1 (strapped at addr 0x2A0):

<table>
<thead>
<tr>
<th>IRQ2</th>
<th>IRQ3</th>
<th>IRQ4</th>
<th>IRQ5</th>
<th>IRQ6</th>
<th>IRQ7</th>
<th>YA1</th>
<th>YA0</th>
<th>INT</th>
<th>SHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
</tbody>
</table>

As a COM2 (strapped at addr 0x1A0):

<table>
<thead>
<tr>
<th>IRQ2</th>
<th>IRQ3</th>
<th>IRQ4</th>
<th>IRQ5</th>
<th>IRQ6</th>
<th>IRQ7</th>
<th>YA1</th>
<th>YA0</th>
<th>INT</th>
<th>SHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
</tbody>
</table>
1.2.6 Tape Drive/Controller Combinations

The tape drivers included in this release work with the following drive/controller combinations. Tape drivers are soon to be included with Personal System/2 XENIX. Check with your software support center for PS/2 cartridge tape drivers.

Supported Tape Controllers and Cartridge Drives

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Controller</th>
<th>Drive</th>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archive</td>
<td>SC400</td>
<td>Scorpion 5945</td>
<td>A</td>
<td>(4)</td>
</tr>
<tr>
<td>Computone</td>
<td>SC400</td>
<td>Scorpion 5945</td>
<td>A</td>
<td>—</td>
</tr>
<tr>
<td>TI</td>
<td>SC400</td>
<td>Scorpion 5945</td>
<td>A</td>
<td>—</td>
</tr>
<tr>
<td>ITT</td>
<td>PC-36</td>
<td>5000(E)</td>
<td>W</td>
<td>—</td>
</tr>
<tr>
<td>COREtape</td>
<td>PC-36</td>
<td>5000(E)</td>
<td>W</td>
<td>—</td>
</tr>
<tr>
<td>Olivetti</td>
<td>PC-36</td>
<td>5000(E)</td>
<td>W</td>
<td>(1)</td>
</tr>
<tr>
<td>Wangtek</td>
<td>PC-36</td>
<td>5000(E)</td>
<td>W</td>
<td>—</td>
</tr>
<tr>
<td>Tecmar</td>
<td>PC-36</td>
<td>QIC-60AT</td>
<td>W</td>
<td>—</td>
</tr>
<tr>
<td>Emerald</td>
<td>xnx-50-2012</td>
<td>Cassette</td>
<td>E</td>
<td>(3)</td>
</tr>
<tr>
<td>Emerald</td>
<td>xnx-60-2002</td>
<td>Cartridge</td>
<td>E</td>
<td>(3)</td>
</tr>
<tr>
<td>Irwin</td>
<td>floppy</td>
<td>145(40MB)</td>
<td>NA</td>
<td>(2)</td>
</tr>
<tr>
<td>Irwin</td>
<td>floppy</td>
<td>125(20MB)</td>
<td>NA</td>
<td>(2)</td>
</tr>
<tr>
<td>Irwin</td>
<td>floppy</td>
<td>110(10MB)</td>
<td>NA</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Default Settings

<table>
<thead>
<tr>
<th>Type</th>
<th>DMA</th>
<th>Interrupt</th>
<th>Base Address (hex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
<td>3</td>
<td>0220H</td>
</tr>
<tr>
<td>W</td>
<td>1</td>
<td>5</td>
<td>0338H</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
<td>25</td>
<td>0300H</td>
</tr>
</tbody>
</table>

Notes

1. The Olivetti tape controller's factory jumper settings do not match the type W drive default values. To use the Olivetti drive without changing the controller card's jumper settings, use the "mkdev
tape" command to select all four of the following settings:

<table>
<thead>
<tr>
<th>Type</th>
<th>DMA</th>
<th>Interrupt</th>
<th>Base Address (hex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>1</td>
<td>25</td>
<td>0288H</td>
</tr>
</tbody>
</table>

2. The Irwin 40-megabyte drive can use either DC2000 or DC1000 tape cartridges and the 10- and 20-megabyte drives use a DC1000 tape cartridge. A DC1000 tape written on a 125 or 145 model drive can be read by either drive.

3. Emerald drives do not work with 20mHz 386 machines at this time.

4. Archive SC400 full length boards are supported. However, the half-length SC402 board is not currently supported under XENIX.

Refer to "The Irwin Tape Drive" notes in the main body of these Release Notes for information on using the Irwin drive. These notes supplement the XENIX Operations Guide Chapter 7, "Using Peripheral Devices."

Note that these drives are sometimes sold under other brand names. Only one cartridge tape subsystem is supported per computer. (It is possible to have one cartridge tape drive plus an Irwin drive configured on a system.) QIC24 format is supported on the full size cartridges. Tape support is raw (character) only, no block device. A tape utility, `tape(C)`, is provided for rewinding, erasing, retensioning, etc. `tape` does not work with the Irwin drive at this time.

To configure your system for one of the above tape units, run `mkdev tape`. If you do not choose specific values for the DMA channel, interrupt, and base address, the values listed above will be used. Note that most addresses are specified in hexadecimal, indicated with a trailing 'H'. If you do not use the default settings, watch for possible interrupt conflicts with other installed devices. The table below indicates what interrupts may be in use on your system. You should not use interrupts 0, 1, or 6, as these are already in use regardless of additional devices. The `mkdev tape` menu indicates the Irwin units as "Mini-Cartridge," and all other units are indicated as "Cartridge" units. The Irwin units are not configurable.
1.2.7 Typical Device Interrupts

<table>
<thead>
<tr>
<th>Interrupt</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Clock</td>
</tr>
<tr>
<td>1</td>
<td>Console</td>
</tr>
<tr>
<td>2</td>
<td>Networks and others</td>
</tr>
<tr>
<td>3</td>
<td>Serial COM2</td>
</tr>
<tr>
<td>4</td>
<td>Serial COM1</td>
</tr>
<tr>
<td>5</td>
<td>Alternate Parallel Port (lp2)</td>
</tr>
<tr>
<td>6</td>
<td>Floppy Disk</td>
</tr>
<tr>
<td>7</td>
<td>Main Parallel Port (lp0 or lp1)</td>
</tr>
</tbody>
</table>

1.2.8 Video Adapters and Monitors

Any video adapter/monitor combination which runs with an adapter that is a true equivalent of a standard adapter should run under the XENIX System V Operating System.

The XENIX System V Operating System supports the use of two video adapters and two monitors, one of type mono and the other of type color.

Adapters which come as the default adapter in supported computers (monochrome or color monitor) will work with the XENIX System V Operating System.

We support VGA video adapters running in EGA mode.

We have used the following video adapters and monitors under the XENIX System V Operating System. Although many standard emulating cards work, these are some specific examples.
### Video Cards and Monitors

<table>
<thead>
<tr>
<th>Card</th>
<th>Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Mono Card</td>
<td>standard monochrome</td>
</tr>
<tr>
<td>Hercules mono</td>
<td>WY-530 (monochrome)</td>
</tr>
<tr>
<td>Persyst mono</td>
<td></td>
</tr>
<tr>
<td>IBM CGA</td>
<td>standard RGB (red green blue) or composite color</td>
</tr>
<tr>
<td>Paradise Modular Graphics Card</td>
<td></td>
</tr>
<tr>
<td>Everex Graphics Edge</td>
<td>Wyse WY-630 (color)</td>
</tr>
<tr>
<td>AST CGA</td>
<td></td>
</tr>
<tr>
<td>Plantronics Color-Plus</td>
<td></td>
</tr>
<tr>
<td>IBM MEGA</td>
<td>IBM MEGA standard RGB color</td>
</tr>
<tr>
<td>ATI EGA Wondercard*</td>
<td>standard monochrome</td>
</tr>
<tr>
<td>ASTEGA</td>
<td></td>
</tr>
<tr>
<td>Wyse WY-440 (EGA card)</td>
<td>WY-640 (color EGA)</td>
</tr>
<tr>
<td>Wyse WY-700</td>
<td>WY-700</td>
</tr>
<tr>
<td>NEC APC-H431</td>
<td></td>
</tr>
<tr>
<td>IBM PGA</td>
<td>IBM PGA</td>
</tr>
<tr>
<td>IBM VGA</td>
<td>Model 8503 (mono)</td>
</tr>
<tr>
<td></td>
<td>Model 8512 (color)</td>
</tr>
<tr>
<td></td>
<td>Model 8513 (color)</td>
</tr>
<tr>
<td></td>
<td>Model 8514 (color)</td>
</tr>
</tbody>
</table>

* EGA Wondercard Advanced Features Switch (DIP switch 8) must be OFF.

**Wyse WY-700 High Resolution Mono Monitor.** There is a known problem with the screen display going blank temporarily. This can occur on any Wyse pc286, IBM PC/AT, or AT clone with this monitor installed. This problem occurs with REV D of the WY-700 monitor and/or daughter board. See ASSY # on lower left edge of board for REV level. You should replace the board with a more recent revision; request return merchandise authorization (RMA) from Wyse Technology.
AST EGA Card. When switching from graphics mode into high-res text mode, the AST card may exhibit character shifting (e.g. spaces to ampersands, etc.). It is necessary to reboot to regain the screen.

Other Non-Standard EGA Cards. Some EGA cards that are not IBM standard may not operate correctly under SCO XENIX. If your card is non-standard or not in the list of supported cards, please check with the card manufacturer for compatibility. If your non-standard card is not operating correctly, enter the command

`stty C80x25`

and press Ctrl-J to execute the command. Your screen may be blank or displaying random patterns and you may not see the characters you enter. This may correct the problem on your card. If this does not restore your screen display, you must reboot your system.

1.2.9 Add-On Hard Disks

Many hard disks, both standard and nonstandard, can be used by the XENIX System V Operating System as long as the disk controller supports the drive. The disk must interface electrically with the disk controller (usually "ST506"). Controllers supporting other drive interfaces such as RLL or ESDI will work as long as the controller presents an ST506-compatible interface to the bus.

DOS does not support non-standard disks (i.e. those not defined in the ROM Fixed Disk BIOS).

Some hard disks come from the factory only partially formatted (e.g. the Maxtor 1140 140MB). This problem may become evident during installation, when badtrk(M) indicates that every sector past a certain cylinder/head location is bad. You should contact the manufacturer to determine whether or not the disk is completely formatted. There are several products available that will format hard disks.

Compatible hard disk controllers are discussed in the next section.

For a standard disk: the motherboard ROM must have an entry for the disk (type) determined by the number of heads, cylinders, tracks per cylinder (heads), sectors per track, and other characteristic information.
Follow the manufacturer's instructions to set switches or configuration.

For nonstandard disks: The user may type in information that overrides the ROM disk configuration information during installation.

If you are unsure of what parameters to enter for your non-standard disk, contact your disk manufacturer for this information. The dkind program (called during installation) uses parameters as defined in the "Fixed Disk BIOS Parameter Table" in Section 5 of the IBM Technical Reference (AT).

Some hard disks have more than 1024 cylinders. At this time, XENIX supports a maximum of 1024 cylinders.

1.2.10 Compatible Hard Disk Controllers

Many hard disks will work with the XENIX System V Operating System. Whether or not a disk works depends upon the controller board. Here are two tests the controller must meet:

1. The disk controller is fully compatible with the standard controller for that configuration. For example, here is a table showing the XENIX configurations and the compatible controllers:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>86XT</td>
<td>XEBEC</td>
</tr>
<tr>
<td>286AT/386AT</td>
<td>WD-WA2</td>
</tr>
<tr>
<td></td>
<td>WD1003</td>
</tr>
<tr>
<td>PS/2</td>
<td>IBM ESDI</td>
</tr>
<tr>
<td></td>
<td>IBM ST506</td>
</tr>
<tr>
<td>286ESDI/386ESDI</td>
<td>SMS 8620, 8627</td>
</tr>
</tbody>
</table>

2. No special vendor software is needed to make the controller work under DOS.

If a controller meets these tests, it might work, but if it fails these tests, it will not work.
1.2.11 Modems and Autodialing

Any standard RS-232 modem works using `uucp(C)` and `cu(C)`. The default autodialer is for the Hayes Smartmodem 1200. An autodial program is also supplied for the Racal Vadic 3451, the 212, and the Hayes Smartmodem 2400. Other autodialing modems can be supported by writing a dialer program, or modifying the existing one in `/usr/lib/uucp/dial`.

The "uucp(C) Notes" section of these `ReleaseNotes` and the `dial(M)` manual page in the XENIX `Reference Manual` contain more information on writing other dialer programs.
1.3 XENIX 286AT Operating System

1.3.1 Machines

We have used the following machines with the XENIX 286 Operating System:

ACER 900
ACS ET 286 Plus
American Research Corporation (ARC-AT)
AST Premium 286
AT&T 6310
Basic Time BT/AT
Compaq Portable, Portable II, DeskPro 286, 386* and DeskPro II
Contel/CADO AT/4
Data General DASHER/286
Epson Equity III and Equity III+
Hewlett-Packard Vectra ES/12 PC
IBM PC AT (6 or 8 mHz version)
IBM 286/XT
ITT XTRA XL
MAD 286 AT
Mitsubishi MP 286
NCR PC-8 **
NEC APC IV
Olivetti M28
PC's LIMITED AT™
Sharp PC 7511
UNIŠYS PC/IT
Tandy 3000
Texas Instruments Business Pro
Texas Instruments System 1100
Tomcat 3200-AT
WYSEpc 286 WY-2200
Victor V286
Zenith Z200 series

* Run in 286 Mode.
** Configure the CMOS database for color monitor, regardless of the type of monitor used.
These machines have been reported to run XENIX-286, but we have not tested them:

- Corona ATP
- Kaypro 286i

1.3.2 Math Chips

The 80287 math co-processor chip is supported.

1.3.3 Memory Cards

We have used the following memory cards:

- AMI SMART PACK 2
- AST
- JustRAM/AT 8MB Card (Monolithic Systems)
- Quadram
- Tecmar
- Talltree Systems
- Silicon Valley Systems
- STB Rio Grande
- Micron Chessmate

1.3.4 Add-On Hard Disks

As noted earlier, many hard disks can be used as long as the motherboard supports the drive, or the ROM parameters are entered at installation time. ROM entries for the IBM PC AT are listed here. Refer to your computer hardware manual for the disk types supported by other 286AT computers.
**Release Notes**

<table>
<thead>
<tr>
<th>Type</th>
<th>Cyls.</th>
<th>Hds.</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>306</td>
<td>4</td>
<td>10MB</td>
</tr>
<tr>
<td>2</td>
<td>615</td>
<td>4</td>
<td>20MB</td>
</tr>
<tr>
<td>3</td>
<td>615</td>
<td>6</td>
<td>30MB</td>
</tr>
<tr>
<td>4</td>
<td>940</td>
<td>8</td>
<td>60MB</td>
</tr>
<tr>
<td>5</td>
<td>940</td>
<td>6</td>
<td>45MB</td>
</tr>
<tr>
<td>6</td>
<td>615</td>
<td>4</td>
<td>20MB</td>
</tr>
<tr>
<td>7</td>
<td>462</td>
<td>8</td>
<td>30MB</td>
</tr>
<tr>
<td>8</td>
<td>733</td>
<td>5</td>
<td>30MB</td>
</tr>
<tr>
<td>9</td>
<td>900</td>
<td>15</td>
<td>110MB</td>
</tr>
<tr>
<td>10</td>
<td>820</td>
<td>3</td>
<td>20MB</td>
</tr>
<tr>
<td>11</td>
<td>855</td>
<td>5</td>
<td>35MB</td>
</tr>
<tr>
<td>12</td>
<td>855</td>
<td>7</td>
<td>50MB</td>
</tr>
<tr>
<td>13</td>
<td>306</td>
<td>8</td>
<td>20MB</td>
</tr>
<tr>
<td>14</td>
<td>733</td>
<td>7</td>
<td>40MB</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>0</td>
<td>Reserved</td>
</tr>
<tr>
<td>16</td>
<td>612</td>
<td>4</td>
<td>20MB</td>
</tr>
<tr>
<td>17</td>
<td>977</td>
<td>5</td>
<td>40MB</td>
</tr>
<tr>
<td>18</td>
<td>977</td>
<td>7</td>
<td>55MB</td>
</tr>
<tr>
<td>19</td>
<td>1024</td>
<td>7</td>
<td>60MB</td>
</tr>
<tr>
<td>20</td>
<td>733</td>
<td>5</td>
<td>30MB</td>
</tr>
<tr>
<td>21</td>
<td>733</td>
<td>7</td>
<td>40MB</td>
</tr>
<tr>
<td>22</td>
<td>733</td>
<td>5</td>
<td>30MB</td>
</tr>
<tr>
<td>23</td>
<td>306</td>
<td>4</td>
<td>10MB</td>
</tr>
</tbody>
</table>

Note that other compatible machines often have different ROM tables. Check your computer hardware reference manual for the appropriate ROM table entries for your computer.

We have used the following hard disks under the 286AT configuration:

- Emerald 50, 70, 140
- Maxtor 140
- CDC 20, 30, 40, 70
- Core

The Bernoulli Box® runs on standard AT compatibles with the device driver from SCO, purchased separately. The XENIX 286
Operating System is available on Bernoulli cartridges.

1.3.5 Compatible Hard Disk Controllers

We have used the following controllers:

- Adaptec ACB-2370T RLL
- Western Digital WD 1003*
- Western Digital WD-WA2*
- DTC WD1010 compatible
- WD ESDI Controller, as in the Compaq Deskpro 386 - WD-1005

* The Western Digital controller cards use either WD1010, WD2010, or WD2020 controller chips.

The following controller cards have been reported to run with XENIX 286, but we have not tested them:

- DTC 5287 (using the PAR83A Controller chip)
1.4 XENIX 386AT Operating System

1.4.1 Machines

We have used the following machines under the XENIX386AT Operating System:

ACER 1100
ALR 6010 FlexCache 386/2
Corvus 331
Compaq 386
Compaq Deskpro 386/20
Hewlett-Packard Vectra RS/16 PC
Hewlett-Packard Vectra RS/20 PC
ITT 386
Mitsubishi PC-386
NEC PowerMate 386
Noble 386 from PC Discount
Olivetti M380
Tandy 4000
Texas Instruments System 1300
Wyse 386
Zenith Z386

The Intel Inboard in an IBM PC/AT or Intel-supported 286AT XENIX compatible is also supported.

The Orchid JET 386 in an IBM PC/AT or Orchid-supported 286AT XENIX compatible has also been reported to run XENIX386.

These machines have been reported to run XENIX 386, but we have not tested them:

NCR PC916

Note that the personality card supplied by NCR must be configured so that the Video Adapter auto-switch feature is disabled.

The XENIX 386 Operating System will run correctly only on 386 systems using a B1 (or later) stepping of the 386 microprocessor. In addition, the 386 should not have the "32 bit multiply bug" documented in the Operating System Release Notes. Usually, 386 chips marked with a "Σ Σ" are tested to be free of the 32 bit multiply problem. 386 chips marked "Σ" or "16 bit software only" do not function correctly with XENIX386.
1.4.2 General Guidelines for 386AT Peripherals

In general, all peripherals which are supported by the XENIX 286 Operating System are supported by XENIX 386 Operating System if the peripheral is speed rated for the faster machine.

1.4.3 Video Cards

The DDGA model 25-3047 video card runs correctly in this release. The DDGA model 3045A video card is not supported in this release.

1.4.4 Memory Cards

It is strongly recommended that you use 32-bit memory from your machine manufacturer. 16-bit memory is much slower, and may actually degrade overall machine performance. Several manufacturers have not resolved DMA issues relating to 16-bit memory, thus such machines will not recognize 16-bit memory (e.g. Zenith). When in doubt, consult the hardware manufacturer.

REMEMBER: Certain manufacturers reserve the upper 384K of the first megabyte for DOS. On some machines, this "shadow" RAM cannot be accessed by XENIX. You must install additional memory in order to run XENIX.

---

**Note**

Memory parity errors seem to be much more prevalent with 32-bit memory, causing the system to panic. Replacing the defective memory is the only way to solve this problem.

---

1.4.5 Add-On Hard Disks

In general, 286AT disk configurations work on the 386AT.

1.4.6 Serial Cards

It is also strongly recommended that multiport cards utilize 16450 serial I/O chips instead of the slower 8250 chips. If you see a "double echo" problem, particularly on multiport cards, it is due to slow serial I/O hardware.
1.4.7 Compatible Hard Disk Controllers

We have used the following controllers:

- Western Digital WD 1003*
- Western Digital WD-WA2*
- Western Digital WD 1005
- DTC WD1010 compatible
- DTC WD2010 compatible

* The Western Digital controller cards use either WD1010, WD2010, or WD2020 controller chips.

1.4.8 Floppy Drives

Machines configured with 3.5 inch media as drive 0 must use a software distribution on 3.5 inch floppies.
1.5 XENIX 286PS Operating System

1.5.1 Machines

We have used the following machines under the XENIX 286PS Operating System:

IBM Personal System/2 Model 50
IBM Personal System/2 Model 60

Note that you should not use the XENIX 286PS Operating System on the IBM Personal System/2 Model 80. Use only the SCO XENIX 386PS Operating System.

1.5.2 Serial Cards

We have used the following Serial cards under the XENIX 286PS Operating System:

IBM Personal System/2 model 3033 dual async card (up to 3 per system)
Control Systems Hostess/MC (8 port card)

1.5.3 Video Cards and Monitors

We have used the following Video cards under the XENIX 286PS Operating System:

IBM Personal System/2 VGA adapter and the 8503, 8512, and 8513 monitors.

1.5.4 Tape Drives

Personal System/2 tape support is being added as Personal System/2 tape devices are just becoming available. Call your software support center for tape driver availability.

We have used the following tape drives with XENIX-286PS:

Mountain Computer FileSafe Tape controller board
Mountain Computer FileSafe Model 7060 Tape drive
Mountain Computer FileSafe Model 7120 Tape drive

1.5.5 Other Hardware

We have used the following hardware under the XENIX 286PS Operating System:

IBM Personal System/2 internal modem model 0349
Release Notes

1.6 XENIX 386PS Operating System

1.6.1 Machines

We have used the following machines under the XENIX 386PS Operating System:

IBM Personal System/2 Model 80

1.6.2 Serial Cards

We have used the following Serial Cards under the XENIX 386PS Operating System:

IBM Personal System/2 model 3033 dual async card (up to 3 per system)
Control Systems Hostess/MC (8 port card)

1.6.3 Video Cards and Monitors

We have used the following Video Cards under the XENIX 386PS Operating System:

IBM Personal System/2 VGA adapter and the 8503, 8512, and 8513 monitors.

1.6.4 Tape Drives

Personal System/2 tape support is being added as Personal System/2 tape devices are just becoming available. Call your software support center for tape driver availability.

We have used the following tape drives with XENIX-386PS:

Mountain Computer Filesafe* Tape controller board
Mountain Computer Filesafe* Model 7060 Tape drive
Mountain Computer Filesafe* Model 7120 Tape drive

1.6.5 Other Hardware

We have used the following hardware under the XENIX 386PS Operating System:

IBM Personal System/2 internal modem model 0349
1.7 XENIX 286HP Operating System

For XENIX 286HP configuration information, consult the documentation included with your machine.

1.7.1 Machines

The minimum machine configuration that can run the XENIX 286HP Operating System is:

Hewlett-Packard Vectra model 45945A

1.7.2 Memory Cards

In addition to standard PC/AT memory, the following HP memory cards work:

Hewlett-Packard 1/2 MB (45973A)
Hewlett-Packard 1 MB (45974A)

1.7.3 Serial I/O boards

In addition to the previously mentioned serial cards, the following HP cards work:

Hewlett-Packard Serial Card (24540A)
Hewlett-Packard Dual Serial/Parallel Card (24541A)

1.7.4 Video Cards and Monitors

In addition to the previously mentioned video cards and monitors, the following HP video cards and monitors work:

Hewlett-Packard Multimode Video Adaptor Card (45981A)
Hewlett-Packard Monochrome Monitor (35731A)
Hewlett-Packard Color Video Adaptor Card (45984A)
Hewlett-Packard Color Monitor (35741A)
Hewlett-Packard EGA Video Adaptor Card (45983A)
Hewlett-Packard EGA Monitor (35743A)
Release Notes

1.7.5 Other HP Hardware

The following terminals have been verified with XENIX-286-HP:

  Hewlett-Packard 2392
  Hewlett-Packard 2393

Termcap entries have been included to support the HP 2392 and 2393 terminals with the following termcap names:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard HP mode</td>
<td>2392</td>
</tr>
<tr>
<td>HP mode without standout and underline</td>
<td>2392ne</td>
</tr>
<tr>
<td>ANSI mode</td>
<td>2392an (supported by most applications)</td>
</tr>
</tbody>
</table>

Set the TERM environment variable to the appropriate name.

The following printers are supported as standard print devices with XENIX-286-HP:

  Hewlett-Packard LaserJet™ Serial/Parallel (2686A)
  Hewlett-Packard ThinkJet™ Serial/Parallel (2225D/2225C)
  Hewlett-Packard QuietJet™ Serial/Parallel (2227A)

1.7.6 Compatible Hard Disk Controllers

The following table lists the hard disk controllers that have been verified with the XENIX 286HP Operating System:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model#</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hewlett-Packard</td>
<td>45815A</td>
<td>supports 45817M 40MB disk and some third party ST-506 hard disk drives</td>
</tr>
<tr>
<td>Hewlett-Packard</td>
<td>45816A</td>
<td>supports 45816M 3 1/2&quot; ruggedized disk</td>
</tr>
<tr>
<td>Hewlett-Packard</td>
<td>45895A</td>
<td>Western Digital compatible hard disk controller</td>
</tr>
</tbody>
</table>

XG-2-29-88-4.1.1/2.2.3   -A-30-   The Santa Cruz Operation
### 1.7.7 Add-On Hard Disks

The following hard disks have been verified using the HP 45815A controller:

<table>
<thead>
<tr>
<th>Drive</th>
<th>Description</th>
<th>Jumper Setting</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priam® 60</td>
<td>60Mb full height</td>
<td>DBC</td>
<td></td>
</tr>
<tr>
<td>Priam® 40</td>
<td>40Mb full height</td>
<td>AEF</td>
<td></td>
</tr>
<tr>
<td>Seagate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST-4051</td>
<td>40Mb full height</td>
<td>AEF</td>
<td></td>
</tr>
<tr>
<td>ST-225</td>
<td>20Mb half height</td>
<td>DEF</td>
<td></td>
</tr>
<tr>
<td>Maxtor® XT1085</td>
<td>68Mb full height</td>
<td>AEC</td>
<td>Mounting bracket may have to be slightly bent</td>
</tr>
</tbody>
</table>

The following hard disks have been verified using the HP 45895A controller:

<table>
<thead>
<tr>
<th>Drive</th>
<th>Description</th>
<th>Disk Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seagate</td>
<td>20Mb</td>
<td>2</td>
</tr>
<tr>
<td>Seagate</td>
<td>40Mb</td>
<td>17</td>
</tr>
<tr>
<td>Priam®</td>
<td>60Mb</td>
<td>12</td>
</tr>
<tr>
<td>Maxtor®</td>
<td>68Mb</td>
<td>4</td>
</tr>
<tr>
<td>Maxtor®</td>
<td>140Mb</td>
<td>9</td>
</tr>
<tr>
<td>CMI</td>
<td>20Mb</td>
<td>2</td>
</tr>
<tr>
<td>CMI</td>
<td>30Mb</td>
<td>3</td>
</tr>
<tr>
<td>CDC</td>
<td>20Mb</td>
<td>2</td>
</tr>
</tbody>
</table>
The following hard disk types have not been verified but may work with the HP 45895A controller:

<table>
<thead>
<tr>
<th>Type</th>
<th>Cyls.</th>
<th>Hds.</th>
<th>Size</th>
<th>Precompensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>306</td>
<td>4</td>
<td>10 Mb</td>
<td>128</td>
</tr>
<tr>
<td>2</td>
<td>615</td>
<td>4</td>
<td>21 Mb</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>615</td>
<td>6</td>
<td>32 Mb</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>940</td>
<td>8</td>
<td>65 Mb</td>
<td>512</td>
</tr>
<tr>
<td>5</td>
<td>940</td>
<td>6</td>
<td>49 Mb</td>
<td>512</td>
</tr>
<tr>
<td>6</td>
<td>615</td>
<td>4</td>
<td>21 Mb</td>
<td>none</td>
</tr>
<tr>
<td>7</td>
<td>462</td>
<td>8</td>
<td>32 Mb</td>
<td>256</td>
</tr>
<tr>
<td>8</td>
<td>733</td>
<td>5</td>
<td>32 Mb</td>
<td>none</td>
</tr>
<tr>
<td>9</td>
<td>900</td>
<td>15</td>
<td>117 Mb</td>
<td>none</td>
</tr>
<tr>
<td>10</td>
<td>820</td>
<td>3</td>
<td>21 Mb</td>
<td>none</td>
</tr>
<tr>
<td>11</td>
<td>855</td>
<td>5</td>
<td>37 Mb</td>
<td>none</td>
</tr>
<tr>
<td>12</td>
<td>855</td>
<td>7</td>
<td>52 Mb</td>
<td>none</td>
</tr>
<tr>
<td>13</td>
<td>306</td>
<td>8</td>
<td>21 Mb</td>
<td>128</td>
</tr>
<tr>
<td>14</td>
<td>733</td>
<td>7</td>
<td>44 Mb</td>
<td>none</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>0</td>
<td></td>
<td>Reserved, do not use.</td>
</tr>
<tr>
<td>16</td>
<td>612</td>
<td>4</td>
<td>21 Mb</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>977</td>
<td>5</td>
<td>42 Mb</td>
<td>300</td>
</tr>
<tr>
<td>18</td>
<td>977</td>
<td>7</td>
<td>59 Mb</td>
<td>none</td>
</tr>
<tr>
<td>19</td>
<td>1,024</td>
<td>7</td>
<td>62 Mb</td>
<td>512</td>
</tr>
<tr>
<td>20</td>
<td>733</td>
<td>5</td>
<td>32 Mb</td>
<td>300</td>
</tr>
<tr>
<td>21</td>
<td>733</td>
<td>7</td>
<td>44 Mb</td>
<td>300</td>
</tr>
<tr>
<td>22</td>
<td>733</td>
<td>5</td>
<td>32 Mb</td>
<td>300</td>
</tr>
<tr>
<td>23</td>
<td>306</td>
<td>4</td>
<td>10 Mb</td>
<td>0</td>
</tr>
</tbody>
</table>
1.8 XENIX 286/386AT ESDI Operating System

1.8.1 Introduction

This section describes the hardware installation and software configuration of SMS OMTI 8620 and 8627 disk drive controllers under SCO XENIX System V Release 2.2 for 286 and 386 personal computers. There is also a note for system integrators on performing low-level formats on new disks, and some discussion on bad tracking and disk space usage.

This product supports one SMS OMTI 8620 or 8627 controller with up to 2 drives attached to it. Either or both drives may have an ESDI or ST506 drive interface. This product provides an OMTI-specific device driver to supplement the Western Digital-specific device driver in standard SCO XENIX System V 286 and 386 Release 2.2.

1.8.2 General Notes

You must know what BIOS is in use on your controller card before you install the disk system. To check your BIOS type, find the BIOS chip on the controller card. Most manufacturer's BIOS chips are found near the bus connectors in space U37. Do not confuse this chip with the OMTI firmware chip which resides near it on the board in space U31. Read and note the model number on the BIOS chip. You need to know this number to accurately set the jumpers on your controller card. Tables are provided later in this section that specify the jumper settings for each different kind of BIOS.

Before XENIX can be installed on a system equipped with an 8620 or 8627 disk controller, you must run your manufacturer's setup program and set the computer up for operation without a hard disk. This is because the OMTI firmware supercedes the instructions on the normal CMOS systems for hard disks. After you run the setup utility, the installed disk(s) may need to be formatted with the sfmt low-level formatting routine, which resides in the OMTI firmware. Low-level disk formatting is usually performed on bundled systems before delivery. If this formatting has not been done, you must format the disk before installing XENIX.
1.8.3 Standard Installation

XENIX cannot be installed if the disk is in need of low-level formatting or if defective tracks have not been accounted for. Check to see if XENIX ESDI displays the following message when you boot XENIX:

disk[E]drive 0: cyls = ...

The "E" label indicates that you can use the sfmt utility to format your disk, if it is not formatted already. (If you do not see this label, do not use sfmt to format your disk.) You are redirected to sfmt if you attempt to modify disk parameters through dkninit at installation time. You will see:

Please use sfmt to modify disk parameters

Reboot, then invoke sfmt at the "Boot:" prompt to do low-level formatting, non-standard disk parameter initialization, and initial processing of manufacturer-supplied defect lists. If you do not run sfmt at this time, you will have to restart your installation procedure and run it before you can successfully install XENIX. sfmt should also be used for non-standard disk support.

The defect-processing algorithm reduces the total number of disk cylinders available for use by XENIX. dkninit will display the new total.

If the "disk[E]" banner is not displayed, do not use sfmt to format your disk. Instead, please contact your controller's vendor for low-level formatting information if you need to format your disk(s).

Enter "sfmt" at the boot prompt if your disk requires low-level formatting:

    Boot
    : sfmt

You see:

This FORMAT routine will DESTROY ALL data on your disk!

Press <RET> to proceed or <ESC> to cancel...

Next you are prompted to enter the number of the drive you are formatting. You see:

XG-2-29-88-4.1.1/2.2.3    - A.-34 -    The Santa Cruz Operation
Enter drive # (0 or 1):
If there is only one hard disk, enter 0. Next you see:

Use default parameters (Y/N)?
If your disk is non-standard, answer “N”. You must now know the parameters for your disk. If you answered “no” you are prompted to enter the total number of cylinders and heads for your disk. You see:

Total CYLS:

Total HEADS:
Next you see:

Write Precomp CYL CONTROL BYTE: 2
sfmt supplies “2” as a default but you can overwrite this answer. Check your manufacturer’s specification for the correct value. Next you see:

Press <RET> to proceed or <ESC> to cancel...
If you wish to proceed, press RETURN. Next you see:

Logical partitioning desired (Y/N)?
Enter “N”. Next you see:

Any defects (Y/N)?
If you do not need to manually enter any bad tracks, press “N”. Enter “Y” if you need to add bad tracks. You see:

(Press <RET> to end defect list)
CYLINDER:
HEAD:
When you have entered all known defects in the hard disk by cylinder and head numbers, press RETURN at the

CYLINDER:
Prompt. You see:

More entries (Y/N)?
Enter “N”. Next you see:
Press <RET> to proceed or <ESC> to cancel...

Now you are prompted to set the interleave factor for your hard disk. Disk speed performance may be severely reduced if your interleave factor is set incorrectly. Check your manufacturer's documentation carefully for the correct interleave factor. You see:

Interleave (1-15):

Note that if your disk supports 35 sectors per track, you should not use an interleave value of 5 or 7. Next you see:

Are you SURE you want to format (Y/N)?

Enter "Y" if you are satisfied that all your answers are correct. You see:

Formatting.....

When sfmt is finished formatting the disk, you see:

Formatting complete,
params saved,
Hit any key to reboot

Press any key and you see the XENIX boot prompt again:

Boot :

Press RETURN to boot XENIX.

dkinit

dkinit is primarily for unusual or non-standard disks. Unless you know your disk is non-standard, assume that it is standard. When dkinit is run during XENIX installation, choose option 1 to display the current disk parameters. If these parameters do not correspond to the hard disk you have, you must modify the current parameters. If the "disk [E]" banner was displayed at power-up, please use sfmt to modify these parameters. Otherwise, follow the instructions provided in the XENIX Installation Guide.

Badtracking

The number of cylinders used for bad track alteration will be subtracted from the total number of cylinders available to the user.
After you have finished scanning for bad tracks during the installation process, examine the bad track table. If the "disk[E]" banner was displayed at power-up and you ran \texttt{sfmt}, check to see if any of the flaws in the manufacturer's disk flaw map are displayed in the XENIX bad track table. If no bad tracks are shown, \texttt{sfmt} located all the bad tracks in the flaw map and you do not need to enter them from the list supplied with the disk. If all the bad tracks from the supplied list appear, \texttt{XENIX badtrack} located the flaws and you do not need to enter them from the supplied list. If, however, only some of the listed bad tracks are displayed, you must enter any bad tracks that are listed on the supplied bad track list but \textit{not} displayed on the screen. If the "disk[E]" banner was not displayed, you must enter all of the flaws in the manufacturer's supplied list that are not already displayed in the bad track table. The following table outlines all possible options and the appropriate actions:

<table>
<thead>
<tr>
<th>Display</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No bad tracks displayed</td>
<td>Do not enter any bad tracks</td>
</tr>
<tr>
<td>All bad tracks displayed</td>
<td>Do not enter any bad tracks</td>
</tr>
<tr>
<td>Some bad tracks displayed</td>
<td>Enter any bad tracks not displayed</td>
</tr>
<tr>
<td>You did not run \texttt{sfmt}</td>
<td>Enter all bad tracks on the supplied list</td>
</tr>
</tbody>
</table>

Use XENIX badtracking to process defects that need to be added to the bad track table at a later date. Allocate space for future bad tracks even if none are found during the initial scan. Keep in mind that if you do not allocate enough space now, and your table fills up later, you must reinstall to add additional bad tracks.

\subsection*{1.8.4 Hardware Installation and Initialization}

The next few sections are for those system integrators and experienced users who are assembling a computer system from scratch, and who are installing disks themselves.

\subsection*{1.8.5 DMA/Programmed I/O Considerations}

The disk controller supports three different I/O modes: DMA, simple programmed I/O and optimized programmed I/O. DMA is Direct Memory Access mode, simple programmed I/O is slow but will work on virtually all machines, and optimized programmed I/O is fast but may not work on all machines. Under XENIX-286, DMA
mode is the default. Under XENIX-386, simple programmed I/O is the default mode. After you install XENIX, you may switch between the different modes by patching the kernel in single-user mode using \texttt{adb} (\texttt{adbL} if your machine is a 286):

\begin{verbatim}
  # adb -w /xenix
  * dkio_type /w n
  * $q
  #
\end{verbatim}

The pound signs (\#) are prompts from the system shell and the asterisks are prompts from \texttt{adb}; do not type them in.

In the patch above, \textit{n} is 1 for the default DMA mode, 2 for simple programmed I/O mode, and 3 for optimized programmed mode.

The default for XENIX-386ESDI is programmed I/O. The default for XENIX-286ESDI is DMA.

Standard personal computers that support I/O channel ready will work with the 286/386 ESDI configuration of XENIX System V Release 2.2 in the optimized programmed I/O mode with no problems. Machines that do not support I/O channel ready will invariably crash, with a high probability of data corruption. If you are unsure as to whether your machine supports I/O channel ready, consult your computer's manufacturer.

1.8.6 Interleave Factors

A 1:1 interleave factor is supported. To change interleave factors, refer to the \texttt{sfmt} instructions.

1.8.7 Drive Size Limits

The limitations for attached disks are 1024 cylinders (10 bits of cylinder addressing) and 16 heads, due to the \texttt{fdisk} structure shared by all operating systems. You can attach larger disks, but you cannot use more than 1024 cylinders, even with multiple \texttt{fdisk} partitions; the excess storage space is unaddressable.

Setting Up a One-Drive System

1. Cabling Requirements: One (1) 34-pin straight-through cable. One (1) 20-pin straight-through cable.
2. On the hard disk: Install drive select jumper to lowest Drive Select (DS0 or DS1).

3. On the controller: Install jumpers W20 to W23 according to the information in the "Drive Jumper Settings" table provided in the "Drive Tables" section on the 286/386AT ESDI Operating System. To find the correct drive table for your hardware, note your board type and BIOS type and find them on the following table. The BIOS types are listed across the top of the table and the board types are listed down the left side. To find the correct table to use, check the listing at the intersection of your BIOS and board types. For example, if your BIOS type is 1002579 and your board type is 8620, you can find your correct board settings in Table A.

<table>
<thead>
<tr>
<th>Board Types</th>
<th>BIOS Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1002579</td>
<td>1002580</td>
</tr>
<tr>
<td>8620</td>
<td>Table A</td>
</tr>
<tr>
<td>8627</td>
<td>†</td>
</tr>
</tbody>
</table>

† indicates a drive/BIOS combination that does not exist.

If your drive is a non-ESDI drive type and it does not correspond to the default ST506 drive type(s), enter disk characteristics as in step 10.

4. Remove the existing hard disk controller and unplug the connecting cables. If a separate floppy drive controller is being used, remove it and connect the 34 pin floppy cable to the J1 connector on the ESDI controller.

5. The number of hard disks in the system must be reported as zero (0) when initializing the system configuration parameters using the setup utility provided by your computer's manufacturer.

6. Install the 34-pin drive interface cable to the J2 connector. Install the 20-pin data cable to either the J3 or J4 connector.
7. Install the ESDI controller in any available slot on the motherboard. CAUTION: Power must be off!

8. Use the manufacturers setup utility to change your system settings to indicate that there is no hard disk used with your system.

9. If you need to format your disk, type `sfmt` at the `Boot:` prompt. You must know the hard disk parameters before you invoke `sfmt`.

10. Answer all questions as prompted. Note: If your drive is not listed in the BIOS drive table answer "N" to "Use defaults (Y/N)?" prompt. Then, enter the correct drive characteristics. If your drive is a non-ESDI drive type and it does not correspond to the default ST506 drive type(s), you are prompted to enter disk characteristics.

11. At the completion of this installation procedure, you will be directed to reboot the system. After doing so, continue with normal XENIX installation procedure.

Setting Up a Two-Drive System


2. On hard disks: set Drive Select to DS0 (or DS1) on the first drive, and Drive Select to DS1 (or DS2) on the second drive. Install termination resistor on drive at end of daisy chain cable. Remove termination resistor on drive in the middle of daisy chain cable.

3. Follow steps 3-9 above.
### User-Configurable Jumpers

<table>
<thead>
<tr>
<th>W20</th>
<th>W21</th>
<th>W22</th>
<th>W23</th>
<th>Refer to Drive Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W17</th>
<th>W18</th>
<th>W19</th>
<th>Winchester I/O Port Base Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0*</td>
<td>0*</td>
<td>0*</td>
<td>320H</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>324H</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>328H</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>32CH</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1A0H</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1A4H</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1A8H</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1ACH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W16</th>
<th>BIOS EPROM Control</th>
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</thead>
<tbody>
<tr>
<td>0*</td>
<td>Enable BIOS</td>
</tr>
<tr>
<td>1</td>
<td>Disable BIOS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W15</th>
<th>BIOS Base Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0*</td>
<td>C8000H</td>
</tr>
<tr>
<td>1</td>
<td>CA000H</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W14</th>
<th>Floppy Disk I/O Port Base Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0*</td>
<td>03F0H</td>
</tr>
<tr>
<td>1</td>
<td>0370H</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W10</th>
<th>W11</th>
<th>Bytes/Sector</th>
<th>Sectors/Track (ST506)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>8620</td>
</tr>
<tr>
<td>0*</td>
<td>0*</td>
<td>512</td>
<td>17</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>512</td>
<td>18</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1024</td>
<td>9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1056</td>
<td>9</td>
</tr>
</tbody>
</table>

0=Jumper not installed  
1=Jumper installed  
* = Jumper as shipped
### Release Notes

<table>
<thead>
<tr>
<th>LUN 0</th>
<th>LUN 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>W9</strong> Sector Type</td>
<td><strong>W6</strong> Sector Type</td>
</tr>
<tr>
<td>0* Soft sectored</td>
<td>0* Soft sectored</td>
</tr>
<tr>
<td>1 Hard sectored</td>
<td>1 Hard sectored</td>
</tr>
<tr>
<td><strong>W8</strong> Drive Class</td>
<td><strong>W5</strong> Drive Class</td>
</tr>
<tr>
<td>0* ST506 Compatible</td>
<td>0* ST506 Compatible</td>
</tr>
<tr>
<td>1 ESDI Compatible</td>
<td>1 ESDI Compatible</td>
</tr>
<tr>
<td><strong>W7</strong> Drive Type</td>
<td><strong>W4</strong> Drive Type</td>
</tr>
<tr>
<td>0* Fixed</td>
<td>0* Fixed</td>
</tr>
<tr>
<td>1 Removable</td>
<td>1 Removable</td>
</tr>
</tbody>
</table>

0=Jumper not installed
1=Jumper installed
*=Jumper as shipped
LUN=Logical Unit Number

### Drive Jumper Settings

**BIOS #1002579, #1002580:**

W20-W23: Hard disk drive jumpers

**BIOS #1002661, #1002662:**

- **W20** Reserved
- **W21** I/O Speed Option:
  - 0* High Performance (not supported by all computers)
  - 1 Normal
- **W22, W23** Hard disk drive jumpers

---

XG-2-29-88-4.1.1/2.2.3 - A-42 - The Santa Cruz Operation
### 1.8.8 Drive Tables

**Table A**
8620 Drive Table
BIOS #1002579, AT3

<table>
<thead>
<tr>
<th>LUN 0</th>
<th>W20</th>
<th>W21</th>
<th>Drive/Model or Compatibles</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td>ESDI Drives</td>
<td>987</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td></td>
<td>Vertex/Prim V170</td>
<td>918</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td>Maxtor XT1140</td>
<td>918</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td></td>
<td>MiniscrIBE 3425</td>
<td>612</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LUN 1</th>
<th>W22</th>
<th>W23</th>
<th>Drive/Model or Compatibles</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td>ESDI Drives</td>
<td>987</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td></td>
<td>Vertex/Prim V170</td>
<td>918</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td>Maxtor XT1140</td>
<td>918</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td></td>
<td>MiniscrIBE 3425</td>
<td>612</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
Table B
8627 Drive Table
BIOS #1002580, BIOS AT4

<table>
<thead>
<tr>
<th>W20</th>
<th>W21</th>
<th>Drive/Model or Compatibles</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUN 0</td>
<td></td>
<td>ESDI Drives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Seagate ST277R</td>
<td>820</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>Seagate ST4144R</td>
<td>1024</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Seagate ST238</td>
<td>615</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

W22  W23

LUN 1

<table>
<thead>
<tr>
<th>W20</th>
<th>W21</th>
<th>Drive/Model or Compatibles</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>ESDI Drives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>Seagate ST277R</td>
<td>820</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>Seagate ST4144R</td>
<td>1024</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Seagate ST238</td>
<td>615</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Table C
8620 Drive Table
BIOS #1002661, AT5

<table>
<thead>
<tr>
<th>W23</th>
<th>Drive Type</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUN 0</td>
<td></td>
<td>612</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Seagate ST225</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ESDI Drive</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

W22

LUN 1

<table>
<thead>
<tr>
<th>W20</th>
<th>W21</th>
<th>Drive Type</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>Seagate ST225</td>
<td>612</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>ESDI Drive</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

XG-2-29-88-4.1.1/2.2.3  - A-44 -  The Santa Cruz Operation
### Table D
8620 Drive Table
BIOS #1002662, BIOS AT6

<table>
<thead>
<tr>
<th>W23</th>
<th>Drive Type</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUN 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Seagate ST238R</td>
<td>615</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>ESDI Drive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| LUN 1 | | | | |
| 0    | Seagate ST238R | 615  | 4     | -              |
| 1    | ESDI Drive     |      |       |                |
# Drive Characteristics Reference Guide

**MFM Hard Disk Drives**

<table>
<thead>
<tr>
<th>Drive/Model</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxtor XT1140</td>
<td>918</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>CMI 6426</td>
<td>640</td>
<td>4</td>
<td>256</td>
</tr>
<tr>
<td>Rodine 352</td>
<td>306</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Microscience HH312</td>
<td>306</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Seagate ST4026</td>
<td>615</td>
<td>4</td>
<td>300</td>
</tr>
<tr>
<td>Cynthia 570</td>
<td>987</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Vertex V170</td>
<td>987</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>DMA/RICOH (Removable 10MB)</td>
<td>612</td>
<td>2</td>
<td>400</td>
</tr>
<tr>
<td>Seagate ST4038</td>
<td>733</td>
<td>5</td>
<td>300</td>
</tr>
<tr>
<td>Seagate ST213</td>
<td>612</td>
<td>2</td>
<td>256</td>
</tr>
<tr>
<td>Miniscribe 3425</td>
<td>612</td>
<td>4</td>
<td>128</td>
</tr>
<tr>
<td>Quantum Q540</td>
<td>512</td>
<td>8</td>
<td>256</td>
</tr>
<tr>
<td>Seagate ST4051</td>
<td>977</td>
<td>5</td>
<td>300</td>
</tr>
<tr>
<td>CDC 3212</td>
<td>612</td>
<td>2</td>
<td>128</td>
</tr>
<tr>
<td>Miniscribe 3012/3212</td>
<td>612</td>
<td>2</td>
<td>128</td>
</tr>
<tr>
<td>CMI 6640</td>
<td>640</td>
<td>6</td>
<td>256</td>
</tr>
<tr>
<td>Tulin 240</td>
<td>640</td>
<td>6</td>
<td>256</td>
</tr>
<tr>
<td>Seagate ST225</td>
<td>615</td>
<td>4</td>
<td>256</td>
</tr>
<tr>
<td>CMI 3426</td>
<td>615</td>
<td>4</td>
<td>256</td>
</tr>
<tr>
<td>CMI 5412</td>
<td>306</td>
<td>4</td>
<td>128</td>
</tr>
<tr>
<td>Lapine 3522</td>
<td>306</td>
<td>4</td>
<td>128</td>
</tr>
<tr>
<td>Otari 514</td>
<td>306</td>
<td>4</td>
<td>128</td>
</tr>
<tr>
<td>Seagate ST412/ST212</td>
<td>306</td>
<td>4</td>
<td>128</td>
</tr>
<tr>
<td>Shugart 712</td>
<td>306</td>
<td>4</td>
<td>128</td>
</tr>
</tbody>
</table>

**Write**

**Note:** This is a list of some prominent MFM drives in the industry. It is not a comprehensive list.

XG-2-29-88-4.1.1/2.2.3   - A-46 -   The Santa Cruz Operation
### Drive Characteristics

**Reference Guide**
**RLL Vendor Certified**
**Hard Disk Drives**

<table>
<thead>
<tr>
<th>Drive/Model</th>
<th>Cyl.</th>
<th>Heads</th>
<th>Write Precomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atasi 3085</td>
<td>1024</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Miniscribe 8438</td>
<td>612</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Microscience HH330</td>
<td>612</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Microscience HH738</td>
<td>612</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Peripheral Tech 357R</td>
<td>615</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Lapine LT300</td>
<td>616</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Priam V170</td>
<td>987</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Priam V185</td>
<td>1024</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Priam 514</td>
<td>1024</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>Priam 519</td>
<td>1024</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Seagate ST251R</td>
<td>820</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Seagate ST277R</td>
<td>820</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Seagate ST4077R</td>
<td>1024</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Seagate ST4144R</td>
<td>1024</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>Toshiba MK53FB</td>
<td>830</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Toshiba MK54FB</td>
<td>830</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Seagate ST238R</td>
<td>615</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Miniscribe 3438</td>
<td>615</td>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:** This is a list of some prominent RLL drives in the industry. It is not a comprehensive list.
1.9 XENIX 6300+ Operating System

XENIX 6300+ Operating System runs standard AT&T hardware with original switch settings.

1.9.1 Memory Cards

Use AT&T memory cards, since the 6300+ has its own 16 bit bus and is not AT memory card compatible.

1.9.2 Hard Disks

The latest BIOS, version 2.01, contains a table of 8 supported disks and their characteristics:

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Example</th>
<th>Cyls</th>
<th>Hds</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10MB</td>
<td></td>
<td>306 cylinders</td>
<td>4 heads</td>
</tr>
<tr>
<td>1</td>
<td>30MB</td>
<td>CDC Wren</td>
<td>697 cylinders</td>
<td>5 heads</td>
</tr>
<tr>
<td>2</td>
<td>20MB</td>
<td>CMI CM6426</td>
<td>640 cylinders</td>
<td>4 heads</td>
</tr>
<tr>
<td>3</td>
<td>40MB</td>
<td>Tandon</td>
<td>981 cylinders</td>
<td>5 heads</td>
</tr>
<tr>
<td>4</td>
<td>40MB</td>
<td>Seagate ST4051</td>
<td>977 cylinders</td>
<td>5 heads</td>
</tr>
<tr>
<td>5</td>
<td>80MB</td>
<td>Miniscribe 8086</td>
<td>1024 cylinders</td>
<td>8 heads</td>
</tr>
<tr>
<td>6</td>
<td>67MB</td>
<td>Micropolis 1325</td>
<td>1024 cylinders</td>
<td>8 heads</td>
</tr>
<tr>
<td>7</td>
<td>20MB</td>
<td>Seagate ST225</td>
<td>612 cylinders</td>
<td>4 heads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or Miniscribe 3425</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note

BIOS table 2.01 contains an error, the entry for type 5 should say 67MB instead of 80MB.

Type 7 is the standard 20 MB disk currently in use in the PC 6300+. The above table is the same as the one contained in BIOS versions 1.04 and 1.06. There are some other parameters in the table that are not listed here. These parameters affect performance rather than capacity, so they are not listed.

Hard disk drives C (and, optionally, D) are identified as entries 0-7 in the table above by setting one DIP switch on the motherboard and two jumpers on the Western Digital controller board. On the
motherboard, there is a package of eight switches labeled "DSW-1." Switch 3 is the most significant bit for drive D, and switch 4 is the most significant bit for drive C. On the HDU controller board, there is a package of eight jumper positions labeled "SW1."

The next two significant bits are jumper positions 4 and 3 for drive C and 2 and 1 for drive D.

In all cases, "OFF" or "Open" is binary "0," and "ON" or "Closed" is binary "1." So the eight possible settings are:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Motherboard DSW-1 switch</th>
<th>Disk Controller Board SW1 jumpers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>On</td>
<td>Closed</td>
</tr>
<tr>
<td>1</td>
<td>On</td>
<td>Closed</td>
</tr>
<tr>
<td>2</td>
<td>On</td>
<td>Open</td>
</tr>
<tr>
<td>3</td>
<td>On</td>
<td>Open</td>
</tr>
<tr>
<td>4</td>
<td>Off</td>
<td>Closed</td>
</tr>
<tr>
<td>5</td>
<td>Off</td>
<td>Closed</td>
</tr>
<tr>
<td>6</td>
<td>Off</td>
<td>Open</td>
</tr>
<tr>
<td>7</td>
<td>Off</td>
<td>Open</td>
</tr>
</tbody>
</table>
1.10 XENIX 86XT Operating System

1.10.1 Machines

We have used the following machines under the XENIX 86XT Operating System:

- American Research Corporation (ARC-XT)
- AT&T 6300 (Olivetti M24 in Europe)
- Compaq Portable, DeskPro™ * and Plus™ *
- Eagle Turbo
- Epson Equity I+
- IBM PC XT®
- ITT XP
- ITT XTRA
- Mitsubishi
- NCR™ PC-6**
- Tandy 1200
- UNI® SYSTM
- Wavematte Bullet-286 XT
- WYSEpc WY-1100
- WYSEpc+ WY-1400

* Internal cartridge tape not supported.
** For the NCR machine, configure the switches on the motherboard for a color monitor, regardless of the type of monitor used.

These machines have been reported to run the XENIX 86XT Operating System, but we have not tested them:

- Compuserve/Canada Arthur in Canada
- Ericsson PC
- Leading Edge
- Victor VPC 30 and VPC 15
1.10.2 Math Chips

We have used the following math co-processor chips under the XENIX 86XT Operating System:

- 8087 For 8088 CPUs.
- 8087-2 For 8086 CPUs.
- 8087-3 For fast 8086 CPUs.

1.10.3 Memory Cards

We have used the following memory cards under the XENIX 86XT Operating System:

- AST 6 Pack+
- Tandon
- Quadram Quadboard
- Sigma Maximizer
- Microsoft RAM card
- Tecmar Captain or First-Mate
- AT&T for the 6300

1.10.4 Accelerator Boards

Accelerator boards are special cards that plug in to an 8088 machine (not an 8086). They replace the 8088 CPU with a 286 CPU and perhaps replace some memory as well. XENIX runs on accelerator boards in 8086 unmapped mode.

The following accelerator board is supported in the XENIX 86XT Operating System standard distribution:

- Seattle Telecom and Data (STD) PC286

1.10.5 Add-On Hard Disks

We have used the following hard disks under the standard disk configuration.
CMI 15
Plus HardCard 10
MiniscrIbe 20
Seagate 20
CDC 30
Rodime 30
Mountain 20, 30
Syquest SQ306 standard
CDC Wren
Seagate ST-225
MiniscrIbe 3425

The following disks have been reported to work under the standard disk configuration, but we have not tested them:

Peachtree 10, 20, 30
Maynard Apollo 30
Franklin Telecom 10, 20, 33
Rodime 10
Tandon 10
Alpha Omega 10, 20, 30
Mountain Hard File

The following tables list the controllers most commonly used with 8086/8088 machines, and the type of hard disks they can support:

<table>
<thead>
<tr>
<th>XEBEC Controller</th>
<th>(standard IBM PC/XT compatible)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
DTC Controller
(standard on AT&T 6300 - fully supported)

<table>
<thead>
<tr>
<th>Type</th>
<th>Cyls</th>
<th>Hds</th>
<th>Size</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>306</td>
<td>2</td>
<td>5 MB</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>375</td>
<td>8</td>
<td>24 MB</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>306</td>
<td>6</td>
<td>15 MB</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>306</td>
<td>4</td>
<td>10 MB</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>306</td>
<td>2</td>
<td>5 MB</td>
<td>Syquest SQ306 standard</td>
</tr>
<tr>
<td>5</td>
<td>697</td>
<td>5</td>
<td>30 MB</td>
<td>CDC Wren</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>20 MB</td>
<td>Seagate ST-225</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>20 MB</td>
<td>Miniscribe 3425</td>
</tr>
</tbody>
</table>

Drive types 8 - 15 reserved

1.10.6 Compatible Hard Disk Controllers

The following table lists the hard disk controllers that we have used under the XENIX 86XT Operating System configuration:

- XEBEC 1210A
- DTC 5150
- WD 1002/WX-2
- Adaptec 2002
- 1st interface
- ADES
- CDC
Appendix B

Common Installation/Configuration Questions and Answers

B.1 Common Questions and Answers  B-1
B.1 Common Questions and Answers

This section is our support department's combined effort to present answers to the most common installation/configuration questions.

1. "EEE"s on Screen When Booting from N1 Floppy
2. Blank or Garbled Display When Booting, Or Display Won't Scroll
3. Error Message: "Panic: memory failure -- parity error"
4. Adding a Serial Card and Terminal
5. Serial Printer is Not Printing
6. Setting Terminal Type Automatically
7. 286 Drivers Won't Work with 386
8. Trouble Configuring Memory on 386 Machine, or System Runs Slow After Adding Memory
9. Parallel Printer is Printing Slowly or Not at All
1. **PROBLEM:** When booting from the N1 floppy, "EEEEEE"'s print on the console and the system refuses to respond.

**REMEDY:** Try booting a DOS floppy, or other bootable diskette. If the machine can boot a diskette, then your N1 floppy is corrupted. You are entitled to a free replacement floppy.

2. **PROBLEM:** When booting up, the console screen blanks, the cursor is gone, or the display is garbled.

**REMEDY:** You may have an incompatible monitor card. Check "Video Adapters and Monitors" under "General Compatibility Guidelines" in Appendix A of these Notes for a list of supported video cards and monitors. If yours is not listed but compatible with one on the list, it should work. If not, check your card's hardware manual to see if there are ways to configure the switch settings so the card is in an IBM-compatible emulation mode and that it is addressing the kind of monitor attached. If changing the switch settings fails, then your monitor card is incompatible, and should be replaced with a compatible card.

3. **PROBLEM:** I see the error message:

   Panic: memory failure -- parity error

**REMEDY:** Some part of your hardware is sending a "non-maskable memory error interrupt" (a signal sent by the hardware that halts the operating system). Run your system's hardware diagnostics tests if available. Physically re-seat your memory cards and chips, and check for bent pins, etc. If these measures fail to correct the problem, or you don't feel comfortable in checking your hardware yourself, seek assistance from professional hardware experts. One frequent cause is memory chips that are slower than factory-recommended chips.
4. **PROBLEM:** I am trying to add a terminal to a serial port, but do not get a login.

**REMEDY:** Follow these procedures to locate the cause of the problem.

A. If you are using a 4 or 8-port serial expansion board, check to see if your board is recognized at bootup by checking the bootup message. If not, the some of switches on your card are not set properly. The most frequent cause of boards not being recognized at boot time is incorrect switch settings for the strap address. Check your board's hardware documentation for the proper switch settings and the "Compatible Hardware" section of these Notes for the correct addresses. COM1 should be configured as interrupt 4 and COM2 as interrupt 3. When the card is correctly configured and recognized in the boot up message, run "/etc/mkdev serial" which creates device files for your extra serial ports.

B. Note that the bootup message only verifies the addresses of the ports. If your interrupt is incorrectly configured on the board, it still will not work. Both the addresses and the interrupt line must be set correctly on the board. You must also make sure that the addresses and interrupt line chosen do not conflict with any other devices (e.g. other serial boards, tape drives, etc.).

C. Make sure you are in multi-user mode, your terminal is plugged in and turned on and set for 9600 baud, 8 data bits, 1 stop bit, no parity. (If your terminal doesn't send these, then see the section titled "Changing the gettydefs File" in Chapter 7 of the Operations Guide for ways to configure your terminal.) The terminal should be connected with a cable so that Transmit Data on the serial port is connected to Read Data on the terminal, and
Transmit Data on the terminal is connected to Read
Data on the serial port (see the serial(HW) manual
page in the XENIX Reference Manual or your
terminal manual for more information.)

D. If the port is enabled, press the RETURN key a few
times to see if a 'login:' prompt appears. If so, you
are ready to login. If not, disable the port by typing:

    disable /dev/ttyname  <RETURN>

where ttyname is the device special filename of the
port in question. (For more information on the
naming convention for serial ports, see serial(HW)
in the Run Time Environment.) Make sure you're
using the non-modem control device.

E. Check the /etc/ttys file so the entry for this serial port
looks like this:

    0mttyname

If it does not look like the example above, then edit
/etc/ttys with a text editor to correct it.

F. From the console, as root, see if you can redirect
output to your terminal by typing:

    date > /dev/ttyname  <RETURN>

If you do not see the date printed on your terminal
and you are not sure of the correct ttyname, try other
ttynames on that serial port. If you still do not see
the date printed, a hardware problem is possible, so
verify the following:

- Your cable is configured correctly (see B.
  above). Also, try using only pins 2, 3 and 7.

- Re-check your terminal setup
  configuration (see #2 above).
Common Installation/Configuration Questions and Answers

- Re-check your switches on your serial port. If you are using a multi-port card, try other lines on that card.

- Try attaching the terminal to a standard serial port, COM1 or COM2, to see if the terminal and cabling is correct.

G. Once you get the date printed on your terminal, then enable the port and look for the 'login:' prompt.

      enable /dev/ttyname  <RETURN>

If you do not see the 'login' prompt, then verify that getty is actually running on that port and that the software is configured properly by typing:

      ps -lft ttyname  <RETURN>

The output should look similar to the following where "login" or "getty" is listed in the "CMD" column.

      F S UID PID PPID C PRI NI ADDR SZ WCHAN TTY TIME CMD
      1 S 214 9210 1 0 30 20 344 22 6994 2a 0:06 getty

H. If you have typed the disable and enable commands many times, it is possible that a new getty cannot be spawned on that port. If so, then shutdown the system, re-boot, enter multi-user mode, and try again.

5. PROBLEM: I can't get a printout on my serial printer.

REMEDY: Make sure your serial printer is configured properly under XENIX:

A. Be sure your printer is capable of supporting XON/XOFF or DTR protocols and is configured for those protocols. Verify that it is turned on and the cable is properly attached to the computer and printer. For more information on XON or XOFF protocols, consult your printer hardware
documentation.

B. If the port is enabled, disable it by typing:

    disable /dev/tnname  <RETURN>

where $tnname$ is the device special file name of the port in question. (For more information on the naming convention for serial ports, see $ser$ial (HW) in the Run Time Environment.) Make sure you're using the non-modem control device.

C. From the console, as root, see if you can redirect output to your printer by typing:

    date > /dev/tnname  <RETURN>

If you do not see the date printed on your printer and you are not sure of the correct $tnname$, try other $tnnames$ on that serial port. If you still do not see the date printed, hardware is suspect so verify the following:

- Your cable is configured correctly. If using XON/XOFF protocol, see Question 5 step B above. Also, try using only pins 2, 3 and 7.

- Re-check your printer configuration by verifying its switches in your printer hardware manual. (See item A above.)

- Re-check your switches on your serial port. If you are using a multi-port card, try other lines on that card and be sure it does not conflict with the standard COM ports.

- Try attaching the printer to a standard serial port, COM1 or COM2, to see if the printer and cabling is correct.

D. When you get the date printed on your printer, you should run $mkdev l p$ to configure the spooler to
support this printer. (See Chapter 7 of the XENIX Operations Guide for more information on lpinit, which is called by mkdev lp.) Then be sure to enter the correct stty(C) options in the spooler’s interface script (/usr/spool/lp/interface/printername) to control the baud rate, XON/XOFF protocol, and other options as necessary. The baud rate and XON/XOFF protocol should match the baud rate set on your printer.

6. **PROBLEM:** How can I get my terminal type set automatically when I login?

**REMEDY:** XENIX can be easily configured to automatically set the terminal type upon login by following these procedures:

A. Login on the terminal in question and determine which *ttyname* you’re using by typing:

```
tty <RETURN>
```

B. Login as root and edit the file `/etc/ttytype` with a text editor. Change the terminal type field for the line associated with the terminal in question to the terminal type you desire to use. Follow the model for the console. If you want your terminal type to be set to ‘wy50’ for `/dev/tty1a`, edit `/etc/ttytype` as follows:

```
wy50 tty1a
```
C. Then the user's start up file must be edited with the appropriate tset(C) command line to automatically set the terminal type. In each C-shell user's .login file, add the following line:

```
tset -s -Q > /tmp/tset$$; source /tmp/tset$$; /bin/rm /tmp/tset$$
```

Be sure to remove the default setenv(C) command line involving TERM and TERMcap from the .login file.

In each Bourne Shell user's .profile, add the following line:

```
eval 'tset -s'
```

Be sure to remove the existing tset command line from the .profile file.

D. Have each user log out, then log in again to test the new terminal type change. After they log in, have them verify the new termtype by typing:

```
env <RETURN>
```

7. **PROBLEM:** My third-party peripheral device (tape, serial card, etc.) that used to work with XENIX 286 OS using their driver, no longer works with XENIX 386 OS. In some cases, my system hangs when trying to reboot after installing their driver.

**REMEDY:** New vendor-supplied device drivers are required for XENIX 386. 286 device drivers will not link into the 386 kernel. Contact the vendor who supplied you with the 286 device driver, and ask them for a new 386 device driver.

8. **PROBLEM:** I'm having trouble configuring more memory on my 386 machine, or since adding more memory, my 386 machine runs more slowly.

**REMEDY:** With a Compaq 386 machine you must fully
populate the memory board that comes with the machine with column static RAM chips, before you can add extended memory. This is generally true with other 386 machines also.

On a Compaq 386, extended memory must be configured to start at the 4 MB address.

Most extended memory cards use 16-bit memory chips with a speed of about 150 ns. This memory is about 8 times as slow as static RAM, and so performance may be noticeably slower. We recommend using only 32-bit memory from your computer's manufacturer. If you must use 16-bit memory, at least use memory with fast (90ns) chips.

9. **PROBLEM:** I'm trying to print on a parallel printer but am getting no response or very slow printing.

**REMEDY:** Verify the following items, as it is important that your parallel ports be configured properly to work under XENIX:

A. The printer must be IBM compatible and should use a standard Centronics interface cable in order for it to work at all.

B. The IBM AT and XT and compatibles, and 6300+ only support up to 2 parallel ports. Deconfigure additional ports.

C. The parallel port on the monochrome card should be configured for interrupt vector 7, and is recognized as lp1 when booting up.

D. The main parallel port should be configured for interrupt vector 7 and is recognized as lp0. So you must use either the main or the monochrome's port - not both - to avoid a hardware conflict which would cause slow printing.
E. The alternate/second parallel port should be configured for interrupt vector 5, and recognized as lp2. Make sure no other hardware is using these interrupts. (See your hardware manual for information on configuring your parallel ports.)

F. Check to make sure your parallel card is recognized by XENIX by rebooting your system. Following the copyright information on the screen, you should see:

Parallel port lpn present

where lpn is the device special filename of the port the printer is attached to (lp0, lp1 or lp2) as described above. If you do not see this message, check the switches and jumpers on your parallel card to make sure they are correct. Also try setting the card for a different configuration, if possible.

G. Be sure your printer is turned on and on-line, and the cable is properly attached to the computer and printer.

H. From the console, logged in as root, see if you can redirect output to your printer by typing:

    date > /dev/lpn <RETURN>

If you do not see the date printed on your printer, there is most likely some type of hardware malfunction, so verify the following:

- Your cable is securely connected and all wires are good. Using the cable on a known good system, or printing under DOS are good ways to test this.

- Re-check your printer configuration by verifying its switches in your printer hardware manual.
• Re-check the switches on your parallel card. It must be recognized at bootup, as described above in Step F.

When you get the date printed on your printer, you should run `mkdev lp` to configure the spooler to support this printer. (See “Using Peripheral Devices” of the XENIX Operations Guide for more information on `lpinit`, the script called by `mkdev lp`.)

I. If your parallel ports are configured properly, as described above and you still get slow printing, your parallel port may not be capable of generating interrupts. See “Slow Parallel Printers” under Software Notes in these Release Notes for information on correcting this problem.
**DISKCP (C)**

**Name**

diskcp, diskcmp – Copies or compares floppy disks.

**Syntax**


**Description**

These commands provide easy copying of a source floppy disk. *dd(C)* is used to make an image of the source floppy (the one you wish to copy). On machines with one floppy drive *diskcp* temporarily transfers the image to the hard disk until a blank “target” floppy is inserted into the floppy drive. On machines with two floppy drives *dd* immediately places the image of the source floppy directly on the target floppy.

The options are:

- **-f** Format the target floppy disk before the image is copied.

- **-d** The computer has dual floppy drives. *diskcp* copies the image directly onto the target floppy.

- **-s** Uses *sum(C)* to compare the contents of the source and target floppies; gives an error message if the two do not match.

- **-48ds9**
  This setting is for low density 48tpi floppies. It is the default setting.

- **-96ds9**
  This setting is for high density 96tpi floppies.

- **-96ds15**
  This setting is for quad density 96tpi floppies.

- **-135ds9**
  This setting is for high density 135tpi 3.5 inch floppies.

- **-135ds18**
  This setting is for quad density 135tpi 3.5 inch floppies.

*diskcmp* functions similarly to *diskcp*. It compares the contents of one floppy disk with the contents of a second floppy disk using the *cmp* utility.
Examples

To make a copy of a floppy, place the source floppy in the drive and type:

diskcp

When *diskcp* is finished copying to the hard disk, it prompts you to insert the target floppy in the drive. If you specify the `-f` flag when you invoke *diskcp*, the program formats the target floppy. When the copy is finished, *diskcp* prompts if you would like to make another copy of the same source disk. If you enter ‘n’, it prompts if you would like to copy another source disk.

Specify the `-d` flag on the command line if you have two floppy drives:

```
diskcp -d
```

Notes

If *diskcp* encounters a write error while copying the source image to the target disk, it formats the disk and tries to write the source image again. This happens most often when an unformatted floppy is used and the `-f` flag is not specified.

Files

```
/usr/bin/diskcp
/usr/bin/diskcmp
/tmp/disk$$
```

See Also

`cmp(C), dd(C), sum(C)`
DOS (C)  

Name

dos, doscat, doscp, dosdir, dosformat, dosls, dosrm, dosrmdir -
Access DOS files.

Syntax

doscat [-r | -m] file ...
doscp [-r | -m] file1 file2
doscp [-r | -m] file ... directory
dosdir directory ...
dosformat [-fqv] drive
dosls directory ...
dosmkdir directory ...
dosrm file ...
dosrmdir directory ...

Description

The dos commands provide access to the files and directories on MS-DOS disks and on a DOS partition of the hard disk. The commands perform the following actions:

doscat Copies one or more DOS files to the standard output. If -r is given, the files are copied without newline conversions. If -m is given, the files are copied with newline conversions (see “Conversions” below).

doscp Copies files between a DOS disk and a XENIX filesystem. If file1 and file2 are given, file1 is copied to file2. If a directory is given, one or more files are copied to that directory. If -r is given, the files are copied without newline conversions. If -m is given, the files are copied with newline conversions (see “Conversions” below).

dosdir Lists DOS files in the standard DOS style directory format.

dosformat Creates a DOS 2.0 formatted diskette. The drive may be specified in either DOS drive convention, using the default file /etc/default/msdos, or using the XENIX

February 29, 1988
special file name. The -f option suppresses the interactive feature. The -q (quiet) option is used to suppress information normally displayed during dos-format. The -q option does not suppress the interactive feature. The -v option prompts the user for a volume label after the diskette has been formatted. The maximum size of the volume label is 11 characters.

dosl

Lists DOS directories and files in a XENIX style (see ls(C)).

dosrm

Removes files from a DOS disk.

dosmkdir

Creates a directory on a DOS disk.

dosrmdir

Deletes directories from a DOS disk.

The file and directory arguments for DOS files and directories have the form:

device:name

where device is a XENIX pathname for the special device file containing the DOS disk, and name is a pathname to a file or directory on the DOS disk. The two components are separated by a colon (:). For example, the argument:

/dev/fd0:/src/file.asm

specifies the DOS file, file.asm, in the directory, /src, on the disk in the device file /dev/fd0. Note that slashes (and not backslashes) are used as filename separators for DOS pathnames. Arguments without a device: are assumed to be XENIX files.

For convenience, the user configurable default file, /etc/default/msdos, can define DOS drive names to be used in place of the special device file pathnames. It may contain the following lines:

A=/dev/fd0
C=/dev/hd0d
D=/dev/hd1d

The drive letter "A" may be used in place of special device file pathname /dev/fd0 when referencing DOS files (see "Examples" below). The drive letter "C" or "D" refer to the DOS partition on the first or second hard disk.
The commands operate on the following kinds of disks:

- DOS partitions on a hard disk
- 5 1/4 inch DOS
- 3 1/2 inch DOS
- 8, 9, 15, or 18 sectors per track
- 40 tracks per side
- 1 or 2 sides
- DOS versions 1.0, 2.0 or 3.0

Conversions

All DOS text files use a carriage-return/linefeed combination, CR-LF, to indicate a newline. XENIX uses a single newline LF character. When the doscat and doscp commands transfer DOS text files to XENIX, they automatically strip the CR. When text files are transferred to DOS, the commands insert a CR before each LF character.

Under some circumstances the automatic newline conversions do not occur. The -m option may be used to insure the newline conversion. The -r option can be used to override the automatic conversion and force the command to perform a true byte copy regardless of file type.

Examples

doscat /dev/fd0:/docs/memo.txt
doscat /tmp/f1 /tmp/f2 /dev/fd0:/src/file.asm

dosdir /dev/fd0:/src
dosdir A:/src A:/dev

doscp /tmp/myfile.txt /dev/fd0:/docs/memo.txt
doscp /tmp/f1 /tmp/f2 /dev/fd0:/mydir

dosformat A:
dosformat /dev/fd0

dosls /dev/fd0:/src
dosls B:
dosmkdir /dev/fd0:/usr/docs
dosrm /dev/fd0:/docs/memo.txt
dosrm A:/docs/memo1.txt
dosrmkdir /dev/fd0:/usr/docs
Files

/etc/default/msdos Default information
/dev/fd* Floppy disk devices
/dev/hd* Hard disk devices

See Also

assign(C), dtype(C)

Notes

It is not possible to refer to DOS directories with wild card specifications. The programs mentioned above cooperate among themselves so no two programs will access the same DOS disk. Only one process will access a given DOS disk at any time, while other processes wait. If a process has to wait too long, it displays the error message, "can't seize a device," and exits with an exit code of 1.

The following hard disk devices:

    /dev/hd0d
    /dev/rhd0d
    */dev/hd1d
    /dev/rhd1d

are similar to /dev/hd0a in that the disk driver determines which partition is the DOS partition and uses that as hd?d. This means that software using the DOS partition does not need to know which partition is DOS (the disk driver determines that).

The XENIX Development System supports the creation of DOS executable files, using cc (CP). Refer to the XENIX C User's Guide and C Library Guide for more information on using XENIX to create programs suitable for DOS systems.
Name

dtype - Determines disk type.

Syntax

dtype [-s] device ...

Description

dtype determines type of disk, prints pertinent information on the standard output unless the silent (-s) option is selected, and exits with a corresponding code (see below). When more than one argument is given, the exit code corresponds to the last argument.

<table>
<thead>
<tr>
<th>Disk Type</th>
<th>Exit Code</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misc.</td>
<td>60</td>
<td>error (specified)</td>
</tr>
<tr>
<td></td>
<td>61</td>
<td>empty or unrecognized data</td>
</tr>
<tr>
<td>Storage</td>
<td>70</td>
<td>dump format, volume n</td>
</tr>
<tr>
<td></td>
<td>71</td>
<td>tar format, extent e of n</td>
</tr>
<tr>
<td></td>
<td>72</td>
<td>cpio format</td>
</tr>
<tr>
<td></td>
<td>73</td>
<td>cpio character (-c) format</td>
</tr>
<tr>
<td>MS-DOS</td>
<td>80</td>
<td>DOS 1.x, 8 sec/track, single sided</td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>DOS 1.x, 8 sec/track, dual sided</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>DOS 2.x, 8 sec/track, single sided</td>
</tr>
<tr>
<td></td>
<td>91</td>
<td>DOS 2.x, 8 sec/track, dual sided</td>
</tr>
<tr>
<td></td>
<td>92</td>
<td>DOS 2.x, 9 sec/track, single sided</td>
</tr>
<tr>
<td></td>
<td>93</td>
<td>DOS 2.x, 9 sec/track, dual sided</td>
</tr>
<tr>
<td></td>
<td>94</td>
<td>DOS 2.x, fixed disk</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>DOS 3.x, 9 sec/track, dual sided</td>
</tr>
<tr>
<td>XENIX</td>
<td>120</td>
<td>XENIX 2.x filesystem [needs fsck]</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>XENIX 3.x or later filesystem [needs fsck]</td>
</tr>
</tbody>
</table>

Notes

word-swapped refers to byte ordering of long words in relation to the host system.

XENIX file systems and dump and cpio binary formats may not be recognized if created on a foreign system. This is due to such system differences as byte and word swapping and structure alignment.

This utility only works reliably for floppy diskettes.
FD (HW)

Name

fd - floppy devices

Description

The fd devices implement the XENIX interface with floppy disk drives. Typically, the `tar(C)`, `cpio(C)` or `dd(C)` commands are used to read or write floppy disks. For instance,

```
tar tvf /dev/fd0
```

tagulates the contents of the floppy disk in drive 0 (zero).

The block special fd devices are also block-buffered. The floppy driver can read or write 512 bytes at a time using raw i/o. Note that block transfers are always a multiple of the 1K disk block size.

The floppy devices are named `/dev/fd0` and `/dev/fd1` (see Notes, below, for more information about device naming procedure).

The corresponding character special (raw) devices, `/dev/rfd0` and `/dev/rfd1`, afford direct, unbuffered transmission between the floppy and the user's read or write transfer address in the user's program.

For information about formatting, see `format(C)`.

The minor device number determines what kind of physical device is attached to each device file (see Notes).

Files

```
/dev/fd0  /dev/rfd048ds8  /dev/rfd096ds15  /dev/rfd0135ds9
/dev/fd1  /dev/rfd148ds8  /dev/rfd196ds15  /dev/rfd1135ds9
/dev/rfd0  /dev/rfd048ds9  /dev/rfd096ds8  /dev/rfd0135ds18
/dev/rfd1  /dev/rfd148ds9  /dev/rfd196ds8  /dev/rfd1135ds18
   /dev/rfd048ss8
   /dev/rfd148ss9
```

Notes

When accessing the character special floppy devices, the user's buffer must begin on a word boundary. The count in a `read(S)`, `write(S)`, or `seek(S)` call to a character special floppy device must be a multiple of 512 bytes.

Device names determine the particular drive and media configuration. The device names have the form: fd048ds9 Where: fd0 = drive number (0, 1, 2 or 3) 48 = number of disk tracks per inch (48
or 96) ds  = single or double sided floppy (ss or ds) 9  = number of
sectors on the floppy (8 or 9)

For instance, /dev/fd048ss9 indicates a 48 track per inch, single
sided, 9 sector floppy disk device in drive 0.

The minor device numbers for floppy drives depend on the drive
and media configuration. The most common are:

<table>
<thead>
<tr>
<th>Drive</th>
<th>48tpi</th>
<th>96tpi</th>
<th>135tpi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ds/8</td>
<td>ds/9</td>
<td>ss/8</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

* reserved for special, non-floppy devices connected to the floppy
controller as unit #3.

The scheme for creating minor device numbers is as follows. When
interpreted as a binary number, each bit of the minor device
number represents some aspect of the device/media configuration.

For example, the minor device number for /dev/fd048ss8 is "8."
Interpreted as a binary number, 8 is:

00001000

This is how each bit, or binary digit, is significant:

<table>
<thead>
<tr>
<th>48tpi - 0</th>
<th>Sectors per Track</th>
<th>ss - 0</th>
<th>Drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>96tpi - 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>135tpi - 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>16</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

February 29, 1988
Page 2
Only the last six digits of the number are used in minor device identification. The first significant digit is the third from the left. In this example, the third digit from the left is zero, thus the device is 48tpi. The next two digits mean:

<table>
<thead>
<tr>
<th>Bits</th>
<th>Sectors per Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 8</td>
<td></td>
</tr>
<tr>
<td>0 0</td>
<td>9</td>
</tr>
<tr>
<td>0 1</td>
<td>8</td>
</tr>
<tr>
<td>1 0</td>
<td>15</td>
</tr>
<tr>
<td>1 1</td>
<td>18</td>
</tr>
</tbody>
</table>

The fourth digit tells whether the floppy is single sided (ss – 0) or double sided (ds – 1). The last two signify the drive number:

<table>
<thead>
<tr>
<th>Bits</th>
<th>Drive Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1</td>
<td></td>
</tr>
<tr>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>0 1</td>
<td>1</td>
</tr>
<tr>
<td>1 0</td>
<td>2</td>
</tr>
<tr>
<td>1 1</td>
<td>3*</td>
</tr>
</tbody>
</table>

* reserved for special, non-floppy devices connected to the floppy controller as unit #3.

Using this information, you can construct any minor device numbers you need.

It is not advisable to format a low density (48tpi) diskette on a high density (96tpi or 135tpi) floppy drive. Low density diskettes written on a high density drive should be read on high density drives. They may or may not be readable on a low density drive.

Use error-free floppy disks for best results on reading and writing.
Name

`mkdev` - Calls scripts to add peripheral devices.

Syntax

```
/etc/mkdev lp
/etc/mkdev hd
/etc/mkdev serial
/etc/mkdev fs [ device file ]
/etc/mkdev fd
/etc/mkdev tape
/etc/mkdev om
/etc/mkdev shl
```

Description

`mkdev` calls the scripts to create the requested type of device file(s). `mkdev` may call `lppinit(C)`, `hdinit`, `serinit`, `fdinit`, `fsinit`, `tapeinit`, `ominit`, or `shlinit`. If no arguments are listed, `mkdev` prints a usage message.

```
/etc/mkdev lp creates device files for use with line printers. (See `lppinit(C)`.)
```

```
/etc/mkdev hd creates device files for use with a peripheral hard disk. The device files for an internal hard disk already exist. `hdinit` invokes the following utilities: `dparam(C)`, `badrk(M)`, `fdisk(C)`, and `divvy(C)`.  
```

```
/etc/mkdev serial creates device files for use with serial cards. The device files for the first and second ports already exist. Additional device files must be created for the ports added when expansion cards are added to the system. The `/etc/TTYs` and `/etc/ttytype` files are updated.
```

```
/etc/mkdev fs performs the system maintenance tasks required to add a new filesystem to the system once the device is created (`mknod(C)`) and the filesystem is made (`mkfs(C)`). It creates the `/file` and `/file/lost+found` directories, reserves slots in the `lost+found` directory, and modifies `/etc/checklist`, `/etc/default/filesys` and `/etc/default` to check (`fsck(C)`), and mount (`mount(C)`, `mount(C)`, `rc(C)`), the filesystem as appropriate. It is usually used in conjunction with `mkdev hd` when adding a second hard disk to the system or with `mkdev fd` when creating a mountable filesystem on a floppy, but can be used on any additional filesystem (for example, on a large internal hard disk).
```
/etc/mkdev fd creates bootable and root file system floppy disks. The three basic options are: boot and root on a single disk (96 or 135 tpi only), boot and root pair (48 tpi) or filesystem only. Use with mkdev fs when creating a filesystem-only floppy.

/etc/mkdev tape configures the tape driver in preparation for linking a new kernel that includes tape support. It adds a standard quarter-inch cartridge tape driver and/or a mini-cartridge tape driver.

The current driver configurations can be displayed, and changed if necessary. A zero in any of the fields means the driver automatically detects the type of tape device installed and uses the built-in values for that device. If the autoconfiguration values are not correct for your drive, refer to your hardware manual for the correct values, configure the driver and relink the new kernel. mkdev tape can also be used to remove a tape driver from the existing kernel.

/etc/mkdev shl initializes necessary devices and configures kernel parameters associated with the number of shell layers sessions available on the system.

Once the driver is configured, you are prompted for re-linking the kernel. The appropriate devices in /dev are created.

The various init scripts prompt for the information necessary to create the devices.

Files

/usr/lib/mkdev fs
/usr/lib/mkdev/hd
/usr/lib/mkdev/lpinit
/usr/lib/mkdev/serial
/usr/lib/mkdev/tape
/usr/lib/mkdev/fd
/usr/lib/mkdev/shl

See Also

badtrk(M), divvy(C), dparam(C), fd(HW), fdisk(C), filesystem(F), format(C), hd(HW), lp(HW), lpinit(C), mkfs(C), mknod(C), mount(C), serial(HW), tape(HW), and the "Using Peripheral Devices" chapter in the XENIX Operations Guide.

Notes

ominit is not supplied with the standard XENIX distribution.
Name

vmstat - Report paging and system statistics.

Syntax

vmstat [-fs] [-n namelist] [-l lines] [-t interval] [count]

Description

vmstat reports some statistics kept by the system on processes, demand paging, and cpu and trap activity. Three types of reports are available:

(default)
A summary of the number of processes in various states, paging activity, system activity, and cpu cycle consumption.

-f Number of fork(S)'s done.

-s A verbose listing of paging and trap activity.

If no interval or count is specified, the totals since system bootup are displayed.

If an interval is given, the number of events that have occurred in the last interval seconds is shown. If no count is specified, this display is repeated forever every interval seconds. Otherwise, when a count is also specified, the information is displayed count times.

Other flags that may be specified include:

-e corefile
Uses the file corefile in place of /dev/kmem.

-n namelist
Use file namelist as an alternate symbol table instead of /xenix.

-l lines
For the default display, repeat the header every lines reports (default is 20).

The fields in the default report are:

procs
The number of processes which are:
In the run queue.

Blocked waiting for resources.

Swapped out.

These values always reflect the current situation, even if the totals since boot are being displayed.

**paging**

Reports on the performance of the demand paging system. Unless the totals since boot are being displayed, this information is averaged over the proceeding *interval* seconds:

*si* Number of processes swapped in.

*so* Number of processes swapped out.

*ch* Page cache hits.

*cm* Page cache misses.

*ffr* Filesystem page reads.

*swr* Swap area page reads.

*sww* Swap area page writes.

*rec* Number of pages reclaimed from the free list.

*shf* Number of pages shared as copy-on-write after *fork*.

*she* Number of pages shared due to cache hits.

*cpy* Number of shared pages copied.

*pf* Number of page faults.

**system**

Reports on the general system activity. Unless the totals since boot are being shown, these figures are averaged over the last *interval* seconds:

February 29, 1988
in  Number of (non-clock) device interrupts.

sy  Number of system calls.

cs  Number of context switches.

cpu  
Percentage of cpu cycles spent in various operating modes:

us  User.

su  System.

id  Idle.

This information may not be displayed on some systems.

The `-f` and `-s` reports are a series of lines of the form:

```
number description
```

which means that `number` of the items described by `description` happened (either since boot or in the last `interval` seconds, as appropriate). These reports should be self-explanatory.

Files

```
xenix
    Default namelist.
```

```
/dev/kmem
    Default source of statistics.
```

See Also

```
fork(S), ps(C), pstat(C)
```
SCO XENIX® System V
Operating System

Release Notes
Roadmap
Installation Guide
Introduction to XENIX
Operations Guide

The Santa Cruz Operation, Inc.
XENIX System V Operating System Release Notes

1. Preface 1

2. IMPORTANT NOTES ABOUT INSTALLATION 1

   2.1 Choosing Swap Area 3

3. Compatible Software 3

4. Features of the 2.1.0 Release 4

   4.1 Autoboot 4

   4.2 Binary Compatibility 4
      4.2.1 XENIX 2.3 Binary Compatibility 4
      4.2.2 XENIX 3.0 Binary Compatibility 5
      4.2.3 XENIX System V Binary Compatibility 5

   4.3 Configurable Console Keyboard and Screen 5

   4.4 DOS support 6

   4.5 8087 and 80287 Support 8

   4.6 Link Kit 8

   4.7 Memory Limitations 9

   4.8 mkdev(C) 9

   4.9 Multiscreen™ and Color Support 9

   4.10 System V sh shell 11

XG86/286-1-27-86-2.1.0 The Santa Cruz Operation
6.12.1 Modern Usage under XENIX 22
6.12.2 Autodialing 22
6.12.3 L-devices and L.sys 22
6.12.4 Communications with 3.0 XENIX Systems 23

6.13 vi and vedit 23
6.14 vsh(C) 23

7. Documentation Notes 24

7.1 Blank Pages in the User's Reference 24
7.2 Hardware Related Manual Pages 25
7.3 Replacement Manual Pages 25

7.4 console(M) 26
7.5 C-shell 26
7.6 master(F) 27
7.7 su(C) 28

8. Restoring Lost Files 28

9. Packages In This Set 29

A. Compatible Hardware 30

A.1 XENIX-86 System V 31
A.1.1 Machines 31
A.1.2 Math Chips 32
A.1.3 Memory Cards 33
A.1.4 Accelerator Boards 33
A.1.5 Serial I/O Boards 34
A.1.6 Tape Units 34
A.1.7 Video Cards and Monitors 34
A.1.8 Networking Cards 35
A.1.9 Add On Hard Disks 35

XG86/286-1-27-86-2.1.0 The Santa Cruz Operation
A.1.10 Compatible Hard Disk Controllers 37

A.2 XENIX–286 System V 39
A.2.1 Machines 39
A.2.2 Math Chips 40
A.2.3 Memory Cards 40
A.2.4 Serial I/O boards 41
A.2.5 Tape Units 41
A.2.6 Video Cards and Monitors 42
A.2.7 Networking Cards 42
A.2.8 Add On Hard Disks 43

A.3 Modems and Autodialing 44

B. Upgrading to XENIX System V 44

B.1 Shut Down the System 46

B.2 Backup the System 46

B.3 Save Special Files 47
   B.3.1 Choosing Which Files To Save 47
   B.3.2 Save the Actual Files 49
   B.3.3 Save Data Files and ar(CP) Libraries 50

B.4 Install XENIX System V 51

B.5 Relink the Kernel 52

B.6 Reinstall Applications 52

B.7 Merge Saved Files 52
1. Preface

This document contains information about features and programs of XENIX-86 and XENIX-286 System V Release 2.1.0 Operating System for personal computers. Please read through this entire document before installing the XENIX operating system.

We are always pleased to hear of user's experience with our product, and recommendations of how it can be made even more useful. All written suggestions are given serious consideration.

2. IMPORTANT NOTES ABOUT INSTALLATION

Please refer to the Installation Guide in the binder marked "XENIX Operating System Run Time Environment" to install the XENIX Operating System. If you have purchased all three systems, (XENIX Operating System, Development System and Text Processing System) you can use the XENIX Installation Guide to install them all at once. If you wish to install the Development System and/or the Text Processing System at a later time, refer to the Release Notes at the beginning of the appropriate guide (XENIX Programmer's Guide "System Development Tools" or XENIX Text Processing Guide). See also the manual page for custom(C). custom allows you to install all or portions of the XENIX System. Read the Release Notes and Installation Guide in their entirety and make sure you completely understand the installation process before installing the product.

It is not advisable to abort the installation process (for example, by using the DEL or Ctrl-\ keys). If you need to stop, for example,
XENIX for personal computers

because you enter incorrect information, start the process again from the beginning rather than trying to proceed from the stopping point.

The three systems are delivered on these (48tpi) floppies:

XENIX Operating System
- volumes N1-N5 (versions 86XT; 6300+)
- volumes N1-N4 (version 286AT)
- volumes B1-B3
- volumes X1-X7

XENIX Development System
(Optional)
- volumes D1-D10

XENIX Text Processing System
- volumes T1-T4

Note

Users upgrading their XENIX 3.0 system to XENIX System V should refer to Appendix B "Upgrading to XENIX System V," later in these Release Notes. Users installing XENIX for the first time can ignore the Upgrade appendix.

If you use custom(C) to install the single file /xenix (the XENIX kernel) you must serialize the kernel by hand. This is done with the command:

/etc/brand serialnumber activationkey /xenix

If you do not do this, the kernel will boot with a very limited number of processes.
2.1 Choosing Swap Area

While installing XENIX System V you are prompted to allocate the amount of swap area you want. If you do not specify the number of blocks of swap area you want, you are automatically given a default amount. This default is minimal. Due to the difficulty in increasing your swap area, it is recommended that you ask for the upper limit amount shown by the divvy(C) program, if you are planning to use large applications (like databases or spreadsheet programs), use the software development set extensively, or make many programs “sticky” for performance reasons.

3. Compatible Software

The following software application packages are available from The Santa Cruz Operation for use with XENIX.

SCO FoxBASE™
SCO Professional™
Informix®
LEVEL II COBOL™
Lyrix™
Multiplan®
uniPATH™ SNA−3270

Relational Database Management System
Electronic Spreadsheet
Relational Database Management System
Mainframe Level Implementation of the business programming language
Word Processing System
Electronic Worksheet
SNA Mainframe
Communications Package

Call your local dealer or The Santa Cruz Operation for more information and for availability of the following software application packages:

Microsoft Networks for XENIX
UX−Basic®

PC network compatible LAN
BASIC Interpretive Compiler
XENIX for personal computers

Your local dealer may also have the following software which users have been able to run on XENIX System V for personal computers:

- Microsoft Pascal 3.3 for XENIX-286
- Microsoft FORTRAN 3.3 for XENIX-286
- RM Fortran V1.1 for XENIX-286
- RM Cobol V2.1a for XENIX-86 or XENIX-286

4. Features of the 2.1.0 Release

This section relates important features of the XENIX operating system.

4.1 Autoboot

When your computer is turned on, it can go through all boot stages automatically. Refer to the autoboot(M) manual page for information on configuring your system to autoboot.

4.2 Binary Compatibility

This section briefly discusses the types of binaries that are known to run on XENIX for personal computers. See the manual page machine(M) for a more complete listing of binary compatibility.

4.2.1 XENIX 2.3 Binary Compatibility

The system can execute Microsoft XENIX version 2.3 8086, split i/d (instruction/data), x.out format binaries (for example, Altos 586 or Intel 86/310/330 binaries). Use of Altos specific system calls is not supported.
It is recommended that DOS be installed on the hard disk before installing XENIX. Installing DOS after XENIX, in some circumstances, changes the fdisk table making the XENIX partition unbootable. (DOS fdisk reports disk size in cylinders, XENIX fdisk reports disk size in tracks.) If this happens, you must recreate the fdisk table. Boot XENIX from a Bootable XENIX floppy or use the Installation BOOT floppy. Run XENIX fdisk(C), delete the XENIX partition, then create the XENIX partition exactly as it was before DOS was installed. If you use the Installation BOOT floppy, delete from the installation procedure after you have run fdisk, and reboot the computer. The XENIX partition is once again bootable.

If you want to install XENIX and DOS on two hard disks refer to the chapter “Using XENIX and DOS on the Same Hard Disk” in the XENIX Installation Guide and the section titled “Adding a Second Hard Disk” in the chapter “Using Peripheral Devices” in the XENIX Operations Guide. Also, refer to the XENIX Reference Manual manual pages for fdisk(C), mount(C), and mkfs(C).

The following hard disk devices are new in XENIX System V:

/dev/hd0d
/dev/rhd0d
/dev/hd1d
/dev/rhd1d

These devices are similar to /dev/hd0a in that the disk driver determines which partition is the DOS partition and uses that as hd?d. This means that software using the DOS partition does not need to know which partition is DOS (the disk driver determines that).

The file /etc/default/msdos is an easily configurable file that aliases default device names used by the dos(C) commands. For example, it now contains the lines:

C=/dev/hd0d
D=/dev/hd1d

Users using the dos(C) utilities can specify “C:” or “D:” on the command line, referring to the DOS partition on the first or second hard disk. For a complete description on using /etc/default/msdos see the manual page dos(C) in the XENIX Reference Manual.
The XENIX Development System supports the creation of DOS executable files, using cc(CP). Refer to the XENIX C User's Guide and C Library Guide for information on using XENIX to create programs suitable for DOS systems.

4.5 8087 and 80287 Support

Your personal computer may include the 8087 or 80287 math co-processor, which is supported by XENIX-86 and XENIX-286. Please note that switches on the main system board must be set properly to enable 8087 or 80287 interrupts. Check your hardware manual for the proper switch settings.

At boot time, XENIX will display "math coprocessor present" if an 8087 or 80287 is detected.

Some 8087 and 80287 exceptions have been masked. Refer to the manual page for 8087(M).

4.6 Link Kit

A Link Kit is provided with the XENIX Operating System. The Link Kit enables you to add device drivers to your system. Additional device drivers are necessary to run non-supported peripheral devices. Refer to Chapter 10 of the XENIX Operations Guide, "Installing Device Drivers", for information about using the Link Kit.

In addition, the XENIX Programmer's Guide contains two chapters that discuss "Writing Devices Drivers," and "Sample Device Drivers." Also, the Link Kit files themselves include useful instructions and examples (including a driver for real-time clocks). Be sure to read the text files (especially the README file) in the directory /usr/sys/conf if you intend to use the Link Kit.

You may request up to 202 buffers when using the Link Kit with XENIX-286. XENIX-86 has no limit to the number of buffers you can request, but it is possible to create more buffers than available memory. If this happens XENIX will not boot.
In order to save disk space, do not install the Link Kit files unless you intend to use them. The kernel contains the data space necessary for installing device drivers in this 2.1.0 release. `custom(C)` should be used to install (or remove) the Link Kit files.

Available kernel data space (needed to link in large or multiple device drivers) has been increased in the 2.1.0 release. Device drivers which previously did not fit into XENIX might now.

4.7 Memory Limitations

Some utilities may not run on systems with less than 512 Kilobytes(K) of main memory. `vsh(C)` (the Microsoft visual shell) and `vi(C)` (the Berkeley full-screen editor) are examples of these. When you invoke a utility that needs more memory than available, the message “Killed” displays on your screen. If your system has 384K of main memory we recommend using XENIX with only one screen enabled. Multi-user mode will function, but performance suffers, with 384K memory.

`vi(C)` and `vsh(C)` are supported for machines with 512K of main memory or greater. Use of any medium model programs may severely impair system performance with less than 512K of main memory.

We recommend using the XENIX Development System only on machines with 512K of main memory or greater.

4.8 `mkdev(C)`

The XENIX Operating System now allows you to add additional filesystems more easily by using the `fs` option with `mkdev(C)`. See the manual page for `mkdev(C)` included with these Release Notes, Chapter 2 “Installation Procedure” in the XENIX Installation Guide, and Chapter 7 “Using Peripheral Devices” in the XENIX Operations Guide.

4.9 Multiscreen™ and Color Support

The console under XENIX can act as a console and up to 9 alternate
XENIX for personal computers

terminals, each of which can support different activities (see the manual pages for console(M) and multiscreen(M) in the XENIX Reference Manual and the chapter "Using Peripheral Devices" in the XENIX Operations Guide).

Note

The number of screens available depends on the amount of memory in your computer, and is displayed when the system boots. The actual number of screens enabled is user configurable. See enable(C) to use the available screens.

When error messages from the XENIX kernel appear, they display on the console screen. When this happens the console screen displays instead of the current screen.

If you have a color monitor you can use the XENIX setcolor(C) utility to select the foreground, background, and graphics screen colors from a palette of 16 colors (see the manual page for setcolor(C) in the XENIX Reference Manual).
4.10 System V sh shell

Included in this release is the "System V sh command programming language", found in /bin/shV and invoked as shV. There are no known problems with this shell, but it is not supported. Let us know if you encounter problems with shV. It has the same functionality as sh(C) found in this and previous releases, with the following additions:

"command" function
MAILCHECK parameter
MAILPATH parameter
SHACCT parameter
SHELL parameter
input/output redirection for some commands
hash -r special command and flag
pwd special command
return special command

See the shV(C) manual page included with these Release Notes.

4.11 Software Reboot

XENIX System V allows software rebooting. You need not power off to reboot. The following message is displayed after a system shutdown:

** Safe to Power Off **
-or-
** Hit Any Key to Reboot **

Fixed disk heads are "parked" (locked) when this message is displayed.
Note

When the floppy drive door is closed, the computer attempts to boot from a floppy. The floppy drive door must be open to boot off the hard disk.
4.12 SVID Conformance Notes

XENIX-286 meets the System V Interface Definition (SVID) published in 1985 by A.T.&T (Select Code 307-127). XENIX System V has been subjected to a stringent set of tests for the purpose of verifying conformance to SVID. SCO XENIX System V conforms to SVID functionality with the following exceptions:

<table>
<thead>
<tr>
<th>Function</th>
<th>SVID Specification</th>
<th>SCO XENIX Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>shmat</td>
<td>Allows non-zero arguments.</td>
<td>shmaddr argument must be zero. The SVID states that shmat() should allow a non-zero shmaddr argument. The segmented architecture of the 86 family precludes allowing attachment of shared memory at specific physical addresses. Because of this, SCO XENIX requires that the shmaddr argument be zero to allow the system to choose the first available address.</td>
</tr>
<tr>
<td>shmop</td>
<td>Shared memory operations. Return “char *shmaddr”</td>
<td>Because of the architecture of the 86 family of chips, SCO XENIX chose to implement shared memory by using far pointers. The SVID “char *shmaddr” is replaced with “char far *shmaddr.” This is for the same reason as listed for shmat above.</td>
</tr>
</tbody>
</table>

shmctl

shmget

XG86/286-1-27-86-2.1.0 - 13 - The Santa Cruz Operation
**XENIX for personal computers**

<table>
<thead>
<tr>
<th>Function</th>
<th>SVID Specification</th>
<th>SCO XENIX Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ptrace</td>
<td>Address specified as (int*)</td>
<td>Address specified as structure shown in section 4.6 of the <em>Development System Release Notes</em>. The SVID states that ptrace() calls should fail if the 'addr' argument is not the start address of a word. Because of word alignment conventions in the 86 family of chips this failure will not occur.</td>
</tr>
</tbody>
</table>

These exceptions are found on the termio manual pages (termio(dev) for SVID and termio(M) for XENIX):

<table>
<thead>
<tr>
<th>Termio Characters/values</th>
<th>SVID Specification</th>
<th>SCO XENIX V Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUIT</td>
<td>Ctrl-\</td>
<td>Ctrl-\</td>
</tr>
<tr>
<td>ERASE</td>
<td>#</td>
<td>Ctrl-H</td>
</tr>
<tr>
<td>KILL</td>
<td>@</td>
<td>Ctrl-U</td>
</tr>
<tr>
<td>c_cc value</td>
<td>7 SWTCH</td>
<td>not included</td>
</tr>
<tr>
<td>38400 baud</td>
<td>B38400</td>
<td>not included</td>
</tr>
<tr>
<td>Block output - hardware control</td>
<td>LOBLK</td>
<td>not included</td>
</tr>
<tr>
<td>default baud rate</td>
<td>B300</td>
<td>B9600</td>
</tr>
<tr>
<td>ISIG causes input characters to be checked against</td>
<td>INTR, SWTCH and QUIT</td>
<td>INTR and QUIT</td>
</tr>
</tbody>
</table>

The c_cc value of SWTCH, the block layer output value of LOBLK, and ISIG checking against SWITCH are all related to the implementation of job control. XENIX System V Release 2.1.0 does not support job control.
4.13 Ulimit

The maximum file size, as specified by ulimit(S), is easily adjusted upward. The login(M) utility checks the file /etc/default/login for the default ulimit size. Refer to the manual pages for default(M), login(M), and ulimit(S).

5. Hardware Notes

This section contains notes relating to hardware issues.

In general, your hardware configuration must have the original settings and boards before you boot XENIX. If you have added any boards, make sure that all switches are set as recommended in the manufacturer's hardware manual for that board. These guidelines must be followed to ensure proper system performance.

XENIX must boot from the physical drive 0 (the internal hard disk).

5.1 Clockrate Adjustment

The clocks of some computers operate at a different frequency than the default setting. You can check the accuracy of your clock rate using date(C) command over a period of days. If the system clock gains or loses time excessively, refer to the manual page clockrate(C) for information on setting the clock rate.

The default clock rate for generic 8086 and 80286 machines is 1.19318. The correct clock rate for an AT&T 6300 or Olivetti M24 is 1.22878.

5.2 IMAGEN printers — ips(C)

When using an IMAGEN printer in parallel printer mode (using ipbs, see ips(C)) you must specify the quote character as ASCII 2 and the EOF character as ASCII 4. Control characters must be "taken as is". Refer to the IMAGEN system manuals provided with the printer, for information on specifying these characters in the printer configuration.
5.3 Serial I/O Chips

Some computers or add on serial I/O cards use the 8250a serial I/O chip. This chip does not handle interrupts properly. DOS does not use interrupts, so the use of this chip with DOS causes no problems. XENIX does make use of interrupts, as it is a multi-tasking operating system. The problem with the serial I/O chip shows up when using uucp(C) or cu(C). Indications that your computer contains an 8250a chip are that uucp(C) may lose characters constantly and generate unkillable uucico processes and that cu(C) at high baud rates hangs and will not exit.

The problem rarely shows up when using the serial port with a terminal. It is associated with high-speed serial input. If you want to use uucp(C) or cu(C) and your computer has one of these chips, we recommend you replace the 8250a chip with an 8250b serial I/O chip or use a multi-function card containing a serial port and configure it as COM1 or COM2. Configure the built-in serial port as COM3 or COM4, and avoid using the port with high-speed input.

5.4 Serial Lines

There are 4 and 8 port serial port expansion cards available. The ports on these cards are accessible only when the jumpered I/O address is properly set. The addresses vary for different manufacturers of boards, and for the port. The following table lists (hexadecimal) addresses for the Hostess, Arnet, AST and Sperry expansion cards. The Hostess and Arnet cards are available in 4 and 8 port versions. The AST and Sperry cards are available in 4 port version only. The Sperry card works with the Sperry PC/IT only.
## Serial Card Addresses

<table>
<thead>
<tr>
<th>Physical Port</th>
<th>Board Type</th>
<th>Primary I/O Address</th>
<th>Primary Status</th>
<th>Alternate I/O Address</th>
<th>Alternate Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM1</td>
<td>Hostess</td>
<td>0x500 n/a</td>
<td>0x680 n/a</td>
<td>0x280 0x2C0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arnet</td>
<td>0x100 0x140</td>
<td></td>
<td>0x700 n/a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AST</td>
<td>0x2A0 n/a</td>
<td>none n/a</td>
<td>0x300 0x340</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMI lamb*</td>
<td>none n/a</td>
<td>none n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COM2</td>
<td>Hostess</td>
<td>0x580 n/a</td>
<td>0x700 n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arnet</td>
<td>0x180 0x1C0</td>
<td>0x300 0x340</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AST</td>
<td>0x1A8 n/a</td>
<td>none n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMI lamb*</td>
<td>0x2C0 0x210</td>
<td>none n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER1</td>
<td>Sperry**</td>
<td>0x400 n/a</td>
<td>none n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER2</td>
<td>Sperry**</td>
<td>0x408 n/a</td>
<td>none n/a</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only continuous mode is supported.  
** These serial cards only work on the Sperry PC/TT.

Check your serial card hardware manual or call the hardware manufacturer for the switch settings that implement these addresses.

Refer to Appendix B "Compatible Hardware" of these Release Notes and the serial(M) manual page for more information on compatible serial I/O cards and serial lines.

### 6. Software Notes

This section explains some software issues of note.

#### 6.1 Include Files and Utilities

Machine dependent Development System include files and utilities are included on the 2.1.0 Operating System NfV Volumes. If you do not install the Link Kit and the Development System set, you will not be prompted to extract any files off some of the NFIn volumes.
5.2 crypt(C)

The crypt(C) command has been removed from XENIX System V. If
you want the crypt(C) utility and associated crypt(S) libraries, and
you live in the United States, contact the support center listed on the
support information card included with the software.

5.3 csh(C) - sh(C) Conflicts

The C-shell, csh(C), has many built-in commands with the same
name and functionality, but different syntax, than those used by the
sh(C) shell. The sh(C) commands are those documented in the
XENIX Reference. An example of two commands which exhibit this
behavior are echo and nice. Refer to the manual page csh(C) for
information on built-in C-shell commands.

An /etc/cshrc file is included with this release. You can customize the
C-shell environment for all csh(C) users by using this file (similar to
/etc/profile for sh(C) users).

6.4 fdisk(C)

The fdisk(C) utility does not allocate the last track on the hard disk
unless the "Use Entire Disk for XENIX" option is used. The
"Create XENIX Partition" option always leaves the last track
unassigned.

For example, if a disk has 2442 tracks, fdisk reports these as tracks
0-2441. It will assign (using the "Create XENIX Partition" option)
tracks 1-2440. Track 0 is reserved. Track 2441 is only assigned with
the "Use Entire Disk for XENIX" option.

6.5 format(C)

The format(C) utility does not format floppies for use under DOS.
Also, XENIX requires error free floppies.
6.6 lp(C)

The standard parallel printer devices (/dev/lp, /dev/lp0, /dev/lp1, and /dev/lp2) send a printer initialization string (init) the first time the device is opened after the system boots. This is done on the first open only so that printers with large text buffers will not be flushed by the sending of another file.

Some parallel printers require initialization every time a file is received for printing. Others require an init if the printer is turned off and back on again (for example, after changing paper or ribbons). The symptom of this situation is that the printer works fine until it is turned off and then back on.

If you need to initialize the printer more often than the standard devices provide, you can create an additional device file for the parallel port in use. This "init device file" can be used when necessary to initialize the printer.

1. Login as super-user

2. Determine which device is the parallel port you are using. This example assumes the device is the main parallel port (/dev/lp0).

3. Make a new device file that sends an init every time it sends a file:

   # /etc/mknod /dev/lp0i c 6 128
   # sync

The commands for the other parallel ports are:

   # /etc/mknod /dev/lp1i c 6 129
   # /etc/mknod /dev/lp2i c 6 130

If your printer needs an init when it is turned off and on, use the following command line after the printer is turned on. Initialize the printer before the first file is sent to the printer (this example assumes the main parallel port):

   # >/dev/lp0i
XENIX for personal computers

If your printer needs an init every time a file is sent (and it doesn't have a large internal text buffer) you can use the /dev/lp0i device all the time:

# rm /dev/lp
# ln /dev/lp0i /dev/lp

The lp(C) command now sends an init every time a file is sent to the printer.

Some printers do not have newline/carriage return mapping. If your printer needs to have newlines mapped to newline/carriage returns, specify the crnlmap filter when you set up the printer using the lpinit(C) command. When you are prompted for the type of printer (dumb printer, Imagen laser printer (parallel interface), Imagen laser printer (serial interface), or other), enter “other”. You are then prompted for the pathname of the interface program. The printer filter file is found in /usr/spool/lp/model/crnmap.

6.7 mvdir

You must be super-user (root) to use this command.

6.8 pg(C)

This release now includes the pg(C) utility.

6.9 runbig(C)

The utility runbig(C) is not included with this release. It will be included in future releases.

6.10 uname(C)

No XENIX utilities currently use the node name in the uname structure. XENIX utilities use the entry in /etc/systemid. However, some sites may want to set the node name in the uname structure.
There are two ways to set the node name in the `uname` structure but you must have the XENIX Development System to make the change either way. You can use `adb(C)` to patch the XENIX kernel, or you can use the link kit to recompile and install a new kernel.

Refer to the Development System Release Notes for instructions on using `adb` to set the node name.

You can use the link kit to create a new kernel, where the only change is the node name. Install the link kit (use `custom(C)`). Use a text editor to change the:

```
node=
```

entry in the file `/usr/sys/conf/c.c`. Follow instructions in Chapter 10 of the XENIX Operations Guide "Installing Device Drivers" to create a new `xenix` and install it.

### 6.11 Using Raw Devices

When using `dd(C)` or `tar(C)` with a raw device, specify the block size as a multiple of `1K`, which is equivalent to `2 "b." This is recommended because `dd (C)` and `tar(C)` use `512` byte blocks. The XENIX filesystem uses `1024` byte blocks. For example, for `dd (C)` using a `9K (system)` block size use:

```
   dd if=/dev/rfd0 bs=18b
```

Specify an even blocking factor with `tar(C)`:

```
   tar cvfb /dev/rfd0 18 file
```

or use the default `tar` settings (see `tar(C)`).

### 6.12 uucp(C) Notes

This section answers questions you may have about `uucp(C)` and `cu(C)`. The installation of the `uucp` programs and utilities is optional. Refer to the chapter "Building a Micnet Network" in the XENIX Operations Guide and the chapter on "Building a Communications System" in the XENIX User's Guide. Also refer to `custom(C)` to install (or remove) communications files.
XENIX for personal computers

6.12.1 Modem Usage under XENIX

Refer to the XENIX Operations Guide chapter “Using Peripheral Devices” for information on modem settings, modem control, aliasing alphabetic characters and dialing with your computer.

6.12.2 Autodialing

The manual page dial(M) includes an example C program for using a Hayes modem with uucp(C). This program, unlike the distributed dial program, does not make entries in the LOGFILE.

In addition to the program on the dial(M) manual page, the C language program, /usr/lib/uucp/dial.c, for the distributed /usr/lib/uucp/dial is included in this release. You can copy and modify dial.c or you can use these as examples to write programs to use other kinds of modems. The makefile distributed in /usr/lib/uucp should be modified to reflect your own dialer program. You must have the XENIX Development System in order to compile C programs.

If you create a dial program for another modem, send us the source. User generated dial programs will be considered for inclusion in future releases.

The uucp dialup timeout has been increased with this release. This increase is sufficient to allow uucp to dial long distance numbers on pulse dial telephone lines.

6.12.3 L-devices and L.sys

We recommend running uucp(C) direct connections at 2400 or 4800 baud so that the system's performance is not impaired. These baud rates are specified in the files /usr/lib/uucp/L-devices and /usr/lib/uucp/L.sys.

Do not use tabs as field separators in the L.sys file.
6.12.4 Communications with 3.0 XENIX Systems

If you have trouble connecting to a XENIX System 3.0 with uucp(C), try making that system "active" and the SCO XENIX System V the "slave".

6.13 vi and vedit

The vedit utility is supported in this release. It is invoked by typing:

```
vedit filename
```

It has essentially the same functionality as vi. The difference is in the option settings. vedit uses novice mode which prevents job control character (Ctrl-Z) mapping, changes the default setting, turns off the magic option, sets the option report=1 and calls the showmode option.

The showmode option informs the vedit user, in a message in the lower right hand corner of the screen, which mode is being used. For instance after the ESC-i command is used, the message reads "INSERT MODE".

Note that you can not set the novice option from within vi or ex. If you want to use the novice option you must use the vedit utility. (It is possible to set the nonovice option from within vedit.)

6.14 vsh(C)

The use of special characters (*, [, ], and ?) is explained in the chapter "Basic Concepts" in the Introduction to XENIX. The visual shell, vsh(C), does not currently support the use of these special characters when specifying file names.

The super-user (root) must initialize the visual shell help file before other users can have access to it. To do so, follow these steps:

1. Login as super-user (root).
2. Invoke the visual shell by entering "vsh" on the command line.
3. When the vsh menu comes up, enter “h” (for help).

4. The help file appears, with another menu. Enter “r” (for resume).

5. The main vsh menu appears again. You can now quit from the v-shell. Enter “q” (for quit), then “y” (to confirm the quit).

The vsh help file is now initialized so that all users have access to online help.

7. Documentation Notes

This section lists errors, changes, and general notes about the documentation.

7.1 Blank Pages in the User’s Reference

There are several blank pages in the User’s Reference “(M)” section. They can be removed from the following locations:

- boot(M): 1 blank page
- console(M): 3 blank pages
- fd(M): 1 blank page
- keyboard(M): 4 blank pages
- machine(M): 1 blank page
7.2 Hardware Related Manual Pages

The following hardware dependent manual pages are located in the (M-HW) section found at the end of the Run Time Environment volume:

- boot(M)
- cmos(M)
- console(M)
- 8086(M)
- fd(M)
- hd(M)
- keyboard(M)
- lp(M)
- machine(M)
- parallel(M)
- serial(M)

7.3 Replacement Manual Pages

The following manual pages have been revised or added. Please replace the manual pages found in the User's Reference with the ones included here. The replacement pages are dated "January 27, 1986".

- mkdev(C)
- shV(C) - new, insert between shutdown(C) and sleep(C)
XENIX for personal computers

7.4 console(M)

The following escape sequences have functions which are not documented on the manual page console(M). These features are experimental extensions to the ANSI specification and are subject to change or removal from other XENIX releases. They are present and functional in the XENIX System V 2.1.0 release:

```
ESC[-CA  \ where C is 0-15. Sets border color on
       \ color adaptors. Color codes are same as
       \ for ESC[2;C1;C2m.

ESC[-F;TB \ Sets bell frequency and duration. F is the
       \ value loaded into the timer-counter, and
       \ T is the bell duration in 1/10ths of a
       \ second (initial settings are 1500 and
       \ 2/10ths of a second).

ESC[-Ss;SeC \ Sets cursor to start at scan line Ss, and
       \ end at scan line Se. Default underline
       \ cursor is 6,7 for color adaptor and 10,2
       \ for monochrome.
```

Another experimental function is the ioctl call for setting the screen color from inside a program:

```
attr = ioctl(fd, GIO_ATTR, 0)
```

The attribute is returned in ioctl( )’s return code. The foreground color is in the least significant nibble.

7.5 C-shell

There are four csh(C) aliases distributed with the XENIX System V csh. These are pushd, popd, swapd, and flipd. These aliases maintain a directory stack. They function as follows:

```
pushd dir  Pushes the current directory onto the top of the
            directory stack, changes to the directory dir.
```
Operating System Release Notes

popd  Changes to the directory at the top of the stack, then removes (pops) the top directory from the stack, and announces the current directory.

swapd  Swaps the top two directories on the stack. The directory on the top becomes the second to the top, and the second to the top directory becomes the top directory.

flipd  Flips between two directories, the current directory and the top directory on the stack. If you are currently in dir1, and dir2 is on the top of the stack, when flipd is invoked, you change to dir2 and dir1 is replaced as the top directory on the stack. When flipd is again invoked, you change to dir1 and dir2 is again the top directory on the stack.

7.6 master(F)

Page 1 of the master(F) manual page says:

Field 2:  interrupt vector size (decimal, in bytes)

It should read:

Field 2:  number of interrupt vectors

Seven lines down it says:

000040  clock ticks

It should read:

000040  clock poll handler
XENIX for personal computers

Eight more lines down it says:
	000100 init handler

It should read:
	000100 no qswitch on interrupt

Page 2 of the master(F) manual page says:

Fields 11-14: maximum of four interrupt vector addresses.

It should read:

Fields 11-14: maximum of four interrupt vector numbers.

7.7 su(C)

In order to enable the logging of super-user su(C) attempts, the file /etc/default/su must contain the line:

SULOG=/usr/admin/sulog

8. Restoring Lost Files

The custom(C) utility is used to list, install, or remove individual files, sets within the XENIX System packages, or entire packages of the XENIX System. Refer to custom(C) in the XENIX Reference Manual for information on using custom.
4.2.2 XENIX 3.0 Binary Compatibility

The system can execute Microsoft XENIX version 3.0 8086, split i/d (instruction/data), x.out format binaries (for example, Altos 586 or Intel 86/310/330 binaries). Use of Altos specific system support calls is not supported.

4.2.3 XENIX System V Binary Compatibility

The binaries produced by the XENIX C compiler will run on SCO XENIX-286, XENIX-186, and XENIX-86 Systems, as well as Microsoft 286 XENIX 3.0 or System V and IBM XENIX 3.0 or System V.

Machines with SCO XENIX-286 installed can run Microsoft or IBM 286 XENIX 3.0 or System V binaries.

4.3 Configurable Console Keyboard and Screen

XENIX System V Release 2.1.0 supports console keyboard and console screen reconfiguration. You can reconfigure the keyboard for a different keytop layout, or program some keys, including function keys, to send strings of characters.

You can map characters so that, on output, they display as international or graphics characters. For example, you can map “e” to display as “è.” Refer to the console(M), keyboard(M), mapkey(M), and setkey(M) manual pages in the XENIX Reference Manual for information on configuring the console keyboard.

/usr/lib/keyboard and /usr/lib/console contain files for British English (UK) and German keyboard layouts and screen mapping.

The XENIX kernel read buffers hold up to 256 characters. Overflow of a buffer causes it to be flushed and the 257th character is not echoed. If this 257th character is dropped during the output of an escape sequence, the output of that sequence is other than expected.

For example, if a function key is programmed to send “[154g” and the function key is held down so that the output of this string on the screen repeats, the 257th string character, “4,” is dropped and the string interpreted would instead be “[15g” that one time.
XENIX for personal computers

Refer to section 7.1 "console (M)" for more information on the console.

4.4 DOS support

XENIX supports the coexistence of MS\textsuperscript{TM}-DOS and XENIX on the same hard disk. Consult Chapter 3 of the XENIX Installation Guide and the manual entries for \texttt{fdisk(C)}, \texttt{divvy(C)}, and \texttt{dos(C)}. The \texttt{fdisk(C)} and \texttt{divvy(C)} utilities create and change multiple disk partitions, allowing separate XENIX and DOS partitions. \texttt{fdisk(C)} has similar functionality to the DOS utility of the same name. The utilities mentioned in \texttt{dos(C)} allow access to DOS files on the hard disk and floppy diskettes.

Should you decide to install XENIX and DOS on the same hard disk, be sure to reserve a sufficiently large partition for XENIX.

\begin{quote}
\textbf{Note}.
\end{quote}

The minimal XENIX System configuration you can install requires approximately 2000 1K blocks, or 2M bytes. The entire XENIX System (XENIX Operating System, XENIX Development System and XENIX Text Processing System) requires approximately 12,000 1K blocks, or 12M bytes. Refer to the manual page \texttt{custom(C)} for information on installing or removing portions of the XENIX System.
9. Packages In This Set

These are the packages in the Operating System:

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>Entire operating system set</td>
</tr>
<tr>
<td>INST</td>
<td>XENIX installation utilities</td>
</tr>
<tr>
<td>PERM</td>
<td>XENIX contents and permissions lists</td>
</tr>
<tr>
<td>RTS</td>
<td>XENIX run time system</td>
</tr>
<tr>
<td>BASE</td>
<td>Basic extended utility set</td>
</tr>
<tr>
<td>BACKUP</td>
<td>System backup and recovery tools</td>
</tr>
<tr>
<td>SYSADM</td>
<td>System administration tools</td>
</tr>
<tr>
<td>FILE</td>
<td>File manipulation tools</td>
</tr>
<tr>
<td>LINK</td>
<td>The link kit</td>
</tr>
<tr>
<td>LPR</td>
<td>Multiple line printer spooler</td>
</tr>
<tr>
<td>MAIL</td>
<td>Electronic mail and local area networking</td>
</tr>
<tr>
<td>CSH</td>
<td>The C-shell</td>
</tr>
<tr>
<td>DOS</td>
<td>DOS utilities</td>
</tr>
<tr>
<td>VSH</td>
<td>The visual shell</td>
</tr>
<tr>
<td>EX</td>
<td>The ex and vi editors</td>
</tr>
<tr>
<td>UUCP</td>
<td>uucp and cu communications utilities</td>
</tr>
<tr>
<td>*GAMES</td>
<td>Fun and games</td>
</tr>
</tbody>
</table>

**Note**

*Games are supplied, as is, for your pleasure and enjoyment. They are NOT supported. On line documentation is supplied for some of the games, in the directory /usr/games/doc.*
A. Compatible Hardware

This appendix describes hardware that can be used with XENIX System V.

The hardware listed in this section has been used with XENIX. However, because compatible machine or add-on peripherals manufacturers may change configuration or functionality of firmware at any time, no guarantee of functionality is implied. Please write us with accurate hardware information for possible inclusion on our lists.

Some of the hardware listed requires "vendor supplied drivers." Ask your hardware vendor for the appropriate device driver for SCO XENIX V. Be forewarned that device drivers intended for versions 2.0.3 or earlier may not function with this 2.1.0 release. You must link device drivers, supplied by the hardware vendors, into the XENIX kernel in order to use some of these devices. For information on linking device drivers, see the section "Link Kit" in these Release Notes and Chapter 10 of the XENIX Operations Guide "Installing Device Drivers."
A.1 XENIX-86 System V

A.1.1 Machines

These machines can run XENIX-86 System V:

- AT&T 6300 (Olivetti M24 in Europe)
- Compuserve/Canada Arthur in Canada
- Compaq Deskpro* and Plus*
- Eagle Turbo
- Ericsson PC
- IBM PC XT
- ITT XP
- ITT XTRA
- Leading Edge
- Mitsubishi
- NCR PC-6**
- Tandy 1200
- Sperry
- WYSE PC

* Internal cartridge tape not supported.
** For the NCR machine, configure the switches on the motherboard for a color monitor, regardless of the type of monitor used.

Note

ITT DOS cannot share the disk with XENIX or MS-DOS. Therefore, XENIX, or a combination of XENIX and MS-DOS must occupy the whole disk on the ITT machines.

Also note that the ITT XP (286 cpu) runs in 8086 mode.
XENIX for personal computers

Some computers arrive with the hard disk only partially formatted. If you have such a machine, use the DOS hard disk format command or Diagnostics diskette to format the entire disk before installing the XENIX Operating System.

Some computers require specific switch settings to run XENIX. If your computer does not run XENIX with the settings as shipped, contact your computer hardware representative for the proper settings.

Some machines may require a clock rate adjustment. Refer to section 5.1 of these Release Notes.

A.1.2 Math Chips

You can use these math co-processor chips under XENIX with the following Central Processing Units (CPUs):

8087 For 8088 CPUs.
8087-2 For 8086 CPUs.
8087-3 For fast 8086 CPUs.
A.1.3 Memory Cards

With memory cards, check the switch settings on both the card and mother board. Refer to the hardware manuals for your computer and for the memory card to find the correct switch settings. XENIX-86 supports up to 640K of main memory.

The following memory cards have been used successfully with XENIX-86:

AST 6 pack+
Quadram quadboard
Sigma Maximizer
Microsoft RAM card
Tecmar Captain or First-Mate
AT&T for the 6300

AT&T 6300 note: It is recommended that only AT&T memory cards be used with the 6300. Other cards may considerably slow the machine.

Note

In general, most memory cards work with XENIX-86. If you experience “panic parity” errors it is often because of low quality memory chips or cards.

The serial ports on many multi-function cards will function as expected if COM1 and COM2 are fully compatible with the IBM specifications for these serial ports. See section 5.4 “Serial Lines” and section A.1.5 “Serial I/O Boards” in these Release Notes.

A.1.4 Accelerator Boards

Accelerator boards are special cards that plug in to an 8088 machine (not an 8086). They replace the 8088 CPU with a 286 CPU and perhaps replace some memory as well. XENIX System V runs on accelerator boards set in 8086 unmapped mode.
XENIX for personal computers

The following accelerator board is supported in the standard distribution:

Seattle Telecom and Data (STD) PC286

A.1.5 Serial I/O Boards

Note that you should not use cards that use the 8250a serial I/O chip. See the Hardware Notes section in these Release Notes on "Serial I/O Chips" for more information on the 8250a chip.

These serial I/O boards are supported in the standard distribution:

- IBM standard COM1 and COM2
- Control Systems Hostess 4 and 8 port versions
- Arnet Controls 4 and 8 port (8250b version)
- (clock option not supported)
- AST FourPORT/XN

A.1.6 Tape Units

The following tape devices are supported using a device driver supplied by the hardware vendor:

- Emerald Systems series 2002 - streaming cartridge
- Computone ATvantage-SX Tape backup - streaming cartridge
- Overland Data TC50X - nine track
  (reel to reel)

A.1.7 Video Cards and Monitors

The following video cards and monitors have been used successfully with XENIX-86. (They are to be used in character mode only, graphics are not currently supported.)
Operating System Release Notes

<table>
<thead>
<tr>
<th>Video Cards and Monitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card</td>
</tr>
<tr>
<td>IBM Mono Card</td>
</tr>
<tr>
<td>AST CGA</td>
</tr>
<tr>
<td>Everex Edge</td>
</tr>
<tr>
<td>IBM CGA</td>
</tr>
<tr>
<td>IBM EGA</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Cards which come as the default card in supported computers (monochrome or color monitor) work fine with XENIX.

Although many standard emulating cards work with XENIX, these are the ones that we know about.

A.1.8 Networking Cards

This networking card is supported using a device driver supplied by the hardware vendor:

Excelan TCP/IP ethernet card

A.1.9 Add On Hard Disks

Many hard disks can be used by XENIX-86 as long as the disk controller supports the drive. Compatible hard disk controllers are discussed in the next section.
XENIX for personal computers

The following tables list the controllers most commonly used with 8086/8088 machines, and the type of hard disks they can support:

### XEBEC Controller

(standard IBM PC XT compatible)

<table>
<thead>
<tr>
<th>Type</th>
<th>Cyls</th>
<th>Hds</th>
<th>Size</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>306</td>
<td>2</td>
<td>5 MB</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>375</td>
<td>8</td>
<td>24 MB</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>306</td>
<td>6</td>
<td>15 MB</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>306</td>
<td>4</td>
<td>10 MB</td>
<td>standard</td>
</tr>
</tbody>
</table>

### DTC Controller

(standard on AT+T 6300 - fully supported)

<table>
<thead>
<tr>
<th>Type</th>
<th>Cyls</th>
<th>Hds</th>
<th>Size</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>306</td>
<td>2</td>
<td>5 MB</td>
<td>Syquest SQ306</td>
</tr>
<tr>
<td>1</td>
<td>375</td>
<td>8</td>
<td>24 MB</td>
<td>standard</td>
</tr>
<tr>
<td>2</td>
<td>306</td>
<td>6</td>
<td>15 MB</td>
<td>CDC Wren</td>
</tr>
<tr>
<td>3</td>
<td>306</td>
<td>4</td>
<td>10 MB</td>
<td>Seagate ST-225</td>
</tr>
<tr>
<td>4</td>
<td>306</td>
<td>2</td>
<td>5 MB</td>
<td>Miniscribe 3425</td>
</tr>
<tr>
<td>5</td>
<td>644</td>
<td>5</td>
<td>30 MB</td>
<td>Miniscribe 3425</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>20 MB</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>20 MB</td>
<td></td>
</tr>
</tbody>
</table>

Drive types 8 - 15 reserved

The following hard disks have been tested successfully with XENIX-86:

<table>
<thead>
<tr>
<th>Disk</th>
<th>Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMI15</td>
<td>XEBEC</td>
</tr>
<tr>
<td>Miniscribe 20</td>
<td>DTC</td>
</tr>
<tr>
<td>Seagate 20</td>
<td>DTC</td>
</tr>
<tr>
<td>CDC 30</td>
<td>DTC</td>
</tr>
<tr>
<td>Rhodime 30</td>
<td>T²</td>
</tr>
<tr>
<td>Mountain Hard File</td>
<td>built-in controller</td>
</tr>
<tr>
<td>Mountain 20, 30</td>
<td>DTC</td>
</tr>
</tbody>
</table>
The following disks are reported to work with XENIX-86, but are untested:

- Peachtree 10, 20, 30
- Maynard Apollo 30
- Franklin Telecom 10, 20, 33
- Rhodime 10
- Tandon 10
- Alpha Omega 10, 20, 30

To determine whether you can use a hard disk with XENIX, the disk must first interface electrically with the disk controller (usually "ST506"). The disk controller ROM must have an entry for the disk (type) determined by the number of heads, and the number of cylinders on the disk. The number of cylinders on your disk must be greater than or equal to the number of cylinders listed for that type. If these conditions are met, you can use the hard disk, but XENIX can only access up to the number of cylinders in the list.

For example, a "Brand X 40" hard disk has 8 heads and 700 cylinders. It is a type 1 disk on a XEBEC or DTC controller. You can use the Brand X disk, but XENIX can access only 375 cylinders (24 megabytes) of the disk. The only way to access the full disk is to replace the ROM on the disk controller with one that recognizes your disk configuration.

A.1.10 Compatible Hard Disk Controllers

Many hard disks will work with XENIX. Whether or not a disk works depends upon the controller board. Here are two tests the controller must meet:

1. The disk controller board is XEBEC compatible; and,

2. There is no special vendor software needed to make the disk work under DOS.

If a controller meets these tests, it might work, but if it fails these tests, it will not work.
XENIX for personal computers

The following table lists the hard disk controllers known to work with XENIX-86:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model#</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>XEBEC</td>
<td>1210A</td>
<td>PC XT std. Miniscribe 10mb as well as CMI 15</td>
</tr>
<tr>
<td>DTC</td>
<td>5150</td>
<td>6300 std. Miniscribe 10, 20, Seagate 20, CDC 30, Mountain 30</td>
</tr>
<tr>
<td>WD</td>
<td>1002/WX-2</td>
<td>a special version of WX-2 is supplied with some CDC 30 disks.</td>
</tr>
<tr>
<td>Adaptec</td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>I² interface</td>
<td></td>
<td>Rhodime 30</td>
</tr>
<tr>
<td>ADES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDC</td>
<td></td>
<td>Comes with the CDC 30 add on hard disk.</td>
</tr>
</tbody>
</table>
Operating System Release Notes

A.2 XENIX-286 System V

This section discusses some of the hardware known to run with XENIX-286.

A.2.1 Machines

These machines can run XENIX-286 System V:

- Compaq Portable* and DeskPro* 286
- Contel/CADO AT/4
- Corona ATP
- Epson Equity III
- IBM PC AT (20 or 30 meg version)
- Kaypro 286i
- Mitsubishi-286
- NCR PC-8 **
- Sperry PC/IT
- Tandy 3000
- Tomcat 3200-AT
- Victor V286

* Internal cartridge tape not supported.
** For the NCR machine, configure the CMOS database for color monitor, regardless of the type of monitor used.

Although the Texas Instruments Business Pro (color monitor only) will run SCO XENIX, TI XENIX is directly available from TI (and supports more peripherals on TI machines).

Note

For machines with bus or processor speeds greater than 6 mHz, check with your peripheral vendor to verify that their hardware will run under your configuration.
XENIX for personal computers

A.2.2 Math Chips

You can use the following math co-processor chip with XENIX-286:

80287 For 80286 CPUs

A.2.3 Memory Cards

With memory cards, check the switch settings on both the card and mother board. Refer to the hardware manuals for your computer and for the memory card to find the correct switch settings. XENIX-286 supports up to 16 megabytes of main memory, however, hardware modifications might be necessary to add this much memory.

The following memory cards have been used successfully with XENIX-286:

AMI SMART PACK 2
AST
Quadram
Tecmar
Talltree Systems
Silicon Valley Systems

Note

In general, most memory cards work with XENIX-286. If you experience “panic parity” errors it is often because of low quality memory chips or cards.
A.2.4 Serial I/O boards

Note that you should not use cards which have the 8250a serial I/O chip. See the section in these Release Notes on "Serial I/O" for more information on the 8250a chip.

The following serial I/O boards are supported in the standard distribution:

- Arnet Controls 4 and 8 port (8250b version)
  (clock option not supported)
- AST FourPORT/XN
- Control Systems Hostess 4 and 8 port versions
- IBM standard COM1 and COM2 cards
- Sperry* 4 port card

* This serial I/O board only works with the Sperry PC/IT.

This serial I/O board is supported using a device driver supplied by the hardware vendor:

- Computone ATvantage-X smart serial expansion

A.2.5 Tape Units

The following tape devices are supported using a device driver supplied by the hardware vendor:

- Computone ATvantage-SX tape backup
- Streaming cartridge
- Emerald Systems series 2002
- Streaming cartridge
- Overland Data TC50X
- Nine track
  (reel to reel)
XENIX for personal computers

A.2.6 Video Cards and Monitors

The following video cards and monitors have been used successfully with XENIX-286. (They are to be used in character mode only, graphics are not currently supported.)

<table>
<thead>
<tr>
<th>Card</th>
<th>Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Mono Card</td>
<td>standard monochrome</td>
</tr>
<tr>
<td>AST CGA</td>
<td>standard RGB (red green blue) or composite color</td>
</tr>
<tr>
<td>Everest Edge</td>
<td>standard monochrome</td>
</tr>
<tr>
<td>IBM CGA</td>
<td>standard RGB color</td>
</tr>
<tr>
<td>IBM EGA</td>
<td>standard monochrome</td>
</tr>
<tr>
<td></td>
<td>IBM EGA</td>
</tr>
</tbody>
</table>

Cards which come as the default card in supported computers (monochrome or color monitors) work fine with XENIX. The TI Business Pro, however, must have a color card and a color monitor.

Although many standard emulating cards work with XENIX, these are the ones that we know about.

A.2.7 Networking Cards

This networking card is supported using a device driver supplied by the hardware vendor:

Excelan TCP/IP ethernet card
Operating System Release Notes

A.2.8 Add On Hard Disks

Many hard disks can be used by XENIX-286 as long as the motherboard ROM supports the drive. ROM entries for the IBM PC AT are listed here. Refer to your computer hardware manual for the disk types supported by other computers.

<table>
<thead>
<tr>
<th>Type</th>
<th>Cyls.</th>
<th>Hds.</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>306</td>
<td>4</td>
<td>10 MB</td>
</tr>
<tr>
<td>2</td>
<td>615</td>
<td>4</td>
<td>20 MB</td>
</tr>
<tr>
<td>3</td>
<td>615</td>
<td>6</td>
<td>30 MB</td>
</tr>
<tr>
<td>4</td>
<td>940</td>
<td>8</td>
<td>60 MB</td>
</tr>
<tr>
<td>5</td>
<td>940</td>
<td>6</td>
<td>45 MB</td>
</tr>
<tr>
<td>6</td>
<td>615</td>
<td>4</td>
<td>20 MB</td>
</tr>
<tr>
<td>7</td>
<td>462</td>
<td>8</td>
<td>30 MB</td>
</tr>
<tr>
<td>8</td>
<td>733</td>
<td>5</td>
<td>30 MB</td>
</tr>
<tr>
<td>9</td>
<td>900</td>
<td>15</td>
<td>110 MB</td>
</tr>
<tr>
<td>10</td>
<td>820</td>
<td>3</td>
<td>20 MB</td>
</tr>
<tr>
<td>11</td>
<td>855</td>
<td>5</td>
<td>35 MB</td>
</tr>
<tr>
<td>12</td>
<td>855</td>
<td>7</td>
<td>50 MB</td>
</tr>
<tr>
<td>13</td>
<td>306</td>
<td>8</td>
<td>20 MB</td>
</tr>
<tr>
<td>14</td>
<td>733</td>
<td>7</td>
<td>40 MB</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>0</td>
<td>Reserved, do not use.</td>
</tr>
</tbody>
</table>

Note that other compatible XENIX-286 machines may have different ROM tables. Check your computer hardware reference manual for the appropriate ROM table entries for your computer.

The following hard disks have been tested with XENIX-286:

CDC20 - with PC AT only
Emerald 50, 70, 140 - with PC AT only
Maxtor 140 - with PC AT as Type 9
CPC30 - with Sperry PC/IT only
XENIX for personal computers

To determine whether you can use a hard disk with XENIX, the disk must first interface electrically with the disk controller (usually "ST506"). The motherboard ROM must have an entry for the disk (type) determined by the number of heads, and the number of cylinders on the disk. The number of cylinders on your disk must be greater than or equal to the number of cylinders listed for that type. If these conditions are met, you can use the hard disk, but XENIX can only access up to the number of cylinders in the list.

For example, a "Brand X 140" hard disk has 15 heads and 1000 cylinders. It is a type 9 disk on the AT. You can use the Brand X disk, but XENIX can access only 900 cylinders (110 megabytes) of the disk. The only way to access the full disk is to replace the ROM on the motherboard (or other hardware modification) with one that recognizes your disk configuration.

A.3 Modems and Autodialing

Any standard RS-232 modem will work with XENIX-86 and XENIX-286 for personal computers using uucp(C) and cu(C). The default autodialer is for the Hayes Smartmodem 1200. An autodialer program is also supplied for the Racal Vadic 3451. Other autodialing modems can be supported by writing a dialer program. See the manual page dial(M) in the XENIX Reference Manual and section 6.12.2 of these Release Notes for information on writing other dialer programs.

B. Upgrading to XENIX System V

The following procedure shows you how to upgrade XENIX-86 3.0 and XENIX-286 3.0 to XENIX System V. This procedure does not apply if you are installing XENIX System V for the first time.

Part of the process is to completely reinstall XENIX. With a complete reinstallation you are assured of having all the latest software, your disk is less fragmented when you are finished, and, if you want, you can easily change the size of the XENIX partition or the size of the XENIX swap zone at this time.
This procedure does not affect any other operating systems (or partitions), such as MS-DOS, that currently share the disk with XENIX 3.0, unless you choose to change partition sizes. Refer to Chapter 3 of the XENIX Installation Guide "Using DOS and XENIX on the Same Disk" if you want to change the size of your XENIX partition.

Before proceeding, be sure to read all of these Release Notes, including new manual pages. Note changes in the software since the last time you installed XENIX.

Follow these steps to upgrade your XENIX system:

1. Shut the system down to Single User (System Maintenance) Mode.
2. Make a full backup of your system.
3. Save particular files from your current system.
4. Install XENIX System V.
5. Relink the kernel, if necessary.
7. Merge the saved files with the reinstalled system.

Note that these are the basic steps and the exact procedure may vary from site to site. Examples are given wherever possible, but you should know how to use commands such as tar(C) (or cpio(C)).

Remember that an initial pound sign (#) in the examples is the root prompt and is a reminder that you should execute the listed command only when logged in as root. You do not enter the pound sign as part of the command.

If you have local system modifications to the kernel, such as additional device drivers, you must relink these into the new link kit after you reinstall XENIX. Check with the supplier of the other software for further details.

When upgrading from SCO XENIX-86 System 3.0 to SCO XENIX-86 System V, you must save applications data files in ASCII or symbolic...
form, not as binaries. This is because the word order was changed from System 3.0 to System V in XENIX-86.

Binaries from SCO, IBM, or Microsoft XENIX-286 System 3.0 are compatible with SCO XENIX-286 System V binaries. However, saving data files in ASCII or symbolic form is still a good idea.

When you restore files after reinstalling XENIX, use the applications to convert your data back to binary form. The procedure for saving data files is discussed in a following section "Data Files and ar(CP) Libraries." Restoring data files is discussed in a following section "Merging Saved Files."

B.1 Shut Down the System

You should be the only person logged in to your computer when you perform the upgrade. Make sure any other users know what you are going to do, and when you are going to do it. They may wish to make their own backups before you bring down the system.

Also, advise users to remove unnecessary files. This makes the whole process faster and requires fewer floppies, if they are your only backup media.

Refer to shutdown(C) in the XENIX Reference for information on bringing the system down to Single User (or System Maintenance) Mode.

B.2 Backup the System

Before you do anything else, make a full backup of the system. Use the tar(C) or cpio(C) commands. Refer to tar(C) and cpio(C) in the XENIX User’s Reference. You cannot use any other filesystem backup utilities.

You should make a backup immediately before you upgrade so that you have the latest possible version of your system. This is especially important in the case of user files, which can change frequently.

Once again, remove any old, unnecessary files. This makes the whole process faster.
B.3 Save Special Files

You can use any backup media, including floppy and tape drives, to save most of your files. Note that if you use a special driver with your backup device, you cannot use that device immediately after installing XENIX System V, since the new kernel is not yet linked with the required device driver. Therefore, for precautionary reasons, we recommend that you backup your files on floppies before you install XENIX System V.

Before you can use any special devices, you must link the new XENIX kernel. If you have source for the device drivers, save the source code on the default backup device, the floppy drive, then recompile the driver on the new system. Also, if you need special, customized libraries, or if any libraries are furnished with your device drivers, save these libraries with the device driver source.

This is important, since you can only read information from the default device, once you reinstall XENIX, until you link the kernel.

B.3.1 Choosing Which Files To Save

You should save any files that are customized or are in some way particular to your system. These files include:

- Applications data files and ar(CP) libraries.
- Any standard system files that are modified for your site.
- Any locally created shell scripts or programs.
- All user directories, subdirectories and files.

At this time, make sure you have the original distributions of any applications packages you use. You must reinstall those software packages after you upgrade the XENIX system.

Save any files you use with your applications, such as databases and control files, in ASCII or symbolic form. For example, if you use Lyrix, you should save all the files in the /usr/lib/wp directory. Note that Lyrix data files are already in ASCII form, and you can save them directly onto your backup media.
XENIX for personal computers

You should check the following standard XENIX system files and directories for local changes made to the XENIX 3.0 standard distribution. Save those files which have local modifications.

**XENIX 3.0 Files**

<table>
<thead>
<tr>
<th>File or Directory:</th>
<th>Examine for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>.profile</td>
<td>root sh startup script.</td>
</tr>
<tr>
<td>/etc/profile</td>
<td>System wide sh startup script.</td>
</tr>
<tr>
<td>/etc/shrc</td>
<td>System wide csh startup script.</td>
</tr>
<tr>
<td>±/etc/default/*</td>
<td>For local changes.</td>
</tr>
<tr>
<td>±/etc/group</td>
<td>Group database.</td>
</tr>
<tr>
<td>±/etc/passwd</td>
<td>User database.</td>
</tr>
<tr>
<td>±/etc/rc</td>
<td>For any local additions.</td>
</tr>
<tr>
<td>±/etc/systemid</td>
<td>The name of your system.</td>
</tr>
<tr>
<td>±/etc/ttytype</td>
<td>Terminal line to terminal type mapping data.</td>
</tr>
<tr>
<td>±/etc/termcap</td>
<td>For any local entries.</td>
</tr>
<tr>
<td>/lib</td>
<td>For locally developed language processors.</td>
</tr>
<tr>
<td>/usr/bin/*</td>
<td>For local additions.</td>
</tr>
<tr>
<td>/usr/dict/words</td>
<td>For local additions to words.</td>
</tr>
<tr>
<td>/usr/include/*</td>
<td>For local additions.</td>
</tr>
<tr>
<td>/usr/lib/mail/*</td>
<td>For local mail routing information.</td>
</tr>
<tr>
<td>/usr/lib/crontab</td>
<td>cron daemon database.</td>
</tr>
<tr>
<td>/usr/lib/font/*</td>
<td>For locally developed font libraries.</td>
</tr>
<tr>
<td>/usr/lib/lint/*</td>
<td>For locally developed lint libraries.</td>
</tr>
<tr>
<td>/usr/lib/tabset/*</td>
<td>For locally developed tab setting files.</td>
</tr>
<tr>
<td>/usr/lib/term/*</td>
<td>For locally developed nroff driving tables.</td>
</tr>
<tr>
<td>/usr/lib/tmac/*</td>
<td>For locally developed nroff/troff macros.</td>
</tr>
<tr>
<td>/usr/lib/uucp/*</td>
<td>For local uucp configuration files and dialers.</td>
</tr>
<tr>
<td>±/usr/news</td>
<td>For local news.</td>
</tr>
<tr>
<td>±/usr/spool/*</td>
<td>For current mail, uucp, at, and other files.</td>
</tr>
<tr>
<td>±/usr/[janed,johnd]</td>
<td>User home directories.</td>
</tr>
</tbody>
</table>
It is very important that the files marked with a dagger (†) be examined carefully before reinstalling on XENIX System V. Check the files for local additions or changes, but do not replace the System V versions with your XENIX 3.0 versions. There are changes to content, and sometimes format, of these files with System V. Using the 3.0 versions of these files can cause problems. This is the case for most of this list. Those directories marked with a double dagger (‡) can safely be copied from your 3.0 system. The last item in the above list refers to all individual user directories on the root file system. User directories may be in another location or /usr may be mountable on your system.

B.3.2 Save the Actual Files

When using floppies, make sure they are error free and formatted. XENIX requires high quality media.

The tar command is a convenient way to save files. You can also use the cpio command. For example, to save the standard system files located in /etc, enter:

```
# cd /
# tar cv /etc/profile /etc/group /etc/rc /etc/tty /etc/ttytype /etc/termcap
```

Remember to use the "relative pathname" format with tar. For example, specify ./etc/profile, not /etc/profile, where the dot (.) indicates the pathname is relative to your current directory.

Make sure you label any floppies or tapes you use with their exact contents, the command used to create the backup, the date and time, and if they are part of a multi-volume set. If you use more than one volume (floppy or tape), use the k option with tar.

These commands save some user directories as well as other directories in /usr:

```
# cd /
# tar cv /usr/john /usr/jane /usr/spool /usr/news
```
XENIX for personal computers

These commands save all the Lyrix custom system files in /usr/lib/wp:

# cd /
# tar cv ./usr/lib/wp

For more information on tar, see the XENIX User's Reference.

B.3.3 Save Data Files and ar(CP) Libraries

If you are using XENIX-86, you must follow these guidelines for saving data files and ar libraries. These steps are not necessary under XENIX-286, however they are a good precaution.

Data Files
Applications, such as Multiplan, Informix and Level II COBOL use data files, which you must save in ASCII or symbolic form.

With Multiplan, use the TRANSFER OPTION command to save data files in symbolic (SYLK) format. Then transfer the SYLK files to your backup media.

See the “Command Directory” in the Multiplan User’s Guide for more information on TRANSFER OPTION. See also Appendix 4 “The SYLK (Symbolic Link) File Format” in the Multiplan User’s Guide.

You can save Informix data files using the Informix UNLOAD command. Also, with UNLOAD you can transfer a file directly to your backup media. For information on UNLOAD, see your Informix manual under “dbstatus.”

All Level II COBOL programs you create are completely portable, so you can save them using tar or cpio without any special handling. However, C-ISAM® files created under XENIX-86 3.0 cannot be transferred to XENIX-86 System V. You must recreate any such files on the new system.

Extracting and merging your data files is described in section B.7, under “Merging Data Files” and “ar(CP) Libraries”, in these Release Notes.
ar(CP) Libraries
To save ar archive files, you:

- Extract the files that make up the archive from the archive file.
- Save the extracted files on your backup media.

For example:

```
# cd /usr/lib
# ar xv libisam.a
```

When the extract command is finished, you save the resulting files on your backup media:

```
# tar cv `ar t libisam.a`
```

Recreating archives on the new system is discussed section B.7, under "Merging Data Files" and "ar(CP) Libraries", in these Release Notes.

B.4 Install XENIX System V

After you have backed up the system and saved all special files that you need for your system, install XENIX System V. Follow the instructions in the XENIX Installation Guide in the binder marked “XENIX Operating System Run Time Environment” to install the XENIX Operating System furnished with System V.

If you have special device drivers, you need to link them into the XENIX kernel when you are finished installing. In this case, make sure you install the link kit software when you reinstall XENIX.

Also, you must recompile any device drivers under SCO XENIX System V. If you are going to recompile any device drivers, be sure to install the Development System. If you do not have source code for the device drivers you use, you should obtain new binaries which run under SCO XENIX System V from the manufacturer or vendor of the device.

When you are finished installing, make sure you are in Single User, or System Maintenance Mode. Then return to the next section to merge the special files you saved with your new operating system.
B.5 Relink the Kernel

If you have special device drivers, you must:

- Recompile the software under XENIX System V, or obtain a replacement.

- Link the driver into the XENIX kernel with the link kit.

Any device drivers compiled under SCO XENIX 3.0 must be recompiled under System V. You may have to obtain an SCO XENIX System V version of any drivers from the driver or device manufacturer if you do not have source code.

Make sure you installed the link kit software. If you have not done so, see custom(C) for information on extracting packages from XENIX System V distributions.

B.6 Reinstall Applications

All SCO XENIX 3.0 applications run on SCO XENIX System V. Therefore, you should use the original distribution floppies to reinstall any applications.

See the appropriate release notes and installation manuals for information on installing any applications programs. Install any such programs as if this is the first time.

Do not copy or save the applications from the old system, unless the original distributions are lost or damaged, and you cannot replace them. It is safer to reinstall applications software packages.

B.7 Merge Saved Files

Once XENIX and any applications are reinstalled, you can merge in new files. This section describes the procedure for merging standard system files, data files, and ar libraries.
Note

Remember that all commands given in this section are only examples. The exact procedure depends upon how and in what order you saved your files and directories.

For standard system files, except for /usr/spool and /usr/[janed,johnd] files, prepare a temporary directory and extract the files from a backup volume into this directory:

```
# mkdir /usr/convert
# cd /usr/convert
# tar x
```

Move the extracted files to their correct locations, for example if you have extracted files which belong in /etc:

```
# mv ./etc/* /etc
```

Repeat the tar extraction for each volume you made.

The spooling directory and the users' home directories are very simple to extract directly into the correct directories. For example, with the media containing /usr/[johnd, janed] and /usr/spool mounted in the default device, enter:

```
# cd /usr
# tar xv
```

Special Lyrix files can be extracted in place from your backup media. For example, with the backup volume containing /usr/lib/wp mounted in the default device:

```
# cd /usr/lib/wp
# tar xv
```
Other files, however, must be merged into the distributed versions by hand, for example, with the following files already extracted into the convert directory:

```
# cd /usr/convert/etc; cp passwd group ttytype /etc
# cd /usr/convert/usr/lib
# cp crontab /usr/spool/cron/crontabs/root
```

Be careful when merging files, especially complex data files like /etc/rc, /etc/termcap, or /etc/tries. Use the diff(C) program to note the differences between newly installed files, and those you save from your previous system. Add the differences, if they are necessary, to the new System V files. Do not directly overwrite the System V versions with your 3.0 version files.

After all the files have been examined and local site information is merged into the System V files, remember to clean up:

```
# cd /; rm -fr /usr/convert
```

Merge Data Files

For Multiplan data files that are saved in symbolic form, extract them into the appropriate directories from the backup media. Then use the Multiplan command TRANSFER OPTIONS to translate the file from symbolic form.

With Informix, extract the data files into the appropriate directories. Use the LOAD command, described in the "dbstatus" section of the Informix manual.

ar(CP) Libraries

To merge archive and library files, create a scratch directory, or work in /tmp. Mount the backup volume containing the appropriate libraries. Remember, you saved them individually.

Extract the files, for example:

```
# cd /tmp
# tar xv
```

Rearchive the extracted files, for instance with our libsam.a example:

```
# ar ruv libsam.a *.o
```
When the archive is created, run the `ranlib` program:

```
# ranlib libisam.a
```

Finally, move the new archive back to the appropriate directory and remove any unneeded files:

```
# mv libisam.a /usr/lib
# rm *.o
```

Your upgrade is now complete.
**Name**

mkdev - Calls scripts to create devices

**Syntax**

//etc/mkdev lp
//etc/mkdev hd
/etc/mkdev serial
/etc/mkdev fs [device file]

**Description**

*mkdev* calls the scripts to create the requested type of device file(s).  
*mkdev* calls either *lpinit*(C), *hdinit*, *serinit*, or *fsinit*. If no arguments are listed, *mkdev* prints a usage message.

/etc/mkdev lp creates device files for use with line printers.

/etc/mkdev hd creates device files for use with peripheral hard disks. The device files for an internal hard disk already exist.

/etc/mkdev serial creates device files for use with serial cards. The device files for the first and second ports already exist. Additional device files must be created for the ports added when expansion cards are added to the system.

/etc/mkdev fs performs the system maintenance tasks required to add a new filesystem to the system once the device is created (*mkfs*(C)) and the filesystem is made (*mkfs*(C)). It creates the /file and /file/lost&found directories, reserves slots in the lost&found directory, and modifies /etc/checklist and /etc/rc to check (*fsck*(C)) and mount (*mount*(C)) the filesystem as appropriate. It is usually used in conjunction with *mkdev* *hd* when adding a second hard disk to the system, but can be used on any additional filesystem (for example, on a large internal hard disk or a floppy.)

The various *init* scripts prompt for the information necessary to create the devices.

**Files**

/etc/hdinit
/etc/lpinit
/etc/serinit
/etc/fsinit

January 27, 1986
See Also

ipinit(C), hd(M), lp(M), serial(M)
Name

brkctl — Allocates data in a far segment.

Syntax

```
char far *brkctl(command, increment, ptr)
    int command;
    long increment;
    char far *ptr;
```

Description

The brkctl system call allocates and deallocates memory in additional data segments in small and middle model programs. In order for the C compiler to make use of the far pointer return values in small and middle model programs, brkctl must be declared to return a far pointer. To enable the 'far' keyword for small model C programs, the compile -Me option must be used. Middle model C programs require the -Mme option.

The brkctl system call should be used only for dynamically allocating additional segments in small and middle model programs. All other uses should be avoided in favor of sbrk(S), malloc(S), and other standard UNIX system services.

In the syntax example (found in the preceding section):

- `command` is either BR_ARGSEG, BR_NEWSEG, or BR_IMPSEG.
- `increment` is a signed long increment.
- 'char far *ptr' is only used when `command` is BR_ARGSEG.

The second argument (`increment`) may not be greater than 64K bytes. The `increment` may not be more negative than the total amount of memory in all far segments plus the amount allocated in the near segment after process creation.

If the `command` is BR_IMPSEG, and a negative `increment` causes one or more segments to be freed, the 'segment in question' (see the Return Values section) is the last remaining segment that was not freed. BR_IMPSEG implies the use of the last data segment. Unless the process is small or middle model and currently has only one data segment, a positive `increment` that would overflow the last data segment causes a new segment to be allocated.
If the `command` is `BR_ARGSEG`, the `increment` may not be more negative than the size of the segment. The third argument (`ptr`), is assumed to be a far pointer in all models; the offset portion is never used.

If the `command` is `BR_NEWSEG`, the `increment` may not be negative at all. Any memory allocated is guaranteed to be at the base of a new segment.

**Return Value**

`Brkctl()` almost always returns a far pointer to the base of the affected region, `(char far *)-1` on error.

When the `increment` is greater than 0, the return value is a pointer to the base of the newly allocated memory.

When the `increment` is less than or equal to 0, the return value is a pointer to the first illegal byte in the segment in question (usually the base of the deallocated memory). If that segment is full (exactly 64K bytes), the return value will be a pointer to the base of the next segment (which may or may not exist).
<table>
<thead>
<tr>
<th>Command</th>
<th>Increment</th>
<th>Ptr</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR_ARGSEG</td>
<td>0</td>
<td>&lt;valid far ptr&gt;</td>
<td>report on segment increment specified segment</td>
</tr>
<tr>
<td>BR_ARGSEG</td>
<td>other</td>
<td>&lt;valid far ptr&gt;</td>
<td>allocate new segment, size = 0</td>
</tr>
<tr>
<td>BR_NEWSEG</td>
<td>0</td>
<td>-</td>
<td>allocate new segment, size = increment</td>
</tr>
<tr>
<td>BR_NEWSEG</td>
<td>other</td>
<td>-</td>
<td>report on last segment; may free up empty segment(s).</td>
</tr>
<tr>
<td>BR_IMPSEG</td>
<td>0</td>
<td>-</td>
<td>increment last segment; on large model (or small and middle model with multiple data segments) may allocate new segment.</td>
</tr>
<tr>
<td>BR_IMPSEG</td>
<td>other</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

See Also

cc(CP), ld(CP), machine(M), malloc(S), sbrk(S)

Notes

Use of the type of low level control possible when using brkctl is not advised. The functionality of brkctl may change in future releases. It is best to use the sbrk, brk, and malloc calls rather than brkctl.

Brkctl is currently available only on protected mode XENIX.

In all models, the 'near' data segment must be the first data segment.

Brkctl calls with BR_IMPSEG and a negative increment that would affect a shared data segment are refused.
SHV (C)

Name

shv - Invokes the shell command interpreter.

Syntax

shv [ -ceiknrstuvx ] [ args ]

Description

The shell is the standard command programming language that executes commands read from a terminal or a file. See Invocation below for the meaning of arguments to the shell.

Commands

A simple-command is a sequence of nonblank words separated by blanks (a blank is a tab or a space). The first word specifies the name of the command to be executed. Except as specified below, the remaining words are passed as arguments to the invoked command. The command name is passed as argument 0 (see exec(S)). The value of a simple-command is its exit status if it terminates normally, or (octal) 1000+status if it terminates abnormally (i.e., if the failure produces a core file). See signal(S) for a list of status values.

A pipeline is a sequence of one or more commands separated by a vertical bar (|). (The caret (^), also has the same effect.) The standard output of each command but the last is connected by a pipe(S) to the standard input of the next command. Each command is run as a separate process; the shell waits for the last command to terminate.

A list is a sequence of one or more pipelines separated by ;, &, &&, or ||, and optionally terminated by ; or &. Of these four symbols, ; and & have equal precedence, which is lower than that of && and ||. The symbols && and || also have equal precedence. A semicolon (;) causes sequential execution of the preceding pipeline; an ampersand (&) causes asynchronous execution of the preceding pipeline (i.e., the shell does not wait for that pipeline to finish). The symbol && (||) causes the list following it to be executed only if the preceding pipeline returns a zero (nonzero) exit status. An arbitrary number of newlines may appear in a list, instead of semicolons, to delimit commands.
A command is either a simple-command or one of the following commands. Unless otherwise stated, the value returned by a command is that of the last simple-command executed in the command:

```
for name [ in word ... ] do list done
```

Each time a for command is executed, name is set to the next word taken from the in word list. If in word is omitted, then the for command executes the do list once for each positional parameter that is set (see Parameter Substitution below). Execution ends when there are no more words in the list.

```
case word in [ pattern [ | pattern ] ... ) list ;; ] ... esac
```

A case command executes the list associated with the first pattern that matches word. The form of the patterns is the same as that used for filename generation (see Filename Generation below).

```
if list then list [ elif list then list ] ... [ else list ] fi
```

The list following if is executed and, if it returns a zero exit status, the list following the first then is executed. Otherwise, the list following elif is executed and, if its value is zero, the list following the next then is executed. Failing that, the else list is executed. If no else list or then list is executed, then the if command returns a zero exit status.

```
while list do list done
```

A while command repeatedly executes the while list and, if the exit status of the last command in the list is zero, executes the do list; otherwise the loop terminates. If no commands in the do list are executed, then the while command returns a zero exit status; until may be used in place of while to negate the loop termination test.

```
(list)
```

Executes list in a subshell.

```
{list;}
```

list is simply executed.

```
name () {list;}
```

Define a function which is referenced by name. The body of functions is the list of commands between { and }. Execution of functions is described below (see Execution.)

The following words are recognized only as the first word of a command and when not quoted:

```
if then else elif fi case esac for while until do done { } 
```
Comments

A word beginning with # causes that word and all the following characters up to a newline to be ignored.

Command Substitution

The standard output from a command enclosed in a pair of grave accents (``) may be used as part or all of a word; trailing newlines are removed.

Parameter Substitution

The character $ is used to introduce substitutable parameters. Positional parameters may be assigned values by set. Variables may be set by writing:

\[ \text{name}=\text{value} \ [ \text{name}=\text{value} \ ] \ldots \]

Pattern-matching is not performed on value.

$\{\text{parameter}\}$

A parameter is a sequence of letters, digits, or underscores (a name), a digit, or any of the characters *, @, #, ?, -, $, and !. The value, if any, of the parameter is substituted. The braces are required only when parameter is followed by a letter, digit, or underscore that is not to be interpreted as part of its name. A name must begin with a letter or underscore. If parameter is a digit then it is a positional parameter. If parameter is * or @, then all the positional parameters, starting with $1$, are substituted (separated by spaces). Parameter $0$ is set from argument zero when the shell is invoked.

$\{\text{parameter}:=\text{word}\}$

If parameter is set and is not a null argument, substitute its value; otherwise substitute word.

$\{\text{parameter}:@=\text{word}\}$

If parameter is not set or is null, then set it to word; the value of the parameter is then substituted. Positional parameters may not be assigned to in this way.

$\{\text{parameter}:%=\text{word}\}$

If parameter is set and is not a null argument, substitute its value; otherwise, print word and exit from the shell. If word is omitted, the message "parameter null or not set" is printed.
${\texttt{parameter:} + \texttt{word}}$

If \texttt{parameter} is set and is not a null argument, substitute \texttt{word}; otherwise substitute nothing. In the above, \texttt{word} is not evaluated unless it is to be used as the substituted string, so that in the following example, \texttt{pwd} is executed only if \texttt{d} is not set or is null:

```bash
echo ${d:+pwd}
```

If the colon (:) is omitted from the above expressions, then the shell only checks whether \texttt{parameter} is set.

The following parameters are automatically set by the shell:

\# The number of positional parameters in decimal

- Flags supplied to the shell on invocation or by the \texttt{set} command

? The decimal value returned by the last synchronously executed command

$ The process number of this shell

! The process number of the last background command invoked

The following parameters are used by the shell:

\textbf{HOME}

The default argument (home directory) for the \texttt{cd} command

\textbf{PATH}

The search path for commands (see \textit{Execution} below)

\textbf{MAIL}

If this variable is set to the name of a mail file, then the shell informs the user of the arrival of mail in the specified file

\textbf{MAILCHECK}

This parameter specifies how often (in seconds) the shell will check for the arrival of mail in the files specified by the \texttt{MAILPATH} or \texttt{MAIL} parameters. The default value is 600 seconds (10 minutes). If set to 0, the shell will check before each prompt.

\textbf{MAILPATH}

A colon (:) separated list of file names. If this parameter is set, the shell informs the user of the arrival of mail in any of the specified files. Each file name can be followed by \% and a message that will be printed when the modification time changes. The default message is \textit{you have mail}. 

January 27, 1986
PS1
Primary prompt string, by default "$"

PS2
Secondary prompt string, by default ">

IFS
Internal field separators, normally space, tab, and newline

SHACCT
If this parameter is set to the name of a file writable by the user, the shell will write an accounting record in the file for each shell procedure executed. Accounting routines such as acctcomi() and accton(C) can be used to analyze the data collected.

SHELL
When the shell is invoked, it scans the environment (see Environment below) for this name. If it is found and there is an 'r' in the file name part of its value, the shell becomes a restricted shell.

The shell gives default values to PATH, PS1, PS2, and IFS, while HOME and MAIL are not set at all by the shell (although HOME is set by login(M)).

Blank Interpretation

After parameter and command substitution, the results of substitution are scanned for internal field separator characters (those found in IFS) and split into distinct arguments where such characters are found. Explicit null arguments ('"" or '"' ) are retained. Implicit null arguments (those resulting from parameters that have no values) are removed.

Filename Generation

Following substitution, each command word is scanned for the characters *, ?, and [. If one of these characters appears, the word is regarded as a pattern. The word is replaced with alphabetically sorted filenames that match the pattern. If no filename is found that matches the pattern, the word is left unchanged. The character , at the start of a filename or immediately following a /, as well as the character / itself, must be matched explicitly. These characters and their matching patterns are:

* Matches any string, including the null string.

? Matches any single character.
SHV (C)

[...]

Matches any one of the enclosed characters. A pair of characters separated by `-' matches any character lexically between the pair, inclusive. If the first character following the opening bracket (`) is an exclamation mark (`!`), then any character not enclosed is matched.

**Quoting**

The following characters have a special meaning to the shell and cause termination of a word unless quoted:

```
; & ( ) | ^ < > newline space tab
```

A character may be quoted (i.e., made to stand for itself) by preceding it with a `\`. The pair `\newline` is ignored. All characters enclosed between a pair of single quotation marks (`""`), except a single quotation mark, are quoted. Inside double quotation marks (`""`), parameter and command substitution occurs and `\` quotes the characters `\`, `"`, `^`, and $. `"$x"` is equivalent to "$1 $2 ...", whereas "$@" is equivalent to "$1" "$2" ..."

**Prompting**

When used interactively, the shell prompts with the value of PS1 before reading a command. If at any time a newline is typed and further input is needed to complete a command, the secondary prompt (i.e., the value of PS2) is issued.

**Spelling Checker**

When using cd(C) the shell checks spelling. For example, if you change to a different directory using cd and misspell the directory name, the shell responds with an alternative spelling of an existing directory. Enter "y" and press RETURN to change to the offered directory, or retype the command line if the offered spelling is incorrect. In this example the shV(C) response is boldfaced.

```
$ cd /usr/spool/uucp
   cd /usr/spool/uucp?y
   ok
```

**Input/Output**

Before a command is executed, its input and output may be redirected using a special notation interpreted by the shell. The following may appear anywhere in a simple-command or may precede or follow a command. They are not passed on to the invoked command; substitution occurs before word or digit is used:
\(<\text{word}\) Use file \text{word}\) as standard input (file descriptor 0).

\(>\text{word}\) Use file \text{word}\) as standard output (file descriptor 1). If the file does not exist, it is created; otherwise, it is truncated to zero length.

\(>>\text{word}\) Use file \text{word}\) as standard output. If the file exists, output is appended to it (by first seeking the end-of-file); otherwise, the file is created.

\(\ll[=]\text{word}\) The shell input is read up to a line that is the same as \text{word}, or to an end-of-file. The resulting document becomes the standard input. If any character of \text{word}\) is quoted, no interpretation is placed upon the characters of the document; otherwise, parameter and command substitution occurs, (unespaced) \texttt{\textbackslash newline} is ignored, and \texttt{\\} must be used to quote the characters \texttt{\textbackslash}, \$\texttt{\textbackslash{\textbackslash}}, and the first character of \text{word}. If \texttt{\textbackslash{\textbackslash}} is appended to \(\ll\), all leading tabs are stripped from \text{word}\) and from the document.

\(\&\text{digit}\) The standard input is duplicated from file descriptor \text{digit}\) (see \texttt{dup}(S)). Similarly for the standard output using \texttt{\&}\).

\(\&=\) The standard input is closed. Similarly for the standard output using \texttt{\&}\).

If one of the above is preceded by a digit, the file descriptor created is that specified by the digit (instead of the default 0 or 1). For example:

\[\ldots\ 2>\&1\]

creates file descriptor 2 that is a duplicate of file descriptor 1.

If a command is followed by \&\, the default standard input for the command is the empty file /dev/null. Otherwise, the environment for the execution of a command contains the file descriptors of the invoking shell as modified by input/output specifications.

\emph{Environment}

The \emph{environment} (see environ(M)) is a list of name-value pairs that is passed to an executed program in the same way as a normal argument list. The shell interacts with the environment in several ways. On invocation, the shell scans the environment and creates a parameter for each name found, giving it the corresponding value. Executed commands inherit the same environment. If the user modifies the values of these parameters or creates new ones, none of these affect the environment unless the \emph{export} command is used.
to bind the shell's parameter to the environment. The environment seen by any executed command is composed of any unmodified name-value pairs originally inherited by the shell, minus any pairs removed by unset, plus any modifications or additions, all of which must be noted in export commands.

The environment for any simple-command may be augmented by prefixing it with one or more assignments to parameters. Thus:

```
TERM=450 cmd args
```

and

```
(export TERM; TERM=450; cmd args)
```

are equivalent (as far as the above execution of cmd is concerned).

If the \(-k\) flag is set, all keyword arguments are placed in the environment, even if they occur after the command name.

**Signals**

The INTERRUPT and QUIT signals for an invoked command are ignored if the command is followed by \&; otherwise signals have the values inherited by the shell from its parent, with the exception of signal 11. See the trap command below.

**Execution**

Each time a command is executed, the above substitutions are carried out. Except for the *Special Commands* listed below, a new process is created and an attempt is made to execute the command via exec(S).

The shell parameter PATH defines the search path for the directory containing the command. Alternative directory names are separated by a colon (:). The default path is `:/bin:/usr/bin` (specifying the current directory, `/bin`, and `/usr/bin`, in that order). Note that the current directory is specified by a null pathname, which can appear immediately after the equal sign or between the colon delimiters anywhere else in the path list. If the command name contains a `/`, then the search path is not used. Otherwise, each directory in the path is searched for an executable file. If the file has execute permission but is not an a.out file, it is assumed to be a file containing shell commands. A subshell (i.e., a separate process) is spawned to read it. A parenthesized command is also executed in a subshell.
Shell procedures are often used by users running the csh. However, if the first character of the procedure is a # (comment character), the csh assumes the procedure is a csh script, and invokes /bin/csh to execute it. Always start sh procedures with some other character if csh users are to run the procedure at any time. This invokes the standard shell /bin/sh.

The location in the search path where a command was found is remembered by the shell (to help avoid unnecessary exec later). If the command was found in a relative directory, its location must be re-determined whenever the current directory changes. The shell forgets all remembered locations whenever the PATH variable is changed or the hash -r command is executed (see below).

Special Commands

Input/output redirection is now permitted for these commands:

: No effect; the command does nothing. A zero exit code is returned.

. file
  Reads and executes commands from file and returns. The search path specified by PATH is used to find the directory containing file.

break [ n ]
  Exits from the enclosing for or while loop, if any. If n is specified, it breaks n levels.

continue [ n ]
  Resumes the next iteration of the enclosing for or while loop. If n is specified, it resumes at the n-th enclosing loop.

cd [ arg ]
  Changes the current directory to arg. The shell parameter HOME is the default arg. The shell parameter CDPATH defines the search path for the directory containing arg. Alternative directory names are separated by a colon (:). The default path is <null> (specifying the current directory). Note that the current directory is specified by a null path name, which can appear immediately after the equal sign or between the colon delimiters anywhere else in the path list. If arg begins with a /, the search path is not used. Otherwise, each directory in the path is searched for arg.
If the shell is reading its commands from a terminal, and the specified directory does not exist (or some component cannot be searched), spelling correction is applied to each component of directory, in a search for the "correct" name. The shell then asks whether or not to try and change directory to the corrected directory name; an answer of \textit{n} means "no", and anything else is taken as "yes".

\textbf{eval [ arg \ldots ]}

The arguments are read as input to the shell and the resulting command(s) executed.

\textbf{exec [ arg \ldots ]}

The command specified by the arguments is executed in place of this shell without creating a new process. Input/output arguments may appear and, if no other arguments are given, cause the shell input/output to be modified.

\textbf{exit [ n ]}

Causes a shell to exit with the exit status specified by \textit{n}. If \textit{n} is omitted, the exit status is that of the last command executed. An end-of-file will also cause the shell to exit.

\textbf{export [ name \ldots ]}

The given \textit{names} are marked for automatic export to the \textit{environment} of subsequently executed commands. If no arguments are given, a list of all names that are exported in this shell is printed.

\textbf{hash [ \textit{-r} ] [ name \ldots ]}

For each \textit{name}, the location in the search path of the command specified by \textit{name} is determined and remembered by the shell. The \textit{-r} option causes the shell to forget all remembered locations. If no arguments are given, information about remembered commands is presented. \textit{Hits} is the number of times a command has been invoked by the shell process. \textit{Cost} is a measure of the work required to locate a command in the search path. There are certain situations which require that the stored location of a command be recalculated. Commands for which this will be done are indicated by an asterisk (*) adjacent to the \textit{hits} information. \textit{Cost} will be incremented when the recalculation is done.

\textbf{newgrp [ arg \ldots ]}

Equivalent to \texttt{exec newgrp \textit{arg} \ldots}

\textbf{pwd}

Print the current working directory. See \texttt{pwd(C)} for usage and description.
read [ name ... ]
One line is read from the standard input and the first word is
assigned to the first name, the second word to the second name,
etc., with leftover words assigned to the last name. The return
code is 0 unless an end-of-file is encountered.

readonly [ name ... ]
The given names are marked readonly and the values of the
these names may not be changed by subsequent assignment. If
no arguments are given, a list of all readonly names is printed.

return [ n ]
Causes a function to exit with the return value specified by n. If
n is omitted, the return status is that of the last command exe-
cuted.

set [ -eknuvx [ arg ... ] ]

-e
If the shell is noninteractive, exits immediately if a command
exits with a nonzero exit status.

-f Disables file name generation.

-h
Locates and remembers function commands as function are
defined (function commands are normally located when the
function is executed).

-k
Places all keyword arguments in the environment for a com-
mand, not just those that precede the command name.

-n
Reads commands but does not execute them.

-u
Treats unset variables as an error when substituting.

-v
Prints shell input lines as they are read.

-x
Prints commands and their arguments as they are executed.
Although this flag is passed to subshells, it does not enable
tracing in those subshells.

--
Does not change any of the flags; useful in setting $1 to -.
Using + rather than − causes these flags to be turned off. These flags can also be used upon invocation of the shell. The current set of flags may be found in $-$. The remaining arguments are positional parameters and are assigned, in order, to $1$, $2$, ... If no arguments are given, the values of all names are printed.

shift

The positional parameters from $2$ ... are renamed $1$ ...

test

Evaluates conditional expressions. See test(C) for usage and description.

times

Prints the accumulated user and system times for processes run from the shell.

trap [ arg ] [ n ] ...

arg is a command to be read and executed when the shell receives signal(s) n. (Note that arg is scanned once when the trap is set and once when the trap is taken.) Trap commands are executed in order of signal number. The highest signal number allowed is 16. Any attempt to set a trap on a signal that was ignored on entry to the current shell is ineffective. An attempt to trap on signal 11 (memory fault) produces an error. If arg is absent, all trap(s) n are reset to their original values. If arg is the null string, this signal is ignored by the shell and by the commands it invokes. If n is 0, the command arg is executed on exit from the shell. The trap command with no arguments prints a list of commands associated with each signal number.

type [ name ] ...

For each name, indicate how it would be interpreted if used as a command name.

ulimit [ [ -f ] n ]

imposes a size limit of n blocks on files.

-f imposes a size limit of n blocks on files written by child processes (files of any size may be read). Any user may decrease the file size limit, but only the super-user (root) can increase the limit. With no argument, the current limit is printed.

If no option is given and a number is specified, -f is assumed.

unset [ name ] ...

For each name, remove the corresponding variable or function. The variables PATH, PS1, PS2, MAILCHECK and IFS cannot be unset.
umask [ 0oo ]
The user file-creation mask is set to the octal number 0oo where o is an octal digit (see umask(C)). If 0oo is omitted, the current value of the mask is printed.

wait [ n ]
Waits for the specified process to terminate, and reports the termination status. If n is not given, all currently active child processes are waited for. The return code from this command is always 0.

Invocation
If the shell is invoked through exec(S) and the first character of argument 0 is -, commands are initially read from /etc/profile and then from $HOME/.profile, if such files exist. Thereafter, commands are read as described below, which is also the case when the shell is invoked as /bin/sh. The flags below are interpreted by the shell on invocation only; note that unless the -c or -s flag is specified, the first argument is assumed to be the name of a file containing commands, and the remaining arguments are passed as positional parameters to that command file:

- c string If the -c flag is present, commands are read from string.

- s

- t
If the -t flag is present, a single command is read and executed, and the shell exits. This flag is intended for use by C programs only and is not useful interactively.

- i
If the -i flag is present or if the shell input and output are attached to a terminal, this shell is interactive. In this case, TERMINATE is ignored (so that kill 0 does not kill an interactive shell) and INTERRUPT is caught and ignored (so that wait is interruptible). In all cases, QUIT is ignored by the shell.

- r
If the -r flag is present, the shell is a restricted shell (see rsh(C)).

The remaining flags and arguments are described under the set command above.
Exit Status

Errors detected by the shell, such as syntax errors, cause the shell to return a nonzero exit status. If the shell is being used non-interactively, execution of the shell file is abandoned. Otherwise, the shell returns the exit status of the last command executed. See the exit command above.

Files

/etc/profile
$HOME/.profile
/tmp/sh*
/dev/null

See Also

cd(C), env(C), login(M), newgrp(C), rsh(C), test(C), umask(C),
dup(S), exec(S), fork(S), pipe(S), signal(S), umask(S), wait(S),
a.out(F), profile(M), environ(M)

Notes

The command readonly (without arguments) produces the same output as the command export.

If << is used to provide standard input to an non-synchronous process invoked by &, the shell gets mixed up about naming the input document; a garbage file /tmp/sh* is created and the shell complains about not being able to find that file by another name.

If a command is executed, and a command with the same name is installed in a directory in the search path before the directory where the original command was found, the shell will continue to exec the original command. Use the hash command to correct this situation.

If you move the current directory or one above it, pwd may not give the correct response. Use the cd command with a full path name to correct this situation.
ROADMAP

A Guide to XENIX Documentation
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CONTENTS

Contents Summary ........................................... 9
Cross Reference........................................... 39
Command/Topic Index ................................. 47
Command Page Index ................................. 63
The documentation for a large and comprehensive operating system can sometimes take on a complexity of its own. The XENIX documentation is a complete set of over 3000 pages spanning information on hundreds of utilities, procedures, and routines. This can be a valuable resource, and the Roadmap is guide to using it as effectively as possible.

The Roadmap is a collection of introductory and reference material that helps you locate documentation on a command, concept, or other area of XENIX. Its purpose is both to orient the user by “mapping” the organization of the guides, and to act as a shortcut to finding information.

The first section orients the user by describing the kinds of things each guide covers. Other sections point the user to the guide appropriate to what is being sought. The user can search for information by command, or by the type of information being sought (getting started, file editing, status information, and so on).
ORGANIZATION

The Roadmap has five parts:

Questions and Answers
This is a group of questions commonly asked about XENIX and its documentation.

Contents Summary
This is a "map" of what each XENIX guide covers. Major chapters are listed and contents are summarized for quick reference.

Cross Reference
This section lists the kinds of everyday tasks you can do with XENIX and in which guide or guides they can be found. This is useful when you want to do something specific, but aren’t sure where to look.

Command Page Index
This section is an index to XENIX command or man pages. You look up the command name to find the page and its location.

Command/Topic Index
This section is also an index to commands. You look up a topic such as Pattern Matching and find the man page.
Several conventions have been used in this guide. For example, the names of guides are abbreviated in text:

<table>
<thead>
<tr>
<th>Guide</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release Notes</td>
<td>RN</td>
</tr>
<tr>
<td>Installation Guide</td>
<td>IG</td>
</tr>
<tr>
<td>Roadmap</td>
<td>RM</td>
</tr>
<tr>
<td>Introduction to XENIX</td>
<td>IX</td>
</tr>
<tr>
<td>User's Guide</td>
<td>UG</td>
</tr>
<tr>
<td>Operations Guide</td>
<td>OG</td>
</tr>
<tr>
<td>Text Processing Guide</td>
<td>TP</td>
</tr>
<tr>
<td>User's Reference</td>
<td>UR</td>
</tr>
</tbody>
</table>

When a section of a guide is noted, it follows the abbreviation for the name of the guide. For example, the User's Reference, which describes many XENIX commands, is divided into three sections, "C," "M," and "F."

The "C" section of the User's Reference is expressed as:

UR(C)

Commands are always shown with the section in which they are found. For example, the vi command is expressed as:

UR vi(C)

---

Note

The Roadmap is a guide to the user documentation listed above. However, the Command Page and Command/Topic Indexes also index the Programmer's Reference:

Programmer's Reference        PR (CP and S sections)

As the Roadmap is a guide to the basic XENIX user documentation, the above programming guides are not otherwise indexed here.
The *Roadmap* is intended as both an orientation to the XENIX documentation, and as a reference guide in itself.

<table>
<thead>
<tr>
<th>YOU CAN USE DIFFERENT SECTIONS TO FIND OUT...</th>
<th>...BY LOOKING IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>How the guides are organized and what each covers</td>
<td>Contents Summary (p. 5)</td>
</tr>
<tr>
<td>Where to look to learn how to do a specific task</td>
<td>Cross Reference (p. 31)</td>
</tr>
<tr>
<td>Where to look to find a certain command</td>
<td>Command/Topic Index (p. 38)</td>
</tr>
<tr>
<td></td>
<td>Command Page Index (p. 56)</td>
</tr>
</tbody>
</table>
Here are some questions commonly asked about the XENIX documentation, with responses.

Q: When should I use the command documentation (man pages) as opposed to the other documentation?

A: The man pages are intended for reference and document commands only. Once you learn the format of man pages, they are a quick way to learn how a command works.

The rest of the documentation explains not only commands, but includes more detailed information and examples.

Q: How do I know which group of man pages documents the commands I'm looking for?

A: In an effort to make the large amount of XENIX command documentation more accessible, man pages have been split across three guides: The User's Reference contains user-oriented commands, The Programmer's Reference contains commands for programming, and The Text Processing Guide documents text processing commands.

Q: I looked for documentation on spell in the User's Reference but couldn't find any. Where do I find out how to use this facility?

A: spell is a text processing tool, so it is documented in the man page section (CT) of the Text Processing Guide.

Roadmap
Q: What printers are supported for use with nroff?

A: A list of nroff compatible printers is included on the nroff man page in the CT section of the Text Processing Guide. See also TP term(CT), and UR term(F).

Q: Where can I find information on the sed and awk programs?

A: sed and awk are facilities that allow large scale, non-interactive of very large or multiple files. They are described in Appendix A of the Text Processing Guide.
CONTENTS
SUMMARY

This section is a quick reference to major topics in the XENIX guides.

The primary chapters of each guide are listed in an easily readable format.
Name

Release Notes - Documents special features of a given XENIX release

Synopsis

- Notes on installation
- Compatibility of XENIX with various kinds of software and hardware
- Features of the specific release
- Notes on hardware and software
- Notes on the documentation
- Listings of the files contained in this release

Description

The Release Notes contain many useful notes, suggestions, and general information about the release of XENIX for your computer. This includes lists of the applications software that are compatible with this release of XENIX, as well as supported hardware such as computers, hard disks, and memory cards.

The Release Notes also include information about features that are new to the release of XENIX, and things that have changed from previous releases.

Finally, documentation errors are listed, plus a complete listing of the XENIX files included on your distribution media.

See Also

Installation Guide, Introduction to XENIX

Roadmap
Name

Installation Guide – Installing XENIX on your computer

Synopsis

- Step by step guide to installing XENIX
- Adding peripherals such as modems, hard disks, and printers
- Using both the XENIX and DOS operating systems

Description

The Installation Guide explains how to install XENIX on your computer. The procedure is largely automated so that all you have to do is insert the media (tape or disk) containing XENIX and answer the questions that appear onscreen. The procedure takes you through installation, and creation of the super-user (administration) account and first user accounts.

Partitioning hard disk to provide more storage space for files is also discussed. This includes setting up filesystems on the disk, and arranging it so that you can use the DOS operating system in addition to XENIX.

See Also

Operations Guide, UR(C): fdisk, badtrk, fsck, su, mkuser
INSTALLATION GUIDE

INSTALLATION PROCEDURE

- First user account
- System distribution
- Installation procedure
- Super-user password

USING DOS ON THE SAME DISK

- Partitioning with fdisk
- Installation on a DOS system
- DOS accessing utilities
Name

Introduction to XENIX - Introduces basic facilities and concepts of XENIX

Synopsis

- Demonstration of a sample XENIX session
- Introduction of basic XENIX concepts
- Performing typical tasks with XENIX

Description

The Introduction to XENIX begins by taking you through a sample XENIX session. This includes "logging in" (typing your name, password, and terminal type), how to correct simple typing mistakes, and how to give XENIX commands.

Basic concepts are then introduced, including: files and filesystems, commands, and how to direct the results of a command to a file.

Finally typical tasks for which XENIX is used are explained, including: manipulating files and directories, controlling processes, and getting status information.

All of this information is included elsewhere in greater depth, but this guide touches on many important concepts, and should be read first to get a quick idea of what you can do with XENIX.

See Also

BASIC CONCEPTS

- Files and file systems
- Commands
- Naming conventions
- Input & output

DEMONSTRATION

- Logging in
- Typing commands
- Mistakes in typing
- Logging out
- Stopping a program
### Tasks

- **System access**
- **Process control**
- **Calculating**
- **Reminder service**

- **Terminal setup**
- **Processing information**
- **File security**
- **Status information**

- **Command line editing**
- **Communicating with other users**
- **Lineprinting**
- **System clock and calendar**

- **Moving in the file system**
Name

User's Guide - Documents basic XENIX facilities

Synopsis

- Using the vi and ed text editors for file editing
- Using mail to send and receive messages
- Working in different command environments called shells
- Using uucp to communicate with remote systems

Description

The User's Guide explains how to use several key XENIX facilities, such as text editing and mail. You can begin using them immediately and they will become powerful tools as you learn more about them.

XENIX provides two programs for text editing: vi and ed. vi is an editor that displays a screenful of text and shows changes as they happen, hence the name vi, which stands for visual.

The ed editor is called a line editor because only the line you are editing is displayed. Though this may seem an inconvenience, you can do many things with ed that are not possible in vi.

Using mail you can send, receive, forward, and reply to messages. XENIX also includes a program called uucp that allows transfer of information to and from other computers.

XENIX uses a set of very flexible command interpreters called shells. The shell is a program that takes a user command (such as mail or vi) and passes it to the computer for action. XENIX offers several shells that are tailored to various kinds of users. All of the shells include powerful command languages that allow unusual control over how and when the commands are actually issued.

See Also

vi(UR-C), ed(UR-C), mail(UR-C), sh(UR-C), csh(UR-C), uucp(UR-C)

N Roadmap
VI: A TEXT EDITOR

- Demonstration
- Editing tasks
- Environment setup
- Solving problems
- Commands summary

MAIL

- Advanced features
- Quick reference
- Demonstration
- Basic concepts
- Commands

Roadmap
### THE SHELL

- Basic concepts
- The shell state
- Procedure examples
- Passing arguments
- Invocation
- Grammar
- Redirection
- Shell variables
- A command's environment
- Shell programming
- Special commands

### BUILDING A COMMUNICATIONS SYSTEM

- Installation
- Log inquiry
- System to system file copy
- Security
- Command execution
- Maintenance
- System to system execution
- uucp spool directory cleanup

---

Roadmap
THE VISUAL SHELL

- Getting started
- Visual shell screen
- Reference

THE C-SHELL

- C-shell history
- Shell variables
- Invocation
- Redirection
- Expressions
- Aliases
- Special characters
- Built-in commands
- Command scripts

Roadmap
<table>
<thead>
<tr>
<th>ED</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Demonstration</td>
<td>• Tasks</td>
</tr>
<tr>
<td>• Basic concepts</td>
<td></td>
</tr>
<tr>
<td>• Speeding up editing</td>
<td>• Summary of commands</td>
</tr>
<tr>
<td>• Context and regular expressions</td>
<td>• Editing scripts</td>
</tr>
<tr>
<td></td>
<td>• Cutting and pasting</td>
</tr>
</tbody>
</table>
Name

Operations Guide – Provides information for the system administrator

Synopsis

- Starting and stopping the system
- Using, maintaining, and backing up filesystems
- Adding new user accounts, passwords, and permissions
- Adding peripheral devices (modems, printers, and terminals)
- Solving system problems

Description

The Operations Guide contains various information for the system administrator, the person who keeps the system running smoothly. This may be you, or your computer may have a designated administrator who performs tasks such as adding user accounts or extra terminals.

This guide discusses how files are maintained. Topics include: file security and how to control access through permission levels, regulating file storage space, and how to back up and copy files. Special filesystems used by XENIX are also described.

Peripheral devices, such as modems, printers, and hard disks are also discussed here. Modems are used to let your computer communicate with remote systems over telephone lines. Information on how to set up a modem is also included.

Typical problems encountered by administrators are listed and procedures and solutions are presented. These include: freeing jammed printers, stopping runaway processes, restoring free storage space, and replacing a forgotten password.

See Also

UR(C): su, passwd, pwadmin, mkfs, mount, chmod, chown, df, du, tar, syslogadmin, stty, micnet

Roadmap
OPERATIONS GUIDE

INTRODUCTION

• The system manager
• The keyboard
• The Super-user account

STARTING AND STOPPING THE SYSTEM

• Starting the system
• Stopping the system
• Logging in as super-user

Roadmap
### MAINTAINING FILE SYSTEMS

- Maintaining free space
- File system integrity

### PREPARING FOR USERS

- Adding a user account
- Forcing a new password
- Changing a user's login group
- Changing a user's password
- Creating a group
- Changing a user ID
- Removing a user account
BACKING UP FILE SYSTEMS

- Strategies for backups
- Using the sysadmin program
- Using the tar command

USING FILE SYSTEMS

- File systems
- Permissions
- Managing file ownership
- System security
- Using accounting features
USING PERIPHERAL DEVICES

- Adding a terminal
- Setting the terminal type
- Changing serial lines
- Removing a terminal
- Setting terminal lines
- Setting serial line operation
- Adding a lineprinter

XENIX DIRECTORIES

- root
- /dev
- /tmp
- /lib
- /mnt
- Log files
- /bin
- /etc
- /usr

Roadmap
SOLVING SYSTEM PROBLEMS

- Restoring a nonechoing terminal
- Stopping a runaway process
- Solving lineprinter problems
- Removing hidden files
- Restoring free space
- Restoring lost system files
- Replacing a forgotten password
- Restoring an inoperable system
- Recovering from a system crash
- Changing initialization

BUILDING A MICNET NETWORK

- Planning a network
- Building a network
- Starting the network
- Testing a micnet network
- Using a uucp system
SPECIAL DEVICE FILES

- File system requirements
- Terminal and network requirements
- Block sizes
- Special filenames
- Gap and block numbers
User's Reference (UR)

Name

User's Reference - Reference to user level XENIX commands

Synopsis

- Lists commonly used XENIX commands in a standard XENIX format

Description

The User's Reference describes the XENIX commands most often used by the typical user. The format is standard for all commands, so once you learn it, reference is quick and efficient.

Each command (or man) page lists the name of the command, how it is used (its "syntax"), and an explanation of the syntax and usage. A section that directs you to other areas of the documentation is also standard. Finally, there is a section called "Notes" that gives special pointers about using the command.

See Also

Programmer's Reference

Roadmap
Text Processing Guide (TP)

Name

Text Processing Guide - Introduces XENIX text processing tools

Synopsis

- Using text editing tools: \texttt{grep, diff, comm, sort, wc, cut, paste}
- Using text analysis tools: \texttt{spell, style, diction}
- Using text processing "shortcuts:" \texttt{macros}
- Formatting and typesetting text: \texttt{nroff/ troff}
- Formatting tables: \texttt{tbl}
- Formatting mathematics: \texttt{eqn}
- Using large-scale editing tools: \texttt{awk, sed}

Description

The Text Processing Guide introduces a powerful set of text manipulation, formatting, and analysis tools. Using some or all of these facilities in combination, you can create surprisingly professional and visually pleasing documents.

This guide summarizes facilities, introduces general formatting concepts, provides sample projects, and explains how to organize your documents so they will be prepared for formatting later.

Orientation is towards real world applications, with many common document elements described, such as: font characteristics, line and character spacing, paragraphs, headings, lists, diagrams, and tables.

A highlight of this guide is a description of a unique set of text analysis tools. Using these, you can analyze grammatical content of a document, including how hard it is to read for the average person. One facility, called \texttt{diction} even checks for redundant or cluttered language.

See Also

\texttt{vi(UR-C), ed(UR-C)}
WRITING AND EDITING TOOLS

- Commands for text processing
- Using spell
- Using style and diction
- Writing tools

OVERVIEW

- Basic concepts
- Summary
- Formatting documents
- A sample project
- Managing writing projects

Roadmap
### MM Reference

- Invoking the macros
- Paragraphs and headings
- Displays
- References
- Memorandum and released paper styles
- Miscellaneous features
- Table of contents
- Lists
- Errors
- Formatting concepts
- Page headers and footers
- Footnotes
- Reserved names
- Summary of macros, strings, and number registers

### Using the MM Macros

- Getting started with mm
- Basic formatting macros
- Using nroff/troff commands
- Checking mm input with mmcheck
USING NROFF/TROFF

- Inserting commands
- Fonts and special characters
- Drawing lines and characters
- Number registers and arithmetic
- Conditionals
- Tabs
- Strings
- Diversions
- Macros
- Point sizes and line spacing
- Indents and line lengths
- Titles, pages and numbering
- Macros with arguments
- Environments

NROFF/TROFF REFERENCE

- Basic formatting requests
- Processing control facilities
- Output and error messages
- Character translations, overstrike, and local motions
- Summary of escape sequences and number registers

Roadmap
FORMATTING TABLES

- Input format
- Examples
- Invoking tbl
- Command summary

EDITING WITH SED AND AWK

- Introduction
- Pattern matching with awk
- Editing with sed
## FORMATTING MATHEMATICS

- Displayed equations
- Basic mathematic constructions
- Layout and design of mathematical text
- Definitions
- Invoking eqln
- Error messages
- In-line equations
- Complex mathematical constructions
- Keywords and precedence summary
CROSS REFERENCE

This section consolidates the XENIX documentation by grouping topics in categories, such as *Getting Started*, *Terminal Specifics*, and *Operations*.

Then it directs you to the appropriate guide and section number covering the topic you are looking for.
GETTING STARTED

- Release notes
- Installation guide
- System overview
- System demonstration
- Basic concepts
- System tasks

TERMINAL SPECIFICS

- Configuring a terminal
- Setting terminal options
- Terminal capabilities
- Terminal modes
- Restoring nonechoing terminal
- Terminal identification
- Adding peripherals (printers, terminals)
- Using peripheral devices

Roadmap
OPERATIONS

- The super user OG 1,2
- Starting and stopping the system OG 2
- Filesystems: maintenance and backups OG 5,6
- XENIX Directories OG B
- System security OG 4,5
- Solving system problems OG 8
- Maintaining free space OG 5
- Adding user accounts OG 3

STATUS

- How much of the disk is full? UR du(C)
- How much of the disk is free? UR df(C)
- Who is on the system? UR who(C)
- What terminal is this? UR tty(C)
- What processes are running? UR ps(C)
- What day/time is it? UR date(C)
- Information about a user UR finger(C)
COMMUNICATIONS

- Using Mail: UG 3
- Between remote computers: UG 6, UR uucp(C)
- Building a communications network: OG 9, UR micnet(M)
- Writing from one terminal to another: IX 4, UR write(C)

FILES

- Conventions: IX 4
- Moving in the filesystem: IX 4, UR pwd, mv(C)
- Using file permissions: IX 4, UR chmod, l(C)
- Listing files: IX 4, UR ls, lc(C)
- Displaying file contents: IX 4, UR more, cat, head, tail(C)
- Deleting, creating a file: IX 4, UR rm(C)
- Moving, copying, naming files: IX 4, UR cp, mv(C)
- Finding files: IX 4, UR find(C)
- Editing files: UG 2, UR vi(C)
- Maintaining and backing up filesystems: OG 5,6
  UR backup, restore, tar(C)
DIRECTORIES

- Printing your working directory  IX4, UR pwd(C)
- Listing directory contents  IX4, UR lc, ls(C)
- Creating, removing  IX4, UR mkdir, rmdir, rm(C)
- Renaming, moving  IX4, UR mv, copy, tar(C)
- Using directory permissions  IX4, UR chmod, l(C)
- XENIX Directories  OG B
- XENIX Special Devices  OG A

THE SHELL

- Variables  UG 4
- Shell environment  UG 4
- Shell procedures/commands  UG 4
- C-shell  UG 7
- Bourne shell  UG 4
- Visual shell  UG 8
- Using expressions  UG 4
- Shell grammar  UG 4

Roadmap
EDITING TOOLS

• Text editors
  UG 2, UR vi, ed(C)
• Formatting languages
  TP 5, 6 UR nroff, troff(C)
• Macro sets
  TP 3, 4
• Checking spelling
  TP spell(CT)
• Checking style and diction
  TP style, diction(CT)
• Creating tables
  TP 7, TP tbl(CT)
• Formatting mathematical equations
  TP 8, TP eqn(CT)

BASIC COMMANDS

• Who am I?
  UR who(C).
• Where am I?
  UR where, pwd(C)
• What day/time is it?
  UR date(C)
• Changing the account password
  UR passwd(C)
• Listing Files/Directories
  UR ls(C)
• Viewing a file
  UR more, cat(C)
• Copying or moving a file
  UR cp, mv(C)
• Removing files/directories
  UR rm(C)
• Changing Directories
  UR cd(C)
• Access to the Line printer
  UR lpr(C)
• Print Working Directory
  UR pwd(C)
COMMAND/TOPIC INDEX

This section lists common XENIX topics, showing on what page, section, and guide they are to be found.
## Command/Topic Index

**Commands, Systems Calls, Library Routines, and File Formats**

<table>
<thead>
<tr>
<th>Command/Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute value, integer</td>
<td>abs(PR-S)</td>
</tr>
<tr>
<td>Absolute value, real</td>
<td>floor(PR-S)</td>
</tr>
<tr>
<td>Accounting file</td>
<td>acct(UR-F)</td>
</tr>
<tr>
<td>Accounting files, printing</td>
<td>acctcom(UR-C)</td>
</tr>
<tr>
<td>Accounting</td>
<td>acct(PR-S)</td>
</tr>
<tr>
<td>Accounting, starting</td>
<td>accton(UR-C)</td>
</tr>
<tr>
<td>acos function</td>
<td>trig(PR-S)</td>
</tr>
<tr>
<td>Alarm clock</td>
<td>alarm(PR-S)</td>
</tr>
<tr>
<td>aliases, hash file</td>
<td>aliases(UR-M)</td>
</tr>
<tr>
<td>Allows/rejects print requests</td>
<td>accept(UR-C)</td>
</tr>
<tr>
<td>Archive file</td>
<td>cpio(UR-F)</td>
</tr>
<tr>
<td>Archive file format</td>
<td>ar(UR-F)</td>
</tr>
<tr>
<td>Archive file format</td>
<td>tar(UR-F)</td>
</tr>
<tr>
<td>Archives and libraries</td>
<td>ar(PR-CP)</td>
</tr>
<tr>
<td>Archives, creating and restoring</td>
<td>tar(UR-C)</td>
</tr>
<tr>
<td>ASCII character set</td>
<td>ascii(UR-M)</td>
</tr>
<tr>
<td>asctime function</td>
<td>ctime(PR-S)</td>
</tr>
<tr>
<td>asin function</td>
<td>trig(PR-S)</td>
</tr>
<tr>
<td>Assembler and link editor output</td>
<td>a.out(UR-F)</td>
</tr>
<tr>
<td>Assembler (pre-merge C compiler), invokes</td>
<td>asx(PR-CP)</td>
</tr>
<tr>
<td>Assembler (merge C compiler), invokes</td>
<td>masm(PR-CP)</td>
</tr>
<tr>
<td>at command</td>
<td>at(UR-C)</td>
</tr>
<tr>
<td>atan function</td>
<td>trig(PR-S)</td>
</tr>
<tr>
<td>atan2 function</td>
<td>trig(PR-S)</td>
</tr>
<tr>
<td>atoi function</td>
<td>atof(PR-S)</td>
</tr>
<tr>
<td>atol function</td>
<td>atof(PR-S)</td>
</tr>
<tr>
<td>atm command</td>
<td>at(UR-C)</td>
</tr>
<tr>
<td>Backup format</td>
<td>backup(UR-F)</td>
</tr>
<tr>
<td>Backup, creating and restoring</td>
<td>sysadmin(UR-C)</td>
</tr>
<tr>
<td>Backup, creating</td>
<td>dump(UR-C)</td>
</tr>
<tr>
<td>Backup, dates</td>
<td>sdate(UR-C)</td>
</tr>
<tr>
<td>Backup, listing</td>
<td>dumpdir(UR-C)</td>
</tr>
<tr>
<td>Backup file system, restoring</td>
<td>restor(UR-C)</td>
</tr>
<tr>
<td>Backup, restoring</td>
<td>restore(UR-C)</td>
</tr>
<tr>
<td>Binary search</td>
<td>bsearch(PR-S)</td>
</tr>
<tr>
<td>Block size, reports hard disk</td>
<td>cmchk(UR-C)</td>
</tr>
<tr>
<td>Boot system automatically</td>
<td>autoboot(UR-C)</td>
</tr>
<tr>
<td>brk function</td>
<td>sbrk(PR-S)</td>
</tr>
<tr>
<td>C compiler</td>
<td>cc(PR-CP)</td>
</tr>
<tr>
<td>Cflow graph generator</td>
<td>cflow(PR-CP)</td>
</tr>
<tr>
<td>C language preprocessor</td>
<td>cpp(PR-CP)</td>
</tr>
<tr>
<td>C language usage and syntax</td>
<td>lint(PR-CP)</td>
</tr>
<tr>
<td>C program, formatting</td>
<td>cb(PR-CP)</td>
</tr>
<tr>
<td>C program cross reference</td>
<td>exref(PR-CP)</td>
</tr>
</tbody>
</table>
C program, determines stack requirements for \[ \text{stackuse} \ (\text{PR} - \text{CP}) \]

C shell \[ \text{csh} \ (\text{UR} - \text{C}) \]

cabs function \[ \text{hypot} \ (\text{PR} - \text{S}) \]

Calculator \[ \text{bc} \ (\text{UR} - \text{C}) \]

Calculator \[ \text{dc} \ (\text{UR} - \text{C}) \]

Calendar, display \[ \text{cal} \ (\text{UR} - \text{C}) \]

calloc function \[ \text{malloc} \ (\text{PR} - \text{S}) \]

ceil function \[ \text{floor} \ (\text{PR} - \text{S}) \]

Change binary file header \[ \text{fixhdr} \ (\text{UR} - \text{C}) \]

Change working directory \[ \text{cd} \ (\text{UR} - \text{C}) \]

Character translation \[ \text{tr} \ (\text{UR} - \text{C}) \]

Characters, classification \[ \text{ctype} \ (\text{PR} - \text{S}) \]

clearer function \[ \text{ferror} \ (\text{PR} - \text{S}) \]

Clears node \[ \text{clear} \ (\text{UR} - \text{C}) \]

Clock, real time \[ \text{clock} \ (\text{PR} - \text{S}) \]

Clock daemon \[ \text{cron} \ (\text{UR} - \text{C}) \]

Clock rate, changes \[ \text{clockrate} \ (\text{UR} - \text{C}) \]

Commands, constructing and executing \[ \text{xargs} \ (\text{UR} - \text{C}) \]

Commands, execution on a remote system \[ \text{remote} \ (\text{UR} - \text{C}) \]

Commands, execution priority \[ \text{nice} \ (\text{UR} - \text{C}) \]

Commands, execution without hangups and quits \[ \text{noglob} \ (\text{UR} - \text{C}) \]

Commands, installing \[ \text{install} \ (\text{UR} - \text{C}) \]

Commands, options \[ \text{getopt} \ (\text{UR} - \text{C}) \]

Commands, scheduled execution \[ \text{at} \ (\text{UR} - \text{C}) \]

Communication, calling other systems \[ \text{cu} \ (\text{UR} - \text{C}) \]

Communication, copying files across systems \[ \text{rcp} \ (\text{UR} - \text{C}) \]

Compares files too large for diff \[ \text{bdiff} \ (\text{UR} - \text{C}) \]

Compares three versions of a file \[ \text{diff3} \ (\text{UR} - \text{C}) \]

Compiler compiler \[ \text{yacc} \ (\text{PR} - \text{CP}) \]

Compiles regular expressions \[ \text{regcmp} \ (\text{PR} - \text{CP}) \]

Computer screen \[ \text{console} \ (\text{UR} - \text{C}) \]

Configuration database, displays and sets \[ \text{cterm} \ (\text{UR} - \text{C}) \]

Constant width text \[ \text{cw} \ (\text{TP} - \text{CT}) \]

Conversion, 3-byte integers and long integers \[ \text{int} \ (\text{PR} - \text{S}) \]

Conversion of archives to random libraries \[ \text{ranlib} \ (\text{PR} - \text{CP}) \]

Conversion, byte swapping \[ \text{swab} \ (\text{PR} - \text{S}) \]

Conversion, date and time to ASCII \[ \text{ctime} \ (\text{PR} - \text{S}) \]

Conversion, integer and base 64 ASCII \[ \text{a64I} \ (\text{PR} - \text{S}) \]

Conversion, ASCII to numbers \[ \text{atof} \ (\text{PR} - \text{S}) \]

Conversions, output \[ \text{ecvt} \ (\text{PR} - \text{S}) \]

Conversions, real to mantissa and exponent \[ \text{frexp} \ (\text{PR} - \text{S}) \]

Conversions, to ASCII characters \[ \text{conv} \ (\text{PR} - \text{S}) \]

Conversions, units \[ \text{units} \ (\text{UR} - \text{C}) \]

Core image file \[ \text{core} \ (\text{UR} - \text{C}) \]

cos function \[ \text{trig} \ (\text{PR} - \text{S}) \]

cosh function \[ \text{sinh} \ (\text{PR} - \text{S}) \]

Creates a new file or rewrites an existing one \[ \text{creat} \ (\text{PR} - \text{S}) \]

Customizes XENIX for user \[ \text{custom} \ (\text{UR} - \text{C}) \]

cwcheck command \[ \text{cw} \ (\text{TP} - \text{CT}) \]
<table>
<thead>
<tr>
<th>File, access and modification dates</th>
<th>settime (UR-C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>File, access and modification times</td>
<td>utime (PR-S)</td>
</tr>
<tr>
<td>File, access permissions</td>
<td>chmod (UR-C)</td>
</tr>
<tr>
<td>File, accessibility</td>
<td>access (PR-S)</td>
</tr>
<tr>
<td>File, building special files</td>
<td>mknode (UR-C)</td>
</tr>
<tr>
<td>File, check for reading</td>
<td>rdchk (PR-S)</td>
</tr>
<tr>
<td>File, checksum and blocks</td>
<td>sum (UR-C)</td>
</tr>
<tr>
<td>File, closing</td>
<td>close (PR-S)</td>
</tr>
<tr>
<td>File, comparing side-by-side</td>
<td>ssdiff (UR-C)</td>
</tr>
<tr>
<td>File, comparing text</td>
<td>diff (UR-C)</td>
</tr>
<tr>
<td>File, comparing</td>
<td>cmp (UR-C)</td>
</tr>
<tr>
<td>File, compressing and expanding</td>
<td>pack (UR-C)</td>
</tr>
<tr>
<td>File, concatenating and displaying</td>
<td>cat (UR-C)</td>
</tr>
<tr>
<td>File, control</td>
<td>fcntl (PR-S)</td>
</tr>
<tr>
<td>File, converting and copying</td>
<td>dd (UR-C)</td>
</tr>
<tr>
<td>File, copying archives</td>
<td>cpio (UR-C)</td>
</tr>
<tr>
<td>File, copying groups</td>
<td>copy (UR-C)</td>
</tr>
<tr>
<td>File, copying</td>
<td>cp (UR-C)</td>
</tr>
<tr>
<td>File, counting lines, words and characters</td>
<td>wc (UR-C)</td>
</tr>
<tr>
<td>File, creation mask</td>
<td>umask (PR-S)</td>
</tr>
<tr>
<td>File, creation mode mask</td>
<td>umask (UR-C)</td>
</tr>
<tr>
<td>File, creation</td>
<td>mknod (PR-S)</td>
</tr>
<tr>
<td>File, differences</td>
<td>diffmk (TP-CT)</td>
</tr>
<tr>
<td>File, displaying repeated lines</td>
<td>uniq (UR-C)</td>
</tr>
<tr>
<td>File, displaying</td>
<td>pr (UR-C)</td>
</tr>
<tr>
<td>File, duplication</td>
<td>dup (PR-S)</td>
</tr>
<tr>
<td>File, error and status</td>
<td>ferror (PR-S)</td>
</tr>
<tr>
<td>File, group ID</td>
<td>chgrp (UR-C)</td>
</tr>
<tr>
<td>File, hexadecimal display</td>
<td>hd (UR-C)</td>
</tr>
<tr>
<td>File, identifying</td>
<td>what (UR-C)</td>
</tr>
<tr>
<td>File, linking</td>
<td>ln (UR-C)</td>
</tr>
<tr>
<td>File, locating</td>
<td>find (UR-C)</td>
</tr>
<tr>
<td>File, locking regions</td>
<td>locking (PR-S)</td>
</tr>
<tr>
<td>File, mode</td>
<td>chmod (PR-S)</td>
</tr>
<tr>
<td>File, moving and renaming</td>
<td>mv (UR-C)</td>
</tr>
<tr>
<td>File, octal display</td>
<td>od (UR-C)</td>
</tr>
<tr>
<td>File, opening</td>
<td>open (PR-S)</td>
</tr>
<tr>
<td>File, owner ID</td>
<td>chown (UR-C)</td>
</tr>
<tr>
<td>File, ownership</td>
<td>chown (PR-S)</td>
</tr>
<tr>
<td>File, permission and ownership</td>
<td>fixperm (UR-M)</td>
</tr>
<tr>
<td>File, printing</td>
<td>lp (UR-C)</td>
</tr>
<tr>
<td>File, printing</td>
<td>lp (UR-M)</td>
</tr>
<tr>
<td>File, reading</td>
<td>read (PR-S)</td>
</tr>
<tr>
<td>File, removal</td>
<td>unlink (PR-S)</td>
</tr>
<tr>
<td>File, removing</td>
<td>rm (UR-C)</td>
</tr>
<tr>
<td>File, scanning</td>
<td>bfs (UR-C)</td>
</tr>
<tr>
<td>File, selecting common lines</td>
<td>comm (UR-C)</td>
</tr>
<tr>
<td>File, size</td>
<td>chsize (PR-S)</td>
</tr>
</tbody>
</table>
File, sorting ........................................ sort(UR-C)
File, splitting by context .......................... csplit(UR-C)
File, splitting by lines ............................. split(UR-C)
File, status ....................................... stat(PR-S)
File, temporary .................................... tmfile(PR-S)
File, tree walking ................................ ftw(PR-S)
File, type .......................................... file(UR-C)
File, updates access and modification times .... touch(UR-C)
File, user and group ID ............................. setuid(PR-S)
File, viewing ...................................... more(UR-C)
File, writing ...................................... write(PR-S)
Filename, creation ................................ mktemp(PR-S)
Filename, temporary ................................ tmpnam(PR-S)
fileno function ..................................... ferror(PR-S)
Files, merging lines ............................... paste(TP-CT)
Files, repositioning ............................... lseek(PR-S)
Files, selecting fields ........................... cut(TP-CT)
Find lines in a sorted list ......................... look(TP-CT)
firstkey function ................................ dbm(PR-S)
Floor, ceiling, and remainder functions ..... floor(PR-S)
Floppy devices .................................... fd(UR-M)
Floppy disk, copy ................................... diskcpi(UR-C)
Floppy disk, formatting ......................... format(UR-C)
fmod function ...................................... floor(PR-S)
Format text file ................................... newform(UR-C)
fprintf function .................................. printf(PR-S)
fwrite function ................................... putc(PR-S)
fwrite function ................................... puts(PR-S)
free function ..................................... malloc(PR-S)
freopen function ................................ fopen(PR-S)
fscanf function ................................... scanf(PR-S)
fstat function ..................................... stat(PR-S)
ftell function ..................................... fseek(PR-S)
ftime function ................................... time(PR-S)
Function key setting ............................. setkey(UR-M)
fwrite function ................................... fread(PR-S)
fxlist function .................................... xlist(PR-S)
gcvt function ..................................... ecvt(PR-S)
getchar function ................................ getc(PR-S)
getegid ............................................ getuid(PR-S)
geteuid ............................................ geteuid(PR-S)
getgid ............................................. getgrent(PR-S)
getgrgid function ................................ getgrgid(PR-S)
getgrent function ................................. getgrent(PR-S)
getgrent function ................................. getgid(PR-S)
getgppg function ................................ getgppg(PR-S)
getppgid function ................................ getppgid(PR-S)
getpwent function ................................. getpwent(PR-S)
getpwuid function ................................ getpwuid(PR-S)
getwc function ................................... getwc(PR-S)
ctime (PR-S)
spline (PR-CP)
group (UR-M)
grpcheck (UR-C)
getruid (PR-S)
newgrp (UR-C)
ssignal (PR-S)
hssearch (PR-S)
machine (UR-M)
hyphen (TP-CT)
id (UR-C)
ips (UR-C)
init (UR-M)
inode (UR-F)
sicm (UR-M)
parallel (UR-M)
serial (UR-M)
abort (PR-S)
cctype (PR-S)
cctype (PR-S)
cctype (PR-S)
cctype (PR-S)
cctype (PR-S)
cctype (PR-S)
cctype (PR-S)
bessel (PR-S)
bessel (PR-S)
bessel (PR-S)
keyboard (UR-M)
a64l (PR-S)
explain (TP-CT)
diction (TP-CT)
banner (UR-C)
frexp (PR-S)
lex (PR-CP)
intro (PR-S)
curses (PR-S)
stdio (PR-S)
line (UR-C)
lp (UR-C)
ladmin (UR-C)
lpinit (UR-C)
lpsched (UR-C)
Line printer, status ........................................ lpstat(UR-C)
Linear search ............................................. lsearch(PR-S)
Link filename to existing file ........................... link(PR-S)
Link editor .................................................. ld(PR-CP)
Link editor .................................................. ld(UR-M)
List contents of directory ................................. l(UR-C)
localtime function ......................................... ctime(PR-S)
log function ................................................ exp(PR-S)
log10 function ............................................. exp(PR-S)
Login name ................................................. cuserid(PR-S)
Login name, user ........................................... logname(PR-S)
Login, name ................................................ logname(UR-C)
Login name, gets .......................................... getlogin(PR-S)
Login, records ............................................. utmp(UR-M)
Login, system .............................................. login(UR-M)
longjmp function ........................................... setjmp(PR-S)
Ito13 function ............................................. lito13(PR-S)
Macro processor ........................................... m4(PR-CP)
Macros, checking usage ................................... checkmm(TP-CT)
Macros, memorandum for line printer .................... mm(TP-CT)
Macros, memorandum for typesetting .................... mnt(TP-CT)
Macros, removal ........................................... deroff(TP-CT)
Macros, so elimination ................................... soelim(TP-CT)
Mail .......................................................... mail(UR-C)
mailies file ................................................ aliases(UR-M)
Manual pages, printing ................................... man(TP-CT)
Mathematical text for typesetting ....................... eqn(TP-CT)
Mathematical text for line printer ...................... neqn(TP-CT)
Mathematics, Bessel functions ............................. bessel(PR-S)
Mathematics, Euclidean distance ......................... hypot(PR-S)
Mathematics, exponential and logarithm functions .. exp(PR-S)
Mathematics, hyperbolic functions ...................... sinh(PR-S)
Mathematics, log gamma function ....................... gamma(PR-S)
Mathematics, trigonometric functions ................... trig(PR-S)
Memory, allocation ........................................ malloc(PR-S)
Memory, locking in process, text or data ............... plock(PR-S)
Memory image, actual ..................................... mem(UR-M)
Memory image, virtual .................................... mem(UR-M)
Memory operations ........................................ memory(PR-S)
Message control operations .............................. msgctl(PR-S)
Message queue ............................................ msgget(PR-S)
Message operations ....................................... msqop(PR-S)
Message, errors .......................................... assert(PR-S)
Messages, system ......................................... messages(UR-M)
Messages, system, displayed on console ............... dmesg(UR-C)
Micnet, alias hash file ................................... aliases(UR-M)
Micnet, alias hash program .............................. aliashash(UR-M)
Micnet, creating and operating ......................... netutil(UR-C)
Micnet, default commands ............................... micnet(UR-M)
Micnet, forwarding aliases ................................... aliases (UR-M)
Micnet, machine aliases ...................................... aliases (UR-M)
Micnet, mailer daemon ........................................ daemon, mn (UR-M)
Micnet, system identification ................................ systemld (UR-M)
Micnet, topology files ........................................ top (UR-M)
Micnet, user aliases ........................................... aliases (UR-M)
modf function .................................................... frexp (PR-S)
Mounted file system table ..................................... mnttab (UR-F)
MS-DOS, accessing files ..................................... dos (UR-C)
Multiple screens ............................................... multiscr (UR-M)
Name list ......................................................... nlist (PR-S)
Name list, prints ............................................... nm (PR-CP)
nbwaitsem function ........................................... waitsem (PR-S)
News ............................................................... news (UR-C)
nextkey function ................................................ dbm (PR-S)
Null file ......................................................... null (UR-M)
Object file, displaying ........................................ hdr (PR-CP)
Object file, printable strings ............................... strings (PR-CP)
Object file, relocatable format ............................. 86rel (UR-F)
Object file, size ................................................ size (PR-CP)
Object file, symbols and relocation ......................... strip (PR-CP)
Option, from argument vector .............................. getopt (PR-S)
Ordering relations ............................................. order (PR-CP)
Password entries ............................................... passwd (UR-M)
Password, aging ................................................ padmin (UR-C)
Password, changing ........................................... passwd (UR-C)
Password, file check .......................................... pwcheck (UR-C)
Password, file entries ........................................ getpwent (PR-S)
Password, file entries, writes .............................. putpwent (PR-S)
Password, for user ID .......................................... getpw (PR-S)
Password, input ................................................. getpass (PR-S)
Pathname, directory name ................................... dirname (UR-C)
Pathnames, filename .......................................... basename (UR-C)
Pattern, searching and processing ......................... awk (UR-C)
Pattern, searching ............................................ grep (UR-C)
pcut command ................................................... pack (UR-C)
polose function ................................................ open (PR-S)
Permuted index ................................................ ptx (TP-CT)
Pipe, creating a tee .......................................... tee (UR-C)
Pipe, creating .................................................. pipe (PR-S)
Pipe, opening and closing ................................. open (PR-S)
pow function .................................................... exp (PR-S)
Prints formatted output of a varargs argument list .... vprintf (PR-S)
Print on an IMAGEN printer ................................ imprint (UR-C)
Process, alarm clock .......................................... alarm (PR-S)
Process, creation .............................................. fork (PR-S)
Process, execution priority .................................. nice (PR-S)
Process, execution time profile ............................ profi1 (PR-S)
Process, execution times .................................... times (PR-S)
Process, group ID ........................................ setpgid(PR−S)
Process, limits ............................................. ulimit(PR−S)
Process, locking in memory ............................. lock(PR−S)
Process, memory allocation ............................. sbrk(PR−S)
Process, real and effective IDs ......................... getuid(PR−S)
Process, status ............................................ ps(UR−C)
Process, suspension until signal ....................... pause(PR−S)
Process, temporary suspension ......................... nap(PR−S)
Process, terminating ..................................... kill(UR−C)
Process, terminating ..................................... kill(PR−S)
Process, termination ..................................... exit(PR−S)
Process, trace ............................................. ptrace(PR−S)
Process, waiting for background process ............. wait(UR−C)
Process, waiting for child process ..................... wait(PR−S)
Process, IDs ................................................ getpid(PR−S)
Processor, halts and flushes block i/o ................ shutdown(PR−S)
Program listing, cross-reference ....................... cref(PR−CP)
Program listing, cross-reference ....................... xref(PR−CP)
Program location .......................................... etext(PR−S)
Program location, finds last ........................... end(PR−S)
Program maintenance .................................... make(PR−CP)
Process communication report ......................... ips(UR−C)
Processes, Controls ...................................... proc(UR−S)
putchar function .......................................... putc(PR−S)
putfw function ............................................ putc(PR−S)
Random number ............................................ random(UR−C)
Random numbers .......................................... rand48(PR−S)
Random numbers .......................................... rand(PR−S)
Rational FORTRAN ......................................... ratfor(PR−CP)
realloc function .......................................... malloc(PR−S)
regcmp function .......................................... regex(PR−S)
Real time clock, sets ................................. setclock(UR−M)
Regular expressions ..................................... regex(PR−S)
Regular expressions, compile and match .............. regexp(PR−S)
Relations, joining ....................................... join(UR−C)
Reminder service .......................................... calendar(UR−C)
Remove messages ......................................... ipcrm(UR−C)
Return value, nonzero .................................. false(UR−C)
Return value, repeated string ......................... yes(UR−C)
Return value, zero ....................................... true(UR−C)
Reverse linefeed .......................................... col(TP−CT)
rewind function .......................................... fseek(PR−S)
Root directory ........................................... chroot(UR−C)
Root directory ........................................... chroot(PR−S)
Run a command too large for normal memory ......... runbig(UR−C)
SCCS file .................................................. sccsfile(UR−F)
SCCS files, combining .................................. comb(PR−CP)
SCCS files, comments .................................. cdc(PR−CP)
SCCS files, comparing .................................. sccsdiff(PR−CP)
SCCS files, creating new versions .................................. delta (PR−CP)
SCCS files, editing ......................................................... sact (PR−CP)
SCCS files, printing ...................................................... prs (PR−CP)
SCCS files, removing .................................................... rmdel (PR−CP)
SCCS files, restoring ..................................................... unget (PR−CP)
SCCS files, retrieving versions ....................................... get (PR−CP)
SCCS files, creating and maintaining ................................ admin (PR−CP)
SCCS files, validating .................................................... val (PR−CP)
SCCS, command help ...................................................... help (PR−CP)
Screen color, setting ...................................................... setcolor (UR−C)
Screen mapping, console ................................................ mapkey (UR−M)
sdfree function ............................................................... sdget (PR−S)
sdleave function ............................................................. sdenter (PR−S)
sdwait function ............................................................... sdgetv (PR−S)
Search binary trees ......................................................... tsearch (PR−S)
Semaphore and record locking in files .............................. lockf (PR−S)
Semaphore control ......................................................... semct1 (PR−S)
Semaphore, gets set ....................................................... semget (PR−S)
Semaphore, creation ...................................................... creatsem (PR−S)
Semaphore, opening ....................................................... opensem (PR−S)
Semaphore, operations .................................................. semop (PR−S)
Semaphore, signaling ..................................................... sigsem (PR−S)
Semaphore, waiting for resource ..................................... waitsem (PR−S)
setgid function ............................................................... setuid (PR−S)
setgrent function ........................................................... getgrent (PR−S)
setpwent function ........................................................... getpwent (PR−S)
Shared data, attaching and detaching ............................... sdget (PR−S)
Shared data, entering and leaving .................................... sdenter (PR−S)
Shared data, synchronized access .................................... sdgetv (PR−S)
Shared memory control ................................................... shmemct1 (PR−S)
Shared memory, gets ...................................................... shmemget (PR−S)
Shared memory operations ............................................. shmemop (PR−S)
Shell ................................................................. sh (UR−C)
Shell, restricted ............................................................ rsh (UR−C)
Shell, visual ............................................................... vsh (UR−C)
Signal, processing ........................................................... signal (PR−S)
Signal, software ............................................................ ssignal (PR−S)
sin function ................................................................. trig (PR−S)
Sorting topologically ...................................................... tsort (PR−CP)
Sorting ................................................................. qsort (PR−S)
Spelling checker ........................................................... spell (TP−CT)
sprintf function ............................................................ printf (PR−S)
sqrt function ................................................................. exp (PR−S)
srand function .............................................................. rand (PR−S)
sscanf function ............................................................. scanf (PR−S)
Standard input, reading strings ....................................... gets (PR−CP)
Standard interprocess communications package ............... stdipc (PR−S)
stat data file ............................................................... stat (UR−F)
Statistical processing ..................................................... prep (TP−CT)
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>store function</td>
<td>dbm(PR-S)</td>
</tr>
<tr>
<td>strcat function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strchr function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strcmp function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strcpy function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strcspn function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strdup function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>Stream, buffered input and output</td>
<td>fread(PR-S)</td>
</tr>
<tr>
<td>Stream, buffers</td>
<td>setbuf(PR-S)</td>
</tr>
<tr>
<td>Stream, character input</td>
<td>getc(PR-S)</td>
</tr>
<tr>
<td>Stream, character output</td>
<td>putc(PR-S)</td>
</tr>
<tr>
<td>Stream, closing and flushing</td>
<td>fclose(PR-S)</td>
</tr>
<tr>
<td>Stream, formatted input</td>
<td>scanf(PR-S)</td>
</tr>
<tr>
<td>Stream, formatted output</td>
<td>printf(PR-S)</td>
</tr>
<tr>
<td>Stream, opening</td>
<td>fopen(PR-S)</td>
</tr>
<tr>
<td>Stream, repositioning</td>
<td>fseek(PR-S)</td>
</tr>
<tr>
<td>Stream, returning character to</td>
<td>ungetc(PR-S)</td>
</tr>
<tr>
<td>Stream, string input</td>
<td>gets(PR-S)</td>
</tr>
<tr>
<td>Stream, string output</td>
<td>puts(PR-S)</td>
</tr>
<tr>
<td>String, convert to double precision number</td>
<td>strtod(PR-S)</td>
</tr>
<tr>
<td>String to integer</td>
<td>strtol(PR-S)</td>
</tr>
<tr>
<td>Strings, extracting</td>
<td>xstr(PR-CP)</td>
</tr>
<tr>
<td>Strings, operations</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strlen function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strncmp function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strcmp function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strncpy function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strpbrk function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strrchr function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>strstr function</td>
<td>string(PR-S)</td>
</tr>
<tr>
<td>Suspending execution of commands for a period</td>
<td>sleep(UR-C)</td>
</tr>
<tr>
<td>Suspending execution of commands for a period</td>
<td>sleep(PR-S)</td>
</tr>
<tr>
<td>System, current name</td>
<td>uname(UR-C)</td>
</tr>
<tr>
<td>System, current name</td>
<td>uname(PR-S)</td>
</tr>
<tr>
<td>System, disk usage</td>
<td>du(UR-C)</td>
</tr>
<tr>
<td>System, free disk blocks</td>
<td>df(UR-C)</td>
</tr>
<tr>
<td>System, information</td>
<td>pstat(UR-C)</td>
</tr>
<tr>
<td>System real time clock</td>
<td>clock(UR-M)</td>
</tr>
<tr>
<td>System, stopping</td>
<td>haltSys(UR-C)</td>
</tr>
<tr>
<td>System shutdown</td>
<td>shutdown(UR-C)</td>
</tr>
<tr>
<td>System, super-block</td>
<td>sync(UR-C)</td>
</tr>
<tr>
<td>System, super-block</td>
<td>sync(PR-S)</td>
</tr>
<tr>
<td>System, time</td>
<td>stime(PR-S)</td>
</tr>
<tr>
<td>System, XENIX configuration</td>
<td>config(PR-CP)</td>
</tr>
<tr>
<td>sys_errlist variable</td>
<td>perror(PR-S)</td>
</tr>
<tr>
<td>sys_nerr variable</td>
<td>perror(PR-S)</td>
</tr>
<tr>
<td>Tables</td>
<td>tbl(TP-CT)</td>
</tr>
<tr>
<td>Tags file</td>
<td>ctags(PR-CP)</td>
</tr>
</tbody>
</table>
tan function ........................................................... trig(PR-S)
tanh function ........................................................ sinh(PR-S)
Terminal connection, establishes outgoing .................. dial(UR-M)
Terminal connection, establishes outgoing .................. dial(PR-S)
Terminal interface, general ...................................... termio(UR-M)
Terminal names, conventional ................................... term(TP-CT)
Terminal options, set .............................................. stty(UR-C)
Terminal table file format ....................................... term(UR-F)
Terminal, capabilities .......................................... termcap(UR-M)
Terminal, capability functions ................................ termcap(PR-S)
Terminal, disable login .......................................... disable(UR-C)
Terminal, enabling logins ....................................... enable(UR-C)
Terminal, enabling messages .................................... mesg(UR-C)
Terminal, filenames ............................................. ctermid(PR-S)
Terminal, interface .............................................. tty(UR-M)
Terminal, login file ............................................. ttys(UR-M)
Terminal, login modes .......................................... getty(UR-M)
Terminal, Speeds and settings ................................ gettydefs(UR-F)
Terminal, name list .............................................. terminals(UR-M)
Terminal, name .................................................... tty(UR-C)
Terminal, setting modes ........................................ tsset(UR-C)
Terminal, writing to all ........................................ wall(UR-C)
Testing conditions ............................................... test(UR-C)
Text editor, Ed, restricted version ......................... red(UR-C)
Text editor, line ................................................ ed(UR-C)
Text editor, line ................................................. ex(UR-C)
Text editor, screen ............................................. vi(UR-C)
Text editor, stream ............................................. sed(UR-C)
Text formatter for line printer ................................ nroff(TP-CT)
Text formatter for typesetter .................................. troff(TP-CT)
tgetflag function ................................................ termcap(PR-S)
tgetnum function ................................................ termcap(PR-S)
tgetstr function ................................................ termcap(PR-S)
tgoto function .................................................... termcap(PR-S)
Time and date .................................................... time(PR-S)
Time of day ...................................................... asktime(UR-C)
Time zone shell variable ...................................... tz(UR-M)
toascii function ................................................ conv(PR-S)
tolower function ............................................... conv(PR-S)
top .next file ................................................... top(UR-M)
toupper function ............................................... conv(PR-S)
tputs function .................................................. termcap(PR-S)
tzset function .................................................. etime(PR-S)
unpack command .................................................. pack(UR-C)
User, adding to the system ................................... mkuser(UR-C)
User, listing action ........................................... whodo(UR-C)
User, listing .................................................... who(UR-C)
User, removing from the system ............................. rmuser(UR-C)
User, switching ................................................ sr(UR-C)
User, writing to a user's terminal .................. write (UR=C)
Users, information .................................... finger (UR=C)
utmp file entry access ................................ getut (PR=S)
utmp file slot, finds .................................. ttyslot (PR=S)
Uucp, administer control files .................. uuinstall (UR=C)
Uucp, clean spool directory ................. uuclean (UR=C)
Uucp, monitor network ........................... uusub (UR=C)
Uucp, status inquiry ............................... uustat (UR=C)
Working directory .................................. chdir (PR=S)
Working directory, pathname .................. getcwd (PR=S)
wtmp file ............................................ utmp (UR=M)
XENIX boot program ............................ boot (UR=M)
XENIX to DOS cross linker ...................... dosid (PR=CP)
y0 function ......................................... bessel (PR=S)
y1 function ......................................... bessel (PR=S)
y_n function ....................................... bessel (PR=S)
COMMAND PAGE INDEX

This section lists all XENIX commands, showing on what page, section, and guide they are to be found.
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.out</td>
<td>a.out (UR-F)</td>
</tr>
<tr>
<td>a64l</td>
<td>a64l (PR-S)</td>
</tr>
<tr>
<td>abort</td>
<td>abort (PR-S)</td>
</tr>
<tr>
<td>abs</td>
<td>abs (PR-S)</td>
</tr>
<tr>
<td>access</td>
<td>access (PR-S)</td>
</tr>
<tr>
<td>acct</td>
<td>acct (UR-F)</td>
</tr>
<tr>
<td>acct</td>
<td>acct (PR-S)</td>
</tr>
<tr>
<td>accept</td>
<td>accept (UR-C)</td>
</tr>
<tr>
<td>acctcom</td>
<td>acctcom (UR-C)</td>
</tr>
<tr>
<td>accton</td>
<td>accton (UR-C)</td>
</tr>
<tr>
<td>acos</td>
<td>trig (PR-S)</td>
</tr>
<tr>
<td>adb</td>
<td>adb (PR-CP)</td>
</tr>
<tr>
<td>admin</td>
<td>admin (PR-CP)</td>
</tr>
<tr>
<td>alarm</td>
<td>alarm (PR-S)</td>
</tr>
<tr>
<td>aliases</td>
<td>aliases (UR-M)</td>
</tr>
<tr>
<td>aliases.hash</td>
<td>aliases (UR-M)</td>
</tr>
<tr>
<td>aliasash</td>
<td>aliasash (UR-M)</td>
</tr>
<tr>
<td>ar</td>
<td>ar (PR-CP)</td>
</tr>
<tr>
<td>ar</td>
<td>ar (UR-F)</td>
</tr>
<tr>
<td>asx</td>
<td>asx (PR-CP)</td>
</tr>
<tr>
<td>ascii</td>
<td>ascii (UR-M)</td>
</tr>
<tr>
<td>asctime</td>
<td>ctime (PR-S)</td>
</tr>
<tr>
<td>asin</td>
<td>trig (PR-S)</td>
</tr>
<tr>
<td>asktime</td>
<td>asktime (UR-C)</td>
</tr>
<tr>
<td>assert</td>
<td>assert (PR-S)</td>
</tr>
<tr>
<td>assign</td>
<td>assign (UR-C)</td>
</tr>
<tr>
<td>at</td>
<td>at (UR-C)</td>
</tr>
<tr>
<td>atan</td>
<td>trig (PR-S)</td>
</tr>
<tr>
<td>atan2</td>
<td>trig (PR-S)</td>
</tr>
<tr>
<td>atof</td>
<td>striod (PR-S)</td>
</tr>
<tr>
<td>atof</td>
<td>atof (PR-S)</td>
</tr>
<tr>
<td>atof</td>
<td>atof (PR-S)</td>
</tr>
<tr>
<td>atof</td>
<td>striol (PR-S)</td>
</tr>
<tr>
<td>atol</td>
<td>atof (PR-S)</td>
</tr>
<tr>
<td>atol</td>
<td>striol (PR-S)</td>
</tr>
<tr>
<td>autoboot</td>
<td>autoboot (UR-M)</td>
</tr>
<tr>
<td>awk</td>
<td>awk (UR-C)</td>
</tr>
<tr>
<td>backup</td>
<td>backup (UR-C)</td>
</tr>
<tr>
<td>backup</td>
<td>backup (UR-F)</td>
</tr>
<tr>
<td>badblkutil</td>
<td>badblkutil (UR-M)</td>
</tr>
<tr>
<td>badtrk</td>
<td>badtrk (UR-M)</td>
</tr>
<tr>
<td>banner</td>
<td>banner (UR-C)</td>
</tr>
<tr>
<td>basename</td>
<td>basename (UR-C)</td>
</tr>
<tr>
<td>batch</td>
<td>at (UR-C)</td>
</tr>
<tr>
<td>bc</td>
<td>bc (UR-C)</td>
</tr>
<tr>
<td>bdiff</td>
<td>bdiff (UR-C)</td>
</tr>
<tr>
<td>bessel</td>
<td>bessel (PR-S)</td>
</tr>
<tr>
<td>bfs</td>
<td>bfs (UR-C)</td>
</tr>
<tr>
<td>boot</td>
<td>boot (UR-M)</td>
</tr>
<tr>
<td>brk</td>
<td>sbreak (PR-S)</td>
</tr>
<tr>
<td>bsearch</td>
<td>bsearch (PR-S)</td>
</tr>
<tr>
<td>cabs</td>
<td>hypot (PR-S)</td>
</tr>
<tr>
<td>cal</td>
<td>cal (UR-C)</td>
</tr>
<tr>
<td>calloc</td>
<td>malloc (PR-S)</td>
</tr>
<tr>
<td>cancel</td>
<td>ip (UR-C)</td>
</tr>
<tr>
<td>cat</td>
<td>cat (UR-C)</td>
</tr>
<tr>
<td>cb</td>
<td>cb (PR-C)</td>
</tr>
<tr>
<td>cc</td>
<td>cc (PR-C)</td>
</tr>
<tr>
<td>cd</td>
<td>cd (UR-C)</td>
</tr>
<tr>
<td>cdc</td>
<td>cdc (PR-C)</td>
</tr>
<tr>
<td>ceil</td>
<td>floor (PR-S)</td>
</tr>
<tr>
<td>cflow</td>
<td>cflow (PR-C)</td>
</tr>
<tr>
<td>chdir</td>
<td>chdir (PR-S)</td>
</tr>
<tr>
<td>checkcw</td>
<td>cw (TP-CT)</td>
</tr>
<tr>
<td>checkmm</td>
<td>checkmm (TP-CT)</td>
</tr>
<tr>
<td>checkeq</td>
<td>eqn (TP-CT)</td>
</tr>
<tr>
<td>checklist</td>
<td>checklist (UR-F)</td>
</tr>
<tr>
<td>chgrp</td>
<td>chgrp (UR-C)</td>
</tr>
<tr>
<td>chmod</td>
<td>chmod (UR-C)</td>
</tr>
<tr>
<td>chmod</td>
<td>chmod (PR-S)</td>
</tr>
<tr>
<td>chown</td>
<td>chown (UR-C)</td>
</tr>
<tr>
<td>chown</td>
<td>chown (PR-S)</td>
</tr>
<tr>
<td>chroot</td>
<td>chroot (UR-C)</td>
</tr>
<tr>
<td>chroot</td>
<td>chroot (PR-S)</td>
</tr>
<tr>
<td>chsize</td>
<td>chsize (PR-S)</td>
</tr>
<tr>
<td>clearerr</td>
<td>feror (PR-S)</td>
</tr>
<tr>
<td>clock</td>
<td>clock (UR-M)</td>
</tr>
<tr>
<td>clock</td>
<td>clock (PR-S)</td>
</tr>
<tr>
<td>clockrate</td>
<td>clockrate (UR-C)</td>
</tr>
<tr>
<td>close</td>
<td>close (PR-S)</td>
</tr>
<tr>
<td>closedir</td>
<td>directory (PR-S)</td>
</tr>
<tr>
<td>cli</td>
<td>cli (UR-C)</td>
</tr>
<tr>
<td>cmchk</td>
<td>cmchk (UR-C)</td>
</tr>
<tr>
<td>cmp</td>
<td>cmp (UR-C)</td>
</tr>
<tr>
<td>cmos</td>
<td>cmos (UR-M)</td>
</tr>
<tr>
<td>col</td>
<td>col(PR-CT)</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>comb</td>
<td>comb(PR-CP)</td>
</tr>
<tr>
<td>comm</td>
<td>comm(UR-C)</td>
</tr>
<tr>
<td>config</td>
<td>config(PR-CP)</td>
</tr>
<tr>
<td>console</td>
<td>console(UR-M)</td>
</tr>
<tr>
<td>conv</td>
<td>conv(PR-S)</td>
</tr>
<tr>
<td>copy</td>
<td>copy(UR-C)</td>
</tr>
<tr>
<td>core</td>
<td>core(UR-F)</td>
</tr>
<tr>
<td>cos</td>
<td>trig(PR-S)</td>
</tr>
<tr>
<td>cosh</td>
<td>sinh(PR-S)</td>
</tr>
<tr>
<td>cp</td>
<td>cp(UR-C)</td>
</tr>
<tr>
<td>cpio</td>
<td>cpio(UR-C)</td>
</tr>
<tr>
<td>cpp</td>
<td>cpp(PR-CP)</td>
</tr>
<tr>
<td>creat</td>
<td>creat(PR-S)</td>
</tr>
<tr>
<td>creatsem</td>
<td>creatsem(PR-S)</td>
</tr>
<tr>
<td>cref</td>
<td>cref(PR-CP)</td>
</tr>
<tr>
<td>cron</td>
<td>cron(UR-C)</td>
</tr>
<tr>
<td>csh</td>
<td>csh(UR-C)</td>
</tr>
<tr>
<td>csplit</td>
<td>csplit(UR-C)</td>
</tr>
<tr>
<td>ctags</td>
<td>ctags(PR-CP)</td>
</tr>
<tr>
<td>ctermid</td>
<td>ctermid(PR-S)</td>
</tr>
<tr>
<td>ctime</td>
<td>ctime(PR-S)</td>
</tr>
<tr>
<td>ctype</td>
<td>ctype(PR-S)</td>
</tr>
<tr>
<td>cu</td>
<td>cu(UR-C)</td>
</tr>
<tr>
<td>curses</td>
<td>curses(PR-S)</td>
</tr>
<tr>
<td>cuserid</td>
<td>cuserid(PR-S)</td>
</tr>
<tr>
<td>custom</td>
<td>custom(UR-C)</td>
</tr>
<tr>
<td>cut</td>
<td>cut(TP-CT)</td>
</tr>
<tr>
<td>cw</td>
<td>cw(TP-CT)</td>
</tr>
<tr>
<td>cwcheck</td>
<td>cwcheck(PR-CP)</td>
</tr>
<tr>
<td>cxfm</td>
<td>cxfm(PR-S)</td>
</tr>
<tr>
<td>daemon.mn</td>
<td>daemon.mn(UR-M)</td>
</tr>
<tr>
<td>date</td>
<td>date(UR-C)</td>
</tr>
<tr>
<td>dbminit</td>
<td>dbm(PR-S)</td>
</tr>
<tr>
<td>dc</td>
<td>dc(UR-C)</td>
</tr>
<tr>
<td>dd</td>
<td>dd(UR-C)</td>
</tr>
<tr>
<td>deassign</td>
<td>deassign(UR-C)</td>
</tr>
<tr>
<td>default</td>
<td>default(UR-M)</td>
</tr>
<tr>
<td>defopen</td>
<td>defopen(PR-S)</td>
</tr>
<tr>
<td>defread</td>
<td>defread(PR-S)</td>
</tr>
<tr>
<td>delete</td>
<td>dbm(PR-S)</td>
</tr>
<tr>
<td>delta</td>
<td>delta(PR-CP)</td>
</tr>
<tr>
<td>deroff</td>
<td>deroff(TP-CT)</td>
</tr>
<tr>
<td>devnm</td>
<td>devnm(UR-C)</td>
</tr>
<tr>
<td>df</td>
<td>df(UR-C)</td>
</tr>
<tr>
<td>dial</td>
<td>dial(UR-M)</td>
</tr>
<tr>
<td>dial</td>
<td>dial(PR-S)</td>
</tr>
<tr>
<td>diction</td>
<td>diction(TP-CT)</td>
</tr>
<tr>
<td>diff</td>
<td>diff(UR-C)</td>
</tr>
<tr>
<td>diff3</td>
<td>diff3(UR-C)</td>
</tr>
<tr>
<td>diffmk</td>
<td>diffmk(PR-CP)</td>
</tr>
<tr>
<td>dir</td>
<td>dir(UR-F)</td>
</tr>
<tr>
<td>dircmp</td>
<td>dircmp(UR-C)</td>
</tr>
<tr>
<td>directory</td>
<td>directory(PR-S)</td>
</tr>
<tr>
<td>dirname</td>
<td>dirname(UR-C)</td>
</tr>
<tr>
<td>disallow</td>
<td>disallow(UR-C)</td>
</tr>
<tr>
<td>diskcmp</td>
<td>diskcmp(UR-C)</td>
</tr>
<tr>
<td>diskcp</td>
<td>diskcp(UR-C)</td>
</tr>
<tr>
<td>divvy</td>
<td>divvy(UR-C)</td>
</tr>
<tr>
<td>dmesg</td>
<td>dmesg(UR-C)</td>
</tr>
<tr>
<td>dos</td>
<td>dos(UR-C)</td>
</tr>
<tr>
<td>doscat</td>
<td>doscat(UR-C)</td>
</tr>
<tr>
<td>doscp</td>
<td>doscp(UR-C)</td>
</tr>
<tr>
<td>dosdir</td>
<td>dosdir(UR-C)</td>
</tr>
<tr>
<td>dosfs</td>
<td>dosfs(UR-C)</td>
</tr>
<tr>
<td>dosls</td>
<td>dosls(UR-C)</td>
</tr>
<tr>
<td>dosmkdir</td>
<td>dosmkdir(UR-C)</td>
</tr>
<tr>
<td>dosrm</td>
<td>dosrm(UR-C)</td>
</tr>
<tr>
<td>dosrmdir</td>
<td>dosrmdir(UR-C)</td>
</tr>
<tr>
<td>drand48</td>
<td>drand48(PR-S)</td>
</tr>
<tr>
<td>dtye</td>
<td>dtye(UR-C)</td>
</tr>
<tr>
<td>du</td>
<td>du(UR-C)</td>
</tr>
<tr>
<td>dump</td>
<td>dump(UR-C)</td>
</tr>
<tr>
<td>dump</td>
<td>dump(UR-F)</td>
</tr>
<tr>
<td>dumpdir</td>
<td>dumpdir(UR-C)</td>
</tr>
<tr>
<td>dup</td>
<td>dup(PR-S)</td>
</tr>
<tr>
<td>dup2</td>
<td>dup2(PR-S)</td>
</tr>
<tr>
<td>8087</td>
<td>8087(UR-M)</td>
</tr>
<tr>
<td>86rel</td>
<td>86rel(UR-F)</td>
</tr>
<tr>
<td>echo</td>
<td>echo(UR-C)</td>
</tr>
<tr>
<td>ecvt</td>
<td>ecvt(PR-S)</td>
</tr>
<tr>
<td>ed</td>
<td>ed(UR-C)</td>
</tr>
<tr>
<td>edata</td>
<td>edata(PR-S)</td>
</tr>
<tr>
<td>egep</td>
<td>egep(UR-C)</td>
</tr>
<tr>
<td>enable</td>
<td>enable(UR-C)</td>
</tr>
<tr>
<td>end</td>
<td>end(PR-S)</td>
</tr>
<tr>
<td>endgrent</td>
<td>endgrent(PR-S)</td>
</tr>
<tr>
<td>endpwent</td>
<td>endpwent(PR-S)</td>
</tr>
<tr>
<td>enduntent</td>
<td>enduntent(PR-S)</td>
</tr>
<tr>
<td>env</td>
<td>env(UR-C)</td>
</tr>
<tr>
<td>environ</td>
<td>environ(UR-M)</td>
</tr>
<tr>
<td>eqn</td>
<td>eqn(TP-CT)</td>
</tr>
<tr>
<td>eqnchar</td>
<td>eqnchar(TP-CT)</td>
</tr>
<tr>
<td>eqncheck</td>
<td>eqncheck(TP-CT)</td>
</tr>
<tr>
<td>erand48</td>
<td>erand48(PR-S)</td>
</tr>
<tr>
<td>erf</td>
<td>erf(PR-S)</td>
</tr>
<tr>
<td>errno</td>
<td>errno(PR-S)</td>
</tr>
<tr>
<td>etext</td>
<td>etext(PR-S)</td>
</tr>
<tr>
<td>ex</td>
<td>ex(UR-C)</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>memcp</td>
<td>Memory copy</td>
</tr>
<tr>
<td>memset</td>
<td>Memory set</td>
</tr>
<tr>
<td>memory</td>
<td>Memory</td>
</tr>
<tr>
<td>msg</td>
<td>Message</td>
</tr>
<tr>
<td>messages</td>
<td>Messages</td>
</tr>
<tr>
<td>micinet</td>
<td>Micenet</td>
</tr>
<tr>
<td>mkdir</td>
<td>Directory mkdir</td>
</tr>
<tr>
<td>mkfs</td>
<td>Directory mkfs</td>
</tr>
<tr>
<td>mknod</td>
<td>Directory mknod</td>
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<td>Directory mnttab</td>
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<tr>
<td>modf</td>
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<tr>
<td>monitor</td>
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<td>multiscreen</td>
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<td>nap</td>
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<td>nbwaitsem</td>
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<td>ncheck</td>
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<td>Directory newform</td>
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<td>newgrp</td>
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<td>news</td>
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<td>nice</td>
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<tr>
<td>nlist</td>
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<tr>
<td>nm</td>
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</tr>
<tr>
<td>nohup</td>
<td>Directory nohup</td>
</tr>
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<td>nrand48</td>
<td>Directory nrand48</td>
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<td>Directory nroff</td>
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<td>od</td>
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<td>Directory paste</td>
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<td>Directory pause</td>
</tr>
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<td>pcat</td>
<td>Directory pcat</td>
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<td>pclose</td>
<td>Directory pclose</td>
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<td>perror</td>
<td>Directory perror</td>
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<td>pg</td>
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<td>pipe</td>
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<td>popen</td>
<td>Directory popen</td>
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<tr>
<td>pstat</td>
<td>Directory pstat</td>
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<td>Directory ptrace</td>
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<td>ptx</td>
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<tr>
<td>putc</td>
<td>Directory putc</td>
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<tr>
<td>putchar</td>
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<td>Directory putc</td>
</tr>
<tr>
<td>putenv</td>
<td>Directory putenv</td>
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<tr>
<td>putpwent</td>
<td>Directory putpwent</td>
</tr>
<tr>
<td>puts</td>
<td>Directory puts</td>
</tr>
<tr>
<td>putline</td>
<td>Directory putline</td>
</tr>
<tr>
<td>putw</td>
<td>Directory putw</td>
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<tr>
<td>pвяз admin</td>
<td>Directory pвяз admin</td>
</tr>
<tr>
<td>pwcheck</td>
<td>Directory pwcheck</td>
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<tr>
<td>pзd</td>
<td>Directory pзd</td>
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<td>qsort</td>
<td>Directory qsort</td>
</tr>
<tr>
<td>quot</td>
<td>Directory quot</td>
</tr>
<tr>
<td>rand</td>
<td>Directory rand</td>
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<tr>
<td>random</td>
<td>Directory random</td>
</tr>
<tr>
<td>ranlib</td>
<td>Directory ranlib</td>
</tr>
<tr>
<td>ratfor</td>
<td>Directory ratfor</td>
</tr>
<tr>
<td>rcp</td>
<td>Directory rcp</td>
</tr>
<tr>
<td>rдchк</td>
<td>Directory rдchк</td>
</tr>
<tr>
<td>read</td>
<td>Directory read</td>
</tr>
<tr>
<td>readdir</td>
<td>Directory readdir</td>
</tr>
<tr>
<td>realloc</td>
<td>Directory realloc</td>
</tr>
<tr>
<td>red</td>
<td>Directory red</td>
</tr>
<tr>
<td>regcmp</td>
<td>Directory regcmp</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------</td>
</tr>
<tr>
<td>regcmp</td>
<td>regex (PR-S)</td>
</tr>
<tr>
<td>regex</td>
<td>regex (PR-S)</td>
</tr>
<tr>
<td>regexp</td>
<td>regexp (PR-S)</td>
</tr>
<tr>
<td>reject</td>
<td>accept (UR-C)</td>
</tr>
<tr>
<td>remote</td>
<td>remote (UR-C)</td>
</tr>
<tr>
<td>restor</td>
<td>restore (UR-C)</td>
</tr>
<tr>
<td>restore</td>
<td>restore (UR-C)</td>
</tr>
<tr>
<td>rewind</td>
<td>fseek (PR-S)</td>
</tr>
<tr>
<td>rewinddir</td>
<td>directory (PR-S)</td>
</tr>
<tr>
<td>rm</td>
<td>rm (UR-C)</td>
</tr>
<tr>
<td>rmdel</td>
<td>rmdel (PR-C)</td>
</tr>
<tr>
<td>rmnuser</td>
<td>rmuser (UR-C)</td>
</tr>
<tr>
<td>rsh</td>
<td>rsh (UR-C)</td>
</tr>
<tr>
<td>runbig</td>
<td>runbig (UR-C)</td>
</tr>
<tr>
<td>sact</td>
<td>sact (PR-C)</td>
</tr>
<tr>
<td>scl</td>
<td>scl (PR-C)</td>
</tr>
<tr>
<td>sbrk</td>
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<tr>
<td>scanf</td>
<td>scanf (PR-S)</td>
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<tr>
<td>seccdif</td>
<td>seccdiff (PR-C)</td>
</tr>
<tr>
<td>seccfile</td>
<td>seccfile (UR-F)</td>
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<tr>
<td>sdate</td>
<td>sdate (UR-C)</td>
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<td>sdent</td>
<td>sdent (PR-S)</td>
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<tr>
<td>sdleave</td>
<td>sdent (PR-S)</td>
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<tr>
<td>sdwaitv</td>
<td>sdgetv (PR-S)</td>
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<tr>
<td>sed</td>
<td>sed (UR-C)</td>
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<tr>
<td>seed48</td>
<td>drand48 (PR-S)</td>
</tr>
<tr>
<td>seekdir</td>
<td>directory (PR-S)</td>
</tr>
<tr>
<td>semctl</td>
<td>semct1 (PR-S)</td>
</tr>
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<td>semget</td>
<td>semget (PR-S)</td>
</tr>
<tr>
<td>semop</td>
<td>semop (PR-S)</td>
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<tr>
<td>serial</td>
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<tr>
<td>setbuf</td>
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<tr>
<td>setclock</td>
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<td>setcolor</td>
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<tr>
<td>setgid</td>
<td>setuid (PR-S)</td>
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<td>setgrent</td>
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<td>setkey (UR-M)</td>
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<td>setpgrp (PR-S)</td>
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<td>setuid (PR-S)</td>
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<tr>
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<td>sh (UR-C)</td>
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<td>shmget</td>
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<td>shmop</td>
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<td>shutdown</td>
<td>shutdown (UR-C)</td>
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<td>signal</td>
<td>signal (PR-S)</td>
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<td>trig (PR-S)</td>
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<td>sort</td>
<td>sort (UR-C)</td>
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<td>spell</td>
<td>spell (TP-CT)</td>
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<td>spline (PR-C)</td>
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<td>split</td>
<td>split (UR-C)</td>
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<td>sprintf</td>
<td>printf (PR-S)</td>
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<td>sputl</td>
<td>sputl (PR-S)</td>
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<td>sqrt</td>
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<td>srand</td>
<td>srand (PR-S)</td>
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<td>srand48 (PR-S)</td>
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<td>sscanf</td>
<td>scanf (PR-S)</td>
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<td>ssignal</td>
<td>ssignal (PR-S)</td>
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<td>stackuse</td>
<td>stackuse (PR-C)</td>
</tr>
<tr>
<td>stat</td>
<td>stat (UR-F)</td>
</tr>
<tr>
<td>stat</td>
<td>stat (PR-S)</td>
</tr>
<tr>
<td>stdio</td>
<td>stdio (PR-S)</td>
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<td>stdipc</td>
<td>stdipc (PR-S)</td>
</tr>
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<td>stime</td>
<td>stime (PR-S)</td>
</tr>
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<td>store</td>
<td>dbm (PR-S)</td>
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<td>string</td>
<td>string (PR-S)</td>
</tr>
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<td>strings</td>
<td>strings (PR-C)</td>
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<tr>
<td>strip</td>
<td>strip (PR-C)</td>
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<td>strien (PR-S)</td>
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<td>strncat</td>
<td>strncat (PR-S)</td>
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<td>strncmp (PR-S)</td>
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<td>strncpy (PR-S)</td>
</tr>
<tr>
<td>strpbrk</td>
<td>string (PR-S)</td>
</tr>
<tr>
<td>strcchr</td>
<td>string (PR-S)</td>
</tr>
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<td>strspn</td>
<td>string (PR-S)</td>
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<td>strtod</td>
<td>strtod (PR-S)</td>
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<td>strtol</td>
<td>strtol (PR-S)</td>
</tr>
<tr>
<td>strtok</td>
<td>string (PR-S)</td>
</tr>
</tbody>
</table>
stty ........................ stty(UR-C)
style ........................ style(TP-CT)
su .......................... su(UR-C)
sulogin ........................ accton(UR-C)
sum .......................... sum(UR-C)
swab ........................ swab(PR-S)
sync .......................... sync(UR-C)
sync .......................... sync(PR-S)
sys_errlist ........................ perror(PR-S)
sys_errlist ....................... perror(UR-C)
sysadmin ........................ sysadmin(UR-C)
system .......................... system(PR-S)
systemid ........................ systemid(UR-M)
tail .......................... tail(UR-C)
tan .......................... tan(PR-S)
tanh .......................... sinh(PR-S)
tar .......................... tar(UR-C)
tar .......................... tar(UR-F)
tbl .......................... tbl(TP-CT)
tdelete .......................... tsearch(PR-S)
tee .......................... tee(UR-C)
telldir ........................ directory(PR-S)
term .......................... term(UR-F)
term .......................... term(TP-CT)
termcap ........................ termcap(UR-M)
termcap ........................ termcap(PR-S)
terminals ........................ terminals(UR-M)
termios ........................ termios(UR-M)
test .......................... test(UR-C)
tfind .......................... tsearch(PR-S)
tgetent ........................ termcap(PR-S)
tgetflag ........................ termcap(PR-S)
tgetnum ........................ termcap(PR-S)
tgetstr ........................ termcap(PR-S)
tgoto .......................... termcap(PR-S)
time .......................... time(PR-C)
time .......................... time(PR-S)
times .......................... times(PR-S)
tmpfile ........................ tmpfile(PR-S)
tmpnam ........................ tmpnam(PR-S)
toaclli ........................ conv(PR-S)
ttolower ........................ conv(PR-S)
top .......................... top(UR-M)
top.next ........................ top(UR-M)
touch .......................... touch(UR-C)
toupper ........................ conv(PR-S)
tputs .......................... termcap(PR-S)
tr .......................... tr(UR-C)
trig .......................... trig(PR-S)
troff .......................... troff(TP-CT)
true .......................... true(UR-C)
tsearch ........................ tsearch(PR-S)
tset .......................... tset(UR-C)
tsort .......................... tsort(PR-C)
tty .......................... tty(UR-C)
tty .......................... tty(UR-M)
ttyname ........................ ttyname(PR-S)
ttys .......................... ttys(PR-M)
ttyslot ........................ ttyslot(PR-S)
twalk .......................... tsearch(PR-S)
types .......................... types(UR-F)
tz .......................... tz(UR-M)
tzset .......................... ctime(PR-S)
ulimit .......................... ulimit(PR-S)
umask .......................... umask(UR-C)
ungetc .......................... ungetc(PR-S)
uniq .......................... uniq(UR-C)
units .......................... units(UR-C)
unlink .......................... unlink(PR-S)
unpack .......................... pack(UR-C)
ustat .......................... ustat(PR-S)
 utime .......................... utime(PR-S)
utmp .......................... utmp(UR-M)
utmpname ......................... getut(UR-C)
uuclean ........................ uuclean(UR-C)
uucp .......................... uucp(UR-C)
uuninstall ........................ uuninstall(UR-C)
 uulog .......................... uucp(UR-C)
 uuname ........................ uucp(UR-C)
 uustat ........................ uustat(UR-C)
 uusub .......................... uusub(UR-C)
uuto .......................... uuto(UR-C)
uupick ........................ uuto(UR-C)
uux .......................... uux(UR-C)
val .......................... val(UR-C)
val .......................... val(PR-C)
vic .......................... vic(UR-C)
view .......................... view(UR-C)
vprintf ........................ vprintf(PR-S)
 vfprintf ........................ vfprintf(PR-S)
 vsprintf ........................ vprintf(PR-S)
vsh .......................... vsh(UR-C)
wait .......................... wait(UR-C)
wait .......................... wait(PR-S)
waitsem .......... waitsem(PR-S)
wall .................. wall(UR-C)
wc ................... wc(UR-C)
what  .. what(UR-C)
who .................. who(UR-C)
whodo ........ whodo(UR-C)
write ........ write(UR-C)
write ................ write(PR-S)
wtmp ................ wttmp(UR-M)
xargs ............... xargs(UR-C)
xlist ................ xlist(PR-S)
xref .................. xref(PR-CP)
xstr .................. xstr(PR-CP)
y0 .................... bessel(PR-S)
y1 .................... bessel(PR-S)
yacc .................. yacc(PR-CP)
yes .................. yes(UR-C)
yn .................. bessel(PR-S)
XENIX® System V

Operating System

Installation Guide
Contents

1  Introduction
   1.1  Overview  1-1
   1.2  Using This Guide  1-1

2  Installation Procedure
   2.1  Overview  2-1
   2.2  XENIX System Distribution  2-1
   2.3  How To Use This Guide  2-1
   2.4  Before You Start  2-3
   2.5  Installation Procedure  2-4
   2.6  Creating the Super–User Password  2-20
   2.7  Creating the First User Account  2-22
   2.8  The Next Step  2-24
   2.9  Troubleshooting  2-25

3  Using DOS and XENIX On the Same Disk
   3.1  Introduction  3-1
   3.2  Partitioning the Hard Disk Using fdisk  3-1
   3.3  Installing XENIX on a DOS System  3-2
   3.4  Using XENIX and DOS With Two Hard Disks  3-3
   3.5  Removing An Operating System From the Hard Disk  3-4
   3.6  DOS Accessing Utilities  3-4
Chapter 1

Introduction

1.1 Overview 1-1
1.2 Using This Guide 1-1
1.1 Overview

This is a guide to installing XENIX on your personal computer. Setting up user accounts and peripheral devices is also discussed.

Topics covered in this guide include:

- How the system is distributed in three packages and what each contains.
- Responding to system prompts in the installation procedure.
- What you need to get started.
- Starting the system for the first time.
- Preparing the hard disk for XENIX.
- Starting the system from the hard disk.
- Setting up user accounts.
- Using a second operating system (DOS) with XENIX.

1.2 Using This Guide

This guide contains the following sections:

Chapter 1: Introduction
   This chapter gives an introduction and overview of topics covered in this guide.

Chapter 2: Installation Procedure
   A step by step guide to installing XENIX on your computer. Starting XENIX for the first time, initializing the hard disk, and setting up user accounts are among the topics discussed.

Chapter 3: Using DOS and XENIX on the Same Disk
   How to use both the XENIX and DOS systems. Includes a description of the fdisk(C) utility used to partition the hard disk for concurrent use of both systems.
Chapter 2

Installation Procedure

2.1 Overview 2-1
2.2 XENIX System Distribution 2-1
2.3 How To Use This Guide 2-1
2.4 Before You Start 2-3
2.5 Installation Procedure 2-4
  2.5.1 Overview 2-4
  2.5.2 What You Need 2-5
  2.5.3 Starting XENIX From The Boot Floppy Set 2-5
  2.5.4 Initializing The Hard Disk 2-7
  2.5.5 Starting XENIX On the Hard Disk 2-16
  2.5.6 Installing the XENIX Distribution 2-19
2.6 Creating the Super–User Password 2-20
  2.6.1 Sysinfo Account 2-21
2.7 Creating the First User Account 2-22
2.8 The Next Step 2-24
2.9 Troubleshooting 2-25
2.1 Overview

This guide explains how to install the XENIX system on a personal computer. The XENIX Operating System is a powerful system of programs that gives your computer the same multi-user, multi-tasking capabilities as many large and expensive computers.

When you install the system, you:

- Initialize the hard disk, then;
- Copy the XENIX utilities from the XENIX distribution media to the initialized hard disk.

2.2 XENIX System Distribution

The complete XENIX System consists of the following three distribution sets:

- The Operating System
- The Development System
- The Text Processing System

The Operating System contains the XENIX programs you need to create multiple user accounts, manage file systems, create and manage files and perform system maintenance tasks.

The Development System contains the XENIX programs you need to create, compile, and debug assembly and high-level language programs.

The Text Processing System contains the XENIX programs you need to create, edit, and typeset documents.

2.3 How To Use This Guide

Read through this guide thoroughly before beginning the installation procedure so that you become familiar with the various steps and terminology used in each section. If you run into difficulties during the installation, call the Support Center listed on the support information card included with the software.
Always follow these rules:

1. During the installation you use the keyboard to enter information. Always:
   - Begin each command after a prompt (often a $, % or # symbol). During the installation process, the prompt can be "<Installation>," under certain conditions.
   - Enter all requested names and numbers exactly as shown.
   - Complete a line by pressing the RETURN key.

   NOTE: The RETURN key is sometimes denoted on the keyboard by a "down-left" arrow, or referred to as the ENTER key.

2. If you make an entering error, you can erase the character:
   - By using the backspace key,

   OR

   - By pressing Ctrl-h.

   - To delete everything you have entered on a line, press Ctrl-u.

3. Some additional items to be aware of:
   - (y/n)? is asking "yes or no?", and always requires a response from you (type "y" or "n" and press the RETURN key).

   - The control symbol (^) refers to the Ctrl key, and is followed by another key which, used in combination with the Ctrl key, has a special meaning.

     Example: ^h means backspace

     Press the Ctrl key and the other key at the same time. This is the same action as using the Shift key.

   - The RETURN key on your keyboard may have a large single arrow pointing left (or the word ENTER) on it rather than the word "return." In this guide, however, it is written this way:

     RETURN
2.4 Before You Start

Before you begin the installation procedure, make sure your computer is fully assembled (and operational) and you are familiar with its operation. In particular you should know:

- How to turn the computer off and on.
- How to insert floppies into the floppy drive.
- How to reset the computer.
- The hard disk is locked or "parked" when the system is shutdown properly. Refer to shutdown(C) in the XENIX User's Reference to shutdown the system. When you see this message:

  **Normal System Shutdown**

  **Safe to Power Off**

  - or -

  **Press Any Key to Reboot**

the hard disk is locked. Lock the hard disk if you move your computer.

If you have just assembled your computer for the first time or are unsure about the items listed above, briefly review the hardware manuals provided with your computer and hard disk. The hard disk must be connected to your computer according to manufacturer's specifications. Also, we suggest you run a system self-test as described in the computer's Operator's Guide in order to detect possible hardware problems.

Other items to be aware of:

- Make sure the FILESYSTEM (N2) floppy is not write protected. (High density 96tpi distributions have a single BOOT/FILESYSTEM floppy.)
Copy the BOOT and FILESYSTEM floppies (BOOT/FILESYSTEM) as soon as you can, then put the originals in a safe place and use the copies. Any floppy can fail with frequent use, so it is a good idea to back-up all your volumes, but especially these first, crucial floppies.

Use the MS\textsuperscript{TM}–DOS floppy copy routine to make backups, before installing XENIX. If you cannot use the DOS routine, you can copy the floppies with the XENIX \texttt{diskcp(C)} command once you have installed the XENIX System. For more information on diskcp, see the XENIX User's Reference.

If you are upgrading from XENIX 3.0 to XENIX System V, be sure to follow the upgrade procedure as outlined in the XENIX Operating System Release Notes.

2.5 Installation Procedure

2.5.1 Overview

The installation procedure has six steps:

1. Start XENIX from the BOOT Floppy (volume N1).

2. Initialize the hard disk with the \texttt{hdinit(C)} program and, if desired, modify the hard disk partition table to share space with the DOS operating system.

3. Re-start the system from the newly initialized hard disk.

4. Copy the XENIX utilities.

5. Create the super-user password.

6. Create the first user account.

The following sections describe each step. After you complete the installation, be sure to store this guide and the distribution floppies in a safe place. You will need them again if you wish to reinstall the system for any reason.
2.5.2 What You Need

To install the XENIX System you need:

- A personal computer with at least 384K bytes of memory.
- One hard disk with at least 10 megabytes of storage.
- One double-sided floppy drive.
- The XENIX System distribution floppy disks.
- A Serial Number (an alphanumeric code printed on the Serialization Card).
- An activation key (an alphabetic code printed on the Serialization Card).

The XENIX System distribution set contains these floppies:

- The XENIX Operating System floppies. The Release Notes delivered with this guide contain a list of the number of floppies in each set and the software packages contained in the Operating System.

2.5.3 Starting XENIX From The Boot Floppy Set

You are ready to start the actual installation process. Find the distribution disks labeled "BOOT" (N1) and "FILESYSTEM" (N2).

---

Note

If your XENIX distribution is on high density, 96tpi floppies, there is only one BOOT/FILESYSTEM floppy.

---

Follow these steps:

1. Insert the BOOT floppy into the drive. If you have more than one floppy drive, use the primary drive. It is sometimes called the boot
drive. Check your computer hardware manual if you are not sure which drive is the primary drive.

2. Turn on your computer and the hard disk.

   The computer loads the XENIX bootstrap program from the floppy disk and begins to execute it. In the upper left corner of the screen, the computer may display the total amount of memory installed. Next, you see:

   XENIX System V

   Boot:

   Press RETURN to boot from the floppy drive. You see the default floppy boot, which looks something like this:

   \texttt{fd(4,0)xenix}

   Then the system performs a self-check to determine if there are any problems with the hardware. The letters A–H appear in succession.

   After XENIX is loaded in memory, the system displays information about how memory is allocated. You also see the number of multiscreens\textsuperscript{TM} available on your system (see \texttt{multiscreen}(M) for more information on multiscreens). The number of multiscreens depends upon the amount of memory your computer has.

3. You see the prompt:

   \texttt{Insert filesystem floppy and press <RETURN>}

   Remove the BOOT floppy (N1) and insert the FILESYSTEM floppy (N2). If you have only one BOOT/FILESYSTEM floppy, leave it in the drive. Press:

   \texttt{RETURN}

4. The remaining letters of the alphabet are displayed. After Z, the message appears:

   No single-user login present
   Entering System Maintenance Mode

   If the letters stop displaying before the letter "Z" is reached, run hardware diagnostics as explained in your computer manual, correct any identified problems and start the installation procedure
again from the beginning. If the letters stop again, call the Support Center listed on the support information card and be prepared to tell them at what letter the display ended.

The self-check using letters A–Z occurs every time you bring up your XENIX system. However, after this initial installation, the self-check does not display messages referring to the FILESYSTEM floppy (N2). Once the system begins to run, the following message is displayed:

XENIX System V Hard Disk Initialization

When you see this message, you are ready to proceed with the second installation step, Initializing The Hard Disk.

2.5.4 Initializing The Hard Disk

As part of the initialization process, you may partition the hard disk, using the fdisk(C) utility, to support both DOS and XENIX on the same hard disk, or you can allow XENIX to use the whole disk.

The following steps describe how to initialize the hard disk.

1. You see the message:

During installation you may choose to overwrite all or part of the present contents of your disk.  
Do you wish to continue? (y/n)
Note

If you have any files on the hard disk that you wish to save before installing XENIX follow this procedure. Enter:

n

and press RETURN.

The following message appears:

Aborting initialization procedure

At this point, the system shuts down automatically, as the following message is displayed on the screen:

** Normal System Shutdown **

** Safe to Power Off **
- or -
** Press Any Key to Reboot **

Remove the floppy, and reboot your existing operating system (DOS). After you have backed up the files you want to save, restart the XENIX installation procedure from the beginning.

Back up files that reside on partitions that you are going to overwrite. Creating a new partition on an unused portion of the hard disk will not overwrite files on another partition. It is not necessary to back up files that reside on an existing partition you are not changing.

2. If you do not have any files you want to save, enter

y

and press RETURN.

The hddinit program invokes fdisk(C), which partitions the hard disk.
Installation Procedure

Note

If you wish to partition the disk so that you can use another operating system in addition to XENIX, do not follow the fdisk steps shown here. Instead, see Chapter 3 of this Installation Guide and the fdisk(C) manual page in the XENIX User's Reference.

Install DOS on the hard disk before installing XENIX. Installing DOS after XENIX, in some circumstances, changes the fdisk table and makes the XENIX partition unbootable. If this happens, you must recreate the fdisk table. Note that DOS fdisk reports disk size in cylinders, XENIX fdisk reports disk size in tracks.

After you set up the desired partitions with fdisk, return to the next part of this installation procedure.

If you are only using XENIX on your hard disk, continue with the following steps.

3. After a moment, an fdisk menu appears on the screen. You see this option list:

   Select one of the following options or 'q' to exit the program

   1. Display Partition Table
   2. Use Entire Disk for XENIX
   3. Create XENIX Partition
   4. Activate XENIX Partition
   5. Delete XENIX Partition

   Please enter your choice:

   Enter option "2" and press RETURN.

   If you have never installed an operating system on your disk, you see a table similar to this:
Current Hard Disk Drive: /dev/rhd00

<table>
<thead>
<tr>
<th>Partition</th>
<th>Status</th>
<th>Type</th>
<th>Start</th>
<th>End</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Active</td>
<td>XENIX</td>
<td>1</td>
<td>1219</td>
<td>1219</td>
</tr>
</tbody>
</table>

Total disk size: 1220 tracks
Press <RETURN> to continue

Note
If you have previously installed an operating system on your disk, you see a table that might look something like this:

Current Hard Disk Drive: /dev/rhd00

<table>
<thead>
<tr>
<th>Partition</th>
<th>Status</th>
<th>Type</th>
<th>Start</th>
<th>End</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Active</td>
<td>UNKNOWN</td>
<td>1</td>
<td>1219</td>
<td>1219</td>
</tr>
</tbody>
</table>

Total disk size: 1220 tracks

Warning! All data on your disk will be lost!
Do you wish to continue? (y/n)

If you would like XENIX to occupy the whole disk, enter ‘y’ and press RETURN.

Even if you have already installed XENIX, and are just reinstalling the system, you should enter ‘y’ and press RETURN at this point if you want XENIX to occupy the whole disk. This insures that fdisk partitions the whole disk for XENIX.

Note that the track numbers and size of your disk may vary from this example.
Press RETURN, and you see the main fdisk menu. You have now set up the partition(s) to use XENIX on your hard disk. To continue with the next step in the installation procedure, enter:

q

and press RETURN.

4. Now you see a menu from the program badtrk(C). With the badtrk program, you can scan your hard disk for defective tracks. The program maps any flaw locations to other, good tracks. It also creates a flaw map, which is a list of all the bad tracks on your hard disk.

The main program menu looks like this:

Select one of the following options or 'q' to exit program:

1. Print Current Bad Track Table
2. Scan Media Surface for Possible Bad Spots
3. Create New Bad Track Table
4. Add Entries to Current Bad Track Table by Head/Cylinder #
5. Add Entries to Current Bad Track Table by Sector Number
6. Delete Entries from Current Bad Track Table

Please enter your choice:

If you have never scanned your disk for bad tracks, enter:

2

and press RETURN. The badtrk program scans the hard disk for possible flaws. The scanning process takes roughly one to two minutes per megabyte of storage on the disk.

As the program scans the disk, it displays the number of each track it examines. Whenever it finds a defective track, it lists the location of that track using both the sector number and cylinder/head conventions. Defective track information is entered into the table and displayed on the screen. An example bad track might be:

```
error on dev Fixed Disk (0/47), block=12954 cmd=0003 status=0018
sector=12971, cylinder/head = 190/3
```
When the scan is complete, the menu reappears. Enter option "1" to see the results of the scan. Your bad track table might look like this:

<table>
<thead>
<tr>
<th>Cylinder</th>
<th>Head</th>
<th>Sector Number(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>190</td>
<td>3 12971-12987</td>
</tr>
</tbody>
</table>

Press <RETURN> to continue

---

Note

If there is a flaw in the first few tracks of the XENIX partition, you are returned to the fdisk utility (see the previous installation step). Repartition the disk with fdisk so that the XENIX partition no longer includes the defective tracks. You will have to experiment to determine how many tracks to exclude. Leave these defective tracks unassigned to any operating system. When you leave fdisk, badtrk runs again. Scan the disk for flaws.

This process continues until badtrk finds no flaws in the first few tracks.

Press RETURN to return to the main menu. If your disk comes with a flaw map, you should enter any flaws from it into the badtrk table. This procedure is described below.

Some disks are not furnished with a flaw maps. If this is the case with your disk, enter:

```
q
```

to leave badtrk. If you have no bad tracks, or made no changes to the bad track table, skip to the next step (5) on dlvry(C).

If you created a new bad track table, or altered an existing one, the program prompts:

```
Do you want to update this device with the new table? (y/n)
```

Enter:

```
y
```
If there are defective tracks, you are prompted:

Do you want to attempt to salvage any valid data on the bad tracks? [may take a long time] (y/n)

Enter ‘y' or ‘n'. Either way, the process of mapping bad tracks takes several minutes. When badtrk finishes, continue the installation procedure.

If your disk is not furnished with a flaw map, skip to step “5” and proceed with the divvy(C) utility.

If your disk does come with a flaw map, proceed with the next steps to enter any defective tracks which are not already indicated in the badtrk flaw table.

Because most disk flaws are marginal or intermittent, your disk's flaw map will probably list more bad tracks than the scanning process reveals. If so, you should now add these defective tracks to the badtrk flaw table.

Select either option “4” or option “5” depending upon the format of the flaw map furnished with your disk. Enter the defective tracks, one per line. If you make a mistake, enter:

q

and press RETURN. When you see the main badtrk menu, enter option “6” to delete a track.

When you are finished making changes to the flaw table, enter:

q

and press RETURN to return to the main menu. At the main badtrk menu, enter:

q

again and press RETURN. badtrk prompts:

Do you want to update this device with the new table?
Enter:

y

and press RETURN to save the changes. You are prompted:

Do you want to attempt to salvage any valid data on the bad tracks? [may take a long time] (y/n)

Answer 'y' or 'n'.

5. You now see several prompts from the divvy(C) utility. This program allocates portions of your partitioned disk for the root and swap areas.

It also allocates a small portion of the disk for a recover area that is used during autoboott. The fsck(C) program uses this recover area to place output when the root device is cleaned.

If you create a very large root filesystem you are asked if you want to create an additional, small portion of the disk as scratch space for fsck. fsck uses the scratch space for temporary storage when cleaning very large filesystems. You should make a scratch filesystem if you have a very large root filesystem, since this makes booting XENIX much easier.

After that, divvy prompts:

There are 10098 blocks in the XENIX area.
Between 1000 and 2000 blocks should be used for the swap area.

Please enter the swap-area allocation, or press <RETURN> to get the default allocation of 1250 blocks:

The actual numbers in this prompt vary depending upon the size of your disk. If you do not plan to install the Development System, enter:

RETURN

for the default values. If you plan to install the Development System, enter a swap-area allocation that is approximately 500 blocks larger than the default.

Next, you see:

Do you require block-by-block control over the layout of the XENIX partition? (y/n)
If you are installing XENIX for the first time, enter:

\[ n \]

and press RETURN. Block–by–block control means you can choose the exact size of filesystems and the swap area to fit your needs. Most user's do not need this kind of precise control, so answering 'n' at this prompt causes divvy to use default settings based on the size of your hard disk.

If you answer 'y' you see a table from the divvy program. Refer to divvy(C) in the User's Reference for more information.

If your disk is larger than 20M bytes, you see the prompt:

Do you want a separate /u filesystem? (y/n)

We recommend that you have a separate filesystem with disks larger than 20M bytes, especially if you anticipate having many, active users. You should leave at least 15M bytes for the root filesystem.

You can call this separate filesystem anything you want, and, if desired, you can change the name later. The name should be different from any other directory or filesystem. We recommend that you use the name /u. For more information on using a /u filesystem, see Chapter 7 of the XENIX Operations Guide, "Using Peripheral Devices." That chapter describes adding a second hard disk (and filesystem), but the discussion of a second filesystem applies here.

If you have enough storage for a separate user filesystem, and want to create one, enter:

\[ y \]

and press RETURN.

---

**Note**

If you create a /u filesystem enter this command after you finish installing the XENIX system and are in System Maintenance Mode:

```
mkdev fs /dev/u /u
```
6. The system now loads a rudimentary XENIX file system onto your hard disk. This takes several minutes. You see the message:

Making file systems

When the *hdinit* program is finished, the system shuts down and displays instructions on booting the newly initialized hard disk. You see:

** Normal System Shutdown **

Remove the FILESYSTEM floppy, and insert the BOOT floppy (N1) into the drive. If you have a single BOOT/FILESYSTEM floppy, leave it in the drive. Press any key to reboot the system.

If you want to add a second hard disk, finish the installation procedure. Then refer to Chapter 7 of the XENIX *Operations Guide*, “Using Peripheral Devices.”

2.5.5 Starting XENIX On the Hard Disk

This section explains how to start the XENIX system using the hard disk.

1. After you see the boot prompt

   Boot :

   enter:

   xenix rootdev=hd(40,0)

   and press RETURN. You see some copyright information, and information about the memory configuration of your system.

   As before, the system performs a self-check to determine where any problems exist with the hardware. The letters A–Z appear successively on screen. If the letters displaying stop before the letter "Z" is reached, run hardware diagnostics as explained in your computer manual. Correct any identified problems and start the XENIX installation procedure again.

   If the letters stop at this point, call the Support Center listed on the support information card and be prepared to tell them the last letter displayed.

2. Now the program *fsck(C)* is run. *fsck* checks the filesystem(s) on your hard disk.
If you have a very large root filesystem, you are prompted for a scratch filesystem name at this first boot up. If you created a scratch filesystem with divvy, enter:

/dev/scratch

This is the only time you have to enter a scratch filesystem name if you have a large filesystem and specified a scratch filesystem with divvy.

If you have a large filesystem, but do not specify a scratch filesystem with divvy, you must enter the name of a scratch filesystem every time you boot your system. An example scratch filesystem in this case is blank, formatted floppy:

/dev/fd0

3. When fsck finishes, you are prompted to make sure the BOOT (N1) floppy is in the drive. You see the following:

Verify Operating System volume N1 is inserted and press <RETURN>

4. After this, follow any additional screen prompts for floppies. Note that you may not be prompted to insert all the volumes in your distribution at this time.

For example, the Link Kit is on one of your volumes and it is not installed at this time. You can install the Link Kit later in this procedure.

If you insert a floppy in the wrong order, you see this prompt:

Error: incorrect volume in drive!

Remove the floppy from the drive, insert the correct volume, and press RETURN.

If there is an error with the extraction procedure, such as a floppy error, the door of the floppy drive is not completely closed, or there is some other problem you may see the message:

Extraction error: try again? (y/n)

Enter:

y

and press RETURN.
5. When the last of the "N" volumes you are prompted for is read, you see the message:

Operating System Serialization

Enter your serial number
and press <RETURN>

Enter the serial number exactly as it is shown on your Serialization Card and press RETURN. Then you see the message:

Enter your activation key
and press <RETURN>

Enter the activation key exactly as it is shown on your Serialization Card and press RETURN.

6. Next you are prompted to enter the "B" series of floppies. You see screen prompts like those for the "N" floppies.

When the last of the "B" floppies are installed, you see:

Does daylight savings time apply at your location? (y/n)

If daylight savings applies, enter 'y.' If not, enter 'n.' After you press RETURN, you see:

Are you in North America? (y/n)

If you enter 'y,' you see:

1. AST – Atlantic Standard Time
2. EST – Eastern Standard Time
3. CST – Central Standard Time
4. MST – Mountain Standard Time
5. PST – Pacific Standard Time
6. YST – Yukon Standard Time
7. HST – Hawaiian/Alaskan Standard Time
8. NST – Nome Standard Time

Enter the number that represents your timezone:

If, for example, your timezone is Nome Standard time, you would enter the number '8' and press RETURN.

If you are not in the United States (or one of the time zones represented above), and entered "n", the following is displayed:

What is the standard abbreviation of your timezone? (3 capital letters)
Type three upper case letters which represent your time zone and press RETURN. Next you will see this message:

How many hours west of Greenwich Mean Time are you?

Answer with a number between -23 and 23, then press RETURN. Do not use fractions.

The time zone variable, TZ, in the file /etc/default/login is changed accordingly. Your time zone is now set. There is no need to change the .profile for a user, unless they call in from a different time zone, and want to override the local standard.

You have now installed the minimal XENIX system, or run time system. You can use many of the standard XENIX utilities, or install other applications packages.

You see another menu which gives you the option of stopping or continuing with the installation. You can, at this point, stop the installation, or you can continue to install the XENIX Operating System in the next section, Installing the XENIX Distribution.

### 2.5.6 Installing the XENIX Distribution

You can now install more of the XENIX Operating System. With the custom(C) program you can selectively extract files from the distribution set to create your own custom XENIX system. You see information about your filesystem(s), including the number of blocks currently used. You also see this menu:

1. Continue installation
2. Stop installation

If you want to install all or part of the Operating System, enter option ‘1’ and press RETURN.

Note that the entire XENIX distribution, including the Development System and Text Processing System requires more than 10M bytes of disk space.

If you choose option ‘1,’ you are prompted for a set to install (customize). Choose from Operating System, Development System, and Text Processing System.

The custom program prompts for the necessary volume numbers. Insert the appropriate floppies and follow the screen prompts. For information on installing portions of the Operating System, see the XENIX Reference section on custom(C).
You can install the Link Kit at this time with custom. Note that you are prompted for your serial number and activation key again. Enter them as you did earlier in the installation.

When you are finished installing XENIX, you see a message about booting the system. You then see:

** Normal System Shutdown **

** Safe to Power Off **

-or-

** Press Any Key to Reboot **

The system shuts down. Remove any floppy that is in the drive.

Press any key to reboot the system and when you see the boot prompt:

```
  Boot
```

press:

RETURN

You see:

```
  hd(40,0)xenix
```

The screen clears and you see some self check diagnostics. You then see:

Type CONTROL-d to proceed with normal startup
(or give root password for system maintenance)

Press RETURN at this point since there is no root password. The next step is to create a password for the root account.

2.6 Creating the Super-User Password

The super-user password keeps the system safe from unauthorized use. It is important that you create a super-user password immediately after the system has been installed to ensure maximum protection of the system and prevent unnecessary use of the super-user (also known as "root") account.

It is very easy to make errors when logged in as super-user that could destroy files. Login as super-user only to install programs and to do system maintenance tasks. For a complete description of the super-user, see the XENIX Operations Guide.

2-20
To create the super-user password, follow these steps:

1. Enter:

   passwd root

   and press RETURN.

   The system displays the message:

   New password:

   The new password can be any sequence of letters, numbers, and/or punctuation marks, but should be at least 5 characters long.

2. Enter the new password and press RETURN.

   The system does not display the password as you enter so enter carefully. After you press RETURN the system displays the message:

   Retype new password:

3. Enter the new password once more and press RETURN. Make sure you enter it correctly, otherwise the program will ignore the change.

   The super-user password is now in place. From now on, the password is required whenever you attempt to access the system as super-user.

   Do not forget the super-user password. To restore a forgotten super-user password you must reinstall the XENIX system. If necessary, keep a copy of the super-user password in a safe place.

2.6.1 Sysinfo Account

There is a special account used to perform system backups. The "sysinfo" account is set up with permissions and privileges similar to the super-user account, but only for performing system backups. See the chapter "Backing Up File Systems" in the XENIX Operations Guide for more on this procedure.

We suggest you create a password for the "sysinfo" account when you create the password for the super-user account "root".
2.7 Creating the First User Account

The last step in the installation is to create the system’s first user account, “guest”. This guest account is a temporary workspace on the system that you may use to practice with the XENIX system. Later, after installation is complete and you are familiar with the XENIX commands, you can remove the guest account and create private accounts for all the system users.

To create the first user account, follow these steps:

1. Enter:

   mkuser

   and press RETURN. The system displays the message:

   Newuser
   Add a new user to the system

   Do you require detailed instructions? (y/n):

   Enter:

   n

   and press RETURN (you can examine the instructions at some other time). You can quit from the program at any “(y/n)” prompt by entering the letter ‘q’ and pressing RETURN.

2. The system prompts for more information:

   Enter new user’s login name:

   Enter:

   guest

   and press RETURN. The name “guest” is now the login name for the new user account.

3. Next, the program prompts for a group name:

   Do you want to use the default group? (y/n)?

   Enter:

   y

   This sets the group to “group”.

2-22
4. Next, the program prompts for the new user's password.

Enter password

Press RETURN. This allows you to use the guest account without giving a password.

5. Next, the program prompts for the shell type. The following displays:

Please specify the type of shell (command interpreter) the user requires. You can type 1, 2, 3, 4, or 5 as follows:

1. Standard (Bourne) Shell.
3. C Shell.
4. Restricted Shell.
5. Uucp.

Enter "1" and press ENTER. The guest account has an sh(C) shell.

6. Finally, the program prompts you for comments.

Please Enter Comment >............................

> Enter:

guest account

and press RETURN.

7. The system then prompts if you want to change anything. Enter:

n

and press RETURN.

8. Finally, you see the prompt:

Add another user? (y/n)

Enter:

n

and press RETURN.
The new guest account is ready. Later, when you turn to the XENIX User’s Guide, you may use this account to, for instance, practice logging in, make directories and run programs.

2.8 The Next Step

If you created a /u filesystem earlier in the installation, you should now run this command:

```
mkdev fs /dev/u /u
```

Of course, if you chose a name other than u for the second filesystem, use that name in the command line above.

If you are familiar with the XENIX Operating System, you may continue with normal startup and begin working. Just press down the CONTROL key and enter “d”. Refer to the explanation of normal startup in the XENIX Operations Guide if you have problems.

If you are not familiar with the XENIX Operating System, we recommend that you halt the system and turn to the XENIX User’s Guide and the XENIX Operations Guide to learn how to start the system, how to log in, and how to run programs.

To halt the system, follow these steps:

1. Enter:

```
/etc/shutdown 0
```

and press RETURN.

2. Wait for the following message:

```
** Normal System Shutdown **

** Safe to Power Off **
  - or -

** Press Any Key to Reboot **
```

3. When you see the shutdown message, it is safe to turn off the power to the computer.
2.9 Troubleshooting

Sometimes things can go wrong in the installation procedure. Most often, there is no problem with the software or the procedure itself. Occasionally there is a problem with the hardware, but most are minor, such as improperly connected cables.

You can avoid most simple errors by reading the Release Notes delivered with this product, and this Installation Guide completely before you try to install the software.

During the installation procedure, don’t assume you know what is about to happen, even if you have installed the XENIX system before. Use the documentation wisely.

If you have difficulty installing the software, here is a list of some of the most common problems, how to avoid them, and how to fix them if they happen:

- **Some hardware (for example, a disk drive) doesn’t seem to work, although it works fine under another operating system.**

  Certain hardware configurations do not work with XENIX. Refer to the “Compatible Hardware” section in the Release Notes for information on what hardware you can use with XENIX.

- **XENIX is installed after DOS, now both operating systems do not work**

  Do not install XENIX after installing DOS on that same hard disk. This is because of the way the two operating systems keep track of space on a disk. XENIX uses tracks, whereas DOS uses cylinders, and, if you install XENIX first, DOS may not find the correct end of its allotted partition.

  If you already have DOS installed on your hard disk, and with to install XENIX, you must first copy the DOS information to your backup media. Then install the XENIX Operating System. Finally, replace DOS.

  See the chapter in this Installation Guide “Using DOS And XENIX On The Same Disk.”

- **Error reading a floppy.**

  Make sure you insert the correct floppy at the correct time. Insert the floppy correctly (see your owner’s manual if you do not know how insert the floppy correctly).
Make sure the floppy drive door is closed after you insert a floppy.

If you are sure the proper floppy is inserted correctly, and you still have a read error, try tapping the floppy lightly against a hard surface, such as a table top. Be careful not to damage the media, though!

- The system does not boot from the BOOT floppy.

Make sure you insert the BOOT floppy. If you insert another floppy instead, you do not see an error message, but the system still does not boot.

The BOOT floppy is shipped with a write protect tab so that you do not accidentally erase it during the installation process. If you erase or damage the BOOT floppy, and you have not made a backup copy, call the SoftCare Support Center number to arrange for a new BOOT floppy.

- The system won’t boot from the hard disk

You may see a message such as:

```
panic: init
```

or another kind of error message. Sometimes this happens because you did not run a bad track scan during installation, and the boot block was written on a bad track.

Whatever the reason, you must reinstall the XENIX system. If you didn’t enter all the flaws furnished on a flaw map, do so this time.

If XENIX still won’t boot, run your system’s and disk’s hardware diagnostics.

- You forget to enter more bad tracks from a manufacturer furnished flaw map

You can add more flaw locations to the bad track map any time you are in System Maintenance mode. Follow these steps if you are still in the installation procedure:

- Finish installing the run time system.

- When you are prompted to continue installing, or stop the installation process, stop the installation process.

- Enter system maintenance mode.
- Run **badtrk** to add the new flaws.
- Salvage any data (when prompted under **badtrk**).
- Run the custom utility to finish installing your system.
Chapter 3

Using DOS and XENIX
On the Same Disk

3.1 Introduction 3–1
3.2 Partitioning the Hard Disk Using fdisk 3–1
3.3 Installing XENIX on a DOS System 3–2
3.4 Using XENIX and DOS With Two Hard Disks 3–3
3.5 Removing An Operating System From the Hard Disk 3–4
3.6 DOS Accessing Utilities 3–4
3.1 Introduction

Many users received the MS-DOS, or other closely compatible DOS, operating system with their computer. This chapter explains how you can still use DOS utilities, files, and applications after you install the XENIX operating system. You can even access DOS files and directories from XENIX. You do not need to throw away your investment in DOS software, or buy another computer just to run XENIX.

Several programs make this possible. The dos(C) utilities allow access to DOS files on diskettes or on the DOS partition on the hard disk. These utilities are discussed later in this chapter. The utility which partitions the disk is called fdisk(C) and is available in DOS and XENIX versions. The next section explains how to use fdisk to run DOS and XENIX on the same hard disk. Another section discusses installing XENIX on the hard disk along with DOS. There is also a section explaining various booting configurations, for users who mostly use XENIX and for users who mostly use DOS.

3.2 Partitioning the Hard Disk Using fdisk

Each version of fdisk is documented in the respective operating system's manual. fdisk(C) is found in the XENIX Reference.

fdisk is interactive and a menu displays your options. When you exit fdisk, the utility asks you whether or not you actually desire to make the specified changes. This feature lessens the chance of making a mistake. Here is an example of an fdisk menu:

1. Create Partition
2. Change Active Partition
3. Delete Partition
4. Display Partition Table
5. Create XENIX Partition for Whole Disk

Enter Choice:

The fdisk utility allows you to set up separate areas (partitions) on your hard disk for both operating systems. The hard disk is divided into tracks. The number of tracks depends upon the size of the hard disk. A partition consists of a group of tracks. One hard disk may contain up to four partitions. Each partition can have a different operating system and associated directories and files. Not all operating systems can be used with fdisk.

The fdisk command allows you to specify which partition is “active”. This means that when you turn on (boot) your computer, the operating system installed in the active partition will start running. The XENIX partition
must be active when you intend to use the XENIX operating system.

The `fdisk` command allows you to specify the number of tracks used by the partition. This will vary according to the size of your hard disk. We recommend using at least a 10 megabyte hard disk to run XENIX. The size of the XENIX partition also depends on the number of software packages you want to install. Refer to the `custom(C)` manual page for information on the installing and removing packages from the three XENIX distribution Systems. 6 megabytes is a good starting point. You can install the XENIX Operating System package in this space, and have space for user files.

The `fdisk` command allows you to specify where the partition begins. `fdisk` will not allow you to construct overlapping partitions, or a partition that begins with a bad track. You do not need to install XENIX in the first partition. When you are running XENIX, the device name of the partition running XENIX is `/dev/hd0a`.

One option of `fdisk` tabulates the current state of the partitions (the Display Partition Table option). This option lists, for each partition, whether the partition is active, the first track, the last track, the number of track used, and the associated operating system. If you enter the Display Partition Table option and press RETURN to see the partition table, the result may look like this:

<table>
<thead>
<tr>
<th>PARTITION</th>
<th>STATUS</th>
<th>TYPE</th>
<th>START</th>
<th>END</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>XENIX</td>
<td>001</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>DOS</td>
<td>801</td>
<td>1219</td>
<td>420</td>
</tr>
</tbody>
</table>

There are two ways to switch operating systems once you have set up separate XENIX and DOS partitions. You can use a floppy diskette with the files necessary to boot the DOS operating system. Because the XENIX partition must be active for XENIX to operate, you cannot use a bootable floppy to boot XENIX. You can use `fdisk` to change the current active partition. This method is appropriate for an occasional change of the active operating system. Turn the computer off. When you re-boot, the operating system associated with the active partition starts running. It is recommended you use a boot floppy to boot the DOS operating system. Booting from a floppy is generally easier, faster and safer than constantly using `fdisk` to change active partitions.

### 3.3 Installing XENIX on a DOS System

If you wish to set up XENIX on a hard disk which previously contained only DOS, first back up all the DOS files and directories. Run `fdisk`, under DOS, and assign a partition to DOS, leaving enough disk space so that XENIX has at least 6 megabytes. Delete DOS from the partition you will assign to XENIX. It will display as `Other` when you display the Partition Table. Make
a note of the tracks assigned to each operating system. Designate Other as the active operating system.

Follow the installation procedure outlined in Chapter 2 of this guide to install XENIX. During the installation procedure fdisk is invoked to partition the hard disk. Use fdisk, to duplicate the assignments made under DOS and assign a partition which is at least 6 megabytes to XENIX. You will see a message warning that the contents of the hard disk will be destroyed. Don’t worry, you backed up the DOS files in this area, and will restore them later. This partition will contain XENIX. Designate "XENIX" as the active operating system.

---

**Note**

Under XENIX, fdisk DOS partitions display as DOS while under DOS, fdisk displays XENIX partitions as Other.

You can only create DOS partitions using DOS fdisk, and only XENIX partitions using XENIX fdisk.

Be aware that DOS fdisk usually reports the size of the hard disk in terms of cylinders.

---

Reboot the system using a DOS boot floppy in the floppy drive or use fdisk to designate DOS as the active operating system, and reboot. You can reinstall your DOS files and directories in the separate partition anytime after you have set up the DOS partition, and finish the XENIX installation. You are then accessing the DOS partition and can reinstall DOS.

If you have an active XENIX partition and boot DOS from a floppy you can transfer to C: to work with the DOS files.

---

### 3.4 Using XENIX and DOS With Two Hard Disks

Your computer always boots the operating system on the first hard disk. XENIX must be bootable from the disk you designate. There are several ways to configure your system to be bootable on both XENIX and DOS. The ways are discussed here.

One configuration consists of designating the A: partition. You then use a DOS boot floppy to boot:

```
A> A: D:
```

---

3-3
to switch to the DOS area on the second hard disk, where D is the designation for the second hard disk.

Another method is to maintain a small DOS partition on the first hard disk. The DOS partition is designated the active partition. In this configuration, the computer always boots DOS. This requires changing the active partition to boot the XENIX operating system.

---

**Note**

Be sure to make a backup copy of your boot floppies if you use them to boot your secondary operating system.

---

### 3.5 Removing An Operating System From the Hard Disk

You may find that you no longer need one of the operating systems installed on your hard disk. If you want to delete an operating system, use fdisk under both operating systems to delete the partition in question. Deleting the partition removes the contents of that partition and leaves unallocated space.

You can then reallocate that space by either adding another XENIX or DOS partition, or enlarging an existing partition. Enlarging a partition requires reinstalling the operating system and (for a XENIX partition) remaking the filesystem on the partition using mkfs(5). Refer to Chapter 7, "Using Peripheral Devices," of the XENIX Operations Guide if you add a second XENIX partition and want to designate this partition as a mounted filesystem.

### 3.6 DOS Accessing Utilities

There is a set of other utility programs which help you bridge the two operating systems. These are the XENIX commands, such as dosls and doscat, described in the XENIX manual page dos(5). These programs allow you to access DOS files and directories which reside in a non-active DOS partition while running XENIX. You can list, copy, move and view the contents of files, and create directories. You may also be able to use the XENIX dd(5) and diskcp(5) commands to copy and compare DOS floppies. The XENIX dtype(5) command tells you what type of floppies you have (various DOS and XENIX types).
Using DOS and XENIX On the Same Disk

Note

You can not execute (run) DOS programs or applications under XENIX.

The XENIX Development System, with the cmerge compiler, has the capability of using the XENIX System to create and compile programs which can be run under DOS operating systems. Refer to the XENIX C User's Guide appendix entitled "XENIX to MS-DOS: A Cross Development System" and the C Library Guide Appendix entitled "A Common Library for XENIX and MS-DOS" for more on using XENIX to create DOS programs.
XENIX® System V

Operating System

Introduction to XENIX
Contents

1 Introduction
1.1 Overview 1-1
1.2 The XENIX System 1-1
1.3 The XENIX Working Environment 1-1
1.4 About This Guide 1-3

2 Demonstration
2.1 Introduction 2-1
2.2 Before You Log In 2-1
2.3 Logging In 2-1
2.4 Typing Commands 2-2
2.5 Mistakes in Typing 2-4
2.6 Read-Ahead and Type-Ahead 2-4
2.7 Strange Terminal Behavior 2-5
2.8 Stopping a Program 2-5
2.9 Logging Out 2-5

3 Basic Concepts
3.1 Introduction 3-1
3.2 Files 3-1
3.3 File Systems 3-3
3.4 Naming Conventions 3-4
3.5 Commands 3-9
3.6 Input and Output 3-11

4 Tasks
4.1 Introduction 4-1
4.2 Gaining Access to the System 4-1
4.3 Configuring Your Terminal 4-3
4.4 Editing the Command Line 4-4
4.5 Manipulating Files 4-5
4.6 Manipulating Directories 4-11
4.7 Moving in the File System 4-15
4.8 Using File and Directory Permissions 4-17
4.9 Processing Information 4-21
4.10 Controlling Processes 4-26
4.11 Getting Status Information 4-27
4.12 Using the Lineprinter 4-30
4.13 Communicating with Other Users  4-33
4.14 Using the System Clock and Calendar  4-35
4.15 Using the Automatic Reminder Service  4-36
4.16 Using Another User's Account  4-36
4.17 Calculating  4-37
Chapter 1

Introduction

1.1 Overview 1-1
1.2 The XENIX System 1-1
1.3 The XENIX Working Environment 1-1
1.4 About This Guide 1-3
1.1 Overview

This guide introduces key concepts of the XENIX system by presenting them in a tutorial format.

It begins with a "demonstration" that explains an actual computer session, including command usage and correcting typing errors. Basic concepts such as files, commands, and pattern matching are also introduced.

Finally, these and other concepts are applied to many "real world" examples, such as file manipulation, terminal configuration, process control, and status information.

---

Note

This guide should be read before the other XENIX documentation; however, for more detailed discussions of all topics covered here, consult the other user's and reference guides in the set.

1.2 The XENIX System

The XENIX system consists of a general-purpose multi-user operating system and over one hundred utilities and application programs. In addition to the XENIX Operating System described in this guide, two other XENIX system packages are available: the XENIX Development System and the XENIX Text Processing System.

1.3 The XENIX Working Environment

The XENIX system is built around the XENIX operating system. The purpose of an operating system is to efficiently organize and control the resources of a computer so that they can be used by real people. These resources include memory, disks, lineprinters, terminals, and any other peripheral devices connected to the system. The heart of the XENIX system is a "multi-user" and "multi-tasking" operating system. A multi-user system permits several users to use a computer simultaneously, thus providing lower cost in computing power per user. A multi-tasking system permits several programs to run at the same time and increases productivity because multiple programs can run simultaneously rather than in sequence.

Because UNIX™ (and thus XENIX) is an accepted standard for "high-end" operating systems, a great deal of software is available for this
environment. In addition, XENIX provides file access to the MS-DOS™ operating system, the most widely used 16-bit operating system in the world. For systems that support DOS, XENIX provides commands that let you access DOS format files and disks. The XENIX system also includes several widely praised enhancements developed at the University of California at Berkeley, and a visual interface similar to other Microsoft productivity tool interfaces.

Other characteristics of the XENIX system include:

- A powerful command language for programming XENIX commands. Unlike other interactive command languages, the XENIX "shell" is a full programming language.

- Simple and consistent naming conventions. Names can be used absolutely, or relative to any directory in the file system.

- Device-independent input and output: each physical device, from interactive terminals to main memory, is treated like a file, allowing uniform file and device input and output.

- A set of related text editors, including a full screen editor.

- Flexible text processing facilities. In XENIX, commands exist to find and extract patterns of text from files, to compare and find differences between files, and to search through and compare directories. Text formatting, typesetting, and spelling error-detection facilities, as well as a facility for formatting and typesetting complex tables and equations are also available.

- A sophisticated "desk-calculator" program.

- Mountable and dismountable file systems that permit addition of floppy disks to the file system.

- A complete set of flexible directory and file protections that allows all combinations of read, write, and execute access for the owner of each file or directory, as well as for groups of users.

- Facilities for creating, accessing, moving, and processing files and directories in a simple and uniform way.
1.4 About This Guide

This guide is organized as follows:

Chapter 1, "Introduction," gives an introduction and overview of the XENIX system.

Chapter 2, "Demonstration," gives you hands-on experience in using the XENIX system.

Chapter 3, "Basic Concepts," explains the fundamental concepts that you need to understand before you begin to use the system. Included here are sections on the file system, naming conventions, commands, and input and output.

Chapter 4, "Tasks" explains how to perform everyday tasks using appropriate XENIX commands.
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Demonstration
Chapter 2

Demonstration

2.1 Introduction 2-1
2.2 Before You Log In 2-1
2.3 Logging In 2-1
2.4 Typing Commands 2-2
2.5 Mistakes in Typing 2-4
2.6 Read-Ahead and Type-Ahead 2-4
2.7 Strange Terminal Behavior 2-5
2.8 Stopping a Program 2-5
2.9 Logging Out 2-5
2.1 Introduction

This chapter contains a demonstration run designed to help you get used to the XENIX system, so that you can quickly start to make effective use of it. It shows you how to login, how to enter at your keyboard, what to do about mistakes in entering, how to enter commands and how to log out.

2.2 Before You Log In

Before you can log in to the system, your name must be added to the XENIX user list. At that time you will be given a login name and a password. You may have to add your name yourself, or someone else may be assigned this task; it all depends on the environment in which your system is used. In any case, see the XENIX Operations Guide and mkuser(C) for detailed information on adding users.

When you are given an account on the XENIX system you will also receive a user name, a password, and a login directory. Once you have these, all you need is a terminal from which you can log in to the system. XENIX supports most terminals and you should have no problem getting your terminal to work with XENIX. Once again, see the XENIX Operations Guide for more information on how to configure your terminal.

2.3 Logging In

Normally the system is sitting idle with a “login:” prompt on the terminal screen. If the system displays nonsense characters when you enter text, then your terminal is probably receiving information at the wrong speed and you should check your terminal switches. If the switches are set correctly, push the BREAK or INTERRUPT key a few times.

When you get a “login:” message, enter your login name, then press RETURN; the system will not do anything until you do. If a password is required, you will be asked for it. The password that you enter does not appear on the screen. This prevents others from viewing it. Do not forget to press RETURN after you enter your password. Next you see the line

TERM = (unknown)

Enter your terminal type (for example, ansi) and press RETURN.

A successful log in produces a “prompt character”, a single character that indicates the system is ready to accept commands. The prompt is usually a dollar sign ($) or a percent sign (%).
You may also get a login message such as:

You have mail

telling you that another system user has sent you mail.

2.4 Typing Commands

Once the prompt character appears, the system is ready to respond to commands entered at the terminal. Try entering:

date

followed by RETURN. The system responds by displaying something like:

Mon Jun 16 14:17:10 EST 1985

Do not forget to press the RETURN key after the command, or nothing will happen. The RETURN key will not be mentioned again, but do not forget -- it has to be entered at the end of each command line. On some terminals RETURN may be labeled "ENTER" or "CR", but in all cases, the key performs the same function.

Another command you might try is who, which lists the names of everyone who is logged in to XENIX. A typical display from the who command might look something like this:

<table>
<thead>
<tr>
<th>Name</th>
<th>Terminal</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>you</td>
<td>console</td>
<td>Jan 16 14:00</td>
</tr>
<tr>
<td>joe</td>
<td>tty01</td>
<td>Jan 16 09:11</td>
</tr>
<tr>
<td>ann</td>
<td>tty02</td>
<td>Jan 16 09:33</td>
</tr>
</tbody>
</table>

The time, given in the fourth column, indicates when the user logged in; ttynn is the system name for each user's terminal, where nn is a unique two-digit number. The console is the special name of the master terminal that is the default for most operations.

If you make a mistake entering the command name, you will see a message on your screen. For example, if you enter:

whom

the system responds with the message:

whom: not found
Note that case is significant in XENIX. The commands

   who

and

   WHO

are not the same; this differs from some operating systems, where case does not matter.

Now try displaying a message on your screen using the **echo** command. Type:

   echo hello world

The **echo** command does what its name implies and echoes the rest of the command line to your terminal:

   hello world

Now try this:

   echo hello world > greeting.file

This time the **echo** command sends its output to a new file named *greeting.file*, instead of to your terminal. Note the use of the greater-than sign (>) to "redirect" the output of the command. Now enter:

   ls

to list just the name of the file. To look at the contents of display it by entering:

   cat greeting.file

Here "cat" stands for concatenate. One purpose of the **cat** command is to combine the contents of several files (that is, "concatenate") and put them in some new file. However, since your terminal display is treated like any other file in XENIX, **cat** is most commonly used to display the contents of files on the screen. Therefore the above command sends the following output to your terminal screen:

   hello world

To remove *greeting.file*, enter:

   rm greeting.file
Introduction to XENIX

Note that XENIX command names are often shortened to mnemonic names. For example, cp is short for “copy”, ls is short for “list”, rm is short for “remove”, cat is short for “concatenate”, mkdir is short for “make directory”, and chmod is short for “change mode”.

2.5 Mistakes in Typing

If you make a mistake in entering while entering a command, there are two ways to edit the line, provided you have not yet pressed RETURN. Pressing the BKSP key causes the last character entered to be erased. Backspacing with the BKSP key can erase characters back to the beginning of the line, but not beyond. Thus, if you type badly, you can correct as you go. For example, entering:

```
  ddBKSPateRETURN
```

is the same as

```
  dateRETURN
```

The XENIX kill character, Ctrl-u, erases all of the characters entered so far on the current input line. So, if the line is irretrievably fouled up, enter Ctrl-u and start the line over.

If you must enter a BKSP or Ctrl-u as part of the text, precede it with a backslash (\), so that the character loses its special “erase” meaning. To enter a BKSP or Ctrl-u in text, enter “\BKSP” or “\Ctrl-u”. The system always prints a new line on your terminal after your Ctrl-u, even if preceded by a backslash. Nevertheless, the Ctrl-u will have been recorded.

To erase a backslash, backspace twice with the BKSP key, as in “\BKSPBKSP”. The backslash is used extensively in XENIX to indicate that the following character is in some way special. Note that the functions performed by BKSP and Ctrl-u are available on all XENIX systems; however, the keys used to perform these functions may vary and can be set by the user with stty(C).

2.6 Read-Ahead and Type-Ahead

XENIX has full read-ahead, which means that you can type as fast as you want, whenever you want, and XENIX will remember what you have entered. If you enter any text while a command is displaying text on the screen, your input characters appear intermixed with the output characters on the screen, but they are stored away and interpreted in the correct order. Therefore, you can enter several commands (i.e., “type ahead”) one after another without waiting for the first to finish. Note that this does
not work when you log in; type-ahead does not work until after you have entered your password and the dollar sign ($) prompt appears.

2.7 Strange Terminal Behavior

Occasionally, your terminal may act strangely. You can often fix such behavior by either turning your terminal off, then quickly turning it back on, or logging out and logging back in; this will reset your terminal characteristics. It is often helpful to enter a Ctrl-q. This restores terminals that are (inadvertently or otherwise) in a non-echoing mode. Ctrl-s stops display to the screen, Ctrl-q restarts display. If logging out and back in, turning the terminal off and on, and entering Ctrl-q does not work, read the description of the command stty(C) in the XENIX Reference Manual for more information about setting terminal characteristics. Also, refer to the next section, "Stopping a Program."

2.8 Stopping a Program

You can abort the execution of most programs and commands by pressing the INTERRUPT key (perhaps called DEL, DELETE, Ctrl-c, or RUBOUT on your terminal). The BREAK key found on many terminals can also be used. Inside some programs, like most text editors, entering INTERRUPT stops whatever the program is doing without aborting the program itself. Throughout this manual, when we say "send an interrupt" we mean press the INTERRUPT key.

2.9 Logging Out

To end a session with XENIX, you must log out. This is done by entering Ctrl-d as the first character on a line. It is not sufficient just to turn off the terminal, since this does not log you out. Some programs can also be ended by entering Ctrl-d, so beware.
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Basic Concepts
Chapter 3

Basic Concepts

3.1 Introduction 3-1

3.2 Files 3-1
  3.2.1 Ordinary Files 3-1
  3.2.2 Special Files 3-2
  3.2.3 Directory files 3-2
  3.2.4 Directory Structure 3-2

3.3 File Systems 3-3

3.4 Naming Conventions 3-4
  3.4.1 Filenames 3-4
  3.4.2 Pathnames 3-5
  3.4.3 Sample Names 3-5
  3.4.4 Special Characters 3-6

3.5 Commands 3-9
  3.5.1 Command Line 3-9
  3.5.2 Syntax 3-10

3.6 Input and Output 3-11
  3.6.1 Redirection 3-12
  3.6.2 Pipes 3-13
3.1 Introduction

This chapter will give you an understanding of the basic concepts you need to function in the XENIX environment. After reading this chapter you should understand how the system's files, directories, and devices are organized and named, how commands are entered, and how a command's input and output can be manipulated. This chapter begins with a discussion of files.

3.2 Files

The file is the fundamental unit of the XENIX file system. In XENIX there are really three different types of files: ordinary files (what we usually mean when we say "file"), directories, and special files. Each of these types of files is described below.

3.2.1 Ordinary Files

Ordinary files typically contain textual information such as documents, data, or program sources. Executable binary files are also of this type. An ordinary file is simply a named concatenation of 8-bit bytes. Whether these bytes are interpreted as text characters, binary instructions, or program statements is up to the programs that examine them. Every ordinary file has the following attributes:

- A filename (not necessarily unique)
- A unique system number called an inode number
- A size in bytes
- A time of creation
- A time of modification
- A time of last access
- A set of access permissions

Files can be protected by assigning appropriate access permissions to assure privacy and security. This is done by providing read-write-execute permissions to files so that the user can control access by the owner, by a group of users, and by anyone else. By default, the owner of a file is its creator. The owner can read the file or write to it. By default, other users can read a file owned by another, but not write to it. File permissions can be altered with the chmod command. This command is discussed in Chapter 4 of this manual.
3.2.2 Special Files

Special files correspond to physical devices such as hard and floppy disks, lineprinters, terminals, and system memory. They are called “device special files”. These files are not discussed in this manual.

3.2.3 Directory files

Directory files are read-only files containing information about the files or directories that are conceptually (but not physically) contained within them. This information consists of the name and inode number of each file or directory residing within the given directory. An inode number is a unique number associated with any given file. All files on the system have inode numbers. A name/inode number pair is called a link. The ls command is used to examine directory files and to list the information about the files conceptually within the named directory. With the inode number, the ls command can also find other information about a file.

The nesting of directories inside other directories is the way in which XENIX implements its characteristic tree-structured directory system. Directories are discussed further in the next section.

Like ordinary files, directories can be protected by assigning appropriate access permissions to assure privacy and security. This is done by giving read-write-search permissions to directories so that the user can control directory access by the owner, by a group of users, and by anyone else. Write permission determines whether files can be added or removed from a directory. By default, the owner of a directory is its creator, and the owner can read, create or remove files within that directory. Similarly by default, a user can read files within the directory of another, but not add or remove files. As with file permissions, directory permissions can be altered with the chmod command. Default permissions can be altered with the umask command.

3.2.4 Directory Structure

With multiple users and multiple projects, the number of files in a file system can proliferate rapidly. Fortunately, as mentioned earlier, XENIX organizes all files into a tree-structured directory hierarchy. This tree structure should be thought of as a physical world in which the user can move from place to place. “Places” are directories. Each user of the system has his own personal directory. Within that directory, the user may have directories or other subdirectories owned and controlled only by the user.

When you log in to XENIX, you are “in” your directory. Unless you take special action when you create a file, the new file is created in your working
directory. This file is unrelated to any other file of the same name in someone else's directory.

A diagram of part of a typical user directory is shown in Figure 3-1.

```
    usr
     / / \
    /   /   \  
  adam eve mary  
 /   / \   /   \text  text
\text \text temp
```

Figure 3-1 A Typical User Directory

In Figure 3-1, the `usr` directory contains each user's own personal directory. Notice that Mary's file named `text` is unrelated to Eve's. This is not important if all the files of interest are in Eve's directory, but if Eve and Mary work together, or if they work on separate but related projects, this division of files becomes handy indeed. For example, Mary could print Eve's `text` by typing:

```
pr /usr/eve/text
```

Similarly, Eve could find out what files Mary has by typing:

```
is /usr/mary
```

### 3.3 File Systems

A file system is a set of files organized in a certain way. In XENIX, this set of files consists of all available resources including data files, directories, programs, lineprinters, and disks. Thus, the XENIX file system is a system for accessing all system resources.

To logically structure the resources of the system, the XENIX file system is organized hierarchically in an inverted "tree structure". See Figure 3-2 for an illustration of a typical tree-structured file system. In this typical tree of files, the root of the tree is at the top and branches of the tree grow downward. Directories correspond to nodes in the tree; ordinary files correspond to "leaves". If a directory contains a downward branch to other files or directories, then those files and directories are "contained" in the given directory. It is possible to name any file in the system by starting at the root (where the root is at the top) and traveling down any of the branches to the desired file. Similarly, you can specify any file in the
system, relative to any directory. Specification of these files depends on a knowledge of the XENIX naming conventions, discussed in the next section.

```
/ (root)
  /
  /
  bin  usr  dev
  /
  /
  cmd
  /
  \
  doug  neil
  /
  \
  mail  news  text  data
```

**Figure 3-2 A Typical File System**

In the typical tree-structured file system of Figure 3-2, the "tree" grows downward. The names `bin`, `usr`, `dev`, `doug`, and `neil` all represent directories, and are all nodes in the tree. In XENIX the name of the root directory is given the one-character name, "/". The names `mail`, `news`, `text`, and `data` all represent normal data files, and are all "leaves" of the tree. Note that the file `cmd` is the name of a command that can be executed. The name `tty` represents a terminal and is also represented in the tree.

### 3.4 Naming Conventions

Every single file, directory, and device in XENIX has both a filename and an absolute pathname. This pathname is a map of the file or directory's location in the system. The absolute pathname is unique to all names in the system; filenames are unique only within directories and need not be unique system-wide. This is similar to someone whose "global" name is John Albert Smith in a telephone directory, but who may be listed simply as John in an office phone list.

#### 3.4.1 Filenames

A simple filename is a sequence of one to fourteen characters other than a slash (/). Every single file, directory, and device in the system has a filename. Filenames are used to uniquely identify directory contents. Thus, no two filenames in a directory may be the same. However, filenames in different directories may be identical.

Although you can use almost any character in a filename, it is best to confine filenames to the alphanumeric characters and the period. Other characters, especially control characters, are discouraged for use in filenames. When a filename contains an initial period, it is "hidden", and
is not displayed by the `ls` command. However the `ls`–a command will 
display the hidden files. The dash (`-`) is used in specifying command 
options, and should be avoided when naming files. In addition, the ques-
tion mark (`?`), the asterisk (`*`), brackets (`[` and `]`), and all quotation marks 
should never be used in filenames, since they are treated specially when 
entering commands.

3.4.2 Pathnames

A pathname is a sequence of directory names followed by a simple 
filename, each separated from the previous name by a slash. If a pathname 
begins with a slash, it specifies a file that can be found by beginning a search 
at the root of the entire tree. Otherwise, files are found by beginning the 
search at the user’s current directory (also known as the working directory). 
The current directory should be thought of as your location in the file sys-
tem. Think of it as a physical place. When you change your current direc-
tory you are moving to some other directory or place in the file system.

A pathname beginning with a slash is called a full (or absolute) pathname 
because it does not vary with regard to the user’s current directory. A path-
name not beginning with a slash is called a relative pathname, because it 
specifies a path relative to the current directory. The user may change the 
current directory at any time by using the `cd` command. The user may 
display the current directory by using the `pwd` command.

3.4.3 Sample Names

Some sample names follow:

```
/       The absolute pathname of the root directory of the 
        entire file system.
/bin    The directory containing most of the frequently used 
        XENIX commands.
/usr    The directory containing each user’s personal direc-
        tory. The subdirectory, `/usr/bin` contains frequently 
        used XENIX commands not in `/bin`.
/dev    The directory containing files corresponding to physi-
        cal devices (e.g., terminals, lineprinters, and disks).
/dev/console The name of the system master terminal.
/dev/tty  The name of the user’s terminal.
/lib     The directory containing files used by some standard 
        commands.
```
Introduction to XENIX

\texttt{/tmp} \hspace{1cm} This directory contains temporary scratch files.

\texttt{/usr/joe/project/A} \hspace{1cm} A typical full pathname; this one happens to be a file named \textit{A} in the directory named \textit{project} belonging to the user named \textit{joe}.

\texttt{bin/x} \hspace{1cm} A relative pathname; it names the file \textit{x} in subdirectory \textit{bin} of the current working directory. If the current directory is /, it names \texttt{/bin/x}. If the current directory is \texttt{/usr/joe}, it names \texttt{/usr/joe/bin/x}.

\texttt{file1} \hspace{1cm} Name of an ordinary file in the current directory.

When using the XENIX system, each user resides "in" a directory called the current directory. All files and directories have a "parent" directory. This directory is the one immediately above, which "contains" the given file or directory. The XENIX file system provides special shorthand notations for this directory and for the current directory:

\begin{itemize}
  \item The shorthand name of the current directory. Thus \texttt{./filexxx} names the same file as \texttt{filexxx}, if such a file exists in the current directory.
  \item The shorthand name of the current directory's parent directory. The shorthand name \texttt{../} refers to the directory that is two levels "above" the current directory
\end{itemize}

### 3.4.4 Special Characters

XENIX provides a pattern-matching facility for specifying sets of filenames that match particular patterns. For example, examine the problem that occurs when naming the parts of a large document, such as a book. Logically, it can be divided into many small pieces such as chapters or sections. Physically, it must be divided too, since the XENIX editor \texttt{vi} cannot handle really big files.

Thus, you should divide a large document into several files. The points at which the document is divided should follow a logical order. You might have a separate file for each chapter:

\begin{verbatim}
chap1
chap2
...
\end{verbatim}
Or, if each chapter is broken into several files, you might have:

chap1.1
chap1.2
chap1.3
...
chap2.1
chap2.2
...

You can then tell at a glance where a particular file fits into the whole.

There are other advantages to a systematic naming convention that are not so obvious. What if you want to print the whole book on the lineprinter? You could enter:

```
lpr chap1.1 chap1.2 chap1.3 ...
```

but you will tire of this quickly and will probably even make mistakes. Fortunately, there is a shortcut: a sequence of names containing a common pattern can be specified with the use of special characters. The special characters discussed in this chapter are:

* Matches zero or more characters

[] Matches any character inside the brackets

? Matches any single character

For example, you can enter:

```
lpr chap*
```

The asterisk (*), sometimes called “star” or “splat” in XENIX, means “zero or more characters of any type”, so this translates into “send all files whose names begin with the word "chap" to the lineprinter”.

This shorthand notation is not a unique property of the lpr command; it can be used in any command.

Using this fact, you can list the names of the files in the book by typing:

```
lsl chap*
```
This produces

chap1.1
chap1.2
chap1.3
...

The star is not limited to the last position in a filename; it can be used anywhere and can occur several times. A star by itself matches all filenames not containing slashes or beginning with periods, so:

```
cat *
```

displays all files in the current directory on your terminal screen.

The star is not the only pattern-matching feature available. Suppose you want to print only chapters 1 through 4, and 9. You can say:

```
lp1 chap[12349]*
```

The brackets ([ and ]) mean "match any of the characters inside the brackets." A range of consecutive letters or digits can be abbreviated, so you can also do this with:

```
lp1 chap[1-49]*
```

(Note that this does not match forty-nine filenames, but only five.) Letters can also be used within brackets: "[a-z]" matches any character in the range "a" through "z".

The question mark (?) matches any single character, so

```
ls ?
```

lists all files that have single-character names, and

```
ls -l chap?.1
```

lists information about the first file of each chapter (i.e., chap1.1, chap2.1, ...).

If you need to turn off the special meaning of any of the special characters (*, ?, and [...] ) enclose the entire argument in single quotation marks.
For example, the following command will print out only files named "?" rather than all one-character filenames:

```
ls *?
```

Pattern-matching features are discussed further in Chapter 4 of the XENIX User’s Guide, “The Shell.”

### 3.5 Commands

Commands are used to invoke executable programs. When you enter the name of a command, XENIX reads the command line that you have entered, looks for a program with the given name, and then executes the program if it finds it. Command lines may also contain arguments that specify options or files that the program may need. The command line and command syntax are discussed in the next two sections.

#### 3.5.1 Command Line

Whether you are entering commands at a terminal, or XENIX is reading commands from a file, XENIX always reads commands from command lines. The command line is a line of characters that is read by the shell command interpreter to determine what actions to perform. This interpreter, or “shell” as it is known, reads the names of commands from the command line, finds the executable program corresponding to the name of the command, then executes that program. When the program finishes executing, the shell resumes reading the command line. Thus, when you are entering at a terminal, you are editing a line of text called the command-line buffer that becomes a command line only when you press RETURN. This command-line buffer can be edited with the BKSP and Ctrl-u keys. Pressing RETURN causes the command-line buffer to be submitted to the shell as a command line. The shell reads the command line and executes the appropriate command. If you press INTERRUPT before you press RETURN, the command-line buffer is erased. Multiple commands can be entered on a single command line provided they are separated by a semicolon (;). For example, the following command line prints out the current date and the name of the current working directory:

```
date ; pwd
```

Commands can be submitted for processing in “the background” by appending an ampersand (&) to the command line. This mode of execution is similar to “batch” processing on other systems. The main advantage
to placing commands in the background is that you can execute other com-
mands from your terminal in the "foreground" while the background com-
mands execute. Thus:

du /usr > diskuse&

determines the disk usage in the directory /usr, a fairly time-consuming
operation, without tying up your terminal. Note that the output is placed in
the file diskuse by redirecting output with the greater-than symbol.
Redirection is discussed in Section 3.6.1.

3.5.2 Syntax

The general syntax for commands is as follows:

    cmd [ switches ][ arguments ][ filename ] [ ... ]

By convention, command names are lowercase. Switches, also called
options, are flags that select various options available when executing the
command. They are optional and usually precede other arguments and
filenames. Switches consist of a dash prefix (−) and an identifying letter.
For example, the ls command’s −l switch (pronounced “minus ell” )
specifies a long directory listing and the command

    ls −r

specifies a directory listing in reverse alphabetical order. In some cases,
switches can be grouped to form a single switch argument. For example,
the command

    ls −rl

is really a combination of two switches, where the −rl switch selects the
option that lists all files in the directory in both reverse alphabetical order
and with the long format.

Sometimes multiple switches must be given separately, as in:

    copy −a −v source destination

Here the −a switch tells the copy command to ask the user for
confirmation before copying the source to the destination. The −v switch
specifies the "verbose" option, which reports copying as it happens.
Other arguments, such as search strings, can also be given, as in:

```
grep` string of text `outfile
```

In the above example,

```
`string of text`
```

is a single argument and is the search string the `grep` command searches for in the file `outfile`. `filename` is the argument that specifies the name of a file required by the command.

Most commands are executable programs compiled by the C compiler or by some other language compiler. Some commands are executable command files called "shell procedures". Shell procedures are discussed in Chapter 4 of the XENIX User's Guide, "The Shell."

### 3.6 Input and Output

By default, XENIX assumes that terminal input comes from the terminal keyboard and output goes to the terminal screen. To illustrate typical command input and output, enter:

```
cat
```

This command now expects input from your keyboard. As input, it accepts as many lines of text as you enter until you press Ctrl-d as an end-of-file or end-of-transmission indicator.

For example, enter:

```
this is two lines
of input
Ctrl-d
```

When you press Ctrl-d, input ends. The `cat` command immediately outputs each line as you enter it. Since output is sent to the terminal screen by default, that is where the two lines are sent. Thus, the complete session will look like this on your terminal screen:

```
$ cat
this is two lines
this is two lines
of input
of input
$ 
```
The flow of command input and output can be “redirected” so that input comes from a file instead of from the terminal keyboard and output goes to a file or lineprinter, instead of to the terminal screen. In addition, you can create “pipes” to make the output from one command become the input to another. Redirection and pipes are discussed in the next two subsections. When you use cat to send input to a file or pipe, the output is not sent until the Ctrl-d end-of-transmission indicator is entered.

3.6.1 Redirection

In XENIX a file can replace the terminal for either input or output. For example:

```
ls
```

displays a list of files on your terminal screen. But if you say:

```
ls > filelist
```

a list of your files is placed in the file filelist (which is created if it does not exist). The symbol for output redirection, the greater-than sign ( > ), means “put the output from the command into the following file, rather than display it on the terminal screen.” As another example of output redirection, you can combine several files into one by capturing the output of cat in a file:

```
cat f1 f2 f3 > temp
```

The output append symbol ( >> ) operates very much like the output redirection symbol, except that it means “add to the end of”. So:

```
cat file1 file2 file3 >> temp
```

means “concatenate file1, file2, and file3 to the end of whatever is already in temp, instead of overwriting and destroying the existing contents.” As with normal output redirection, if temp doesn’t exist, it is created for you.

In a similar way, the input redirection symbol ( < ) means “take the input for a program from the following file, instead of from the terminal”. Thus, you could make a script of editing commands and put them into a file called script. Then you could execute the commands in the script on a file by typing:

```
ed file < script
```
As another example, if you used an editor to prepare a letter in the file
*letter.txt*, you could send it to several people with:

```
mail adam eve mary joe < letter.txt
```

### 3.6.2 Pipes

One of the major innovations of the XENIX system is the concept of a
"pipe". A pipe is simply a way to connect the output of one command to
the input of another, so that the two run as a sequence of commands called
a pipeline.

For example:

```
sort frank.txt george.txt hank.txt
```

combines the three files named *frank.txt*, *george.txt*, and *
hank.txt*, then sorts the output. Suppose that you want to then find all unique words in
these files and view the result. You could enter:

```
sort frank.txt george.txt hank.txt > temp1
uniq < temp1 > temp2
more temp2
rm temp1 temp2
```

But this is more work than is necessary. What you want is to take the out-
put of *sort* and connect it to the input of *uniq*, then take the output of *uniq*
and connect it to *more*. You would use the following pipe:

```
sort frank.txt george.txt hank.txt | uniq | more
```

The vertical bar character (|) is used between the *sort* and *uniq* com-
mands to indicate that the output from *sort*, which would normally have
been sent to the terminal, is to be redirected from the terminal to the stan-
dard input of the *uniq* command, which in turn sends its output to the
*more* command for viewing.

There are many other examples of pipes. For example, this command for-
mats and paginates a list of your files in three columns:

```
ls | pr -3
```
The program `wc` counts the number of lines, words, and characters in its input, and `who` prints a list of users currently logged on, one per line. Thus, this command tells you the number of users who are logged in by counting the number of lines that comes from the `who` command:

```
who | wc -l
```

This command counts the number of files in the current directory:

```
ls | wc -l
```

Notice the difference in output between `wc -l` and `wc`. By default, `wc` tells you how many lines, word and characters, there are in the input. However, `wc -l` tells you only how many lines.

Any program that reads from the terminal keyboard can read from a pipe instead. Any program that displays output to the terminal screen can send input to a pipe. You can have as many elements in a pipeline as you wish.
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Tasks
Chapter 4
Tasks

4.1 Introduction 4-1

4.2 Gaining Access to the System 4-1
   4.2.1 Logging In 4-1
   4.2.2 Logging Out 4-2
   4.2.3 Changing Your Password 4-2

4.3 Configuring Your Terminal 4-3
   4.3.1 Changing Terminals 4-3
   4.3.2 Setting Terminal Options 4-4

4.4 Editing the Command Line 4-4
   4.4.1 Entering a Command Line 4-4
   4.4.2 Erasing a Command Line 4-4
   4.4.3 Halting Screen Output 4-5

4.5 Manipulating Files 4-5
   4.5.1 Creating a File 4-5
   4.5.2 Displaying File Contents 4-5
   4.5.3 Combining Files 4-7
   4.5.4 Moving a File 4-8
   4.5.5 Renaming a File 4-8
   4.5.6 Copying a File 4-9
   4.5.7 Deleting a File 4-9
   4.5.8 Finding Files 4-10
   4.5.9 Linking a File to Another File 4-10

4.6 Manipulating Directories 4-11
   4.6.1 Printing the Name of Your Working Directory 4-11
   4.6.2 Listing Directory Contents 4-12
   4.6.3 Creating a Directory 4-14
   4.6.4 Removing a Directory 4-14
   4.6.5 Renaming a Directory 4-14
   4.6.6 Moving a Directory 4-14
   4.6.7 Copying a Directory 4-15

4.7 Moving in the File System 4-15
   4.7.1 Finding Out Where You Are 4-16
   4.7.2 Changing Your Working Directory 4-16
4.8 Using File and Directory Permissions  4-17
   4.8.1 Changing Permissions  4-19
   4.8.2 Changing Directory Search Permissions  4-21

4.9 Processing Information  4-21
   4.9.1 Comparing Files  4-21
   4.9.2 Echoing Arguments  4-22
   4.9.3 Sorting a File  4-23
   4.9.4 Searching for a Pattern in a File  4-23
   4.9.5 Counting Words, Lines, and Characters  4-24
   4.9.6 Delaying a Process  4-25

4.10 Controlling Processes  4-26
   4.10.1 Placing a Process in the Background  4-26
   4.10.2 Killing a Process  4-27

4.11 Getting Status Information  4-27
   4.11.1 Finding Out Who is on the System  4-28
   4.11.2 Finding Out What Processes Are Running  4-28
   4.11.3 Finding Out Lineprinter Information  4-29

4.12 Using the Lineprinter  4-30
   4.12.1 Printing Files: lp  4-30
   4.12.2 Using lp Options  4-31
   4.12.3 Cancelling a Print Request: cancel  4-32
   4.12.4 Finding Out the Status of A Print Request: lpstat  4-32

4.13 Communicating with Other Users  4-33
   4.13.1 Sending Mail  4-33
   4.13.2 Receiving Mail  4-34
   4.13.3 Writing to a Terminal  4-34

4.14 Using the System Clock and Calendar  4-35
   4.14.1 Finding Out the Date and Time  4-35
   4.14.2 Displaying a Calendar  4-35

4.15 Using the Automatic Reminder Service  4-36

4.16 Using Another User’s Account  4-36

4.17 Calculating  4-37
4.1 Introduction

This chapter explains how to perform common tasks with XENIX. The individual commands used to perform these tasks are discussed more thoroughly in the XENIX Reference Manual.

4.2 Gaining Access to the System

To use the XENIX system, you must first gain access to it by logging in. When you log in you are placed in your own personal working area. Logging in, changing your password, and logging out are described below.

4.2.1 Logging In

Before you can log in to the system, you must be given a system "account." Your name must be added to the user list, and you must be given a password and a mailbox.

Depending on how your system is administered, you may have to add your name to the user list yourself, or someone else may be assigned this task. If you must add your own account to the system, see the XENIX Operations Guide and mkuser(C) in the XENIX Reference Manual for more information. This section assumes your account has already been set up.

Normally, the system sits idle and the prompt "login:" appears on the terminal screen. If your screen is blank, or displays nonsense characters, press the INTERRUPT key a few times.

When the "login:" prompt appears, follow these steps:

1. Enter your login name and press RETURN. If you make a mistake, press Ctrl-u to start the line again. After you press RETURN the word "Password:" appears on your screen.

2. Enter your password carefully, then press RETURN. The letters do not appear on your screen as you enter, and the cursor does not move. If you make a mistake, press RETURN to restart the login procedure.

If you have entered your login name and password correctly the "prompt character" appears on the screen. This is usually a dollar sign ($). The prompt tells you that the XENIX system is ready to accept commands from the keyboard.
If you make a mistake, the system displays the message:

```
Login incorrect
login:
```

If you get this message, follow the above procedure again. You must enter all the letters of your user name and password correctly before you are given access to the system; XENIX does not allow you to correct your mistakes when entering your password.

Depending on how your system is set up, after you log in you may see a “message of the day” that says something like “Welcome to XENIX”, or an announcement that is of interest to all users.

### 4.2.2 Logging Out

The logout procedure is simple—all you need to do is press:

```
Ctrl-d
```

alone on a line. In general, Ctrl-d signifies the end-of-file in XENIX, and is often used within programs to signal the end of input from the keyboard. In such cases, Ctrl-d will not log you out; it will simply terminate input to a particular program if you are within that program. This means that it may sometimes be necessary to press Ctrl-d several times before you can log yourself out. For example, if you are in the mail program you must press Ctrl-d once to exit the mail program, then again to log out.

### 4.2.3 Changing Your Password

To prevent unauthorized users from gaining access to the system, each authorized user must have a password. When you are first given an account on a XENIX system you are assigned a password by the system administrator. Some XENIX systems require you to change your password at regular intervals. Whether yours does or not, it is a good idea to change your password regularly to maintain system security. This section tells you how to change your password.

Use the `passwd` command to change your password. Follow these steps:

1. Enter:

   ```
   passwd
   ```

   and press RETURN.
The following message appears:

Changing password for user
Old password:

2. Carefully enter your old password. It is not displayed on the screen.
If you make a mistake, press RETURN. The message "Sorry" appears, then the system prompt. Begin again with step 1.

3. When you have entered your old password the message:

   New password:

appears. Enter your new password and press RETURN.

4. The message:

   Re-enter new password:

appears. Enter your new password again. If you make a mistake,
press RETURN. The message:

   They don't match; try again

appears, and you must begin again with step 1. When you have com-
pleted the procedure, the system prompt appears.

4.3 Configuring Your Terminal

On most systems, the primary monitor is already configured for use with
XENIX. However, other terminals of various types may be connected to a
XENIX system. In these cases it is important to know how to set terminal
options and how to specify the terminal you are using. You may also want
to change the standard configuration of the standard primary monitor. The
following section discusses these topics.

4.3.1 Changing Terminals

The terminal type is displayed each time you log in. If you ever need to log
in to XENIX on a terminal of a type different than the terminal you nor-
mally use, you may need to change your environment by editing the .profile
file in your home directory. To do this, use a text editor to locate the tset
line that looks something like this:

eval 'tset -m :\?unknown -s -r -Q'
Change *unknown* in this line to the terminal type of your terminal. For example, if you normally log in on a vt100 terminal, change the line to:

```bash
eval 'tset -m \?vt100 -s -r -Q'
```

Each time you log in you then see the message:

```
TERM = (vt100)
```

Press RETURN and the terminal type is set to vt100, or enter another terminal type and press RETURN.

### 4.3.2 Setting Terminal Options

There are a number of terminal options that can be set with the command `stty`. When entered without parameters, `stty` displays the current terminal settings. For example, typical output might look like this:

```
speed 9600 baud
erase 'h' ; kill 'u'
even -nl
```

Each of the above characteristics can be set with `stty`. For more information, see `stty (C)` in the XENIX Reference Manual.

### 4.4 Editing the Command Line

When you sit in front of a terminal and enter commands at your keyboard, there are a number of special keys that you can use. The most useful ones are described below.

#### 4.4.1 Entering a Command Line

From your terminal, entering a command line consists of typing characters then pressing RETURN. Once you have pressed RETURN the computer reads the command line and commands specified on that line are executed. You may enter as many command lines as you want without waiting for commands to complete, because XENIX supports type-ahead of characters.

#### 4.4.2 Erasing a Command Line

When entering commands, typing errors are bound to occur. To erase the current command line, press Ctrl-u.
4.4.3 Halting Screen Output

In many cases, you will be examining the contents of a file on the terminal screen. For longer files, the contents will often scroll off the screen faster than you can examine them. To temporarily halt a program’s output to the terminal screen, press Ctrl-s. To resume output, press Ctrl-q.

4.5 Manipulating Files

File manipulation (creating, displaying, combining, copying, moving, naming, and deleting files), is one of the most important capabilities an operating system provides. The XENIX commands that perform these functions are described in the following sections.

4.5.1 Creating a File

To create a file and place text in it, use the editor vi, described in Chapter 2 of the XENIX User’s Guide, “vi: A Text Editor.” If for some reason you wish to create an empty file, enter:

```
> filename
```

where filename is the name of the empty file. In general, new files are created by commands as needed.

4.5.2 Displaying File Contents

The more command displays the contents of a file one screenful at a time. It has the form:

```
more options filename
```

more is useful for looking at a file when you do not want to make changes to it. For example, to display the contents of the file memos, enter:

```
more memos
```

more can be invoked with options that control where the display begins, and how the file is displayed.

These options include:

```
+linenumber
```

Beginning the display at the line in the file designated by linenumber.
Introduction to XENIX

+/text
Begin the display two lines before text, where text is a word or number. If text is two or more words, they must be enclosed in double quotation marks.

-c
Redraws the screen instead of scrolling.

-r
Displays control characters, which are normally ignored by more.

To begin looking at the file memo at the first occurrence of the words “net gain”, for example, enter:

more +/"net gain" memo

If the file is more than one screenful long, the percentage of the file that remains is displayed on the bottom line of the screen. To look at more of the file, use the following scrolling commands:

RETURN Scrolls down one line.

d Scrolls down one-half screen.

SPACE Scrolls down a full screen.

nSPACE Scrolls down n lines.

. Repeats the previous command.

You cannot scroll backward, toward the beginning of the file.

You can search forward for patterns in more with the slash (/) command.

For example, to search for the pattern “net gain”, enter:

/net gain/

and press RETURN. more displays the message:

...skipping

at the top of the screen, and scrolls to a location two lines above “net gain.”

If you are looking at a file with more and decide you want to change the file, you can invoke the vi editor by pressing:

v


4-6
more quits automatically when it reaches the end of a file. To exit more before the end of a file, enter:

q

The head and tail commands display the first and last ten lines of a file, respectively. They are useful for checking the contents of a particular file.

For example, to look at the first ten lines of the file memo, enter:

head memo

You can also specify how many lines the head and tail commands display. For example:

tail -4 memo

displays the last four lines of memo.

The cat command also displays the contents of a file. cat scrolls the file until you press Ctrl-s to stop it. Pressing Ctrl-q will continue the scrolling. cat stops automatically at the end of a file. If you wish to stop the display before the end of the file, press INTERRUPT. To display the contents of one file, enter:

cat file1

To display the contents of more than one file, enter:

cat file1 file2 file3

4.5.3 Combining Files

The cat command is frequently used to combine files into some other new file.

Thus, to combine the two files named file1 and file2, into a new file named bigfile, enter:

cat file1 file2 >bigfile

Note here that we are putting the contents of the two files into a new file with the name bigfile. The greater than sign (>) is used to redirect output of the cat command to the new file.
You can also use `cat` to append one file to the end of another file. For example, to append `file1` to `file2`, enter:

```
cat file1 >> file2
```

The contents of `file1` are added to `file2`. `file1` still exists as a separate entity.

### 4.5.4 Moving a File

The `mv` command moves a file into another file in the same directory, or into another directory.

For instance, to move a file named `text` to a new file named `book`, enter:

```
mv text book
```

After this move is completed, no file named `text` will exist in the working directory, because the file has been renamed `book`.

To move a file into another directory, give the name of the destination directory as the final name in the `mv` command. For instance, to move `file1` and `file2` into the directory named `/tmp`, enter:

```
mv file1 file2 / tmp
```

The two files you have moved no longer exist in your working directory, but now exist in the directory `/tmp`. The above command has exactly the same effect as entering the following two commands:

```
mv file1 / tmp/file1
mv file2 / tmp/file2
```

The `mv` command always checks to see if the last argument is the name of a directory and, if so, all files designated by filename arguments are moved into that directory.

### 4.5.5 Renaming a File

To rename a file, simply “move” it to a file with the new name: the old name of the file is removed. Thus, to rename the file `anon` to `johndoe`, enter:

```
mv anon johndoe
```

Note that moving and renaming a file are essentially identical operations.
4.5.6 Copying a File

There are two forms of the `cp` command: one in which files are copied into a directory, and another in which a file is copied to another file. Thus, to copy three files into a directory named `filer`, enter:

```
cp file1 file2 file3 filer
```

In the above command, three files are copied into the directory `filer`; the original versions still reside in the working directory. Note that the filenames are identical in the two directories. Like the `mv` command, `cp` always checks to see if the last argument is the name of a directory, and, if so, all files designated by filename arguments are copied into that directory.

To create two copies of a file in your own working directory, you must rename the copy. To do this, the copy command can be invoked as follows:

```
cp file filecopy
```

After the above command has executed, two files with identical contents reside in the working directory. To learn how to copy directories, see section 4.6.7, “Copying a Directory”, later in this chapter.

4.5.7 Deleting a File

To delete or remove files, enter:

```
rm file1 file2
```

In the above command, the files `file1` and `file2` are removed from your working directory.

The command:

```
rm -i file1 file2
```

allows you to interactively remove files by asking you if you really want to delete each of the files `file1` and `file2`. If you press `y` followed by a RETURN, the given file is removed; if you press `n` the file is left untouched. This command is useful when cleaning up a directory that contains many files.
4.5.8 Finding Files

The `find` command searches for files that have a specified name. `find` is useful for locating files that have the same name, or just for finding a file if you have forgotten which directory it is in.

The command has the form:

```
find pathname -name filename -print
```

The `pathname` is the pathname of the directory you want to search. `find` searches recursively, that is, it starts at the named directory and searches downward through all files and subdirectories under the directory specified in `pathname`.

The `-name` option indicates that you are searching for files that have a specific `filename`. (There are other search conditions you can use with `find`; see `find`(C) in the XENIX Reference Manual.)

`filename` is the name of the file you are searching for.

The `-print` option indicates you want to print the pathnames of all the files that match `filename` on your terminal screen. You may direct this output to a file instead of your screen with the output redirection symbol, `>`. (There are other actions that can be performed with `find`, such as removing and moving files; see `find`(C) in the XENIX Reference Manual.) For example, the following command finds every file named `memo` in the directory `/usr/joe` and all its subdirectories:

```
find /usr/joe -name memo -print
```

The output might look like this:

```
/usr/joe/memo
/usr/joe/accounts/memo
/usr/joe/meetings/memo
/usr/joe/mail/memo
```

4.5.9 Linking a File to Another File

The `ln` command joins two files in different directories so that when the file is changed in one directory, it is also changed in the other directory. This can be useful if several users need to share information, or if you want a file to appear in more than one directory. This command has the form:

```
ln file newfile
```
where file is the original file, and newfile is the new, linked file. For example, the following command links memos in /usr/joe to joemos in /usr/mary:

\[
\text{ln /usr/joe/memos /usr/mary/joemos}
\]

Whenever /usr/joe/memos is updated, the file /usr/mary/joemos is also changed.

When you link files a name is associated with an inode. An inode specifies a unique set of data on the disk. One or more names can be associated with this data. Thus, the above command assures that the files dir1/file1 and dir2/file2 have identical contents.

There are three things that are not immediately obvious about linking files:

1. Linking large sets of files to other parallel files can save a considerable amount of disk space.

2. Linking files used by more than one person is risky, because any party can alter the file and thus affect the contents of all files linked to it.

3. Removing a file from a directory does not remove other links to the file. Thus the file is not truly deleted from the system. For example, if you delete a file that has 4 links, 3 links remain.

For more information about linking see ln (C) in the XENIX Reference Manual.

4.6 Manipulating Directories

Because of the hierarchical organization of the file system, there are many directories and subdirectories in the XENIX system. Within the file system are directories for each user of the system. Within your user directory you can create, delete, and copy directories. Commands that let you manipulate directories are described in the following sections.

4.6.1 Printing the Name of Your Working Directory

All commands are executed relative to a "working" directory. The name of this directory is given by the pwd command, which stands for "print working directory." For instance, if your current working directory is /usr/joe, when you enter:

\[
\text{pwd}
\]
you will get the output:

    /usr/joe

You should always think of yourself as residing "in" your working directory.

4.6.2 Listing Directory Contents

You can list the contents of a directory with the `lc` command. This command sorts the names of files and directories in a given directory, and lists them in columns. If no directory name is given, `lc` lists the contents of the current directory. The `lc` command has the form:

    lc options name

For example, to list the contents of the directory `work`, enter:

    lc work

Your output might look like this:

    accounts  meetings  notes
    mail      memos      todo

If no `name` is specified, `lc` lists the contents of the current directory. If `accounts` is the current directory, for example, the command:

    lc

lists the names of the files and subdirectories in that directory.

The following options control the sort order and the information displayed by the `lc` command:

    -a  Lists all files in the directory, including the "hidden" files (filenames that begin with a dot, such as `.profile` and `.mailrc`).
    -r  Lists names in reverse alphabetical order.
    -t  Lists names in order of last modification, the latest (most recently modified) first. When used with the `-r` option, lists the oldest first.
-R  Lists all files and directories in the current directory, plus each file and directory below the current one. The "R" stands for "recursive."

-F  Marks directories with a backslash (\) and executable files with an asterisk (*).

The `ls` command works much like the `ls` command except that it lists files in vertical, rather than columnar, form. The `ls -l` command gives a "long" listing of a directory, producing an output that might look something like this:

```
total 501
  drwxr-x--- 2 boris grp1 272 Apr 5 14:33 dir1
  drwxr-x--- 2 enid grp1 272 Apr 5 14:33 dir2
  drwxr-x--- 2 iris  grp1 592 Apr 6 11:12 .dir3
-rw-r----- 1 olaf  grp2 282 Apr 7 15:11 file1
-rw-r----- 1 olaf  grp2  72 Apr 7 13:50 file2
-rw-r----- 1 olaf  grp2 1403 Apr 1 13:22 file3
```

Reading from left to right, the information given for each file or directory includes:

- Permissions
- Number of links
- Owner
- Group
- Size in bytes
- Time of last modification
- Filename

The information in this listing and how to change permissions are discussed below in Section 4.8, "Using File and Directory Permissions."

For more information about listing the contents of a directory, see `ls (C)` in the XENIX Reference Manual.
4.6.3 Creating a Directory

To create a subdirectory in your working directory, use the `mkdir` command. For instance, to create a new directory named `phonenumbers`, simply enter:

```
mkdir phonenumbers
```

After this command has been executed, a new empty directory will exist in your working directory.

4.6.4 Removing a Directory

To remove a directory located in your working directory, use the `rmdir` command. For instance, to remove the directory named `phonenumbers` from the current directory, simply enter:

```
rmdir phonenumbers
```

Note that the directory `phonenumbers` must be *empty* before it can be removed; this prevents catastrophic deletions of files and directories. If you want to live dangerously, it is possible to recursively remove the contents of a directory using the `rm` command, but that will not be explained here. See `rm(C)` in the XENIX *Reference Manual* for more information.

4.6.5 Renaming a Directory

To rename a directory, use the `mv` command. For instance, to rename the directory `little.dir` to `big.dir`, enter:

```
mv little.dir big.dir
```

This is a simple renaming operation; no files are moved.

4.6.6 Moving a Directory

The `mv` command also moves directories. This command has the form:

```
mv oldirectory newdirectory
```

where `newdirectory` is a directory that already exists.
For example, to move the directory /usr/joe/accounts into /usr/joe/overdue enter:

\texttt{mv /usr/joe/accounts /usr/joe/overdue}

The new pathname of /usr/joe/accounts is /usr/joe/overdue/accounts.

\subsection*{4.6.7 Copying a Directory}

The \texttt{copy} command copies directories. This command has the form:

\texttt{copy options olddir newdir}

To copy all the files in the directory /usr/joe/memos into /usr/joe/notes enter:

\texttt{copy /usr/joe/memos /usr/joe/notes}

The files in /usr/joe/memos are copied into /usr/joe/notes. The \texttt{copy} command has the following options:

\begin{itemize}
  \item \texttt{-l} Links the copied files to the original.
  \item \texttt{-m} Gives the copied files the same modification dates as the original files.
  \item \texttt{-r} Copies the directory recursively, i.e., copies all the directories under the named directory.
\end{itemize}

\subsection*{4.7 Moving in the File System}

When using the XENIX system, it helps to imagine a large tree structure of files and directories. Each directory should be thought of as a place that you can move into or out of. At all times you are "someplace" in the tree structure. This place is called either your working directory or current directory. The commands used to find out where you are and to move around in the tree structure are discussed below.
4.7.1 Finding Out Where You Are

Your current location in the file system is the name of the working directory. You can find out this name by using the `pwd` command, which stands for "print working directory." For example, if you are in the directory `/usr` then entering the command:

```
pwd
```

prints out the name:

```
/usr
```

4.7.2 Changing Your Working Directory

Your working directory represents your location in the file system: it is "where you are" in XENIX. To alter this location in the XENIX file system, use the change directory (cd) command:

```
cd
```

This changes your working directory to your home directory. To move to any other directory, specify that directory as an argument to `cd`.

For instance, the following command:

```
cd /usr
```

moves you to the `/usr` directory. Because you are always "in" your working directory, changing working directories is much like "traveling" from directory to directory.

To move up one directory from your current directory, enter:

```
cd ..
```

For example, the above command would move you from the directory `/usr/joe/work` to `/usr/joe`. Similarly, the command:

```
cd ../..
```

would move you from the directory `/usr/joe/work` to `/usr`, moving you up two directories.
4.8 Using File and Directory Permissions

The XENIX system allows the file owner to restrict access to files and directories, limiting who can read, write and execute files owned by him. To determine the permissions associated with a given file or directory, use the `ls -l` command. The output from the `ls -l` command should look something like this:

```
total 501
drwxr-x--- 2 boris grp1 272 Apr 5 14:33 dir1
drwxr-x--- 2 enid grp1 272 Apr 5 14:33 dir2
drwxr-x--- 2 iris grp1 592 Apr 6 11:12 dir3
-rw-r----- 1 olaf grp2 282 Apr 7 15:11 file1
-rw-r----- 1 olaf grp2 72 Apr 7 13:50 file2
-rw-r----- 1 olaf grp2 1403 Apr 1 13:22 file3
```

Permissions are indicated by the first ten characters of the output. The permissions for `dir1`, the first file in the above list, are:

```
drwxr-x---
```

The first character indicates the type of file and must be one of the following:

- Indicates an ordinary file.
- `d` Indicates a directory.
- `c` Indicates a character special device such as a lineprinter or terminal.
- `b` Indicates a block special device such as a hard or floppy disk.
- `n` Indicates a name special file (i.e., a semaphore used for controlling access to some resource).
- `s` Indicates a shared data file.
- `p` Indicates a named pipe.

From left to right, the next nine characters are interpreted as three sets of three permissions each. Each respective set of three indicates the following permissions:

- Owner permissions
- Group permissions
- All other user permissions
Within each set, the three characters indicate permission to read, to write, and to execute the file as a command, respectively. For a directory, "execute" permission means permission to search the directory for any included files or directories.

Ordinary file permissions have the following meanings:

- **r**: The file is readable.
- **w**: The file is writeable.
- **x**: The file is executable.
- **-**: The indicated permission is not granted.

For directories, permissions have the following meanings:

- **r**: Files can be listed in the directory; the directory must also have "x" permission.
- **w**: Files can be created or deleted in the directory; as with "r", the directory itself must also have "x" permission.
- **x**: The directory can be searched. A directory must have "x" permission before you can move to it with the cd command (i.e., cd to it), access a file within it, or list the files in it. Remember that a user must have "x" permission to do anything useful to the directory.

The following are some typical directory permission combinations:

- **d--------**: No access at all. This is the mode that denies access to the directory to a class of users.
- **drwx------**: Allows access by only the owner to use ls, create files, delete files, access files (subject to file permissions), and cd to the directory. This is the typical permission for the owner of a directory.
- **drwxr-x---**: Allows access by members of the group to use ls, and access files subject to file permissions. Group members can cd to this directory, but cannot create or delete files in it. This is the typical permission an owner gives to others who need access to files in his directory.
- **drwx-x--x**  With these permission settings users other than the owner cannot use ls but can cd to the directory. Other
users can only access a file within this directory by its exact name; they cannot use special characters. Files cannot be created or deleted in the directory by anyone except the owner. This mode is rarely used, but can be useful if you want to give someone access to a specific file in a directory without permitting access to other files in the same directory.

This chapter discusses ordinary files, executable files, and directories only. For information about other types of files, see ls (C) in the XENIX Reference Manual.

4.8.1 Changing Permissions

The chmod command changes the read, write, execute, and search permissions of a file or directory. This command is useful if you have created a file in one mode, but want to give others permission to read, write or execute it.

The chmod command has the form:

    chmod  instruction  filename

The instruction segment of the command indicates which permissions you want to change for which class of users. There are three classes of users, and they are defined as follows:

u  User, the owner of the file or directory

g  Group, the group the owner of the file belongs to

o  Other, all users of the system

a  All classes of users

There are three types of permissions, as follows:

r  Read, which allows permitted users to look at but not change or delete the file.

w  Write, which allows permitted users to change or even delete the file.

x  Execute, which allows permitted users to execute the file as a command.
For example, assume file1 exists with the following permissions:

```
-rw-r--r--
```

In the above example, the owner of the file has read and write permission, group members have read permission, and others have no access at all.

To give file1 read permission for all classes of users, enter:

```
chmod a+r file1
```

In the instruction segment of the command (a+r) the "a" stands for "all."

The resulting permissions are:

```
-rw-r--r--
```

For file1 with the attributes:

```
-rw-------
```

The following command gives write and execute permissions to members of a group only:

```
chmod g+w+x file1
```

This command would alter the permission attributes so they look like this:

```
-rw--w+x--
```

To remove write and execute permission by the user (owner) and group associated with file1, enter:

```
chmod ug-w+x file1
```
4.8.2 Changing Directory Search Permissions

Directories also have an execute permission. This attribute signifies search permission, rather than execute permission, since directories cannot be executed. If this permission is denied to a particular user, then that user cannot even list the names of the files in the directory.

For example, assume that the directory dir1 has the following attributes:

```
drwxr-xr-x
```

To remove search permission for other users to examine dir1, enter:

```
chmod o-xr dir1
```

The new attributes for dir1 are:

```
drwxr-x---
```

4.9 Processing Information

In many cases, files will contain information that you may want to process. Various utility programs exist on XENIX to process information. A set of these programs and their uses are described in the following sections.

4.9.1 Comparing Files

To compare two text files use the `diff` command to print out those lines that differ between the files that you specify.

For example, suppose that a file named men has the contents:

```
Now is the time for all good men to
Come to the aid of their party.
```

and that a file named women has the following contents:

```
Now is the time for all good women to
Come to the aid of their party.
```

If this is the case, then the command:

```
diff men women
```
produces the following results:

```
1c1
< Now is the time for all good men to
---
> Now is the time for all good women to
```

A three-way difference listing can be created with the `diff3` command. For information about `diff3` see `diff3(C)` in the XENIX Reference Manual.

### 4.9.2 Echoing Arguments

The `echo` command echos arguments to the standard output. For example, entering:

```
echo hello
```

outputs:

```
hello
```

on the terminal screen. To output several lines of text, surround the echoed argument in double quotation marks and press RETURN between lines. A secondary prompt will appear until you enter the final double quotation mark. For example, enter:

```
echo "Now is the time
For all good men
To come to the
Aid of their party."
```

This will output:

```
Now is the time
For all good men
To come to the
Aid of their party.
```

echo is particularly useful if you should ever program in the shell command language. For more information about the shell, see Chapter 4, "The Shell", XENIX User's Guide.
4.9.3 Sorting a File

One of the most useful file processing commands is sort. By default, sort sorts the lines of a file according to the ASCII collating sequence (i.e., it alphabetizes them).

For example, to sort a file named phonelist, enter:

```
sort phonelist
```

In the above case, the sorted contents of the file are displayed on the screen. To create a sorted version of phonelist named phonesort, enter:

```
sort phonelist >phonesort
```

Note that sort is useful for sorting the output from other commands. For example, to sort the output from execution of a who command, enter:

```
who | sort >whosort
```

This command takes the output from who, sorts it, and then sends the sorted output to the file whosort.

A wide variety of options are available for sort. For more information, see sort(C) in the XBNIX Reference Manual.

4.9.4 Searching for a Pattern in a File

The grep command selects and extracts lines from a file, printing only those lines that match a given pattern. For example, to print out all lines in a file containing the word “tty38”, enter:

```
grep 'tty38' file
```

In general, you should always enclose the pattern you are searching for in single quotation marks (''), so that special metacharacters are not expanded unexpectedly by the shell.

As another example, assume that you have a file named phonelist that contains a name followed by a phone number on each line. Assume also that there are several thousand lines in this list. You can use grep to find the phone number of someone named Joe, whose phone number prefix is 822, as follows:

```
grep 'joe' phonelist | grep '822-' >joes.number
```

grep finds all occurrences of lines containing the word “joe” in the file phonelist. The output from this command is then filtered through another grep command, which searches for an “822-” prefix, thus removing any
unwanted joes. Finally, assuming that a unique phone number for joe
exists with the "822-" prefix, that name and number are placed in the file
joes.number.

For more information about grep, its relatives fgrep and egrep, and the
types of patterns it can be used to search for (called regular expressions)
see grep (C) in the XENIX Reference Manual.

4.9.5 Counting Words, Lines, and Characters

wc is a utility for counting words in a file. The letters "wc" stand for word
count. Words are presumed to be separated by punctuation, spaces, tabs,
or newlines. wc also counts characters and lines; all three counts are
reported by default.

For example, to count the number of lines, words, and characters in the
file textfile, enter:

wc  textfile

Typical output describing lines, words and characters might be:

    4432   18188   97808  textfile

To specify a count of characters, words, or lines only, you must use an
appropriate mnemonic switch.

To illustrate, examine the following three commands and the output pro-
duced by each:

wc -c  textfile
    97808  textfile

wc -w  textfile
    18188  textfile

wc -l  textfile
    4432  textfile

The first example prints out the number of characters in textfile, the second
prints out the number of words, and the third prints out the number of
lines.
4.9.6 Delaying a Process

The `at` program allows you to set up commands to be executed at a specified time. It is useful if you want to execute a command when you are not planning to be at your terminal, or even logged in.

The `at` command accepts standard input and has the form:

```
cat file | at time day
```

`file` is the name of the file that contains the command or commands to be executed. `time` is the time of day, in digits, followed by “am” or “pm.” One- and two-digit numbers are interpreted as hours, three- and four-digit numbers as hours and minutes. More than four digits is not permitted.

`day` is optional. It is either a month name followed by a day number, or a day of the week. If no `day` is specified, the command will be executed today.

For example, if you want to find out what processes are running at 10 pm on Tuesday, place the following line in a file named `use`:

```
ps -a > /usr/myname/use
```

(See Chapter 2, “vi: A Text Editor,” of the XENIX User’s Guide for information on creating and inserting text into files.)

After you have written out the file and returned to command level, enter:

```
cat use | at 10pm tues
```

Press RETURN. The XENIX prompt reappears and you may continue working. At 10 pm on Tuesday, XENIX will execute `ps -a` and place the output in the file `use`. `at` is unaffected by logging out.

To check what files you have waiting to be processed, use the `at -l` command. `at -l` lists the files the user owns to be processed, along with the following information:

- The file’s ID number
- The command invoking the file (`at` or `batch`).
- The date and time the file will be processed

To cancel an `at` command, first check the list of files you have to be processed and note the file ID number. Then use the `at -r` command to remove the file or files from the list.
Introduction to XENIX

The `at -r` command has the form:

```
    at -r number
```

For example:

```
    at -r 504510300.a
```

removes file number 504510300.a, canceling whatever commands were included in that file. A user can only remove his own files.

4.10 Controlling Processes

In XENIX, several processes can run at the same time. For example, you may run the `sort` program on a file in the "background," and edit another file in the "foreground" while the `sort` program is running. Things that you directly control at your keyboard are called foreground processes. Other processes, which you can initiate but that you otherwise have little control over, are called background processes. At any one time you can have only one foreground process executing, but multiple background processes may execute simultaneously. Controlling foreground and background processes is the subject of this section.

4.10.1 Placing a Process in the Background

Normally, commands sent from the keyboard are executed in strict sequence; one command must finish executing before the next can begin. Executing commands of this type are called foreground processes. A background process, in contrast, need not finish executing before you give your next command. Background commands are especially useful for commands that may take a long time to complete.

To place a process in the background, enter an ampersand (&) at the end of the command. For example, to count the number of words in several large files while simultaneously continuing with whatever else you have to do, enter:

```
    wc file1 file2 file3 >count.&
```

Output is collected in the file `count`. If output were not put in `count`, it would appear on the screen at unpredictable times as you continue with your work.

When processes are placed in the background, you lose control of them as they execute. For instance, entering `INTERRUPT` does not abort a background process. You must use the `kill` command, described in the following section, instead.
4.10.2 Killing a Process

To stop execution of a foreground process, press your terminal's INTER-
RUPT key. This kills whatever foreground command is currently running.
To kill all your processes executing in the background, enter:

    kill 0

To kill only a specified process executing in the background, first enter:

    ps

`ps` displays the Process Identification Numbers (PIPs) of your existing
processes, for example:

    PID  TTY   TIME  CMD
    3459  03  0:15  -sh
    4831  03  1:52  cc    program.s
    5185  03  0:00  ps

In the above example, you might enter:

    kill 4831

where 4831 is the PID of the process that you want killed.

---

**Note**

Killing a process associated with the vi editor may leave the terminal
in a strange mode. Also, temporary files that are normally created
when a command starts, and then deleted when the command
finishes, may be left behind after a kill command. Temporary files are
normally kept in the directory `/tmp`. This directory should be
checked periodically and old files deleted.

---

4.11 Getting Status Information

Because XENIX is a large, self-contained computing environment, there
are many things that you may want to find out about the system itself, such
as who is logged in, how much disk space there is, what processes are
currently running. This section explains the types of information available
from the system and how to get it.
4.11.1 Finding Out Who is on the System

The `who` command lists the names, terminal line numbers, and login times of all users currently logged on to the system. For example, enter:

```
who
```

This command produces something like the following output on your terminal screen:

```
arnold tty02 Apr  7 10:02
daphne tty21 Apr  7 07:47
elliot tty23 Apr  7 14:21
ellen tty25 Apr  7 08:36
gus tty26 Apr  7 09:55
adrian tty28 Apr  7 14:21
```

The `finger` command provides more detailed information, such as office numbers and phone extensions. For more information, about using `finger` see `finger(1)` in the XENIX Reference Manual.

4.11.2 Finding Out What Processes Are Running

Because commands can be placed in the background for processing, it is not always obvious which processes you are responsible for. The `ps` command stands for "process status" and displays information about currently running processes associated with your terminal. For instance, the output from a `ps` command might look like this:

```
  PID TTY TIME CMD
10308 38  1:36 ed chap02.man
        49 38  0:29 -sh
11267 38  0:00 ps
```

The PID column gives a unique process identification number that can be used to kill a particular process. The TTY column shows the terminal that the process is associated with. The TIME column shows the cumulative execution time for the process. Processes can be killed using the `kill` command. See section 4.10.2, "Killing a Process," for information on how to use the `kill` command.

To find out all the processes running on the system, use the `-a` option:

```
ps -a
```
To find out about the processes running on a terminal other than the terminal you are using, use the -t option and specify the terminal number. For example, to find out what processes are associated with terminal 13, enter:

```
ps -t13
```

For more information about `ps` and its options, see `ps(1)` in the XENIX Reference Manual.

### 4.11.3 Finding Out Lineprinter Information

You can find out the status of files you requested printed with the `lpstat` command. `lpstat` displays information on an individual file or on all your files waiting to be printed.

To find out the status of one file, you need to know the "request ID." When you make print requests using the `lp` command, you find a request ID displayed on your terminal screen. The request ID has the form:

```
printer—idnumber
```

`printer` is the name of the printer your file will be printed on (check with your system manager for the names of printers available to you) and `idnumber` is a unique number identifying your file.

To find out the status of a particular file, enter:

```
lpstat request ID
```

`lpstat` responds by displaying the date and time you made your print request and the number of characters remaining to be printed.

To find out the status of all your files waiting to be printed on the lineprinters, enter:

```
lpstat
```

`lpstat` responds by displaying the request IDs and status information for all your files.

You can find out what files are waiting to be printed on a particular printer by using `lpstat` with the `-p` option. This command has the form:

```
lpstat -p printer
```

`lpstat` responds by printing the request IDs and status information for all the files waiting to be printed on the named printer.
For more information on `lpstat` and its options, see `lpstat(5)` in the XENIX Reference Manual.

4.12 Using the Lineprinter

The XENIX lineprinter commands are easy to use and give you great flexibility when you want to print a file. With a few simple commands, you can print multiple copies of a file, cancel a print request, or ask for a special option on a particular printer. Since the XENIX lineprinter system is designed to be easily adapted to many different environments, check with your system manager to find out what lineprinters and printer options are available to you.

4.12.1 Printing Files: `lp`

To print copies of your files, you can use either the `lp` command or `lpr`. These commands are equivalent. The examples in this section use `lp`.

For example, to print one copy of a file named `memo`, enter:

```
lp memo
```

You can request that several files be printed. For example, to print three files named `memo`, `report`, and `letter`, enter:

```
lp memo report letter
```

When you make print requests, `lp` responds by displaying your “request ID” on your terminal screen. Your request ID might look like this:

```
pr4-532
```

The first part (pr4) is the name of the printer your file will be printed on. The second part (532) identifies your file. Should you later wish to cancel your print request or check its status, you will find it useful to remember your request ID. For more information on these tasks, see sections 4.12.3, “Canceling a Print Request,” and 4.12.4, “Finding Out the Status of A Print Request: Lpstat.”

One copy of each file you named will be printed on the default destination printer on your system.

You can use `lp` with pipes and other commands. The command to paginate a file is `pr`. To paginate and print a file named `textfile`, enter:

```
pr textfile | lp
```
To sort, paginate, and print a file named \textit{datafile}, enter:

\begin{verbatim}
sort datafile | pr | lp
\end{verbatim}

\section*{4.12.2 Using \texttt{lp} Options}

The \texttt{lp} command has several options to help you control the output from your printer.

You can specify the number of copies you want printed by using the number option, -n. For example, to print two copies of a file named \textit{report}, enter:

\begin{verbatim}
lp report -n2
\end{verbatim}

Another option, -d, specifies your file's destination, that is, which printer your file will be printed on. Check with your system manager for the names of the printers available to you. To have two copies of a file named \textit{report} printed on a printer named \textit{quick}, enter:

\begin{verbatim}
lp report -n2 -dquick
\end{verbatim}

Other useful options include:

- \texttt{c} Makes a copy of the files you are printing. This prevents you from inadvertently removing or changing the file before it is printed.

- \texttt{m} Sends you mail telling you your file has been printed.

- \texttt{o} Specifies printer options. For example, you may be able to request that your document be printed using 12 pitch type. Check with your system manager to see what options are available for each printer or groups of printers on your system.

- \texttt{r} Removes your files after printing.

For more information on options available for the \texttt{lp} command, see \texttt{lp(C)} in the XENIX \textit{Reference Manual}. 
4.12.3 Canceling a Print Request: cancel

You can cancel a print request. For example, to stop printing a file with a request ID of laser-245, enter:

    cancel laser-245

The `cancel` command immediately stops the file from being printed, even if the printer has already begun the print request.

You can also use the `cancel` command to stop whatever is currently printing on a particular printer. With `cancel`, you can easily free up a printer to print the next file, or stop it from printing strange output without contacting your system manager.

For example, to cancel whatever file is currently printing on a printer named `slow`, enter:

    cancel slow

If the file did not belong to you, mail will automatically be sent to the file's owner reporting that the print request was canceled.

4.12.4 Finding Out the Status of A Print Request: lpsstat

To find out the status of your files waiting to be printed, enter:

    lpsstat

`lpsstat` gives output similar to:

<table>
<thead>
<tr>
<th>request ID</th>
<th>login name</th>
<th>characters</th>
<th>date</th>
</tr>
</thead>
<tbody>
<tr>
<td>prt1-121</td>
<td>chrisw</td>
<td>450</td>
<td>Dec 15 09:30</td>
</tr>
<tr>
<td>laser-450</td>
<td>chrisw</td>
<td>4968</td>
<td>Dec 15 09:46</td>
</tr>
</tbody>
</table>

The first column shows the request ID for each of your files being printed; the second column is your login name. In the third column, the number of characters to be printed is shown, and the fourth column lists the dates and times you made your print requests.
To learn the status of a particular file, use the `lpstat` command with your request ID. For example, to find out the status of a file with the request ID of `daisy-256`, enter:

```
lpstat daisy-256
```

`lpstat` displays the status of that file only.

You can also request the status of various printers on your system by using the `-p` option or by giving the name of the particular printer you are interested in.

To find out the status of all the printers on your system, enter:

```
lpstat -p
```

To find out the status of a printer named `quick`, enter:

```
lpstat -pquick
```

`lpstat` displays the request ID and status information for each file currently waiting to be printed on the printer named `quick`.

For more information on `lpstat` and its options, see `lpstat(1)` in the XENIX Reference Manual.

### 4.13 Communicating with Other Users

Because the XENIX system supports multiple users, it is very convenient to communicate with other users of the system. The various methods of communication are described below.

#### 4.13.1 Sending Mail

`mail` is a system-wide facility that permits you and other system users to send and receive mail. To send mail to another user on the system, enter:

```
mail joe
```

where `joe` is the name of any user of the system. Following entry of the command, you enter the actual text of the message you want to send. Entry of text is terminated by pressing `Ctrl-d`.
A complete session at the terminal might look like this on your screen:

```
mail -s "Meeting today" joe
There will be a meeting at 2:00 today
to review recent problems with the
new system.
Crtl-d
```

Note the use of the -s switch to specify the subject of the message.

For practice, send mail to yourself. (This is not as strange as it might sound
— mail to yourself is a handy reminder mechanism.) You can also send a
previously prepared letter, and you can send mail to a number of people all
at once. For more details, see Chapter 3, "Mail", of the XENIX User's
Guide, and mail(C) in the XENIX Reference Manual.

### 4.13.2 Receiving Mail

When you log in, you may sometimes get the message:

```
you have mail
```

To read your mail, enter:

```
mail
```

A heading for each message is then displayed on your terminal screen.
When you press RETURN, the contents of the first message are displayed.
Subsequent messages are displayed, one message at a time, most recent
message first, each time you press RETURN.

After each message is displayed, mail waits for you to tell it what to do with
the message. The two basic responses are d, which deletes the message,
and RETURN, which does not delete the message (so it will still be there the
next time you read your mailbox). To exit mail, enter: q, for "quit." Other
responses are described in the XENIX Reference Manual under mail(C).

### 4.13.3 Writing to a Terminal

To write directly to another user's terminal, use the write command. For
example, to write to joe's terminal, enter:

```
write joe
```
After you have executed the command by pressing RETURN, each subsequent line that you enter is displayed both on your own terminal screen and on Joe's. To terminate the writing of text to Joe, enter a Ctrl-d alone on a line.

The procedure for a two-way write is for each party to end each message with a distinctive signal; normally (o) for "over"; when a conversation is about to be terminated use the signal (oo) for "over and out."

4.14 Using the System Clock and Calendar

There are several XENIX commands that will tell you the date and time, or display a calendar for any month or year you choose. The following sections explain these commands.

4.14.1 Finding Out the Date and Time

The date command displays the time and date. Enter:

date

The date and time are displayed.

4.14.2 Displaying a Calendar

The cal command displays the calendar of any month or year you specify. This command has the form:

    cal month year

For example, to display the calendar for March, 1952 enter:

    cal 3 1952
The result is:

March 1952

2  3  4  5  6  7  8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31

The month must always be expressed as a digit. To display the calendar for an entire year, leave out the month. The year must always be expressed in full; the command "cal 85" displays the calendar for the year 85, not 1985.

4.15 Using the Automatic Reminder Service

An automatic reminder service is normally available for all XENIX users. Once each day, XENIX uses the calendar command to examine each user's home directory for a file named calendar, the contents of which might look something like this:

1/23 David's wedding
2/9  Mira's birthday
3/30 Paul's birthday
4/27 Meeting at 2:00
9/1  Karen's birthday
10/3  License renewal

calendar examines each line of the calendar file, extracting from the file those lines containing today's and tomorrow's dates. These lines are then mailed to you to remind you of the specified events.

4.16 Using Another User's Account

You can easily access another user's files, regardless of the permission settings, with the su command. The su procedure resembles logging in, and you must know the other user's password.

For example, to become user Joe, enter:

```
su joe
```

and press RETURN. When the password prompt appears, enter Joe's password. To cancel the effect of the su command and return to your own account, press Ctrl-d.
4.17 Calculating

The `bc` command invokes an interactive desk calculator that can be used as if it were a hand-held calculator. A typical session with `bc` is shown below. Comments explain what action is performed after each input line.

```c
/* This is a comment */
123.456789 + 987.654321     /* Add and output */
1111.111110
9.0000000 - 9.0000001 /* Subtract and output */
-.0000001
64/8    /* Divide and output */
8
1.12345678934 * 2.3 /* Note precision */
2.58395061548
19%4    /* Find remainder */
3
3^4 /* Exponentiation */
81
2/1*2 /* Note precedence */
4
2/(1*2) /* Note precedence again */
1
x = 46.5 /* Assign value to x */
y = 52.5 /* Assign value to y */
x + y + 1.0000 /* Add and output */
100.0000
obase=16 /* Set hex output base */
15 /* Convert to hex */
F
16 /* Convert to hex */
10
64 /* Convert to hex */
40
255 /* Convert to hex */
FF
256 /* Convert to hex */
100
512 /* Convert to hex */
200
quit/* Must type whole word */
```

Also available are scaling, function definition, and programming statements much like those in the C programming language. Other features include assignment to named registers and subroutine calling. For more information, see Chapter 5, "bc: A Calculator", XENIX User's Guide.
Index

CHARACTERS

* see Asterisk (*)
- see Dash (-)
. see Period (.)
/ see Slash (/)
? see Question mark (?)
' see Quotation marks, single (')
[] see Brackets ([]) 
> see Greater-than sign (>)

A

a character, permission change 4–20
-a option
  function 3-10
Absolute pathname see Pathname
Account, new user 2-1
Addition see Calculation
Alphabetizing see sort command
Ampersand (&)
  background command 3-9
  background process 4-26
Appending see Output
Appending files 4-8
Argument
  switch see Switch
Asterisk (*)
  filename, use avoidance 3-5
  filename wildcard 3-8
  pattern matching functions 3-7
at command 4-25
at -r command 4-25

B

Background process 4-26, 4-27
ampersand (&) operator 4-26
Backslash (\)
  erasing 2-4
  escape character 2-4
BACKSPACE key
  erasure function 2-4
  literal 2-4
  delete character 2-4
Batch processing see Command
bc command
  calculation 4-37
/bin directory
  contents 3-5
Binary file see File
BKSP key
  command-line buffer editing 3-9
Block special device 4-17
Brackets ([])
  filename, use avoidance 3-5
  pattern-matching functions 3-8
BREAK key
  program stopping 2-5
  terminal nonsense character removal 2-1

C

cal command 4-35
Calculation
  example 4-37
  calendar command 4-36
cancel command see lp command
Case significance 2-3
cat
  command 4-7
  file
    combining 4-7
    contents display 2-3
  cd command 4-16
  directory change 3-5
Changing
  password 4-2
  terminal types 4-3
Character counting 4-24
Character special device 4-17
chmod
  command 4-19, 4-21
  directory permission change 3-2
  file permission change 3-1
Commands
  see also Specific Command
  at -r 4-25,
  background submittal 3-9
  batch processing see Background submittal
  cal 4-35
  cat 4-7, 4-8
  cd 4-16
  copy 4-15
  cp 4-9
  dash (-) use 3-5
calculation 4-37
date 4-35
diff 4-21
diff3 4-22
directory
  see /bin directory
  see Directory
echo 4-22
entering error correction 2-4
Index

Commands (continued)
  execution 3-9
  RETURN key required 2-2
  sequence 4-26
  find 4-10
  head 4-7
  kill 4-28
  Id 4-12
  ln 4-10
  lowercase letters 3-10
  mkdir 4-14
  more 4-5
  multiple commands entry 3-9
  mv 4-8
  name error 2-2
  passwd 4-2
  program invocation 3-9
  ps 4-27
  pwd 4-16
  RETURN key required 2-2
  rm 4-9
  rmfd 4-14
  sort 4-23
  stty 4-4
  syntax 3-10
  tail 4-7
  typing error correction 2-4
  wc 4-24
  Command line
    ampersand (&) effect 3-9
    buffer defined 3-9
    defined 3-9
    entry 4-4
    erasure 4-4
    interpretation 3-9
    multiple commands entry 3-9
    RETURN key effect 4-4
  Comparing files 4-21
  Concatenate see cat command
  Control characters
    filename use restrictions 3-4
  Copying
    see also cp command
  a directory 4-15
  command 4-15
  files 4-9
  Counting, wc command 4-24
  cp command 4-9
  Creating a directory 4-14
  Creating a file 4-5
  Ctrl-c, program stopping 2-5
  Ctrl-d
    end-of-file 4-2
    logging out 2-5
    mail 4-33
  Ctrl-q, output resumption 4-5
  Ctrl-s, output stopping 4-5

Ctrl-u
  command-line buffer editing 3-9
  kill character 2-4
  line kill 4-4
  literal 2-4

Current directory
  change 3-5
  change procedure 4-16
  description 4-16
  printing 4-11
  shorthand name 3-6
  user residence 3-6

D

d command
  mail, message deletion see Mail
  Dash (-), permission
    denial notation 4-18
    ordinary file notation 4-17
    command option use 3-5
    filename, use avoidance 3-5
    switch use 3-10
  date command 2-2 4-35
  DELETE key
    program stopping 2-5
  Deleting a file 4-9
  Deletion see d command
  /dev directory
    contents 3-5
  /dev/console directory
    contents 3-5
  /dev/tty directory
    contents 3-5
  Device
    filename 3-4
    pathname 3-4
  Device special file see Special file
  diff command 4-21
  diff3 4-22

Directory
  access permission see Permission
  /bin see /bin directory
  changing 4-16
  command see cd command
  composition 3-2
  copying 4-15
  creating 4-14
  current directory see Current directory
  description 3-2
  /dev see /dev directory
  diagram 3-3
  file see File
Directory (continued)

File (continued)
comparing 4-21
composition 3-1
copying 4-9
creating 4-5
creation
permission see Permission
time 3-1
write permission control 3-2
defined 3-1
deleting 4-9
deletion
write permission control 3-2
directory see Directory
displaying 4-5, 4-7
editing see vi
filename see Filename
inode number see Inode number
linking 4-10
listing 3-2
manipulation 4-5
modification time 3-1
moving 4-8
name see Filename
pathname
printing 4-16
required 3-4
pattern search see Pattern matching facility
permission 4-17
see also Permission
changing 4-19
listing 4-13
protection 3-1
removal 4-9
renaming 4-8
scratch file directory 3-6
size in bytes 3-1
sorting 4-23
special file see Special file
temporary file see Temporary file
types designated 3-1
Filename
asterisk (*) wildcard 3-8
characters’ use restrictions 3-4
description 3-4
eample designated 3-6
long listing 4-13
question mark (?) representation 3-8
required 3-1, 3-4
unique to directory 3-4
File system
defined 3-3
diagram 3-4
organization 3-3
find command 4-10
Finding a file 4-10
finger command 4-28
Foreground process 4-26, 4-27
Full pathname see Pathname

E

echo command 2-3, 4-22
description, use 2-3
egrep see grep command
Entering error correction 2-4
Exponentiation
see Calculation
see bc

F

fgrep see grep command
File
access
control 3-1
last access time 3-1
permission see Permission
addition see creation
alphabetizing see sorting
appending 4-8
attributes 3-1
binary file 3-1
combining 4-7

I-3
Index

G

Greater-than sign (>)
  file combination 4-7
  output redirection 3-12
  redirection symbol 2-3
  grep command 4-23
  Group permission see Permission

H

head command 4-7
Home directory 4-16

I

Inode number
  defined 3-2
  link see Link
  ls command 3-2
  required for file 3-1, 3-2
Input
  keyboard origin 3-11
  redirection see Redirection
  termination 4-2
INTERRUPT key
  command-line buffer cancellation 3-9
  foreground process killing 4-27
  logging in, nonsense character removal 2-1
  program stopping 2-5

K

Kill
  character see Ctrl-u
  command 4-27, 4-28
  Killing a process 4-27

L

l command 4-13
  -l option
  lc command 2-3, 4-12
  listing 2-3
  lc command 2-3, 4-12 (continued)
  Less-than symbol (<)
  input redirection 3-12
  /lib directory
  contents 3-5
  Line
  counting see wc command
  Lineprinter
  status information 4-29
  Link
  command see ln command
  defined 3-2
  description 4-11
  long listing 4-13
  Linking files 4-10
Listing
  see lc command
  see l command
  directory contents 4-12
  ln command 4-10, 4-11
  Logging in
    Login directory
      new user 2-1
    Login message 2-2
    Login name
      new user 2-1
    Login procedure 2-1, 4-1
    nonsense character removal 2-1
    prompt character 2-1
    terminal behavior remedy 2-5
    type-ahead restriction 2-5, 4-1
  Logging out
    procedure 2-5, 4-2
    terminal behavior remedy 2-5
  lp command
    -c option 4-31
    cancel 4-32
    -d option 4-31
  lpstat command 4-32
    -m option 4-31
    -n option 4-31
    -o option 4-31
    -r option 4-31
    request ID 4-30
    use with pipes 4-30
    use with pr command 4-30
lp
  lpstat 4-32, 4-33
  lpstat command 4-29
  ls command
    function 3-2
    inode number use 3-2
M

Mail
  d command 4-34
  exit
  q command 4-34
message
  deletion 4-34
  display 4-34
prompt 4-34
q command
  exit 4-34
reading 4-34
reminder service 4-36
  -s option 4-34
sending 4-33
you have mail message 2-2

Make directory see mkdir command
mkdir command 4-14
more command 4-5
Move see mv command
mv command 4-8, 4-14
directory moving 4-14

N

Named pipe 4-17
Name special file 4-17

O

(o), write command message card 4-35
(oo), write command message card 4-35
Option
  configuration 3-10
  grouping 3-10
  multiple options
    grouping see grouping
    separate listing 3-10
  position 3-10
  terminal 4-4
Ordinary file see File
Output
  appending
    procedure 3-12
  symbol (>>>) 3-12
control 4-5
file reception 2-3
redirection 2-3, 4-7
  see also Redirection
resumption 4-5
terminal screen destination 3-11

P

Parent directory
  description 3-6
  shorthand name 3-6
passwd command 4-2
Password
  changing 4-2
  invisible on screen 2-1
  logging in 2-1
  new user 2-1
Pathname
  absolute pathname
    example 3-6
    required 3-4
    slash (/) significance 3-5
    unique to system 3-4
  defined 3-5
  full pathname see absolute pathname
  relative pathname
    defined 3-5
    example designated 3-6
    structure 3-5
Pattern matching facility
  cancellation 3-8
  characters 3-7
  description 3-6
  grep command 4-23
Period (.)
  filename use 3-5
  working directory change 4-16
Permission
  block special device notation 4-17
  change 3-2
  denial notation 4-18
  directory permission
    assignment 3-2
    change 3-2, 4-19
    combinations designated 4-18
    file creation, deletion notation 4-18
    file listing notation 4-18
    notation 4-17
    search notation 4-18
    search permission 4-21
  write permission 3-2
execute notation 4-18
file permission
  change 3-1
  denial notation 4-18
  execute permission 4-18
  file creation, deletion notation 4-18
  file listing notation 4-18
  file protection 3-1
  notation 4-17
  read notation 4-18
  required 3-1
Permission (continued)
  file permission (continued)
    write notation 4-18
    listing 4-17
    notation 4-17
    read notation 4-18
    search notation 4-18
    symbols designated 4-17
    type 4-17
    user class specification 4-20
    write notation 4-18

PID
  process identification number 4-27, 4-28

Pipe
  function 3-13
  procedure 3-13
  symbol ( ) 3-13

Pipeline
  defined 3-13

Printing
  Print working directory see pwd command

Process
  background see Background process
  foreground see Foreground process
  Process identification number see PID
  status 4-28

Program stopping 2-5
  Prompt character 2-1, 4-1
  ps command 4-27, 4-28
  pwd command 4-11, 4-16

Q

q command
  mail
    exit 4-34

Question mark (?)
  filename, use avoidance 3-5
  pattern-matching functions 3-8
  single character representation 3-8

Quit see q command

Quotation marks, double (" ) 3-5

Quotation marks, single (’)
  filename, use avoidance 3-5
  grep command 4-23
  pattern matching cancellation 3-8

R

r character, read permission notation 4-18
  -r option 3-10
  -R option, recursive listing 4-13

Read-ahead 2-4

Redirect
  input redirection
    procedure 3-12
    symbol (<) 3-12
  output redirection 4-7
    symbol (>) 2-3, 3-12

Reference Manual
  directory removal information 4-14
  linking information 4-11
  sort command information 4-23
  stty information 4-4
  terminal characteristics setting 2-5

Relative pathname see Pathname

Reminder service
  automatic 4-36

Remove directory 4-14

Remove see rm command

Renaming a file 4-8

Request ID
  1p command 4-30

RETURN key
  command execution 2-2, 4-4
  command-line buffer submittal 3-9
  mail, message display 4-34
  rm command 2-3, 4-9
  rmdir command 4-14
  RUBOUT key, program stopping 2-5

S

  -s option
    mail, subject specification 4-34

Screen
  see Scrolling screen
  see Terminal screen

Scrolling
  commands
    more 4-6
    control 4-5
    screen
      stopping 4-5

Search permission see Permission

Search strings
  example designated 3-11

Searching for a file 4-10
  example designated 3-11

Semaphore 4-17

Semicolon (;)
  command separation 3-9

Shell
  command interpretation 3-9
  echo command 4-22

Single quotation marks
  see Quotation marks, single (’)

Slash (/)
  pathname significance 3-5
Index

Slash (/) (continued)
sort command 4-23
Special characters designated 3-7
pattern matching 3-6
Special file
description 3-2
Shared data file 4-17
Status
command see ps command
information procedures 4-27
stty command
terminal setting 2-5, 4-4
Subdirectory 4-16
Subtraction see Calculation
Switch
defined 3-10
regulations see Option
System
basic concepts 3-1
characteristics 1-2
composition 1-1
tree-structured directory system 3-2

T

tail command 4-7
Temporary file
directory (/tmp) 4-27
kill command warning 4-27
Terminal
changing 4-3
name designation 2-2
options setting 4-4
resetting 2-5
strange behavior remedy 2-5
writing to see write command
Terminal screen
output see Output
scrolling screen see Scrolling screen
/tmp directory 3-6, 4-27
contents 3-6
tty, terminal system name 2-2
Type-ahead 2-4, 4-4
Typing error correction 2-4

U

ugo, permission classification 4-20
umask command
directory permission change 3-2
User
addition 2-1
classification 4-19

User (continued)
mail see Mail
new user 2-1
permission see Permission
/usr directory
contents 3-5
/usr/bin directory
contents 3-5

V

-v option
function 3-10
Vertical bar (|)
pipe symbol 3-13

W

w character
directory permission notation 4-18
file permission, write notation 4-18
wc command 3-14, 4-24
word count 3-14
who command 3-14, 4-28
logged in users list 3-14
Word counting see wc command
Working directory see Current directory
write command 4-34
message end
(o) 4-35
(oo) 4-35

X

x character
directory permission search 4-18
file permission, execute notation 4-18

I-7
XENIX® System V

Operating System

Operations Guide
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# Contents

## 1 Introduction

1.1 Overview  1-1  
1.2 The System Manager  1-1  
1.3 The Super-User Account  1-1  
1.4 The Keyboard  1-2  
1.5 About This Guide  1-3  

## 2 Starting and Stopping the System

2.1 Introduction  2-1  
2.2 Starting the System  2-1  
2.3 Logging In As the Super-User  2-3  
2.4 Stopping the System  2-4  

## 3 Preparing XENIX for Users

3.1 Introduction  3-1  
3.2 Adding a User Account  3-1  
3.3 Changing a User's Password  3-5  
3.4 Forcing a New Password  3-6  
3.5 Creating a Group  3-7  
3.6 Changing a User's Login Group  3-8  
3.7 Changing a UserID  3-10  
3.8 Removing a User Account  3-11  

## 4 Using File Systems

4.1 Introduction  4-1  
4.2 File Systems  4-1  
4.3 Permissions  4-5  
4.4 Managing File Ownership  4-9  
4.5 System Security  4-10  
4.6 Using XENIX Accounting Features  4-13  

## 5 Maintaining File Systems

5.1 Introduction  5-1  
5.2 Maintaining Free Space  5-1  
5.3 File System Integrity  5-6  

-1-
6 Backing Up File Systems

6.1 Introduction 6-1
6.2 The Sysinfo Account 6-1
6.3 Strategies for Backups 6-1
6.4 Using the sysadmin Program 6-3
6.5 Using the tar Command 6-10

7 Using Peripheral Devices

7.1 Introduction 7-1
7.2 Using Multiscree n™ 7-1
7.3 Using a Cartridge Tape Drive 7-2
7.4 Configuring Serial Ports 7-5
7.5 Setting Up a Serial Console 7-6
7.6 Adding a Terminal 7-7
7.7 Setting Terminal Lines 7-10
7.8 Changing Serial Line Operation 7-15
7.9 Setting the Terminal Type 7-16
7.10 Removing a Terminal 7-18
7.11 Modem Usage under XENIX 7-18
7.12 Adding a Lineprinter 7-24
7.13 Adding Additional Memory 7-34
7.14 Adding a Hard Disk 7-36
7.15 Creating Boot and Root Floppy Disks 7-46

8 Solving System Problems

8.1 Introduction 8-1
8.2 Restoring a Nonechoing Terminal 8-1
8.3 Resolving Dialer Difficulties 8-1
8.4 Solving Lineprinter Problems 8-2
8.5 Stopping a Runaway Process 8-2
8.6 Replacing a Forgotten Password 8-3
8.7 Removing Hidden Files 8-3
8.8 Restoring Free Space 8-4
8.9 Restoring Lost System Files 8-4
8.10 Restoring an Inoperable System 8-4
8.11 Recovering from a System Crash 8-4
8.12 Mapping a Bad Track 8-5
8.13 Changing XENIX Initialization 8-6

9 Building a Micnet Network

9.1 Introduction 9-1
9.2 Planning a Network 9-1
9.3 Building a Network 9-5
9.4 Starting the Network  9-11
9.5 Testing a Micnet Network  9-12
9.6 Using a Uucp System  9-15

A  XENIX Special Device Files

A.1 Introduction  A-1
A.2 File System Requirements  A-1
A.3 Special Filenames  A-1
A.4 Block Sizes  A-1
A.5 Gap and Block Numbers  A-2
A.6 Terminal and Network Requirements  A-2

B  XENIX Directories

B.1 Introduction  B-1
B.2 The Root Directory  B-1
B.3 The /bin Directory  B-1
B.4 The /dev Directory  B-1
B.5 The /etc Directory  B-2
B.6 The /lib Directory  B-3
B.7 The /mnt Directory  B-3
B.8 The /tmp Directory  B-3
B.9 The /usr Directory  B-4
B.10 Log Files  B-4
Chapter 1

Introduction

1.1 Overview 1-1
1.2 The System Manager 1-1
1.3 The Super-User Account 1-1
1.4 The Keyboard 1-2
1.5 About This Guide 1-3
1.1 Overview

The XENIX operating system is a powerful system of programs, which allows you to accomplish a full spectrum of tasks, from developing high-level and assembly language programs to creating, editing, and typesetting documents. To keep this powerful system running smoothly, the XENIX system requires careful control of its operation and a regular schedule of maintenance. This guide explains how to operate and maintain the XENIX operating system on your computer, ensuring maximum performance with the least number of system problems.

This guide also explains how to expand a XENIX system with a Micnet network. A Micnet network allows serial communication between other XENIX systems in your work environment. The Micnet programs and commands include the netutil program, which is used to install the network, and the mail, rep, and remote commands, which are used to pass messages, files, and commands over the network.

See Chapter 9, "Building A Micnet Network" for a complete explanation of this facility.

1.2 The System Manager

Every XENIX system should have one person in charge of system maintenance and operation. In this guide, that person is called the system manager. It is the system manager's duty to ensure the smooth operation of the system and to perform tasks that require special privileges.

Depending on the size of the system and the number of users on the system, a system manager's job can be anything from a once-a-week task to a full-time job. Even if the system is small, the system manager should faithfully perform each required maintenance task, since sloppy maintenance can affect XENIX performance.

All tasks in this guide are presented from the system manager's point of view, but many can also be accomplished by ordinary users. Since some of the tasks dramatically change the system's operation, we recommend that, whenever possible, the system manager perform these tasks. This can prevent unwanted or unnecessary changes to the system.

1.3 The Super-User Account

The super-user account is a special account for performing system maintenance tasks. It gives the system manager unusual privileges that ordinary users do not have, such as accessing all files in the system, and executing privileged commands. Many of the tasks presented in this guide require that the system manager be logged in as the super-user. To do this, the sys-
system manager must know the super-user password created during the installation of the XENIX system (see the XENIX Installation Guide).

Users who are authorized to act as the super-user, including the system manager, should log in as the super-user only when it is necessary to perform a system maintenance task. Even if the system manager is the only person using the system, he should create a user account for himself and use it for day-to-day work, reserving the super-user account for system maintenance tasks only.

The number of individuals who are given the super-user password should be kept to a minimum. Misuse of the super-user powers by naive users can result in a loss of data, programs, and even the XENIX system itself.

1.4 The Keyboard

Many keys and key combinations have special meanings in the XENIX system. These keys and key combinations have special names that are unique to the XENIX system, and may or may not correspond to the keytop labels on your keyboard. To help you find the special keys, the following table shows which keys on a typical terminal correspond to XENIX system keys. A list for your particular terminal is in keyboard(HW).

In this table, a hyphen (−) between keys means "hold down the first key while pressing the second."

<table>
<thead>
<tr>
<th>XENIX Name</th>
<th>Keytop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>BREAK</td>
<td>Delete</td>
<td>Stops current action and returns to the shell. This key is also called the INTERRUPT or DELETE key.</td>
</tr>
<tr>
<td>BACKSPACE</td>
<td>Backspace</td>
<td>Deletes the first character to the left of the cursor.</td>
</tr>
<tr>
<td>Ctrl-d</td>
<td>Ctrl-d</td>
<td>Signals the end of input from the keyboard; also exits current shell or initiates the &quot;logout&quot; procedure if the current shell is the login shell.</td>
</tr>
<tr>
<td>Ctrl-h</td>
<td>Erase</td>
<td>Deletes the first character to the left of the cursor. Also called the ERASE key.</td>
</tr>
<tr>
<td>Key Sequence</td>
<td>Key Sequence</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Ctrl-q</td>
<td>Ctrl-q</td>
<td>Restarts printing after it has been stopped with Ctrl-s.</td>
</tr>
<tr>
<td>Ctrl-s</td>
<td>Ctrl-s</td>
<td>Stops printing at the standard output device, for example a terminal. Does not stop the program.</td>
</tr>
<tr>
<td>Ctrl-u</td>
<td>Ctrl-u</td>
<td>Deletes all characters on the current line. Also called the KILL key.</td>
</tr>
<tr>
<td>Ctrl-\</td>
<td>Ctrl-\</td>
<td>Quits current command and creates a core file (Recommended for debugging only). See core(F) for more information.</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>Esc</td>
<td>Exits the current mode; for example, exits insert mode when in the editor vi.</td>
</tr>
<tr>
<td>RETURN</td>
<td>Return</td>
<td>Terminates a command line and initiates an action from the shell.</td>
</tr>
</tbody>
</table>

Many of these special function keys can be modified by the user. See stty(C) for more information.

### 1.5 About This Guide

The tasks presented in this guide range from simple ones requiring very little knowledge about XENIX, to quite complex tasks requiring extensive knowledge about XENIX and your computer.

Each chapter explains the tools and knowledge you need to complete the tasks described in that chapter. In some cases, you may be required to refer to other manuals, such as the XENIX User's Guide.

Chapter 1, "Introduction," introduces this guide.

Chapter 2, "Starting and Stopping the System," explains how to start and stop the XENIX system and how to log in as the super-user, the XENIX system's special system manager account.
Chapter 3, "Preparing XENIX for Users," explains how to create accounts for the users who work on your system, how to assign groups, and how to manage user IDs.

Chapter 4, "Using File Systems," explains how to create and mount file systems, how to set permissions, and how to keep the system secure.

Chapter 5, "Maintaining File Systems," explains how to maintain free space on the root file system and other file systems.

Chapter 6, "Backing Up File Systems," explains how to create backup copies of the root file system and other file systems.

Chapter 7, "Using Peripheral Devices," explains how to add terminals, printers and other peripheral devices.

Chapter 8, "Solving System Problems," explains how to solve system problems such as a jammed lineprinter or a forgotten password.

Chapter 9, "Building a Micnet Network," explains how to create a multiple system mailing network with Micnet.

Appendix A, "XENIX Special Device Files," presents a list of the XENIX system special files, and explains how to use these files when creating and maintaining file systems.

Appendix B, "XENIX Directories," presents a list of commonly used XENIX directories and log files.
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Starting/Stopping System
Chapter 2

Starting and Stopping the System

2.1 Introduction 2-1

2.2 Starting the System 2-1
   2.2.1 Loading the Operating System 2-1
   2.2.2 Cleaning the File System 2-1
   2.2.3 Choosing the Mode of System Operation 2-2

2.3 Logging In As the Super-User 2-3

2.4 Stopping the System 2-4
   2.4.1 Using the shutdown Command 2-4
   2.4.2 Using the haltsys Command 2-5
2.1 Introduction

This chapter explains how to start and stop the XENIX system. It also explains how to log in as the super-user.

2.2 Starting the System

Starting a XENIX system requires more than just turning on the power. You must also perform a series of steps to initialize the system for operation. Starting the system requires:

- Loading the operating system
- Cleaning the file system (if the system was improperly stopped)
- Choosing the mode of system operation

The following sections describe each of these procedures.

2.2.1 Loading the Operating System

The first step in starting the system is to load the operating system from the computer’s hard disk. Follow these steps:

1. Turn on power to the computer and hard disk. The computer loads the XENIX bootstrap program and displays the message:

   Boot:

2. Press the RETURN key. The bootstrap program loads the XENIX operating system.

When the system is loaded, it displays information about itself and checks to see if the “root file system” (i.e., all files and directories) is clean. If it is clean, you may choose the mode of operation. If not, the system requires you to clean the file system before choosing.

2.2.2 Cleaning the File System

You must clean the file system if the system displays the message:

   Proceed with cleaning (y or n)?

This message indicates that the system was not stopped properly as described in the section, “Stopping the System”, given later in this
chapter. The XENIX operating system requires a clean file system to perform its tasks.

To clean the file system, enter y (for "yes") and press the RETURN key. The system cleans the file system, repairing damaged files or deleting files that cannot be repaired. It reports on its progress as each step is completed. At some point, it may ask if you wish to salvage a file. Always answer by entering y and pressing the RETURN key.

When cleaning is complete, the system usually asks you to choose the mode of operation, but it may also display the message:

** Normal System Shutdown **
** Safe to Power Off **
- or -
** Press Any Key to Reboot **

If it displays this message, you must reload the system. You can do this by pressing any key or resetting the computer and repeating the steps given in the previous section. For instructions on how to reset your computer, see the hardware manual provided with the computer.

2.2.3 Choosing the Mode of System Operation

You may choose the mode of XENIX operation as soon as you see the message:

Type CONTROL-d to continue with normal startup,
(or give the root password for system maintenance):

The system has two modes: normal operation and system maintenance mode. Normal operation is for ordinary work on the system. This is the mode you should choose to allow multiple users to log in and begin work. System maintenance mode is a specialized mode reserved for work to be done by the system manager. It does not allow multiple users.

To choose normal operation, press the Ctrl-d key. The system displays a startup message and begins to execute commands found in the command file /etc/rc described in Chapter 8, “Solving System Problems.” When the commands are finished, the system displays the “login:” prompt. You may then log in as a normal user, as described in the XENIX Introduction to XENIX, or as the super-user, as described in the next section.
To choose system maintenance mode, enter the super-user’s password (sometimes called the “root password”) and press the RETURN key. The system displays the message of the day and the maintenance mode prompt (#). The commands in the /etc/rc file are not executed. (Choose system maintenance mode only if you must do system maintenance work that requires all other users to be off the system.)

2.3 Logging In As the Super-User

Many system maintenance tasks, when performed during normal operation, require that you log in as the super-user. For example, you must be logged in as the super-user to stop the system.

Before you may log in as the super-user, you need the super-user password. You also need to see the “login:” message on your terminal’s screen. If you do not see this message, press the Ctrl-d key until it appears.

To log in as the super-user, follow these steps:

1. When you see the “login:” message, enter the super-user’s login name

   root

   and press the RETURN key. The system prompts you for the super-user’s password.

2. Enter the super-user’s password and press the RETURN key. The system does not display the password as you enter it, so enter each letter carefully.

The system opens the super-user account and displays the message of the day and the super-user prompt (#).

Take reasonable care when you are logged in as the super-user. In particular, you should be very careful when deleting or modifying files or directories. Avoid using wildcard designators in filenames and frequently check your current working directory. Small errors can cause annoying and unwanted changes to the system and user files. Some errors can cause irretrievable damage to a file or the system.

You can leave the super-user account at any time by pressing Ctrl-d.
2.4 Stopping the System

Stopping the XENIX system takes more than just turning off the computer. You must prepare the system for stopping by using either the `shutdown` or the `haltsys` command. The following sections describe each command.

2.4.1 Using the `shutdown` Command

The `shutdown` command is the normal way to stop the system and should be used whenever the system is in normal operation mode. It warns other users that the system is about to be stopped and gives them an opportunity to finish their work.

To stop the system with the `shutdown` command, follow these steps:

1. Log in as the super-user (see the section "Logging in as Super-User" in this chapter). The system opens the super-user account and displays the message of the day and the super-user's prompt.

2. Enter:

```
/etc/shutdown
```

and press the RETURN key. The system loads the command which in turn prompts you for the number of minutes you wish to elapse before the computer stops:

```
Minutes till shutdown? (0-15):
```

3. Enter any number from 0 to 15 and press the RETURN key. The system displays a warning message at each terminal, asking logged in users to finish their work and log out. As soon as all users are logged out or the specified time has elapsed, the system closes all accounts and displays the message:

```
** Normal System Shutdown **
** Safe to Power Off **
-or-
** Press Any Key to Reboot **
```

and stops.

You may now turn off the computer.
2.4.2 Using the haltsys Command

The haltsys command may be used to halt the system immediately. In general, it should be used only when no other users are on the system or when the system is in system maintenance mode.

To stop the system with the haltsys command, follow these steps:

1. Log in as the super-user (not required when in system maintenance mode). The system opens the super-user account and displays the message of the day and the super-user prompt.

2. Enter:

    /etc/haltsys

    and press the RETURN key. The system displays the message:

    **Normal System Shutdown**
    **Safe to Power Off**
    -or-
    **Press Any Key to Reboot**

    and stops.

You may now turn off the hard disk and computer.
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User Accounts
Chapter 3
Preparing XENIX for Users

3.1 Introduction 3-1
3.2 Adding a User Account 3-1
3.3 Changing a User's Password 3-5
3.4 Forcing a New Password 3-6
3.5 Creating a Group 3-7
3.6 Changing a User's Login Group 3-8
3.7 Changing a User ID 3-10
3.8 Removing a User Account 3-11
3.1 Introduction

User accounts help the XENIX system manager keep track of the people using the system, and control their access to the system’s resources. Ideally, each user should have a user account. Each account has a unique “login name” and “password” with which the user enters the system, and a “home directory” where the user does his work.

It is the system manager’s job to create accounts for all users on the system. It is also the manager’s job to maintain user accounts by changing user passwords, login groups, and user IDs when necessary.

This chapter explains how to:

- Add user accounts to the system
- Change an account’s password
- Force new passwords
- Create a group
- Change an account’s login group
- Change an account’s user ID
- Remove user accounts from the system

The following sections describe each in detail.

3.2 Adding a User Account

You may add a user account to the system with the mkuser program. The program creates a new entry in the XENIX system’s /etc/passwd file. This entry contains information about the new user, such as login name and initial password, that the system uses to let the user log in and begin work. The program also creates a home directory for the user, a mailbox for use with the mail command, and a .profile or .login file which contains XENIX commands that are executed when the user logs in.

To create a new user account, follow these steps:

1. Login as the super-user.
2. Enter:

    mkuser

    and press the RETURN key. The system displays the following message:

    Mkuser
    -------
    Add a user to the system

    Do you require detailed instructions? (y/n):

3. Enter the letter y (for "yes"), if you want information about the program, otherwise type the letter n (for "no"). Enter q (for "quit") only if you wish to stop the program and return to the system. If you type a "q" to any "(y/n)" prompt, the program will stop and no changes will be made.

    When the program continues, it prompts you to enter the new user’s login name:

    Enter new user’s login name:

    The login name is the name by which XENIX will know the user. It is usually a short version of the user’s actual name, typed in lowercase letters. For example, either "johnd" (a first name and last initial) or "jdoe" (a first initial and last name) is customary for the user John Doe.

4. Enter the new name, and press the RETURN key. The program now prompts you for information about the new user’s group name and group number.

    A group name is the name of the group of users to which the new user will belong. Users in a group have access to a common set of files and directories. The group name is optional. If not given, the XENIX system’s common group “group” (with group ID 50) is used.

    The program prompts:

    Do you want to use the default group? (y/n):

    If you enter "y", the user’s group name will be "group" and the group ID number will be 50.
If you enter "n", the program responds with a list of existing groups:

Existing groups are:

Group "group" (50): demo vdemo cdemo

Do you want to use one of these groups? (y/n):

If you enter either "y" or "n", you are asked which group you want to use. Enter the name of the group. You may create a new group by entering in the new name.

Next, you are prompted for a group number. The group ID, or number, may be any number from 50 to 30000 that isn't already used for another group.

5. After entering the group name and ID, you are prompted for the initial password.

Enter password:

The initial password is the password you assign to the new user. The user will use the initial password to enter the account for the first time. Once in the account, the user should create a new password for himself, one that is hard to guess. (See the section "Changing Your Password" in Chapter 4 of the Introduction to XENIX.)

6. Enter the password, and press the RETURN key.

7. Next, you are prompted for a shell type. You see a list and brief explanation of the available shells (sh, vsh, csh, rsh, and uucp login) and the prompt:

ENTER Shell type (1, 2, 3, 4 or 5) and press RETURN:

sh is the standard (Bourne) shell. vsh is the menu driven "visual" shell, csh is the c-shell rsh is the restricted shell, and uucp login is an entry in /usr/lib/uucp/uucico enabling logging in to the system via uucp. For more information, see vsh (C) in the XENIX Reference Guide.

8. Enter the desired shell number and press RETURN. After you have entered the shell type, the program prompts you for a comment:

Please enter Comment >----------------------
>

3-3
A comment is information about the new user, such as a department name and phone extension. Although, the comment is optional, it is useful if the finger command is often used to display information about users. If given, the comment must be no more than 20 characters long, including spaces. It must not contain any colons (:). The example

John Doe, 123

shows the recommended form for a comment.

9. Enter the comment. Make sure it is 20 characters or less. If you do not wish to enter a comment, just press the RETURN key.

The program now displays what you have entered and the special user entry that it has created for the new user. This entry is copied to the special system file /etc/passwd. The entry shows the login name, the password (encrypted), the user ID, the group ID, the comment, the user's home directory, and the startup program. Items in the entry are separated by colons (:). (For a full description of each item, see passwd(M) in the XENIX Reference Manual.)

The program then gives you an opportunity to change the user name, password, group, or comment:

Username is “johnd”, user ID is 2001.
Group name is “group”, group number is 50.
Comment field is: John Doe, 123
Shell is “/bin/csh”

Do you want to change anything? (y/n):

10. Enter the letter y (for “yes”) and press the RETURN key, if you wish to change something. Enter n (for “no”) and skip to the next step if you wish to complete the new account. (Enter q, for “quit”, only if you wish to leave the program and abort the new account.)

If you enter y, the program prompts for the item you wish to change:

username
password
group
comment
shell

Enter the name of the item you wish to change and press RETURN. After you have changed an item, you see the complete list of items and are asked if you wish to make other changes. When you are finished with any changes, the program adds the user.
11. The program displays the message:

    Password file updated

followed by a description of the actions it has taken to add the new user account to the system. The program then asks if you wish to add another user to the system.

12. Enter y if you wish to add another user. Otherwise, enter n to stop the program and return to the super-user prompt.

A user can log into a new account as soon as it is created. For details see the *Introduction to XENIX*.

### 3.3 Changing a User’s Password

Normally, an ordinary user can change the password of his own account with the `passwd` command (see the *Introduction to XENIX*). Sometimes, however, it may be necessary for the super-user to change the password for him, for example, if the user has forgotten his password and cannot get into the account to change it. The super-user may change the password of any user (including himself) with the `passwd` command.

To change a password, follow these steps:

1. Log in as the super-user.

2. Enter:

    ```
    passwd login-name
    ```

    (where `login-name` is the user's login name) and press the RETURN key. The command displays the message:

    New password:

3. Enter the new password and press the RETURN key. The command does not display the password as you type it, so type carefully. The command then prompts you to enter the password again:

    Retype new password:

4. Enter the password again and press the RETURN key.

To see how an ordinary user can change his own password with the `passwd` command, see the *Introduction to XENIX*.
3.4 Forcing a New Password

From time to time, a user account may need a higher level of security than ordinary. Since the security of any account depends on its password, it is important to keep the password as secret as possible. One way to provide greater security is to force users to change their passwords on a regular basis.

You can force users to change their passwords by using the **pwadmin** command. This command automatically dating each password and requires the user to provide a new password when the specified number of weeks have passed. The command also requires users to wait a minimum number of weeks before allowing them to restore their previous password. To use the **pwadmin** command, you must log in as the super-user.

You can enable password aging for a specified user by using the **-a** option. Enter:

```
pwadmin -a login-name
```

where **login-name** is the login name of a user. The user will then be required to wait a minimum number of weeks before he can change his password, and will be forced to change his password after a maximum number of weeks have elapsed. The **-a** option uses the default minimum and maximum values found in the **/etc/default/passwd** file.

You can choose your own minimum and maximum number of weeks by using the **-min** and **-max** options. For example, a common pair of minimum and maximum values is 2 and 8. To set the minimum and maximum dates, enter:

```
pwadmin -min num -max num login-name
```

where **num** is a number in the range 0 to 63, and **login-name** is simply the login name of the user whose password you are administering. Note that the minimum and maximum cannot both be 0, and that the minimum must not be greater than the maximum.

If you are unsure of the current minimum and maximum values for a password, you can display them by entering:

```
pwadmin -d login-name
```

This command does not change the current values.
If you wish to force a user to change his password immediately, enter:

```
pwadmin -f login-name
```

The user is prompted on his next login to supply a new password.

When a password no longer requires extra security, you can remove the current minimum and maximum values for the password by entering:

```
pwadmin -n login-name
```

The system will no longer prompt for changes.

For more information about password aging, see `pwadmin(C)` and `passwd(M)` in the XENIX Reference Manual.

### 3.5 Creating a Group

A group is a collection of users who share a common set of files and directories. The advantage of groups is that users who have a common interest in certain files and directories can share these files and directories without revealing them to others. Initially, all users belong to the common system group named "group", but you can create new groups by modifying the XENIX system file `/etc/group` using a XENIX text editor.

To create a new group, you need to choose a group name and a group identification number (group ID). You also need to make a list of the users in the new group. The group name may be any sequence of letters and numbers up to eight characters long, and the group ID may be any number in the range 50 to 30000. Both the group name and ID must be unique, i.e., they must not be the same as any existing group name or ID.

To create a new group, follow these steps:

1. Login as the super-user.
2. Display the contents of the `/etc/group` file by entering:

   ```
cat /etc/group
   ```

   and pressing the RETURN key. The `cat` command displays the contents of the `/etc/group` file. The file contains several entries, each defining the group name, group ID, and users for a group. Each entry has the form:

   `group-name:group-ID:users`
The users are shown as a list of login names separated by commas (,). For example, a typical file may look like this:

other:x:1:demo
sys:x:2:
group::50:johnd,suex

3. Check the /etc/group file entries to see that the group name and ID you have chosen are unique.

4. If the group name and ID are unique, invoke a XENIX text editor (see the XENIX User's Guide) and specify /etc/group as the file to edit.

5. Locate the last line in the file, then insert the new entry in the form given above. For example, if you wish to create a group named "shipping" with group ID "142" and users "johnd", "marym", and "suex", enter:

shipping::142:johnd,marym,suex

6. Exit the editor.

To make sure you have entered the group names correctly, use the grpcheck command to check each entry in the /etc/group file. If the new entry is free of errors, no other changes to the file are required.

You can create any number of new groups. Each group may have any number of members. Furthermore, any user may be a member of any number of groups. Multiple group membership is especially convenient for users who have interests that span a variety of areas.

If a user is a member of several groups, he can gain access to each group by using the newgrp command. See the Introduction to XENIX for details.

3.6 Changing a User's Login Group

When a user logs in, the system automatically places the user in his "login group". This is the group given by the group ID in the user's /etc/passwd file entry (see the section "Adding a User Account" in this chapter). You can change the user's login group by changing the group ID. To change the group ID you need the group ID of the new login group, and you need to know how to use a XENIX text editor (see the XENIX User's Guide).

To change the group ID, follow these steps:

1. Login as the super-user.
2. Use the `cd` command to change the current directory to the `/etc` directory. Enter:

```
  cd /etc
```

3. Use the `cp` command to make a copy of the `/etc/passwd` file. Enter:

```
  cp passwd passwd+
```

4. Invoke a text editor and specify `/etc/passwd+` as the file to edit.

5. Locate the desired user’s password entry. Each entry begins with the user’s login name.

6. Locate the user’s group ID number in the user’s password entry. It is the fourth item in the entry. Items are separated by colons (`:`). For example, the entry:

```
marym:9iKlwp:205:50:Mary March, 122:/usr/marym:/bin/sh
```

has group ID “50”.

7. Delete the old group ID and insert the new one. Be sure you do not delete any other portion of the user’s password entry.

8. Exit the editor.

9. Use the `mv` command to save the old `/etc/passwd` file. Enter:

```
  mv passwd passwd-
```

10. Use the `mv` command to make the edited file the new `/etc/password` file. Enter:

```
  mv passwd+ passwd
```

You can make sure you have entered the new login group correctly by using the `pwcheck` command. If the new entry is correct, no other changes to the file are required.

You must not change the group IDs for system accounts such as “cron” and “root”. System accounts are any accounts whose user IDs are less than 200. The user ID is the third item in the password entry.

Note that changing a user’s login group does not change the “group ownership” of his files. Group ownership defines which group has access to a user’s files. If users in the new group wish to access the user’s files, you must change the group ownership with the `chgrp` (for “change group”) command. For details, see the section “Changing Group Ownership” in Chapter 4.
3.7 Changing a User ID

Sometimes it is necessary to change the user ID in a user’s account entry to allow a user to access files and directories transferred from other computers. In particular, if a user has different accounts on different computers and frequently transfers files and directories from one computer to another, the user IDs in each of his account entries must be made the same. You can make them the same by modifying the account entries in the `/etc/passwd` file.

To change a user ID, follow these steps at every computer for which the user has an account:

1. Log in as the super-user.
2. Use the `cd` command to change the current directory to the `/etc` directory. Enter:
   ```
   cd /etc
   ```
3. Use the `cp` command to make a copy of the `/etc/passwd` file. Enter:
   ```
   cp passwd passwd+
   ```
4. Invoke a XENIX text editor and specify `/etc/passwd+` as the file to edit.
5. Locate the user’s account entry. Each entry begins with the user’s login name.
6. Locate the current user ID. The ID is the third item in the entry. For example, the entry:
   ```
   marym:9iK1wp:205:50:Mary March, 122:/usr/marym:/bin/sh
   ```
   has a user ID “205”. Substitute the new user ID for the old one.
7. Exit the text editor.
8. Use the `mv` command to save the old `/etc/passwd` file. Enter:
   ```
   mv passwd passwd-
   ```
9. Use the `mv` command to make the edited file the new `/etc/passwd` file. Enter:

```
mv passwd+ passwd
```

No other changes to the file are required.

In most cases, you can change the user ID to the same number as the user's most-used account. But the new number must be unique at every system for which the user has an account. If there is any conflict (for example, if the number already belongs to another user on one of the systems), you must choose a new number. You can choose any number greater than 200. Just make sure it is unique, and that you copy it to all systems on which the user has an account.

Once a user's ID has been changed, you must change the "user ownership" of the user's files and directories from the old user ID to the new one. You can do this with the `chown` (for "change owner") command described in Chapter 4, "Using File Systems."

For example, to change the ownership of johnd's home directory, enter:

```
chown johnd /usr/johnd
```

Note that you may use the `find` command described in Chapter 6, "Backing Up File Systems," to locate all files and directories with the user's old user ID.

3.8 Removing a User Account

It is sometimes necessary to remove a user account from the system. You can remove a user account with the `rmuser` program. The program deletes the user's entry from the `/etc/passwd` file and removes the user's home directory and mailbox.

Before you can remove the user account, you must remove all files and directories from the user's home directory, or move them to other directories. If you wish to save the files, you may use the `tar` command to copy the files to a floppy disk (see the section "Copying Files to a tar disk" in Chapter 6).

To remove a user account, follow these steps:

1. Login as the super-user.
2. Enter:

```
cd /usr/login-name
```

and press the RETURN key to change to the user's home directory. The `login-name` must be the user's login name.

3. Make sure that you have made copies of all important files and directories in the user's home directory.

4. Use the `rm` (for "remove") command to remove all files and directories from the user's home directory. This includes any files that begin with a period (.), Directories can be removed by using the `-r` (for "recursive") option of the `rm` command. For example, the command:

```
rm -r bin
```

removes the directory named `bin` and all files within this directory.

5. After removing all files and directories, make sure the user's mailbox is empty. Enter:

```
cat /usr/spool/mail/login-name
```

and press the RETURN key, where `login-name` is the user's login name. If the mailbox contains text, enter:

```
cat /dev/null > /usr/spool/mail/login-name
```

and press the RETURN key.

6. When the user's home directory and mailbox are empty, enter:

```
cd /usr
```

and press the RETURN key. The user's home directory cannot be removed until you have moved to another directory.

7. Enter:

```
rmuser
```

and press the RETURN key. The program displays a message explaining how to remove a user:

```
****rmuser-remove a user from the system****
```

Press ENTER when you are ready.
The program then prompts you for the login name of the user you wish to remove:

Enter name of id to be removed.

8. Enter the user's login name. You should now see the message:

Removing user name from the system. CONFIRM? (y/n/q):

9. Enter y (for “yes”) to remove the user from the system. Otherwise enter n (for “no”) to stop the removal, or q (for “quit”) to stop the program. The program removes the user's entry from the /etc/passwd file, the user's mailbox, .profile file, and home directory. The program displays the message:

User name removed from the system

The program now gives you a chance to remove another user:

Do you want to remove another user? (y/n/q):

10. Enter y to remove another user. Otherwise, enter n or q to stop the program.

Note that the rmuser program will refuse to remove an account that has a system name, such as “root”, “sys”, “sysinfo”, “cron”, “uucp”, or a system ID (user ID below 200). Also, the program cannot remove a user account if the user's mailbox still has mail in it, or if the user's home directory contains files other than .profile.
Replace this Page
with Tab Marked:

File Systems
Chapter 4

Using File Systems

4.1 Introduction 4-1

4.2 File Systems 4-1
   4.2.1 Creating a File System 4-1
   4.2.2 Mounting a File System 4-3
   4.2.3 Unmounting a File System 4-4
   4.2.4 Formatting Floppy Disks 4-5

4.3 Permissions 4-5
   4.3.1 Displaying Permissions 4-6
   4.3.2 Changing Permissions 4-7
   4.3.3 Changing the File Creation Mask 4-8

4.4 Managing File Ownership 4-9
   4.4.1 Changing User Ownership 4-9
   4.4.2 Changing Group Ownership 4-10

4.5 System Security 4-10
   4.5.1 Physical Security 4-10
   4.5.2 Access Security 4-11
   4.5.3 Protecting Special Files 4-11
   4.5.4 Copying Floppy Disks 4-11

4.6 Using UNIX Accounting Features 4-13
   4.6.1 Starting Process Accounting 4-13
   4.6.2 Displaying Accounting Information 4-14
4.1 Introduction

This chapter describes one of the most important responsibilities of a system manager: controlling and recording users' access to the files and directories on the system. It introduces file systems, permissions, system security, and process accounting.

4.2 File Systems

A file system is the XENIX system's way of organizing files on mass storage devices such as hard and floppy disks. A file system consists of files, directories, and the information needed to locate and access these items.

Each XENIX system has at least one file system. This file system is called the root file system and is represented by the symbol "/". The root file system contains all the XENIX programs that may be used by the system manager. It usually contains all the user directories as well.

A XENIX system may also have other file systems that contain user directories and application programs. One reason for using other file systems is to expand the available storage space of the system. Each additional file system adds its free space to the system's total space. New file systems can be specifically created by a user, then mounted onto the system so they can be used.

You can create a file system with the mkfs command. This command sets the size and format of the file system and may also copy some files to the new system. You can mount a file system with the mount command. Once mounted, you may access the files and directories in the file system as easily as files and directories in the root file system. (The root file system is permanently mounted.) When you are finished with a file system, you can unmount it with the umount command.

You can create new file systems on any media with the mkfs command. A reason for creating new file systems on floppy disks is to establish a collection of application programs and data files that can be easily mounted and used when needed.

The following sections explain how to create and use file systems.

4.2.1 Creating a File System

You can create a file system on a formatted floppy disk by using the mkfs command.
To create a file system on a floppy disk, you need:

- A formatted floppy disk
- The special filename of a floppy disk drive
- The disk block size of the disk
- The gap and block numbers for the disk

To format a floppy disk, see the section “Formatting Floppy Disks” in this chapter. The special filenames for the disk drives, the disk block size, and the gap and block numbers depend on the specific system and are given in Appendix A.

Note that if a file system already exists on the disk, it will be destroyed by this procedure. For this reason, be particularly careful not to create a new file system on the root file system. If you destroy the root file system, you will have to reinstall the XENIX system.

To make a file system on a floppy disk, follow these steps:

1. Log in. You do not have to be logged in as the super-user to use the `mkfs` command.

2. Insert a formatted floppy disk into a floppy disk drive. Make sure there is no read-only tab on the disk jacket.

3. Enter:

```
/etc/mkfs specialfile blocksize gap block
```

(where `specialfile`, `blocksize`, `gap`, and `block` are supplied by you) and press the RETURN key. The system automatically creates the file system. If it discovers data already on the disk, the system displays the message:

```
mkfs: specialfile contains data. Overwrite? (y/n):
```

If you are sure the disk contains nothing that you want to save, enter `y` and press the RETURN key to overwrite the data and continue creating the file system. Otherwise, enter `n`. If you enter `n`, no file system is created.
For example, the following command creates a file system on the floppy disk drive `/dev/fd1`, with blocksize 320 and gap and block numbers 2 and 8:

```
/etc/mkfs /dev/fd1 320 2 8
```

The actual filename, blocksize, gap, and block numbers vary. For the information specific to your machine see Appendix A.

### 4.2.2 Mounting a File System

Once you have created a file system, you can mount it with the `mount` command. To mount a file system you need:

- The special filename of a disk drive
- The name of an empty directory

The special filenames of disk drives are given in Appendix A. The directory to receive the file system may be any directory as long as it is empty (contains no files) and is not your current working directory. Note that the directory `/mnt` is specifically reserved for mounted file systems.

To mount a file system, follow these steps:

1. **Log in.** You do not have to be logged in as the super-user to use this command.

2. **Insert the disk containing the file system into a floppy disk drive.**

3. **Enter the appropriate `mount` command, and press the RETURN key.** The command should have the form:

   ```
   /etc/mount specialfile directoryname
   ```

   where `specialfile` is the special filename of the disk drive containing the disk, and `directoryname` is the name of the directory to receive the file system. If the disk has a read-only tab, make sure you include the switch `-r` at the end of the command.

For example, you can use the following command to mount the disk in disk drive `/dev/fd1` onto the directory named `/account`:

```
/etc/mount /dev/fd1 /account
```

Remember to make sure that the specified directory is empty before issuing the command. If the command displays the message:

```
mount: Structure needs cleaning
```
use the fsck command to clean the file system and try to mount it again (see the section "File System Integrity" in Chapter 5). If the command displays the message:

mount: Device busy

either the file system has already been mounted and cannot be mounted twice, or a user is currently in the directory. You must wait for users to leave a directory before you can mount the directory.

To check that the file system was properly mounted, use the cd command to change to the directory containing the mounted system and the ls command to list the contents. The command displays the files and directories in the file system. Be sure to use the cd command to leave the directory after finishing your work in it.

Note that frequently used file systems can be mounted automatically when starting the system by appending the appropriate mount commands to the /etc/rc file. See the section, "Changing the /etc/rc File," in Chapter 8 for details.

4.2.3 Unmounting a File System

You can unmount a mounted file system with the umount command. Unmounting a file system does not destroy its contents. It merely removes access to the files and directories in the file system.

To unmount a mounted file system, enter:

/etc/umount specialfile

and press the RETURN key. The specialfile is the name of the special file corresponding to the disk drive containing the disk with the file system. The command empties the directory that previously contained the file system, and makes the directory and the corresponding disk drive available for mounting another file system.

For example, the following command unmounts a file system from the disk drive /dev/fd1:

/etc/umount /dev/fd1

Before unmounting a file system, make sure that no files or directories are being accessed by other commands or programs. The umount command displays the following message if you or another user are currently in the directory containing the file system:

umount: Device busy

4-4
4.2.4 Formatting Floppy Disks

You can format floppy disks with the `format` program. Formatted disks are required whenever you create a file system. They are also required when you back up a file system with the `sysadmin` program (see Chapter 6, "File System Backups").

To format a floppy disk, follow these steps:

1. Insert a disk into floppy disk drive 0. Make sure there is no read-only tab on the disk jacket.

2. Enter:

   `format /dev/device-name`

   and press the RETURN key. The program formats the disk.

**Warning:** The `format` command is machine-specific. Refer to the `format (C)` manual page originally included in the XENIX Installation Guide for more information.

If you do not insert the disk properly into the drive, the program displays an error message and stops.

In general, the system manager should format spare floppy disks in advance. Note that formatting removes all data from the disk, so if you are formatting a disk that already contains data, make sure that the data is nothing you wish to save.

4.3 Permissions

Permissions control access to all the files and directories in a XENIX system. In XENIX, ordinary users may access those files and directories for which they have permission. All other files and directories are inaccessible.

There are three different levels of permissions: user, group, and other. User permissions apply to the owner of the file; group permissions apply to users who have the same group ID as the owner; and other permissions apply to all other users.
4.3.1 Displaying Permissions

You can display the permission settings for all the files in a directory with the `l` (for "list directory") command. This command lists the permissions along with the name of the file's owner, the size (in bytes), and the date and time the file was last changed. The command display has the following format:

```
-rw-rw-- 1 johnd group 11515 Nov 17 14:21 file1
```

The permissions are shown as a sequence of ten characters at the beginning of the display. The sequence is divided into four fields. The first field (the "type" field) has a single character, the other fields ("user", "group", and "other") have three characters each. The characters in the fields have the following meanings.

In the type field:

- `d` Indicates the item is a directory
- `-` Indicates the item is an ordinary file
- `b` Indicates the item is a device special block I/O file
- `c` Indicates the item is a device special character I/O file

In the "user", "group", and "other" fields:

- `r` Indicates read permission. Read permission for a file means you may copy or display the file. Read permission for a directory means you may display the files in that directory.
- `w` Indicates write permission. Write permission for a file means you may change or modify the file. Write permission for a directory means you may create files or subdirectories within that directory.
- `x` Indicates execute permission (for ordinary files) or search permission (for directories). Execute permission for a file means you may invoke the file as you would a program. Execute permission for a directory means you may enter that directory with the `cd` command.
- `-` Indicates no permission.

For example, the permissions:

```
-rwxrwxrwx
```

indicate an ordinary file with full read, write, and execute access for everyone (user, group, and other).
The permissions:

```
-rw-------
```

indicate an ordinary file with read and write access for the user only.

The permissions:

```
drwxr-x--x
```

indicate a directory with search access for everyone, read access for the user and group, and write access for only the user.

When you create a file, the XENIX system automatically assigns the following permissions:

```
-rw-r--r--
```

This means that everyone may read the file, but only the user may write to it. When you create a directory, the system assigns the permissions:

```
drwxr-xr-x
```

This means everyone may search and read the directory, but only the user may create and remove files and directories within it.

### 4.3.2 Changing Permissions

You can change the permissions of a file or a directory with the `chmod` (for “change mode”) command. This command requires that you tell it how to change the permissions of a specific file or directory. You do so by indicating which levels of permissions you wish to change (user “u”, group “g”, or other “o”), how you wish to change them (add “+” or remove “-”), and which permissions you wish to change (read “r”, write “w”, or execute “x”). For example, the pattern:

```
 u+x
```

adds execute permission for the user. The pattern:

```
 go-w
```

removes write permission for group and other.

The `chmod` command has the form:

```
 chmod pattern file...
```
where file is the name of a file or directory. If more than one name is given, they must be separated by spaces. For example, to change the permissions of the file "receivables" from "-rw-r--r--" to "-rw-------", enter:

```
chmod go-r receivables
```

Press the RETURN key.

After using chmod, use the ls command to check the results. If you have made a mistake, use chmod again to correct the mistake.

### 4.3.3 Changing the File Creation Mask

The file creation mask is a special number, kept by the system, that defines the permissions given to every file and directory created by a user. Initially, the mask has the value "022" which means every file receives the permissions:

```
-rw-r--r--
```

Every directory receives the permissions:

```
drwxr-xr-x
```

You can change the mask and the initial permissions your files and directories receive by using the umask command.

The umask command has the form:

```
umask value
```

where value is a three-digit number. The three digits represent user, group, and other permissions, respectively. The value of a digit defines which permission is given as shown by the following table:

<table>
<thead>
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<th>Permission</th>
</tr>
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<tbody>
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<td>Read and write (also execute for directories)</td>
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</tr>
<tr>
<td>5</td>
<td>Write</td>
</tr>
<tr>
<td>6</td>
<td>Execute for directories</td>
</tr>
<tr>
<td>7</td>
<td>No permissions</td>
</tr>
</tbody>
</table>

4-8
For example, the command:

```
umask 177
```

sets the file creation mask so that all files and directories initially have read and write permission for the user, and no permissions for all others.

### 4.4 Managing File Ownership

Whenever a file is created by a user, the system automatically assigns “user ownership” of that file to that user. This allows the creator to access the file according to the “user” permissions. The system also assigns a “group ownership” to the file. The group ownership defines which group may access the file according to the “group” permissions. The group is the same group to which the user who created the file belongs.

Only one user and one group may have ownership of a file at any one time. (These are the owner and group displayed by the `l` command.) However, you may change the ownership of a file by using the `chown` and `chgrp` commands.

#### 4.4.1 Changing User Ownership

You can change the user ownership of a file with the `chown` command. The command has the form:

```
chown login-name file ...
```

where `login-name` is the name of the new user, and `file` is the name of the file or directory to be changed. For example, the command:

```
chown johnd projects.june
```

changes the current owner of the file `projects.june` to “johnd”.

The `chown` command is especially useful after changing the user ID of a user account (see the section, “Changing a User’s ID” in Chapter 3).

You must be logged in as the super-user to use this command.
4.4.2 Changing Group Ownership

You can change the group ownership of a file with the `chgrp` command.

The command has the form:

```
chgrp group-name file ...
```

where `group-name` is the name of a group given in the `/etc/group` file and `files` are the name of the file you wish to change. For example, the command:

```
chgrp shipping projects.june
```

changes the group ownership of the file `projects.june` to the group named "shipping".

The `chgrp` command is especially useful if you have changed the login group of a user (see the section, "Changing a User's Login Group" in Chapter 3).

4.5 System Security

Every system, no matter what its size, should have some form of protection from unauthorized access to the computer, disks, and system files. The following sections suggest ways for a system manager to protect the system.

4.5.1 Physical Security

You can protect the physical components of the computer, especially system disks, by taking these steps:

1. Keep unessential personnel out of the work area.
2. Organize and lock up all floppy disks when not in use. They should not be stored with the computer itself.
3. Keep disks away from magnetism, direct sunlight, and severe changes in temperature.
4. Do not use ball point pens to write labels on disks.
5. Make backup copies of all floppy disks (see the section, "Copying Floppy Disks," in this chapter).
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File Systems
Chapter 4

Using File Systems

4.1 Introduction  4-1

4.2 File Systems  4-1
  4.2.1 Creating a File System  4-1
  4.2.2 Mounting a File System  4-3
  4.2.3 Unmounting a File System  4-4
  4.2.4 Formatting Floppy Disks  4-5

4.3 Permissions  4-5
  4.3.1 Displaying Permissions  4-6
  4.3.2 Changing Permissions  4-7
  4.3.3 Changing the File Creation Mask  4-8

4.4 Managing File Ownership  4-9
  4.4.1 Changing User Ownership  4-9
  4.4.2 Changing Group Ownership  4-10

4.5 System Security  4-10
  4.5.1 Physical Security  4-10
  4.5.2 Access Security  4-11
  4.5.3 Protecting Special Files  4-11
  4.5.4 Copying Floppy Disks  4-11

4.6 Using XENIX Accounting Features  4-13
  4.6.1 Starting Process Accounting  4-13
  4.6.2 Displaying Accounting Information  4-14
4.1 Introduction

This chapter describes one of the most important responsibilities of a system manager: controlling and recording users' access to the files and directories on the system. It introduces file systems, permissions, system security, and process accounting.

4.2 File Systems

A file system is the XENIX system's way of organizing files on mass storage devices such as hard and floppy disks. A file system consists of files, directories, and the information needed to locate and access these items.

Each XENIX system has at least one file system. This file system is called the root file system and is represented by the symbol "/". The root file system contains all the XENIX programs that may be used by the system manager. It usually contains all the user directories as well.

A XENIX system may also have other file systems that contain user directories and application programs. One reason for using other file systems is to expand the available storage space of the system. Each additional file system adds its free space to the system's total space. New file systems can be specifically created by a user, then mounted onto the system so they can be used.

You can create a file system with the mkfs command. This command sets the size and format of the file system and may also copy some files to the new system. You can mount a file system with the mount command. Once mounted, you may access the files and directories in the file system as easily as files and directories in the root file system. (The root file system is permanently mounted.) When you are finished with a file system, you can unmount it with the umount command.

You can create new file systems on any media with the mkfs command. A reason for creating new file systems on floppy disks is to establish a collection of application programs and data files that can be easily mounted and used when needed.

The following sections explain how to create and use file systems.

4.2.1 Creating a File System

You can create a file system on a formatted floppy disk by using the mkfs command.
To create a file system on a floppy disk, you need:

- A formatted floppy disk
- The special filename of a floppy disk drive
- The disk block size of the disk
- The gap and block numbers for the disk

To format a floppy disk, see the section “Formatting Floppy Disks” in this chapter. The special filenames for the disk drives, the disk block size, and the gap and block numbers depend on the specific system and are given in Appendix A.

Note that if a file system already exists on the disk, it will be destroyed by this procedure. For this reason, be particularly careful not to create a new file system on the root file system. If you destroy the root file system, you will have to reinstall the XENIX system.

To make a file system on a floppy disk, follow these steps:

1. Log in. You do not have to be logged in as the super-user to use the mkfs command.

2. Insert a formatted floppy disk into a floppy disk drive. Make sure there is no read-only tab on the disk jacket.

3. Enter:

   `/etc/mkfs specialfile blocksize gap block`

   (where `specialfile`, `blocksize`, `gap`, and `block` are supplied by you) and press the RETURN key. The system automatically creates the file system. If it discovers data already on the disk, the system displays the message:

   `mkfs: specialfile contains data. Overwrite? (y/n):`

   If you are sure the disk contains nothing that you want to save, enter `y` and press the RETURN key to overwrite the data and continue creating the file system. Otherwise, enter `n`. If you enter `n`, no file system is created.
For example, the following command creates a file system on the floppy
disk drive /dev/fd1, with blocksize 320 and gap and block numbers 2 and 8:

/etc/mkfs /dev/fd1 320 2 8

The actual filename, blocksize, gap, and block numbers vary. For the
information specific to your machine see Appendix A.

4.2.2 Mounting a File System

Once you have created a file system, you can mount it with the mount com-
mand. To mount a file system you need:

- The special filename of a disk drive
- The name of an empty directory

The special filenames of disk drives are given in Appendix A. The direc-
tory to receive the file system may be any directory as long as it is empty
(contains no files) and is not your current working directory. Note that the
directory /mnt is specifically reserved for mounted file systems.

To mount a file system, follow these steps:

1. Log in. You do not have to be logged in as the super-user to use this
   command.

2. Insert the disk containing the file system into a floppy disk drive.

3. Enter the appropriate mount command, and press the RETURN
   key. The command should have the form:

   /etc/mount specialfile directoryname

   where specialfile is the special filename of the disk drive containing
   the disk, and directoryname is the name of the directory to receive
   the file system. If the disk has a read-only tab, make sure you
   include the switch -r at the end of the command.

For example, you can use the following command to mount the disk in disk
drive /dev/fd1 onto the directory named /account:

/etc/mount /dev/fd1 /account

Remember to make sure that the specified directory is empty before issu-
ing the command. If the command displays the message:

mount: Structure needs cleaning

4-3
use the `fsck` command to clean the file system and try to mount it again (see the section "File System Integrity" in Chapter 5). If the command displays the message:

`mount: Device busy`

either the file system has already been mounted and cannot be mounted twice, or a user is currently in the directory. You must wait for users to leave a directory before you can mount the directory.

To check that the file system was properly mounted, use the `cd` command to change to the directory containing the mounted system and the `1` command to list the contents. The command displays the files and directories in the file system. Be sure to use the `cd` command to leave the directory after finishing your work in it.

Note that frequently used file systems can be mounted automatically when starting the system by appending the appropriate `mount` commands to the `/etc/rc` file. See the section, "Changing the `/etc/rc` File," in Chapter 8 for details.

### 4.2.3 Unmounting a File System

You can unmount a mounted file system with the `umount` command. Unmounting a file system does not destroy its contents. It merely removes access to the files and directories in the file system.

To unmount a mounted file system, enter:

```
/etc/umount specialfile
```

and press the RETURN key. The `specialfile` is the name of the special file corresponding to the disk drive containing the disk with the file system. The command empties the directory that previously contained the file system, and makes the directory and the corresponding disk drive available for mounting another file system.

For example, the following command unmounts a file system from the disk drive `/dev/fd1`:

```
/etc/umount /dev/fd1
```

Before unmounting a file system, make sure that no files or directories are being accessed by other commands or programs. The `umount` command displays the following message if you or another user are currently in the directory containing the file system:

`umount: Device busy`
4.2.4 Formatting Floppy Disks

You can format floppy disks with the `format` program. Formatted disks are required whenever you create a file system. They are also required when you back up a file system with the `sysadmin` program (see Chapter 6, "File System Backups").

To format a floppy disk, follow these steps:

1. Insert a disk into floppy disk drive 0. Make sure there is no read-only tab on the disk jacket.

2. Enter:

   ```
   format /dev/device-name
   ```

   and press the RETURN key. The program formats the disk.

**Warning:** The `format` command is machine-specific. Refer to the `format (C)` manual page originally included in the XENIX Installation Guide for more information.

If you do not insert the disk properly into the drive, the program displays an error message and stops.

In general, the system manager should format spare floppy disks in advance. Note that formatting removes all data from the disk, so if you are formatting a disk that already contains data, make sure that the data is nothing you wish to save.

4.3 Permissions

Permissions control access to all the files and directories in a XENIX system. In XENIX, ordinary users may access those files and directories for which they have permission. All other files and directories are inaccessible.

There are three different levels of permissions: user, group, and other. User permissions apply to the owner of the file; group permissions apply to users who have the same group ID as the owner; and other permissions apply to all other users.
4.3.1 Displaying Permissions

You can display the permission settings for all the files in a directory with the `l` (for "list directory") command. This command lists the permissions along with the name of the file’s owner, the size (in bytes), and the date and time the file was last changed. The command display has the following format:

```
-rw-rw- -- - johnd group 11515 Nov 17 14:21 file1
```

The permissions are shown as a sequence of ten characters at the beginning of the display. The sequence is divided into four fields. The first field (the "type" field) has a single character, the other fields ("user", "group", and "other") have three characters each. The characters in the fields have the following meanings.

In the type field:

- d Indicates the item is a directory
- - Indicates the item is an ordinary file
- b Indicates the item is a device special block I/O file
- c Indicates the item is a device special character I/O file

In the "user", "group", and "other" fields:

- r Indicates read permission. Read permission for a file means you may copy or display the file. Read permission for a directory means you may display the files in that directory.
- w Indicates write permission. Write permission for a file means you may change or modify the file. Write permission for a directory means you may create files or subdirectories within that directory.
- x Indicates execute permission (for ordinary files) or search permission (for directories). Execute permission for a file means you may invoke the file as you would a program. Execute permission for a directory means you may enter that directory with the `cd` command.
- - Indicates no permission.

For example, the permissions:

```
-rwxrwxrwx
```

indicate an ordinary file with full read, write, and execute access for everyone (user, group, and other).
The permissions:

```
-rw-------
```

indicate an ordinary file with read and write access for the user only.

The permissions:

```
drwxr-x--x
```

indicate a directory with search access for everyone, read access for the user and group, and write access for only the user.

When you create a file, the XENIX system automatically assigns the following permissions:

```
-rw-r--r--
```

This means that everyone may read the file, but only the user may write to it. When you create a directory, the system assigns the permissions:

```
drwxr-xr-x
```

This means everyone may search and read the directory, but only the user may create and remove files and directories within it.

### 4.3.2 Changing Permissions

You can change the permissions of a file or a directory with the `chmod` (for "change mode") command. This command requires that you tell it how to change the permissions of a specific file or directory. You do so by indicating which levels of permissions you wish to change (user "u", group "g", or other "o"), how you wish to change them (add "+" or remove "-"), and which permissions you wish to change (read "r", write "w", or execute "x"). For example, the pattern:

```
u+x
```

adds execute permission for the user. The pattern:

```
go-w
```

removes write permission for group and other.

The `chmod` command has the form:

```
chmod pattern file ...
```
where *file* is the name of a file or directory. If more than one name is given, they must be separated by spaces. For example, to change the permissions of the file "receivables" from "-rw-r--r--" to "-rw-------", enter:

```
chmod go-r receivables
```

Press the RETURN key.

After using `chmod`, use the `l` command to check the results. If you have made a mistake, use `chmod` again to correct the mistake.

### 4.3.3 Changing the File Creation Mask

The file creation mask is a special number, kept by the system, that defines the permissions given to every file and directory created by a user. Initially, the mask has the value "022" which means every file receives the permissions:

```
-rw-r--r--
```

Every directory receives the permissions:

```
drwxr-xr-x
```

You can change the mask and the initial permissions your files and directories receive by using the `umask` command.

The `umask` command has the form:

```
umask value
```

where *value* is a three-digit number. The three digits represent user, group, and other permissions, respectively. The value of a digit defines which permission is given as shown by the following table:

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<td>Read and write</td>
</tr>
<tr>
<td>2</td>
<td>Read (also execute for directories)</td>
</tr>
<tr>
<td>3</td>
<td>Read</td>
</tr>
<tr>
<td>4</td>
<td>Write (also execute for directories)</td>
</tr>
<tr>
<td>5</td>
<td>Write</td>
</tr>
<tr>
<td>6</td>
<td>Execute for directories</td>
</tr>
<tr>
<td>7</td>
<td>No permissions</td>
</tr>
</tbody>
</table>

4-8
For example, the command:

```
umask 177
```

sets the file creation mask so that all files and directories initially have read and write permission for the user, and no permissions for all others.

### 4.4 Managing File Ownership

Whenever a file is created by a user, the system automatically assigns "user ownership" of that file to that user. This allows the creator to access the file according to the "user" permissions. The system also assigns a "group ownership" to the file. The group ownership defines which group may access the file according to the "group" permissions. The group is the same group to which the user who created the file belongs.

Only one user and one group may have ownership of a file at any one time. (These are the owner and group displayed by the `1` command.) However, you may change the ownership of a file by using the `chown` and `chgrp` commands.

#### 4.4.1 Changing User Ownership

You can change the user ownership of a file with the `chown` command. The command has the form:

```
chown login-name file ...
```

where `login-name` is the name of the new user, and `file` is the name of the file or directory to be changed. For example, the command:

```
chown johnd projects.june
```

changes the current owner of the file `projects.june` to "johnd".

The `chown` command is especially useful after changing the user ID of a user account (see the section, "Changing a User's ID" in Chapter 3).

You must be logged in as the super-user to use this command.
4.4.2 Changing Group Ownership

You can change the group ownership of a file with the `chgrp` command.

The command has the form:

```
chgrp group-name file ...
```

where `group-name` is the name of a group given in the `/etc/group` file and `files` are the name of the file you wish to change. For example, the command:

```
chgrp shipping projects.june
```

changes the group ownership of the file `projects.june` to the group named "shipping".

The `chgrp` command is especially useful if you have changed the login group of a user (see the section, "Changing a User's Login Group" in Chapter 3).

4.5 System Security

Every system, no matter what its size, should have some form of protection from unauthorized access to the computer, disks, and system files. The following sections suggest ways for a system manager to protect the system.

4.5.1 Physical Security

You can protect the physical components of the computer, especially system disks, by taking these steps:

1. Keep unessential personnel out of the work area.
2. Organize and lock up all floppy disks when not in use. They should not be stored with the computer itself.
3. Keep disks away from magnetism, direct sunlight, and severe changes in temperature.
4. Do not use ball point pens to write labels on disks.
5. Make backup copies of all floppy disks (see the section, "Copying Floppy Disks," in this chapter).
4.5.2 Access Security

You can protect the system from access by unauthorized individuals by taking these steps:

1. Remind users to log out of their accounts before leaving the terminal.

2. Discourage users from choosing passwords that are easy to guess. Passwords should be at least six characters long and include letters, digits, and punctuation marks.

3. Keep the super-user password secret from all but necessary personnel.

4.5.3 Protecting Special Files

You can prevent ordinary users from gaining direct access to the data and program files on the system's hard and floppy disks by protecting the system's special files. The XENIX special files, in the /dev directory, are used primarily by the system to transfer data to and from the computer's hard and floppy disks, as well as other devices, but can also be used by ordinary users to gain direct access to these devices.

Since direct access bypasses the system's normal protection mechanisms and allows ordinary users to examine and change all files in the system, it is wise to protect the special files to ensure system security.

To protect the XENIX special files, log in as the super-user and use the chmod command to set appropriate permissions. For example, to disallow any access by ordinary users, set the permissions of such special files as /dev/mem, /dev/kmem, /dev/root, and /dev/usr to read and write access for the user only. Note that you must not change the permissions for the /dev/tty files.

4.5.4 Copying Floppy Disks

To ensure against the loss of data stored on floppy disks, you can use the diskcp(C) command, or the dd(C) command to make copies of floppy disks on new, formatted disks.

diskcp makes use of dd and provides a simple interface to that program. dd is very powerful, and you can use it to perform many different kinds of copying.

You must copy information onto formatted disks. If you format floppies under XENIX, you can use them over again without reformatting.
If you have disks that have been formatted under another operating system, you must reformat them under XENIX before you can use them to make copies of XENIX disks. Be aware that floppies formatted under some operating systems cannot be used under other operating systems, even with reformatting.

You can use the `format(C)` command to format floppies. This command is described in the section "Formatting Floppy Disks" in this chapter. The `diskcp` can also format floppies for you. This is discussed in the next steps.

To copy a floppy disk using `diskcp`:

1. Insert the disk you want to copy, also known as the `source` floppy, in drive 0, your primary floppy drive.

2. Insert another floppy in the other drive. This floppy is also known as the `target` disk. Note that any information already on the target disk will be destroyed.

   If you have only one disk drive, leave the source floppy in the drive. `diskcp` will prompt you to remove the source disk at the correct time.

3. To format the floppy disk before the image is copied, enter the command:

   ```
   diskcp -f
   ```

   and press RETURN.

   If your computer has dual floppy drives. Enter the following command to copy the image directly on the target floppy:

   ```
   diskcp -d
   ```

   and press RETURN.

   If you do not need to format the target floppy, simply enter:

   ```
   diskcp
   ```

   and press RETURN.

4. Follow the instructions as they appear on your screen. Note that with a single drive system, you are prompted to remove the source disk and insert the target disk.
To copy a disk using `dd`, follow these steps:

1. Insert the disk to be copied into floppy drive 0.

2. Insert a formatted disk into drive 1. If necessary, you can format a disk with the `format` command described in “Formatting Floppy Disks” in this chapter.

3. Enter:

   ```
   dd if=/dev/fd0 of=/dev/fd1 count=blkcount
   ```

   and press the RETURN key. The `blkcount` is the number of blocks on the disk to be copied (see Appendix A for details).

This command copies the first disk to the second, then displays a record of the number of blocks copied.

4.6 Using XENIX Accounting Features

The XENIX system provides a set of commands that allow the system manager to perform process accounting. Process accounting is a simple way to keep track of the amount of time each user spends on the system. The process accounting commands keep a record of the number of processes (i.e., programs) started by a user, how long each process lasts, and other information such as how often the process accesses I/O devices, and how big the process is in bytes.

Process accounting is helpful on systems where users are being charged for their access time, but it may also be used to develop a detailed record of system, command, and system resource usage.

There are several commands which may be used to do process accounting. Of these, the most useful are `accton` and `acctcom`. The `accton` command starts and stops process accounting. When invoked, the command copies pertinent information about each process to the file named `/usr/adm/pacct`. The `acctcom` command is used to display this information. The command has several options for displaying different types of accounting information.

4.6.1 Starting Process Accounting

Process accounting can be started at any time, but is typically started when the system itself is started. You can start process accounting with the `accton` command. Enter:

```
accton /usr/adm/pacct
```
The command automatically creates a new file `/usr/adm/pacct` and begins to copy process accounting information to it. If the `/usr/adm/pacct` file exists before starting `accton`, the file contents are deleted.

You can start process accounting automatically whenever you reboot the system. To do this, edit the system startup file `/etc/rc`. Among other commands, there are several that start up process accounting, as well as backup the accounting log file `/usr/adm/pacct`.

These commands are commented out, but if you remove the comment characters at the beginning of those lines, the commands are executed everytime you reboot the system. Make these lines in `/etc/rc`:

```
# mv /usr/adm/pacct /usr/adm/opacct
# > /usr/adm/pacct ; chmod 644 /usr/adm/pacct
# [ -x /etc/accton ] && /etc/accton /usr/adm/pacct
```

look like this:

```
mv /usr/adm/pacct /usr/adm/opacct
> /usr/adm/pacct ; chmod 644 /usr/adm/pacct
[ -x /etc/accton ] && /etc/accton /usr/adm/pacct
```

Note that when you start the system after editing `/etc/rc`, the contents of the `/usr/adm/pacct` file is saved in the file `/usr/adm/opacct` overwriting the contents of `/usr/adm/opacct`.

### 4.6.2 Displaying Accounting Information

The `acctcom` command reads processing accounting information from the `/usr/adm/pacct` file by default, then displays selected information on your terminal screen. The command usually displays basic accounting information, such as the process's program name, the name of the user who invoked the process, the start and stop times for the process, and the number of execution seconds in real time and CPU time. The command has several options that can be used to display selected information.

To display the average size of each process, enter:

```
acctcom
```

The command displays the basic information plus the average size of each process.
To display basic accounting information about a specific command, enter:

```
acctcom -n command
```

where *command* is the name of the command you are interested in. The command responds by displaying each entry for the specified *command*. For example, to display each entry for the system command, enter:

```
acctcom -n units
```

displays each entry for the system command *units*.

To display information about the number and size of input and output counts, enter:

```
acctcom -i
```

The command displays basic program information plus the number of characters and blocks transferred or read by each program.

To display information about a program's use of system resources, enter:

```
acctcom -h
```

The command displays the basic information plus the "use factor." The use factor is a number generated and used by the system to determine how each process should be scheduled for execution. Processes with high use factors use a high percentage of the system resources and are therefore scheduled after processes with lower factors.
Chapter 5

Maintaining File Systems

5.1 Introduction 5-1

5.2 Maintaining Free Space 5-1
  5.2.1 Strategies for Maintaining Free Space 5-1
  5.2.2 Displaying Free Space 5-2
  5.2.3 Sending a System-Wide Message 5-2
  5.2.4 Displaying Disk Usage 5-3
  5.2.5 Displaying Blocks by Owner 5-3
  5.2.6 Mailing a Message to a User 5-4
  5.2.7 Locating Files 5-4
  5.2.8 Locating core and Temporary Files 5-5
  5.2.9 Clearing Log Files 5-5
  5.2.10 Expanding the File System 5-6

5.3 File System Integrity 5-6
  5.3.1 Repairing the File System 5-7
  5.3.2 Automatic File System Check 5-7
5.1 Introduction

File system maintenance, an important task of the system manager, keeps the XENIX system running smoothly, keeps the file systems clean, and ensures adequate space for all users. To maintain the file systems, the system manager must monitor the free space in each file system, and take corrective action whenever it gets too low.

This chapter explains the file system maintenance commands. These commands report how much space is used, locate seldom-used files, and remove or repair damaged files.

5.2 Maintaining Free Space

The XENIX system operates best when at least 15% of the space in each file system is free. In any system, the amount of free space depends on the size of the disk containing the file system and the number of files on the disk. Since all disks have a fixed amount of space, it is important to carefully control the number of files stored on the disk.

If a file system has less than 15% free space, system operation usually becomes sluggish. If no free space is available, the system stops any attempts to write to the file system. This means that the user’s normal work on the computer (creating new files and expanding existing ones) stops.

The only remedy for a file system which has less than 15% free space is to delete one or more files from the file system. The following sections describe strategies for keeping the free space available.

5.2.1 Strategies for Maintaining Free Space

The system manager should regularly check the amount of free space of all mounted file systems and remind users to keep their directories free of unused files. You can remind users by including a reminder in the message of the day file /etc/motd. (See the section, “Changing the /etc/motd File” in Chapter 8).
If the amount of free space slips below 15%, the system manager should:

1. Send a system-wide message asking users to remove unused files.
2. Locate exceptionally large directories and files, and send mail to the owner asking him to remove unnecessary files.
3. Locate and remove temporary files and files named core.
4. Clear the contents of system log files.

Finally, if the system is chronically short of free space, it may be necessary to create and mount an additional file system.

5.2.2 Displaying Free Space

You can find out how much free space exists in a particular file system with the df (for “disk free”) command. This command displays the number of “blocks” available on the specific file system. A block is 512 characters (or bytes) of data.

The df command has the form:

\[ \text{df } \text{specialfile} \]

where specialfile can be the name of a XENIX special file corresponding to the disk drive containing the file system (see Appendix A, “XENIX Special Device Files”). If you do not give a special filename, then the free space of all normally mounted file systems is given.

For example, to display the free space of the root file system /dev/root, enter:

\[ \text{df } /dev/root \]

and press the RETURN key. The command displays the special filename and the number of free blocks. You may compute the percentage of free space by comparing the displayed value with the total number of blocks in the file system. See Appendix A, “XENIX Special Device Files,” for a list of the total blocks.

5.2.3 Sending a System-Wide Message

If free space is low, you may send a message to all users on the system with the wall (for “write to all”) command. This command copies the messages you enter at your terminal to the terminals of all users currently logged in.
To send a message, enter:

    wall

and press the RETURN key. Enter the message, pressing the RETURN key to start a new line if necessary. After you have entered the message, press Ctrl-d. The command displays the message on all terminals in the system. To leave the wall command, press Ctrl-d. This removes the link to other terminals.

5.2.4 Displaying Disk Usage

You can display the number of blocks used within a directory by using the du command. This command is useful for finding excessively large directories and files.

The du command has the form:

    du directory

The optional directory must be the name of a directory in a mounted file system. If you do not give a directory name, the command displays the number of blocks in the current directory.

For example, to display the number of blocks used in the directory /usr/johnd, enter:

    du /usr/johnd

and press the RETURN key. The command displays the name of each file and directory in the /usr/johnd directory and the number of blocks used.

5.2.5 Displaying Blocks by Owner

You can display a list of users and the number of blocks they own by using the quot (for “quota”) command. The command has the form:

    quot specialfile

The specialfile must be the name of the special file corresponding to the disk drive containing the file system (see Appendix A, “XENIX Special Devices Files”).

For example, to display the owners of files in the file system mounted on the disk drive /dev/fd1, enter:

    quot /dev/fd1
and press the RETURN key. The command displays the users who have files in the file system and the number of blocks in these files.

5.2.6 Mailing a Message to a User

If a particular user has excessively large directories or files, you may send a personal message to the user with the mail command.

To begin sending a message through the mail, enter:

    mail login-name

and press the RETURN key. The login-name must be the login name of the recipient. To send a message, enter the message, press the RETURN key, and then press Ctrl-d. If the message has more than one line, press the RETURN key at the end of each line. The mail command copies the message to the user's mailbox, where he may view it also by using the mail command. See the XENIX User's Guide for details.

5.2.7 Locating Files

You may locate all files with a specified name, size, date, owner, and/or last access date by using the find command. The command is useful for locating seldom-used and excessively large files.

The find command has the form:

    find directory parameters

The directory must be the name of the first directory to be searched. (It will also search all directories within that directory.) The parameters are special names and values that tell the command what to search for (see find (C) in the XENIX Reference Manual for complete details). The most useful parameters are:

    -name file
    -atime number
    -print

The -name parameter causes the command to look for the specified file. The -atime parameter causes the command to search for files which have not been accessed for the number of days. The -print parameter causes the command to display the locations of any files it finds.
For example, to locate all files named core in the directory /usr, enter:

```
find /usr -name core -print
```

and press the RETURN key. The command displays the locations of all files it finds.

### 5.2.8 Locating core and Temporary Files

You can locate core, and temporary files with the `find` command.

A core file contains a copy of a terminated program. The XENIX system sometimes creates such a file when a program causes an error from which it cannot recover. A temporary file contains data created as an intermediate step during execution of a program. These files may be left behind if a program contained an error or was prematurely stopped by the user. The name of a temporary file depends on the program that created it.

In most cases, the user has no use for either core or temporary files, and they can be safely removed.

When searching for core or temporary files, it is a good idea to search for files which have not been accessed for a reasonable period of time. For example, to find all core files in the /usr directory which have not been accessed for a week, enter:

```
find /usr -name core -atime +7 -print
```

and press the RETURN key.

### 5.2.9 Clearing Log Files

The XENIX system maintains a number of files, called log files, that contain information about system usage. When new information is generated, the system automatically appends this information to the end of the corresponding file, preserving the file's previous contents. This means the size of each file grows as new information is appended. Since the log files can rapidly become quite large, it is important to periodically clear the files by deleting their contents.

You can clear a log file by entering:

```
cat < /dev/null > filename
```

where `filename` is the full pathname of the log file you wish to clear. A log file normally receives information to be used by one and only one program, so its name usually refers to that program. Similarly, the format of a file depends on the program that uses it. See Appendix B, "XENIX Files and
Directories,” for descriptions of the log files.

In some cases, clearing a file affects the subsequent output of the corresponding program. For example, clearing the file /etc/ldd_date forces the next backup to be a periodic backup (see Chapter 6, “Backing Up File Systems”).

5.2.10 Expanding the File System

If free space is chronically low, it may be to your advantage to expand the system’s storage capacity by creating and mounting a new file system. Once mounted, you may use this new file system for your work, or even copy user or system directories to it.

A chronic shortage of space usually results from having more users on the system than the current hard disk can reasonably handle, or having too many directories or files. In either case, creating a new file system allows some of the users and directories to be transferred from the hard disk, freeing a significant amount of space on the existing file system and improving system operation. For details about creating and mounting file systems, see Chapter 4, “Using File Systems.”

5.3 File System Integrity

Since file systems are normally stored on hard and floppy disks, occasional loss of data from the file system through accidental damage to the disks is not unusual. Such damage can be caused by conditions such as an improper system shutdown, hardware errors in the disk drives, or a worn out disk.

Such damage usually affects one or two files, making them inaccessible. In very rare cases, the damage causes the entire file system to become inaccessible.

The XENIX system provides a way to restore and repair a file system if it has been damaged. The `fsck` (for “file system check”) command checks the consistency of file systems and, if necessary, repairs them. The command does its best to restore the information required to access the files, but it cannot restore the contents of a file once they are lost. The only way to restore lost data is to use backup files. For details about backup disks, see Chapter 6, “Backing Up File Systems.”
5.3.1 Repairing the File System

You can repair a file system with the fsck command. The command has the form:

    fsck specialfile

The *specialfile* must be the name of the special file corresponding to the disk drive containing the file system (see Appendix A, "XENIX Special Device Files").

For example, to check the file system on the disk in the disk drive /dev/fd1, enter:

    fsck /dev/fd1

and press the RETURN key. The program checks the file system and reports on its progress with the following messages.

** Phase 1 - Check Blocks and Sizes  
** Phase 2 - Pathnames  
** Phase 3 - Connectivity  
** Phase 4 - Reference Counts  
** Phase 5 - Check Free List

If a damaged file is found during any one of these phases, the command asks if it should be repaired or salvaged. Enter y to repair a damaged file. You should always allow the system to repair damaged files even if you have copies of the files elsewhere or intend to delete the damaged files.

Note that the fsck command deletes any file that it considers too damaged to be repaired. If you suspect a file system problem and wish to try to save some of the damaged file or files, check other possible remedies before you invoke the command.

5.3.2 Automatic File System Check

The XENIX system sometimes requests a check of the file system when you first start it. This usually occurs after an improper shutdown (for example, after a power loss). The file system check repairs any files disrupted during the shutdown. For details, see the section "Cleaning the File System" in Chapter 2.
Chapter 6

Backing Up File Systems

6.1 Introduction 6-1

6.2 The Sysinfo Account 6-1

6.3 Strategies for Backups 6-1

6.4 Using the sysadmin Program 6-3
   6.4.1 Creating Backups 6-3
   6.4.2 Getting a Backup Listing 6-4
   6.4.3 Restoring Backup Files 6-5
   6.4.4 Restoring an Entire Filesystem 6-7
   6.4.5 Editing /etc/default/filesys and /etc/default/archive 6-8

6.5 Using the tar Command 6-10
   6.5.1 Copying Files With tar 6-10
   6.5.2 Restoring Files With tar 6-11
6.1 Introduction

A file system backup is a copy, on backup media such as floppy disks or tape, of the files in the root directory and other regularly mounted file systems. A backup allows the system manager, when logged in as root or sysinfo to save a copy of the file system as it was at a specific time. The copy may be used later to restore files that are accidentally lost or temporarily removed from the file system to save space.

This chapter explains how to create backups of the root directory and other file systems, and how to restore files from the backups.

6.2 The Sysinfo Account

Always use the sysinfo account whenever you make or restore backups. This is because:

- You should always perform backups using the same user and group ID, and;

- sysinfo has restricted root permissions for backups.

If you try to create backups as an ordinary user, you do not have access permissions for all files. If you make backups as root you may accidentally destroy files because root can do anything at all.

The sysinfo account solves this dilemma by having restricted root permissions. The sysinfo user can read all files but may overwrite only those owned by sysinfo.

The sysinfo account is already set in /etc/passwd. Only root can become sysinfo, and only then using the su(C) command. No one may log in as sysinfo.

6.3 Strategies for Backups

The system manager should back up the root directory, and any other mounted file systems, on a regular basis. In particular, the manager should make daily copies of all files modified during the day, and should make periodic (e.g., weekly) copies of the entire root directory and other mounted file systems.

The XENIX system offers two ways to back up file systems, the sysadmin(C) program and the tar(C) command.
The **sysadmin** program is a formal maintenance program for systems that require a rigorous schedule of file system backups. The program automatically locates modified files, copies them to backup media, and optionally produces a list of the files. If your system has many users and a large number of files that are modified daily, use **sysadmin** to make regular backups.

The **tar** command is useful on systems with one or two users, or on any system where ordinary users wish to make personal copies of their directories and files. The command lets the system manager or user choose the files and directories to be copied. The command does not, however, automatically locate modified files.

A typical backup schedule includes a daily backup and a periodic backup once a week. A daily backup copies only those files modified during that day; a periodic backup copies all files in the file system. The appropriate schedule for a system depends on how heavily the system is used, and how often files are modified. In all cases, a periodic backup should be done at least once a month.

The system manager should schedule backups at times when few, if any, users are on the system. This ensures that the most recent version of each file is copied correctly.

A regular schedule of backups requires a large number of floppy disks and adequate storage for the disks. Daily backups should be saved at least two weeks; periodic backups should be saved indefinitely. Disks should be properly labeled with the date of the backup and the names of the files and directories contained in the backup. After a backup has expired, the disk may be used to create new backups.

---

**Note**

If the number of floppies needed for making backups grows too large, the system manager can use the **backup** command instead of **sysadmin**. **backup** is called by **sysadmin** and by using **backup** directly, the system administrator can tailor the number of floppies used to fit the needs of the individual site. Refer to **backup** in the XENIX Reference.
6.4 Using the sysadmin Program

The **sysadmin** program performs daily and periodic backups, lists backup files, and restores individual files from backup disks and tapes. The program presents each task as an item in a menu. To perform a task, simply choose the appropriate item from the menu and supply the required information.

6.4.1 Creating Backups

You may create backups on any archival media available on your system. If you use media that requires formatting, such as floppy disks, you may wish to format several volumes before you begin. The exact number of volumes depends on the number and size of files to be backed up. For details on how to format a floppy disk, see the section "Formatting Floppy Disks" in Chapter 4. You also have the option to do formatting from the **sysadmin** program, in which case the program issues the formatting command.

To create a backup, follow these steps:

1. **Login** as the super-user.

2. **Enter**:

   `sysadmin`

   and press **RETURN**. The program displays a file system maintenance menu.

   **Filesystem Maintenance Options**

   1. Do a daily backup (level 9)
   2. Do a periodic backup (level 0)
   3. Get a backup listing
   4. Restore backed-up file(s)
   5. Restore an entire filesystem

   Enter an option or enter q to quit:

3. Enter "1" for a daily backup or "2" for a periodic backup and press **RETURN**. Note that if the system has never had a periodic backup, it automatically performs one, even if you have chosen a daily backup.
4. You see two menus in sequence. The first is a selection of filesystems to back up, and the second is a selection of backup, or archival media.

Each menu also presents the option "Other:". The "Other" option appears in many of the sysadmin menus. Using this option, you can backup or restore filesystems that are not described in /etc/default/filesys and use backup devices that are not described in /etc/default/archive. sysadmin uses these two files, which are described in the section of this chapter "Editing /etc/default/filesys and /etc/default/archive", to create the filesys and archive device menus. With the "Other" option, you can use filesystems and devices you have not yet described in the default files.

If you select this option, you are prompted for further information. See "Editing /etc/default/filesys and /etc/default/archive" for more information.

5. Load a volume, tape or disk, into the selected drive, and press RETURN. The system displays the current date and the date of the last backup. It displays "the epoch" if there has been no backup. The system then begins to copy files to the drive. If a volume runs out of space, the program displays the message:

Change volumes

6. Remove the first volume, insert a new volume, then press RETURN. The program continues to copy files to the new volume. Repeat this step until the program displays the message:

DONE

When doing a periodic backup, you may need to repeat the last step several times before the backup is complete. You should label each volume as you remove it from the drive. For example, label the first volume "Volume 1", the second "Volume 2", and so on.

6.4.2 Getting a Backup Listing

You can keep a record of the files you have backed up by invoking the sysadmin program and selecting the third item in the menu. The program copies the names of all files from the backup disks to the temporary file /tmp/backup.list, or to another file of your choice. This listing is useful when you need to recover a file from a backup, and especially convenient if you wish to keep detailed records of the files copied in each backup.
To get the listing, follow these steps:

1. Login as the super-user.

2. Enter:

   sysadmin

   and press RETURN. The program displays the system maintenance menu.

3. Enter "3" and press RETURN. You are prompted for the name of the file in which to place the listing. Enter RETURN if you wish to use the default /tmp/backup.list. The program prompts you to insert the first backup volume.

4. Load the first volume, then press RETURN. The program automatically reads the filenames off the backup volume and places them in the list file.

To print the backup list on a lineprinter, quit sysadmin and enter:

   lpr filename

where filename is the name of the file that contains the backup list, and press RETURN. To save space after printing the file, you should remove it with the rm(C) command.

### 6.4.3 Restoring Backup Files

You can restore files from the backup volumes by invoking the sysadmin program and selecting the fourth item in the menu. You will need the complete set of backup volumes containing the latest version of the file or files you wish to restore, and you need the "full pathname" of the file or files you wish to restore. This pathname is given in the backup listing.

To restore a file, follow these steps:

1. Login as the super-user.

2. Enter:

   sysadmin

   and press RETURN. The program displays the file system maintenance menu.
3. Enter "4" and press RETURN. You see:

1. Restore file(s) to their original location(s)
2. Restore file(s) to another location

Enter an option, or enter q to quit:

4. When you select option 1, be aware that files with the same names as files currently on your disk will overwrite the disk files. If you are not absolutely sure that your backup contains the preferred version of the files, you should restore them in a temporary location, such as /tmp, and compare them with your current files on disk using diff(C) or cmp(C).

5. If you select option 2, you are prompted for a directory name. Your restored files are placed in that directory, and are named by the numbers (inode numbers) displayed by the restore program. Be sure to write these numbers down, in order to identify your files.

6. The program prompts you to enter the full pathname of a file you wish to restore. Enter the pathname and press RETURN. The program prompts for another pathname. Enter another pathname, or press RETURN to continue the program. If you press RETURN, the program prompts you to insert the first volume in the backup set.

7. Next you are prompted for the archive device. Select the same drive and medium on which your backup was created, for example, tape or floppy disk.

8. Load volume 1 of the backup set into the drive, then press RETURN. The program displays the inode numbers of the files you have given, then prompts for a volume number.

9. Remove the first volume and replace it with the last volume made of the backup set into the drive, enter its number and press RETURN. The program searches the volume for the specified files and places copies into the specified locations on your hard disk.

10. The program prompts for volume numbers until all of the files have been found. Continue to read volumes in reverse order until the first volume made has been loaded and you have returned to the main menu. See the restore(C) manual page in the XENIX User's Reference for more information.
11. If you select another directory as the destination for the restored files, the files are placed in that directory and named by their inode numbers. You can move them to any location using the `mv(C)` command:

```
mv inode filename
```

`inode` is what `sysadmin` names the file when it restores it. `filename` is the new name you want for the file. For example, to restore a file `/usr/johnd/projects.june` from 224, enter:

```
mv 224 /usr/johnd/projects.june
```

6.4.4 Restoring an Entire Filesystem

To restore an entire filesystem, select option "5" in the main `sysadmin` menu. Do not use this option carelessly; all information currently in the target filesystem will be overwritten. Restore an entire filesystem only onto a clear or newly-made filesystem, or onto a filesystem that is completely corrupted or inaccessible. See `divvy(C)`, `mkfs(C)` and other documentation on making filesystems.

You can use this option to restore any filesystem, including the root filesystem. However, there are special considerations; if your system will boot and run but there are missing or corrupted files, you can use option 4 from `sysadmin` to recover the necessary files.

If you need to restore the entire root filesystem, you must at least partially reinstall XENIX. If your system is very similar to the standard XENIX distribution, you should reinstall the original XENIX distribution and use `sysadmin` to replace single files that you have modified. Note that it is faster and easier to replace files from the distribution disks than from backup copies. However, if your system has been significantly changed from the distribution, you may decide to only partially reinstall XENIX and recover the filesystem from backups.

---

**Note**

If you decide to partially reinstall XENIX, be very careful during the hard disk initialization portion of the installation. It is vital to preserve the hard disk partitions and parameters if there are other divisions resident on the disk.
To completely reinstall XENIX, consult the XENIX Installation Guide you received with your distribution. To partially reinstall, and recover your filesystem from backups, perform the following steps:

- Use your original distribution disks and install only the XENIX runtime system and the sysadmin package.

- When the packages have been installed, quit custom and reboot your system.

- While in single-user mode, invoke sysadmin and select option 5 to restore an entire filesystem. You are warned that this is a serious task and are asked to decide whether you wish to continue.

- Next you see the filesystem menu. Select the filesystem that you wish to restore, or the “Other” option to enter the name of another filesystem, perhaps the one that you have just created. If you select the root filesystem, you see a shortened version of the previous warning, and you are asked if you wish to continue. If you select “Other”, you are prompted for the device name of the filesystem that you wish to back up or restore.

- Next you see the archive menu. Select the medium on which your filesystem is backed up, for example, tape or floppy.

- You are prompted to load the first volume of the backup into the selected drive. The restore program prompts you to change volumes if necessary.

6.4.5 Editing /etc/default/filesys and /etc/default/archive

The files /etc/default/filesys and /etc/default/archive are used by sysadmin to create the filesystem and archive device menus. Even though each menu provides the option “Other” so that you can use filesystems and devices not described, you should keep these default files up to date as your system changes. These files are also used by other programs, and should be maintained as specified for these programs.
Each device, filesystem or drive, in these files is represented by a one line entry which consists of "name=value" pairs, separated by spaces or tabs. For example, the following is a possible entry in /etc/default/archive:

```
cdev=/dev/rfd048ds9 desc="Floppy Drive 0 (48dsdd)"
  blocking=18 size=360 format="format -f /dev/rfd048ds9"
```

The value part of "name=value" pairs "desc="Floppy Drive 0 (48dsdd)"") and "format="format -f /dev/rfd048ds9"") contain spaces, therefore they must be surrounded by quotes in order to be interpreted correctly.

Note that the newline is preceded by a backslash (\), which causes the two lines to be interpreted as one line. This convention makes the files easier to read.

The minimum necessary information about an archive device is:

- a character device name (cdev=) or a block device name (bdev=), and
- a size, (size=). Without these, sysadmin will not use the entry.
- In addition to these, a description, (desc=), can be added which appears in the archive device menu. If a format command is included, then you may format media from the sysadmin program.
- A blocking factor for the medium, (blocking=), is included in the above example for use by other programs. It is not used by sysadmin.

The size (size=), in the above example, is considered to be a number of K, or kilobytes. If an entry is included for density, (density=), as in the following example, then the size is taken to mean a number of feet, which is more appropriate for tape than for floppy disks:

```
cdev=/dev/rmt0 desc="Cartridge Drive (600ft tape)"
  blocking=20 size=600 density=20000
```

The minimum necessary information about a filesystem is:

- a character device name, (cdev=), or a block device name, (bdev=).
- Additionally, you may include a description, (desc=), which appears in the sysadmin filesystem menu,
and the mount directory, (mountdir=), which is also used by
/etc/mnt, in addition to sysadmin. The name remount, in the
example below is used exclusively by /etc/rc.

    bdev=/dev/root cdev=/dev/rroot mountdir=/ \n    desc="The root filesystem" remount=no

If your system does not use certain drives included in /etc/default/archive,
or if you add an entry to either file, and then later decide that you don't
need it any longer, rather than deleting the entry, you can place a pound
sign (#) at the beginning of that line, and it will be treated as a comment
and ignored. Later, if you need the entry again, then you can delete the #.
For example, the entry below is ignored. You only need a # in front of the
first line, since the back slash still has the effect of causing the two lines to
be treated as one line.

    #cdev=/dev/rfd048ds9 desc="Floppy Drive 0 (48dsdd)" \n    blocking=18 size=360 format="format -f /dev/rfd048ds9"

6.5 Using the tar Command

The tar command copies files and directories to and from your backup
media (floppy disks or tape). On systems with one or only a few users, it
gives the system manager a direct way to make backup copies of the files
modified during a day. On systems with many users, it gives ordinary users
a way to make personal copies of their own files and directories.

6.5.1 Copying Files With tar

The tar command has the form:

    tar cvf specialfile files

The specialfile is the name of the special file corresponding to a disk or tape
drive (see Appendix A, "XENIX Special Device Files"). Also, the section
in this chapter "tar Defaults" discusses default specialfiles. The files are the
names of the files or directories you wish to copy.

To use the tar command, you need:

- Media; tape or formatted floppies. For details on formatting a disk,
  see the section "Formatting Floppy Disks" in Chapter 4, and
  format(8) in the XENIX Reference.

- The names of the files and/or directories you wish to copy.
For example, to copy the files $a$, $b$, and $c$ to a floppy disk in the drive /dev/fd1, enter this command and press RETURN:

```
tar cvf /dev/fd1 a b c
```

To copy a directory named *recipes*:

```
tar cvf /dev/fd1 recipes
```

To copy the contents of the current directory, and all subdirectories, enter this command and press RETURN:

```
tar cvf /dev/fd1 .
```

Note that files are restored according to the pathnames given when they are first copied. Therefore, never use full, absolute pathnames when making *tar* backups, because you might accidentally erase an existing version of backed up files. For example, **never do this**:

```
tar cvf /usr/allan/examplefile
```

### 6.5.2 Restoring Files With *tar*

To restore files from a backup made with the *tar* command, use this command:

```
tar xvf specialfile
```

The *specialfile* must be the name of the special file corresponding to the disk drive containing the *tar* disk.

Files are copied from the backup media to your current directory, and all pathnames are preserved. If there are directories on the backup, they are recreated relative to the current directory.

For example, to restore files from the disk in the drive /dev/fd1, enter:

```
tar xvf /dev/fd1
```

and press RETURN.

Since the *tar* command copies files only to the current directory, make sure you are in the desired directory before you invoke the command.
Using Peripheral Devices
Chapter 7

Using Peripheral Devices

7.1 Introduction 7-1

7.2 Using Multiscreen™ 7-1

7.3 Using a Cartridge Tape Drive 7-2
7.3.1 Installation and Configuration 7-2
7.3.2 Accessing the Drive 7-3
7.3.3 The tar Command 7-3
7.3.4 Tape Drive Maintenance 7-3
7.3.5 /etc/default Entries 7-4
7.3.6 Tape Formatting 7-5

7.4 Configuring Serial Ports 7-5

7.5 Setting Up a Serial Console 7-6

7.6 Adding a Terminal 7-7

7.7 Setting Terminal Lines 7-10
7.7.1 The gettydefs File 7-11
7.7.2 Changing the gettydefs File 7-12
7.7.3 Checking the Terminal Settings 7-14

7.8 Changing Serial Line Operation 7-15

7.9 Setting the Terminal Type 7-16

7.10 Removing a Terminal 7-18

7.11 Modem Usage under XENIX 7-18
7.11.1 Serial Lines 7-18
7.11.2 Dialing Out From Your Computer 7-19
7.11.3 Dialing Into Your Computer Under XENIX 7-22
7.11.4 Shared Dial-In/Dial-Out 7-22
7.11.5 Hayes Modem Settings 7-22
7.11.6 Modem Control 7-24

7.12 Adding a Lineprinter 7-24
7.12.1 Installing a Printer: lpinit 7-25
7.12.2 Stopping the Print Spooling Daemon: lpsched 7-29
7.12.3 Creating an Init Device File  7-30
7.12.4 Moving Requests Between Printers: lpmove  7-31
7.12.5 Accepting and Rejecting Print Requests: accept  7-31
7.12.6 Enabling and Disabling Printers  7-32
7.12.7 Printer Interface Programs  7-33

7.13 Adding Additional Memory  7-34

7.14 Adding a Hard Disk  7-36
   7.14.1 Mounting Another File System  7-43
   7.14.2 Using A Second File System  7-44

7.15 Creating Boot and Root Floppy Disks  7-46
7.1 Introduction

One important task of the system manager is to add peripheral devices such as terminals, hard disks, tape drives and lineprinters to the system. Adding these devices lets more users access the system, provides extra storage space for users' files and directories, and adds to overall system capabilities.

To add a peripheral device, the system manager must:

- connect the physical device to the computer, then
- use the correct system commands to enable the device for operation.

This chapter explains how to do this and how to maintain the devices once they are added.

Note that physical connections between a device and the system vary depending upon hardware. This chapter provides some information about making the necessary physical connections, but for more information about these connections, see the hardware manuals provided with the device and your computer.

7.2 Using Multiscreen™

With multiscreens, the video display and keyboard act as several separate terminals. You switch between screens by holding down the alt key and pressing f1-f10. The tty01 is the “alt-f1” terminal, tty02 is the “alt-f2” terminal, tty03 is “alt-f3”, etc. The multiple screen feature uses the /dev/tty[01...12] device files. These device files provide character I/O between the system and the computer screen and keyboard. The actual number of multiscreens available depends upon the amount of memory in your personal computer and is displayed when the system boots. There are generally between two and six multiscreens enabled, up to a maximum of twelve.

Each multiscreen (device file) is independent of the rest, so you can log in and run programs on each screen. Output from programs is saved in a screen buffer, and when you switch back to a screen, you see the latest screenful of output. If you stop output to a screen, for example by entering Ctrl-S, this affects only that screen. Output continues on all the other screens.

Although all of the multiscreens may be open and active at the same time, you can see only one screen at a time. The selected multiscreen is the terminal currently “connected” to the keyboard.
XENIX Operations Guide

To select any active screen, press `alt-Fn`, where `Fn` is one of the function keys on the far left side of the keyboard. For example, this keystroke switches you to screen 6, corresponding to `/dev/tty06`:

```
alt-F6
```

You can also rotate through the screens by pressing `Ctrl-PrtSc` (using the `Ctrl` key and the `PrtSc` key). Use this feature to access screens for which you do not have function keys. For example, if you have twelve multiscreens enabled, but the computer keyboard only has ten function keys, you can display screen eleven by first going to screen 10, then pressing `Ctrl-PrtSc`. To access screen 12, press `Ctrl-PrtSc` again. If you press `Ctrl-PrtSc` a third time, you rotate back to the first multiscreen, `tty01`.

Refer to the XENIX Reference for more on `multiscreen(M)` and `screen(HW)`.

The system displays the number of multiscreens enabled on boot. This number is determined by the amount of memory in your computer. Do not try to use more than the auto-configured number of screens.

7.3 Using a Cartridge Tape Drive

A tape cartridge drive is a mass storage device that uses 1/4 inch tape cartridges to store data. It is also referred to as a QIC (quarter inch cartridge) tape drive. A tape cartridge can hold many times the data that can be stored on floppies, making it much more useful for large backup operations.

The drives that are supported under XENIX, are listed in the Operating System Release Notes. For hardware-specific information, refer to the manual for your drive and `tape(HW)` in the XENIX Reference.

7.3.1 Installation and Configuration

Refer to the your tape drive hardware manual for physical installation instructions. Once it is connected to your computer, enter this command to configure the drive:

```
mkdev tape
```

`mkdev` runs an interactive program called `tapeinit` which explains the configuration process and prompts you for necessary input.

See `mkdev(C)` for more information.
7.3.2 Accessing the Drive

You use a QIC tape drive much like a floppy. You can use the standard commands such as \texttt{tar(C)}, \texttt{dd(C)}, \texttt{cpio(C)}, \texttt{backup(C)}, \texttt{dump(C)}, and \texttt{restore(C)} commands are used to access a cartridge tape drive. This section summarizes tape operations and how to perform simple backups and restores. For instructions on how to perform system backups and related filesystem maintenance, see the chapter on "Backing Up File Systems" in this guide.

7.3.3 The \texttt{tar} Command

The \texttt{tar} command is useful for making a backup copy of entire directories. The command has the syntax:

\begin{verbatim}
tar cvf devicefile files
\end{verbatim}

The \texttt{devicefile} is the file name that corresponds to the cartridge drive. \texttt{files} are the names of the files or directories to be copied. For example, to copy all the files in the directory \texttt{/u/bogart} to the cartridge drive \texttt{/dev/rct0}, enter:

\begin{verbatim}
tar cvf /dev/rct0 /u/bogart
\end{verbatim}

To restore files stored on tape, insert the cartridge containing the files or directories you wish to restore and enter the following command:

\begin{verbatim}
tar xvf devicefile
\end{verbatim}

\texttt{tar} restores all the files on the tape to the present directory.

For detailed information on backup operations and other methods of copying files, refer to \texttt{tar(C)}, \texttt{cpio(C)}, \texttt{backup(C)}, and \texttt{restore(C)} in the XENIX Reference.

7.3.4 Tape Drive Maintenance

The \texttt{tape(C)} utility is performs various tape maintenance operations. It sends commands and receives status from the tape drive. The basic form of the command is:

\begin{verbatim}
tape command [ devicefile ]
\end{verbatim}

For example, to rewind the cartridge tape device \texttt{/dev/rct0}, enter:

\begin{verbatim}
tape rewind /dev/rct0
\end{verbatim}
Other commands are:

**erase**  Erase tape cartridge. Also retensions.

**reset**  Reset tape controller and tape drive. Clears error conditions and returns tape subsystem to power up state.

**reten**  Retension tape cartridge. Should be used periodically to remedy slack tape problems, generally resulting in an unusually large number of tape errors.

After certain tape operations are executed, the system returns a prompt before the tape controller has finished its operation. If you enter another tape command too quickly, the message "device busy" is displayed until the tape device is finished with its previous operation.

You should clean the tape drive heads and retension cartridges to keep everything operating error-free.

### 7.3.5 /etc/default/Entries

Depending on the utilities used, you will need to create entries in certain files in the `/etc/default` directory. These entries are the default information that utilities such as `tar` use when accessing the given device. Using `tar` and a QIC tape drive (configured as `/dev/rct0`) as an example, the device would require the following entry in `/etc/default/tar`:

```
archive0=/dev/rct0 20 300 y
```

In this case, `/dev/rct0` is the default device (archive0), with a blocking factor of 20, and a volume size of 300 feet. **y** indicates that (yes) the device is a tape drive. If you are configuring archive0 to access an rctmini tapedrive, the entry would be:

```
archive0=/dev/rctmini 18 0 y
```

The utilities `backup` and `restore` have similar files and entries. For more information on default files, see `default(M)` in the XENIX Reference and the manual entry for the particular command.
7.3.6 Tape Formatting

Tape cartridges used with the mini tape drive (ctmini) must be formatted before use. Use the `format(C)` utility to format a cartridge tape. For example, this formats a ctmini tape cartridge:

```
format /dev/rctmini
```

The -e option erases servo information:

```
format -e /dev/rctmini
```

See also `tape(HW)` and `format(C)` for more information.

7.4 Configuring Serial Ports

If you wish to add a multi-port expansion card, you also need to create new device files for the additional ports. Use `mkdev` command with the `serial` option. This calls an interactive program, `serinit`, to initialize the serial ports on the installed card.

To configure the additional ports, follow these steps:

1. Install the expansion card. See the instructions furnished with the serial card and with your computer.

   Boot the system and enter system maintenance mode.

2. When you are in system maintenance mode, enter:

   ```
   /etc/mkdev serial
   ```

3. This invokes `serinit`, which begins with the following display:

   ```
   You would like to install a:

   1. 1 port card
   2. 4 port card
   3. 8 port card

   Select an option or enter 'q' to quit:
   ```
Enter the appropriate number and press RETURN. The program will respond with the following menu (if your system has two slots, only COM1 and COM2 appear):

The card is configured as:

1. COM1
2. COM2
3. COM3
4. COM4

Select an option or enter 'h' for help or 'q' to quit.

If you select “h”, a table is displayed containing ports, card types, I/O and status addresses.

Enter the appropriate number and press RETURN. After accepting the selected port, `serinit` will display messages indicating the new ports that have been configured and their modem control counterparts. For example, tty2a and tty2A refer to the same serial port, but tty2A has modem control, whereas tty2a refers to the same port without modem control. Do not attempt to access both the modem control and non-modem control ports of the same serial line simultaneously.

You have now configured your serial ports. Make sure the serial ports are also defined in the system configuration.

Check your hardware manual to determine how your system is configured, via a CMOS database or by switch settings on the main system board. If your system is configured using a CMOS database, the ports are defined in the database (see `cmos(HW)`).

Otherwise, define the ports by setting the proper switches on the main system board. Refer to your hardware manual for the settings. Note: You will get an error message if an attempt is made to access a serial port that has not been installed and defined.

### 7.5 Setting Up a Serial Console

You can configure a serial device as the system console rather than the display adapter. The `boot` program sets the default console at boot time in the following manner:

1. `boot` reads `/etc/default/boot` and looks for the entry `SYSTTY=x` where `x` specifies the system console device.
2. If `SYSTTY` is not found or `/etc/default/boot` is unreadable, `boot` checks for a display adapter and designates it as the system console.

3. If no display adapter is found, `boot` looks for tty1a, sets the serial port to 9600 baud, 8 data bits, 1 stop bit, and no parity, and uses it as the system console.

If you wish to use a serial console, simply create an entry in `/etc/default/boot` as follows:

```
SYSTTY=x
```

where `x` is "0" or "1", for the display adapter or COM1 serial port, respectively. You can also use the command `systty=x` at the boot prompt to change the system console device. Note that this command does not create or change an `SYSTTY` entry in `/etc/default/boot`.

### 7.6 Adding a Terminal

Adding extra terminals gives more users simultaneous access to the system. You can add a terminal by connecting it to an RS-232 serial line on the system and enabling it with the `enable(C)` command.

Many different terminals work well with the XENIX operating system. A short list of recommended models is given in `terminals(M)` in the XENIX Reference. The file `/etc/termcap` contains a more comprehensive list of terminals that work with XENIX. For a description of `/etc/termcap`, see `termcap(M)` in the XENIX Reference.

Before you add a terminal, you must know how to connect the terminal to a serial line on the computer. You also need to know the name of the serial line. Physical connections for the terminal are usually explained in the terminal hardware manual. The names of the standard available serial lines are given in Appendix A, "XENIX Special Device Files." If you add a serial card, the possible names of the additional device files are listed in the manual section `serial(HW)`.

The following steps show how to install a terminal with the standard "COM" serial lines, or with serial expansion cards:

1. This step is for serial expansion cards. If you are adding a terminal directly to a COM port, skip to the next step.

   If you are using a supported 4 or 8-port expansion board, check to see if your board is recognized at bootup by checking the XENIX bootup message. If the boot process does not accurately report your board, then the switches on your card are not set properly. Check your board’s hardware documentation for the proper switch settings and the XENIX `Release Notes` for the correct addresses.
This only applies to boards that are listed as supported in the Release Notes. Vendor supplied drivers may not print a recognition message at boot time.

Configure your board for the correct interrupts for the two standard COM ports. COM1 should be configured as interrupt 4 and COM2 as interrupt 3. Most serial cards use one interrupt per board, so two four-port boards could use COM1 and COM2. Be aware of the requirements of other products and hardware to avoid interrupt conflicts. See serial(HW) in the XENIX Reference for more information on COM1 and COM2.

When a supported card is correctly configured for the desired COM port and recognized at bootup, run this command:

/etc/mkdev serial

This creates device files for your extra serial ports.

2. Make sure you are in multi-user mode. You are if you typed Ctrl-D, at the startup prompt “Type CONTROL-D to proceed with Normal Startup (or give root password for system maintenance):”.

Make sure your terminal is plugged in, turned on, and set for 9600 baud, 8 data bits, 1 stop bit, and no parity. If your terminal does not work in this mode, see the section “Changing the gettydefs File” later in this chapter, and stty(C) in the XENIX Reference for alternate ways to configure your terminal.

Some terminals are designed to connect directly to a computer with a straight cable. Others are designed to connect to a modem instead. In the latter case, you need a cable that has pins 2 and 3 crossed. This is called a “null modem” or “modem connecter”. The terminal should be connected with a cable so that Transmit Data on the serial port is connected to Read Data on the terminal, and Transmit Data on the terminal is connected to Read Data on the serial port. Signal Ground should be connected to Signal Ground. Other pins probably do not need to be connected.

For more information on your specific terminal, see your terminal manual, or a reference on serial communication.

3. If the port is enabled, press the RETURN key a few times to see if a “login:” prompt appears. If so, you are ready to log in. If not, use the console or a working terminal to log in as the superuser (root), and disable the port with this command:

`disable /dev/ttyname`
In the above command, `ttyname` is the device special name of the port in question. Make sure you are using a non-modem control. For example, `/dev/tty1a`, not `/dev/tty1A`. For more information on serial port names, see `serial(HW)`, in the XENIX Reference and the section “Configuring Serial Ports” in this chapter.

4. Check the `/etc/ittys` file so that the entry for this serial port looks like this:

```
0mttyname
```

In this example, `ttyname` is the name of the device file, for example `/dev/tty1a`. If the entry does not look like this, edit the file with a text editor to correct it.

Also, if `/etc/ittys` contains entries for `tty11`, `tty12`, `tty13` and replace them with `tty1a`, `tty2a`, `tty1A` and respectively. Make sure you remove duplicate entries for the same serial port.

5. From the console, as `root`, see if you can redirect output to the terminal by typing:

```
date > /dev/ttyname
```

If you do not see the date printed on the terminal and you are not sure of the correct `ttyname`, try other `ttnames` on that serial port. If you still do not see the date printed on the terminal, there may be a problem with the hardware.

Verify the following:

- The terminal is plugged in.

- The cable is configured correctly. If the serial port you are using has a 25-pin connector (DB-25), insure that pins 2, 3 and 7 are being used as specified in step (2) above. Again, note that other pins probably do not have to be used.

However, if your system or expansion card has a 9-pin connector (DB-9), then you must have a 9-pin to 25-pin connector. Consult your hardware manual for information on 9-pin to 25-pin connections.

- Re-check your terminal setup configuration. See step (2).

- Re-check the switches on your serial port. If you are using a multi-port card, try other lines on that card.

- Try attaching the terminal to a standard serial port, COM1 or COM2, to see if the terminal and cabling are working
correctly. If you are already using a COM port, try switching to another one.

If you have already installed another terminal successfully, try switching hardware one piece at a time, with the working terminal. This may help you isolate a hardware problem.

6. Once you are able to get the date printed on your terminal, enable the port and look for the “login:” prompt:

   enable /dev/ttyname

If you do not see the “login:” prompt, verify that getty is actually running on the port and that the software is configured properly with this command:

   ps -t ttyname

The output should look similar to the following, where “login” or “getty” is listed in the “command” column:

<table>
<thead>
<tr>
<th>PID</th>
<th>TTY</th>
<th>TIME</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>2557</td>
<td>1a</td>
<td>0:06</td>
<td>getty</td>
</tr>
</tbody>
</table>

7. If you have typed the enable and disable commands many times, it is possible that a new getty cannot be spawned on that port. If so, shutdown the system, reboot, go into multiuser mode and try again.

7.7 Setting Terminal Lines

Your XENIX system can automatically adapt to several different terminal baud rates and settings. The same program that displays the login message, getty(C), reads these terminal line values from a table, trying each setting until one is successful, and the user can log in to the system. This table provides several default settings for different kinds of terminals lines.

On your XENIX system, getty automatically executes as part of the login process. The table of terminal settings is found in a file called /etc/gettydefs. You can edit gettydefs to add different sets of terminal characteristics or to change the existing ones.
7.7.1 The gettydefs File

The file `/etc/gettydefs` contains the information that `getty` uses to set up terminal line characteristics such as baud rate. The file is in the form of a table. Each table entry is divided into five fields. These fields include:

```
label# initial-flags # final-flags #
login-prompt #next-label[#login program]
```

The fields are:

- **label**: Identifies the `gettydefs` entry to `getty`. This could be a number or a letter. `label` corresponds to the line mode field in `/etc/tty`. `init` passes the line mode to `getty` as an argument.

- **initial-flags**: Sets terminal line characteristics when `getty` first establishes the connection. `getty` recognizes the flags listed in `tty(4)`, in the XENIX Reference. Often the only flag in this field is the one setting the baud rate. For example, `/300` would set the speed to 300.

- **final-flags**: Sets the terminal line characteristics just before `getty` executes `login`. These flags describe the operating characteristics for the line. The baud rate (B) is set again. Other common flags include SANE (a composite flag that sets a number of terminal characteristics to reasonable values), TAB3 (expands tabs with spaces), IXANY (enables any character to restart output), and HUPCL (hangs up line on final close). Flags can be entered in any order.

- **login-prompt**: Contains the login prompt message that greets users. This field is printed exactly as it is entered including spaces and tabs. The `@` in the login-prompt field is expanded to the first line in the file `/etc/systemid` (unless the `@` is preceded by a `\`).

Several character sequences are recognized, including:

- \n: Line feed
- \r: Carriage return
- \t: Tab
- \f: Form feed
- \v: Vertical tab
- \b: Backspace
- \vnnn: (3 octal digits)
  The specified ASCII characters
next-label Identifies the next label in gettydefs for getty to try if the current one is not successful. getty tries the next label if a user presses the BREAK key while attempting to log in to the system. Groups of entries, such as dial-up or TTY lines, should form a closed set so that getty cycles back to the original entry if none of the entries is successful.

login-program The name of the program which actually logs users onto XENIX. The default program is /etc/login.

If preceded by the keyword "AUTO," getty does not prompt for a username, but instead uses the devicename (i.e. dev/tty03) as the username and immediately executes the login-program.

Each field is separated by pound sign (#), and each entry in gettydefs is separated by a blank line.

An entry in gettydefs might look like this:

4# B1200 # B1200 SANE TAB3 HUPCL #Login: #2#AUTO

The number 4 identifies this entry to getty. In the next field, the baud rate is set to 1200. The final settings in the third field include the baud rate (B1200), SANE (a composite flag for a number of characteristics), and HUPCL (hangs up line on final close). The login prompt appears as "Login:," and if this setting is not successful, getty proceeds to label 2 in gettydefs. AUTO attempts to log in the user "/dev/console (or other tty)" executing /etc/login.

If the last entry also contains a filename, that login program is executed. (Note that the filename and the corresponding login program are user created.) For example, including a file such as /etc/dial_login for a line connected to a modem can be used. It would set the user ID, acquire a password, validate the user, and then become the user. It could possibly require a password for the system in addition to an account password and even have a special set of login environment variables included in /etc/default/dial_login.

7.7.2 Changing the gettydefs File

The file /etc/gettydefs already exists on your XENIX system and has sets of entries for the dial-up lines, and terminal lines. These different sets correspond to line mode settings in /etc/ittys. The init program passes the line mode as an argument to getty.
You can edit `gettydefs` to add new terminal settings or to change existing ones. For example, the settings for terminal lines on your XENIX system might look like this:

```
1# B2400 # B2400 SANE IXANY TAB3 #@!login: #2
2# B4800 #B4800 SANE IXANY TAB3 #@!login: #3
3# B9600 # B9600 SANE IXANY TAB3 #@!login: #1
```

To change the sample `gettydefs` file so that the first baud rate `getty` attempts is 1200, do the following:

1. Enter a text editor to edit the first line of the file `gettydefs`.
2. Change the second and third fields from B2400 to B1200.
3. Exit the text editor, saving `gettydefs`.

The sample file should look like this:

```
1# B1200 # B1200 SANE IXANY TAB3 #@!login: #2
2# B4800 #B4800 SANE IXANY TAB3 #@!login: #3
3# B9600 # B9600 SANE IXANY TAB3 #@!login: #1
```

You can also add additional terminal line settings to `gettydefs`. Flags and permissible values for terminal settings are listed in `tty (M)`, in the XENIX Reference.

When you add a new entry, be sure that the groups of entries in `gettydefs` form a closed set, so the next-label field of the last entry directs `getty` back to the first entry in the group.

To add an entry for a baud rate of 300 to the preceding sample `gettydefs` file, follow these steps:

1. Enter a text editor to edit the file `/etc/gettydefs`.

7-13
2. Locate the point where you want to insert the new settings for `gettydefs`. The order of the entries does not matter; `getty` only looks for the label. In this example, the new entry will be the last entry in the file.

3. Insert a carriage return after the last line in the file and enter the following on a new line:

   `4# B300 # B300 SANE IXANY TAB3 #@!login: #1`

4. To incorporate label 4 into the set of labels, change the `next label` field for entry 3 to 4:

   `3# B4800 # B4800 SANE IXANY TAB3 #@!login: #4`

   `getty` is now directed from label 3 to 4, and then back to 1.

5. Exit the text editor, saving the revised `gettydefs` file.

The new `gettydefs` looks like this:

```
1# B1200 # B1200 SANE IXANY TAB3 #@!login: #2
2# B4800 # B4800 SANE IXANY TAB3 #@!login: #3
3# B9600 # B9600 SANE IXANY TAB3 #@!login: #4
4# B300 # B300 SANE IXANY TAB3 #@!login: #1
```

### 7.7.3 Checking the Terminal Settings

Each time you change the terminal line settings or add new entries to `gettydefs`, you should check to make sure that the new values that make sense to `getty`. To do this you use the command `getty` with the check option, `-c`, and the filename.

For example, to check `gettydefs`, enter:

```
getty -c /etc/gettydefs
```
If any of the values and settings in `gettydefs` are not permitted, `getty -c` displays them on your terminal screen.

For more information on `getty` and `gettydefs`, see `getty(M)` and `gettydefs(F)`, in the XENIX Reference.

### 7.8 Changing Serial Line Operation

Whenever you enable a terminal with the `enable` command, the system automatically sets the operating characteristics of the serial line to a set of default values. Sometimes these values do not match the values used by the terminal and, therefore, must be changed to allow communication between the system and the terminal. You can display and change the operating characteristics of a serial line with the `stty` (for "set tty") command.

You can display the current operating characteristics of a serial line by entering this command at the terminal connected to that line:

```bash
stty
```

If it is impossible to log in at that terminal, you can use another terminal to display the characteristics. Log in as the super-user at another terminal, and enter:

```bash
stty < specialfile
```

In the above command, `specialfile` is the name of the device special file corresponding to the serial line (see Appendix A, "XENIX Special Device Files"). For example, this command displays the current characteristics of the serial line named `/dev/tty1a`:

```bash
stty < /dev/tty1a
```

The command displays the baud rate, the parity scheme, and other information about the serial line. The meaning of this information is explained in `stty(C)` in the XENIX Reference.

One common change to a serial line is changing the baud rate. This is usually done from a terminal connected to another serial line since changing the rate disrupts communication between the terminal and system. Before you can change the rate, you need to know the current baud rate of the terminal (review the terminal hardware manual to see how to determine the current baud rate). Once you have the baud rate, log in as the super-user at the other terminal, and enter:

```bash
stty baud-rate < specialfile
```
where *baud-rate* is the current baud rate of the terminal, and *specialfile* is the name of the device special file corresponding to the serial line you wish to change. The baud rate must be in the set 50, 75, 110, 134, 150, 200, 300, 600, 1200, 2400, 4800, and 9600. For example, the command:

```bash
stty 9600 < /dev/tty1a
```

changes the baud rate of the serial line `/dev/tty1a` to 9600. Note that the "less than" symbol (`<`) is used for both displaying and setting the serial line from another terminal.

Another common change is changing the way the system processes input and output through the serial line. Such changes are usually made from the terminal connected to the serial line. For example, the command:

```bash
stty tabs
```

causes the system to expand tabs with spaces (used with terminals which do not expand tabs on their own), and the command:

```bash
stty echo
```

causes the system to remove a deleted character from the terminal screen when you back over it with the BACKSPACE key.

Note that the *stty* command may also be used to adapt a serial line to an unusual terminal, to another type of serial device which requires parity generation and detection, or special input and output processing.

For a full description of this command, see *stty*(C) in the XENIX Reference.

### 7.9 Setting the Terminal Type

The XENIX system requires that the terminal type be clearly defined before any work is done at the terminal. The preferable method for setting your terminal type is to assign the type to the TERM variable, a special environment variable that associates the terminal you are using with a list of characteristics given in the `/etc/termcap` file. The characteristics tell the system how to interpret your terminal's keys and how to display data on your terminal screen.
If you are using the Bourne shell (sh), the TERM assignment has the form:

\[ \text{TERM} = \text{termtype}; \text{ export \ } \text{TERM} \]

If you are using the C-shell (csh), the TERM assignment has the form:

\[ \text{setenv \ \text{TERM} \ termtype} \]

The termtype must be one of the names associated with one of the terminals defined in the /etc/termcap file. The assignment must be entered at the terminal whose type you are setting.

For example, to set the terminal type to “ansi” from Bourne shell, go to the terminal you wish to set, enter at the shell prompt (“$”):

\[ \text{TERM} = \text{ansi}; \text{ export \ } \text{TERM} \]

and press the RETURN key. From C-shell, enter at the shell prompt (“%”):

\[ \text{setenv \ \text{TERM} \ ansi} \]

and press RETURN.

If you are not sure which name you may use for termtype, you can view the names by displaying the /etc/termcap file. To display the file, enter:

\[ \text{cat \ /etc/termcap} \]

and press the RETURN key. Since the file is very large, you will need to use the Ctrl-s key to stop the display at every full screen. You may view more of the file by pressing the Ctrl-q key or the Spacebar.

You can let the system define the terminal type automatically whenever you log in by including the TERM assignment in your .profile file (see Chapter 8 “Solving System Problems” under “Changing the .profile File”).

For an alternate method of setting your terminal type see tset(C) in the XENIX Reference.

If you do let the system set the terminal type be careful when logging in on terminals that are not the same as your normal terminal. The XENIX system has no way of checking whether or not the terminal assignment is correct for the given terminal and assumes that it is the same as your normal terminal. If it is not, you must set the terminal type manually.
7.10 Removing a Terminal

From time to time it may be necessary to remove a terminal from the system, for example, if you wish to replace it with some other device. Before you can remove a terminal, you must disable it with the `disable(C)` command.

To remove a terminal, follow these steps:

1. Turn off the power to the terminal.
2. Log in as the super-user at another terminal.
3. Use the `disable` command to disable the terminal. The command has the form:
   
   ```
   disable specialfile
   ```
   
   where `specialfile` is the name of the serial line to which the terminal is attached. For example, the command:
   
   ```
   disable /dev/tty1a
   ```
   
   disables the terminal connected to serial line `/dev/tty1a`.

4. Disconnect the terminal from the system.

The serial line previously connected to the terminal is now free to accept another device.

When using the `disable` command, make sure that you wait a full minute between each use of the command. Failure to do so can cause a system crash.

7.11 Modem Usage under XENIX

7.11.1 Serial Lines

XENIX supports modem control on serial ports. The following device names refer to the serial ports with and without modem control.

<table>
<thead>
<tr>
<th>Device:</th>
<th>Function:</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/tty1a</td>
<td>main serial adapter without modem control.</td>
</tr>
<tr>
<td>/dev/tty1A</td>
<td>main serial adapter with modem control.</td>
</tr>
<tr>
<td>/dev/tty2a</td>
<td>alternate serial adapter without modem control.</td>
</tr>
<tr>
<td>/dev/tty2A</td>
<td>alternate serial adapter with modem control.</td>
</tr>
</tbody>
</table>
/dev/tty1a and /dev/tty1A refer to the same serial port (likewise for /dev/tty2a and /dev/tty2A). The operating system uses different device-driver subroutines for each. Never attempt to use both modem and non-modem control ports at the same time or you will see the warning:

"cannot open: device busy"

For systems including multi-port serial cards, the devices /dev/tty[1,2][a-m] refer to use without modem control, and the devices /dev/tty[1,2][A-M] refer to use with modem control.

7.11.2 Dialing Out From Your Computer

The cu(C) and uucp(C) utilities are used to call remote systems and transfer data under XENIX. The file /usr/lib/uucp/L-devices (referred to as L-devices) contains information used by these programs to determine the characteristics of a particular serial line. The L-devices file comes set for the most common uses of cu and uucp.

The L-devices file contains lines which specify the device for the line, the call-unit associated with the line (0 for direct lines), and the baud rate, that are to be used by uucp. The following table shows example L-devices lines for various types of connections (direct or modem).

<table>
<thead>
<tr>
<th>Serial Line</th>
<th>Connection</th>
<th>L-devices line</th>
</tr>
</thead>
<tbody>
<tr>
<td>main serial adapter</td>
<td>(direct)</td>
<td>DIR tty1a 0</td>
</tr>
<tr>
<td>main serial adapter</td>
<td>(modem)</td>
<td>ACU tty1A tty1A</td>
</tr>
<tr>
<td>alternate serial adapter</td>
<td>(direct)</td>
<td>DIR tty2a 0</td>
</tr>
<tr>
<td>alternate serial adapter</td>
<td>(modem)</td>
<td>ACU tty2A tty2A</td>
</tr>
</tbody>
</table>

* example baud rate. Substitute the baud rate for your machine or modem.

Direct hookups depend on the baud rate setting of the login on the remote machine.

Modem hookups depend on the capability of your modem and the modem you are dialing.

Modem control devices should be used with lines connected to modems.

Note that these L-devices lines are compatible alternatives; they can exist in your L-devices file at the same time.
It is best to disable a line login before a dial-out program uses it. (See the section on “Shared Dial-In/Dial-Out”. To disable a line, enter:

```
disable tty
```

This command disables `/dev/tty1a for dialing out:

```
disable /dev/tty1a
```

To invoke `cu` for a direct line, enter:

```
cu dir
```

`cu` will select the first device from the `L-devices` file that matches the connection type, (DIR or ACU) and the speed. The default speed is 1200 baud. To select a specific line use the `-l` option. For example:

```
cu -l tty2a dir
```

This makes specific use of tty2a. To request a speed other than the default (1200), request use the `-s` option:

```
cu -s 9600 dir
```

This will find the first direct, 9600 baud line, in this case tty2a.

For dialing, both `cu` and `uucp` use the file `/usr/lib/uucp/dial`, an executable C program. This program dials a Hayes® Smartmodem 1200 or Smartmodem 1200B (a plug in modem card).

If you are using a Hayes® Smartmodem 2400, the dialer program you will need to use is in `/usr/lib/uucp/dialHA24`. To replace the default dialer with the 2400 version, use the following commands:

```
cd /usr/lib/uucp

ln dialHA24 dial
```

The source for the default `dial` and a `makefile` for recompiling the source program are included in the directory `/usr/lib/uucp`. If you have any other kind of modem, you can modify either of the two source files and create your own `dial` program. Note that you must have the XENIX Development System installed to compile a new `dial` program.
To replace the `dial` program with another program, follow these steps:

1. Change directory to `/usr/lib/uucp` with the following command:
   ```
   cd /usr/lib/uucp
   ```

2. Edit the file `makefile` in the directory `/usr/lib/uucp` and find the line that reads:
   ```
   EXES= dialHA12
   ```
   and change the name from `dialHA12` to the name of the dialing program you wish to use. When this is done, exit the file, saving the changes you have made.

3. Next, enter the command:
   ```
   make
   ```
   to your shell prompt and press RETURN.

4. When the `make` command is finished, link the file `dial` to the new dialing program you have compiled. Use the command:
   ```
   ln dialing_program dial
   ```

5. You now have a new `/usr/lib/uucp/dial` program.

The dialer program can also be a `sh(C)` script.

When you are hooking up your modem, or any other device, make sure that serial wires connected to your computer are not left hanging. An unterminated line connected to your computer can considerably reduce system performance. Unplug a modem wire at the computer. Three-wire cables are not sufficient when using modems. Several other pins must be connected for the modem to operate properly. If you are unsure as to what to use, a ribbon cable that connects all pins will work correctly.
7.11.3 Dialing Into Your Computer Under XENIX

To allow dialing into your computer, you must enable a serial line that recognizes modem control signals, with the `enable(C)` command. When using the `enable` command, make sure that you wait a full minute between each use of the command. Failure to do so may send too many signals to the `init(C)` program, which will then terminate. If `init` terminates, no new logins are possible.

To use the main serial adapter, enter:

```
disable tty1a
enable tty1A
```

Or, for the alternate serial adapter, enter:

```
disable tty2a
enable tty2A
```

Note that tty1A and tty1a refer to the same (main) serial line, and tty2A and tty2a refer to the same (alternate) serial line. Do not use the same line in both its modem and non-modem invocations at the same time as this will cause an error.

7.11.4 Shared Dial-In/Dial-Out

XENIX supports the use of dial-in and dial-out on the same modem line, without having to disable the login.

When a dial-out program is using the line, the login will be disabled. If someone is logged in on a line when a dial-out program attempts to use it, the dial-out program will fail to open the device.

For this feature to work correctly, the modem control device must be used, and carrier detection must be enabled in the modem. (For information on using dial-in/dial-out in conjunction with `uucp`, refer to Chapter 6 in the XENIX User's Guide "Building a Communications System.")

7.11.5 Hayes Modem Settings

Proper modem configuration is necessary when using `cu` and `uucp`. Modem settings differ for each modem. Consult your modem manual for the proper switch settings.
Smartmodem 1200

If you have a Hayes Smartmodem 1200, switches 3 and 8 should be down:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>up</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>down</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When switch 3 is down, the resulting codes will be sent to, (echoed by), the modem to the terminal or computer. When switch 8 is down, the modem is able to interpret the command being issued. This allows both the XENIX and DOS communications systems to work.

Smartmodem 2400

The Hayes 2400 Smartmodem requires on-line configuration if it is to be used as a dial-in line. Note that the Hayes 2400 does not answer the phone with a 2400 baud carrier if it is not set up with 2400 baud commands. You must configure the modem by issuing set up commands via cu(C). The form of the cu command is:

```
cu -s2400 -1 ttynn dir
```

`nn` is the "tty" number of the serial line. To configure a modem on tty1a, enter this command and press <RETURN>:

```
cu -s2400 -1 tty1a dir
```

Next, enter the following commands to configure the modem. They will be saved in the modem's non-volatile memory. If you do not want to save the settings, do not enter the last command (at&w). Commands are in the left column and short descriptions of what they do are in the right column. Follow each command with a RETURN:

- `at&f` Fetch factory configuration.
- `att` Tone dialing.
- `atl0` Low speaker volume.
- `at&d2` Set dtr "2": go on hook when dtr drops.
- `at&c1` Set dcd "1": dcd tracks remote carrier.
- `ats0=1` Answer phone after 1 ring (AA light should come on).
ate0  No echo (modem will no longer echo what is sent to it).

atq1  Quiet mode (modem will not respond with "OK" after this command or any that follow).

at&w  Saves settings in non-volatile memory.

Exit from cu by entering a "tilde" and a "period", followed by a RETURN:

```
~
```

The modem is now configured and ready for use.

/usr/lib/uucp/L.sys is the file containing information about systems to which uucp can connect. In order to prefix a number in L.sys with a non-numeric character, that character must be defined in the file /usr/lib/uucp/L-dialcodes. In some cases this is needed to pass special codes on to modems. For example, a modem might require the string "P" to pulse dial (to dial on a line with pulse dial, instead of touch tone dial). A sample L-dialcodes line is:

```
PULSE P
```

The number would be listed in L.sys as "PULSE4085551234". For more information on L-dialcodes and L.sys, refer to Chapter 6 in the XENIX User's Guide "Building a Communications System".

7.11.6 Modem Control

uucp must be used with modem control serial lines.

The modem must be set to respond to DTR (Data Terminal Ready). Check your modem manual for instructions on setting DTR. Note that the dialer port should be owned by uucp.

7.12 Adding a Lineprinter

This section explains how to add new lineprinters to your XENIX system and how to use the lineprinter commands to organize and control your printing.

The XENIX lineprinter spooling system is a collection of commands that help you, as system manager, to efficiently install, monitor, and control the lineprinters serving your system. When a user requests a file to be printed using the lp(C) command, the lineprinter system responds with a "request ID." This consists of the name of the printer on which the file will be printed and a unique number identifying the file. With this request ID, the
user can find out the status of the print request or cancel it. The \texttt{lp} options help the user to easily control printer output. For more information on \texttt{lp}, see "Using the Lineprinter," in the \textit{Introduction to XENIX}.

There are several terms used to describe the line printer system:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>device</td>
<td>The target for \texttt{lp} output. It can be a hard-wired printer, a terminal that is sometimes used as a printer, or a regular file. A device can be represented by a full XENIX pathname.</td>
</tr>
<tr>
<td>printer</td>
<td>The name assigned by the system manager to represent a device. This name can have up to 14 characters. At different times, a printer may be associated with different devices.</td>
</tr>
<tr>
<td>class</td>
<td>An ordered list of printers. Print requests sent to a class of printers are printed by the first available member of that class.</td>
</tr>
<tr>
<td>destination</td>
<td>A destination is where print requests are sent. A destination can be a class or a printer.</td>
</tr>
</tbody>
</table>

Consult your computer and lineprinter hardware manuals for information on making the connection between your system and printing devices.

### 7.12.1 Installing a Printer: \texttt{lpinit}

To install new printing devices on your XENIX system, use the \texttt{lpinit(C)} command. Before you use \texttt{lpinit} you should first know the port to which the lineprinter is connected or the XENIX pathname of the device (for example, /dev/tty1a) and the lineprinter interface program. A model interface program is supplied with your XENIX system. For more information on printer interface programs, see "Printer Interface Programs."

When you give the \texttt{lpinit} command, you are prompted with a series of questions. For most of them you need to supply your own answers, entering the information as you are prompted. When you are prompted for the printer name, however, you are given a default name option. If you wish to choose the default answer, simply press the \texttt{RETURN} key. If you make a mistake while responding to the questions, just press the \texttt{DELETE} key or the \texttt{INTERRUPT} key and start again.
Example

The following example shows how to add a line printer to your system. The printer name is `printer1`, the device pathname is `/dev/tty1a`, and it will be the default printer for your system:

Before you give the `lpinit` command, you must make sure that the line to the printer is working correctly. To check this, you should connect the printer to your system, turn it on, and send text from the system to the port that is connected to the printer. For example, the command:

```
cat /etc/motd > /dev/tty1a
```

should cause a copy of the `/etc/motd` file to print on your printer. If this test fails, you should check and make sure that:

- The printer is correctly connected to the computer.
- The connecting cable is in good condition.
- Your printer is powered on.
- The port is recognized by XENIX.

`lpinit` will not configure the printer correctly if the line is not working. When you are sure that the computer can communicate with the printer, perform the following steps:

1. Enter the command:

   `/etc/lpinit`

2. If the scheduler is running you are reminded that any jobs which are printing may be interrupted and you are prompted if you want to continue.
3. The following menu is displayed:

```
Do you wish to:
  1 - Add a new printer.
  2 - Remove a printer.
  3 - Reconfigure an existing printer.
  4 - Assign a default printer.
  5 - Print lp status information.

Select an option or enter q to quit:
```

Enter "1" and press RETURN.

4. Next you are prompted:

```
Are you adding a (P)arallel or (S)erial printer?
```

Enter "P" or "S" and press RETURN.

5. `lpinit` displays a list of available parallel or serial ports.

Enter your choice and press RETURN.

6. `lpinit` displays the following message:

```
Enter a name for the printer, press <RETURN> to use the default name (printer) or enter q to return to the previous menu.
```

Printer names can be up to 14 characters long and can be any combination of numbers, letters, or underscore characters. Enter the printer name, `printer1`, and press the RETURN key.

7. `lpinit` displays the following message on your screen:

```
If you have an unusual printer you must create an interface program in /usr/spool/lp/model. For a sample interface program look at /usr/spool/lp/model/dumb.
```
8. Now you are prompted for a printer type. The screen displays a numbered list of the available printer types on your system, followed by these instructions:

Enter one of the interface programs above or the full pathname of an interface program or enter q to return to the previous menu:

Enter one of the options, then press RETURN.

9. After you have finished responding to these questions, lpin init displays the following message:

destination “printer1” now accepting requests
printer “printer1” now enabled

Then, lpin init automatically gives the instructions to enable printer1 and allow it to accept print requests.

10. After enabling printer1, lpin init prompts you to respond to one more question:

Is this the default printer? (y/n)

You can enter Y (for yes) or N (for no) depending upon whether you want user print requests to be automatically routed to printer1 or not.

11. One last message is displayed:

If you need to modify your interface program after installing it, the installed version is in /usr/spool/lp/interface/printer1.

After you have responded to these questions, lpin init starts lpsched, and users can begin printing files on the new printer.
Using Peripheral Devices

You can also add printers to your system using the \texttt{lpadmin} command discussed in "Installing a Printer." However, you will need to give separate commands to stop \texttt{lpsched}, to enable the printer, and to allow it to accept print requests. For more information on these programs and commands, see sections "Stopping the Print Spooling Daemon," "Accepting and Rejecting Print Requests," and "Enabling and Disabling Printers."

### 7.12.2 Stopping the Print Spooling Daemon: \texttt{lpsched}

The spooling daemon, \texttt{lpsched}, routes print requests through the correct printer interface program and then to the lineprinter. No printing can be done on your system unless \texttt{lpsched} is running. The program \texttt{lpsched} starts automatically each time your XENIX system is restarted. Sometimes it is necessary to stop \texttt{lpsched}, especially if you want to reconfigure printers or if you want to add new printers using the \texttt{ladmin} command (\texttt{lpinit}) automatically stops and restarts \texttt{lpsched}.

This section explains how to find out whether or not \texttt{lpsched} is running, how to stop and restart it, and how to recreate it if necessary.

To find out whether or not \texttt{lpsched} is running, enter:

\texttt{lpstat -r}

The system responds with a message indicating whether \texttt{lpsched} is either running or not.

To shutdown the scheduler, \texttt{lpsched}, enter:

\texttt{/usr/lib/lpsched}

\texttt{lpsched} stops running and all printing stops as well. Printing requests stopped in the middle of printing reprint when \texttt{lpsched} starts again.

After you have finished configuring the printers, you should restart \texttt{lpsched}. To do this, enter:

\texttt{/usr/lib/lpsched}

\texttt{lpstat -r} should confirm that \texttt{lpsched} is running.

Each time \texttt{lpsched} sends a print request to an interface program, it records an entry in a log file, \texttt{/usr/spool/lp/log}. The entry includes the user name, the request ID, the name of the printer the request will be printed on, and the date and time requested. \texttt{lpsched} also records any error messages in this file. After you have stopped \texttt{lpsched}, the log file is renamed.
/usr/spool/lp/oldlog and lpsched starts a new log file. Requests waiting to be printed before lpsched was stopped may have an entry in both log files.

For more information on lpsched, see lpsched(C), XENIX Reference.

7.12.3 Creating an InitDevice File

The standard parallel printer devices (/dev/lp, /dev/lp0, /dev/lp1, and /dev/lp2) send a printer initialization string (init) the first time the device is opened after the system boots. This is done on the first open only so that printers with large text buffers will not be flushed by the sending of another file.

Some parallel printers require initialization every time a file is received for printing. Others require an init if the printer is turned off and back on again (for example, after changing paper or ribbons). The symptom of this situation is that the printer works fine until it is turned off and then back on.

If you need to initialize the printer more often than the standard devices provide, you can create an additional device file for the parallel port in use. This “init device file” can be used when necessary to initialize the printer.

1. Login as super-user

2. Determine which device is the parallel port you are using. This example assumes the device is the main parallel port (/dev/lp0).

3. Use lpinit to associate one of the parallel init devices (lp01, lp1i, lp2i) with the printer (select option 3 “reconfiguring an existing printer”).

If your printer needs an init when it is turned off and on, use the following command line after the printer is turned on. Initialize the printer before the first file is sent to the printer (this example assumes the main parallel port):

   # >/dev/lp0i

If your printer needs an init every time a file is sent (and it doesn’t have a large internal text buffer) you can use the /dev/lp0i device all the time.

The lp(C) command now sends an init every time a file is sent to the printer.

Some printers do not have newline/carriage return mapping. If your printer needs to have newlines mapped to newline/carriage returns, specify the crnlmap filter when you set up the printer using the lpinit(C) command. When you are prompted for the type of printer (dumb printer,
Imagen laser printer (parallel interface), Imagen laser printer (serial interface), or other), enter “other”. You are then prompted for the pathname of the interface program. The printer filter file is found in 
/usr/spool/lp/model/crnmap.

7.12.4 Moving Requests Between Printers: lpmove

You can move print requests between printing destinations by using the command lpmove. This command does not move print requests while the scheduler, lpsched, is running. To stop lpsched, see “Stopping the Print Spooling Daemon.” lpmove will move individual print requests by request ID, or all requests waiting to be printed on a particular printer.

For example, to move a request with a request ID of quick-532 to a printer named slow, enter:

/usr/lib/lpmove quick-532 slow

The print request now has a new request ID: slow-532.

To move all requests on a printer named quick to slow, enter:

/usr/lib/lpmove quick slow

For more information on lpmove, see lpsched (C), in the XENIX Reference.

7.12.5 Accepting and Rejecting Print Requests: accept

The accept command allows printers or classes of printers to accept print requests made with the lp command. You can allow a printer to accept requests after it has been properly configured. The printer, however, will not begin printing the requests until the enable command is given. If you added a printer to your system using the lpinit command, these steps were automatically performed. For information on enable, see “Enabling and Disabling Printers.”

For example, to have print requests accepted for a class of printers named class1, enter:

/usr/lib/accept class1

If you want to prevent requests from being routed to a printer, you can use the reject command. The -r options allows you to send users a message explaining why a printer is out of service.
For example, to prevent printing requests, from being routed to a printer, `printer4`, because of repairs, enter:

```
/usr/lib/reject -r "printer4 needs repair" printer4
```

A user who requests a file to be printed on `printer4` will receive the following message:

```
lp: cannot accept requests for destination "printer4"
--printer printer4 needs repair
```

To find out the acceptance status of printing destinations, enter:

```
lpstat -a
```

For more information on `lpstat`, see “Using the Lineprinter” in the *Introduction to XENIX*. For more information on `accept/reject`, see `accept(C)`, in the XENIX Reference.

### 7.12.6 Enabling and Disabling Printers

The `enable` command allows `lpsched` to print files on printers. A printer can accept requests for printing after the `accept` command is given for it, but in order for the files to be printed, the `enable` command must be given as well.

For example, to enable a printer named `daisy`, enter:

```
enable daisy
```

You can disable printers with the `disable` command. The scheduler, `lpsched`, will not send printing requests to disabled printers regardless of their acceptance status. The `-r` option allows you to send a message to users explaining why a printer has been disabled.

For example, to disable a printer named `laser` because of a paper jam, enter:

```
disable -r "paper jam" laser
```

Users requesting the status of `laser` with the command `lpstat -p laser` will receive the following message:

```
printer "laser" disabled since Dec 5 10:15
paper jam
```

For more information on these two commands, see `enable(C)` and `disable(C)` in the XENIX Reference.
7.12.7 Printer Interface Programs

Each printer on your system must have a printer interface program. This can be a shell script, C program, or any other executable program. Your XENIX system provides a model interface program. It is written as a shell script and can be found in /usr/spool/lp/model. You can use this program as is, modify it, or write your own interface program.

If you want to write or modify a printer interface program, the following information may be helpful.

When `lpsched` routes a printing request to a printer `P`, `/usr/spool/lp` invokes the interface program for `P` as follows:

```
interface P id user title copies options file
```

These flags are:

- **interface**: the directory which contains executable copies of interface programs
- **P**: the interface program being executed
- **id**: the request id returned by `lp`
- **user**: the login name of the user who made the request
- **title**: an optional title given by the user
- **copies**: the number of copies requested
- **options**: a list of printer dependent options separated by blanks
- **file**: the full pathname of a file to be printed

When the interface program is started, its standard input comes from `/dev/null` and both standard output and standard error output are directed to the printer’s device. Devices are opened for reading as well as writing when file modes permit. If a device is a regular file, all output is appended to the end of that file.

Interface programs may format their output in any way. They must, however, ensure proper `stty` modes for terminal characteristics such as baud rate and output options. In a shell script interface, this means that printer’s device must be open for reading — take the standard input for the `stty` command from the device.

The file `/etc/default/lpd` contains a line “BANNERS=d” where `d` is the number of banner pages to be printed at the front of every printing request. Interface programs should examine this file and behave accordingly.
After printing is completed, the interface program should exit with a code showing that the print job was successful. Exit codes are interpreted by the printer scheduler, `lp_sched`, as follows:

<table>
<thead>
<tr>
<th>Exit Code</th>
<th>Meaning to <code>lp_sched</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Print job was successful</td>
</tr>
<tr>
<td>1 to 127</td>
<td><code>lp_sched</code> found a problem while printing this particular request, for example, too many unprintable characters. This problem will not affect future printing requests. <code>lp_sched</code> notifies users by mail that there was an error in printing the request.</td>
</tr>
<tr>
<td>greater than 127</td>
<td>These codes are reserved for internal use by <code>lp_sched</code>. Interface programs must not exit with codes in this range.</td>
</tr>
</tbody>
</table>

Finally, when problems occur in printing that are likely to affect future printing requests, the printer interface program should disable printers so that print requests are not lost. When a busy printer is disabled, the interface program will be terminated with a signal 15 so that print requests are not lost.

For more information on printer interface programs, see `lpadmin(C)`, in the XENIX Reference.

7.13 Adding Additional Memory

You can improve system performance and run larger programs by increasing the amount of internal memory.

To increase internal memory follow these steps:

1. Turn off your computer.

2. Install additional memory according to the manufacturer's instructions. Make sure you have set all switches as noted in the instructions.

3. Boot XENIX. The boot screen details how the additional memory has affected your system.

4. Some features of XENIX may have been expanded. For example, you may have:
   - More multiscreens
• More buffers

• A larger maximum user process size

The number of multiscreens may be unchanged. Since the number of multiscreens can be set by the user, you may have already set a specific limit to the number of multiscreens available. If you have not set a limit to the number of multiscreens then you are already using the maximum number of multiscreens that XENIX allows.

The number of buffers may also be unchanged. Since the number of buffers can also be set by the user, you may have already set a specific limit to the number of buffers available. If you have not set a limit to the number of buffers then you are already using the maximum number of buffers that XENIX allows.

If the maximum user process size is unchanged, then it is now limited by the size of the swap file system instead of the amount of internal memory. You can:


• Change the process so that it runs without being swapped. Refer to proct1(S) for details.

You can follow the same procedure if you wish to remove internal memory from the system.

If the memory hardware reports an error to XENIX, XENIX displays the message:

panic: parity

You then see the software reboot message:

** Normal System Shutdown **

** Safe to Power Off **

- or -

** Press Any Key to Reboot **

If the system repeatedly panics from parity errors, consider replacing the memory chips.
Note

Some machines have a hardware limitation on the maximum amount of memory that can be installed. Refer to your computer hardware manual to determine the maximum amount of memory you can install.

7.14 Adding a Hard Disk

You can give the system extra room for storing users' files and directories by adding a hard disk to the system. This is often the only remedy for a system that has one hard disk and suffers from chronic lack of space. See the Release Notes for a list of hard disks compatible with the current XENIX release.

You can only have one disk controller card. Software support is now provided for hard disks that do not have matching entries in the ROM tables. Switch settings on the disk controller card may need to be changed. Check your hardware manual for the hard disk drive and the computer for this information.

Before adding the new disk, you must know how to connect it to the computer. Connecting the hard disk is explained in the hardware manual provided with the disk.

Make sure the second drive passes the manufacturers diagnostics before running XENIX. If it does not pass the diagnostic tests, you cannot use it with XENIX.

This is an outline of the procedure to add another hard disk:

- Connect the hard disk, then boot the system and enter system maintenance mode.

- Use the /etc/mkdev program. mkdev executes hdinit which, in turn, runs four interactive programs: dkininit to initialize the hard disk characteristics, fdisk(C), to separate the disk into MS-DOS and XENIX areas (the DOS area is optional), badtrk(M), to identify and map any bad areas on your disk, and divvy(C), to partition your disk into file systems.
Note

In the steps outlined below, you are prompted to respond to a variety of prompts. Although it is not always designated in this documentation, remember to press RETURN (or ENTER) after you have typed each response. XENIX waits indefinitely until this is done.

These are the steps to add another hard disk with one XENIX file system and no DOS area:

1. Connect the hard disk, then boot the system and enter system maintenance mode.

2. When you are in system maintenance mode, enter:

   /etc/mkdev hd

3. The first utility invoked by hdinit is dkinit, which sets parameters for non-standard hard disks. You see the menu

   Hard Disk Drive 1 Configuration

   1. Display current disk parameters
   2. Modify current disk parameters
   3. Select default disk parameters

   Enter an option or ‘q’ to quit:

If you have a standard hard disk, type “q” followed by <RETURN>. This selects the default parameters for your hard disk. Unless you know that your disk is non-standard, assume that it is standard and continue.

If your disk is non-standard, dkinit operates as follows:

If you enter “1” or “2”, you see the following display:

<table>
<thead>
<tr>
<th>Disk Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cylinders</td>
<td>value</td>
</tr>
<tr>
<td>2. Heads</td>
<td>value</td>
</tr>
<tr>
<td>3. Write Reduce</td>
<td>value</td>
</tr>
<tr>
<td>4. Write Precomp</td>
<td>value</td>
</tr>
<tr>
<td>5. Ecc</td>
<td>value</td>
</tr>
<tr>
<td>6. Control</td>
<td>value</td>
</tr>
<tr>
<td>7. Landing Zone</td>
<td>value</td>
</tr>
<tr>
<td>8. Sectors/track</td>
<td>value</td>
</tr>
</tbody>
</table>
When you see the display, "value" is replaced with the default value for that variable.

If you entered a "1", you now see the first menu again. If you entered a "2", you are now prompted:

Enter a parameter to modify or 'q' to return to the main menu:

If you enter "q", you see the first menu again. If you enter any of "1" - "8", you see the prompt:

Enter the new value or <RETURN> to use the existing value:

If you wish to change the value, enter a new value now or enter <RETURN> to use the existing value.

After the table values are displayed or modified, the initial menu is again displayed and you must type "q" to exit dkmnt. Exiting dkmnt by typing "q" overwrites any parameters you have changed with the new values. If you wish to restore the default parameters after making modifications, enter "3" from the first menu before typing "q" to exit dkmnt.

dkmnt is used to support non-standard hard disks. The normal user, while adding a second hard disk, will simply enter "q" when confronted with the dkmnt initial menu. When the dkmnt program exits, the hdinit program invokes fdisk(C), which partitions the hard disk.

4. When fdisk starts, you see this menu:

Select one of the following options or 'q' to exit the program

1. Display Partition Table
2. Use Entire Disk for XENIX
3. Create Partition
4. Activate Partition
5. Delete Partition

Enter your choice or 'q' to quit:

If you want to use your whole disk for XENIX, enter '2', then press RETURN. If your hard disk already contains valid partitions, fdisk displays the current partition table followed by the message:

Warning! All data on your disk will be lost!
Do you wish to continue? (y/n)
If you would like XENIX to occupy the whole disk, enter 'y' and press RETURN.

If no partitions were previously installed on your hard disk, fdisk will allocate the entire disk for XENIX without displaying the above warning.

Note that fdisk reserves the first track for masterboot and the last cylinder of the hard disk for disk diagnostics. Thus your partition begins on track 1 instead of track 0 and it ends on track 1219 instead of track 1223.

You see the partition table again, with the following changes:

Current Hard Disk Drive: /dev/rhd01

<table>
<thead>
<tr>
<th>Partition</th>
<th>Status</th>
<th>Type</th>
<th>Start</th>
<th>End</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Active</td>
<td>XENIX</td>
<td>1</td>
<td>1219</td>
<td>1218</td>
</tr>
</tbody>
</table>

Total disk size: 1224 (5 tracks reserved for masterboot and diagnostics)

Press <RETURN> to continue.

After you press RETURN, you see the main fdisk menu, shown above. Note that the XENIX partition must be active before exiting fdisk. Type 'q' to exit fdisk and continue with the installation.

For more information on having DOS and XENIX on your hard disk, see fdisk(C).

If you had a large portion of the disk already allocated to DOS, you must run DOS to deallocate this area. See fdisk(C) for more information on sharing disks between DOS and XENIX. No matter what configuration you produce with fdisk, the active partition must be the XENIX partition when you are through.

5. The next menu is from the bad track mapping program, badtrk. It displays this menu:

1. Print Current Bad Track Table
2. Scan Disk (You may choose Read-Only or Destructive later)
3. Add Entries to Current Bad Track Table by Cylinder/Head Number
4. Add Entries to Current Bad Track Table by Sector Number
5. Delete Entries Individually From Current Bad Track Table
6. Delete All Entries From Bad Track Table

Please enter your choice or 'q' to quit.
Enter ‘2’, then press RETURN. If badtrk thinks that the table may have been changed, you are prompted if you want to update this device with a new table. You should answer ‘y’. Next, you are prompted if you want to salvage any data on the bad tracks, and warned that this may take a long time. You should answer ‘n’ unless you have data on the bad tracks that you need to restore and there is no other way (i.e. backups) to recover the information, in which case you should respond ‘y’.

You see the following submenu:

1. Scan entire XENIX partition
2. Scan a specified range of tracks
3. Scan a specified filesystem

Enter the number corresponding to the type of scan you wish to perform. If this is a fresh installation, (that is you are installing XENIX for the first time or performing a complete reinstallation), you probably want to select option ‘1’.

If you choose option ‘2’ or ‘3’, you are then prompted to specify the area you want badtrk to scan.

After you have selected the area you want scanned, you are given the choice:

1. Quick scan (approximately 1 min/megabyte)
2. Thorough scan (approximately 7 mins/megabyte)

Option ‘2’ should be selected if this is a fresh installation. Once you respond to the above prompt, you are prompted:

Do you want this to be a destructive scan? (y/n)

If you respond ‘n’, a non-destructive, readonly scan begins. However, for your fresh installation, respond ‘y’. You are warned:

This will destroy the present contents of the region you are scanning.
Do you wish to continue? (y/n)

Respond ‘y’ for your fresh installation and you see the following message:

Scanning in progress, press ‘q’ to interrupt at any time.

After you have responded to the above prompts, the program scans the active partition of the hard disk for flaws. The larger your disk, the longer the scanning process takes, so a very large disk may take a while.
As `badtrk` scans the disk, it displays the number of each track it examines, and the percentage of the disk already scanned. Pressing "q" at any time interrupts the scan. You will then be prompted to continue scanning or to return to the main menu. Whenever `badtrk` finds a defective track, it lists the location of that track using both the sector number and cylinder/head conventions.

If your disk comes with a flaw map, cross-check your map against the results of the disk scanning. Because most disk flaws are marginal or intermittent, any flaw map will almost certainly contain more flaws than the scanning process will reveal. Depending on the format of your flaw map, select either option '3', "Add Entries to Current Bad Track Table by Cylinder/Head Number", or option '4', "Add Entries to Current Bad Track Table by Sector Number", and enter the flaws, one per line. Enter 'q' when you are finished.

Exit `badtrk` by entering 'q' at the main menu.

The program now displays the number of identified bad tracks. You are prompted to enter the number of tracks to be allocated as replacements for bad tracks. You will see a recommended number of tracks to allocate as space for replacement. This number is based on the number of known bad tracks and an allowance for tracks that will go bad in the future. You should choose to allocate at least as many tracks as recommended. Please make this choice carefully, because if you want to change this amount later, you will have to reinstall XENIX.

Next, `badtrk` prompts:

Do you want to update this device with the new table?

To save the changes made to the bad track table, enter 'y'. If an irrevocable mistake has been made in the bad track table at some time during this process, enter 'n', modify the bad track table to contain the desired entries, and then enter 'q' at the main menu to return to the prompt displayed above.

You are prompted:

Do you want to attempt to salvage any valid data on the bad tracks? [may take a long time] (y/n)

Generally you should respond 'n' to this prompt. However, if you have not made a backup of needed data on the bad tracks and there is no other way of recovering this information, you may want to respond 'y', keeping in mind that this process may take a long time.
6. Next, you see a prompt from divvy. The divvy program divides a partition into file systems. You can create up to seven divisions on a single partition, and name them anything you like.

If the hard disk you are installing is 20 megabytes or larger, you will be prompted for the number of file systems you want to create. Press RETURN to use the default value of one file system. Smaller hard disks automatically default to creating one file system.

You are next prompted for block control of your hard disk. You see:

Do you require block by block control over
the layout of the XENIX partition? (y/n)

Enter 'y' and press RETURN. This allows you to create up to seven file systems on a single XENIX partition, and assign specific names to whatever file systems you create. You must enter 'y' if you prompted to create more than 1 file system in the previous prompt.

You see the main divvy menu and a display that shows you how your disk is divided:

<table>
<thead>
<tr>
<th>Name</th>
<th>New File System?</th>
<th>#</th>
<th>First Block</th>
<th>Last Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>root</td>
<td>no, exists</td>
<td>0</td>
<td>0</td>
<td>24344</td>
</tr>
<tr>
<td>swap</td>
<td>no, exists</td>
<td>1</td>
<td>24345</td>
<td>25345</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>recover</td>
<td>no,exists</td>
<td>6</td>
<td>25346</td>
<td>25546</td>
</tr>
<tr>
<td>h30a</td>
<td>no, exists</td>
<td>7</td>
<td>0</td>
<td>25546</td>
</tr>
</tbody>
</table>

n[ame] Name or rename a division.
c[reate] Create a new filesystem on this division.
p[revent] Prevent a new file system from being created on this division.
s[ tart] Start a division on a different block.
c[end] End a division on a different block.
r[estore] Restore the original division table.

Please enter your choice or 'q' to quit:

Each row in the divvy table corresponds to a file system. For example, in this table, the name of file system 0 is "root".
Use option ‘n’ to change the name of a filesystem. You could name it \texttt{u} (for “user”), for example.

Do not change the configuration of file system 7. It is reserved for internal use by XENIX.

Exit from \texttt{divvy} by entering ‘q’. The program may prompt whether to install the new partition table, return to the main menu or exit the program without installing partition table. Select option ‘i’ to install the partition table.

If you have a large file system, you may be prompted if you want a scratch device to be created for you. You should answer yes.

For more information on \texttt{divvy(C)} see the XENIX Reference.

7.14.1 Mounting Another File System

To use an additional disk, or create a second, mounted file system, enter this command:

\begin{verbatim}
mkdev fs /dev/u /u
\end{verbatim}

This command does the following:

- Creates a directory \texttt{/u} (also known as the mount point).
- Creates the\texttt{lost+found} directory (used by \texttt{fsck} to recover files if the file system is corrupted).
- Mounts the device (\texttt{/dev/u}) on \texttt{/u}, cleans it, and unmounts it.
- Removes write permissions on the directory \texttt{/u} for group and all other users except root.
- Creates files in the \texttt{/u/lost+found} directory, then removes them. This allocates inodes for the directory, so that if the file system is corrupted and runs out of inodes, \texttt{fsck(C)} is still able to recover files.
- Adds the following line to \texttt{/etc/checklist}:

\begin{verbatim}
/dev/u
\end{verbatim}

- Modifies \texttt{/etc/default/filesys} so that the new file system is automatically mounted, checked and cleaned when appropriate.
To mount or unmount /dev/u on /u, use the following two commands respectively:

```
mount fs /dev/u /u
umount fs /dev/u /u
```

### 7.14.2 Using A Second File System

You can access the files on your new file system by first mounting it in the appropriate directory (we used /u as an example in the preceding section). After you mount the file system, all directories and files on it are usable just as any others on the system.

If you want to have user accounts on your mountable file system, change the variable "HOME" in the file /etc/default/mkuser. The "HOME" variable defines the directory where user accounts are placed. This variable is used by the `mkuser` program, which adds new users to the system.

Edit the file `/etc/default/mkuser`. There is a line which may look like this:

```
HOME=/usr
```

Change `/usr` to the name of the directory where you want to place user accounts. In our example, this is `/u`. The line should now read:

```
HOME=/u
```

Now, whenever you run the `mkuser` script to add a new user, that user's account will be in `/u`.

If there are already users on the system, and you want to move their accounts to the new file system, you can use the `copy` command to copy their accounts to the new file system. You must also change the users' entries in `/etc/passwd` to reflect the new pathname of their home directories.

Follow these steps to move user accounts from one file system to another:

1. Make sure the new file system is mounted. Also, be sure you are either in system maintenance mode, or logged in as root.
2. Change directories to the top of the current user account directory. If, for example, the user accounts are in /usr, enter:

   cd /usr

   and press RETURN.

3. List the contents of this directory:

   1c

   You see a list of account names, for example:

   alisonb  dean  jerrys  sams
   bif      gregt  lost+found  tammyr
   buckm    jeffj  pj      vicki

4. Enter:

   copy -orm /usr /u

   and press RETURN.

5. When the copy command has finished, enter:

   cd /u

   and press RETURN. List the new contents of /u to make sure all of the accounts have been copied correctly.

6. After you are sure that all of the accounts have been completely copied, you can remove the user accounts in the previous user file system.

7. Change the home directory for each user as listed in /etc/passwd. An example entry in /etc/passwd might be:

   alisonb:CoHiKNs.:271:104:Alison Berry:/usr/alisonb:/bin/esh
You see one such line for every user on your system. Change the field:

```
:usr/alisonb:
```

to match the user’s new home directory:

```
:/u/alisonb:
```

Do this for every user whose home directory has changed.

### 7.15 Creating Boot and Root Floppy Disks

`mkdev(C)` provides a utility to create bootable and root system floppy disks. `mkdev invokes fdir`n, a menu-driven program which allows the user to select the disk format and filesystem type. There are three basic types generated: boot and root on a single disk (96 tpi only), boot and root pair (48 tpi), or filesystem only (which simply invokes `mkfs(C)`). The formats supported are: 48 tpi, 96 tpi-15 sectors/track, in 5 1/4 and 3 1/2 inch formats. To create the floppy, enter:

```
/etc/mkdev fd
```

and you will see the following display:

```
Choices for type of floppy filesystem.

1. 48 tpi, double sided, 9 sectors per track
2. 96 tpi, double sided, 15 sectors per track

Enter an option or enter q to quit:
```

Enter the correct type and press RETURN. You are then prompted for the disk:

```
Insert a xx tpi floppy into drive 0. Press Return to continue.
```
Insert your floppy and press RETURN. The program responds with another menu:

Choices for contents of floppy filesystem.

1. Filesystem only  
2. Bootable only  
3. Root filesystem only  
4. Root and Boot (only available for 96tpi floppy)

Enter an option or enter q to quit:

Select the appropriate filesystem and press RETURN. fdinit generates the filesystem and will display the following message when complete:

```
xx tpi filesystem floppy complete.
```
Replace this Page with Tab Marked:

System Problems
Chapter 8

Solving System Problems

8.1 Introduction 8-1
8.2 Restoring a Nonechoing Terminal 8-1
8.3 Resolving Dialer Difficulties 8-1
8.4 Solving Lineprinter Problems 8-2
8.5 Stopping a Runaway Process 8-2
8.6 Replacing a Forgotten Password 8-3
8.7 Removing Hidden Files 8-3
8.8 Restoring Free Space 8-4
8.9 Restoring Lost System Files 8-4
8.10 Restoring an Inoperable System 8-4
8.11 Recovering from a System Crash 8-4
8.12 Mapping a Bad Track 8-5
8.13 Changing XENIX Initialization 8-6
  8.13.1 Changing the /etc/rc File 8-6
  8.13.2 Changing the .profile Files 8-7
  8.13.3 Changing the /etc/motd File 8-7
8.1 Introduction

This chapter explains how to solve problems that affect the operation of the system. The problems range in complexity from how to fix a nonechoing terminal, to how to restore lost system files.

8.2 Restoring a Nonechoing Terminal

A nonechoing terminal is any terminal that does not display characters entered at the keyboard. This abnormal operation can occur whenever a program stops prematurely as a result of an error, or when the user presses the BREAK key.

To restore the terminal to normal operation, follow these steps:

1. Press the Ctrl-j key. The system may display an error message. If it does, ignore the message.

2. Enter:

   \texttt{stty sane}

   and press the Ctrl-j key. The terminal does not display what you enter, so enter accurately.

After pressing Ctrl-j, the terminal should be restored and you may continue your work.

8.3 Resolving Dialer Difficulties

If the dialer program has aborted abnormally, the serial line you are using will remain enabled for dial out. (See \texttt{dial(1)} in the \textit{XENIX Reference Manual}. To check to see if a line is still in a dial out state, use this command:

   \texttt{who -a}

If the serial line is still in a dial-out state, (the entry for the line will read: DIALOUT) use the \texttt{ungetty} command. For example, to correct \texttt{tty1a}, enter this command and press RETURN:

   \texttt{/usr/lib/ungetty -r tty1a}
The line should be now be enabled as a dial-in line.

8.4 Solving Lineprinter Problems

No printing can be done on the lineprinter spooling system unless the print scheduler, lpsched, is running. To check the status of lpsched, enter:

lpsstat -r

To restart lpsched, enter the following on two lines:

/usr/lib/lpshut
/usr/lib/lpsched

Calling the file /usr/lib/lpshut cleans the system and /usr/lib/lpsched start it up again.

Access to files and directories in /usr/spool/lp by lp can be another source of spooling problems. You can check the lpsched log file, /usr/spool/lp/log. This is a record of the print scheduler's activity and errors. If lpsched refuses to run or a printer refuses to print, check to make sure that:

- The printer is enabled; see lp(C) in the XENIX Reference Manual.
- The files and directories in /usr/spool/lp are readable and writable by lp.

For more information on the lineprinter spooling system, see the section "Adding A Lineprinter" in Chapter 7.

8.5 Stopping a Runaway Process

A runaway process is a program that cannot be stopped from the terminal at which it was invoked. This occurs whenever an error in the program "locks up" the terminal, that is, prevents anything you enter from reaching the system.

To stop a runaway process, follow these steps:

1. Go to a terminal that is not locked up.
2. Log in as the super-user.

3. Enter:

   ps -a

   and press the RETURN key. The system displays all current processes and their process identification numbers (PIDs). Find the PID of the runaway program.

4. Enter:

   kill PID

   and press the RETURN key. The PID is the process identification number of the runaway program. The program should stop in a few seconds. If the process does not stop, enter:

   kill -9 PID

   and press the RETURN key.

The last step is sure to stop the process, but may leave temporary files or a non-echoing terminal. To restore the terminal to normal operation, follow the instructions in the section "Restoring a Nonechoing Terminal" in this chapter.

8.6 Replacing a Forgotten Password

The XENIX operating system does not provide a way to decipher an existing password. If a user forgets his password, the system manager must change the password to a new one. To change an ordinary user password, follow the instructions in the section "Changing a User's Password" in Chapter 3.

8.7 Removing Hidden Files

A hidden file is any file whose name begins with a dot (.). You can list the hidden files in a directory by entering:

   ls -a

   and pressing the RETURN key.
You can remove most hidden files from a directory by entering:

```
rm .[a-z]*
```

and pressing the RETURN key. Remaining files can be removed individually.

### 8.8 Restoring Free Space

The system displays an "out of space" message whenever the root directory has little or no space left to work. To restore system operation, you must delete one or more files from the root directory. To delete files, follow the steps outlined in the section "Maintaining Free Space" in Chapter 5.

### 8.9 Restoring Lost System Files

If a system program or data file is accidentally modified or removed from the file system, you can recover the file from the periodic backup disk with the `sysadmin` program. To restore the files, follow the instructions in the section “Restoring a Backup File” in Chapter 6.

### 8.10 Restoring an Inoperable System

On very rare occasions, one or more of the critical XENIX system files may be accidentally modified or removed, preventing the system from operating. In such a case, you must reinstall the XENIX system, and restore user program and data files from backup disks. To reinstall the system, follow the instructions in the XENIX *Installation Guide*. To restore files from backup disks, follow the instructions in the section “Restoring a Backup File” in Chapter 6.

### 8.11 Recovering from a System Crash

A system crash is a sudden and dramatic disruption of system operation that stops all work on the computer. System crashes occur very rarely. They are usually the result of hardware errors or damage to the root file system which the operating system cannot correct by itself. When a system crash occurs, the system usually displays a message explaining the cause of the error, then stops. This gives the system manager the chance to recover from the crash by correcting the error (if possible), and restarting the system.
A system crash has occurred if the system displays a message beginning with "panic:" on the system console, or the system refuses to process all input (including INTERRUPT and QUIT keys) from the system console and all other terminals.

To recover from a system crash, follow these steps:

1. Use the error message(s) displayed on the system console to determine the error that caused the crash. If there is no message, skip to step 3.

2. Correct the error, if possible. A complete list of error messages and descriptions for correcting the errors is given in messages (M) in the XENIX Reference Manual. (Even if the problem cannot be located or corrected, it is generally worthwhile to try to restart the system at least once by completing the remaining steps in this procedure.)

3. Turn off the computer and follow the steps described in Chapter 2, "Starting the System," to restart the system.

4. If the system will not restart, or crashes each time it is started, the operating system is inoperable and must be reinstalled. Follow the procedures described in the XENIX Installation Guide to reinstall the system and in Chapter 6, "Backing Up File Systems," to restore user’s files.

5. If the system cannot be started from the "Boot" disk in the distribution set for installation, the computer has a serious hardware malfunction. Contact a hardware service representative for help.

8.12 Mapping a Bad Track

Bad tracks on the hard disk are mapped during the XENIX installation procedure. This allows XENIX to avoid those areas of the disk that cannot be read or written. However, hard disks can develop bad tracks after XENIX is installed and running. If this occurs, the badtrk(M) utility should be run by the super-user (root) enabling XENIX to avoid the new bad track(s). badtrk must be run in single-user mode. Use /etc/shutdown su to enter single-user mode from multi-user mode (see shutdown(C)).

badtrk is a menu-driven utility for viewing, adding, or deleting entries to the bad track table. See badtrk(M) in the XENIX Reference Manual for more on its options and their use.
8.13 Changing XENIX Initialization

One common problem is adapting the system initialization to suit your system environment. This problem occurs whenever you have added new devices such as terminals or disk drives to the system, and wish these devices to be automatically enabled or mounted whenever you start normal system operation. You can adapt system initialization by modifying the system initialization files.

The XENIX initialization files contain XENIX commands and/or data which the system reads at system startup or whenever a user logs in. The files typically mount file systems, start programs, and set home directories and terminal types. The initialization files are named /etc/rc, .profile, and /etc/motd.

The system manager may modify these files to create any desired initial environment. The files are ordinary text files and may be modified using a text editor such as ed (see the XENIX User’s Guide). Note, however, that the /etc/rc and files contain XENIX commands and comments, and have the command file format described in Chapter 4, “The Shell,” in the XENIX User’s Guide.

8.13.1 Changing the /etc/rc File

The /etc/rc file contains XENIX system initialization commands. The system executes the commands at system startup. The commands display a startup message, start various system daemons, and mount file systems. You can display the contents of the file with the more command. Enter:

more /etc/rc

and press the RETURN key.

You may change the contents of the file so that the system executes any set of commands you wish. For example, if you want the system to automatically mount a new file system, simply append the appropriate mount command in the file. The system will execute the command on each startup.

To append a command to the file, follow these steps:

1. Log in as the super-user.

2. Invoke a text editor and specify the /etc/rc as the file to be edited.

3. Locate the place in the file you wish to insert the command (e.g., if the command mounts a file system, insert it with other mounting commands).
4. Insert the command on a new line. Make sure you enter the command correctly. The system rejects any incorrect commands and the commands that follow it when the file is read at system startup.

5. Exit the editor.

No other changes to the file are required. Be careful not to delete any commands already in the file unless you are sure they are not needed.

8.13.2 Changing the .profile Files

The .profile files contain commands that initialize the environment for each user. The commands in the file are executed whenever the user logs in. The file usually contains commands that set and export various system variables (e.g., TERM, PATH, MAIL). These variables give the system information such as what terminal type is being used, where to look for programs the user runs, where to look for the user's mailbox, what keys to expect for the "kill" and "backspace" functions, and so on (see Chapter 4, "The Shell," in the XENIX User's Guide).

There is one .profile file for each user account on the system. The files are placed in the user's home directory when the account is created. An ordinary user may modify his own .profile file or allow the system manager to make modifications. In either case, the file can be edited like the /etc/rc file by using a text editor. Commands can be added or removed as desired.

8.13.3 Changing the /etc/motd File

The message of the day file, /etc/motd, contains the greeting displayed whenever a user logs in. Initially, this file contains the name and version number of the XENIX system. It can be modified to include messages such as a reminder to clean up directories, a notice of the next periodic backup, and so on.

The /etc/motd file is an ordinary text file, so you can change the message by editing the file with a text editor. One common change is to include a reminder to delete unused files in order to preserve disk space. In general, you should limit the size of the file to include no more than a screenful of information.
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Micnet
Chapter 9

Building a Micnet Network

9.1 Introduction  9-1

9.2 Planning a Network  9-1
  9.2.1 Choosing Machine Names  9-2
  9.2.2 Choosing a Network Topology  9-2
  9.2.3 Drawing a Network Topology Map  9-3
  9.2.4 Assigning Lines and Speeds  9-3
  9.2.5 Choosing Aliases  9-4

9.3 Building a Network  9-5
  9.3.1 Creating the Micnet Files  9-5
  9.3.2 Saving the Micnet Files  9-9
  9.3.3 Restoring Micnet Files  9-10

9.4 Starting the Network  9-11

9.5 Testing a Micnet Network  9-12
  9.5.1 Checking the Network Connections  9-12
  9.5.2 Using the LOG File to Locate a Problem  9-13
  9.5.3 Stopping the Network  9-15
  9.5.4 Modifying the Micnet Network  9-15

9.6 Using a Uucp System  9-15
9.1 Introduction

A Micnet network allows communications between two or more independent XENIX systems. The network consists of computers connected by serial communication lines (that is, RS-232 ports connected by cable). Each computer in the network runs as an independent system, but allows users to communicate with the other computers in the network through the mail, rcp, and remote commands. These commands pass information such as mail, files, and even other commands, from one computer to another.

It is the system manager's task to build and maintain a Micnet network. The system manager decides how the computers are to be connected, makes the actual physical connections, then uses the netutil program to define and start the network.

This chapter explains how to plan a network and then build it with the netutil program. In particular, it describes:

- How to choose machine names and aliases
- How to draw the network topology map
- How to assign serial lines
- How to create the Micnet files
- How to distribute the Micnet files
- How to test the Micnet network

9.2 Planning a Network

To build a Micnet network, the netutil program requires that you provide the names of the computers that will be in the network, a description of how the computers are to be connected, a list of the serial lines to be used, the names of the users who will use the network, and what aliases (if any) they will be known by.

To keep the task as simple as possible, you should take some time to plan the network and make lists of the information you will be required to supply. To help you make these lists, the following sections suggest ways to plan a network.
9.2.1 Choosing Machine Names

A Micnet network requires that each computer in the network have a unique "machine name." A machine name helps distinguish each computer from other computers in the network. It is best to choose machine names as the first step in planning the network. This prevents confusion later on, when you build the network with the netutil program.

A machine name should suggest the location of the computer or the people who use it. You can also use any name you wish. The name must be unique and consist of letters and digits. The Micnet programs use only the first eight characters of each name, so be sure those characters are unique.

The netutil program saves the machine name of a computer in a /etc/systemid file. One file is created for each computer. After you have built and installed the network, you can find out the machine name of the computer you are using by displaying the contents of this file.

9.2.2 Choosing a Network Topology

The network topology is a description of how the computers in the network are connected. In any Micnet network, there are two general topologies from which all topologies can be constructed. These are "star" and "serial."

In a star topology, all computers are directly connected to a central computer. All communications pass through the central computer to the desired destination.

In a serial topology, the computers form a chain, with each computer directly connected to no more than two others. All communications pass down the chain to the desired destination.

A network may be strictly star, strictly serial, or a combination of star and serial topologies. The only restriction is that no network may form a ring. For example, you cannot close up a serial network by connecting the two computers at each end.

The kind of topology you choose depends on the number of computers you have to connect, how quickly you want communications to proceed, and how you want to distribute the task of passing along communications. A star topology provides fast communication between computers, but requires both a large portion of the central computer's total operation time and a large number of serial lines on the central computer. A serial topology distributes the communication burden evenly, requiring only two serial lines per computer, but is slow if the chain is very long (communication between computers can take several minutes). Often a combination of star and serial topologies makes the best network. In any case, make the
choice you think is best. If you discover you have made a wrong choice, you may change the network at any time.

9.2.3 Drawing a Network Topology Map

A network topology map is a sketch of the connections between computers in the network. You use the map to plan the number and location of the serial lines used to make the network.

You can make the map while you work out the topology. Simply arrange the machine names of each computer in the network on paper, then mark each pair of computers you wish to connect with serial lines. For example, the topology map for three computers might look like this:

a --------- b --------- c

As you draw, make sure that there is no more than one connection between any two computers in the network. Furthermore, make sure that no rings are formed (a ring is a series of connections that form a closed circle). Multiple connections and rings are not permitted.

9.2.4 Assigning Lines and Speeds

Once you have made the topology map, you can decide which serial lines to use. Since every connection between computers in the network requires exactly two serial lines (one on each computer), you need to be very careful about assigning the lines. Follow these steps:

1. Make a list of the serial lines (TTY lines) available for use on each computer in the network. You can display a list of the serial lines on a computer by displaying the file /etc/ttyS. A line is available if it is not connected to any device such as a terminal or modem.

2. Using the topology map, first pick a computer, then assign one (and only one) serial line to each connection shown for that computer. The serial lines must be from the list of available lines for that computer. No line may be assigned more than once. For example, if computer a has only one available serial line (tty1a), then the topology map should look like this:

a --------- b --------- c
tty1a
3. Repeat step 2 for all computers in the topology map. Make sure that each connection is assigned a line and that no two connections on any given computer have the same line. When finished, the map should look like this:

```
a----------b----------c
tty1a  tty2a  tty3a  tty4a
```

If a computer does not have enough available serial lines to meet its needs, you can make the lines available by removing the devices already connected to them. If you cannot remove devices, you must redraw your topology map.

4. Using the topology map, assign a serial line transmission speed for each computer pair. The speed must be within the normal range for XENIX serial lines (typically 110 to 9600). Transmission speeds are a matter of preference. In general, a higher speed means a smaller amount of time to complete a transmission, but a greater demand on system’s input and output capabilities. In some cases, transmission speeds are a matter of hardware capabilities. Some hardware is not capable of transmission speeds greater than 1200 baud. For this reason, 1200 is the recommended speed when first installing MicroNet. You may then increase the speed if you find the hardware can support it.

5. After the topology map is completely filled in, make a list of all computer pairs, showing their machine names, serial lines, and transmission speeds. You will use this list when installing the network.

9.2.5 Choosing Aliases

Once you have decided how to connect the computers in the network, you can choose aliases for users in the network. An alias is a simple name that represents both a location (computer) and a user. Aliases are used by the `mail` command to allow you to refer to specific computers and users in a network without giving the explicit machine and user names. Although not a required part of the network, aliases can make the network easier to use and maintain.

There are three kinds of aliases: standard, machine, and forward. A standard alias is a name for a single user or a group of users. A machine alias is a name for a computer or an entire network (called a site). A forward alias is a temporary alias for a single user or group of users. A forward alias allows users who normally receive network communications at one computer to receive them at another.
When you build a network with the netutil program, you are asked to provide standard aliases only. (You can incorporate machine and forward aliases into the network at your leisure.) Each standard alias must have a unique name and a list of the login names of the users it represents. You may choose any name you wish as long as it consists of letters and numbers, begins with a letter, and does not have the same spelling as the login names. The name should suggest the user or group of users it represents. The login names must be the valid login names of users in the network.

To help you prepare the aliases for entry during the netutil program, follow these steps:

1. Make a list of the user aliases (that is, the aliases that refer to just one user) and the corresponding login names of each user.

2. Make a separate list of the group aliases (that is, the aliases that refer to two or more users) and the login names or user aliases (from the first list) of the corresponding users. A group alias may have any number of corresponding users.

Note that there are a number of predefined group aliases. The name all is the predefined alias for all users in the network. The machine names of the computers in the network are predefined aliases for the users on each computer. Do not use these names when defining your own aliases.

9.3 Building a Network

You build a network with the netutil program. The program allows you to define the machines, users, and serial lines that make up the network.

To build a network, you must first create the Micnet files that define the network and then transfer these files to each computer in the network. After each computer receives the files, you may start the network and use it to communicate between computers.

The following sections describe how to build the network.

9.3.1 Creating the Micnet Files

The Micnet files are created with the install option of the netutil program. The install option asks for the names, aliases, and serial lines of each computer in the network. As you supply the information, it automatically creates the files needed for each computer. These files can then be transferred to the other computers in the network with the save and restore options of netutil. This means you can build the entire network from just one computer.
To use the install option, follow these steps:

1. Log in as the super-user.

2. Enter:
   
   netutil

   and press the RETURN key. The program displays the network utility menu. The install option is the first item in the menu.

3. Enter the number 1, and press the RETURN key. The program displays the following message:

   Compiling new network topology
   Overwrite existing network files? (yes/no)?

   Enter y and press the RETURN key to overwrite the files. The existing network files must be overwritten to create the new network. The first time you install the network, these files contain default information that need not be saved. If you install the system a second time or expand the system, it may be wise to save a copy of these files before starting the install option. The files can be saved on a floppy or a hard disk with the save option described later in this chapter.

   Once you have entered y, the program displays the following message:

   Enter the name of each machine
   (or press RETURN to continue installation).
   Machine name:

4. Enter the machine name and press the RETURN key. You may enter more than one name on a line by separating each with a comma or a space. After you have entered all the names, press the RETURN key to continue to the next step. The program displays the names you entered and asks if you wish to make changes.

5. Enter y (for “yes”) if you wish to enter all the names again. Otherwise, enter n (for “no”) or just press the RETURN key to move on to the next step. If you enter n, the program displays the message:

   For each machine, enter the names of the machines to be connected with it
   Machine a:
   Connect to:
6. Using the list of machine pairs you created when planning the network, enter the machine names of the computers connected to the given computer. You may enter more than one name on a line by separating each name with a comma (,) or a space. When you have entered the machine names of all computers connected to the given computer, press the RETURN key. The program prompts for the names of the computers connected to the next computer.

7. Repeat step 5 for all remaining computers. As the program prompts for each new set of connections, it will show a list of the machine names it already knows to be connected with the current computer. You need not enter these names. The program automatically checks for loops. If it finds one, it ignores the machine name that creates the loop and prompts for another.

Finally, when you have given the connections for all computers in the network, the program displays a list of the connections and asks if you wish to make corrections.

8. Enter y, if you wish to enter the connections again. Otherwise, enter n, to move to the next step. If you enter n, the program displays the message:

   For each machine pair, enter the tty name and tty speeds
   For the a <== b machine pair.

   Tty on a:

9. Using the list of serial line assignments you created when planning the network, enter the serial line name or number (for example, tty03 or 3) for the first computer in the pair and press the RETURN key. The program displays the message:

   Tty on b:

10. Enter the serial line name for the second computer in the pair and press the RETURN key. The program displays the message:

   Speed:

11. Enter the speed (for example, 1200) and press the RETURN key. The program asks for the serial lines and transmission speed of the next pair.

12. Repeat step 8 for all remaining machine pairs. When you have given serial lines and speeds for all pairs, the program displays this information and asks if you wish to make corrections.

13. Enter y, if you wish to enter the serial lines and speeds again. Otherwise, enter n, to move to the next step.
The program displays the message:

Enter the names of users on each machine:

For machine a:
Users on a:

14. Enter the login name of a user on the given computer, then press the RETURN key. You may enter more than one name on a line by separating each name with a comma (,) or a space. When you have entered all names for the given computer, press the RETURN key. The program displays the names of the users on the computer and asks if you wish to make corrections.

15. Enter y, if you wish to enter the user names again. Otherwise, enter n. If you enter n, the program prompts you for the names of the users on the next computer.

16. Repeat steps 13 and 14 for all remaining computers. After you have entered the names of users for every computer, the program prompts you to enter any aliases:

Do you wish to enter any aliases? (yes/no)?

17. Enter y, if you wish to enter aliases. Otherwise, enter n, to complete the installation. If you enter y, the program displays the message:

Each alias consists of two parts, the first is the alias name, the second is a list of one or more of the following:
valid user names
previously defined aliases
machine names

Aliases:

18. Using the list of aliases you created when planning the network, enter the name of an alias and press the RETURN key. The program displays the message:

Users/Aliases:

19. If the alias is to name a single user, enter the login name of that user and press the RETURN key. The program then prompts for another alias.

If, on the other hand, the alias is to name several users, enter the login names of the users. If one or more of the users to be named by the alias are already named by other aliases, enter the aliases instead of the login names. If all the users on one computer are to be named by the alias, enter the machine name instead of the login names. In
any case, make sure that each item entered on the line is separated from the next by a comma (,) or a space. If there are more items than can fit on the line, enter a comma after the last item on that line and press the RETURN key. You can then continue on the next line. After all names and aliases have been entered, press the RETURN key. The program then prompts you for another alias.

20. Repeat steps 17 and 18 for all remaining user aliases in your list. When you have given all aliases, press the RETURN key. The program displays a list of all aliases and their users and asks if you wish to make corrections.

21. Enter y, if you wish to enter all aliases again. Otherwise, enter n, to complete the installation.

Once you direct netutil to complete the installation, it copies the information you have supplied to the network files, displaying the name of each file as it is updated. Once the files are updated, you may use the save option to copy the Micnet files to floppy disk.

9.3.2 Saving the Micnet Files

You can save copies of the Micnet files on backup media (floppy disk) or hard disk with the save option of the netutil program. Saving the files allows you to transfer them to the other computers in the network. Before you can save the files to a floppy you need to format a floppy disk (see the section “Formatting Floppy Disks” in Chapter 4). Saving the files to the hard disk enables you to use uucp(C) to transfer the files to other machines.

To save the files, follow these steps:

1. Login as the super-user.

2. Enter:

    netutil

    Press the RETURN key. The program displays the network utility menu.

3. Enter the number 2, and press the RETURN key. The program displays the message:

    Save to /dev/fdx (yes/no)?

    where x is a drive number.
4. If you wish to use the specified disk drive, insert a blank, formatted floppy disk into the drive, wait for the drive to accept the disk, then enter "yes", and press the RETURN key. If you do not wish to use the drive, enter "no", and press the RETURN key. The program displays a prompt asking you for the filename of the disk drive (or file) you wish to use. Insert a blank, formatted disk into your chosen drive, wait for the drive to accept the disk, then enter the filename of the drive. The name of the default backup device (disk drive) is specified in the file `/etc/default/micnet`. This device can be changed depending on system configuration.

In either case, the program copies the Micnet files to the floppy disk.

5. Remove the floppy disk from the drive. Using a soft tip marker (do not use a ball point pen), label the disk "Micnet disk".

As soon as all files have been copied, you can transfer them to all computers in the network.

9.3.3 Restoring Micnet Files

The last step in building a Micnet network is to copy the Micnet files from the Micnet disk to all computers in the network. Do this with the restore option of the netutil program. For each computer in the network, follow these steps:

1. Log in as the super-user.

2. Enter:

   `netutil`

   Press the RETURN key. The program displays the network utility menu.

3. Enter the number 3, and press the RETURN key. The program displays the message:

   `Restore from /dev/fdx (yes/no)?`

   where x is the number of a drive.
4. If you wish to use the specified disk drive, insert the Micnet disk into the drive, wait for the drive to accept the disk, then enter "yes" and press the RETURN key. If you do not wish to use the drive, enter "no" and press the RETURN key. The program displays a prompt asking you for the filename of the disk drive you wish to use. Insert the Micnet disk into your chosen drive, wait for the drive to accept the disk, then enter the filename of the drive.

In either case, the program copies the network files to the appropriate directories, displaying the name of each file as it is copied. Finally, the program displays the message:

   Enter the name of this machine:

5. Enter the machine name of the computer you are using and press the RETURN key. The program copies this name to the new /etc/systemid file for the computer. If necessary, it also disables the serial lines to be used on the computer, preparing them for use with the network.

When the files have been copied, you may start the network with the start option.

9.4 Starting the Network

Once the Micnet files have been transferred to a computer, you can start the network with the start option of the netutil program. The start option starts the Micnet programs which perform the tasks needed to communicate between the computers in the network.

To start the network, follow these steps for each computer in the network:

1. Log in as the super-user.

2. Enter:

   netutil

   Press the RETURN key. The system displays the network utility menu.

3. Enter 4, and press the RETURN key. The program searches for the /etc/systemid file. If it finds the file it starts the network. If it does not, it prompts you to enter the machine name of the computer and then creates the file. The program also asks if you wish to log errors and transmissions. In general, these are not required except when checking or testing the network. When starting the network for the first time, enter n in response to each question and press the RETURN key.
Once the network has started, you may move to the next computer and start the network there.

Note that, for convenience, you can let each computer start the network automatically whenever the system itself is started. Simply include the command:

```
netutil start
```

in the system initialization file, `/etc/rc`, of each computer. To add this command, use a text editor as described in the section "Changing the `/etc/rc File" in Chapter 8. You can add the `-x` or `-e` options to this command line if you wish to log transmissions or errors. Even if you do not use these options, Micnet copies a log in and log out message to the system `LOG` file each time you start and stop the network. This means you will need to periodically clear the file. See the section "Clearing Log Files" in Chapter 5.

9.5 Testing a Micnet Network

After you have started a network for the first time, you should test the network to see that it is properly installed. In particular, you must determine whether or not each computer is connected to the network.

To test the network, you will need to know how to use the `mail` command (see Chapter 3, "Mail," in the XENIX User's Guide). The following sections explain how to test the network and how to correct the network if problems are discovered.

9.5.1 Checking the Network Connections

You can make sure that all computers are connected to the network by mailing a short message to all (the alias for all users in the network) with the `mail` command. Follow these steps:

1. Choose a computer.
2. Log in as the super-user.
3. Use the `mail` command (see the XENIX User's Guide) and the `all` alias to mail the message:

```
Micnet test
```

to all users in the network.
4. Check the mailboxes of each user in the network to see if the message was received. To check the mailboxes, log in as the super-user at each computer and use the `cat` command to display the contents of each user's mailbox.

The name of each user's mailbox has the form:

```
/usr/spool/mail/login-name
```

where `login-name` is the user's login name.

The network is properly installed when all users have received the message. If the users at one or more computers fail to receive the message, the computers are not properly connected to the network. To fix the problem, you need to locate the computer which has failed to make a connection. The next section explains how to do this.

**9.5.2 Using the LOG File to Locate a Problem**

You can locate a problem with connections by examining the `LOG` files on each computer in the network. The `LOG` files contain records of the interaction between each pair of computers. There are two `LOG` files for each pair of computers (one file on each computer). The `LOG` files on any given computer are kept in subdirectories of the `/usr/spool/micnet` directory. Each subdirectory has as its name the `machine-name` of the other computer in the pair. You can examine the contents of a `LOG` file by entering:

```
cat /usr/spool/micnet/remote/machine-name/LOG
```

and pressing the RETURN key. The `machine-name` must be the name of a computer that is paired with the computer you are using.

Each `LOG` file should contain a "startup message" which lists the name of each computer in the pair, and the serial line through which the pair is connected. It also shows the date and time at which the network was started. The message should look like:

```
daemon.mn: running as MASTER
Local system: a
Remote system: b, /dev/tty02
Tue Sep 24 22:30:35 1985
```

A startup message is added to the file each time the network starts successfully. If the message is not present, one or more of the network files and directories cannot be found. Make sure that you have used the `restore` option to transfer all the network files to the computer. Also, make sure that the `/etc/systemid` file contains the correct machine name for the given computer.
Each LOG file will contain a "handshake" message if the connection between the computer pair has been established. The message:

    first handshake complete

is added to the file on a successful connection. If the message is not present, make sure that the network has been started on the other computer in the pair. The network must be started on both computers before any connection can be made. If the network is started on both computers but the handshake message does not appear, then the serial line may be damaged or improperly connected. Check the serial line to make sure that the cable is firmly seated and attached to the correct RS-232 connectors on both computers. If necessary, replace the cable with one known to work.

If both the startup and handshake messages appear in the LOG file but the network is still not working, then there is a problem in transmission. You can create a record of the transmissions and errors encountered while transmitting by restarting the network and requesting Micnet to log all transmissions and errors. Just enter y (for "yes") when the start option asks if you wish to log errors or transmissions.

Error entries contain the error messages generated during transmission. Each message lists the cause of the error and the subroutine in which the error was detected. For example, the message:

    rsync: bad Probe resp: 68

shows that the rsync subroutine received a bad response (character 68 hexadecimal) from the other computer. You may use this information to track down the cause of the problem. One common problem is stray information being passed down the serial line by electronic noise. Make sure that the serial line's cable is properly protected against noise (for example, that the cable does not lie near any electric motor, generator, or other source of electromagnetic radiation). Also make sure the cable is in good condition.

Transmission entries contain a record of normal transmissions between computers. Each entry lists the direction, byte count, elapsed time, and time of day of the transmission. For example, the entry:

    rx: 0c 01 22:33:49

shows that 12 characters (0c hexadecimal) were received (rx) at 22:33:49. The elapsed time for the transmission was 1 second. You can use the records to see if messages are actually being transmitted.
9.5.3 Stopping the Network

You can stop the network with the `stop` option of the `netutil` program. This option stops the Micnet programs, stopping communication between computers in the network.

To stop the network, follow these steps on each computer in the network:

1. Log in as the super-user.

2. Enter:
   
   `netutil`

   Press the RETURN key. The program displays the network utility menu.

3. Enter 5, and press the RETURN key. The program stops the network programs running on the computer.

9.5.4 Modifying the Micnet Network

You can modify a Micnet network at any time by changing one or more of the Micnet files. You can reinstall the network with the `netutil` program. For very small changes (for example, correcting the spelling of an alias), you can modify the Micnet files directly with a text editor. The files and their contents are described in detail in the M section of the XENIX Reference Manual.

Before making any changes to a file, a copy should be made. You can make a copy with the `cp` command. You can replace an old file with the updated file using the `mv` command. Once one or more files have been changed on one computer, the files must be transferred to the other systems in the network using the `save` and `restore` options. These options can only be used after you have stopped the network.

Note that changes to the `aliases` file will not be incorporated into the system until the `aliashash` program is executed. This program produces the `aliases.hash` file needed by the network to resolve aliases. See `aliashash` (M) in the XENIX Reference Manual for a description of this command.

9.6 Using a Uucp System

You can send and receive mail from other Micnet sites by installing a uucp system on one computer in your site. A uucp system is a set of XENIX programs that provide communication between computers using ordinary telephone lines.
To use a uu<sub>cp</sub> system with your Micnet network, follow these steps:

1. Install a uu<sub>cp</sub> system on one computer in the Micnet site. Installation of a uu<sub>cp</sub> system requires a modem and the uu<sub>cp</sub> software provided with the XENIX Operating System. See the XENIX User's Guide for complete details.

2. Add the entry:

```
  uu<sub>cp</sub>:
```

  to the <i>maliases</i> file of the computer on which the uu<sub>cp</sub> system is installed.

3. For all other computers in your site, add the entry:

```
  uu<sub>cp</sub>:machine-name:
```

  to the <i>maliases</i> file. The <i>machine-name</i> must be the name of the computer on which the uu<sub>cp</sub> system is installed. One may also use the longer form of entry on the computer on which the uu<sub>cp</sub> system is installed.

You can test the uu<sub>cp</sub> system by mailing a short letter to yourself via another site. For example, if you are on the site "chicago", and there is another Micnet site named "seattle" in the system, then the command:

```
  mail seattle!chicago!johnd
```

will send mail to the "seattle" site, then back to your "chicago" site, and finally to the user "johnd" in your Micnet network. Note that a uu<sub>cp</sub> system usually performs its communication tasks according to a fixed schedule, and may not return mail immediately.
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with Tab Marked:

Appendices
Appendix A

XENIX Special Device Files

A.1 Introduction  A-1
A.2 File System Requirements  A-1
A.3 Special Filenames  A-1
A.4 Block Sizes  A-1
A.5 Gap and Block Numbers  A-2
A.6 Terminal and Network Requirements  A-2
A.1 Introduction

This appendix contains information needed to create file systems and add terminals to the XENIX system. For a full description of the special files mentioned here, see section HW of the XENIX Reference Manual found at the back of this volume.

A.2 File System Requirements

Many of the file system maintenance tasks described in this guide require the use of special filenames, block sizes, and gap and block numbers. The following sections describe each in detail.

A.3 Special Filenames

A special filename is the name of the device special block or character I/O file, which corresponds to a peripheral device, such as a hard or floppy disk drive. These names are required in such commands as mkfs, mount, and df to specify the device containing the file system to be created, mounted, or searched.

The following table lists the special filenames and corresponding devices, for hard and floppy disk drives on a typical computer.

<table>
<thead>
<tr>
<th>Device Special Filenames — Disks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filename</td>
</tr>
<tr>
<td>/dev/fd0</td>
</tr>
<tr>
<td>/dev/fd1</td>
</tr>
<tr>
<td>/dev/hd00</td>
</tr>
<tr>
<td>/dev/root</td>
</tr>
<tr>
<td>/dev/usr</td>
</tr>
</tbody>
</table>

A.4 Block Sizes

The block size of a disk is the number of blocks of storage space available on the disk, where a block is typically 512 or 1024 bytes of storage. Refer to the machine(HW) manual page or use cmchck(C) to determine the size of blocks on your system. Many commands require input that defines the number of blocks to be operated on. Other commands report disk space in terms of 512 byte blocks, in particular df, du, ls, lc, and find. A 500 byte file on a 1024 byte block file system is reported as using 2 blocks by these utilities, as the file uses one system block which is equivalent to two 512
byte blocks. The size of a 10 megabyte hard disk in 1024 byte blocks is 9792. Note that some of the blocks on the disk are reserved for system use and cannot be accessed by user programs. The block size of a typical floppy disk depends on the total storage capacity of the disk, as given by the manufacturer.

A.5 Gap and Block Numbers

The gap and block numbers are used by the mkfs, and possibly fsck, commands to describe how the blocks are to be arranged on a disk. The following table lists the gap and block numbers for the floppy and hard disks used with a typical computer.

<table>
<thead>
<tr>
<th>Disks</th>
<th>Gap</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floppy Disk, 48ds9</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Floppy Disk, 96ds15</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Hard Disk</td>
<td>1</td>
<td>34</td>
</tr>
</tbody>
</table>

The number of blocks can also be determined by multiplying the number of sectors per track (usually 17) by the number of heads on the hard disk, dividing by 2 (since there are 2 blocks per sector), and rounding off to the nearest integer.

A.6 Terminal and Network Requirements

The enable and disable commands are used to add and remove terminals on a system. The install option of the netutil program is used to build a network. The preceding commands and option require the names of the serial lines through which a terminal or network is to be connected. The following table lists the device special filenames of the two serial lines (actually two serial ports either with or without modem control). The character I/O files corresponding to these serial lines can be found in the /dev directory. Note that the files /dev/console and /dev/tty02 through /dev/tty10 represent "hardwired" devices and are not available for connection to terminals or hardware. Also, refer to serial(HW) for more information on serial lines.

<table>
<thead>
<tr>
<th>Filename</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/tty1a</td>
<td>main serial line (without modem control)</td>
</tr>
<tr>
<td>/dev/tty2a</td>
<td>alternate serial line (without modem control)</td>
</tr>
<tr>
<td>/dev/tty1A</td>
<td>main serial line (with modem control)</td>
</tr>
<tr>
<td>/dev/tty2A</td>
<td>alternate serial line (with modem control)</td>
</tr>
</tbody>
</table>
Appendix B

XENIX Directories

B.1 Introduction
B.2 The Root Directory
B.3 The /bin Directory
B.4 The /dev Directory
B.5 The /etc Directory
B.6 The /lib Directory
B.7 The /mnt Directory
B.8 The /tmp Directory
B.9 The /usr Directory
B.10 LogFiles
B.1 Introduction

This appendix lists the most frequently used files and directories in the XENIX system. Many of these files and directories are required for proper XENIX operation and must not be removed or modified. The following sections briefly describe each directory.

B.2 The Root Directory

The root directory (/) contains the following system directories:

/bin XENIX command directory
/dev Device special directory
/etc Additional program and data file directory
/lib C program library directory
/mnt Mount directory (reserved for mounted file systems)
/usr User service routines (may contain user home directories)
/tmp Temporary directory (reserved for temporary files created by programs)

All of the above directories are required for system operation.

The root directory also contains a few ordinary files. Of these files, the most notable is the xenix file which contains the XENIX kernel image.

B.3 The /bin Directory

The /bin directory contains the most common XENIX commands, that is, the commands likely to be used by anyone on the system. The following is a list of a few of the commands:

basename echo passwd su
cp expr rm sync
date fsck sh tar
dump login sleep restor
dumpdir mv stty test

These commands and all others in the /bin directory are required.

B.4 The /dev Directory

The /dev directory contains special device files which control access to peripheral devices. All files in this directory are required, and must not be removed.
The following is a list of the files:

- `/dev/console`: System console
- `/dev/lp`: Lineprinter
- `/dev/mem`: Physical memory
- `/dev/null`: Null device (used to redirect unwanted output)
- `/dev/rXX`: Unbuffered interface to corresponding device name
- `/dev/root`: Root file structure
- `/dev/swap`: Swap area
- `/dev/ttyXX`: Terminals
- `/dev/tty`: The terminal you are using

### B.5 The `/etc` Directory

The `/etc` directory contains miscellaneous system program and data files. All files are required, but many may be modified.

The following program and data files must not be removed or modified:

- `/etc/mnttab`: Mounted device table
- `/etc/mount`: For mounting a file structure
- `/etc/mkfs`: For creating a file structure
- `/etc/init`: First process after boot

The following data files may be modified, if desired. No files may be removed.

- `/etc/passwd`: Password file
- `/etc/rc`: Bootup shell script
- `/etc/ttys`: Terminal set up
- `/etc/termcap`: Terminal capability map
- `/etc/motd`: Message of the day
The data files in the directory `/etc/default` contain default information which is used by system commands (see `default(M)`). The following data files may be modified. No files may be removed.

- `/etc/default/archive` sysadmin(C) default information
- `/etc/default/backup` backup(C) default information
- `/etc/default/boot` autoboot(M) information
- `/etc/default/cron` cron(C) default logging information
- `/etc/default/dumpdir` dumpdir(C) default information
- `/etc/default/filesys` sysadmin(C) default information
- `/etc/default/login` login(M) default information
- `/etc/default/lpd` lp(C) default information
- `/etc/default/micnet` micnet(M) default information
- `/etc/default/mkuser` mkuser(C) default information
- `/etc/default/msdos` Location of DOS disks (A:, B:, ...)
- `/etc/default/passwd` passwd(C) default information
- `/etc/default/quot` quot(C) default information
- `/etc/default/restor` restore(C) default information
- `/etc/default/su` su(C) default information
  (Note that you must create this file yourself.)
- `/etc/default/tar` tar(C) default information

B.6 The `/lib` Directory

The `/lib` directory contains runtime library files for C and other language programs. The directory is required.

B.7 The `/mnt` Directory

The `/mnt` directory is an empty directory reserved for mounting removable file systems.

B.8 The `/tmp` Directory

The `/tmp` directory contains temporary files created by XENIX programs. The files are normally present when the corresponding program is running, but may also be left in the directory if the program is prematurely stopped. You may remove any temporary file that does not belong to a running program.
B.9 The /usr Directory

The /usr directory contains the home directories of all users on the system. It also contains several other directories which provide additional XENIX commands and data files.

The /usr/bin directory contains more XENIX commands. These commands are less frequently used or considered nonessential to XENIX system operation.

The /usr/include directory contains header files for compiling C programs.

The /usr/lib directory contains more libraries and data files used by various XENIX commands.

The /usr/spool directory contains various directories for storing files to be printed, mailed, or passed through networks.

The /usr/tmp directory contains more temporary files.

The /usr/adm directory contains data files associated with system administration and accounting. In particular, the /usr/adm/messages file contains a record of all error messages sent to the system console. This file is especially useful for locating hardware problems. For example, an unusual number of disk errors on a drive indicates a defective or misaligned drive. Since messages in the file can accumulate rapidly, the file must be deleted periodically.

B.10 Log Files

A variety of directories contain log files that grow in size during the normal course of system operation. Many of these files must be periodically cleared to prevent them from taking up valuable disk space (see the section "Clearing Log Files" in Chapter 5). The following table lists the files (by full pathname) and their contents.

<table>
<thead>
<tr>
<th>Filename</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/etc/ddate</td>
<td>Records date of each backup.</td>
</tr>
<tr>
<td>/usr/adm/pacct</td>
<td>Records accounting information; grows rapidly when process accounting is on.</td>
</tr>
<tr>
<td>/usr/adm/messages</td>
<td>Records error messages generated by the system when started.</td>
</tr>
</tbody>
</table>

B-4
/etc/wtmp
Records user logins and logouts.

/usr/adm/sulog
Records each use of the su command; grows only if option is set in the /etc/default/su file. You must create /etc/default/su. See su(C) in the XENIX Reference.

/usr/lib/cron/cronlog
Records each use of the at and cron commands.

/usr/spool/micnet/remote/*/LOG
Records transmissions between machines in a Micnet network. The * must be the name of a remote machine connected to the current machine.

For more information on these files, see the appropriate sections in the XENIX Reference.
Index

A

accept command 7-31
AUTO
gettydefs file 7-12

B

BACKSPACE key 1-2
Backup system see File system
/bin directory contents B-1
Block
arrangement on disk A-2
defined 5-2
number A-2
ownership 5-3
size A-1
Bootstrap program 2-1
BREAK key 1-2

C

C program
compilation header files B-4
library files B-3
Cartridge Tape
configuration 7-2
/etc/default/files 7-4
formatting 7-4
maintenance 7-3
using 7-2
Checking terminal settings 7-14
chmod command
permissions change 4-7
special file protection 4-11
Command
/etc/rc file, inclusion 8-6
location
/bin directory B-1
/usr/bin directory B-4
.profile file, inclusion 8-7
Computer
see also micenet network
Micenet network
collection test 9-12
Copying
directories to floppy and tape 6-10
files to floppy and tape 6-10
files with tar 6-10

Copying (continued)
floppy disks 4-11
Core file, described 5-5
Ctrl-\ key 1-2
Ctrl-H key 1-2
Ctrl-O key 1-2
Ctrl-S key 1-2
Ctrl-U key 1-2

D

Daily backup see File system
dd
copying a floppy 4-13
/dev directory
contents B-1
special file 4-11
Device special filenames A-1
df command
free space display 5-2
dial_login
gettydefs file entry 7-12
Directory
access permissions see Permissions
block usage 5-3
copying to floppy and tape 6-10
location 5-4
permissions see Permissions
removal 3-11
disable
a terminal 7-18
command 7-18
lineprinters 7-18, 7-32
Disabling a terminal 7-18
Disk
block number A-2
block size A-1
damage see File system
free space see File system
gap number A-2
security 4-10
usage 5-3
diskcp 4-12
formatting a floppy 4-12
du command 5-3

E

enable
command 7-32
lineprinters 7-32
Error messages B-32
ESCAPE key 1-2

I-1
Index

/etc directory contents B-2
/etc/default directory
  contents B-3
/etc/default/archive file
  contents B-3
/etc/default/backup file
  contents B-3
/etc/default/boot file
  contents B-3
/etc/default/cron file
  contents B-3
/etc/default/dumpdir file
  contents B-3
/etc/default/filesys file
  contents B-3
/etc/default/login file
  contents B-3
/etc/default/lpd file
  contents B-3
/etc/default/micnet file
  contents B-3
/etc/default/mkuser file
  contents B-3
/etc/default/msdos file
  contents B-3
/etc/default/passwd file
  contents B-3
/etc/default/quot file
  contents B-3
/etc/default/restor file
  contents B-3
/etc/default/su file
  contents B-3
/etc/default/tar file
  contents B-3
/etc/gettydefs file 7-11
  changing the file 7-12
/etc/group file, modification 3-7
/etc/motd file
  contents 8-7, B-2
  free space reminder 5-1
  modification 8-6, 8-7
/etc/passwd file
  user entry 3-4
  user ID change 3-10
/etc/password file
  contents B-2
/etc/rc file
  contents 8-6, B-2
  Micnet network startup 9-12
  modification 8-6
/etc/systemid file
  machine name contents 9-2
  Micnet network startup 9-11
/etc/termcap file
  contents B-2
  terminal 7-16
Execute permission 4-6

F

File
  access
    permissions see Permissions
  backup see File system
  copying to floppy and tape 6-10
  core 5-5
  core file see Core file
  damage see File system
  data loss 5-6
  determining block size 5-3
  hidden file removal 8-3
  inaccessibility 5-6
  initialization file see Initialization file
  location 5-4
  log 5-5
  log clearing 5-5
  lost file restoration see File system
  permissions see Permissions
  recovery from backup see File system
  removal
    unused files 5-2
  repair see File system
  restoration see File System
  system see File system
  temporary
    removal 5-5
  time of last access 5-4
  unused file removal 5-2

File system
  amount of free space 5-1
  automatic check 5-7
  backups 6-1
    creation 6-3
    daily 6-2
    disk storage 6-2
    floppy disk labeling 6-4
    frequency 6-1
    listing procedure 6-4
    periodic 6-2
    restoration 6-5
    schedule 6-2
    sysadmin program 6-1
    sysinfo account 6-1
    tar command 6-1
  cleaning 2-1
  copies 6-1
  creation
    filesys 6-8, 4-1
  damage
    causes 5-6
    restoration 5-6
  data loss 5-6
  defined 4-1
  destruction 4-2.
File system (continued)
display free space 5-2
expansion 5-6
free space
displaying 5-2
lack of 5-1
maintaining 5-1
restoration 8-4
lack of free space 5-1
maintaining free space 5-1
maintenance 5-1
mounting
automatic 4-4
initialization files 8-6
procedure 4-1, 4-3
repair 5-6
restoration 6-7
root 4-1
unmounting 4-4
umount command 4-1, 4-4
Filename
device special files A-1
find command 5-4
Floppy disk
block size A-1
bootable floppy disk 7-46
copying 4-11
damage see File system
file system creation 4-1
formatting 4-5
Micenet file saving 9-9
root filesystem disk 7-46
security 4-10
Formatting floppy disks 4-5
Free space see File system
fsck command 5-6

Hard disk
adding a second 7-36
installing user accounts 7-44
using a mountable file system 7-44
adding another 7-36
block size A-1
damage see File system
mounting 7-43
Hayes modem with XENIX 7-22
Hidden file removal 8-3
Home directory
removal 3-11
setting, initialization files 8-6
user account 3-1

I

Initialization file
contents 8-6
/etc/motd file see /etc/motd file
/etc/rc file see /etc/rc file
modification 8-6
.profile see .profile file
Internal memory
addition of 7-34
INTERRUPT key 1-2

K

Keyboard, described 1-2
kill command
runaway process stopping 8-3
KILL key 1-2

G

Gap number A-2
getty
-c option 7-14
program 7-10
gettydefs file 7-11
alternate login programs 7-12
autologin 7-12
changing the file 7-12
Group
access 3-8
creation 3-7
defined 3-7
ID 3-2, 3-7
changing 3-8
name 3-2, 3-7
number 3-2
permissions see Permissions
haltsys command 2-5

I

l command
listing permissions 4-6
/lib directory contents B-3
Lineprinter
accept command 7-31
adding
lpinit command 7-25, 7-24
creating init device
lpinit command 7-30
disable command 7-32
dumb model interface 7-33
enable command 7-32
interface programs 7-33
lpinit command 7-30
lpmove command 7-31
Lineprinter (continued)
  lpsched program
    see also lpsched program
  lpsched program 7-29
  lpshut command 7-29
  lpstat command 7-29
  moving requests
    lpmove command 7-31
  reject command 7-31
  scheduler program
    lpsched program 7-29
  solving problems 8-2
LOG file
  contents 9-13
  Micenet network
    connection error location 9-13
Log files 5-5
Login group 3-8
Login name
  Micenet network
    entry 9-8
  new user 3-2
  sending mail 5-4
  user account 3-1
Login programs
  dial_login 7-12
Login programs, alternate
  gettydefs file 7-12
lpinit command 7-25, 7-30
lpmove command 7-31
lpsched program
  finding out the status 7-29
  lpshut command 7-29
  lpstat command 7-29
  stopping lpsched 7-29, 7-29, 8-2
lpshut command 7-29
lpstat command 7-29, 8-2

Micenet network (continued)
  alias (continued)
    group
      creation 9-5
      machine 9-4
      preparation 9-5
      standard 9-4
      composition 9-1
    computer
      connection test 9-12
      machine name 9-2
    connection see Computer
      /etc/systemid file
        machine name contents 9-2
        system startup 9-11
    file
      copying to computers 9-10
      creation 9-5
      modification 9-15
      restoration 9-10
      saving 9-9
      transfer 9-5
    forward alias 9-4
    group alias
      creation 9-5
      handshake message 9-13
    install option 9-5
    LOG file
      connection error location 9-13
      contents 9-13
    machine alias 9-4
    machine name
      choice 9-2
      file entry 9-6
      saving 9-2
    modification 9-15
    netutil program
      information required 9-1
    install option 9-5
    network building 9-5
    restore option 9-10, 9-5
    save option 9-5, 9-9
    start option 9-11
    stop option 9-15
    planning 9-1
    restore option 9-10, 9-5
    save option 9-5, 9-9
    serial line
      assignment 9-3
      name entry 9-7
      transmission speed 9-4
    serial topology
      description 9-2
    standard alias 9-4
    star topology
      description 9-2
    start option 9-11
    startup
      procedure 9-11
Index

Index

Parallel lineprinter
adding 7-24
Parity errors
memory 7-35
passwd command 3-5
Password
change procedure 3-5
complexity, system access security 4-11
forgotten 8-5
new user 3-3
user account 3-1
Periodic backup see File system
Permissions
change 4-7
description 4-5
execute permission 4-6
fields 4-6
group permissions 4-5
initial assignment 4-7
levels 4-5
no permission 4-6
other permissions 4-5
read permission 4-6
search permission 4-6
special files 4-11
user permissions 4-5
write permission 4-6

PID
killing, runaway process stopping 8-3
Printer
see Lineprinter
Printing scheduler
see ipsched program
Process
runaway 8-2
stopping 8-2
.profile file
contents 8-7
modification 8-6, 8-7
removal 3-13
setting the terminal type 7-17
Program
runaway process 8-2
start, initialization files 8-6
termination, core file placement 5-5

quot command
block ownership display 5-3
Index

R

rcp command 9-1
Read permission 4-6
reject command 7-31
remote command 9-1
rm command 8-4
rmuser command
limitations 3-13
stopping 3-13
user account removal 3-11
root
directory backup 6-1
directory contents B-1
super-user login name 2-3
symbol (/) 4-1
Scrolls, multiple see Multiscroll 7-1
Search permission 4-6
Serial console 7-6
Serial line
adding terminals 7-7
device special filenames A-2
dial-in/dial-out problems 8-1
Micnet network
assignment 9-3
name entry 9-7
transmission speed 9-4
Serial ports
configuring 7-5
Setting
console 7-6
terminal lines 7-10
terminal type 7-16
Setting terminal lines 7-10
Setting the terminal type 7-16
Shutdown
command 2-4
improper shutdown
file check 5-7
shutdown command 2-4
Slash (/), root symbol 4-1
Special file
protection 4-11
security 4-11
Starting the system 2-1
Stopping the system 2-4
Super-user
account 1-1
leaving the account 2-3
log in 2-3
login name (root) 2-3
password 1-1
secrecy 4-11
precautions 2-3
prompt (#) 2-3
restricted use 1-2
special file access 4-11

Super-user password
secrecy 4-11
sysadmin program
archive 6-8
creating backups 6-3
description 6-2
file restoration 6-5, 8-4
file system restoration 6-7
filesys creation 6-8
listing backups 6-4
sysinfo account
backups 6-1
System
See reinstallation
access security 4-11
accounts 3-13
adding disk storage 4-1
administration directory B-4
cleaning the file system 2-1
inoperable system restoration 8-4
maintenance 1-1
account 1-1
mode 2-2
physical security 4-10
problems, fixing 8-1
security 4-10
starting 2-1
stopping 2-4
system wide message 5-2
System maintenance mode
stopping 2-5
System manager
backups 6-1
duties 1-1
file access 4-1
file system maintenance 5-1
free space maintenance 5-1
initialization files modification 8-6
Micnet network maintenance 9-1
super-user account 1-1
system maintenance mode 2-2
user account creation, maintenance 3-1
System wide message 5-2

T

Tape Drive
configuration 7-2
/etc/default files 7-4
formatting 7-4
maintenance 7-3
using 7-2
tar command
copying files 6-10
creating copies 6-10
description 6-2
restoring copies 6-11
Temporary file removal 5-5
TERM variable 7-16
Terminal adding 7-7
disabling 7-18
lockup, runaway process 8-2
non echoing terminal 8-1
type setting
initialization files 8-6
type setting 7-16
Time
file access 5-4
/tmp directory contents B-3
tty line see Serial line

U

umount command 4-1, 4-4
User
  block ownership display 5-3
  changing the ID 3-10
  group see Group
  ID 3-10
  login group see Login group
  new user 3-1
  password see Password
  permissions see Permissions
User account
  adding 3-1
  comments 3-4
  directory removal 3-11
  file removal 3-11
  login name 3-2
  .profile file modification 8-7
  removal
  procedure 3-11
Using a serial console 7-6
/usr directory contents B-4
/usr/spool/ip/model file 7-33

W

wall command 5-2
Write permission 4-6

X

xenix file B-1
XENIX keys, described 1-2
Contents

Hardware Dependent (HW)

8087          Math co-processor for Intel family CPUs.
intro         Introduction to miscellaneous features and files.
boot          XENIX boot program.
clockrate     Changes clock rate.
cmos          Displays and sets the configuration data base.
fd            Floppy devices.
hd            Internal fixed disk drive.
keyboard      Name and function of special keyboard keys.
lp, lp0, lp1, lp2 Line printer device interfaces.
machine       Description of host machine.
parallel      Interface to parallel ports.
randisk       Memory block device.
screen, tty[01-n], Display adapter and video monitor.
color,
monochrome,
ega, pga
serial, tty1[a-h],
tty1[A-H],
tty2[a-h],
tty2[A-H]
setty          Interfaces to serial ports.
tape          Sets options for the video monitor.
terminal       Cartridge tape device.
            Login terminal.
Name

intro – Introduction to machine related miscellaneous features and files.

Description

The hardware-dependent section (HW) contains information useful in maintaining the system. Included are descriptions of files, devices, tables and programs that are important in maintaining the entire system that are directly related to the kind of computer on which the system runs. This section is intended for use with the 86 family of Intel CPUs, specifically 8086, 8088, 80186, 80286 and 80386 based computers.
8087 (HW)

Name

8087

Syntax

8087
80287

Description

The 8087 is the INTEL math co-processor for the 8086. The 80287 is the INTEL math co-processor for the 80286. The kernel tests for the presence of an 8087 or 80287 at startup.

If your system has an 8087 or 80287, you must turn off a switch main system board in order to enable 8087 interrupts. Check you hardware manual to determine the proper switch and setting. If your system does not have an 8087, or the switch is on, the kernel will run a set of emulator routines which are much slower.

The C compiler available with the program development package generates the appropriate 8087 (or 80287) opcodes. C routines compiled with this compiler have run as much as 200 times as fast as the emulated code. In particular, the standard math library routines run considerably faster if you have an 8087 (or 80287).

The overflow, division by zero, and invalid operand exceptions return a SIGFPE signal. This signal can be caught. The rest of the 8087 and 80287 floating point exceptions (underflow, denormalized operand, and precision error) are masked.

Notes

The emulator returns meaningless information on divide by zero.

There is no obvious way to tell which 8087 (or 80287) exception generated the SIGFPE.
Name

boot – XENIX boot program.

Description

`boot` is an interactive program used to load and execute standalone XENIX programs. It is used primarily for loading and executing the XENIX kernel, but can load and execute any other programs that are linked for standalone execution. `boot` is a required part of the XENIX Operating System and must be present in the root directory of the root file system to ensure successful loading of the XENIX kernel.

The `boot` program is invoked by the system each time the computer is started. To restart the system without going through lengthy shutdown procedures, you can use the `reboot` command. This causes the system to reboot after shutting down without waiting for keyboard input. See `haltsys(3)` for more information.

For diskette boot, the procedure has three stages:

1. The ROMs load the boot block from sector 0 of the floppy, where sector 0 of the disk is the same as sector 0 of the filesystem.

2. The boot block loads `/boot` from the floppy filesystem.

3. `/boot` executes and prompts the user.

For fixed disk boot, the procedure has five stages:

0 of the filesystem.

The ROMs load in the `masterboot` block from sector 0 on the hard disk.

2. The `masterboot` block then loads the partition boot block from sector 0 of the active partition (see `fdisk(3)`).

3. Then, boot1 is loaded from the next four tracks.

4. `boot1` loads `/boot` from the XENIX file system.

5. `/boot` executes and prompts the user.

`/boot` and `/xenix` may lie on tracks that have been mapped by `badtrk(M)`.

The fixed disk boot procedure is invoked if the diskette drive is empty.

April 1, 1987
When first invoked, boot prompts for the location of a program to load by displaying the message:

XENIX System V

Boot :

To specify the location of a program, a device and filename must be given. The filename must include the full pathname of the file containing the standalone program. You can display a list of the current allowable device names by typing a question mark (?).

The format for the device and pathname is as follows:

```
xx(m,o)filename
  or
xx(m)filename
```

where:

- `xx` = device name
  (`'hd'` for the hard disk or `'fd'` for diskette device)
- `m` = minor device number
  (40 for the root filesystem on the hard disk)
- `o` = offset in the partition (usually 0). This is optional.

filename = standard XENIX pathname. Must start with a
slash if the program is not in the root directory.

All numbers are in decimal. See the manual pages for `hd(HW)` and
`fd(HW)` for minor device numbers of these devices. Specifying the
offset is optional. The location of the program to be loaded must
always be entered first on the command line and be present if other
boot options are specified either on the command line or in
/etc/default/boot.

If you want boot to pause and wait for a <RETURN> before exe-
cuting the program that it loads, enter the word “prompt” on the
command line. For example, if you enter “prompt” and press
<RETURN>, boot prints the following message and waits for you
to press the return key again:

Loaded, press <RETURN>.

The prompt can be changed to another string as in this example:

```
prompt= "change diskettes now"
```

boot loads xenix from the diskette, prints the message “change
diskettes now”, and waits for <RETURN> to be pressed. No other
characters can appear between prompt, the “=” sign and the
prompt string, although string may contain spaces. When you press
<RETURN>, xenix will begin execution. “Prompt” can be set
either on the command line or in `/etc/default/boot`. If a prompt is
not specified, `boot` executes the loaded program without pausing.

If you have just loaded the `boot` program from the distribution
diskette, simply press `<RETURN>` and `boot` defaults to the correct
values.

To load XENIX from a hard disk, enter:

```
hd(40,0)xenix
```

To use the default boot string specified in `/etc/default/boot`, simply
press `<RETURN>` when the system displays the boot prompt, and
`boot` uses the values specified by `DEFBOOTSTR` in
`/etc/default/boot`.

If nothing is typed after a short while and `LOADXENIX` is set to
YES in the default `root` file system's `/etc/default/boot` file, `boot`
times out and behaves as though a `<RETURN>` had been pressed,
except that an "auto" is added to the boot string. `boot` proceeds
through the boot procedure, and `init(M)` is passed a `-a` flag with no
"prompt".

It is recommended that you install DOS on the hard disk before
XENIX. See the manual page for `dos(C)`. However, once you install
DOS you can boot it at the XENIX "Boot" prompt by entering
"dos".

During XENIX installation, a custom `masterboot` is placed on the
hard disk. If a non-standard disk is specified, its parameters are
stored and enabled in this `masterboot`.

### Configuring The Kernel

`boot` passes any boot string typed at the boot prompt to the kernel,
except for the "prompt" string.

The kernel reads the boot string to determine which peripherals are
the root, pipe and swap devices. If no devices are specified in
either the `/etc/default/boot` description or on the command line,
the default devices compiled into the kernel are used.
Additional arguments in the boot string can alter this default action. These arguments have the form:

\[
\text{dev}=\text{xx}(m,o) \\
\text{or} \\
\text{dev}=\text{xx}(m)
\]

where:

- \( \text{dev} \) = The desired system device (\text{root[dev]}, \text{pipe[dev]}, or \text{swap[dev]})
- \( \text{xx, m, o} \) = same as for the boot device

If any combination of \text{root}, \text{pipe} or \text{swap} is specified, then those system devices will reside on that device, with the unspecified system devices using the defaults compiled in the kernel. Setting one device does not affect the default values for the other system devices.

Selecting The System Console

You can select the system console at boot time either by entering the command \text{systty=x} at the boot prompt, or by placing the keywords \text{SYSTTY=x} in the file \text{/etc/default/boot}. The letter \( x \) represents either a number or a string parameter.

If you use the \text{stty=x} command at boot time, \text{boot} uses the string parameter \( x \) to pass the selected console device to the kernel. The values of the boot string parameter \text{systty} are:

- \text{sio} Serial port COM1
- \text{scrn} Display adapter

For example, to assign the system console to the serial port at COM1, enter this command at the boot prompt:

\[
\text{systty=si0}
\]

If you do not specifically set the system console at boot time, the \text{boot} program follows these steps to determine the system console:

- \text{boot} reads \text{/etc/default/boot} and looks for the keywords \text{SYSTTY=x} where \( x \) is a number that specifies the system console device.

\[
0 \text{ indicates the serial adapter at COM1.} \\
1 \text{ indicates the display adapter.}
\]

- If \text{SYSTTY} is not found or \text{/etc/default/boot} is unreadable, \text{boot} checks for a display adapter and assigns it as the system console.
If no display adapter is found, boot looks for COM1, sets the serial port to 9600 baud, 8 data bits, 1 stop bit, and no parity, and uses it as the system console.

Thus, to have boot automatically set the system console to the serial port at COM1, enter this line in /etc/default/boot:

```
STTY=0
```

**Aliasing**

A set of system devices can be aliased to a single keyword by defining the keyword in the file /etc/default/boot. This keyword can then be entered on the "Boot" command line and the boot program then reads the corresponding system devices from /etc/default/boot and pass them to the kernel. An alias has the following form:

```
key=file [root=xx(m) pipe=xx(m) swap=xx(m) prompt[="string"]]
```

In all cases, the device specification can also have the format dev=xx(m,o), where o is the offset.

For example, if you have a root file system on a second hard disk and want to use it, but want to boot using the xenix located on the first hard disk, enter the following line into the /etc/default/boot description:

```
disk2=hd(40,0)xenix root=hd(104,0) prompt="Using second disk"
```

The next time you boot the system from the first hard disk, enter "disk2" in response to the "Boot" prompt. xenix will be loaded from the first hard disk, and when you see the message, "Using second disk", press <RETURN>. xenix will now boot and use the root file system on the second hard disk. Note that you must edit the /etc/default/boot file in the root file system on the device from which boot will be read, in this case the first hard disk.

**Boot options**

Boot options can be changed via keywords in /etc/default/boot. The following keywords are recognized by boot:

```
LOADXENIX=YES
```

If YES, boot automatically loads XENIX after a moderate delay.
DEFBOOTSTR=string  

string is used as the default boot string for timeouts and for no input on the command line. There can be no white space between DEFBOOTSTR, the "=" sign and string.

SYSTTY=x  

If x is zero (0), the system console device is set to the serial adapter at COM1. If x is one (1), the system console is set to the main display adapter.

RONLYROOT=NO  

Whether or not the root filesystem is to be mounted readonly. This should only be set to "yes" during installation.

Diagnostics

If an error occurs, masterboot displays an error message, and locks the system. The following is a list of the most common messages and their meanings:

IO ERR  

An error occurred when masterboot tried to read in the partition boot of the active operating system.

BAD TBL  

The bootable partition indicator of at least one of the operating systems in the fdisk table contains an unrecognizable code.

NO OS  

There was an unrecoverable error that prevented the active operating system's partition boot from executing.

When boot displays error messages, it returns to the "Boot" prompt. The following is a list of the most common messages and their meanings:

bad magic number  

The given file is not an executable program.

can't open <pathname>  

The supplied pathname does not correspond to an existing file, or the device is unknown.

Stage 1 boot failure  

The bootstrap loader cannot find or read the boot file. You must restart the computer and supply a file system disk with the boot file in the root directory.
not a directory
The specified area on the device does not contain a valid XENIX filesystem.

zero length directory
Although an otherwise valid filesystem was found, it contains a directory of apparently zero length. This most often occurs when a pre-System V XENIX filesystem (with incorrect, or incompatible word ordering) is in the specified area.

float:read(x)=y
An attempted read of x bytes of the file returned only y bytes. This is probably due to a premature end-of-file. It could also be caused by a corrupted file, or incorrect word ordering in the header.

Files

/etc/default/boot
/etc/masterboot
/etc/hdboot0
/etc/hdboot1

See Also

autoboot(M), badtrk(M), fd(HW), fdisk(M), haltsys(C), hd(HW), init(M), sulogin(M)

Notes
The computer tries to boot off any diskette in the drive. If the diskette does not contain a valid bootstrap program, errors occur.

The boot program cannot be used to load programs that have not been linked for standalone execution. To create standalone programs, the -A option of the XENIX linker (ld(CP)) and special standalone libraries must be used.

Standalone programs can operate in real or protected mode, but they must not be large or huge models. Programs in real mode can use the input/output routines of the computer’s startup ROM.

RONLYROOT should only be set to “yes” for installation. If it is set to “yes” during day-to-day operations, it will prevent you making changes to the root filesystem. You will then be required to boot from the floppy drive, edit the /etc/default/boot file and reboot.
Name

clockrate — Changes clock rate.

Syntax

/etc/clockrate frequency

Description

/etc/clockrate alters the interrupt timer clock frequency (different from the CPU clock frequency) to bring the system clock in sync with the computer's clock. This frequency is expressed in Megahertz (megaHZ) and can be found in the computer's hardware reference manual.

To set a new clockrate to 1.22878, for example, type:

# /etc/clockrate 1.22878

/etc/clockrate is a compiled "C" program, which modifies the kernel found in /xenix.

/etc/clockrate only needs to be run once, unless you reinstall the XENIX distribution floppies.

Files

/etc/clockrate

Notes

Your computer may not be able to change the clockrate with this utility.
Name

cmos – Displays and sets the configuration data base.

Syntax

```
cmos [ address [ value ] ]
```

Description

The `cmos` command displays and/or sets the values in the CMOS configuration data base. This battery-powered data base stores configuration information about the computer that is used at power up to define the system hardware configuration and to direct boot procedures. The data base is 64 bytes long and is reserved for system operation. Refer to your computer hardware manual for more information.

The `cmos` command is typically used to alter the current hardware configuration when new devices are added to the system. When only `address` is given, the command displays the value at that address; If both `address` and a `value` are given, the command assigns the value to that address. If no arguments are given, the command displays the entire contents of the data base.

The CMOS configuration data base may also be examined and modified by reading from and writing to `/dev/cmos` file. Because successful system operation depends on correct configuration information, the data base should be modified by experienced system administrators only.

The computer manufacturer’s diagnostic diskette should be run before setting the CMOS data base.

Files

```
/etc/cmos
/dev/cmos
```

Notes

Not all computers have a CMOS configuration data base. Some computers use switches on the main system board to configure the system. Refer to your computer hardware reference manual to determine whether you have a configuration data base.
Name

fd - floppy devices

Description

The fd devices implement the XENIX interface with floppy disk drives. Typically, the `tar(C)`, `cpio(C)` or `dd(C)` commands are used to read or write floppy disks. For instance,

```
tar tvf /dev/fd0
```

tabulates the contents of the floppy disk in drive 0 (zero).

The block special fd devices are also block-buffered. The floppy driver can read or write 512 bytes at a time using raw i/o. Note that block transfers are always a multiple of the 1K disk block size.

The floppy devices are named `/dev/fd0` and `/dev/fd1` (see Notes, below, for more information about device naming procedure).

The corresponding character special (raw) devices, `/dev/rfd0` and `/dev/rfd1`, afford direct, unbuffered transmission between the floppy and the user's read or write transfer address in the user's program.

For information about formatting, see `format(C)`.

The minor device number determines what kind of physical device is attached to each device file (see Notes).

Files

```
/dev/fd0    /dev/rfd048ds8    /dev/rfd096ds15
/dev/fd1    /dev/rfd148ds8    /dev/rfd196ds15
/dev/rfd0   /dev/rfd048ds9    /dev/rfd096ds8
/dev/rfd1   /dev/rfd148ds9    /dev/rfd196ds8
            /dev/rfd048ss8
            /dev/rfd148ss9
```

Notes

When accessing the character special floppy devices, the user's buffer must begin on a word boundary. The count in a `read(S)`, `write(S)`, or `seek(S)` call to a character special floppy device must be a multiple of 512 bytes.

Device names determine the particular drive and media configuration. The device names have the form: `fd048ds9` Where: `fd0` = drive number (0, 1, 2 or 3) 48 = number of disk tracks per inch (48
or 96) ds = single or double sided floppy (ss or ds) 9 = number of sectors on the floppy (8 or 9)

For instance, /dev/fd048ss9 indicates a 48 track per inch, single sided, 9 sector floppy disk device in drive 0.

The minor device numbers for floppy drives depend on the drive and media configuration. The most common are:

<table>
<thead>
<tr>
<th>Drive</th>
<th>48tpi</th>
<th>96tpi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ds/8</td>
<td>ds/9</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>3*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* reserved for special, non-floppy devices connected to the floppy controller as unit #3.

The scheme for creating minor device numbers is as follows. When interpreted as a binary number, each bit of the minor device number represents some aspect of the device/media configuration.

For example, the minor device number for /dev/fd048ss8 is “8.” Interpreted as a binary number, 8 is:

00001000

This is how each bit, or binary digit, is significant:

<table>
<thead>
<tr>
<th>48tpi - 0</th>
<th>Sectors per Track</th>
<th>ss - 0</th>
<th>Drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>96tpi - 1</td>
<td></td>
<td>ds - 1</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>16</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

April 1, 1987
Only the last six digits of the number are used in minor device identification. The first significant digit is the third from the left. In this example, the third digit from the left is zero, thus the device is 48tpi. The next two digits mean:

<table>
<thead>
<tr>
<th>Bits</th>
<th>Sectors per Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

The fourth digit tells whether the floppy is single sided (ss - 0) or double sided (ds - 1). The last two signify the drive number:

<table>
<thead>
<tr>
<th>Bits</th>
<th>Drive Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3*</td>
</tr>
</tbody>
</table>

* reserved for special, non-floppy devices connected to the floppy controller as unit #3.

Using this information, you can construct any minor device numbers you need.

It is not advisable to format a low density (48tpi) diskette on a high density (96tpi) floppy drive. Low density diskettes written on a high density drive should be read on high density drives. They may or may not be readable on a low density drive.

Use error-free floppy disks for best results on reading and writing.
**Name**

hd. – Internal hard disk drive

**Description**

The files `hd00`, `hd01` through `hd04`, `hd0a` through `hd0d`, `root`, and `swap` provide block-buffered access to the primary hard disk. The corresponding files for a second hard disk are listed below.

`root` refers to the root file system; `swap` refers to the swap area; `hd00` is the entire disk; `hd01` through `hd04` are the four partitions recognized by ROM-BIOS. Partition one is generally the XENIX partition. These special device files access the disks via the system’s normal buffering mechanism and may be read and written without regard to the size of physical disk records.

The following are the names of the fixed disk partitions. Each partition can be accessed through a block interface, for example `/dev/hd01`, or through a character (raw) interface, for example `/dev/rhd01`.

<table>
<thead>
<tr>
<th>Device File Names for Fixed Disks</th>
<th>Disk 1</th>
<th>Disk 2</th>
<th>Partition</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>/dev/hd00</code></td>
<td><code>/dev/hd10</code></td>
<td>entire disk</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd00</code></td>
<td><code>/dev/rhd10</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/hd01</code></td>
<td><code>/dev/hd11</code></td>
<td>first partition</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd01</code></td>
<td><code>/dev/rhd11</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/hd02</code></td>
<td><code>/dev/hd12</code></td>
<td>second partition</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd02</code></td>
<td><code>/dev/rhd12</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/hd03</code></td>
<td><code>/dev/hd13</code></td>
<td>third partition</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd03</code></td>
<td><code>/dev/rhd13</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/hd04</code></td>
<td><code>/dev/hd14</code></td>
<td>fourth partition</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd04</code></td>
<td><code>/dev/rhd14</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/hd0a</code></td>
<td><code>/dev/hd1a</code></td>
<td>active partition</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd0a</code></td>
<td><code>/dev/rhd1a</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/hd0d</code></td>
<td><code>/dev/hd1d</code></td>
<td>DOS partition</td>
<td></td>
</tr>
<tr>
<td><code>/dev/rhd0d</code></td>
<td><code>/dev/rhd1d</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/u</code></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/ru</code></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/root</code></td>
<td></td>
<td></td>
<td>root file system</td>
</tr>
<tr>
<td><code>/dev/rroot</code></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>/dev/swap</code></td>
<td></td>
<td></td>
<td>swap area</td>
</tr>
<tr>
<td><code>/dev/rswap</code></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Note that the last three file names do not exist for a second disk.

The device file names for DOS partitions function similarly to `/dev/hd?'.

To access DOS partitions, specify letters such as "C:" or "D:" to indicate first or second partitions. The file `/etc/default/msdos` contains lines that assign a letter abbreviation for the DOS device name. Refer to `dos(C)`.

The following table lists the minor device numbers for possible disk partitions. The minor device names for the raw devices are identical.

<table>
<thead>
<tr>
<th>Minor Device Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partition:</strong></td>
</tr>
<tr>
<td>hd00</td>
</tr>
<tr>
<td>hd01</td>
</tr>
<tr>
<td>hd02</td>
</tr>
<tr>
<td>hd03</td>
</tr>
<tr>
<td>hd04</td>
</tr>
<tr>
<td>hd0a</td>
</tr>
<tr>
<td>hd0d</td>
</tr>
<tr>
<td>root</td>
</tr>
<tr>
<td>swap</td>
</tr>
<tr>
<td>u (on 1st disk)</td>
</tr>
<tr>
<td>recover</td>
</tr>
</tbody>
</table>

Files

```
/dev/hd0a  /dev/hd1a
/dev/rhd0a /dev/rhd1a
/dev/hd0?  /dev/hd1?
/dev/rhd0? /dev/rhd1?
/dev/hd0d  /dev/hd1d
/dev/rhd0d /dev/rhd1d
/dev/u    /dev/ru
/dev/root  /dev/root
/dev/swap  /dev/swap
```

See Also

`badtrk(C), divvy(C), dos(C), mkdev(C)`
Diagnostics

The following messages may be printed on the console:

invalid fixed disk parameter table

and:

Error on Fixed Disk (minor n), blkno = nnnnn, cmd=nnnn, status=nnnn,
sector = nnnn, Cylinder/head = nnnn

Possible reasons for the first error include:

- The kernel is unable to get drive specifications, such as number of heads, cylinders, and sectors per track, from the disk controller ROM.

- Improper configuration.

- The disk is not turned on.

- The disk is not supported.

The second error specifies the following information:

- blkno : The XENIX block number within the device.

- cmd : The last command sent to the disk controller.

- status : The first byte of error status from the disk controller.

- sector and Cylinder/head specify the location of a possible flaw. This information is used with badtrk(M).

Notes

On the first disk, hd00 denotes the entire disk and is used to access the master boot record and partition table. For the second disk, hd10 denotes the entire disk and is used to access its partition table. Do not write to hd10 and hd00.
Name

keyboard – The PC keyboard.

Description

The PC keyboard is used to enter data, switch screens, and send certain control signals to the computer. XENIX performs terminal emulation on the PC screen and keyboard, and, in doing so, makes use of several particular keys and key combinations. These keys and key combinations have special names that are unique to the XENIX system, and may or may not correspond to the keytop labels on your keyboard. These keys are described later.

When you press a key, one of the following happens:

- An ASCII value is entered
- A string is sent to the computer.
- A function is initiated.
- The meaning of another key, or keys, is changed.

When a key is pressed (a keystroke), the keyboard sends a scan-code to the computer, it is interpreted by the keyboard driver. The interpretation of key codes may be modified so that keys can function differently from their default actions.

There are three special occurrences, or keystrokes:

- Switch screens.
- Send signals.
- Change the value of previous character, characters or string.

Switching Screens (Multiscreen)

To get to the next consecutive screen, enter Ctrl–PrtSc using the Ctrl key, and the PrtSc key. Any active screen may be selected by entering alt–F<sub>n</sub>, where F<sub>n</sub> is one of the function keys. F1 refers to the PC display (/dev/tty01).
Signals

A signal affects some process or processes. Examples of signals are Ctrl-d (end of input, exits from shell), Ctrl-\ (quits a process), Ctrl-s (stop output to the screen), and Ctrl-q (resume sending output).

Typically, characters are mapped to signals using stty(C). The only way to map signals is using stty.

Altering Values

The actual code sent to the keyboard driver can be changed by using certain keys in combination. For example, the SHIFT key changes the ASCII values of the alphanumeric keys. Holding down the Ctrl key while pressing another key sends a control code (Ctrl-d, Ctrl-s, Ctrl-q, etc.).

Special Keys

To help you find the special keys, the following table shows which keys on a typical console correspond to XENIX system keys. In this table, a hyphen (-) between keys means ‘hold down the first key while pressing the second.’

<table>
<thead>
<tr>
<th>XENIX Name</th>
<th>Keytop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTR</td>
<td>Del</td>
<td>Stops current action and returns to the shell. This key is also called the RUB OUT or INTERRUPT key.</td>
</tr>
<tr>
<td>BACKSPACE</td>
<td>←</td>
<td>Deletes the first character to the left of the cursor. Note that the “cursor left” key also has a left arrow (←) on its keytop, but you cannot backspace using that key.</td>
</tr>
<tr>
<td>Ctrl-d</td>
<td>Ctrl-d</td>
<td>Signals the end of input from the keyboard; also exits current shell.</td>
</tr>
<tr>
<td>Ctrl-h</td>
<td>Ctrl-h</td>
<td>Deletes the first character to the left of the cursor. Also called the ERASE key.</td>
</tr>
<tr>
<td>Ctrl-q</td>
<td>Ctrl-q</td>
<td>Restarts printing after it has been stopped with Ctrl-s.</td>
</tr>
<tr>
<td>Ctrl-s</td>
<td>Ctrl-s</td>
<td>Suspends printing on the screen (does not stop the program).</td>
</tr>
<tr>
<td>Ctrl-u</td>
<td>Ctrl-u</td>
<td>Deletes all characters on the current line. Also called the KILL key.</td>
</tr>
<tr>
<td>Ctrl-\</td>
<td>Ctrl-\</td>
<td>Quits current command and creates a core file, if allowed. (Recommended for debugging only.)</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>Esc</td>
<td>Special code for some programs. For example, changes from insert mode to command mode in the vi(C) text editor.</td>
</tr>
<tr>
<td>RETURN</td>
<td>(down-left arrow or ENTER)</td>
<td>Terminates a command line and initiates an action from the shell.</td>
</tr>
<tr>
<td>Fn</td>
<td>Fn</td>
<td>Function key ( n ). F1-F12 are unshifted, F13-F14 are shifted F1-F12, F25-F36 are Ctrl-F1 through F12, and F37-F48 are Ctrl-Shift-F1 through F12. The next ( Fn ) keys (F49-F60) are on the number pad (unshifted):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F49 - '7' F50 - '8' F51 - '9' F52 - ',' F53 - '.' F54 - '5'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F55 - '6' F56 - '+' F57 - '1' F58 - '2' F59 - '3' F60 - '0'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For keys F61 through F96, see /usr/lib/keyboard/strings. These function keys are not available on all keyboards, but you can map other keys to represent them.</td>
</tr>
</tbody>
</table>

The keyboard mapping is performed through a structure defined in /usr/include/sys/keyboard.h. Each key can have ten states. The first eight are:

- Base
- Shift
- Ctrl
- Alt
- Ctrl-Shift
- Alt-Shift
- Alt-Ctrl
- Alt-Ctrl-Shift
There are two additional states indicated by two special bytes. The first is a "special state" byte whose bits indicate whether the key is "special" in one or more of the first eight states.

The second is one of four characters (C, N, B, O) which indicate how the lock keys affect the particular key. This is discussed further in the next section, "Scan Codes."

Scan Codes

The following table describes the default contents of /usr/lib/keyboards/keys. The column headings are:

<table>
<thead>
<tr>
<th>SCAN CODE</th>
<th>The scan code generated by the keyboard hardware when a key is pressed. There is no user access to the scan code generated by releasing a key.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE</td>
<td>The normal value of a key press.</td>
</tr>
<tr>
<td>SHIFT</td>
<td>The value of a key press when the SHIFT is also being held down.</td>
</tr>
<tr>
<td>LOCK</td>
<td>Indicates which lock keys affect that particular key:</td>
</tr>
<tr>
<td></td>
<td>- C indicates Capslock</td>
</tr>
<tr>
<td></td>
<td>- N indicates Numlock</td>
</tr>
<tr>
<td></td>
<td>- B indicates both</td>
</tr>
<tr>
<td></td>
<td>- O indicates locking is off</td>
</tr>
</tbody>
</table>

Keys affected by the lock keys C, B, or N, send the shifted value (scan code) of current state when that lock key is on. When the shift key is depressed while a lock key is also on, the key reverts (toggles) to its original state.

The other columns are the values of key presses when combinations of the CTRL, ALT and SHIFT keys are also held down.

All values, except for keywords, are ASCII character values. The keywords refer to the special function keys.
<table>
<thead>
<tr>
<th>SCAN</th>
<th>BASE</th>
<th>SHIFT</th>
<th>CTRL</th>
<th>ALT</th>
<th>ALT</th>
<th>ALT</th>
<th>CTRL</th>
<th>LOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>1</td>
<td>esc</td>
<td>esc</td>
<td>nop</td>
<td>nop</td>
<td>esc</td>
<td>esc</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>2</td>
<td>&quot;'&quot;</td>
<td>&quot;'&quot;</td>
<td>nop</td>
<td>nop</td>
<td>&quot;'&quot;</td>
<td>&quot;'&quot;</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>3</td>
<td>&quot;@&quot;</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;@&quot;</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>4</td>
<td>&quot;#&quot;</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;#&quot;</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>5</td>
<td>&quot;$&quot;</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;$&quot;</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>6</td>
<td>&quot;%&quot;</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;%&quot;</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>7</td>
<td>&quot;^&quot;</td>
<td>&quot;^&quot;</td>
<td>rs</td>
<td>rs</td>
<td>&quot;^&quot;</td>
<td>&quot;^&quot;</td>
<td>rs</td>
<td>O</td>
</tr>
<tr>
<td>8</td>
<td>&quot;'&quot;</td>
<td>&quot;'&quot;</td>
<td>nop</td>
<td>nop</td>
<td>&quot;'&quot;</td>
<td>&quot;'&quot;</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>9</td>
<td>&quot;=&quot;</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;=&quot;</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>10</td>
<td>&quot;('</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;('</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>11</td>
<td>&quot;('</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>&quot;('</td>
<td>nop</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>12</td>
<td>&quot;*&quot;</td>
<td>&quot;*&quot;</td>
<td>ns</td>
<td>ns</td>
<td>&quot;*&quot;</td>
<td>&quot;*&quot;</td>
<td>ns</td>
<td>O</td>
</tr>
<tr>
<td>13</td>
<td>&quot;+'</td>
<td>&quot;+'</td>
<td>nop</td>
<td>nop</td>
<td>&quot;+'</td>
<td>&quot;+'</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>14</td>
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<td>del</td>
<td>bs</td>
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<td>O</td>
</tr>
<tr>
<td>15</td>
<td>btab</td>
<td>btab</td>
<td>nop</td>
<td>nop</td>
<td>btab</td>
<td>btab</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>16</td>
<td>'Q'</td>
<td>'Q'</td>
<td>dc1</td>
<td>dc1</td>
<td>'Q'</td>
<td>'Q'</td>
<td>dc1</td>
<td>C</td>
</tr>
<tr>
<td>17</td>
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<td>'W'</td>
<td>etb</td>
<td>etb</td>
<td>'W'</td>
<td>'W'</td>
<td>etb</td>
<td>C</td>
</tr>
<tr>
<td>18</td>
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<td>'E'</td>
<td>enq</td>
<td>enq</td>
<td>'E'</td>
<td>'E'</td>
<td>enq</td>
<td>C</td>
</tr>
<tr>
<td>19</td>
<td>'R'</td>
<td>'R'</td>
<td>dc2</td>
<td>dc2</td>
<td>'R'</td>
<td>'R'</td>
<td>dc2</td>
<td>C</td>
</tr>
<tr>
<td>20</td>
<td>'T'</td>
<td>'T'</td>
<td>dc4</td>
<td>dc4</td>
<td>'T'</td>
<td>'T'</td>
<td>dc4</td>
<td>C</td>
</tr>
<tr>
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<td>'Y'</td>
<td>'Y'</td>
<td>em</td>
<td>em</td>
<td>'Y'</td>
<td>'Y'</td>
<td>em</td>
<td>C</td>
</tr>
<tr>
<td>22</td>
<td>'U'</td>
<td>'U'</td>
<td>nak</td>
<td>nak</td>
<td>'U'</td>
<td>'U'</td>
<td>nak</td>
<td>C</td>
</tr>
<tr>
<td>23</td>
<td>'T'</td>
<td>'T'</td>
<td>ht</td>
<td>ht</td>
<td>'T'</td>
<td>'T'</td>
<td>ht</td>
<td>C</td>
</tr>
<tr>
<td>24</td>
<td>'O'</td>
<td>'O'</td>
<td>si</td>
<td>si</td>
<td>'O'</td>
<td>'O'</td>
<td>si</td>
<td>C</td>
</tr>
<tr>
<td>25</td>
<td>'P'</td>
<td>'P'</td>
<td>dle</td>
<td>dle</td>
<td>'P'</td>
<td>'P'</td>
<td>dle</td>
<td>C</td>
</tr>
<tr>
<td>26</td>
<td>'Y'</td>
<td>'Y'</td>
<td>esc</td>
<td>esc</td>
<td>'Y'</td>
<td>'Y'</td>
<td>esc</td>
<td>C</td>
</tr>
<tr>
<td>27</td>
<td>'g'</td>
<td>'g'</td>
<td>gs</td>
<td>gs</td>
<td>'g'</td>
<td>'g'</td>
<td>gs</td>
<td>O</td>
</tr>
<tr>
<td>28</td>
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<td>cr</td>
<td>nl</td>
<td>nl</td>
<td>cr</td>
<td>cr</td>
<td>nl</td>
<td>O</td>
</tr>
<tr>
<td>29</td>
<td>ctrl</td>
<td>ctrl</td>
<td>ctrl</td>
<td>ctrl</td>
<td>ctrl</td>
<td>ctrl</td>
<td>ctrl</td>
<td>O</td>
</tr>
<tr>
<td>30</td>
<td>'a'</td>
<td>'a'</td>
<td>soh</td>
<td>soh</td>
<td>'a'</td>
<td>'a'</td>
<td>soh</td>
<td>C</td>
</tr>
<tr>
<td>31</td>
<td>'s'</td>
<td>'s'</td>
<td>dc3</td>
<td>dc3</td>
<td>'s'</td>
<td>'s'</td>
<td>dc3</td>
<td>C</td>
</tr>
<tr>
<td>32</td>
<td>'D'</td>
<td>'D'</td>
<td>eat</td>
<td>eat</td>
<td>'D'</td>
<td>'D'</td>
<td>eat</td>
<td>C</td>
</tr>
<tr>
<td>33</td>
<td>'F'</td>
<td>'F'</td>
<td>ack</td>
<td>ack</td>
<td>'F'</td>
<td>'F'</td>
<td>ack</td>
<td>C</td>
</tr>
<tr>
<td>34</td>
<td>'g'</td>
<td>'g'</td>
<td>bel</td>
<td>bel</td>
<td>'g'</td>
<td>'g'</td>
<td>bel</td>
<td>C</td>
</tr>
<tr>
<td>35</td>
<td>'h'</td>
<td>'h'</td>
<td>bs</td>
<td>bs</td>
<td>'h'</td>
<td>'h'</td>
<td>bs</td>
<td>C</td>
</tr>
<tr>
<td>36</td>
<td>'j'</td>
<td>'j'</td>
<td>nl</td>
<td>nl</td>
<td>'j'</td>
<td>'j'</td>
<td>nl</td>
<td>C</td>
</tr>
<tr>
<td>37</td>
<td>'K'</td>
<td>'K'</td>
<td>vt</td>
<td>vt</td>
<td>'K'</td>
<td>'K'</td>
<td>vt</td>
<td>C</td>
</tr>
<tr>
<td>38</td>
<td>'L'</td>
<td>'L'</td>
<td>np</td>
<td>np</td>
<td>'L'</td>
<td>'L'</td>
<td>np</td>
<td>C</td>
</tr>
<tr>
<td>39</td>
<td>'n'</td>
<td>'n'</td>
<td>nop</td>
<td>nop</td>
<td>'n'</td>
<td>'n'</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>40</td>
<td>'m'</td>
<td>'m'</td>
<td>nop</td>
<td>nop</td>
<td>'m'</td>
<td>'m'</td>
<td>nop</td>
<td>C</td>
</tr>
<tr>
<td>41</td>
<td>'n'</td>
<td>'n'</td>
<td>nop</td>
<td>nop</td>
<td>'n'</td>
<td>'n'</td>
<td>nop</td>
<td>O</td>
</tr>
<tr>
<td>42</td>
<td>lshift</td>
<td>lshift</td>
<td>lshift</td>
<td>lshift</td>
<td>lshift</td>
<td>lshift</td>
<td>lshift</td>
<td>O</td>
</tr>
<tr>
<td>43</td>
<td>'\'</td>
<td>'\'</td>
<td>fs</td>
<td>fs</td>
<td>'\'</td>
<td>'\'</td>
<td>fs</td>
<td>O</td>
</tr>
<tr>
<td>44</td>
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<td>'Z'</td>
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<td>sub</td>
<td>'Z'</td>
<td>'Z'</td>
<td>sub</td>
<td>C</td>
</tr>
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<td>45</td>
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<td>'X'</td>
<td>can</td>
<td>can</td>
<td>'X'</td>
<td>'X'</td>
<td>can</td>
<td>C</td>
</tr>
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<td>'C'</td>
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<td>etx</td>
<td>'C'</td>
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<td>etx</td>
<td>C</td>
</tr>
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<td>syn</td>
<td>'v'</td>
<td>'v'</td>
<td>syn</td>
<td>C</td>
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<td>so</td>
<td>'n'</td>
<td>'N'</td>
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<td>so</td>
</tr>
<tr>
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<td>cr</td>
<td>'m'</td>
<td>'M'</td>
<td>cr</td>
<td>cr</td>
</tr>
<tr>
<td>51</td>
<td>','</td>
<td>'&lt;'</td>
<td>nop</td>
<td>nop</td>
<td>','</td>
<td>'&lt;'</td>
<td>nop</td>
<td>nop</td>
</tr>
<tr>
<td>52</td>
<td>'&gt;'</td>
<td>']'</td>
<td>nop</td>
<td>nop</td>
<td>'&gt;'</td>
<td>']'</td>
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<td>nop</td>
</tr>
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<td>nop</td>
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<td>rshift</td>
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<td>rshift</td>
<td>rshift</td>
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<td>rshift</td>
</tr>
<tr>
<td>55</td>
<td>&quot;#&quot;</td>
<td>&quot;#&quot;</td>
<td>nscr</td>
<td>nscr</td>
<td>&quot;#&quot;</td>
<td>&quot;#&quot;</td>
<td>nscr</td>
<td>nscr</td>
</tr>
<tr>
<td>56</td>
<td>alt</td>
<td>alt</td>
<td>alt</td>
<td>alt</td>
<td>alt</td>
<td>alt</td>
<td>alt</td>
<td>alt</td>
</tr>
<tr>
<td>57</td>
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<td>' '</td>
<td>' '</td>
<td>' '</td>
<td>' '</td>
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<td>clock</td>
<td>clock</td>
<td>clock</td>
<td>clock</td>
<td>clock</td>
<td>clock</td>
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<td>59</td>
<td>fkey1</td>
<td>fkey13</td>
<td>fkey25</td>
<td>fkey37</td>
<td>scr1</td>
<td>scr11</td>
<td>scr1</td>
<td>scr11</td>
</tr>
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<td>fkey14</td>
<td>fkey26</td>
<td>fkey38</td>
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<td>scr12</td>
<td>scr2</td>
<td>scr12</td>
</tr>
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<td>61</td>
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<td>fkey15</td>
<td>fkey27</td>
<td>fkey39</td>
<td>scr3</td>
<td>scr13</td>
<td>scr3</td>
<td>scr13</td>
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<td>fkey28</td>
<td>fkey40</td>
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<td>scr14</td>
<td>scr4</td>
<td>scr14</td>
</tr>
<tr>
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<td>fkey5</td>
<td>fkey17</td>
<td>fkey29</td>
<td>fkey41</td>
<td>scr5</td>
<td>scr15</td>
<td>scr5</td>
<td>scr15</td>
</tr>
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<td>64</td>
<td>fkey6</td>
<td>fkey18</td>
<td>fkey30</td>
<td>fkey42</td>
<td>scr6</td>
<td>scr16</td>
<td>scr6</td>
<td>scr16</td>
</tr>
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<td>fkey31</td>
<td>fkey43</td>
<td>scr7</td>
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<td>66</td>
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<td>fkey32</td>
<td>fkey44</td>
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<td>scr8</td>
<td>scr8</td>
<td>scr8</td>
</tr>
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<td>67</td>
<td>fkey9</td>
<td>fkey21</td>
<td>fkey33</td>
<td>fkey45</td>
<td>scr9</td>
<td>scr9</td>
<td>scr9</td>
<td>scr9</td>
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<td>68</td>
<td>fkey10</td>
<td>fkey22</td>
<td>fkey34</td>
<td>fkey46</td>
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<td>scr10</td>
<td>scr10</td>
<td>scr10</td>
</tr>
<tr>
<td>69</td>
<td>nlock</td>
<td>nlock</td>
<td>dc3</td>
<td>dc3</td>
<td>nlock</td>
<td>nlock</td>
<td>dc3</td>
<td>dc3</td>
</tr>
<tr>
<td>70</td>
<td>slot</td>
<td>slot</td>
<td>slot</td>
<td>slot</td>
<td>slot</td>
<td>slot</td>
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<td>'7'</td>
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<tr>
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<td>fkey51</td>
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<td>'9'</td>
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<td>'9'</td>
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<tr>
<td>74</td>
<td>fkey52</td>
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<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
</tr>
<tr>
<td>75</td>
<td>fkey53</td>
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<td>'4'</td>
<td>'4'</td>
<td>'4'</td>
<td>'4'</td>
<td>'4'</td>
<td>'4'</td>
</tr>
<tr>
<td>76</td>
<td>fkey54</td>
<td>'5'</td>
<td>'5'</td>
<td>'5'</td>
<td>'5'</td>
<td>'5'</td>
<td>'5'</td>
<td>'5'</td>
</tr>
<tr>
<td>77</td>
<td>fkey55</td>
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<td>'6'</td>
<td>'6'</td>
<td>'6'</td>
<td>'6'</td>
<td>'6'</td>
<td>'6'</td>
</tr>
<tr>
<td>78</td>
<td>fkey56</td>
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<td>'1'</td>
<td>'1'</td>
<td>'1'</td>
<td>'1'</td>
<td>'1'</td>
<td>'1'</td>
</tr>
<tr>
<td>79</td>
<td>fkey57</td>
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<td>'2'</td>
<td>'2'</td>
<td>'2'</td>
<td>'2'</td>
<td>'2'</td>
<td>'2'</td>
</tr>
<tr>
<td>80</td>
<td>fkey58</td>
<td>'3'</td>
<td>'3'</td>
<td>'3'</td>
<td>'3'</td>
<td>'3'</td>
<td>'3'</td>
<td>'3'</td>
</tr>
<tr>
<td>81</td>
<td>fkey59</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
<td>'0'</td>
</tr>
<tr>
<td>82</td>
<td>fkey60</td>
<td>'9'</td>
<td>'9'</td>
<td>'9'</td>
<td>'9'</td>
<td>'9'</td>
<td>'9'</td>
<td>'9'</td>
</tr>
<tr>
<td>83</td>
<td>del</td>
<td>del</td>
<td>del</td>
<td>del</td>
<td>del</td>
<td>del</td>
<td>del</td>
<td>del</td>
</tr>
<tr>
<td>84</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
<td>nop</td>
</tr>
<tr>
<td>85</td>
<td>fkey11</td>
<td>fkey23</td>
<td>fkey35</td>
<td>fkey47</td>
<td>scr11</td>
<td>scr11</td>
<td>scr11</td>
<td>scr11</td>
</tr>
<tr>
<td>86</td>
<td>fkey12</td>
<td>fkey24</td>
<td>fkey36</td>
<td>fkey48</td>
<td>scr12</td>
<td>scr12</td>
<td>scr12</td>
<td>scr12</td>
</tr>
</tbody>
</table>

The next table lists the "value" of each of the special keywords used in /usr/lib/keyboard/keys (and the preceding table). mapkey(M) places a "value" in the ioctl buffer during key mapping. The keywords are only used in the scan code file (/usr/lib/keyboard/keys) for readability.
<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>nop</td>
<td>0</td>
<td>No operation - no action from keypress</td>
</tr>
<tr>
<td>lshift</td>
<td>2</td>
<td>Left hand shift</td>
</tr>
<tr>
<td>rshift</td>
<td>3</td>
<td>Right hand shift</td>
</tr>
<tr>
<td>clock</td>
<td>4</td>
<td>Caps lock</td>
</tr>
<tr>
<td>nlock</td>
<td>5</td>
<td>Numeric lock</td>
</tr>
<tr>
<td>scroll</td>
<td>6</td>
<td>Scroll lock</td>
</tr>
<tr>
<td>alt</td>
<td>7</td>
<td>Alt key</td>
</tr>
<tr>
<td>btab</td>
<td>8</td>
<td>Back tab key - generates fixed sequence (esc [ Z)</td>
</tr>
<tr>
<td>ctrl</td>
<td>9</td>
<td>Control key</td>
</tr>
<tr>
<td>nscr</td>
<td>10</td>
<td>Switch to the next screen</td>
</tr>
<tr>
<td>scr1</td>
<td>11</td>
<td>Switch to screen #1</td>
</tr>
<tr>
<td>scr16</td>
<td>26</td>
<td>Switch to screen #16</td>
</tr>
<tr>
<td>fkey1</td>
<td>27</td>
<td>Function key #1</td>
</tr>
<tr>
<td>fkey96</td>
<td>122</td>
<td>Function key #96</td>
</tr>
</tbody>
</table>

This table lists names and decimal values that are interchangeable in the `mapkey` file. Names are used in place of numeric constants to make it easier to read the scan code table. Again, only the decimal values are placed in the `ioctl` buffer. These are taken from `ascii(M)`.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>nul</td>
<td>0</td>
<td>dc1</td>
<td>17</td>
</tr>
<tr>
<td>soh</td>
<td>1</td>
<td>dc2</td>
<td>18</td>
</tr>
<tr>
<td>stx</td>
<td>2</td>
<td>dc3</td>
<td>19</td>
</tr>
<tr>
<td>etx</td>
<td>3</td>
<td>dc4</td>
<td>20</td>
</tr>
<tr>
<td>eot</td>
<td>4</td>
<td>nsk</td>
<td>21</td>
</tr>
<tr>
<td>enq</td>
<td>5</td>
<td>syn</td>
<td>22</td>
</tr>
<tr>
<td>ack</td>
<td>6</td>
<td>etb</td>
<td>23</td>
</tr>
<tr>
<td>bel</td>
<td>7</td>
<td>can</td>
<td>24</td>
</tr>
<tr>
<td>bs</td>
<td>8</td>
<td>em</td>
<td>25</td>
</tr>
<tr>
<td>ht</td>
<td>9</td>
<td>sub</td>
<td>26</td>
</tr>
<tr>
<td>nl</td>
<td>10</td>
<td>esc</td>
<td>27</td>
</tr>
<tr>
<td>vt</td>
<td>11</td>
<td>fs</td>
<td>28</td>
</tr>
<tr>
<td>np</td>
<td>12</td>
<td>gs</td>
<td>29</td>
</tr>
<tr>
<td>cr</td>
<td>13</td>
<td>rs</td>
<td>30</td>
</tr>
<tr>
<td>so</td>
<td>14</td>
<td>ns</td>
<td>31</td>
</tr>
<tr>
<td>si</td>
<td>15</td>
<td>del</td>
<td>127</td>
</tr>
<tr>
<td>dle</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Keyboard Mapping**

The PC keyboard is mapped as part of terminal emulation. This kind of mapping is performed only on the computer keyboard, not on remote terminals. Use `mapkey` to change keyboard mapping. To change the mapping for individual channels (multiscreens), use `mapchan(M)`.
Keyboard mapping can also be performed using ioctl. The syntax is the same as for string key mapping (see previous section).

For keyboard mapping, cmd is GIO_KEYMAP to display the current map, and PIO_KEYMAP puts the prepared buffer into place.

String Key Mapping

To map string (function) keys, use the mapstr (see mapkey(M)) utility. mapstr modifies the string mapping table where function keys are defined.

The string mapping table is an array of 512 bytes (typedef srmap_t) containing null terminated strings that redefine the function keys. The first null terminated string is assigned to the first string key, the second string to the second string key, and so on.

There is no limit to the length of any particular string as long as the whole table does not exceed 512 bytes, including nulls. Strings are made null by the introduction of extra null characters.

The following is a list of default function key values:

<table>
<thead>
<tr>
<th>Key #</th>
<th>Function</th>
<th>Shift Function</th>
<th>Ctrl Function</th>
<th>Ctrl Shift Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ESC[M</td>
<td>ESC[Y</td>
<td>ESC[k</td>
<td>ESC[w</td>
</tr>
<tr>
<td>2</td>
<td>ESC[N</td>
<td>ESC[Z</td>
<td>ESC[l</td>
<td>ESC[x</td>
</tr>
<tr>
<td>3</td>
<td>ESC[O</td>
<td>ESC[a</td>
<td>ESC[m</td>
<td>ESC[y</td>
</tr>
<tr>
<td>4</td>
<td>ESC[P</td>
<td>ESC[b</td>
<td>ESC[n</td>
<td>ESC[z</td>
</tr>
<tr>
<td>5</td>
<td>ESC[Q</td>
<td>ESC[c</td>
<td>ESC[o</td>
<td>ESC[@</td>
</tr>
<tr>
<td>6</td>
<td>ESC[R</td>
<td>ESC[d</td>
<td>ESC[p</td>
<td>ESC[</td>
</tr>
<tr>
<td>7</td>
<td>ESC[S</td>
<td>ESC[e</td>
<td>ESC[q</td>
<td>ESC[\</td>
</tr>
<tr>
<td>8</td>
<td>ESC[T</td>
<td>ESC[f</td>
<td>ESC[r</td>
<td>ESC[}</td>
</tr>
<tr>
<td>9</td>
<td>ESC[U</td>
<td>ESC[g</td>
<td>ESC[s</td>
<td>ESC[&lt;</td>
</tr>
<tr>
<td>10</td>
<td>ESC[V</td>
<td>ESC[h</td>
<td>ESC[t</td>
<td>ESC[^</td>
</tr>
<tr>
<td>11</td>
<td>ESC[W</td>
<td>ESC[i</td>
<td>ESC[u</td>
<td>ESC[</td>
</tr>
<tr>
<td>12</td>
<td>ESC[X</td>
<td>ESC[j</td>
<td>ESC[v</td>
<td>ESC[}</td>
</tr>
</tbody>
</table>

| Home  | ESC[H    | End           | ESC[F         |
| Up arrow | ESC[A   | Down arrow   | ESC[B         |
| Page up | ESC[I   | Page down    | ESC[G         |
| Left arrow | ESC[D  | 5            | ESC[E         |
| Right arrow | ESC[C | Insert       | ESC[L         |
You can also map string keys using `ioctl(S)`. The syntax is:

```c
#include <sys/keyboard.h>
ioctl(fd, cmd, buf)
int fd, cmd;
char *buf;
...
```

For string key mapping where `cmd` is `GIO_STRMAP` to display the string mapping table and `PIO_STRMAP` to put the new string mapping table in place.

**Files**

```
/usr/lib/keyboard/keys
/usr/lib/keyboard/strings
```

**See Also**

`mapchan(F)`, `mapchan(M)`, `mapkey(M)`, `multiscreen(M)`, `screen(HW)`, `setkey(C)`, `stty(C)`
Name

lp, lp0, lp1, lp2 – Line printer device interfaces.

Description

The lp0, lp1, and lp2 files provide access to the optional parallel ports of the computer. The lp0 and lp2 files provide access to parallel ports 1 and 2, respectively. The lp1 file provides access to the parallel port on the monochrome adaptor.

Only one of lp0 and lp1 may be used on a given system. To access two parallel printers on a system, use either lp0 or lp1, and lp2.

Files

/dev/lp0
/dev/lp1
/dev/lp2

See Also

lp(C), lpadmin(C), lpsched(C), lpinit(C)

Notes

The standard lp ports, lp0, lp1, and lp2 send a printer initialization string the first time the file is opened after the system is booted.

Not all computers have an alternate parallel port slot.
Name

Machine – Description of host machine.

Description

This page lists the internal characteristics of personal computers which use the Intel 8086 processor family and its associated hardware. The information is intended for software developers who wish to transfer relocatable object or executable files from other XENIX machines to a personal computer then prepare the files for execution on the personal computer.

Central Processing Unit

Intel 8086, 8088, 80186, 80286, 80386

Disk Block Size (BSIZE)

1024 bytes

Memory Management Scheme

Unmapped (8086, 8088, 80186)
Segmented (80286)
Segmented and paged (80386)

Split Instruction and Data

Supported

Variable Stack Size

Supported (8086, 80386 only)
(8086, 80386 default configuration)

Fixed Stack Size

Supported
(80286 default configuration)

Clock Ticks

.05 second (8086, 8088, 80186)
.02 second (80286, 80386)

Binary Compatibility

The small and middle model binary programs created by the C compiler cc(CP) run on many processors. The following chart shows which XENIX systems running on which processors produce code executable on other machines. It is assumed that system specific system calls are not used to produce portable code. cc(CP) produces code by default, but can also be used as a cross development compiler, by using the appropriate flags.

SCO-nn is XENIX distributed by The Santa Cruz Operation, Inc. MS-nn is XENIX distributed by Microsoft Corporation. Intel XENIX is distributed by Intel Corporation. Altos XENIX is distributed by Altos Computer Systems. nn designates the machine processor. System designates the version of XENIX, either 2.3, 3.0, or System V.

April 1, 1987
## Binary Compatibility

<table>
<thead>
<tr>
<th>Your System Processor</th>
<th>Default compiler produces programs which run on System/Processor</th>
<th>Runs default programs created on System/Processor</th>
<th>Compiles (cross development) programs for System/Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCO-86 3.0</strong></td>
<td>SCO-86 [3.0, Sys V] SCO-186 [3.0, Sys V] SCO-286 SysV</td>
<td>SCO-86 3.0  SCO-186 3.0 Intel, Altes-86 2.3, 3.0</td>
<td>DOS*</td>
</tr>
<tr>
<td><strong>SCO-286 3.0</strong></td>
<td>SCO-286 [3.0, Sys V] MS-286 [3.0†, Sys V]</td>
<td>SCO-286 3.0  MS-286 3.0† Intel, Altes-86 2.3, 3.0</td>
<td>DOS*</td>
</tr>
<tr>
<td><strong>MS-286 3.0†</strong></td>
<td>MS-286 [3.0†, Sys V] MS-286 Sys V</td>
<td>SCO-286 3.0  MS-286 3.0† Intel, Altes-86 2.3, 3.0</td>
<td>DOS*</td>
</tr>
</tbody>
</table>

* MS-DOS for i8086/8088, i80186 and i80286 processors.
† MS-286 3.0 XENIX is equivalent to Intel 286 3.0 XENIX.
‡ untested, pending release of this product.

April 1, 1987  
Page 2
See also

clockrate(HW), cc(CP), ld(CP), a.out(F).
Name

parallel - Parallel interface devices.

Description

There are several parallel devices:

/dev/lp0  Main parallel adapter.
/dev/lp1  Adapter on monochrome video card.
/dev/lp2  Alternate parallel adapter (on appropriate machines).

It is not possible to have all three parallel devices on one system. XT computers only allow the use of /dev/lp0. Some AT computers allow the use of two parallel devices, /dev/lp0, and either /dev/lp1, or /dev/lp2.

If a parallel device fails to interrupt properly, the parallel driver enters "poll mode." Once interrupts are received from the device, the driver returns to its original mode.

The parallel driver delays a certain amount of time when a parallel device is closed. The amount of delay can affect printer performance, but is necessary to compensate for different sizes of printer buffers and printer speeds. For example, this command sets the delay on close to 1 second, specified in 10ths of a second by Ctrl-J (ASCII value 10):

```bash
stty echo \"J\" < /dev/lp0
```

The default delay value is 2 seconds (^T).

Notes

Parallel adapters on add-on cards will function, but switches must be set correctly. Some compatible computers have ports lp0 and lp1 reversed.

The `stty(C)` command for output processing is supported on a parallel device. `stty` options that have no effect on a parallel device are ignored and no error messages are displayed.

Usage

Usually invoked by through `lp(C)`, but can be written to directly.
Files

/dev/lp0
/dev/lp1
/dev/lp2

See Also

lp(C), lp(HW), lpadmin(C), lpinit(C), lpsched(C), serial(HW)
Name

ramdisk - Memory block device

Description

The ramdisk device driver provides a block interface to memory. A ramdisk can be used like any other block device, including making it into a file systems using mkfs(C). There are eight ramdisks available.

The characteristics of a ramdisk file are determined by its minor device number. The bits in the minor device number encode its size, longevity, and which of the eight possible ramdisks it is.

The three low-order bits of the minor device number determine which of the eight ramdisks is being accessed.

The next four bits of the minor device number determine the size of the ramdisk. The size of a ramdisk must be a power of 2, and must be at least 16K. Since 4 bits are available, there are 16 possible sizes, starting at 16K and doubling every time the size indicator is incremented, to produce possible sizes of 16K, 32K, 64K, and up.

The high-order bit is a longevity indicator. If set, memory is permanently allocated to that ramdisk, and can be deallocated only by rebooting the system. Permanent ramdisks can only be allocated by the superuser. However, once a permanent ramdisk is allocated (by opening it), it can be read and written by anyone having the appropriate permissions on the ramdisk inode.

If clear, the ramdisk is deallocated when no processes have it open. To create an easily removable, but semi-permanent ramdisk, use a separate process to keep the device open for as long as necessary.
Since a complete set of *ramdisks* (8) would consume 256 inodes, only one example 16K *ramdisk* (/dev/ram00) is created when the system is installed. The system administrator can use this example to determine the major device numbers for any other required *ramdisks*. The following table shows how the minor device number is constructed:

<table>
<thead>
<tr>
<th>Description</th>
<th>Longevity</th>
<th>Size (see next table)</th>
<th>Ram Disk No.</th>
<th>Minor Device Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>16K (#1)</td>
<td>0</td>
<td>0000000</td>
<td>001</td>
<td>1</td>
</tr>
<tr>
<td>(Temporary)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16K (#1)</td>
<td>1</td>
<td>0000000</td>
<td>001</td>
<td>129</td>
</tr>
<tr>
<td>(Permanent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64K (#0)</td>
<td>0</td>
<td>0010000</td>
<td>000</td>
<td>16</td>
</tr>
<tr>
<td>(Temporary)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>512K (#7)</td>
<td>1</td>
<td>010111</td>
<td>111</td>
<td>175</td>
</tr>
<tr>
<td>(Permanent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The contents of the size field and the corresponding *ramdisk* size is shown in the next table.

<table>
<thead>
<tr>
<th>Size Bits</th>
<th>Ramdisk Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0</td>
<td>16K</td>
</tr>
<tr>
<td>0 0 0 1</td>
<td>32K</td>
</tr>
<tr>
<td>0 0 1 0</td>
<td>64K</td>
</tr>
<tr>
<td>0 0 1 1</td>
<td>128K</td>
</tr>
<tr>
<td>0 1 0 0</td>
<td>256K</td>
</tr>
<tr>
<td>0 1 0 1</td>
<td>512K</td>
</tr>
<tr>
<td>0 1 1 0</td>
<td>1M</td>
</tr>
<tr>
<td>0 1 1 1</td>
<td>2M</td>
</tr>
<tr>
<td>1 0 0 0</td>
<td>4M</td>
</tr>
<tr>
<td>1 0 0 1</td>
<td>8M</td>
</tr>
<tr>
<td>1 0 1 0</td>
<td>16M</td>
</tr>
<tr>
<td>1 0 1 1</td>
<td>32M</td>
</tr>
<tr>
<td>1 1 0 0</td>
<td>64M</td>
</tr>
<tr>
<td>1 1 0 1</td>
<td>128M</td>
</tr>
<tr>
<td>1 1 1 0</td>
<td>256M</td>
</tr>
<tr>
<td>1 1 1 1</td>
<td>512M</td>
</tr>
</tbody>
</table>
Once you determine the major and minor device numbers of a new `ramdisk`, make the appropriate device node using `mknod(C)`.

To make a file system on a non-permanent `ramdisk`, the device file must be held open between the `mkfs` and the `mount(C)` operations. Otherwise, the `ramdisk` is allocated at the start of the `mkfs` command, and deallocated at its end. Once the `ramdisk` is mounted, it is open until it is unmounted.

The following shell fragment shows one way to use `mkfs` on a non-permanent 512K `ramdisk`, then mount it:

```
( /etc/mkfs /dev/ram40 512
  /etc/mount /dev/ram40 /dev/mnt
) > /dev/ram40
```

Notes

- `ramdisks` must occupy contiguous memory. If free memory is fragmented, opening a `ramdisk` may fail even though there is enough total memory available. Ideally, all `ramdisks` should be allocated at system startup. This helps prevent the `ramdisks` themselves from fragmenting memory.

- `ramdisks` are geared towards use in specialized applications. In many cases, you will notice a decrease in system performance when `ramdisks` are used, because XBNIX can generally put the memory to better use elsewhere.

Files

`/dev/ram00`

See Also

`mkfs(C), mount(C), mknod(C)`
Name

screen – tty[01–n], color, monochrome, ega, pga
– Display adapter and video monitor.

Description

The tty[01–n] device files provide character I/O between the system and the video display monitor and keyboard. Each file corresponds to a separate teletype device. Although there is a maximum of 10 screens, the exact number available (n) depends upon the amount of memory in the computer.

Each device consists of two files: a readable file from the keyboard and a writable file to one of five display devices: color, monochrome, ega, and pga. The color file provides access to a color/graphics adapter; the monochrome file to the monochrome adapter; the ega file to the enhanced graphics adapter; the pga file to the professional graphics adapter. The screens are modeled after a 24 line, 80 column ASCII terminal, unless specified otherwise.

tty01 is the default output device for keyboard input. If the /dev/console is the default output device for system error messages, and the display being used is switched to graphics mode, console messages are not displayed. They are, instead, redirected to the kernel error handler where they can then be retrieved by the application which took over the screen.

Although all tty[01–n] devices may be open concurrently, only one of the corresponding devices can be active at any given time. The active device displays its own screen and takes sole possession of the keyboard. It is an error to attempt to access the color, monochrome, ega or pga file when no corresponding adapter exists.

To get to the next consecutive screen, enter Ctrl–PrtSc using the Ctrl key, and the PrtSc key. Any active screen may be selected by entering alt–Fn, where Fn is one of the function keys. F1 refers to the tty01 device.
Control Modes

To change the display mode used for the video monitor, open the device file associated with that mode. For example, to switch to display output on an installed CGA, a program should open /dev/color and use the selector mapping ioctl's on the file descriptor that is returned from the open call. Using device files helps ensure future compatibility.

Programs can also use the stty(C) or stty(HW) commands, or an ioctl(S) with the following requests:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWAPMONO</td>
<td>Selects the monochrome display as the output device for the video monitor.</td>
</tr>
<tr>
<td>SWAPCGA</td>
<td>Selects the regular color display as the output device for the video monitor.</td>
</tr>
<tr>
<td>SWAPPGA</td>
<td>Selects the professional color display as the output device for the video monitor.</td>
</tr>
<tr>
<td>SWAPEGA</td>
<td>Selects the enhanced color display as the output device for the video monitor.</td>
</tr>
</tbody>
</table>

To obtain information about the display adapter type currently attached to the video monitor, you can use ioctl(S) with the following request:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONS_CURRENT</td>
<td>Returns the display adapter type currently attached to the video monitor. The return value can be one of: MONO, CGA, EGA, or PGA.</td>
</tr>
</tbody>
</table>

Display Modes

To switch display modes on the various display devices, you can use the stty(C) or stty(HW) commands, or you can use ioctl(S) with the following requests:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW_B80x25</td>
<td>Selects 80x25 black and white text display mode.</td>
</tr>
<tr>
<td>SW_C80x25</td>
<td>Selects 80x25 color text display mode.</td>
</tr>
</tbody>
</table>
SW_BG320  Selects 320x200 black and white graphics display mode.

SW_CG320  Selects 320x200 color graphics display mode.

SW_BG640  Selects 640x200 black and white graphics display mode.

SW_EGAMONO80x25  Selects EGA (Enhanced Graphics Adapter) mode 7 - emulates support provided by the monochrome display.

SW_EGAMONOAPA  Selects EGA support for 640x350 graphics display mode (EGA mode F).

SW_ENHMONOAPA2  Selects EGA mode F*.

SW_ENHB40x25  Selects enhanced EGA support for 40x25 black and white text display mode.

SW_ENHC40x25  Selects enhanced EGA support for the 40x25 color text display mode.

SW_ENHB80x25  Selects enhanced EGA support for 80x25 black and white text display mode.

SW_ENHC80x25  Selects enhanced EGA support for 80x25 color text display mode.

SW_CG320_D  Selects EGA support for 320x200 graphics display mode. (EGA mode D.)

SW_CG640_E  Selects EGA support for 640x200 graphics display mode (EGA mode E).

SW_CG640x350  Selects EGA support for 640x350 graphics display mode (EGA mode 10).

SW_ENH_CG640  Selects EGA mode 10*.

SW_MCAMODE  Reinitializes the monochrome adapter.

Switching to an invalid display mode for a display device will result in an error.
Getting Display Modes

To obtain information about the current display modes, you can use `ioctl(S)` with the requests that follow. These apply to the color graphics adapter, the enhanced graphics adapter or the professional graphics adapter:

- **CGA_GET**
  Returns the current display mode setting of the color graphics adapter.

- **PGA_GET**
  Returns the current display mode setting of the professional graphics adapter.

- **EGA_GET**
  Returns the current display mode setting of the enhanced graphics adapter.

- **MCA_GET**
  Returns the current display mode setting of the monochrome adapter.

- **CONS_GET**
  Returns the current display mode setting for whatever display adapter is being used.

Memory Mapping Modes

The `ioctl(S)` routine is used to map the display memory of the various devices into the user's data space. It returns a selector for the display memory. The macro `sotofar` is used to create a far pointer from this selector so the display memory can be accessed. The `sotofar` macro is located in `/usr/include/sys/param.h`. Refer to your hardware manual for details on various displays, adapters, and controllers.

You can use `ioctl(S)` requests to map the display memory as follows:

- **MAPCONS**
  Maps the display memory of the adaptor currently being used into the user's data space. Not meant to work with MAPPGA1K.

- **MAPMONO**
  Maps the monochrome adapter's display memory into the user's data space.

- **MAPCGA**
  Maps the color adapter's display memory into the user's data space.

- **MAPPGA**
  Maps the professional graphics controller's display memory into the user's data space.

- **MAPEGGA**
  Maps the enhanced graphics adapter's display memory into the user's data space.
MAPPGA1K: Maps the professional graphics controller 1K communications fifos (etc.) into the user’s data space.

For example, the following code can be used to acquire a pointer to the start of the user data space associated with the color graphics adapter display memory:

```c
char far *dp;
int selector;

fd=open("/dev/color", O_WRONLY);
selector = ioctl(fd, MAPCGA,0);
dp = sotofar(selector, 0);
```

Note that when the display memory is mapped into the user space, the adapter’s start address registers are not set. The start address can be reset in two ways, so that the start address of the display memory corresponds to the upper left hand corner of the screen:

1. Switch modes with an ioctl() (the “switch” can be to the present mode). See the “Display Modes” section of this manual page.

2. Change the start address high and low address with the in-on-port/out-on-port ioctl().

The in-on-port/out-on-port ioctl()’s can also be used to determine the current value in the start address register, and then set up a pointer to point to the offset in the mapped-in data space.

**Graphics Adapter Port I/O**

You can use ioctl(S) to read or write a byte from or to the graphics adapter port. The arg parameter of the ioctl call uses the io_arg data structure:

```c
struct port_io_arg {
    struct port_io_struct args[4];
};
```
As shown above, the `port_io` structure points to an array of four `port_io` data structures. The `port_io` structure has the following format:

```
struct port_io_struct {
    char dir;  /* direction flag (in vs. out) */
    unsigned_int port;  /* port address */
    char data;  /* byte of data */
};
```

You may specify one, two, three, or four of the `port_io_struct` structures in the array for one `ioctl` call. The value of `dir` can be either `IN_ON_PORT` to specify a byte being input to the graphics adapter port or `OUT_ON_PORT` to specify a byte being output to the graphics adapter port. `Port` is an integer specifying the port address of the desired graphics adapter port. `Data` is the byte of data being input or output as specified by the call.

If you are not using any of the `port_io` structures, load the `port` with 0, and leave the unused structures at the end of the array. Refer to the hardware manuals for port addresses and functions for the various adapters.

You can use the following `ioctl(S)` commands to input or output a byte on the graphics adapter port:

- **MGAIO**  
  Inputs or outputs a byte on the monochrome adapter port as specified.

- **CGAIO**  
  Inputs or outputs a byte on the color graphics adapter port as specified.

- **EGAIO**  
  Inputs or outputs a byte on the enhanced graphics adapter port as specified.

- **PGAIO**  
  Inputs or outputs a byte on the professional graphics adapter port as specified.

To input a byte on any of the graphics adapter ports, load `dir` with `IN_ON_PORT` and load with the port address of the graphics adapter. The byte input from the graphics adapter port will be returned in `data`.

To output a byte, load `dir` with `OUT_ON_PORT`, load `port` with the port address of the graphics adapter, and load `data` with the byte you want output to the graphics adapter port.
Function Keys

`ioctl(S)` can be used to define or obtain the current definition of a function key. The `arg` parameter of the `ioctl` call uses the `fkeyarg` data structure:

```c
struct fkeyarg {
    unsigned int keynum;
    char keydef [MAXFK];
    /* Comes from char flen; ioctl.h via comct.h */
}
```

You can use the following `ioctl(S)` requests to obtain or assign function key definitions:

- **GETFKEY** Obtains the current definition of a function key. The function key number must be passed in `keynum`. The string currently assigned to the key will be returned in `keydef` and the length of the string will be returned in `flen` when the `ioctl` is performed.

- **SETFKEY** Assigns a given string to a function key. The function key number must be passed in `keydef` and the length of the string (number of characters) must be passed in `flen`.

Screen Attribute Sequences

The following character sequences are defined by ANSI X3.64-1979 and may be used to control and modify the screen display. Each `Pn` is replaced by the appropriate ASCII number (decimal) to produce the desired effect. The last column is for `termcap(M)` codes, where "n/a" means not applicable.

The use of 7 or 8 bit characters in the escape sequence is a valid invocation for each action defined. For example the ANSI ED command can be invoked via the "ESC [ Pn S" (0x1b-0x5b-Pn-0x4a, 7 bit chars) sequence or the "CSI Pn J" (0x9b-Pn-0x4n, 8 bit chars) sequence.
<table>
<thead>
<tr>
<th>ANSI</th>
<th>Sequence</th>
<th>Action</th>
<th>Termcap Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ED</strong></td>
<td><strong>ESC [Pn J</strong></td>
<td>Erases all or part of a display. $Pn=0$: erases from active position to end of display. $Pn=1$: erases from the beginning of display to active position. $Pn=2$: erases entire display.</td>
<td>cd</td>
</tr>
<tr>
<td><strong>(Erase in Display)</strong></td>
<td><strong>CSI Pn J</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EL</strong></td>
<td><strong>ESC [Pn K</strong></td>
<td>Erases all or part of a line. $Pn=0$: erases from active position to end of line. $Pn=1$: erases from beginning of line to active position. $Pn=2$: erases entire line.</td>
<td>cc</td>
</tr>
<tr>
<td><strong>(Erase in Line)</strong></td>
<td><strong>CSI Pn K</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ECH</strong></td>
<td><strong>ESC [Pn X</strong></td>
<td>Erases $Pn$ characters</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>(Erase Character)</strong></td>
<td><strong>CSI Pn X</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CBT</strong></td>
<td><strong>ESC [Pn Z</strong></td>
<td>Moves active position back $Pn$ tab stops.</td>
<td>bt</td>
</tr>
<tr>
<td><strong>(Cursor Backward Tabulation)</strong></td>
<td><strong>CSI Pn Z</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SU</strong></td>
<td><strong>ESC [Pn S</strong></td>
<td>Scroll screen up $Pn$ lines, introducing new blank lines at bottom.</td>
<td>sf</td>
</tr>
<tr>
<td><strong>(Scroll Up)</strong></td>
<td><strong>CSI Pn S</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td><strong>ESC [Pn T</strong></td>
<td>Scrolls screen down $Pn$ lines, introducing new blank lines at top.</td>
<td>sr</td>
</tr>
<tr>
<td><strong>(Scroll Down)</strong></td>
<td><strong>CSI Pn T</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CUP</strong></td>
<td><strong>ESC [P1; P2 H</strong></td>
<td>Moves active position to location $P1$ (vertical) and $P2$ (horizontal).</td>
<td>cm</td>
</tr>
<tr>
<td><strong>(Cursor Position)</strong></td>
<td><strong>CSI P1; P2 H</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>HVP (Horizontal &amp; Vertical Position)</td>
<td>ESC[P1;P2 f</td>
<td>Moves active position to location P1 (vertical) and P2 (horizontal).</td>
<td></td>
</tr>
<tr>
<td>CUU (Cursor Up)</td>
<td>ESC[Pn A</td>
<td>Moves active position up Pn number of lines.</td>
<td></td>
</tr>
<tr>
<td>CUD (Cursor Down)</td>
<td>ESC[Pn B</td>
<td>Moves active position down Pn number of lines.</td>
<td></td>
</tr>
<tr>
<td>CUF (Cursor Forward)</td>
<td>ESC[Pn C</td>
<td>Moves active position Pn spaces to the right.</td>
<td></td>
</tr>
<tr>
<td>CUB (Cursor Backward)</td>
<td>ESC[Pn D</td>
<td>Moves active position Pn spaces backward.</td>
<td></td>
</tr>
<tr>
<td>HPA (Horizontal Position Absolute)</td>
<td>ESC[Pn 2</td>
<td>Moves active position to column given by Pn.</td>
<td></td>
</tr>
<tr>
<td>HPR (Horizontal Position Relative)</td>
<td>ESC[Pn a</td>
<td>Moves active position Pn characters to the right.</td>
<td></td>
</tr>
<tr>
<td>VPA (Vertical Position Absolute)</td>
<td>ESC[Pn d</td>
<td>Moves active position to line given by Pn.</td>
<td></td>
</tr>
<tr>
<td>VPR (Vertical Position Relative)</td>
<td>ESC[Pn e</td>
<td>Moves active position down Pn number of lines.</td>
<td></td>
</tr>
<tr>
<td>IL (Insert Line)</td>
<td>ESC[Pn L</td>
<td>Inserts Pn new, empty blank lines.</td>
<td></td>
</tr>
<tr>
<td>ICH (Insert Character)</td>
<td>ESC[Pn @</td>
<td>Inserts Pn blank places for Pn characters.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>DL</td>
<td>Deletes Pn lines.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| ESC\[Pn M  
| CSI Pn M |                                                 |       |
| DCH   | Deletes Pn number of characters.                |       |
| ESC\[Pn P  
| CSI Pn P |                                                 |       |
| CPL   | Moves active position to beginning of line, Pn lines up. |       |
| ESC\[Pn F  
| CSI Pn F |                                                 |       |
| CNL   | Moves active position to beginning of line, Pn lines down. |       |
| ESC\[Pn E  
| CSI Pn E |                                                 |       |
| SGR   | Resets bold, blink, blank, underscore, and reverse. Color: Restores normal selected colors. |       |
| ESC\[0 m  
| CS10 m  |                                                 |       |
| SGR   | Sets bold. Color: Sets intensity (changes color to lt_color). |       |
| ESC\[1 m  
| CS11 m  |                                                 |       |
| SGR   | Lock keyboard. Ignores keyboard input until unlocked. Characters are not saved. |       |
| ESC\[2 h |                                                 |       |
| SGR   | Send screen to host. Current screen contents are sent to the application. |       |
| ESC\[2 i |                                                 |       |
| SGR   | Unlock keyboard. Re-enable keyboard input.      |       |
| ESC\[21 |                                                 |       |
| SGR   | Sets underscore. Color: No effect.              |       |
| ESC\[4 m  
| CS14 m  |                                                 |       |
| SGR   | Sets blink. Color: Changes background lt_color to color; foreground blinks. |       |
| ESC\[5 m  
| CS15 m  |                                                 |       |
ESC[7 m  Sets reverse video.  so
CSI 7 m   Color: Uses reverse
selected colors.
ESC[10 m  Select primary font.  GE
CSI 10 m
ESC[11 m  Select first alternate
CSI 11 m  font. Allows ASCII
n/a characters less than
32 to be displayed as
ROM characters.
ESC[12 m  Select second alternate
CSI 12 m  font. Toggles
high bit of extended
ASCII code before
displaying as ROM
characters.

The following color codes and sequences are defined by International Organization for Standardization ISO DP 6429.

<table>
<thead>
<tr>
<th>C</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Black</td>
</tr>
<tr>
<td>1</td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>Green</td>
</tr>
<tr>
<td>3</td>
<td>Yellow</td>
</tr>
<tr>
<td>4</td>
<td>Blue</td>
</tr>
<tr>
<td>5</td>
<td>Magenta</td>
</tr>
<tr>
<td>6</td>
<td>Cyan</td>
</tr>
<tr>
<td>7</td>
<td>White</td>
</tr>
<tr>
<td>ISO</td>
<td>Sequence</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>SGR</td>
<td>ESC[3C m</td>
</tr>
<tr>
<td></td>
<td>(Select Graphic Rendition)</td>
</tr>
<tr>
<td></td>
<td>ESC[4C m</td>
</tr>
<tr>
<td></td>
<td>(non-display)</td>
</tr>
<tr>
<td></td>
<td>ESC[8 m</td>
</tr>
</tbody>
</table>

The following color codes and sequences are additional control sequences.

<table>
<thead>
<tr>
<th>Ca</th>
<th>Color</th>
<th>Ca</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Black</td>
<td>8</td>
<td>Grey</td>
</tr>
<tr>
<td>1</td>
<td>Blue</td>
<td>9</td>
<td>Lt. Blue</td>
</tr>
<tr>
<td>2</td>
<td>Green</td>
<td>10</td>
<td>Lt. Green</td>
</tr>
<tr>
<td>3</td>
<td>Cyan</td>
<td>11</td>
<td>Lt. Cyan</td>
</tr>
<tr>
<td>4</td>
<td>Red</td>
<td>12</td>
<td>Lt. Red</td>
</tr>
<tr>
<td>5</td>
<td>Magenta</td>
<td>13</td>
<td>Lt. Magenta</td>
</tr>
<tr>
<td>6</td>
<td>Brown</td>
<td>14</td>
<td>Yellow</td>
</tr>
<tr>
<td>7</td>
<td>White</td>
<td>15</td>
<td>Lt. White</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Sequence</th>
<th>Action</th>
<th>Termcap Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGR</td>
<td>ESC[2;C1;C2 m</td>
<td>Color only. Sets foreground (C1) and background (C2) colors.</td>
<td>n/a</td>
</tr>
<tr>
<td>SGR</td>
<td>ESC[7;C1;C2 m</td>
<td>Reverse video. Color: Sets foreground (C1) and background (C2) reverse video colors.</td>
<td>n/a</td>
</tr>
<tr>
<td>SGR</td>
<td>ESC[3;0 m</td>
<td>Color only. Clears blink bit.</td>
<td>n/a</td>
</tr>
<tr>
<td>SGR</td>
<td>ESC[3;1 m</td>
<td>Color only. Sets blink bit.</td>
<td>n/a</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| SGR      | **ESC[4 m**  Underscores. **n/a**  
**Color:** No effect  
Sets cursor to start at scan line $Ss$, and ends at scan line $Se$. Default underline cursor is 6,7 for color adaptors and 11,12 for monochrome. |
| n/a      | **ESC[=Ss ; Se C**  
Sets border color on color adaptors. Color codes are same as for **ESC[2 ; C1 ; C2 m**. |
| n/a      | **ESC[=CA**  
where $C$ is 0-15. **n/a**  
Sets border color on color adaptors. Color codes are same as for **ESC[2 ; C1 ; C2 m**. |
| n/a      | **ESC[Pn g**  
Accesses alternate graphics set. Not the same as “graphics mode.” Refer to your owner’s manual for decimal/character codes (Pn) and possible output characters. |
| n/a      | **ESC Q Fn ’string ’**  
Define function key Fn with string. String delimiters ’ and ’ may be any character not in string. Function keys are numbered 0 through 9 ($F1 = 0$, $F2 = 1$, etc.). |
| n/a      | **ESC[Pn z**  
**CSIPn z**  
Pn should be equal to the number of the screen to switch to. Will only work if screen was configured for at boot, else no action will take place. |
Sets bell frequency and duration. \( F \) is the value loaded into the timer-counter, and \( T \) is the bell duration in 1/10ths of a second (initial settings are 1500 and 2/10ths of a second).

Files

/dev/console
/dev/tty[02 -n]
/dev/color
/dev/monochrome
/dev/ega
/dev/pba

See Also

console(M), ioctl(S), keyboard(HW), keypad(M), mapkey(M), mapchan(M), multiscreen(M), setcolor(C), stty(C), systty(M), termcap(M), tty(M)
Name

tty1[a–h], tty1[A–H], tty2[a–h], tty2[A–H] — Interface to serial ports

Description

The tty1[a–h], tty1[A–H], tty2[a–h] and tty2[A–H] files provide access to the standard and optional serial ports of the computer. Each file corresponds to one of the serial ports (with or without modem control). Files are named according to the following conventions:

- The first number in the file name corresponds to the COM expansion slot.
- Lower case letters indicate no modem control.
- Upper case letters indicate the line has modem control.

tty1a and tty1A both refer to COM 1, whereas tty2a and tty2A both refer to COM 2.

For example, with a four port expansion board installed at COM 1 and a single port board installed at COM 2, you can access:

<table>
<thead>
<tr>
<th>tty1a</th>
<th>tty1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>tty1b</td>
<td>tty1B</td>
</tr>
<tr>
<td>tty1c</td>
<td>tty1C</td>
</tr>
<tr>
<td>tty1d</td>
<td>tty1D</td>
</tr>
<tr>
<td>tty2a</td>
<td>tty2A</td>
</tr>
</tbody>
</table>

Each serial port has modem and non-modem invocations. The device names in the following table refer to the serial ports, with and without modem control. The first section of the table describes boards at COM 1 and the second section describes boards installed at COM 2. "Minor" is the minor device number for the port (see mknod(C)).
<table>
<thead>
<tr>
<th>Serial Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Board Type</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1 Port</td>
</tr>
<tr>
<td>4 Port</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>8 Port</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1 Port</td>
</tr>
<tr>
<td>4 Port</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>8 Port</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Interrupt Vectors:**

All board(s) installed at COM 1 - 4
All board(s) installed at COM 2 - 3

For a list of I/O addresses, see the *Release Notes* furnished with your distribution.

**Access**

The files may only be accessed if the corresponding serial interface card is installed and its jumper I/O address correctly set. Also, for multi-port expansion cards, you must use the `mkdev(C)` program to create more than the default number of files. See `mkdev (C)` in the *XENIX Reference*.

The serial ports must also be defined in the system configuration. Check your hardware manual to determine how your system is configured, via a CMOS database or by switch settings on the main system board. If your system is configured using a CMOS database, the ports are defined in the database (see `cmos(HW)`). Otherwise, define the ports by setting the proper switches on the main system.
board. Refer to your computer hardware manual for switch settings.

It is an error to attempt to access a serial port that has not been installed and defined.

The serial ports can be used for a variety of serial communication purposes such as connecting login terminals to the computer, attaching printers, or forming a serial network with other computers. Note that a serial port may operate at most of the standard XENIX baud rates, and that the ports (on most computers) have a DTE (Data Terminal Equipment) configuration. The following table defines how each pin is used.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>Receive Data</td>
</tr>
<tr>
<td>6</td>
<td>Request to Send</td>
</tr>
<tr>
<td>7</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>8</td>
<td>Carrier Detect (Data Set Ready)</td>
</tr>
<tr>
<td>20</td>
<td>Data Terminal Ready</td>
</tr>
</tbody>
</table>

Only pins 2, 3, and 7 are necessary for a terminal (or direct) connection.

See tty(M) and termio(M) for the details of serial line operation in the XENIX system.

Files

/dev/tty1[a-h]
/dev/tty1[A-H]
/dev/tty2[a-h]
/dev/tty2[A-H]

See Also

cmos(HW), csh(C), cu(C), getty(M), mkdev(C), mknod(C)
nohup(C), open(S), termio(M), tty(M), uucp(C)
Notes

If you login via a modem control serial line, hanging up logs that line out and kills your background processes. See *nohup*(C) and *csh*(C)).

You cannot use the same serial port with both modem and non-modem control at the same time. For example, you cannot use tty1a and tty1A simultaneously.

Use a modem cable to connect your modem to a computer.
Name

```
ssy - Sets the options for the video monitor.
```

Syntax

```
ssy [ -a ] [ -g ] [ options ]
```

Description

`ssy` sets certain terminal I/O options for the device that is the current standard input; without arguments, it reports the settings of certain options. With the `-a` option, `ssy` reports all of the option settings; with the `-g` option, it reports current settings in a form that can be used as an argument to another `ssy` command. The following options describe control modes for the video monitor and other display devices attached to a display adapter. This information is hardware specific; refer to `ssy(M)` for options generic to this utility. Additional details on the modes described here can be found in `screen(HW)` and `keyboard(HW)`.

**Control Modes for the Video Monitor**

- **mono** Selects the monochrome display as the output device for the console screen. This mode is valid if a standard monochrome adapter is present or if a standard enhanced graphics adapter (EGA) is present and the EGA is currently in one of the monochrome display modes.

- **color** Selects a standard regular color display as the output device for the console screen. This mode is valid if a color graphics adapter is present or if a standard EGA is present and is currently in one of the color graphics compatibility modes.

- **enhanced** Selects the enhanced color display as the output device for the console screen. This mode is valid if an EGA is present and is currently in a non-monochrome display mode.

- **herc** Selects the monochrome display as the output device for the console screen. This mode is valid if a Hercules monochrome graphics adapter is present and is currently in a full monochrome graphics mode.

- **pro** Selects the professional color display for the output device for the console screen. This mode is valid if a standard professional graphics adapter is present.
Note that on systems with more than one display adapter, the keyboard multiscreen switchings only work on the current primary screen display adapter.

_Choice Modes for the Attached Display Devices_

**B80x25** Selects 80x25 black and white text display mode.

**C80x25** Selects 80x25 color display text mode.

**BG320** Selects 320x200 black and white graphics display mode.

**CG320** Selects 320x200 color graphics display mode.

**BG640** Selects 640x200 black and white graphics display mode.

The keyboard and display control modes above are valid for the following configurations: standard color graphics adapter (CGA) attached to an standard regular color display, standard enhanced graphics adapter (EGA) (modes 0-6) attached to a standard regular color display or an standard enhanced color display, and an standard professional graphics adapter (PGA) attached to a standard professional graphics display.

**CG320.D**
Selects EGA support for 320x200 graphics display mode (EGA mode D).

**CG640.E**
Selects EGA support for 640x200 graphics display mode (EGA mode E).

The two options above are only valid when an EGA is attached to a standard regular color display or an enhanced color display.

**EGAMONO80x25**
Selects EGA Mode 7 as the display mode. Emulates the support provided by the standard monochrome display adapter.

**EGAMONOAPA**
Selects EGA support for 640x350 graphics display mode (EGA mode F).

**ENHMONOAPA2**
Selects EGA mode F*.

The three options above are only valid when a standard EGA is attached to an IBM monochrome display.
**STTY (HW)**

**ENH_B80x25**
Selects enhanced EGA support for 80x25 black and white text display mode (EGA mode 2*).

**ENH_C80x25**
Selects enhanced EGA support for 80x25 color text display mode (EGA mode 3*).

**CG640x350**
Selects EGA support for 640x350 graphics display mode (EGA mode 10).

**ENH.CG640**
Selects EGA mode 10*.

The six options above are only valid when a standard EGA is attached to a standard enhanced color display.

**MCAMODE**
Reinitializes the monochrome graphics adapter.

**Warning:** If invalid options are used for any of these display modes, the behavior of the attached device(s) may be erratic.

**See Also**

`console(M), ioctl(S), keyboard(HW), screen(HW), stty(C), tty(M)`

**Notes**

Many combinations of options make no sense, but no checking is performed.
Name

tape - Cartridge tape device.

Description

The *tape* device implements the XENIX interface with a tape drive. Typically, the *tar(C)*, *cpio(C)*, *dd(C)*, *backup(C)*, *dump(C)*, or *restore(C)* commands are used to access a tape drive.

A single tape drive with a raw (character, non-blocking) interface is supported. There are two standard tape device types. Devices beginning with the "r" prefix, (for "raw device"), should be used for most normal tape work, while devices with the "n" prefix, ("for no rewind on hold"), should be used for storing and restoring multiple files.

The following table summarizes the base naming conventions for the tape drives supported:

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ct0,1</td>
<td>QIC24 unit 0,1</td>
</tr>
<tr>
<td>ct2,3</td>
<td>QIC11 unit 0,1</td>
</tr>
<tr>
<td>ctmini</td>
<td>floppy controller-based cartridge tape</td>
</tr>
<tr>
<td>mt0,1</td>
<td>reel to reel unit 0,1 1600 bpi</td>
</tr>
<tr>
<td>mt2,3</td>
<td>reel to reel unit 0,1 800 bpi</td>
</tr>
<tr>
<td>mt4,5</td>
<td>reel to reel unit 0,1 6250 bpi</td>
</tr>
</tbody>
</table>

*tape*(C) describes the commands used to access tape drives.

Files

/dev/rct0
/dev/nrc0
/dev/rct2
/dev/nrc2
/dev/rctmini

Notes

After certain tape operations are executed, the system returns a prompt before the tape controller has finished its operation. If the user enters another tape command too quickly, a "device busy" error is returned until the tape device is finished with its previous operation.

Periodic tape cartridge retensioning and tape head cleaning are necessary for continued error-free operation of the tape subsystem. Use *tape*(C), to retension the tape.
See Also

backup (C), cpio (C), dd (C), dump (C), format (C), tape (C),
tar (C) restore (C),
Name

terminal – Login terminal.

Description

A terminal is any device used to enter and display data. It may be connected to the computer:

- By a serial wire, either direct or dialup
- As a virtual terminal, for example with emulator software
- Through a display adapter

A terminal has an associated device file `/dev/tty*`.

Files

`/dev/tty*`

See Also

`console(M), disable(C), enable(C), mkdev(C), serial(HW), stty(C), stty(HW), termcap(M), term(F), terminals(M)`