IBM RT PC Advanced Interactive Executive Operating System Version 2.2

Using the AIX Operating System

Programming Family

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IBM RT PC Advanced Interactive Executive Operating System Version 2.2

Using the AIX Operating System

First Edition (April 1988)

Portions of the code and documentation described in this book were developed at the Electrical Engineering and Computer Sciences Department at the Berkeley Campus of the University of California under the auspices of the Regents of the University of California.

This edition applies to Version 2.2 of the IBM RT AIX Operating System licensed program. The previous edition still applies to Version 2.1 of the IBM RT AIX Operating System licensed program and may still be ordered using Order Number SBOF-0169. Changes are made periodically to the information herein; these changes will be reported in technical newsletters or in new editions of this publication.

About This Book

This book includes the information you need to be able to:

- Start your IBM RT system and use simple commands.
- Display and print the contents of files.
- Use the AIX file system.
- Work with processes and the shell.
- Send and receive mail.
- Communicate with other IBM RTs using a variety of networking programs. The AIX Operating System is based on UNIX® System V,

Who Should Read This Book

This book is written for those who want to learn how to use the basic features of the AIX Operating System.

RT is a registered trademark of International Business Machines Corporation.

RT and AIX are trademarks of International Business Machines Corporation.

UNIX was developed and licensed by AT&T. It is a registered trademark of AT&T in the United States of America and other countries.

Before You Begin

Before you can begin to work with this book, your RT system must be set up and the AIX Operating System must be installed. In addition, you should have a **user name** and possibly a password. If your system is not installed, see *Installing and Customizing the AIX Operating System.* If you need a user name, see *Managing the AIX Operating System.*

Before you can use any communication facility described in this book, you must have the appropriate hardware and software. These requirements are described in *IBM RT Planning Guide, Options Installation,* and *Installing and Customizing the AIX Operating System.*

Note: Beginning with Chapter 2, many of the tasks in this book require you to use one of the RT text editing programs. When you begin Chapter 2, please pay careful attention to the list of text editing programs in "About This Chapter" on page 1-3.

How to Use This Book

This book is also divided into chapters, each devoted to a major AIX Operating System concept or feature:

- Chapter 1, "Getting Started on the AIX Operating System," explains how you gain access to the system and how you use AIX Operating System commands to perform work on the system. After you are familiar with the information in this chapter, you should be able to use your system to follow the examples in the remainder of the book.

- Much of the work you do on the system produces or modifies ***files*** (collections of data stored together in the computer under one name). Chapter 2, "Using Files and the File System" explains some of the ways in which you can view the contents of files, either by displaying them on the screen or by printing them. The chapter also explains how the AIX ***file system*** works. It is one of the most important AIX Operating System concepts. Besides explaining the structure and principles of the

file system, this chapter also has many examples of file system use that you can follow on your system.

- Chapter 3, "Using Security Features" explains the controlled access mode features which can be run on your system, discusses user and group passwords, and describes programs that can compromise the security of your system.

- At any given time, when your system is running, a number of different ***processes*** perform a different tasks. Chapter 4, "Using Processes and the Shell" on page 4-1 explains the relationship between programs and processes and some basic ways to run processes, modify the way processes work, and monitor their progress.

  This chapter also explains some of the more advanced ways to control processes, using features of the AIX Operating System shell program, while Appendix A, "Using Advanced Shell Features—A Reference" contains information about the shell that you may find useful if you are developing your own shell programs or procedures.

- Chapter 5, "Sending and Receiving Mail" explains how to use the AIX mail programs to send and receive messages to other people on your RT or other RTs.

- Chapter 6, "Using Local Communications Facilities" shows ways to send messages to people who are logged on to your RT. This chapter also explains how to hold on-line conferences on the RT.

- Chapter 7, "Creating a Remote Communications Facility" discusses using the **connect** command to create a remote communication facility.

- Chapter 8, "Using the Basic Networking Utilities" explains how to use BNU commands to perform tasks on local and remote systems.

- Chapter 9, "Using the Interface Program for use with TCP/IP" shows how to use TCP/IP to communicate from one RT to another, or from an RT to another system.

- Chapter 10, "Using Asynchronous Terminal Emulation (ATE)" explains how to use Asynchronous Terminal Emulation to communicate between an RT and a remote computer.

In addition, this book also includes supplementary material about creating and editing files in Appendix B, and a glossary and an index to make it easier for you to find information.

A Reader's Comment Form and Book Evaluation Form are provided at the back of this book. Use the Reader's Comment Form at any time to give IBM information that may improve the book. After you become familiar with the book, use the Book Evaluation Form to give IBM specific feedback about the book.

You can use this book in one of two ways:

- As a training manual. Read and work through it from the first chapter to the last one. This should give you a general understanding of the AIX Operating System.
- As a reference manual. Use the "Contents" and "Index" to locate particular topics. This is a good way to refresh your memory or learn more details about the AIX Operating System.

Special Features

This book uses type style to distinguish among kinds of information. General information is printed in the standard type style (the type style used for this sentence). The following type styles indicate other types of information:

New terms
Each time a new term is introduced, its first occurrence is printed in this type style (for example, "the AIX Operating System ***file system***").

System parts
The names for keys, commands, files, and other parts of the system are printed in this type style (for example, "the **cp** command").

Variable information
The names for information that you must provide are printed in this type style (for example, "type *yourname*").

`Special characters`
Any characters that have a special meaning are printed in this type style (for example, "the & and && operators have different uses"). This type is also used for the names of files that you create as you work through this book (for example, "create a file named `afile`").

`Information you are to type`
Many examples in this book are designed for you to try them on your own system; the information that you should type is printed in this type style (for example, "type `ls text` and press **Enter**").

Note: If kanji is installed on your system, use system names, user names and file names that only contain ASCII characters. See *Japanese Language Support User's Guide*.

Where appropriate, the chapters and major sections of this book begin with a box containing quick reference material, for example:.

To Use a Quick Reference Box

1. Skip the quick reference boxes the first time you read a section.
2. Use the quick reference boxes as a fast path through the book.
3. Refer to the quick reference boxes to refresh your memory.

You should use the boxes for reference after you are generally familiar with the contents of a section or chapter. You can skip the box the first time you read a section. The boxes make a convenient ***fast path*** through the book, but they are not comprehensive and they are not intended to take the place of the explanatory material in each section.

After the quick reference boxes, each chapter in this book takes the same general approach to the topics it covers—a series of explanations and examples. The examples build upon each other; in many instances, an example uses a file created in a previous example. Therefore, if you intend to follow the examples on your system, it is important for you to work through each chapter from start to finish.

In the examples, the characters you should type are printed in blue, as this example shows:

```
$ ls
  afile
  bfile
  cfile
$ _
```

After you type the characters on a line, press the **Enter** key.

In the text, whenever you are told to ***enter*** a command or other information, you should type the information and then press the **Enter** key.

Also included in the binder with this book are two aids for using the AIX system:

- A Quick Reference Card, which contains the essential steps for a number of basic tasks. The Quick Reference Card should be most useful after you are generally familiar with the information in the book.

- A keyboard reference chart for four of the different display stations that you can use with the AIX system. Certain special functions require a different sequence of keys on different keyboards. The keyboard reference chart for a particular display station shows you which keys to press on that keyboard to produce the special function.

Related Books

- *IBM RT Installing and Customizing the AIX Operating System* provides step-by-step instructions for installing and customizing the AIX Operating System, including how to add or delete devices from the system and how to define device characteristics. This book also explains how to create, delete, or change AIX and non-AIX minidisks.
- *IBM RT Managing the AIX Operating System* provides instructions for performing such system management tasks as adding and deleting user IDs, creating and mounting file systems, repairing file system damage, and managing data communications facilities.
- *IBM RT AIX Operating System Commands Reference* lists and describes the AIX Operating System commands.
- *IBM RT Guide to Operations* describes the IBM 6151 and IBM 6150 system units, the displays, keyboard, and other devices that can be attached. This guide also includes procedures for operating the hardware and moving the IBM 6151 and IBM 6150 system units.
- *IBM RT Problem Determination Guide* provides instructions for running diagnostic routines to locate and identify hardware problems. A problem determination guide for software and three high-capacity (1.2MB) diskettes containing the IBM RT diagnostic routines are included.
- *IBM RT Usability Services Guide* shows how to create and print text files, work with directories, start application programs, and do other basic tasks with Usability Services. (Packaged with *Usability Services Reference*)
- *IBM RT Usability Services Reference* supplements *IBM RT Usability Services Guide* by including information on using all of the Usability Services commands. (Packaged with *Usability Services Guide*)
- *IBM RT Exploring Usability Services* is an online tutorial for first-time users of the Usability Services. This tutorial

simulates the user interface and shows how to use the keyboard and the optional mouse, how to manipulate windows, and how to use files and directories.

- *IBM RT Messages Reference* lists messages displayed by the IBM RT and explains how to respond to the messages.

- *IBM RT Using DOS Services* provides step-by-step information for using AIX Operating System shell. (Available optionally; packaged with *IBM RT DOS Services Reference*)

- *IBM RT AIX Operating System Technical Reference* is a four-volume set.

  System Calls and Subroutines, describes the system calls and subroutines that a C programmer uses to write programs for the AIX Operating System.

  Files and Extensions, contains information about the extensions to the kernel and base operating system, including file formats, special files, and GSL subroutines.

  VRM Programming Support, describes the VRM programming environment, including the internal VRM routines, VRM floating-point support, use of the VRM debugger, and the supervisor call instructions that form the Virtual Machine Interface.

  VRM Device Support, describes device IPL and configuration, minidisk management, the virtual terminal and block I/O subsystems, as well as the interfaces to VRM device driver and data link control components. This volume also describes the programming conventions for developing your own VRM code and installing it on the system. (Available optionally)

- *IBM RT INed* provides guide and reference information for using the INed program to create and revise files.

- *IBM RT AIX Operating System Programming Tools and Interfaces* describes the programming environment of the AIX Operating System and includes information about using the operating system tools to develop, compile, and debug programs.

In addition, this book describes the operating system services and how to take advantage of them in a program. This book also includes a diskette that includes programming examples, written in C language, to illustrate using system calls and subroutines in short, working programs. (Available optionally)

Ordering Additional Copies of This Book

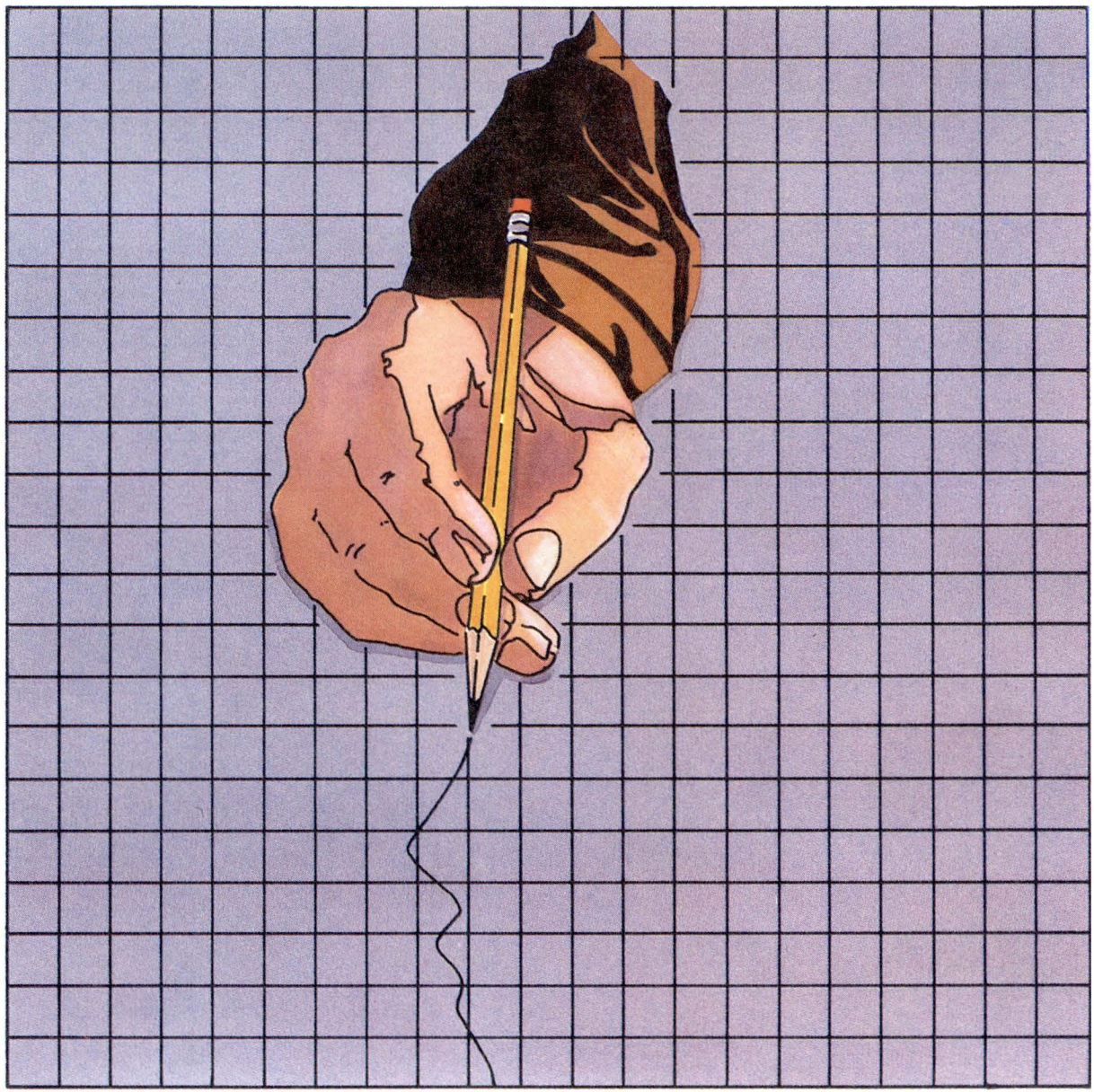
To order additional copies of this publication (without program diskettes), use either of the following sources:

- To order from your IBM representative, use Order Number SBOF-1809.
- To order from your IBM dealer, use Part Number 27F4362.

A binder, the *Using the AIX Operating System* manual, the *AIX Operating System Quick Reference Card*, and the keyboard reference chart set are included with the order. For information on ordering the binder, manual, and quick reference separately, contact your IBM representative or your IBM dealer.

Contents

Chapter 1. Getting Started on the AIX Operating System



CONTENTS

About This Chapter

This chapter introduces you to the basic tasks of using the RT AIX Operating System. If you are not familiar with the parts of the system, see *Guide to Operations* to identify your system's components and the location of their power switches.

After you finish this chapter, you should next learn how to create and modify files with a ***text editing program***. (A ***file*** is simply a collection of data stored together under a given name.) The following editing programs are available on the AIX system:

- **ed** (see Appendix B, "Creating and Editing Files with **ed**" on page B-1)
- **INed** editor (see *INed*)
- **vi** (see *AIX Operating System Commands Reference*).

Your system may have other editing programs as well.

Once you complete this chapter and learn how to use an editing program, you should have the basic skills necessary to start using the operating system.

Note: Before you can work through this book on your AIX system, the components of your system must be set up and the AIX Operating System must be installed. In addition, you may be required to have a user name and a password. If your system is not set up and installed, see *Installing and Customizing the AIX Operating System.* If you do not have a user name and a password, see *Managing the AIX Operating System.*

INed is a registered trademark of INTERACTIVE Systems Corporation.

Logging In to the AIX Operating System

Before you can use the AIX Operating System, your system must be running and you must be ***logged in*** (identified as a valid system user). If your system displays the prompt "`login:`" after going through its initial operations, log in with the procedure described in the following quick reference box, or refer to "Logging In to the System" on page 1-5 for detailed information about the ***login process***.

If your system displays the prompt "`autologin of` *name*", it has logged you in automatically. You can now continue your work with this chapter at "Logging Out of the AIX Operating System" on page 1-6.

Logging in to the AIX Operating System

- If your system is not running:

  1. Turn on the power switch for each component.
  2. Continue with step 1 in the next section.

- If your system is already running:

  1. Type your user name following the `login:` prompt:

     `login:` *username*

  2. Press the **Enter** key.

     If you do not have a password, you do not receive the next prompt.

  3. If the `password` prompt appears, type your password, which the system does *not* display on the screen, and then press **Enter**:

     `password:` [*your password*]

Starting the System

When you start the RT, the system goes through a series of internal procedures before it is ready to use. When the system is ready, it displays a copyright notice and the following prompt:
`login:`

Logging In to the System

When the prompt `login:` appears on your screen, type your user name and press **Enter**. This is the login process.

If your system displays the prompt `autologin of` *name*, it has logged you in automatically. In that case, you may continue with "Logging Out of the AIX Operating System" on page 1-6.

After you enter your user name, the system displays the prompt `password:`. Enter your password. For security reasons, the system does not display your password as you type it.

Note: If you do not have a password, the system does not display this prompt. Although your system may not require you to have a password, it is usually a good idea to set one for yourself. For an explanation of how to set or change your password, see "Setting and Changing Your Password" on page 1-10.

When the system completes the login procedure, it displays a prompt, usually a dollar sign followed by a space ($), which is called the ***shell prompt***. The system is now ready to accept a command.

Note: The usual prompt is $ (the shell prompt). Another standard prompt is #. However, it is possible that the prompt on your system is set to some other character or characters.

If your system does not display a prompt, you are not logged in. You may, for example, have typed your user name or your password incorrectly. Try to log in again. Remember to press the **Enter** key after you finish typing each entry. If you still cannot log in, see *Managing the AIX Operating System.*

Logging Out of the AIX Operating System

You generally log out and leave the operating system running for other users.

If you have ***superuser*** authority or if you are a member of the system group, you can also stop the operating system.

Warning: It is very important that you use the **shutdown** command before you turn off the power to your system. Failure to do so may result in the loss of data.

Logging Out and Stopping the System

The $ (shell) prompt must be displayed before you can log out of the system.

- To log out and leave the operating system running:
  - Press **END OF FILE (Ctrl-D)**.
- To stop the operating system and send a message to other users warning them of the shutdown so they can log off:
  - Type `shutdown` and press the **Enter** key.
- To stop the operating system, bypass the shutdown message to other users, and bring the system down as fast as possible:
  - Type `shutdown` and press **Enter**.

- To log out of the system, press **Ctrl-D**. After logging you out, the system displays the `login` prompt for the next user.
- If you want to turn off the power to the system, you must first stop the operating system in an orderly way with the **shutdown** command.

When the operating system stops running, you receive the following message:

```
....Shutdown completed....
```

- On some systems, only selected users can use the **shutdown** command. If you are not responsible for shutting down your system, simply log out and leave the system running.

For more information about **shutdown**, see *Managing the AIX Operating System*.

Using Operating System Commands

Operating system ***commands*** are programs that perform tasks on the AIX system. The AIX Operating System has a large set of commands, which are described in the remaining chapters of this book and in *AIX Operating System Commands Reference.*

In addition to using the commands provided with the system, you can also create your own personalized commands. Refer to "Writing and Running Shell Procedures" on page 4-26 for information about creating these special commands.

- When you work with the operating system, you typically enter commands following the $ (shell) prompt on the ***command line.*** For example, to display a list of the contents, if any, of your current directory, enter the AIX command **ls**:

  ```
  $ ls
  ```

- Remember to press the **Enter** key after you finish typing your entry.

- If you make a mistake while typing a command, use the **Backspace** key to erase the incorrect characters and then retype them. The ← cursor movement key does not work for this purpose.

- An option, called a ***flag*** in the command format, alters the way a command works. Most commands have several flags. For example, if you type the the **-l** (**l**ong) flag following the **ls** command, the system provides additional information about the contents of the directory.

  The following example shows how to use the **-l** flag with the **ls** command:

  ```
  $ ls -l
  ```

- An ***argument*** is a string of characters, usually the name of a file or directory, that follows a command name. An argument specifies what data the command is to work with. If you use

flags with a command, arguments follow the flags on the command line.

In the following example, **/bin** (the name of a directory) is an argument:

```
$ ls -l /bin
```

The **ls -l /bin** command gives a long (detailed) listing of the contents of the directory **/bin**.

Note: "Understanding Files, Directories, and Path Names" contains a detailed explanation of files and directories.

- If you start a command and then decide that you do not want to complete that action, press **Ctrl-Backspace** or **Alt-Pause (INTERRUPT)** to cancel it.

  INTERRUPT and other special function keys are described in "Performing Special Functions" on page 1-14.

- While a command is running, the system does not display the $ (shell) prompt. When the command completes its action, the system displays the $ prompt again, indicating that you can enter another command.

Setting and Changing Your Password

A user name is a code that you use to identify yourself to the system. A ***password*** is a code that you use to verify your identity.

Your user name is public information and generally does not change. Your password, on the other hand, is private, and you should change it periodically with the **passwd** command to protect your data from unauthorized access.

If your account does not have a password, you can use the **passwd** command to set one.

Setting or Changing Your Password

1. Enter the following at the prompt:

   ```
   passwd
   ```

2. After the prompt `Old password:` appears, enter your old password:

   `Old password:` *your old password*

   Remember that the system does *not* display your password on the screen.

3. After the prompt `New password` appears, enter your new password:

   `New password:` *your new password*

4. Enter your new password a second time in response to the prompt:

   `Re-enter new password:` *your new password*

To set or change your password, enter the **passwd** command:

```
$ passwd
```

Remember to press the **Enter** key after typing your entry. The system then responds with the following message and prompt:

```
Changing password for username
Old password:
```

Note: If you do not have an old password, the system does not display this prompt.

Type your old password following the prompt `Old password:`. For security reasons, the system does not display your password as you type it.

After the system verifies your old password, it is ready to accept your new password, and displays the following prompt:

```
New password:
```

Type your new password following the prompt. Remember that your entry does not appear on the screen.

Finally, to verify the new password (since you cannot see it as you type), the system prompts you to enter the new password again.

```
Re-enter new password:
$ _
```

When the $ (shell) prompt returns to the screen, your new password is in effect.

- Try to remember your password; you cannot log in to the system without it. However, if you do forget your password, see *Managing the AIX Operating System.*
- The system recognizes only the first eight characters in a password.
- On most systems, you can change your password as frequently, or as rarely, as you like. However, certain sites may set limits on how often users may change their passwords or on the length of time passwords remain valid.

For information about setting password time limits, see *Managing the AIX Operating System.*

Using Display Station Features

You can accomplish most of the tasks described in this book using the typewriter-style letter and number keys on your keyboard, plus a few other special keys also located on the keyboard.

The Keyboard

Figure 1-1 shows the standard IBM RT Keyboard.

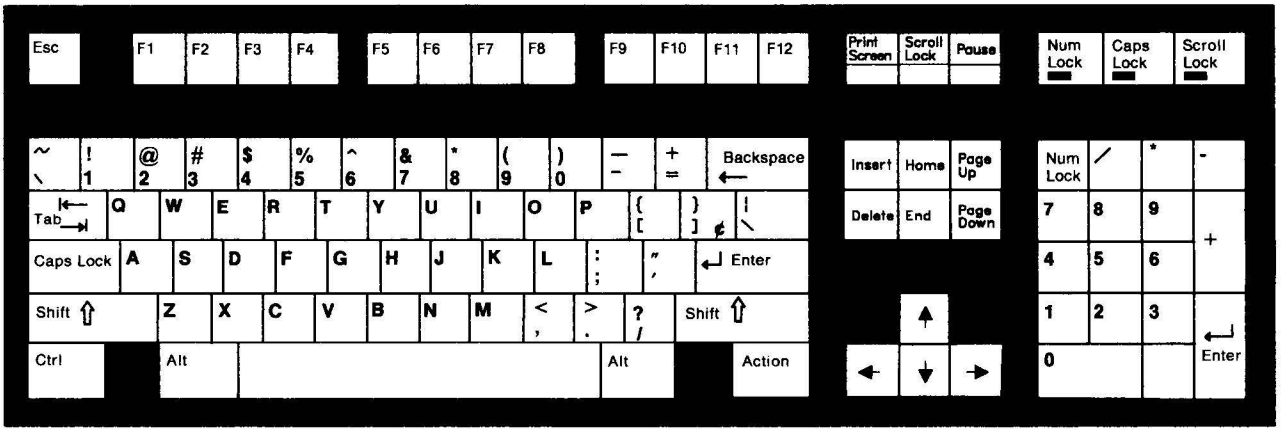


Figure 1-1. The IBM RT Keyboard

In addition to the regular typewriter-style letters and keys, the keyboard also has a number of keys the perform special actions.

Special Keys

Following is a list showing some of the special keys that you use in addition to, or in conjunction with the regular typewriter-style keys on the keyboard.

Key	Action
Alt	Used with other keys for special functions. For example, **Alt-Pause** cancels a command or interrupts an action.
Ctrl	Used with other keys for special functions. **Ctrl-D**, for example, logs you off the system.
Enter	Sends your typed input from the keyboard to the system and moves the cursor from the end of one line to the beginning of the next.
Esc	Ends certain system activities. You also use this key in conjunction with other keys for special functions.
←	**(Cursor Left)** Moves the cursor to the left one character at a time. **Note:** The ***cursor*** is the underscore or rectangle on your screen that moves as you type characters or press the cursor movement keys.
→	**(Cursor Right)** Moves the cursor to the right one character at a time.
↑	**(Cursor Up)** Moves the cursor up one line at a time.
↓	**(Cursor Down)** Moves the cursor down one line at a time.

You often use these keys to perform certain specialized operations.

Performing Special Functions

To perform certain functions, you must often use two or more keys together. For example, to log out of the AIX Operating System, you must send the **END OF FILE** signal. To do so, you press and hold the **Ctrl** key and then press the **D** key.

The names of special functions are printed in this book in uppercase letters. Following is a list of special functions and the IBM RT Keyboard keys you press to use them.

Special Function	Keys Used
DUMP	**Ctrl-(Left)Alt-End** (kernel dump)
END OF FILE	**Ctrl-D**
INTERRUPT	Alt-Pause
NEXT WINDOW	**Alt-Action**
QUIT WITH DUMP	**Ctrl-V** (application dump)
SOFT IPL	**Ctrl-Alt-Pause** (restart system, power already on)
RESUME OUTPUT	**Ctrl-Q**
STOP OUTPUT	**Ctrl-S**
HORIZONTAL TAB	**Ctrl-I**
VERTICAL TAB	**Ctrl-K**
FORM FEED	**Ctrl-L**
CARRIAGE RETURN	**Ctrl-M** (same function as **Enter**)
LINE FEED	**Ctrl-J**

Note: **Ctrl-J** works sometimes when the system will not process **Enter**. If you get strange information on the screen or the system does not respond when you press **Enter**, reset the characteristics of the display station with the following command:

Ctrl-J `stty sane echo -tabs` **Ctrl-J**

Your keyboard may differ in some ways from the keyboard illustrated in Figure 1-1 on page 1-12.

Using Different Keyboards

You can use the AIX Operating System from any of several different display stations, each of which has a different keyboard:

- The main RT display station, sometimes called the ***console***, which includes the IBM RT Keyboard
- The IBM 3151 ASCII Display
- The IBM 3161 ASCII Display
- The DEC VT100[1]
- The DEC VT220[2]
- The IBM PC, using the Crosstalk XVI[3] program.

Keyboard Reference Charts

At the back of this book is a keyboard reference chart for each of the different keyboards used with the AIX Operating System. Use the keyboard reference chart for your keyboard to determine which keys produce the special functions described in "Performing Special Functions" on page 1-14.

Setting Display Station Characteristics

You can use the **stty** command to modify the way in which a display station works. The general format of **stty** is:

`stty` *option*

1 DEC and VT100 are registered trademarks of Digital Equipment Corporation.

2 DEC and VT220 are registered trademarks of Digital Equipment Corporation.

3 Crosstalk XVI is a registered trademark of Microstuf Company, Inc.

Following is a list of the **stty** options, called flags in the command format, that you may find useful in setting the characteristics of your display station.

Flag	Action
-a	Displays the current **stty** settings.
echo	Causes the **Backspace** key to erase characters when you backspace over them.
enhedit	Makes special features available for editing the command line. The **-enhedit** flag (notice the minus sign) turns off the special command line editing features after they have been turned on. **Note:** For more information on the **enhedit** flag, see "Special Command Line Editing Features" on page 1-18.
page	Causes the system to display information one screen at a time instead of scrolling through the entire output of a command without pause. When **page** is set, press another key (for example, **Enter**) to display the next screen of information. To disable the **page** function, use the **-page** flag. The **-page** flag is the normal setting, called the ***default***, until you change it. Use **page** in conjunction with **length** to set the number of lines displayed on the screen.
length *n*	Sets screen length to *n* lines, where *n* is a number from 1 to 255. **Note:** The **length** flag works *only* in conjunction with the **page** flag.

In the following example, the **stty** command turns on the special command line editing features, sets the system to display

information one screen at a time, and sets the length of the screen to 22 lines:

```
$ stty enhedit page length 22
$ -
```

For more information about **stty** flags, see **stty** in *AIX Operating System Commands Reference.*

For information about running **stty** automatically, and for additional information about display station features, see *Managing the AIX Operating System.*

Special Command Line Editing Features

The **enhedit** flag of the **stty** command provides certain command line editing features that you may find convenient in using the system.

Each time you enter a command, the system stores a copy of the command line in a temporary storage area called a ***buffer***. The buffer holds up to eight lines, or ***templates***. As you move the cursor on the command line, a ***marker*** moves to the equivalent position in the buffer.

Note: You can change the buffer size with the **enhedstack** parameter in the **/etc/master** file. Refer to *Managing the AIX Operating System* for information about this operation.

Use the ↑ (cursor up) and ↓ (cursor down) keys to change to another template in the buffer. When you have changed to the last template in the buffer, the buffer "wraps around" (returns) to the first template.

Using the information stored in the buffer, the command line editing features can replace all or part of the last eight lines you entered from the terminal, making it easy to enter the same line again or to modify a previous template to produce a similar line.

The special command line editing features are described in the list below. To enable (turn on) these features on your local system, type the following and then press **Enter**:

```
stty enhedit
```

If you want to enable the special command line editing features on a remote terminal rather than on your local system, enter the following:

```
stty enhedit ascedit
```

Note: The following list uses key names as they appear on the IBM RT Keyboard. If you are using a different keyboard, see the appropriate keyboard reference chart. The keys for remote terminals are shown in parentheses.

Key	Name and Function
F1 or → **(Esc 1)**	**Display character** Either of these keys displays one character from the current template each time you press it.
F2 **(Esc 2)**	**Display before** Displays all characters of the current template line from the buffer before the first occurrence of the next character you type, but following the position of the marker in the buffer.
F3 **(Esc 3)**	**Display line** Displays all the characters in the current template line.

F4
(Esc 4) **Display after**

Moves the marker to the first occurrence of the next character you type, but does not display any characters. Use F1, F2, or F3 to display characters after positioning the marker with F4.

F5
(Esc 5) **Load buffer**

Places the contents of the input line into the buffer, replacing the current template without running the command.

Backspace
or ← **Erase character**

Either of these keys erases the preceding character each time you press it, enabling you to correct typing errors on an input line.

Note: If you are not using the special editing features, you can use the **Backspace** key to correct errors, but not the ←, which erases characters from the input line but not from the buffer template.

Insert
(Esc i) **Insert character**

Turns the insert mode on or off. When insert mode is on, you can insert characters between other characters on the line without changing the position of the marker in the buffer.

Delete
(Esc d) **Skip character**

Moves the marker in the buffer one position to the right without erasing the skipped character. The cursor remains in the same position on the input line.

Esc
(Esc Esc) **(Ctrl-U) Erase command line**

Erases the entire input line, but does not affect the contents of the buffer.

↑
(Esc h) **Display next command line**

Moves the marker to the next line template in the buffer, and displays the entire template.

↓
(Esc l) **Display previous command line**

Moves the marker to the previous line template in the buffer, and displays the entire template.

Using Virtual Terminals

It may be easier to understand the concept of ***virtual terminals*** if you know something about how the AIX system handles commands. Ordinarily, you enter a command, wait for the command to "execute," or complete its action, and then enter your next command.

The AIX system, however, can actually run more than one command at the same time. For example, if your system has more than one display station, you can enter a command at one display station, move to the next display station and enter another command, and so on, until you have commands running at every display station on the system.

The RT virtual terminal feature gives you the equivalent of multiple display stations. However, rather than moving from one display station to the next to enter different commands, you remain seated at the main display station and use commands and keys to move from one virtual terminal to the next. In a way, a virtual terminal is like a window opening into the operating system, and you can perform different tasks in each of these "windows."

Note: Only the main RT display station has the virtual terminal feature. If you try to use virtual terminals on the main display station and find that they do not work, see *Managing the AIX Operating System* for an explanation of how to make the virtual terminal feature available.

Using Virtual Terminals

1. To start a virtual terminal, enter:

   ```
   open sh
   ```

2. To move from one virtual terminal to another, press:

   NEXT WINDOW (Alt-Action)

3. To close (stop) a virtual terminal, press:

   END OF FILE (Ctrl-D)

4. Before you log out, close all virtual terminals you have opened.

- The **open sh** command opens a virtual terminal with the standard operating system command interpreter (**sh**, or the shell). If you want to open a virtual terminal with a different command interpreter, substitute the name of that program for **sh**.

- After you open a virtual terminal, you can enter a command just as you normally would. If you have several virtual terminals open, **NEXT WINDOW** moves you from one to the next, in the order in which you opened them, as though they

are connected in a ring. The maximum number of virtual terminals that the system can have open concurrently is 16.

For more information about virtual terminals and other features of the main display station, see *Managing the AIX Operating System.*

Communicating with Other Systems: An Overview

The AIX Operating System contains several communication facilities that help you transfer information electronically from one location to another. Depending on the facility, this transfer can be within a local system or between systems, and involve any of the following:

- Two terminals or work stations
- Two computer systems
- A work station and a computer system.

Note: Modems and cables, discussed in *Managing the AIX Operating System*, are required for some facilities.

Ask your system manager which of the facilities discussed in this section are available to you. Then select the facility best suited to each of your communication tasks.

- If Japanese Language Support is installed on your system, it is important to note that communcations between machines can produce undetermined effects if you use files that contain kanji characters and you send the communications through equipment that does not support Japanese Language Support. See *Japanese Language Support User's Guide.*
- For additional information, refer to the information listed in the brief descriptions that follow, and to *IBM RT Planning Guide.*

Basic Communication Concepts

If you need basic information about electronic communications, refer to *Data Communications Concepts* (GC21-5169).

Local System Communications

Several commands in the Base System Program and the Multi-User Services facility provide message-related functions for a local system.

With these commands you can:

- Send and receive messages (using the **who**, **write**, and **mesg** commands).
- Conduct on-line conferences (using the **confer** command).

The Base System Program commands are part of the AIX Operating System and require no additional installation. The Multi-User Services commands, on the other hand, are in a component of the facility called Inter-workstation Commands and do require separate installation.

If you want to install just the Inter-workstation Commands, select option 3 on the install menu (diskette 1 of Multi-User Services) and follow the directions that appear on the display.

- For detailed information about installing the Inter-workstation Commands, refer to *Installing and Customizing the AIX Operating System.*
- To use these commands, refer to Chapter 6, "Using Local Communications Facilities."

Remote Communications Using A Base System Program Command

In addition to local system communication commands, the Base System Program for AIX also contains a special command used to establish communications with a remote system. This command, **connect**, is discussed in detail in "Preparing to Establish a Remote Connection" on page 7-4.

The **connect** command is an integral part of the Base System Program, so you don't have to install any additional software in order to use it.

- For more information about this communication facility, refer to Chapter 7, "Creating a Remote Communications Facility."

Remote File Access

AIX supports two facilities, Distributed Services and IBM AIX/RT Network File System (NFS)[4], that let you create and access files located on other machines in the network from your local RT work station. Unlike remote copy or transfer facilities, with Distributed Services and NFS you can access entire file systems, and read and write to the files directly instead of reading and writing to copies. This means you can share files with other users as well as access additional disk space. You can use the same commands to work with the remote files that you use when working with the files that exist on your local system.

Distributed Services allows users working on RT work stations to create and access files located on other RT work stations in the network. For detailed information about Distributed Services, see *Managing the AIX Operating System.*

Network File System (NFS) allows users working on RT work stations to create and access the files located on other computers in the network, even if they are not RT AIX Operating System

---

[4] The Network File System was developed by Sun Microsystems, Inc.. NFS is a registered trademark of Sun Microsystems, Inc.

systems. Included with NFS is a software component called the Yellow Pages (YP)[5] that the person who manages your system can use to administer system information, such as passwords and machine names. For detailed information about IBM AIX/RT Network File System and Yellow Pages, see *Managing the AIX Operating System.*

When Distributed Services or NFS is installed, the person who manages your system ***mounts***, or makes available, on your computer sets of commonly used remote file systems. This means that you automatically have access to the remote files when the system starts just as you do the local files on your RT work station. If you have the appropriate authority and permissions, you can access other remote files directly using the **mount** command. See the **mount** command in *AIX Operating System Commands Reference* for detailed information and conditions.

The Distributed Services licensed program and the IBM AIX/RT Network File System licensed program are on individual diskettes that are purchased in addition to the software for the AIX Operating System.

- For detailed information about installing each facility, refer to *Installing and Customizing the AIX Operating System.*
- For detailed information about configuring each facility, refer to the appropriate sections in *Managing the AIX Operating System.*

Note: You can see if either Distributed Services or NFS is installed on your system by listing the contents of your licensed program directory with the list directory (**ls**) command, which is discussed in greater detail later in this book. Type the following at the command line:

```
ls /usr/lpp
```

When you press Enter, the licensed programs installed on your system are listed. Look for the entries ds for Distributed Services

---

5 Yellow Pages is a trademark of Sun Microsystems, Inc.

or nfs for Network File System. It is possible that either one or both programs are installed.

Basic Networking Utilities (BNU) Program

The Basic Networking Utilities (BNU) program includes a set of directories, files, programs, and commands that let you communicate with a remote system over a dedicated (hardwired) line or a telephone line.

BNU enables you to perform certain tasks as ***background processes***. This means that once a BNU task is running, you can use your workstation for other jobs. For example, you can send a file to a remote system for printing and, while it prints, edit another document stored on the same remote computer, while remaining seated at your RT.

The tasks you can perform with BNU include the following:

- Gather and send files from one system to a specific user or destination file on a local or remote system.
- Execute commands on another system without logging in to it.
- Route file transfers through several intermediate systems.

BNU is part of the Extended Services feature of the AIX Operating System. To install just the BNU component on your system, select the appropriate option on the install menu (diskette 1 of Extended Services). Then follow the instructions that appear on the display.

- For detailed information about installing BNU, refer to *Installing and Customizing the AIX Operating System.*
- For information about using BNU, refer to Chapter 8, "Using the Basic Networking Utilities."
- For information about customizing BNU, refer to *Managing the AIX Operating System.*

Interface Program for use with TCP/IP

The Interface Program for use with TCP/IP uses the Transmission Control Protocol/Internet Protocol to make a connection to a remote system on a network.

You can use TCP/IP for the following kinds of operations:

- Transfer files between the local and remote systems.
- Log in as a user on the remote system.

TCP/IP is on a separate diskette that comes with the AIX Operating System.

- For information about installing the Interface Program, refer to *Interface Program for use with TCP/IP.*
- To use this facility, refer to Chapter 9, "Using the Interface Program for use with TCP/IP."

Asynchronous Terminal Emulation (ATE)

The Asynchronous Terminal Emulation (ATE) facility makes it possible for you to establish a connection and log in to a terminal on another computer system, such as a data base service.

With ATE you can perform the following types of operations:

- Make a connection to a remote computer system
- Emulate a remote terminal
- Use the commands and programs of the remote system
- Transfer files.

Note: ATE does not let you send files to a specific user on a remote system, or perform file transfers while you continue with other work at your terminal. For these tasks, the BNU programs,

described in Chapter 8, "Using the Basic Networking Utilities," may better fit your needs.

ATE is on an individual diskette that comes with the AIX Operating System.

- For installation information, see *Installing and Customizing the AIX Operating System.*
- For information about using ATE, refer to Chapter 10, "Using Asynchronous Terminal Emulation (ATE)."
- For information about customizing ATE, refer to *Managing the AIX Operating System.*

Before You Continue...

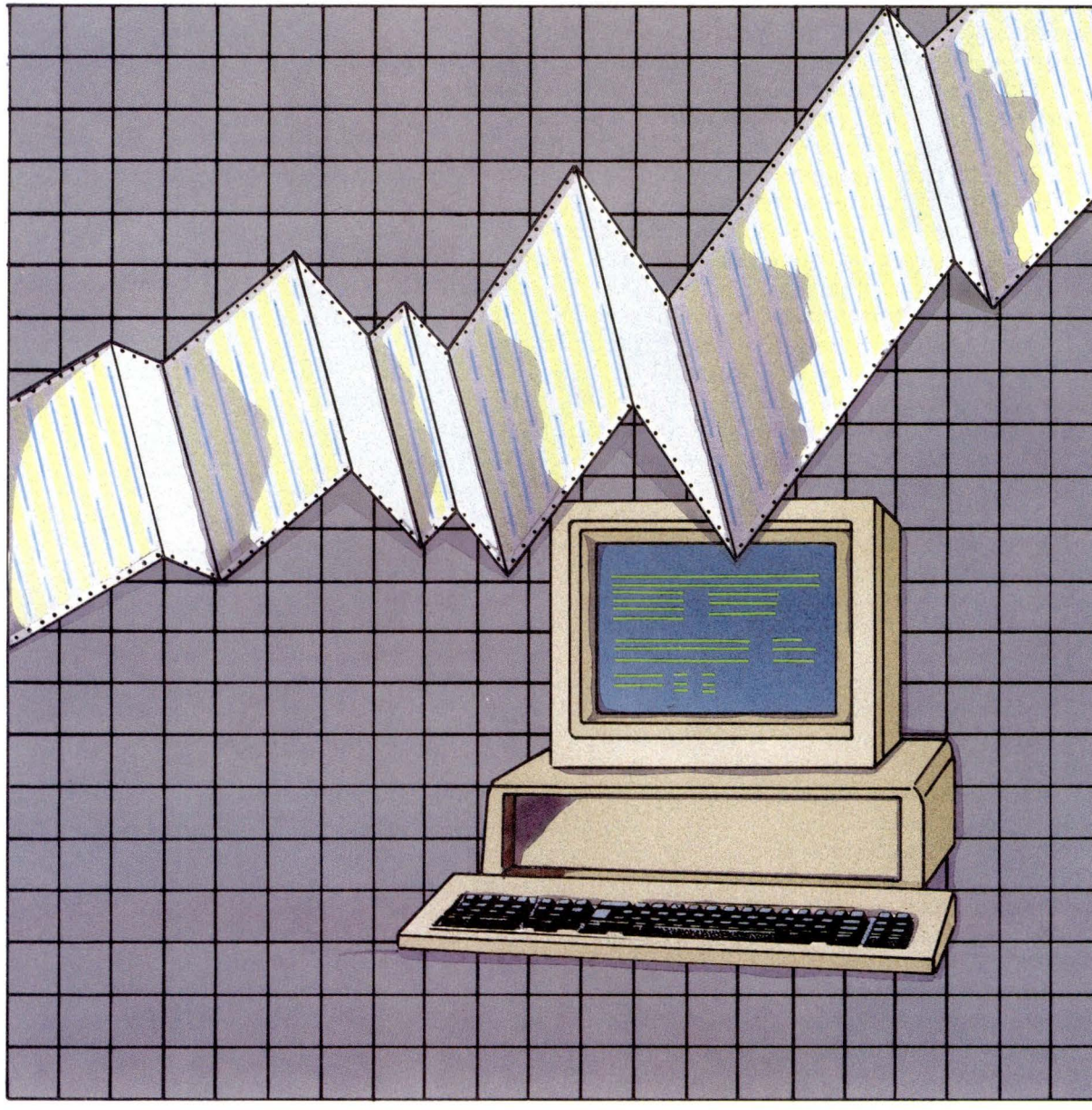
Before you continue with the remainder of this book, you should become familiar with a text editing program.

You can use any of the available AIX editing programs:

- **ed** (see Appendix B, "Creating and Editing Files with **ed**")
- **INed** (see *INed*)
- **vi** (see *AIX Operating System Commands Reference*).

Your system may have other editing programs as well. Use any text editor with which you are familiar, or follow the instructions in "Creating Sample Files for This Chapter" on page 2-7 for creating a file with the **ed** program.

Chapter 2. Using Files and the File System



CONTENTS

About This Chapter

A ***file*** is a collection of data stored together in the computer. This chapter explains how to display and print your files and how to arrange your files into a useful order by creating a ***file system***. This chapter explains the AIX file system and the commands you use to work with it.

When you want to examine the contents of a file, you have two options:

- Display the file on the screen of your work station.
- Print the file on the system printer.

This chapter explains how to display or print the file so that its content is either ***unformatted*** or ***formatted***.

Unformatted The system displays or prints the file just as it is, without adding any special characteristics that govern the appearance of the contents.

Formatted The system displays or prints the file with particular characteristics that dictate the appearance of the contents, such as page headings, the number of spaces between lines, the number of characters per line, and the number of lines per page.

This chapter also explains file system components, including files, directories, and path names. Understanding this material can help you design a file system that is appropriate for the type of information you use and the way you work.

A good way to learn about the file system is to try the examples in this chapter on your work station; you can practice handling both files and directories. You should do each example in order so the information on your screen is consistent with the information in this guide.

In the examples, the entries you should type are shaded in blue (like `pwd`) and printed in `characters like this`. When the text instructs you to "enter" a command name or a string of characters, type the characters and then press the **Enter** key.

This chapter describes file systems that are stored on the AIX fixed disk. You can also create file systems on diskettes. For information about creating and using diskette file systems, see *Managing the AIX Operating System.*

Note: This chapter requires you to work with three files that you create with a ***text editing program***. "Creating Sample Files for This Chapter" on page 2-7 explains how to create these files.

Later chapters of this guide require you to be generally familiar with one of the AIX text editing programs listed in "About This Chapter" on page 1-3.

Creating Sample Files for This Chapter

You need three practice files to work through the display and printing examples in this chapter. The following editing example shows how to use the **ed** program to create these files.

Note: If you are familiar with a different editing program, you can use that program to create the practice files. If you have already created three files with an editing program, you can use those files by substituting their names for the file names used in the examples.

In the following examples, you should type the text that is shaded in blue (like `ed file1`) and printed in `special characters, like this`. Do not, however, type the system prompts or responses.

Note: The **ed** program is a ***line editor***, which means you can work on only one line of text at a time. You can't use the cursor control keys (the arrow keys) to move the cursor up or down a line. Once you press **Enter** to start a new line of text, you cannot move back to a previous line to change it. You do not have to press **Enter**, however, unless you want to start a new line before the cursor reaches the end of the current line. You can just continue typing because **ed** automatically "wraps around" and continues the text on the following line.

You start the **ed** program by typing the command **ed** and the name of a new or existing file, and then pressing the **Enter** key:

```
$ ed file1
```

This is a new file, so the system responds with a prompt in the form of a question mark (?) and the file name that you entered.

```
?file1
```

You indicate that you want to add text to the new file by typing the letter `a` on a line by itself and then pressing **Enter**. The entries on your screen now look like this:

```
$ ed file1
?file1
a
```

Now type the text of the file, beginning on the line following the `a`.

Note: It does not matter if you make typing mistakes when entering this text. However, if you type something incorrectly and want to correct it before you move to the next line, use the **Backspace** key to erase backward over the current line of text.

```
$ ed file1
?file1
a
You start the ed program by entering
the command ed, followed by the name
of a new or existing file.
```

That's all you need to type for the text of `file1`. Make sure you press **Enter** at the end of the last line of text.

Indicate that you have finished your current work by first typing a period (.) on the line following the last line of text and pressing **Enter**. Then enter the letter `w`.

Note: In the remainder of this book, the use of the word "enter" in an example or a quick reference box indicates that you should type the indicated information and then press the **Enter** key.

Entering the letter w indicates to the system that you want to "write," or save a copy of the new file. Your screen will look like this:

```
$ ed file1
?file1
a
You start the ed program by entering
the command ed, followed by the name
of a new or existing file.
.
w
101
```

The number 101 following the w indicates the number of characters in the file.

You are still in **ed**, so you can continue creating the sample files used in the remainder of this chapter. The process is exactly the same as the one you used to create file1; only the text is different.

```
e file2
?file2
a
If you are creating a new file, the ed
program first displays the prompt ?.  You
then type an a on a line by itself to indicate
that you are ready to add text to the file.
.
w
171
e file3
?file3
a
When you finish entering your text, enter a period
on a line by itself.  Then enter w to write (or save)
a copy of the new file.
.
w
129
q
```

Notice that the final entry in the example is the letter q. You can exit from the **ed** program in one of two ways. You can:

- Enter the letter q (remember that the use of "enter" means to type the material and then press the **Enter** key.)
- Use the **Ctrl-D** sequence.

Displaying Files—The pg (page) Command

If the $ (shell) prompt is on your screen, you can use the **pg** (page) command to display the contents of one or more files.

Note: You can also use an editing program to display files.

Displaying a File

- Use the following format to display the contents of a file. Enter the command and the name of the file at the prompt:

  pg *filename*

- The *filename* entry can be the name of one file, or a series of file names separated by spaces:

  pg *filename filename filename*

Displaying Files Without Formatting—The pg (page) Command

In the following example, the pg command displays the contents of the file named file1:

```
$ pg file1
```

The system responds with the following:

```
You start the ed program by entering
the command ed, followed by the name
of a new or existing file.
$ _
```

Now use the **pg** command to view the contents of both `file1` and `file2`. Notice that the command displays both files without a break between them.

```
$ pg file1 file2
You start the ed program by entering
the command ed, followed by the name
of a new or existing file.
If you are creating a new file, the ed
program first displays the prompt ?.  You
then type an a on a line by itself to indicate
that you are ready to add text to the file.
$ _
```

Note: The **pg** command always displays multiple files in the order in which you listed them on the command line.

When you display files that contain more lines than will fit on the screen, the **pg** command pauses as it displays each screen. To see the next screen of information, press **Enter**.

Formatting Files for Display—The pr Command

Formatting is the process of controlling the way in which the contents of your files appear when you display or print them. The **pr** command formats a file in a simple but useful style. Used without any options, the **pr** command does the following:

- Divides the contents of the file into pages
- Puts the date, time, page number, and file name in a heading at the top of each page
- Leaves five blank lines at the end of the page to skip over the perforations between sheets of continuous form paper.

Sometimes you may prefer to display or print a file in a more sophisticated format. You can use a number of options, called flags in the command format, to specify additional formatting features. Figure 2-1 on page 2-12 explains several of these flags.

Formatting a File with the pr Command

Enter the following to apply simple formatting characteristics to a file:

`pr` *filename*

When you use the **pr** command to format a file for display, the contents of the file may scroll up and off your screen too quickly for you to read them. In that case, you can view the formatted file using the **stty page** command, described in "Setting Display Station Characteristics" on page 1-16. This command instructs the system to pause at the end of each page. You then press **Enter** to display the next page.

A number of command flags enable you to control the way in which **pr** formats your files. Figure 2-1 explains some of the most useful **pr** command flags.

Flag	Action	Example
+*num*	Begins formatting on page number *num*. Otherwise, formatting begins on page 1.	`pr +2 file1`
-*num*	Formats page into *num* columns. Otherwise, **pr** formats pages with one column.	`pr -2 file1`

Figure 2-1 (Part 1 of 2). pr Command Flags

Flag	Action	Example
-m	Formats all specified files at the same time, side-by-side, one per column.	`pr -m file1 file2`
-d	Formats double-spaced output. Otherwise, output is single-spaced.	`pr -d file1`
-w*num*	Sets line width to *num* characters. Otherwise, line width is 72 characters.	`pr -w40 file1`
-o*num*	Offsets (indents) each line by *num* character positions. Otherwise, offset is 0 character positions.	`pr -o5 file1`
-l*num*	Sets page length to *num* lines. Otherwise, page length is 66 lines.	`pr -l30 file1`
-h	Uses next string of characters, rather than the file name, in the header. If the string includes blanks or special characters, it must be enclosed in quote marks ' ' (single quote marks).	`pr -h 'My Novel' file1`
-t	Prevents **pr** from formatting headings and the blank lines at the end of each page.	`pr -t file1`
-s*char*	Separates columns with the character *char* rather than with blank spaces. You must enclose special characters in quote marks.	`pr -s'*' file1`

Figure 2-1 (Part 2 of 2). pr Command Flags

Note: For detailed information about the flags available with the **pr** command, refer to the description of the command in *AIX Operating System Commands Reference.*

You can use more than one flag at a time with the **pr** command. In the following example, you instruct **pr** to format the file `efile` with these characteristics:

- In two columns (`-2`)
- With double spacing (`d`)
- With the title `My Novel` rather than the name of the file.

```
$ pr -2dh 'My Novel' efile
$ _
```

For detailed information about the **pr** command, refer to *AIX Operating System Commands Reference.*

Printing Files—The print Command

Use the **print** command to send one or more files to the system printer.

The **print** command actually places files in a ***print queue***, which is a list of files waiting to be printed. Once the **print** command places your files in the queue, you can continue to do other work on your system while you wait for the files to print.

The general form of the **print** command is:

print *filename*

If your system has more than one printer, use the following format to specify where you want the file to print. The *printername* entry is the name of a particular printer:

print *printername filename*

Note: If your system has more than one printer, one of them is the ***default*** printer. When you do not enter a specific *printername*, your print request goes to the default printer.

Printing a File

- Use the following format, entered at the $ prompt, to print a file on the default system printer:

  `print` *filename*

  You can print multiple files using the following format:

  `print` *filename1 filename2 filename3*

- If your system has more than one printer, specify the printer you want to use with the following format:

  `print` *printername filename*

  Note: Printers often have names such as **lp0**, **lp1**, . . . **lpn**. If your system has multiple printers, ask your system manager for the printer names.

The following example shows how to use the **print** command to print one or more files on a printer named `lp0`:

```
$ print lp0 file1
$ print lp0 file2 file3
$ _
```

The first **print** command sends the file `file1` to the **lp0** printer and then displays the $ prompt. The second **print** command sends `file2` and `file3` to the same print queue, and then displays the shell prompt before the files finishprinting.

Several **print** command flags enable you to control the way in which your file prints. Following is the general format for using a flag with this command:

print *flag filename*

Figure 2-2 explains some of the most useful **print** command flags.

Flag	Action	Example
-ca *filename*	Cancels a print request. (Do not specify *printername.*)	`print -ca file1`
-nc=*num*	Prints *num* copies of the file. Normally, only one copy is printed.	`print -nc=3 file1`
-no	Notifies you when the print job is completed by placing a message on your screen.	`print -no file1`
-q	Displays the status of the print queue and printer.	`print -q`
-tl=*title*	Places *title* on the first page of the printed document and displays *title* when you use the **-q** flag.	`print -tl=Book file1`
-to=*name*	Labels the printout for delivery to this person.	`print -to=fred afile`
-cp	Copies the file. If you want to change a file while you are waiting for the current copy to print, use the **-cp** flag.	`print -cp file1 file2`

Figure 2-2. print Command Flags

You can specify more than one flag with the **print** command.

For detailed information on printing and printer control, refer to the following:

- *Managing the AIX Operating System*
- **piobe** in *AIX Operating System Commands Reference*
- **print** in *AIX Operating System Commands Reference.*

Understanding Files, Directories, and Path Names

A ***file*** is a collection of data stored in a computer. A file stored on a computer is like a folder stored in a filing cabinet in that you can retrieve a computer file, open it, process it, close it, and store it as a unit. Every computer file has a unique ***file name***, which both users and the system use to refer to the file.

A computer file contains ***records***, which can be data (such as text) or programming code. The records in a computer file are analogous to the documents in a file folder. Like documents, records are related to each other and organized in some fashion.

A ***file system*** is the arrangement of many different pieces of information into a useful pattern. Any time you organize information, you create something like a computer file system. For example, the structure of a manual file system (file cabinets, file drawers, file folders, and documents) resembles the structure of a computer file system.

Once you have organized your file system, manual or computer, you can find a particular piece of information quickly because you understand the structure of the system. To understand the AIX file system, you should first become familiar with three concepts:

- Files and file names
- Directories
- Tree structures and path names.

Files and File Names

A file can contain the text of a document, a computer program, records for a general ledger, the numerical or statistical output of a computer program, or other data.

A file name, which can be up to 14 characters long, can contain letters, numbers, and underscores. File names should not include characters that have a special meaning to the shell, including \ (back slash), & (ampersand), and . (period or dot). For information about characters with special meanings to the shell, refer to "Shell Reserved Characters and Words" on page A-34.

Note: Unlike some operating systems, the AIX Operating System distinguishes between uppercase and lowercase letters in file names (that is, it is ***case sensitive***). For example, the following three file names specify three different files: `filea`, `Filea`, and `FILEA`.

It is a good idea to use file names that reflect the actual contents of your files. For example, a file name such as `memo.advt` indicates that the file contains a memo dealing with advertising. A file name such as `a.,,,,.,`, on the other hand, tells you little or nothing about the contents of that file.

It is also a good idea to use a consistent pattern to name related files. For example, suppose you have a report which is divided into chapters, with each chapter contained in a separate file. You might name these files in the following way:

chap1
chap2
chap3
and so on . . .

Files are generally organized under directories and subdirectories.

Directories and Subdirectories

With the RT file system, you can organize your files into groups and subgroups that resemble the cabinets, drawers, and folders in a manual file system. These groups are called ***directories***, and the subgroups are called ***subdirectories***. A well-organized system of directories and subdirectories lets you retrieve and manipulate the data in your files quickly and efficiently.

Directories differ from files in two significant ways:

- Directories are organizational tools; files are storage places for data.
- Directories contain the names of files, other directories, or both.

Note: In order to distinguish between files and directories, you may find it convenient to use two different naming conventions when you assign names to these entities. If you can't tell by the name, you can determine whether a file is an ordinary file, a directory, or another type of file by executing either the **ls -l** *filename* command or the **file** *filename* command.

When you first log in to the RT, the system automatically places you in your ***login directory***, which was created for you when your computer account was established. However, a file system in which all files are arranged under your login directory is not necessarily the most efficient method of organizing your data.

As you work with the system, you may want to set up additional directories and subdirectories so you can organize your files into useful groups.

Note: "Creating a Directory—The mkdir (Make Directory) Command" on page 2-26 discusses the process of creating new directories.

Once your files are arranged, you will probably need to move around between directories as you work first in File A, located in Directory X, and then in File B, located in Directory Y. The directory in which you are working at any given time is your ***current*** or ***working directory***.

You can always find out the name of your current, or working directory by executing the AIX command **pwd** (print working directory):

```
$ pwd
```

The system displays the name of your working directory in a form such as the following:

```
/usr/msg
```

indicating that you are currently working in a directory named /msg, which is located under the /usr directory.

Note: The /usr/msg notation is called the ***path name*** of your working directory. See "File System Structure and Path Names" for information about path names.

Whenever you are uncertain what directory you are working in, or where that directory fits in the system, use the **pwd** command to find out.

File System Structure and Path Names

The files and directories in the AIX file system are arranged hierarchically, in a structure that resembles an upside-down tree with the roots at the top and the branches at the bottom. This arrangement is called a "tree structure."

Figure 2-3 shows a typical AIX file system arranged in a tree structure. The names of directories are printed in blue and the names of files are printed in black.

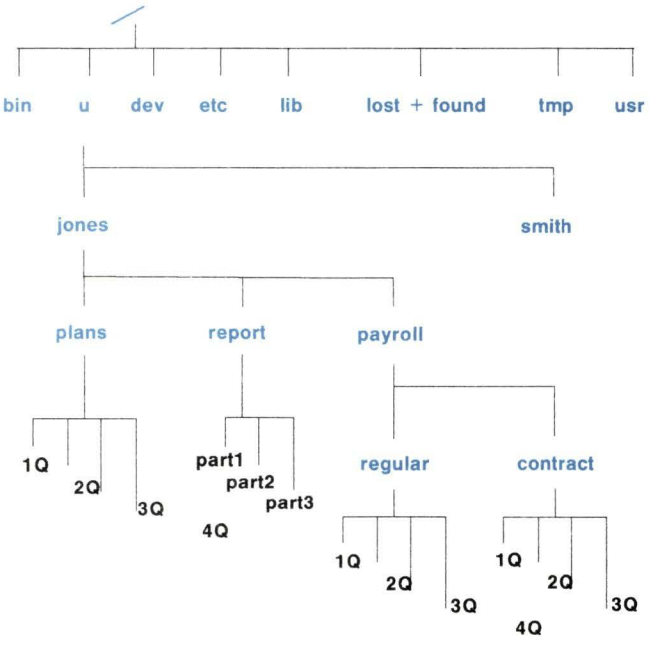


Figure 2-3. A Typical AIX File System

The Tree-Structure File System

At the top of the file system shown in Figure 2-3 (that is, at the root of the inverted tree structure) is a directory called the **root directory**. The symbol that represents this first major division of the file system is a slash (/).

At the next level down from the root of the file system are eight directories, each with its own system of subdirectories and files. The illustration, however, shows only the subdirectories under the directory named **u**. These are the login directories for the users of this system.

The third level down the tree structure contains the login directories for two of the system's users, `smith` and `jones`. It is in these directories that `smith` and `jones` begin their work after logging in.

The fourth level of the figure shows three directories under the `jones` login directory: `plans`, `report`, and `payroll`.

The fifth level of the tree structure contains both files and subdirectories. The `plans` directory contains four files, one for each quarter. The `report` directory contains three files comprising the three parts of a report. Also on the fifth level are two subdirectories, `regular` and `contract`, which further organize the information in the `payroll` directory.

A higher level directory is frequently called a ***parent directory***. For example, in Figure 2-3 on page 2-22 the directories `plans`, `report`, and `payroll` all have `jones` as their parent directory.

Path Names

A ***path name*** specifies the location of a directory or a file within the file system. For example, when you want to change from working in File A in Directory X to File B in Directory Y, you enter the path name to File B. The AIX operating system then uses this path name to search through the file system until it locates File B.

A path name consists of a sequence of directory names separated by slashes (/) that ends with a directory name or a file name. The first element in a path name specifies where the system is to begin searching, and the final element specifies the target of the search. The following path name is based on Figure 2-3 on page 2-22:

```
/u/jones/report/part3
```

The first / represents the root directory and indicates the starting place for the search. The remainder of the path name indicates that the search is to go to the `u` directory, then to directory `jones`, next to directory `report`, and finally to the file `part3`.

Whether you are changing your current directory, sending data to a file, or copying or moving a file from one place in your file system to another, you use path names to indicate the objects you wish to manipulate.

A path name that starts with a / (the symbol representing the root directory) is called a ***full path name***. You can also think of a full path name as the complete name of a file or a directory. Regardless of where you are working in the file system, you can always find a file or a directory by specifying its full path name.

Note: If there are other users on your system, you may or may not be able to get to their files and directories, depending upon the permissions set for them. For more information about file and directory permissions, see "Changing Permissions—The chmod (Change Mode) Command" on page 2-75.

The AIX file system also lets you use ***relative path names***. Relative path names do not begin with the / that represents the root directory because they are *relative* to the current directory. You can specify a relative path name in one of three ways:

- As the name of a file in the current directory
- As a path name that begins with the name of a directory one level below your your current directory
- As a path name that begins with . . (**dot dot**, the relative path name for the parent directory).

  Note: Every directory contains at least two entries: . . (**dot dot**) and . (**dot**, which refers to the current directory).

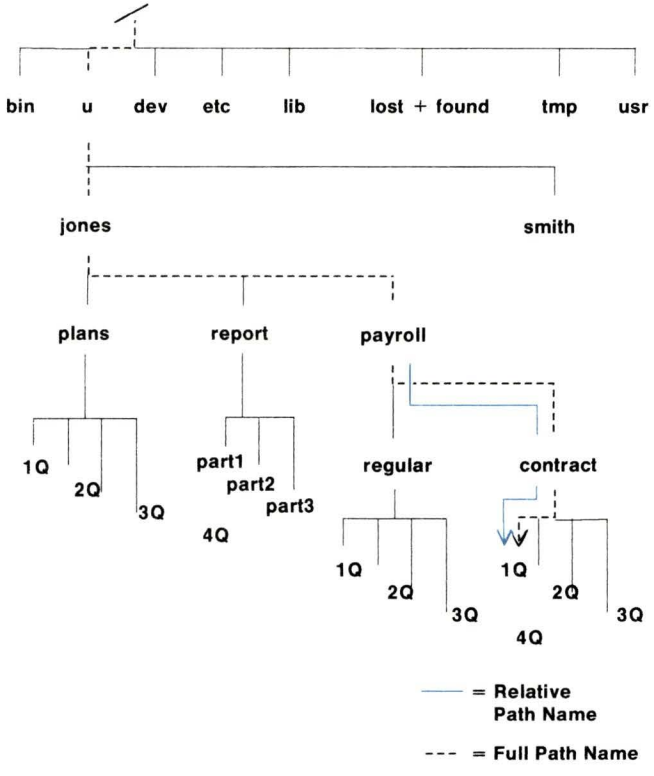


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Figure 2-4. Relative and Full Path Names

In Figure 2-4, for example, if your current directory is `jones`, the relative path name for the file `1Q` in directory `contract` is `payroll/contract/1Q`.

Note: Compare this relative path name with the full path name for the same file, `/u/jones/payroll/contract/1Q`. You can see that using relative path names means less typing and more convenience.

The rest of this chapter explains how to create and modify the file system, and how to use file system commands.

Creating a Directory—The mkdir (Make Directory) Command

The directories in a computer file system correspond to the file drawers in a manual filing system. Like file drawers, directories enable you to organize individual files into useful groups. For example, you could put all the sections of a report in a directory named `report`, or the data and programs you use in cost estimating in a directory named `estimate`. A directory can contain files, other directories, or both.

Note: Before you can work through the examples in the rest of this chapter, you must be logged in on the system and have in your login directory the three files created in "Creating Sample Files for This Chapter" on page 2-7: `file1`, `file2`, and `file3`. If you are using files with different names, make the appropriate substitutions as you work through the examples. To produce a listing of the files in your current directory, enter the `ls` command, which is explained in detail in "Listing Directory Contents— The ls (List) Command" on page 2-29.

Your login directory is created for you when you first begin using the RT, but you will probably need additional directories to organize the files you create and edit while working with the system. Creating a new directory with the **mkdir** (make directory) command is a very simple process.

The form of the **mkdir** command is:

mkdir *dirname*

where *dirname* is the name of the new directory.

The system creates *dirname* as a subdirectory of your working directory. This means that the new directory is located at the next level below your current directory.

Creating a Directory

Enter the **mkdir** command in the following form:

`mkdir` *dirname*

The *dirname* entry is the name you want to assign to the new directory.

To create a directory, enter the **mkdir** command followed by the name you want to assign to the new directory. The following example shows how to create a directory named `project`:

```
$ mkdir project
$ _
```

The new directory, `project`, is located one level below the current directory in the file-system tree structure, as shown in Figure 2-5.

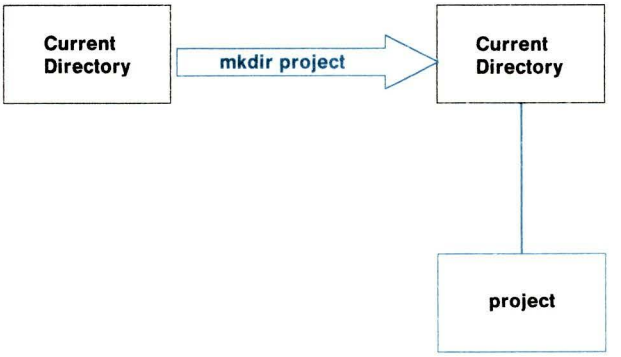

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Figure 2-5. Relationship Between a New Directory and the Current Directory

Like file names, directory names can be up to 14 characters in length. These names can contain letters, numbers, periods, commas, and underscores. The system does not have a symbol or notation that automatically distinguishes between a file name and a directory name, so you may find it useful to establish your own naming conventions to designate files and directories.

Listing Directory Contents— The ls (List) Command

You can display a listing of the contents of one or more directories by executing the **ls** (list) command. The general format of this command follows:

ls

This simple command, which you will use frequently, produces a list of the files and subdirectories (if any) in your current, or working directory. You can also display other types of information with the **ls** command, such as listing the contents of directories other than your working directory.

The **ls** command has a number of options, called flags in the command format, that enable you to display different types of information about the contents of a directory. Refer to "Flags Used with the ls Command" on page 2-31 for information about these flags.

Listing the Contents of a Directory

Enter the **ls** command in the following format:

`ls` *dirname*

The *dirname* entry is the name of the directory whose contents you want to display.

Note: For information about using the **ls** command with the **-l** flag to check the access permission for individual files, refer to "Protecting Files and Directories" on page 2-70.

Listing the Contents of Your Current Directory

Use the **ls** command to list the contents of your current directory. Enter the following at the $ prompt:

```
$ ls
```

The system displays the following type of listing:

```
$ ls
file1
file2
file3
project
$ _
```

Used without flags in this format, the **ls** command simply displays a list of the names of the files and directories in your current directory.

Listing the Contents of Other Directories

To display a listing of the contents of a directory other than your current directory, use the `ls` command followed by the path name of the target directory.

In the following example, the current directory is your login directory. Use the **ls** command to display a list of the contents of a directory named **/u**. Notice that the name of the **u** directory is preceded by a slash (/), which indicates that the system should begin searching in the root directory.

```
$ ls /u
amy
beth
george
jerry
mark
monique
ron
$ _
```

As you can see from this example, the **ls** command ordinarily sorts directory and file names alphabetically.

Note: Your listing of the **/u** directory will not be exactly like this one, but it will contain the names of login directories for users on your system. The listing may also contain a different set of system files, depending on the way in which your system is customized.

Flags Used with the ls Command

In its simplest form, the **ls** command displays only the names of files and directories contained in the specified directory. However, **ls** has several options, or flags, that provide additional information about the listed items or change the way in which the system displays the listing.

When you want to include flags with the **ls** command, use the following format:

ls *-flagname(s)*

The *-flagname(s)* entry is actually the first letter of the name of the flag. For example, the **-l** flag produces a **long** listing of the directory contents, as shown in the table below. Notice also that all the **ls** flags are preceded by a hyphen (-).

If you want to use multiple flags with the command, type the flag names together in one string:

ls -ltr

The following table lists some of the most useful **ls** command flags.

Flag	Action
-l	Lists in **long** format. An **-l** listing provides the type, permissions, number of links, owner, group, size and time of last modification for each file or directory listed.
-t	Sorts the files and directories by the **time** they were last modified (latest first), rather than alphabetically by name.
-a	Lists **all** entries. Without this flag, the **ls** command does not list the names of entries that begin with . (period), such as relative directory names, **.profile**, and **.login**.
-r	Reverses the order of the sort to get **reverse alphabetic** order (**ls -r**), or **reverse time** order (**ls -tr**).

Figure 2-6. ls Command Options

The following example shows a long (**-l**) listing of a current directory (your user name will replace the *uname* entry):

```
$ ls -l
total 4
-rw-r--r--   1 uname    system     101 Jun  5 10:03 file1
-rw-r--r--   1 uname    system     171 Jun  5 10:03 file2
-rw-r--r--   1 uname    system     130 Jun  5 10:06 file3
drwxr-xr-x   2 uname    system      32 Jun  5 10:07 project
$ _
```

The following table explains the information displayed on your screen after you execute the **ls -l** command.

Field	Information
total 4	Number of 512-byte blocks taken up by files in this directory.
drwxr-xr-x	File type and permissions set for each file or directory. The first character in this field indicates file type: • - (hyphen) for ordinary files • d for directories • b for block special files • c for character special files • p for pipe (first in, first out) special files • l for a symbolic links. Remaining characters indicate what **r**ead, **w**rite, and **e**xecute permissions are set for owner, group, and others. For more information on permissions, see "Changing Permissions—The chmod (Change Mode) Command" on page 2-75.
1	Number of links to each file. For an explanation of ***file links***, see "Linking Files—The ln (Link) Command" on page 2-49.
uname	User name of the file's owner.
system	Group to which the file belongs.
101	Number of characters in the file.
Jun 5 10:03	Date and time the file was created or last modified.
file1	Name of the file or directory.

Figure 2-7. ls -l Command Information

There are other **ls** command flags that you may find useful as you gain experience with the AIX system. Refer to the explanation of the **ls** command in *AIX Operating System Commands Reference* for detailed information about the **ls** command flags.

Changing Directories—The cd (Change Directory) Command

The **cd** (change directory) command changes your current (working) directory. You can access any directory in the file system from any other directory in the file system by executing **cd** with the proper path name.

Note: You must have permission to access a directory before you can use the **cd** command to make that directory your current directory. For information about directory permissions, see "Protecting Files and Directories" on page 2-70.

Following is the general form of the **cd** command:

cd *pathname*

You can use either a full path name or a relative path name with the **cd** command, depending on the location of the directory.

Note: If you enter the **cd** command without a path name, the system returns you to your login directory. To check the name of your current directory, enter the **pwd** (print working directory) command.

Changing Your Current Directory

Enter the **cd** command in the following form:

`cd` *pathname*

The *pathname* entry can be either the full path name or the relative path name of the directory that you want to set as your current (working) directory.

Returning to Your Login Directory

Enter the **cd** command in the following format:

```
cd
```

Changing Your Current Directory

In the next example, you first enter the **pwd** command to display the name (which is also the path name) of your working directory.

Note: Unless you have already entered the **cd** command, you are currently in your login directory, which is represented in the examples by the notation /u/*uname*.

```
$ pwd
/u/uname
```

Now enter the **cd** command with the relative path name `project` to change to the `project` directory.

```
$ cd project
```

The system makes `project` the current directory. Enter **pwd** again to verify that the **cd** command has executed successfully.

```
$ pwd
/u/uname/project
$ _
```

Returning to Your Login Directory

To return to your login directory from any other directory in the file system, use the **cd** command without a path name:

```
$ cd
$ pwd
/u/uname
$ _
```

To change your current directory to a directory that is either above your current directory or on a different branch of the file-system tree structure, enter the **cd** command with a full path name:

```
$ pwd
/u/uname
$ cd /u
$ pwd
/u
$ _
```

Using Relative Directory Names (. and .. Notation)

Every directory contains at least two entries represented by . ("dot") and .. ("dot dot"). These entries refer to directories relative to the current directory.

. ("dot") This entry refers to the current directory.

.. ("dot dot") This entry refers to the parent directory of your working directory. The parent directory is the directory immediately above the current directory in the file-system tree structure.

To display the relative directory names, use the **-a** flag with the **ls** command. (For more information about the **ls** command and its flags, see "Listing Directory Contents— The ls (List) Command" on page 2-29.)

Note: In the following example, type the name of your login directory instead of the entry *uname*.

```
$ cd uname/project
```

In the following example, the first **ls** command does not return any information about the contents of the directory `project` because you have not yet created any files or subdirectories in `project`.

```
$ ls
```

Now execute the **ls** command with the **-a** flag to list the directory entries that begin with a . (dot)—the relative directory names.

```
$ ls -a
.
..
$ _
```

You can use the relative directory name .. to refer to files and directories located above the current directory in the file-system tree structure. That is, if you want to move up the directory tree one level, you can use the relative directory name for the parent directory rather than using the full path name.

In the following example, the `cd ..` command changes the current directory from `project` to your login directory, which is the parent directory of `project`. Remember that the *uname* entry represents your login directory.

```
$ pwd
/u/uname/project
$ cd ..
$ pwd
/u/uname
$ _
```

To move up the directory structure more than one level, you can use a series of relative directory names, as shown in the following example. The slash (/) entry here represents the root directory.

```
$ cd ../..
$ pwd
/
$ _
```

Removing Files—The rm (Remove File) Command

When you no longer need a file, you can remove it with the **rm** (remove file) command. You use this command to remove a single file, multiple files, and, with the appropriate flag, multiple files and directories.

Following is the general format of the **rm** command:

rm *filename*

The *filename* entry can be simply the name of the file, the relative path name of the file, or the full path name of the file. The format you use depends on where the file is located in relation to your current directory.

Removing a File

Enter the **rm** command in the following form:

`rm` *filename*

The *filename* entry can be a simple file name, a full or relative path name, or a list of file names.

Removing a Single File

In the following example, you remove the file called `file1` from your login directory.

First, return to your login directory with the **cd** (change directory) command. Next, enter the **pwd** (print working directory) command to verify that your login directory is your current working directory, and then list its contents. Remember that the system substitutes the name of your login directory for the notation **/u/***uname* in the example.

```
$ cd
$ pwd
/u/uname
$ ls
file1
file2
file3
project
```

Enter the **rm** command to remove `file1`, and then list the contents of the directory to verify that the system has removed the file.

```
$ rm file1
$ ls
file2
file3
project
```

- You must have permission to access a directory before you can remove files from it. For information about directory permissions, see "Protecting Files and Directories" on page 2-70.

- You can also remove files with the **del** (delete) command, which prompts you for verification before deleting a file. For an explanation of **del**, see the description of the command in *AIX Operating System Commands Reference.*

Note: You can ***link*** multiple file names to a single file. In addition to removing one or more files, **rm** also removes the links between files and file names. The **rm** command actually removes the file itself only when it removes the last link to that file. For information about links, see "Linking Files—The ln (Link) Command" on page 2-49.

Removing Multiple Files—Matching Patterns

You can remove more than one file at a time with the **rm** command by using the following ***pattern-matching*** characters. Such characters can represent another character, or a string of characters.

*	Matches any string of characters in a file name.
?	Matches any character in a file name.
[. . .]	Matches any of the characters enclosed between the brackets.

For example, the pattern-matching string `*.jun` matches any of the following file names: `receivable.jun`, `payable.jun`, `payroll.jun`, and `expenses.jun`. You could remove all four of these files from your current directory with the `rm *.jun` command.

Warning: Be certain that you understand how the * pattern-matching character works before you use it. For example, the **rm** * command removes *every file* in your current directory. Instead of using **rm** to remove a file, you may prefer to use the * character with the **del** command, which prompts you for verification before deleting a file or files.

You can also use the pattern-matching character ? with the **rm** command to remove files whose names are the same except for a single character. For example, if your current directory contains the files `record1`, `record2`, `record3`, and `record4`, you could remove all four files with the `rm record?` command.

For detailed information about pattern-matching characters, see "Matching Patterns" on page 4-23.

Removing Multiple Files and Directories—the -r Flag

Ordinarily, the **rm** command removes only files, not directories.

Note: For information about removing directories with the **rmdir** command, see "Removing Directories—The rmdir (Remove Directory) Command" on page 2-43.

You can, however, remove directories with the **rm** command by entering it with the **-r** (recursive) flag. When used with **rm**, the **-r** flag first deletes the files from a directory and then deletes the directory itself. Following is the format for the **rm** command with the **-r** flag:

rm -r *pathname*

Warning: Be certain that you understand how the **-r** flag works before you use it. For example, entering the `rm -r *` command would *delete all files and directories to which you have access.* If you have superuser authority, this command could *delete all system files.*

Another flag used with the **rm** command, the **-i** (interactive) flag, enables you to remove files selectively. When using the **rm -r** command to remove files or directories, it is a good idea to include the **-i** flag in the command line, in the following form:

rm -ri *pathname*

When you enter the command in this form, the system prompts you for verification before actually removing the specified item(s). In this way, by answering `y` (yes) or `n` (no) in response to the prompt, you control the the actual removal of a file or the directory.

Removing Directories—The rmdir (Remove Directory) Command

When you no longer need a particular directory, you can remove it from the file system with the **rmdir** (remove directory) command. This command removes only empty directories—those that contain no files or subdirectories. You cannot remove your current (working) directory with the **rmdir** command.

Note: For information about removing files from directories, see "Removing Files—The rm (Remove File) Command" on page 2-39.

Following is the general format of the **rmdir** command:

rmdir *dirname*

The *dirname* entry is the name, or path name, of the directory you want to remove.

Removing a Directory

1. Make sure the directory is empty.

   a. Enter the following to list the directory's contents:

      ```
      ls -a
      ```

   b. Use the **rm** command to remove any files. Remember that entering this command with the * pattern-matching character removes *all files* from your current directory.

      ```
      rm *
      ```

   c. Use **rmdir** to remove any directories.

      ```
      rmdir dirname
      ```

      Note: You can also use the **rm -r** command to remove both files and subdirectories from your current directory. You may choose to enter the command with the **-i** (interactive) flag (**rm -ri**) in order to have the system prompt you for verification before actually removing any entries.

2. Use the **cd** command to move to a different directory (usually the parent directory):

   ```
   cd ..
   ```

3. Enter the following, where *dirname* is the name or path name of the directory you want to remove:

   ```
   rmdir dirname
   ```

Before working through the examples in this chapter, create three subdirectories in the directory `project`.

First, use the command `cd project` to set `project` as your current directory. Next, use the **mkdir** command to create the directories `schedule`, `tasks`, and `costs`. Finally, use the **cd** command to return to your login directory.

```
$ cd project
$ pwd
/u/uname/project
```

Now create the three new subdirectories and then list the contents of the `project` directory.

```
$ mkdir costs schedule tasks
$ ls
costs
schedule
tasks
```

Return to your login directory.

```
$ cd
$ pwd
/u/uname
$ _
```

Removing a Directory

The **rmdir** command removes only empty directories. If you try to remove a directory that contains any files or subdirectories, the **rmdir** command gives you an error message, as the following example shows:

```
$ rmdir project
rmdir:    project not empty
$ _
```

Before you can remove the directory `project`, you must first remove the contents of that directory. In the following example, the **cd** command makes `project` your current directory, and then the **ls** command lists the contents of `project`:

```
$ cd project
$ ls
costs
schedule
tasks
```

Now remove the directory `schedule` from the current directory, and then list the remaining contents of the `projects` directory:

```
$ rmdir schedule
$ ls
costs
tasks
$ _
```

Removing Multiple Directories

You can remove more than one directory at a time with the **rmdir** command by using pattern-matching characters—characters that represent other characters or a string of characters. Following are two of the most frequently used pattern-matching characters:

`*` Matches any string of characters in a file name.

`?` Matches any character in a file name.

For example, the characters `*s` (a pattern-matching string) match the names of both the `tasks` and `costs` directories, but do not match the name `schedule`. (Remember that you actually removed the `schedule` directory in the previous example.) The `rmdir *s` command would therefore remove both `tasks` and `costs`.

Note: Entering the **rmdir** command with the * character (**rmdir** *) removes *all* empty directories from your current directory.

The string ??s?? also matches the names of both the tasks and costs directories. Each of these names consists of two characters matched by ??, the character s, and two more characters, again matched by ??. The rmdir ??s?? command would therefore also remove both of these directories from your current directory.

You can use the * and ? pattern-matching characters together. In the following example, the *s?s string matches the directories tasks and costs. Both names consist of a string of characters matched by *, an s, another character matched by the ?, and a final s.

```
$ rmdir *s?s
```

Now enter the **ls** command to verify that the project directory contains no entries:

```
$ ls
$ _
```

For detailed information about pattern-matching characters, see "Matching Patterns" on page 4-23.

Removing Your Current Directory

You cannot remove your current directory while you are still working in it. You can remove it only after you move into another directory. You generally enter the **cd** .. (**dot dot**) command to move into the parent directory of your current directory, and then enter **rmdir** with the path name of the target directory.

The directory project is empty. To remove project, first move to your login directory, which is the parent directory of project. Then use the **rmdir** *dirname* command to remove project, and enter **ls** to confirm the removal.

```
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
```

Your login directory now contains only [illegible] and [illegible]

Linking Files—The ln (Link) Command

A ***link*** is a connection between a file name and the file itself. An ordinary file usually has one link—a connection to its original file name. However, you can use the **ln** (link) command to connect a file to more than one file name at the same time. This is convenient when you need to use the data in a particular file in more than one location on the system.

You can link files across directories in the same file system using the **ln** command in the following form:

ln *filename1 filename2*

The *filename1* entry is the name of an existing file. The *filename2* entry is a new file name to be linked to the existing *filename1*.

If you want to link files and directories across file systems, you can create ***symbolic links***. To create a symbolic link, add an **s** flag to the **ln** command sequence and specify the full path names of both files. The ln command for symbolic links takes the following form:

ln -s */dirname1/filename1 /dirname2/filename2*

Symbolic links are discussed in greater detail later in this section.

Linking Files

Enter the **ln** command in the following form:

`ln` *filename1 filename2*

The *filename1* entry is the name of an existing file.

The *filename2* entry is the name of the file that you want to link to *filename1*.

If you want to create a symbolic link, use the **-s** flag and the path names of the files with the command.

Using Links

Links are convenient whenever you need to work with the same data in more than one place. For example, suppose you have a file containing assembly-line production statistics. You use the data in this file in two different documents—in a monthly report prepared for management, and in a monthly synopsis prepared for the line workers.

You can link the statistics file to two different file names, for example `mgmt.stat` and `line.stat`, and place these file names in two different directories. In this way you save storage space because you have only one "real" copy of the file. More importantly, you do not have to update multiple files. Because `mgmt.stat` and `line.stat` are linked, editing one automatically updates the other, and both files always contain the same data.

In the following example, the **ln** command links the new file name `checkfile` to the existing file named `file3`:

```
$ ln file3 checkfile
$ _
```

Now use the **pg** command to verify that `file3` and `checkfile` are two names for the same file:

```
$ pg file3
```

The system displays the following:

```
When you finish entering your text, enter a period
on a line by itself.  Then enter w to write (or save)
a copy of the new file.
```

Now display the text of `checkfile`:

```
$ pg checkfile
When you finish entering your text, enter a period
on a line by itself.  Then enter w to write (or save)
a copy of the new file.
$ _
```

Notice that both `file3` and `checkfile` contain the same information. Any change that you make to the file under one name will show up when you access the file by its other name. Updating `file3`, for example, will also update `checkfile`.

If your two files were located in directories that are in two different file systems, you need to create a symbolic link to link them. For example, to link a file called `newfile` that is in the `/reports` directory to the file called `mtgfile` in the `/summary` directory, you can create a symbolic link by using the following:

```
$ ln -s /reports/newfile /summary/mtgfile
```

The information in both files is still updated in the same manner as explained above.

How Links Work—Understanding File Names and i-numbers

Each file has a unique identification number, called an ***i-number***. The i-number refers to the file itself—data stored at a particular location—rather than to the file name.

A directory entry is simply a link between an i-number representing a physical file and a file name. It is this relationship between files and file names that enables you to link multiple file names to the same physical file—that is, to the same i-number.

To display the i-numbers of files in your current directory, use the **ls** command with the **-i** (print i-number) flag in the following form:

ls -i

Now examine the identification numbers of the files in your login directory, which is your current directory unless you have entered the **cd** command since working through the last example. The number preceding each file name in the listing is the i-number for that file.

```
$ ls -i
1079 checkfile
1078 file2
1079 file3
$ _
```

The i-numbers in your listing will probably differ from those shown in this example. However, the important thing to note is the identical i-numbers for `file3` and `checkfile`, the two files linked in the previous example. In this case, the i-number is 1079.

In the case of symbolic links, the link becomes a new file with a new i-number. It does not add another directory entry to the link's i-number but instead has its own i-number for identification in both file systems.

Removing Links

The **rm** (remove file) command does not always remove a file. For example, suppose that a file—that is, an i-number—is linked to more than one file name. In that case, the **rm** command removes the link between the i-number and that file name but leaves the physical file intact. The **rm** command actually removes a physical file only after it has removed the last link between that file and a file name, as shown in Figure 2-8 on page 2-53.

Note: For detailed information about the **rm** command, refer to "Removing Files—The rm (Remove File) Command" on page 2-39.

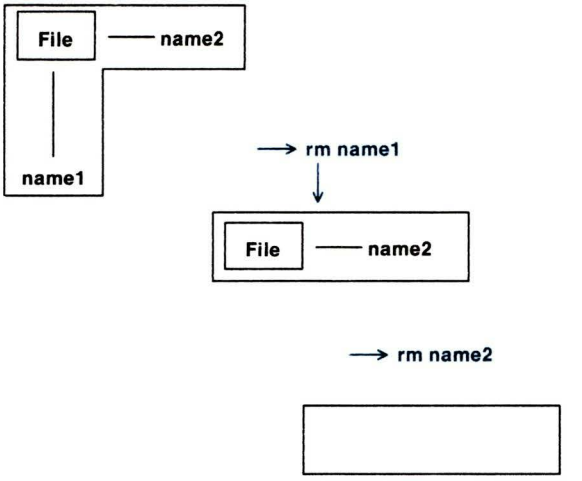


Figure 2-8. Removing Links and Files

When a symbolic link is removed, the file, or link, no longer exists.

To determine the number of file names linked to a particular i-number, use the **ls** command with the **-i** (print i-number) and the **-l** (long listing) flags, in the following form:

ls -il

Now examine the links in your login directory. Remember that the i-numbers displayed on your screen will differ from those shown in the example.

```
$ ls -il
total 3
 1079 -rw-r--r-- 2 uname system  130 Jun 5 10:06 checkfile
 1078 -rw-r--r-- 1 uname system  171 Jun 5 10:03 file2
 1079 -rw-r--r-- 2 uname system  130 Jun 5 10:06 file3
$ _
```

Again, the first number in each entry shows the i-number for that file name. The second element in each line shows the file permissions, which "Protecting Files and Directories" on page 2-70 describes in detail.

The third field for each entry, the number to the left of the user name, represents the number of links to that i=number. Notice that `file3` and `checkfile` have the same i-number, 1079, and that both show two links. Each time the **rm** command removes a file name, it reduces the number of links to that i-number by one.

In the following example, use the **rm** command to remove the file name `checkfile`.

```
$ rm checkfile
```

Now list the contents of the directory with the **ls -il** command. Notice that the **rm** command has reduced the number of links to i-number 1079, which is the same i-number to which `file3` is linked, by one.

```
$ ls -il
total
 1078 -rw-r--r--  1 uname  system  171 Jun 5 10:03 file2
 1079 -rw-r--r--  1 uname  system  130 Jun 5 10:06 file3
$ _
```

Because only one link to i-number 1079 remains, the **rm** command would now remove both the name `file3` and the physical file associated with it. Do not enter the command at this time, however, because you will be using `file3` in the following examples.

Symbolic Links

Symbolic links allow you to create links to directories as well as files, and to link the directories and files across file system boundaries. When you create a symbolic link, you are creating a file that contains a pointer to another file or directory. The pointer is simply the path name to the destination file or directory. When the symbolic link file is read, the contents of the file (the path name) is used to identify the destination of the symbolic link.

For example, a symbolic link called `/u/user1/projects/status.user2` contains the destination path name `/u/user2/status` which is used to link it. When User1 reads status reports for the entire group, the reports are read from the `/u/user1/projects` directory. When User1 cats, or joins, the `status.user2` file, the system substitutes the destination path name `/u/user2/status` for `status.user2`.

Note: To see the symbolic links, use the **li** or **ls** command with the **-l** flag.

Using Symbolic Links To Share Information

You can use symbolic links to share file information since the linking process updates all the linked files when you update one of them. For example, suppose User1 and User2 are working together ona project which requires them to use the same files. By using a symbolic link, both users have subdirectories in their home directory that contain the files they need. When User1 updates any of the files, User2 can look at the files and see the updates.

User1 creates a directory called `/u/user1/project` and User2 can create the symbolic link to it by changing to the home directory (using **cd**) and typing the following:

```
$ ln -s /u/user1/project project
```

Accessing Directories Through Symbolic Links

It is important to note that accessing a directory through a symbolic link is different from accessing it through its **real** name. In particular, using the .. (root) component of the directory results in accessing the directory's real parent directory, not the parent directory of the symbolic link.

For example, suppose User2 is working on a file in the /u/user2/project directory, which is the symbolic link to /u/user1/project. In order to change to the parent directory (/u/user2/project), User2 types the following:

```
$ cd /u/user2/project
$ cd ..
$ pwd
/u/user1
```

Instead of being in the /u/user2 directory, User2 is now in the directory called /u/user1.

Removing Symbolic Links

Symbolic links are unique when they are removed. When links are removed, the original file remains in tact. When a symbolic link is removed, the file is really a pointer to another file so the data is deleted. For example, if User1 deletes the status.user2 file in the /u/user1/projects directory, the real file /u/user2/status remains intact. If User2 deletes the /u/user2/status file, the symbolic link (which is the path to User1's status.user2 file) can no longer be followed since /u/usr2/status no longer exists.

Copying Files—The cp (Copy) Command

The **cp** (copy) command copies files either within your current directory, or from one directory into another directory.

The **cp** command is especially useful in making back up copies of important files. Because the back up and the original are two distinct files, you can make changes to the original while still maintaining an unchanged copy in the back up file. This is helpful in case something happens to the original version. Also, if you decide you do not want to save your most recent changes to the original file, you can begin again with the back up file.

Note: Compare the **cp** command, which actually copies files, with the **ln** command, which creates multiple names for the same file. "Linking Files—The ln (Link) Command" on page 2-49 explains the **ln** command in some detail. Refer also to *AIX Operating System Commands Reference* for additional information about the **cp** and **ln** commands.

Copying Files

- To copy a file, enter the **cp** command in the following form:

  `cp` *source destination*

  The *source* entry is the name of the file to be copied. The *destination* entry is the name of the file to which you want to copy *source*.

  The *source* and *destination* entries can be file names in your current directory, or path names to different directories.

- To copy files to a different directory, enter:

  `cp` *source destination*

  In this case, *source* is a series of one or more file names and *destination* is a path name that ends with the name of the target directory.

Copying Files in the Current Directory

The **cp** command creates the destination file if it does not already exist. However, if a file with the same name as the destination file does exist, **cp** copies the source file over the existing destination file.

Warning: If the destination file exists, the **cp** command erases the contents of that file before it copies the source file. Be certain that you do not need the contents of the destination file, or that you have a back up copy of the file, before you use it as the destination file for the **cp** command.

In the following example, the destination file does not exist, so the **cp** command creates it. First list the contents of the directory, which is still your login directory unless you have entered the **cd** command since working through the last example.

```
$ ls
file2
file3
```

Now copy the source file, `file2`, into the new destination file, `file2x`:

```
$ cp file2 file2x
```

List the contents of the directory to verify that the copying process was successful:

```
$ ls
file2
file2x
file3
$ _
```

Copying Files into Other Directories

If you have followed the examples to this point, you do not have a subdirectory in your login directory. You need a subdirectory to work through the following example, so create one called `extra` with the **mkdir** command:

```
$ mkdir extra
$ _
```

In the next example, first enter the **cp** command to copy the file `file2` into directory `extra`:

```
$ cp file2 extra
```

Now list the contents of `extra` to verify that it contains a copy of `file2`:

```
$ ls extra
file2
$ _
```

You can also use the **cp** command to copy multiple files from one directory into another directory. Enter the command in the following form:

cp *filename1 filename2 dirname*

In the following example, enter the **cp** command to copy both `file2` and `file3` into the `extra` directory, and then list the contents of that directory:

```
$ cp file2 file3 extra
$ ls extra
file2
file3
$ _
```

To change the name of a file when you copy it into another directory, enter the name of the source file (the original file), the directory name, a slash (/), and then the new file name. In the following example, copy `file3` into the `extra` directory under the new name `notes`. Then list the contents of the `extra` directory:

```
$ cp file3 extra/notes
$ ls extra
file2
file3
notes
$ _
```

Renaming or Moving Files and Directories—The mv (Move) Command

You can use the **mv** (move) command to perform the following actions:

- Move one or more files from one directory into another directory
- Rename files or directories.

  Note: You can use the **mv** command only to rename directories; you cannot use it to move one directory into another directory.

Following is the general format of the **mv** command:

mv *oldfilename newfilename*

The *oldfilename* entry is the name of the file you wish to move or rename. The *newfilename* entry is the new name you want to assign to the original file.

The **mv** command links a new name to an existing i-number and breaks the link between the old name and that i-number. It is useful to compare the **mv** command with the **ln** and **cp** commands, which are explained in "Linking Files—The ln (Link) Command" on page 2-49 and "Copying Files—The cp (Copy) Command" on page 2-57. Refer also to the descriptions of these commands in *AIX Operating System Commands Reference.*

Note: When you use **mv** to move files into other directories, be very careful to type the name of the destination directory correctly. If you do not supply a valid destination directory name, **mv** simply renames the file within the same directory, using the invalid directory name as a file name.

Renaming Files and Directories

Enter the **mv** command in the following form:

`mv` *oldfilename newfilename*

The *oldfilename* and *newfilename* entries can be names of files in the current directory, or path names to files in a different directory.

Renaming Files

In the following example, first list the i-number of each file in your current directory with the **ls -i** command. Then enter the **mv** command to change the name of file `file2x` to `newfile`. (The i-numbers displayed on your screen will differ from the numbers in the example.)

```
$ ls -i
1085 extra
1078 file2
1088 file2x
1079 file3
$ mv file2x newfile
```

Again, list the contents of the directory:

```
$ ls -i
1085 extra
1078 file2
1079 file3
1088 newfile
$ _
```

Notice two things in this example:

- First, the **mv** command removes the entry `file2x` and adds the entry `newfile`.
- Second, the i-number for the original file (`file2x`) and `newfile` is the same—1088.

The **mv** command removes the link between i-number 1088 and file name `file2x`, replacing it with a link between i-number 1088 and file name `newfile`. However, the command does not change the file itself.

Renaming Directories

You can use the **mv** command to rename directories *only* when those directories have the same parent directory.

As shown in Figure 2-9, you could use the **mv** command to change the name of the directory `/u/jones/plans` to `/u/jones/schemes` because both directories have the same parent directory, `/u/jones`.

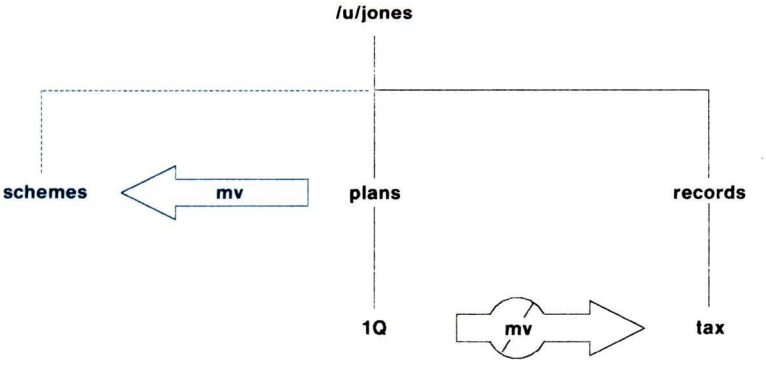


Figure 2-9. Directories That Can and Cannot Be Renamed

However, you could not change the name of the directory /u/jones/plans/1Q to /u/jones/records/tax with the **mv** command because the two directories have different parent directories.

In the following example, the first **ls -i** command lists the i-numbers for all entries in the current directory. Notice the i-number of the extra directory.

```
$ ls -i
1085 extra
1078 file2
1079 file3
1088 newfile
```

Now enter the **mv** command to change the name of extra to change and list the contents of the current directory again:

```
$ mv extra change
$ ls -i
1085 change
1078 file2
1079 file3
1088 newfile
$ _
```

Notice that the second **ls -i** command does not list the original directory name extra. However, it does list the new directory change, and it displays the same i-number (1085 in this example) for the new directory as for the original extra directory.

Moving Files into a Different Directory

You can also use the **mv** command to move one or more files from your current directory into a different directory.

Note: Type the directory name carefully because the **mv** command does not distinguish between file names and directory names. If you enter an invalid directory name, the **mv** command simply takes that name as a new file name. The result is that the file is renamed rather than moved.

In the following example, the **ls** command lists the contents of your current directory. Then the **mv** command moves `file2` from your current directory into the `change` directory.

```
$ ls
change
file2
file3
newfile
```

Now enter the **move** command to place `file2` into the `change` directory and then list the contents of your current directory to make sure the file is gone:

```
$ mv file2 change
$ ls
change
file3
newfile
```

Finally, list the contents of the `change` directory to verify that the command has moved the file:

```
$ ls change
file2
file3
notes
$ _
```

Backing up and Restoring Files

Files and directories represent a significant investment of time and effort. At the same time, all computer files are potentially easy to change or erase, either intentionally or by accident. A ***backup copy*** of a file is a duplicate of that file stored on a different storage medium (diskette or tape).

When you have a recent backup copy of a file, you have a good place to start over if your original file is damaged or lost. To make backup copies of individual files, use the **backup** command, which has the following basic format:

backup

The **backup** command has a number of flags that enable you to back up various parts of the system in various ways. You will be probably be most concerned with backing up individual files, so you will generally enter the **backup** command with the **-i** (individual) flag:

backup -i

The **backup -i** command backs up the specified files onto a ***formatted diskette***. Use the **format** command to prepare a diskette as a backup medium.

Warning: Formatting *erases* any data stored on a diskette. Be sure you do not need the data stored on the diskette you format as a backup medium.

Formatting a Diskette

1. Enter the **format** command in the following form:

   ```
   format
   ```

   The system displays the following message:

   ```
   Insert a new diskette for /dev/fd0
   and strike ENTER when ready
   ```

2. Insert a diskette in diskette drive 0 (also referred to as drive A) and press **Enter**.

   The system displays the following message:

   ```
   Formatting . . .
   ```

   When the diskette is formatted, the system displays the message:

   ```
   Formatting . . . Format completed
   ```

The diskette is now ready for use.

Backing up Individual Files

1. To back up individual files, enter the **backup -i** command in the following form:

   ```
   backup -i
   ```

2. When the system displays the prompt

   ```
   Please mount volume 1 on /dev/rfd0
   ... and type return to continue _
   ```

   insert a *formatted* diskette into diskette drive 0 (also referred to as drive A) and press **Enter**.

3. After the cursor returns to the left side of the screen, enter *one file name per line* until you have entered the names of all the files you want to back up. Remember to press the **Enter** key after typing each file name, including the last one.

4. Once you have typed the last file name and pressed **Enter**, use the **END OF FILE (Ctrl-D)** sequence to begin the backup process.

5. When the backup is complete, the system displays the following type of message:

   ```
   Done      at day date time year
   n blocks on n volume(s)
   ```

   Remove the diskette, label it clearly, and store it in a safe place.

The **backup** command copies files in a compact form that is not directly usable. To make the backup file copies usable, enter the **restore** command to transfer them from the diskette to the system.

Restoring Individual Files

1. Insert the backup diskette into diskette drive 0 (also referred to as drive A).
2. Enter the **restore** command in the following form:

   `restore -x` *filename*

   The *filename* entry is the name of the individual file.

Making backup copies of individual files is important and should be a routine part of your work. However, your backup routine should also include regular backups of complete file systems.

For information about backing up and restoring file systems, see the descriptions of the **backup** and **restore** command in *AIX Operating System Commands Reference.* Refer also to the information about backing up and restoring a file system in *Managing the AIX Operating System.*

Protecting Files and Directories

The AIX Operating System has a number of commands that enable you to limit access to your files and directories. You can protect a file or directory by setting or changing its ***permissions***, which are simply codes that determine the way in which anyone working on your system can use the stored data.

Setting or changing permissions is also referred to as setting or changing the ***protections*** on your files or directories. You generally protect your data for one or both of the following reasons:

- Your files and directories contain sensitive information that should not be available to everyone who uses your system.
- Not everyone who has access to your files and directories should have the power to alter them.

Checking and Setting Permissions

1. To display the current file permissions, enter the **ls** command with the **-l** flag. To display the permissions for a single file, enter the following:

   `ls -l` *filename*

   The *filename* entry is the name of the file for which you want to display the permissions.

2. If necessary, use the **chmod** command to change the file permissions:

   `chmod` *group-operation-permission filename*

   You can also use the following form of the **chmod** command:

   `chmod` *octalnumber filename*

3. If necessary, use the **chown** command to change the ***owner*** of the file:

   `chown` *owner filename*

4. If necessary, use the **chgrp** command to change the ***group*** ID or group name:

   `chgrp` *group filename*

Warning: Two or more users can make changes to the same file at the same time without realizing it. Several users, for example, might be editing the same file concurrently. In this case, the system saves the changes made by the last user to close the file; changes made by the other users are lost. It is therefore a good idea to set file permissions to allow only authorized users to modify files. The specified users should then communicate about when and how they are using the files.

Each file and directory has nine permissions associated with it:

- Each file/directory has the following three ***types of permissions***:

  r (read)
  w (write)
  x (execute)

- These permissions are associated with each of the following three ***classes of users***:

  u (user/owner)
  g (group)
  o (all others)

The **r** permission allows users to view or print the file. The **w** permission allows users to write to (modify) the file. The **x** permission allows users to execute (run) the file or to search directories.

The **owner** of a file or directory is generally the person who created it. If you are the owner of a file, you can change the file permissions with the **chmod** command, which is described in "Changing Permissions—The chmod (Change Mode) Command" on page 2-75.

The **group** specifies the group to which the owner belongs. If you are the owner of a file, you can change the ***group ID*** of the file with the **chgrp** command, described in "Changing Owners and Groups" on page 2-81.

Note: If you do not own a file, you cannot change its permissions or group ID unless you have superuser authority.

The meanings of the three types of permissions differ slightly between ordinary files and directories, as Figure 2-10 shows.

Permission	For a File	For a Directory
r (read)	Contents can be viewed or printed.	Contents can be read, but not searched. Normally **r** and **x** are used together.
w (write)	Contents can be changed or deleted.	Entries can be added or removed.
x (eXecute)	File can be used as a command (program).	Directory can be searched.

Figure 2-10. Differences Between File and Directory Permissions

Displaying File Permissions

To display the permissions for all of the files in your current directory, enter the **ls -l** command:

```
$ ls -l
total 3
drwxr-xr-x  2 uname  system   96 Jun 5 11:08 change
-rw-r--r--  1 uname  system  130 Jun 5 10:06 file3
-rw-r--r--  1 uname  system  101 Jun 5 10:44 newfile
$ _
```

The first string of each entry in the directory shows the permissions for that file or directory. For example, the first entry, `drwxr-xr-x`, shows the following:

- That this is a directory (the `d` notation)
- That the owner has permission view it, write in it, and search it (the `rwx` sequence)
- That the group can view it and search it, but not write in it (the first `r-x` sequence)
- That all others can view it and search it, but not write in it (the second `r-x` sequence).

The third field shows the file's **owner**, represented by *uname*, and the fourth field shows the **group** to which the owner belongs.

You also can use the **ls -l** command to list the permissions for a single file, or the **ls -ld** command to list the permissions for a single directory:

```
$ ls -l file3
-rw-r--r--  1 uname  system  130 Jun 5 10:06 file3
$ ls -ld change
drwxr-xr-x  2 uname  system   96 Jun 5 11:08 change
$ _
```

Taken together, all the permissions for a file or directory are called its ***permission code***. As Figure 2-11 shows, a permission code consists of four parts:

- A character that shows the file type: **-** (hyphen) for an ordinary file; **d** for a directory; **b** for a block special file; **c** for a character special file; and **p** for a pipe ("first in, first out") special file.
- A three-character ***permission field*** that shows **user** (owner) permissions
- A three-character permission field that shows **group** permissions
- A three-character permission field that shows permissions for all **others**.

File Types	Owner Permissions	Group Permissions	Permissions for Others
- d b c p s	r w x	r w x	r w x

Figure 2-11. File and Directory Permission Fields

When you create a file or directory, the system automatically supplies a predetermined permission code. A typical file permission code is:

```
-rw-r--r--
```

A typical directory permission code is:

```
drwxr-xr-x
```

The hyphens (-) in some positions following the file-type notation indicate that the specified class of user does not have permission for that operation.

To change the predetermined permission code, you must change your ***file-creation mode mask*** with the **umask** (set file-creation mode mask) command. For an explanation of **umask**, see the description of the command in *AIX Operating System Commands Reference.*

Changing Permissions—The chmod (Change Mode) Command

Your ability to change permissions gives you a great deal of control over the way your data can be used. Use the **chmod** (change mode) command to set or change the permissions for your files and directories.

For example, you obviously permit yourself to read, modify, and execute a file. You generally permit members of your group to read a file; depending upon the nature of your work and the composition of your group, you often allow them to modify or execute it. You generally prohibit all other system users from having any access to a file.

Note: You must be the owner of the file or directory (or have superuser authority) before you can change its permissions. This means that your user name must be in the third field in an **ls -l** listing of that file.

There are two ways to specify the permissions set by the **chmod** command:

- You can specify permissions with letters and operation symbols
- You can specify permissions with octal numbers.

Changing File and Directory Permissions

You can use either of the following formats of the **chmod** command to change file and directory permissions.

- You can use letters and operation symbols to change file and directory permissions. Enter the **chmod** command in the following form:

  `chmod` *group-operation-permission filename*

- You can also use octal numbers to change file and directory permissions. Enter the **chmod** command in the following form:

  `chmod` *octalnumber filename*

In both examples, the *filename* entry is the name of the file whose permissions you want to change.

Specifying Permissions with Letters and Operation Symbols

Following is the basic format of the **chmod** command:

chmod *group operation permission filename*

Groups, operations, and permissions are defined as follows:

- Use one of these letters to represent the *group*:

  u for user (owner)
  g for group
  o for all others (besides owner and group)
  a for all (user, group, and all others)

- Use one of these symbols to represent the *operation*:

  \+ add permission
  – remove permission
  = assign permission regardless of previous setting

- Use one or more of these letters to represent the type of *permission*:

  r for *read*
  s for *set user or group ID*
  t for *save text in virtual memory*
  w for *write*
  x for *execute*

Changing File Permissions: In the following example, first enter the **ls -l** command to display the permissions for the file `newfile`:

```
$ ls -l newfile
-rw-r--r--  1 uname  system  101 Jun 5 10:44 newfile
```

Now enter the **chmod** command with the flags **go+w**. This format gives both the group (**g**) and all other system users (**o**) write permission (**+w**) for the file:

```
$ chmod go+w newfile
```

Next, list the new permissions for the file:

```
$ ls -l newfile
-rw-rw-rw-  1 uname  system  101 Jun 5 10:44 newfile
$ _
```

Changing Directory Permissions

The procedure for changing directory permissions is the same as that for changing file permissions. However, to list the information about a directory, you use the **ls -ld** command:

```
$ ls -ld change
drwxr-xr-x  2 uname  system  96 Jun 5 11:08 change
```

Now change the permissions with the **chmod g+w** command so that the group (**g**) has write permission (**+w**) for the directory change.

```
$ chmod g+w change
$ ls -ld change
drwxrwxr-x  2 uname  system  96 Jun 5 11:08 change
$ _
```

Using Pattern-Matching Characters: If you want to make the same change to the permissions of all entries in a directory, you can use the pattern-matching character * (asterisk) with the **chmod** command.

Note: For information about pattern-matching characters, see "Shell Reserved Characters and Words" on page A-34.

In the following example, the command **chmod g+x *** gives execute (**x**) permission to all groups (**g**) for all files (*) in the current directory:

```
$ chmod g+x *
```

Now enter the **ls -l** command to show that the group now has execute (**x**) permission for all files in the current directory.

```
$ ls -l
total 3
drwxrwxr-x  2 uname  system   96 Jun 5 11:08 change
-rw-r-xr--  1 uname  system  130 Jun 5 10:06 file3
-rw-rwxrw-  1 uname  system  101 Jun 5 10:44 newfile
$ _
```

Setting Absolute Permissions: An ***absolute*** permission assignment resets all permissions for a file or files, regardless of how the permissions were set previously.

In the following example, the **ls -l** command lists the permissions for the file `file3`. Then the command **chmod a=rwx** gives all three permissions (**rwx**) to all users (**a**).

```
$ ls -l file3
-rw-r-xr--  1 uname  system  130 Jun 5 10:06 file3
$ chmod a=rwx file3
$ ls -l file3
-rwxrwxrwx  1 uname  system  130 Jun 5 10:06 file3
$ _
```

You can also use an absolute assignment (=) to remove permissions.

In the following example, the command **chmod a=rw- newfile** removes the execute permission (**x**) for all groups (**a**) from the file `file3`:

```
$ chmod a=rw- file3
$ ls -l file3
-rw-rw-rw-  1 uname  system  130 Jun 5 10:06 file3
$ _
```

Specifying Permissions with Octal Numbers

In addition to specifying permissions with letters and operation symbols, you can also use the **chmod** command with ***octal numbers***.

An octal number corresponds to each type of permission:

4 = **r**ead
2 = **w**rite
1 = **e**xecute

To specify a group of permissions (a permissions field), add together the appropriate octal numbers:

3 = -wx (2 + 1)
6 = rw- (4 + 2)
7 = rwx (4 + 2 + 1)
0 = --- (no permissions)

The entire permission code for a file or directory is specified with a addition three-digit octal number, one digit each for **owner**, **group**, and **others**. The following table shows how octal numbers relate to permission fields.

Octal Number	Owner Field	Group Field	Others Field	Complete Code
777	rwx	rwx	rwx	rwxrwxrwx
755	rwx	r-x	r-x	rwxr-xr-x
700	rwx	---	---	rwx------
666	rw-	rw-	rw-	rw-rw-rw-

Figure 2-12. How Octal Numbers Relate to Permission Fields

To use octal number permission codes with the **chmod** command, enter the command in the following form:

chmod *octalnumber filename*

Enter the following example to change the permission of `file3` using octal numbers:

```
$ ls -l file3
-rw-rw-rw-  1 uname  system  130 Jun 5 10:06 file3
$ chmod 754 file3
$ ls -l file3
-rwxr-xr--  1 uname  system  130 Jun 5 10:06 file3
$ _
```

It is more difficult to learn to specify permissions with octal numbers than it is to specify them with letters. However, once you are familiar with the octal number system, you may find using it more efficient than setting permissions with letters and operation symbols.

Changing Owners and Groups

In addition to setting permissions, you can control how a file or directory is used by changing its owner or group. Use the **chown** command to change the owner and the **chgrp** command to change the group.

Changing the Owner of a File or Directory

Enter the **chown** command in the following form:

`chown` *owner file*

The *owner* entry is the user name of the new owner of the file.

The *file* entry is a list of one or more files whose ownership you want to change.

Changing the Group of a File or Directory

Enter the **chgrp** command in the following form:

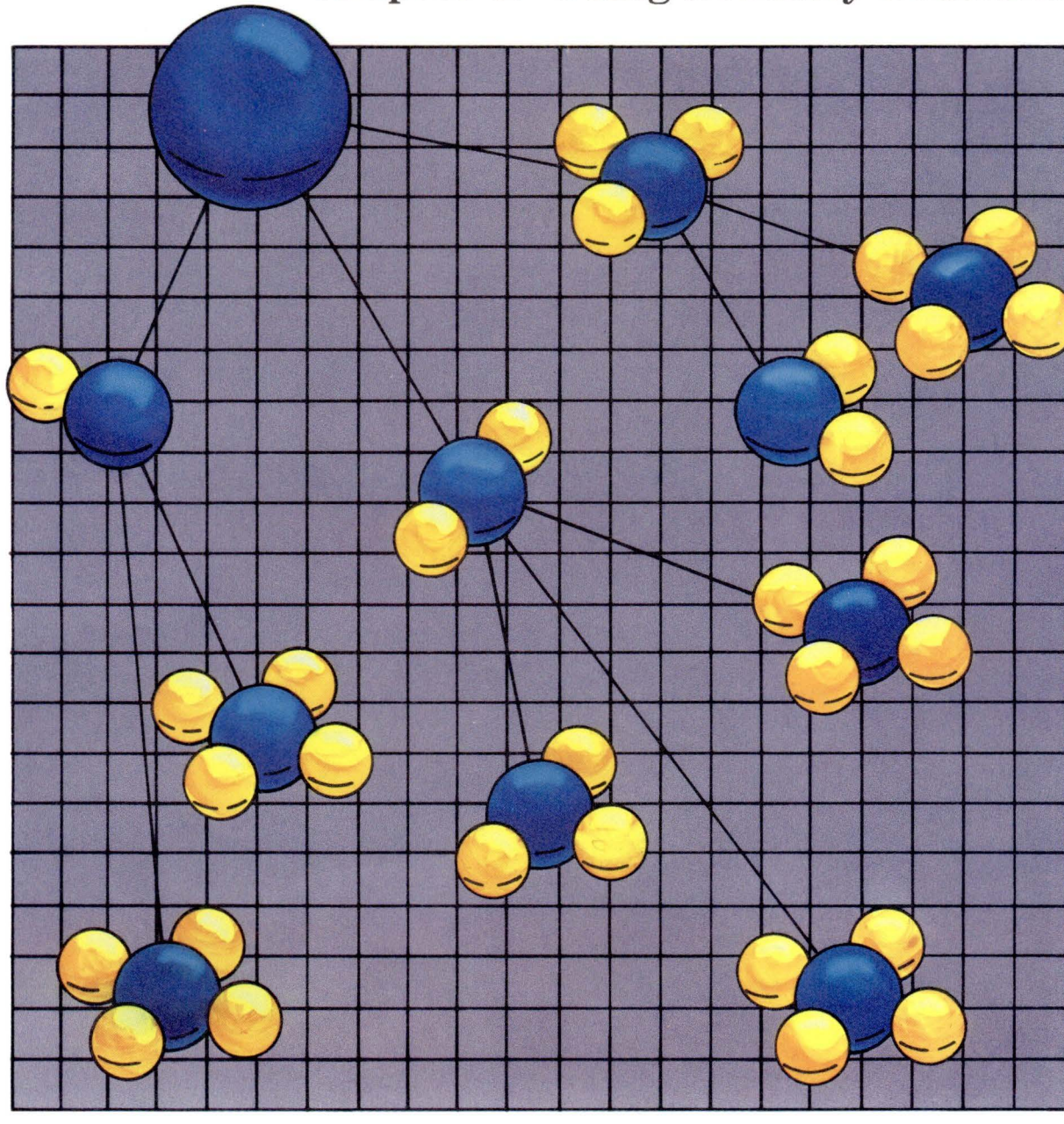
`chgrp` *group file*

The *group* entry is the the group ID or group name of the new group.

The *file* entry is a list of one or more files whose ownership you want to change.

For more information about the **chown** and **chgrp** commands, see the descriptions of the command in *AIX Operating System Commands Reference.*

Chapter 3. Using Security Features



CONTENTS

About This Chapter

This chapter explains how to control security on the AIX Operating System.

A system will be secure if you follow its access control policy and maintain proper user accountability as described in this chapter.

Your system may not use all the security controls discussed in this chapter. Ask the person who administers your system for information on the security policy in effect on your system.

User Authentication

The AIX Operating System requires user ***authentication***. Authentication establishes the user's identity. AIX uses passwords to establish this identity. This section discusses how to select and change a password, and how the user and group databases control user authentication. It also explains the trusted communication path and how to use it.

Understanding Password Security

All other system security controls depend on password security. Passwords must be protected to prevent unauthorized users from accessing the system.

In addition to the system password restrictions (see "Following Password Restrictions" on page 3-5), there may be additional password restrictions set by the person who administers your system. For example, the person who administers your system may specify that you can use only three alphabetic characters and four numbers. See the person who administers your system for more information.

Passwords are stored in a separate file to prevent unauthorized users from

- Reading encrypted passwords
- Guessing the password by using a program designed to do so.

Your encrypted user password is stored in the **/etc/security/passwd** file. Encrypted group passwords are stored in the **/etc/security/group** file.

Passwords are easier to remember if you choose them yourself. Choosing your own password increases security because you do not need to write down that password. The person who administers your system should establish password selection guidelines that prevent users from choosing easily guessed passwords.

Selecting a Good Password

Use the following guidelines to select a password, even if your system does not enforce any password restrictions:

- Do not choose a word found in a dictionary. Use nonalphabetic characters, and place them in the middle of the password.
- Do not use personal information as your password, or as a substring of it. For example, names (yours or your family's), initials, or the make or model of your car.
- Do not use old passwords, or the same prefix or suffix in successive passwords.
- Choose a password that is hard-to-guess, not hard-to-remember, so you do not have to write it down.

Following Password Restrictions

Passwords can be up to eight ASCII characters long.

AIX enforces the following system password restrictions. Remember, the person who administers your system can set additional restrictions.

maxage
The maximum number of weeks before your password expires. The default value is 0.

minage
The number of weeks before you can change a password. The default value is 0.

minalpha
The minimum number of alphabetic characters you must use. The default value is 0.

minother
The minimum number of "other" characters you must use, such as punctuation or numbers. The default value is 0. The maximum value is eight minus minalpha.

> **Note:** The minimum length of a password is minalpha + minother.

maxrepeat
The maximum number of consecutive duplicate characters allowed in a password. The default is 8.

mindiff
The minimum number of characters in the new password that must be different from the old password. The default value is 0.

Be sure to read carefully the following section before you change your password. If you change your password and the new password is not proper, you receive a message stating the specific problem and the restrictions in effect for the system.

Changing Your Password

Use the **passwd** command to change your password. If the password you choose is not acceptable, the system prompts you until you supply an acceptable password. See *AIX Operating System Commands Reference* for more information on the **passwd** command.

When you change your password, you receive a prompt for your old password. You are then asked to enter the new password twice to prevent typing errors. For security reasons, passwords never appear on the screen.

When you change your password, use the AIX trusted communication path to avoid being taken advantage of by a ***trojan horse*** program. For more information on trojan horses, see "Avoiding Trojan Horses and Computer Viruses" on page 3-18. For more information on the trusted path, see "Using the Trusted Communication Path" on page 3-10. Change your password as

frequently as the administrator specifies. If the **login** program detects that your password has expired, you must change it, or the **login** program will not let you log in to the system.

Change your password often, especially if you think it might have been compromised. Do not tell your password to other users.

Controlling System Security with User and Group Databases

User and group databases contain records which, among other things, define the following:

- Who can use the system
- What their access rights are
- How they may be audited.

The person who administers your system assigns the appropriate values for each attribute for each user and group on the system.

Not all user and group attributes are readable by every user on every system. Each database is separated into two files, so the security-sensitive attributes are protected separately.

For the user database, ordinary information is stored in **/etc/passwd**. Attributes important for security are stored in **/etc/security/passwd**.

For the group database, ordinary information is stored in **/etc/group** and security information is stored in **/etc/security/group**.

User Database

Each record in the user database defines a login account for a specific user and contains the following attributes. Some of these attributes can be altered only by the person who administers your system.

user name
A unique character string identifying you to the system. It is also referred to as your login name, and is specified in the **/etc/passwd** file in association with your user ID.

user ID (uid)
A unique number identifying you to the system. It is specified in the **/etc/password** file in association with your user name.

principal group ID
A number identifying your default group. Each user belongs to one or more groups.

home directory
Your current directory after logging in to the system. It is usually a directory you own and use to store private files.

initial program
The program run by the **login** program after you successfully log in to the system. It is normally a shell program used to interpret commands.

other information
Other information can contain the following:

- The full name of the user.
- Maximum file size—A number limiting the maximum size of any file you create or extend.
- Site specific information—An attribute serving various purposes for each installation. It normally records biographical information.

The following attributes are stored in the **/etc/security/passwd** file. This file is accessible only to the person who administers your system.

password
A character string used to authenticate the user. It is stored in encrypted form.

lastupdate
The date on which the password was last changed. Normally, the **passwd** program sets this value.

auditclasses
An attribute defining which audit events are recorded in the process of auditing a user.

restrictions
An attribute specifying how and whether a particular account can be used.

Group Database

Each record in the group database defines the login account of a group. Groups provide a convenient way to share files among users with a common interest or who are working on the same project. Each record contains the following attributes:

group name
A unique character string identifying the group to the system. It is specified in the **/etc/group** file, in association with the group ID.

group ID (gid)
A unique number identifying the group to the system. It is specified in the **/etc/group** file, in association with the group name.

group members
A list of users who belong to the group. This list is stored in the **/etc/group** file.

The following attributes are stored in **/etc/security/group**. This file is accessible only by the person who administers your system.

password
Provides a means to authenticate users who are not defined as members of the group, but who wish to join during a particular login session.

lastupdate
The date on which the password was last changed. Normally, the **users** program sets this value.

Using the Trusted Communication Path

Although system security is always important, there are times when you must be certain of a secure communications path with the system. For example, when you change a password or log in to the system you must be sure that the password cannot be stolen.

AIX provides a trusted communication path, which you invoke with a secure attention key (**SAK**).

The **SAK** is a key sequence: **Ctrl-x** followed by **Ctrl-r**. If you press the **SAK**, all user processes associated with the terminal you are using are ended, and access permission is revoked for any user process with access to your terminal. This establishes the clean environment necessary for secure communication between the user and the system.

Warning: Use caution when using the **SAK**. It ends all processes associated with the terminal. Normally, use it only at the beginning or the end of a session.

Press the **SAK** in the following situations:

- When changing your password or ID using the **su** or **passwd** commands. All processes are ended, and a special shell, called the ***trusted shell***, is run. This shell provides you with a restricted environment to perform administrative tasks without the risks of being taken advantage of by security-compromising programs. (see "Avoiding Trojan Horses and Computer Viruses" on page 3-18). After you finish with the trusted shell, you can continue your login session or log off the system.

- When logging into the system, to ensure connection to the real **login** program. If you press the **SAK** and the login screen (the herald as defined in **/etc/ports**) scrolls up, you are assured of a secure path. If the trusted shell appears, it is a signal that the initial login screen was a trojan horse program (see "Avoiding

Trojan Horses and Computer Viruses" on page 3-18). This could mean that someone was trying to steal your password. Use the **who** command to see who is logged in to the system then log off and notify the person who administers your system.

Access Control

AIX system access is controlled on a discretionary basis. The owner of a resource can grant access permissions to other users. These users can, in turn, transmit those access permissions to still other users.

AIX supports traditional UNIX information resources, including interprocess communication mechanisms such as message queues, shared memory segments, pipes, semaphores, and sockets. These mechanisms provide only temporary storage of data and are not managed directly by users; therefore, most users do not need to be aware of their security properties.

A file is an information resource that permanently stores user data. Chapter 2, "Using Files and the File System" describes how to use the file system and control file access permissions. This section also discusses how to gain access to files and how to protect your files from unauthorized access.

Using su and newgrp Commands

The **su** and **newgrp** commands allow you to alter your identity during a login session.

The **su** command allows you to log in to another user's account if you know that user's password. The **su** command authenticates you and then resets both the process's user ID and ***effective user ID*** to the value of the newly specified user ID. The effective user ID is the user ID currently in effect for the process, although it may not be the user ID of the process owner. (See *AIX Operating System Commands Reference*).

The **newgrp** command changes your principal group to any other group to which you belong, or for which you know the password. The **newgrp** command authenticates you, if you do not belong to the group you specify, and then resets the process's group ID to the newly specified group ID. It also sets the ***effective group ID*** to the same value. The effective group ID is the group ID currently in effect for the process, although it may not be the group ID of the process owner. (See *AIX Operating System Commands Reference*).

Note: When you type in data that could compromise security, such as a password, be sure that a trusted communication path has been established. For information on trusted communication paths, see "Using the Trusted Communication Path" on page 3-10.

Using File and Directory Permissions

In order to provide proper security for your files, you must correctly set the access permissions for the files and the directories containing the files. "Protecting Files and Directories" on page 2-70 explains the permissions associated with files and directories.

Permissions are initially set by the program that created the file or directory, using an attribute known as the ***user mask*** (**umask**), which is described in this chapter.

Using Permission Bits

Permission bits define the access rights for an associated file. There are nine bits, which can specify three separate modes of access for the following three classes of users:

- The **owner** of the file
- The **group** of the file
- The default class, **others**.

Permission bits can:

- Grant or deny the specified access mode to the file owner

- Grant access permissions to the members of the group associated with the file (excluding the file owner)
- Grant or deny access to all users who are not the owner or a member of the group of the file.

Setting the umask

The **umask** is a numeric value that determines the access permissions or modes when a file or directory is created. The **umask** defines the maximum permissions for and object. The program can further restrict the access permissions on that information resource.

Use the **umask** command to set the **umask** in your user login profile, which runs when you log in to the system. (See *AIX Operating System Commands Reference* for information on the **umask** command.)

To set the **umask**, specify which permissions are *not* to be initially granted. For example, if you specify a **umask** of 027:

- The **owner** is allowed all permissions.
- The **group** is not allowed write permission.
- The **others** are not allowed any permissions.

Proper values are dependent upon how freely information resources are shared. A good middle ground is a **umask** of 027, as indicated above. In very secure environments, a **umask** of 077 is preferred. This value means that the only user to have access by default is the owner. The owner must explicitly grant access to the file for anyone else to use it.

Setting the **umask** is very similar to setting the permission bits discussed in "Specifying Permissions with Octal Numbers" on page 2-79. The permission code for a file or directory is specified with a three-digit octal number. Each digit represents a type of permission. The position of each digit (first, second, or third) represents 3 bits that correspond to the following:

- The first is for the **owner** of the file (you).
- The second is for the **group** of the file.

- The third is for the default class **others.**

An octal number corresponds to each type of permission:

4 = read
2 = write
1 = execute

To specify a group of permissions (a permissions field), add together the appropriate octal numbers. For example:

3 = write and execute permission (2 + 1)
6 = read and write permission (4 + 2)
7 = read, write, and execute permission (4 + 2 + 1)
0 = no permissions

The bits set by the **umask** are set to 0 (cleared) in the mode of the file being created.

Granting Access Permissions

The AIX Operating System allows you to grant separate access permissions for files and directories.

For Files: You can grant read, write, and execute access permissions for files. These permissions allow you to do the following:

Read Read the contents of the file.
Write Alter the file.
Execute Run the program contained in the file.

For Directories: You can grant read, write, and search access permissions for directories. These permissions allow you to do the following:

Read Read the contents of the directory (the names of the files in the directory).

Write Add or remove files in the directory.

Note: Be very careful in granting write permission

for your directories. This permission allows a user to add and remove any file in the directory without permission to that specific file. The user can remove the file, and create another file in its place with the same name. Normally, no other user should have write permission for one of your private directories, unless you are the owner of a directory that contains the shared files for a project or group. No user should ever have write permission for your home directory.

Search Search for a file in the directory, but not read it directly. It allows a process to examine the directory during path resolution.

Granting Permissions for Files and Directories: Use the permission bits for each file and directory to specify access permissions for a process. The following conditions determine which bits you use to specify access:

- If the process's effective user ID matches that of the owner of the file, the **user** permission bits determine access rights for the process.
- If the process's effective user ID does not match the file owner's user ID, but the process's effective group ID matches one of the file's group IDs, the **group** permission bits determine access rights for the process.
- If neither the process's effective user ID nor effective group ID matches the file's user ID or one of the group IDs, the **others** permission bits determine access rights for that process.

To grant access to a file or directory, use the determining permission bits. Set the permission bit that corresponds to the type of access you want to grant to each user or group.

Changing Access Permissions

"Changing Permissions—The chmod (Change Mode) Command" on page 2-75 explains how to use the **chmod** command to modify the permissions on both your files and directories.

Using setuid and setgid Programs

A program that has been made **setuid** or **setgid** runs with the access rights of its owner. Normally, when a user runs a program that is owned by another user, it runs with the current user's access rights. If, however, the owner makes that program **setuid** or **setgid**, that program runs with the owner's access rights.

A program that has been made **setuid** or **setgid** will guard the access rights and enforce a different access policy than can be set forth with permission bits. For example, granting write permission with permission bits for a file means that a user could write over the file and alter it completely. But a program that is **setuid** or **setgid** might allow a user only to append new data to the file, but not alter the existing contents.

Although these programs allow for greater control of access permissions than is provided by the permission bits, they can also be a security risk if designed incorrectly. A **setuid** or **setgid**program should not return control to the user while it is running with the access rights of its owner. If it were to return control to the user, that user could make unrestricted use of the owner's access rights.

Accountability

Users of the AIX operating system are accountable for their actions. Proper accountability consists of user authentication and auditing. This section discusses user auditing.

Auditing System Users

Auditing provides a means to identify the potential or actual security violations in the system by recording security-relevant actions for each user in the system audit trail. The person who administers your system examines this trail to determine any security problems.

The AIX operating system provides an auditing subsystem to help detect potential or actual system security violations. Throughout the system, security-relevant actions (called ***audit events***) are detected and logged. The person who administers your system defines a set of events called ***audit classes*** for your system. The user audit classes determine which audit events are recorded when that user's processes are running in the system.

When you log in to an account using **login** or **su** the initial process runs tagged with the audit classes of that account. That session is audited for all audit events listed under those audit classes.

The AIX auditing subsystem allows flexibility in recording events. On a given system, some users may be audited rigorously, while others are audited only slightly, or not at all. Usually, the degree of auditing is tailored to the amount of privilege or nature of the access rights. Users with special privileges or access rights for sensitive files are usually audited in more detail.

Typical users do not have direct communication with the auditing subsystem. The person who administers your system normally consults with you if there are problems with your account, such as usage pattern changes or attempts to gain unauthorized access privileges.

Auditing Printed Output

In the AIX operating system, the person who administers your system can specify security labels for printed output to ensure proper distribution of printed material. The person who administers your system can specify labels for the header and trailer pages, and for the top and bottom of each page.

If the person who administers your system specifies header or trailer page labeling, you *cannot* suppress these pages by using the **-bp** or **-nb** options with the **print** command. These options are ignored if header or trailer page labeling is specified.

If the person who administers your system specifies labeling for either the top or bottom of each page, it may cause problems on pages formatted with pagination or graphics. You can override this labeling by using the **-nl** option with the **print** command. When you use the **-nl** option, the **print** command logs an audit event.

Security Considerations

Problems can occur if you do not follow proper security guidelines when using AIX. This section discusses some of these problems.

Avoiding Trojan Horses and Computer Viruses

There are dangers in running untrusted software (software that is from an unknown source or that has not been validated for system security). When you run a program, that program has all of your access rights, and nothing prevents the program from being used to illicitly access, observe, or alter sensitive files. You should be aware of two types of programs that compromise security:

trojan horse
: A trojan horse is a program which performs, or appears to perform, its defined task properly; however, it also performs

different, additional functions. The trojan horse program emulates the program that you are running, but it can vandalize your files by altering or deleting them, or compromise the files by making illegal copies of them.

A typical trojan horse is a **login** trojan horse, which puts the system's login screen on the display and waits for you to enter a user name and password. The program mails or copies this information to the user responsible for the trojan horse. The trojan horse exits, causing the real **login** program to run. Most users assume they typed the password incorrectly, and are not aware that they have been deceived.

computer virus
A computer virus program is really a type of trojan horse. Normally, a trojan horse waits passively for the right user to run it (usually a privileged user). Viruses spread themselves to other executable files, thus increasing the threat and extent of compromise of privacy or integrity.

To avoid programs like these, use the following guidelines:

- Invoke the AIX trusted path (see "Using the Trusted Communication Path" on page 3-10) to do any of the following:
  - Log in to the system.
  - Change a password.
  - Reset the user ID.
  - Log out of the system.

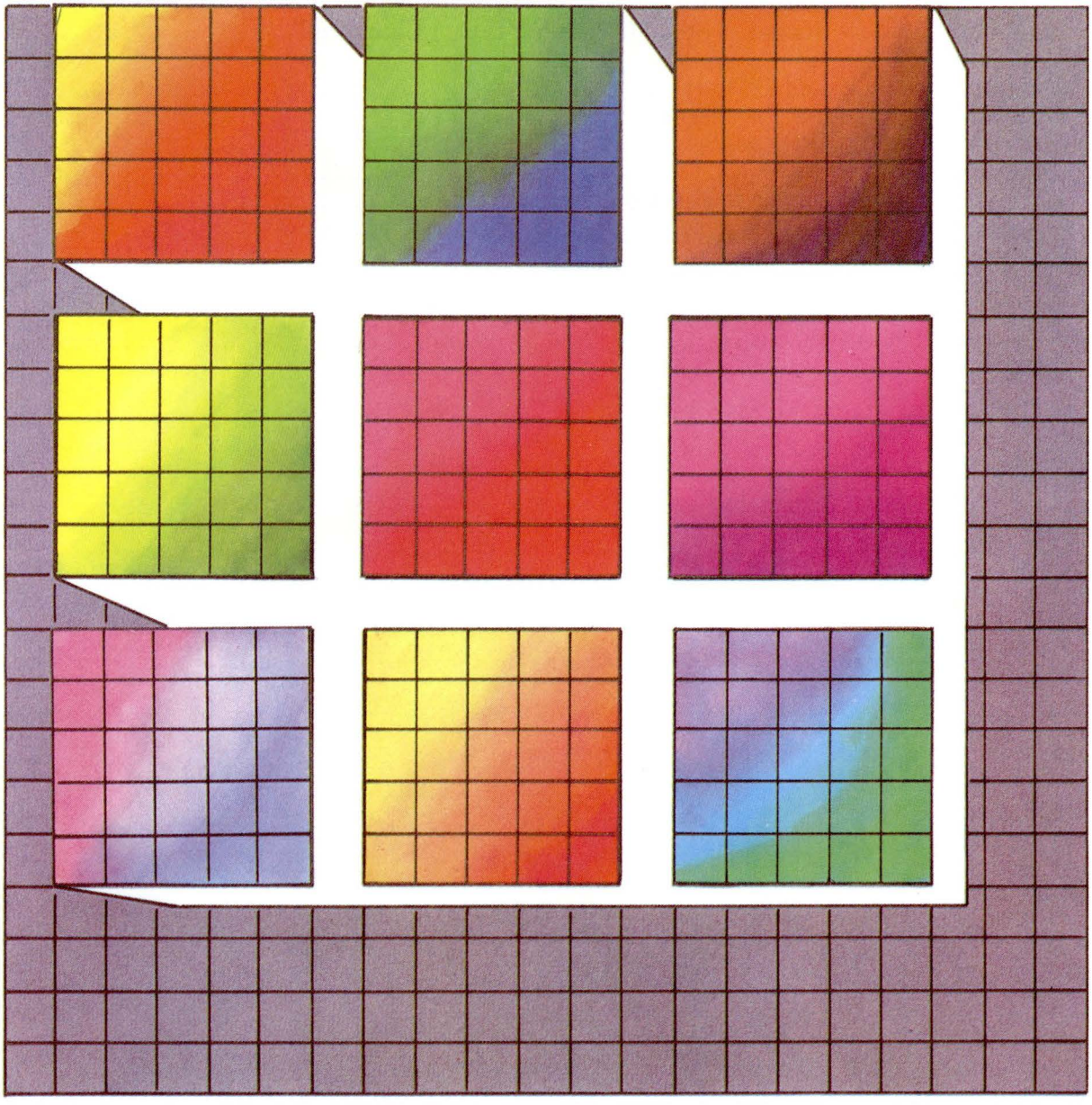
  Be careful when you set the value of the **$PATH** shell variable. This variable controls which directories are searched for entered commands. A common trojan horse imitates the name of a common system command, such as **ls**. If you change your current directory to a directory containing an **ls** trojan horse and then list the files in this directory, the trojan horse can copy this directory and make it **setuid**. This gives the illegal user access rights to your directories.

  Your path should only include system directories like **/etc, /bin,** and **/usr/bin**, and your own directories. The current directory should not be included, especially is the user is

capable of administering the system. If the current directory is included, it should always be last in the search path. See the **sh** command in *AIX Operating System Commands Reference* for more detailed information on paths.

- Be careful of programs that were not installed by the person who administers your system. Programs that are obtained from bulletin boards and other unknown origins are particularly suspect. Even if the program includes source code, it is not always possible to examine the program carefully enough to determine if it is trustworthy.

Chapter 4. Using Processes and the Shell



CONTENTS

About This Chapter

The first part of this chapter explains the concept of a process and the ways in which you can run a process, check the status of a running process, and stop a process.

Once you understand this introductory material, you should be able to use the techniques described in the second part of this chapter, "Using the Shell with Processes" on page 4-15, to create and control more complex processes.

A good way to learn about processes is to work through the examples in this chapter on your system. In the examples, the entries you should type are shaded in blue (like `ps`) and printed in `special characters like this`. When the text instructs you to "enter" a command name or a string of characters, type the characters and then press the **Enter** key.

Understanding Programs and Processes

A ***program*** is a set of instructions that a computer can interpret and run. You may think of most programs as belonging to one of two categories:

- application programs such text editors, accounting packages, or electronic spreadsheets, and
- programs that are components of the AIX Operating System such commands, the shell, and your login procedure.

While a program is running, it is called a ***process***.

The AIX Operating System can run a number of different processes at the same time. When more than one process is running, a scheduler built into the operating system gives each process its fair share of the computer's time, based on established priorities.

Note: Only the person who manages your system can raise these priorities. However, any user can lower priorities with the **nice** command, which is explained in *AIX Operating System Commands Reference.*

This section, which is an introduction to using processes, explains how to perform the following types of operations:

- Check the status of processes
- Cancel processes
- Run processes in the background.
  - Check the status of background processes
  - Cancel background processes.

For more detailed information about processes and how to control them, see "Using the Shell with Processes" on page 4-15. For reference-oriented material about features of the shell, consult Appendix A, "Using Advanced Shell Features—A Reference."

Checking Process Status—The ps (Process Status) Command

A program that is actually running on the computer is referred to as a ***process***.

For example, a file on the system contains the program for the **cp** command, which copies files. When you enter this command, you start a **cp** process that runs until the system displays the path name of your current directory. This display signals that the copy is complete and that the **cp** procees is finished.

Any time the system is running, several processes are also running. You can use the **ps** (process status) command to find out which processes are running, and to display information about those processes.

Checking Process Status

Enter the **ps** command in the following form:

```
ps
```

In the following example, the **ps** command displays the status of all processes associated with your display station:

```
$ ps
   PID   TTY     TIME COMMAND
    98 console  0:02 sh
   113 console  0:01 ps
    81 console  0:00 qdaemon
$ _
```

You interpret these entries as follows:

PID Process identification. The system assigns a ***process identification number*** (PID number) to each process when that process starts. There is no relationship between a process and a particular PID number; that is, if you start the same process several times, it will have a different PID number each time.

TTY Terminal designation. On a system with more than one terminal, this field tells you which terminal started the process. On a system with only one display station, this field can contain the designation **console** or the designation for one or more virtual terminals.

TIME Time devoted to this process by the computer; displayed in minutes and seconds as of when you enter **ps**.

COMMAND
The name of the command (or program) that started the process. In this example, `sh` is the shell program, `ps` is the process status command that displayed this information, and `qdaemon` is a program that lets you send data to the printer.

Generally, the simple **ps** command described here tells you all you need to know about processes. However, you can control the type of information that the **ps** command displays by using its flags. One of the most useful **ps** flags is **-e**, which causes **ps** to return information about all processes, not just those associated with your display station.

For an explanation of the **ps** command flags, see **ps** in *AIX Operating System Commands Reference.*

Canceling a Process

If you start a process and then decide you do not want to let it finish, you can cancel it by pressing **INTERRUPT**, which is **Alt-Pause** on the RT PC.

Note: **INTERRUPT** does not cancel ***background*** processes. To cancel a background process, you must use the procedure described under "Ending a Background Process—The kill Command" on page 4-13.

Canceling a Running Process

Press:

INTERRUPT ((Left)Alt-Pause)

Note: Most simple AIX commands are not good examples for demonstrating how to cancel a process—they run so quickly that they finish before you have time to cancel them.

The examples in the rest of this chapter therefore use a command that takes more than a few seconds to run: `find / -type f -print`. This command displays the path names for all files on your system. You do not need to study the **find** command in order to complete this chapter—it is used here simply to demonstrate how to work with processes.

If, however, you want to learn more about the **find** command, see **find** in *AIX Operating System Commands Reference.*

In the following example, the **find** command starts a process. After the process runs for a few seconds, you can cancel it by pressing **INTERRUPT**:

```
$ find / -type f -print
/usr/lib/acct/acctcms
/usr/lib/acct/acctcon1
/usr/lib/acct/acctcon2
/usr/lib/acct/acctdisk
/usr/lib/acct/acctmerg
/usr/lib/acct/accton
/usr/lib/acct/acctprc1
/usr/lib/acct/acctprc2
/usr/lib/acct/acctwtmp
/usr/lib/acct/chargefee
/usr/lib/acct/ckpacct
/usr/lib/acct/dodisk
/usr/lib/acct/fwtmp
/usr/lib/acct/lastlogin
/usr/lib/acct/monacct
/usr/lib/acct/nulladm
/usr/lib/acct/prctmp
/usr/lib/acct/prdaily
/usr/lib/acct/prtacct
/usr/lib/acct/runacct
/usr/lib/acct/sdisk
/usr/lib/acct/shutacct                    <INTERRUPT>
$ _
```

The system returns the $ (shell) prompt to the screen. Now you can enter another command.

Redirecting Input and Output

A command usually reads its input from the keyboard (***standard input***) and writes its output to the display (***standard output***). Often, though, you may want a command to read its input from a file, write its output to a file, or both. You can select input and output files for a command with the shell notation shown in Figure 4-1.

Notation	Action	Example
<	Reads standard input from a file.	`wc <file3`
>	Writes standard output to a file.	`ls >file3`
> >	Adds standard output to the end of a file.	`ls >>file3`

Figure 4-1. Shell Notation for Reading Input and Redirecting Output

This section explains how to read input from a file and how to write output to a file.

Reading Input from a File—The < Symbol

Use the < (less than) symbol to take input from a file, as the following example shows:

```
$ wc <file3
       3       27      129
$ _
```

The **wc** (word count) command counts the number of lines, words, and characters in the named file. If you do not supply an argument, the **wc** command reads its input from the keyboard. In this example, however, input for **wc** comes from the file named `file3`.

Note: The **wc** command has three flags, **-l** (line count only), **-w** (word count only), and **-c** (character count only), which you can use separately or in combination with each other.

Redirecting Output—The > and > > Symbols

To send output to a file, use either the > (greater than) or the >> symbol. The > symbol causes the shell to replace the contents of the file with the output of the command; the shell deletes the contents of the original file. The >> symbol adds (appends) the output of the command to the end of a file. If you use > or >> to write output to a file that does not exist, the shell creates the file.

In the next example, the output of **ls** goes to the file named `file`:

```
$ ls >file
$ _
```

If the file already exists, the shell replaces its contents with the output of **ls**. If `file` does not exist, the shell creates it.

In the following example, the shell adds the output of **ls** to the end of the file named `file`:

```
$ ls >>file
$ _
```

If `file` does not exist, the shell creates it.

In addition to their standard output, processes often produce error or status messages known as ***diagnostic output***. For information about redirecting diagnostic output, see "Standard Error and Other Output" on page A-29.

Running Background Processes

Besides allowing the processes of several users to run at the same time, the AIX Operating System allows a single user to run more than one process at a time. You run concurrent multiple processes by entering the appropriate commands with a symbol that instructs AIX to run those commands as background processes.

The material in this section explains the following tasks:

- entering a command that runs as a background process
- starting a background process
- checking the status of a background process
- "killing" a background process.

The & Operator

The & (ampersand) operator at the end of a command tells the system to run that command in the background. Once a process is running in the background, you can perform additional tasks by entering other commands at your display station.

Running a Background Process

Enter the name of the command followed by an ampersand:

command name&

Starting a Background Process

Generally, background processes are most useful with commands that take a long time to run. Because they increase the total amount of work the processor is doing, however, background processes also slow down the rest of the system. This may or may not be a problem, depending upon how much the system slows and the nature of the other work you do while background processes run.

Note: You can use the **nice** command to lower the priority of a process, even a background process. For information about the **nice** command, see **nice** in *AIX Operating System Commands Reference.*

Most processes direct their output to standard output, even when they run in the background. Unless redirected, standard output goes to the display station. Because the output from a background process can interfere with your other work on the system, it is usually good practice to redirect the output of a background process to a file or a printer. Then you can look at the output whenever you are ready.

In the following example, the **find** command runs in the background (&) and directs its output to a file named `dir.paths` (with the > operator):

```
$ find / -type f -print  >dir.paths &
24
$ _
```

When the background process starts, the system assigns it a PID number (24 in this example), displays the number, and then prompts you for another command.

Note: Your process numbers probably will be different from the ones shown in these examples.

For more information about redirecting output, see "Redirecting Input and Output" on page 4-8.

Checking Background Process Status

As long as a background process is running, you can check its status with the process status (**ps**) command explained under "Checking Process Status—The ps (Process Status) Command" on page 4-5. You can also check the status of a particular process by using the **-p** flag and the PID number with the **ps** command (for example, `ps -p` *PID number*).

The following example shows how to start another **find** process and then check its status:

```
$ find / -type f -print >dir.paths &
25
$ ps -p 25
   PID   TTY     TIME COMMAND
    25 console  0:40 find
$ _
```

For an explanation of the data that the **ps** command displays, see "Checking Process Status—The ps (Process Status) Command" on page 4-5.

You can check background process status as often as you like while the process runs. In the following example, the **ps** command displays the status of the **find** process five times:

```
$ find / -type f -print >dir.paths &
28
$ ps -p 28
   PID   TTY    TIME COMMAND
    28 console  0:18 find
$ ps -p 28
   PID   TTY    TIME COMMAND
    28 console  0:29 find
$ ps -p 28
   PID   TTY    TIME COMMAND
    28 console  0:49 find
$ ps -p 28
   PID   TTY    TIME COMMAND
    28 console  0:58 find
$ ps -p 28
   PID   TTY    TIME COMMAND
    28 console  1:02 find
$ ps -p 28
   PID   TTY    TIME COMMAND
$ _
```

Notice that the sixth **ps** command returns no status information (because the **find** process ended before the last **ps** command was entered).

Ending a Background Process—The kill Command

If you decide, after starting a background process, that you do not want the process to finish, you can cancel the process with the **kill** command. Before you can cancel a background process, however, you must know its PID number.

If you have forgotten the PID number of that process, use the **ps** command, described in "Checking Process Status—The ps (Process Status) Command" on page 4-5, to list the PID numbers of all processes.

Note: If you want to end all the processes you have started, use the **kill 0** command. You do not have to know the PID numbers to use **kill 0**.

After the **find** command begins to execute in the following example, the **ps** command, without the **-p** flag, displays the status of all processes:

```
$ find / -type f -print >dir.paths &
38
$ ps
   PID   TTY    TIME COMMAND
    20 console  0:11 sh
    38 console  0:10 find
    16 console  0:01 qdaemon
    39 console  0:03 ps
$ kill 38                          [or kill 0]
$ ps
38 Terminated
   PID   TTY    TIME COMMAND
    20 console  0:11 sh
    16 console  0:01 qdaemon
    41 console  0:03 ps
$ _
```

The command **kill 38** stops the background **find** process, and the second **ps** command returns no status information about PID number 38. The system does not display the termination message until you enter your next command, unless that command is **cd**.

Note: In this example, `kill 38` and `kill 0` have the same effect because only one process has been started from this display station.

Using the Shell with Processes

The shell is a program that interprets commands for the AIX Operating System and provides a command programming language. Although the commands described in the previous chapters of this book are interpreted by the shell, you do not have to know anything about the shell itself in order to use them.

In contrast, this section of this chapter describes some tasks you can perform using specific features of the shell to:

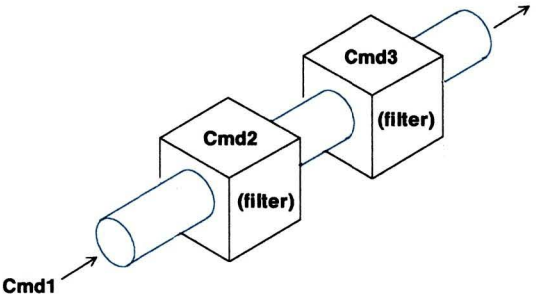
- Connect commands to each other
- Use multiple commands and groups of commands
- Use special characters to match file names
- Write shell procedures (programs).

For detailed information about using these and other shell features, seeAppendix A, "Using Advanced Shell Features—A Reference"

Using Pipes and Filters

A ***pipe*** is a one-way connection between two related commands. One command writes its output to the pipe, and the other process reads its input from the pipe. When two or more commands are connected by the | (pipe) operator, they form a ***pipeline***.

Each command in a pipeline runs as a separate process. Figure 4-2 on page 4-16 represents the flow of input and output through a pipeline: The output of the first command (Command 1) is the input for the second command (Cmd 2); the output of the second command is the input for the third command (Cmd 3).



AJ6NL006

Figure 4-2. Flow Through a Pipeline

A ***filter*** is a command that reads its standard input, transforms that input, and then writes the transformed input to standard output. Filters are typically used as intermediate commands in pipelines—that is, they are connected by a | (pipe) operator, for example, `ls -R|pg` (the **-R** flag causes **ls** to list ***recursively*** the contents of all directories from the current, or named, directory to the bottom of the hierarchy).

Certain commands that are not filters have a flag that causes them to act like filters. For example, the **diff** (compare files) command ordinarily compares two files and writes their differences to standard output. The usual format for **diff** follows:

diff *file1 file2*

However, if you use the - (hyphen) flag in place of one of the file names, **diff** reads standard input and compares it to the named file.

In the following pipeline, **ls** writes the contents of the current directory to standard output; **diff** compares the output of **ls** with the contents of a file named `dirfile`, and writes the differences to standard output one page at a time (with the **pg** command):

```
ls | diff - dirfile | pg
```

In the next pipeline example, the standard output of `ls -l /` becomes the standard input to `grep r-x`, a command (in this case a filter) that searches its standard input for a string (r-x) and writes all lines that contain the pattern to its standard output. The

standard output of `grep r-x` becomes the standard input to `wc`, which counts the number of lines, words, and characters in its standard input:

```
$ ls -l / | grep r-x | wc
     12     108     717
$ _
```

To get the same results without using a pipeline, you would first have to direct the output of `ls -l/` to a file (for example, `ls -l / >file`). Next, you would have to use that file as input for `grep r-x` and redirect the output of `grep` to another file (for example, `grep r-x <file >file.0`). Finally, you would have to use the output file of `grep` as input for `wc` (for example, `wc <file.0`). Using a pipeline is a much more efficient way to accomplish this operation.

Pipelines operate in one direction only (left to right), and all processes in a pipeline can run at the same time. A process pauses when it has no input to read or when the pipe to the next process is full.

Using Multiple Commands and Command Lists

The shell usually takes the first word on a command line as the name of a command, and then takes any other words as arguments to that command. However, the operators shown in Figure 4-3 give you five different ways to use more than one command on a single command line:

Operator	Action	Example
;(semicolon)	Causes commands to run in sequence.	*cmd1*;*cmd2*

Figure 4-3 (Part 1 of 2). Multiple Command Operators

Operator	Action	Example
&&	Runs the next command if current command succeeds.	*cmd1*&&*cmd2*
||	Runs the next command if the current command fails.	*cmd1*||*cmd2*
&	Causes command to run in the background. (Described under "Running Background Processes" on page 4-10.)	*cmd1*>*file* &*cmd2*&
|	Creates a pipeline. (Described under "Using Pipes and Filters" on page 4-15.)	ls|wc

Figure 4-3 (Part 2 of 2). Multiple Command Operators

Separating Commands on the Same Line with a Semicolon (;)

You can type more than one command on a line if you separate commands with the ; (semicolon). In the following example, the shell runs `ls` and waits for it to finish:

```
$ ls ; who ; date ; pwd
change
file3
newfile
uname       console/1       Jun 5 14:39
Wed Jun 5  14:42:51  CDT  1985
/u/uname
$ _
```

When `ls` is finished, the shell runs `who`, and so on through the last command.

To make the command line easier to read, you can separate commands from the ; (semicolon) with blanks or tabs. The shell ignores blanks and tabs used in this way.

Making Commands Conditional—The || and && Operators

When you connect commands with the || or && operators, the shell runs the first command and then runs the remaining commands only under the following conditions:

||	The shell runs the next command if the current command does not complete (that is, if the command fails [returns a nonzero value]).
&&	The shell runs the next command if the current command completes (that is, the command succeeds [returns a value of zero]).

In the following example, the shell checks the exit status of *cmd1*:

```
$ cmd1 || cmd2
$ _
```

If *cmd1* fails, the shell runs *cmd2*. (If *cmd1* succeeds, the shell abandons the command line and prompts you for another command.)

In the next example, the shell again checks the exit status of *cmd1*:

```
$ cmd1 && cmd2 && cmd3 && cmd4 && cmd5
```

If *cmd1* succeeds, the shell runs *cmd2*. If *cmd2* succeeds, the shell runs *cmd3*, and on through the series until a command fails or the last command ends. (If any command on the command line fails, the shell abandons the command line and prompts you for another command.)

Grouping Commands

The shell provides two ways to group commands, as shown in Figure 4-4.

Command Grouping Symbol	Action
( ) (parentheses)	The shell creates a subshell to run the grouped commands as a separate process.
{ } (braces)	The shell runs the grouped commands as a unit.

Figure 4-4. Command Grouping Symbols

Using (Parentheses)

In the following example, the shell runs the commands enclosed in ( ) (parentheses) as a separate process:

```
$ (cd x;ls);ls
$ _
```

The shell creates a ***subshell*** (a separate shell program) that moves to directory x (`cd x`) and lists the files in that directory (`ls`). The first shell does not change directories. After the subshell process is complete, the shell lists the files in the current directory (`ls`).

If this command were written without the ( ), the original shell would move to directory x, list the files in that directory, and then list the files in that directory again. There would be no subshell and no separate process for the `cd x;ls` command.

The shell recognizes the ( ) wherever they occur in the command line. To use parentheses literally (that is, without their command-grouping action), quote them by placing a \ (backslash) immediately before either the (or the), for example, \(.

For more information on quoting in the shell, see "Quoting" on page 4-21.

Using { } (Braces)

When commands are grouped in { }, the shell executes them without creating a subshell. In the following example, the shell runs `date`, writing its output to the file `today.grp`, and then runs `who`, writing its output to `today.grp`:

```
$ { date; who; }>today.grp
$ _
```

If the commands were not grouped together with braces, the shell would write the output of `date` to the display and the output of `who` to the file.

The shell recognizes { } (braces) in pipelines and command lists, but only if the left brace is the first character on a command line.

For other meanings of braces in the shell, see "Using Braces as Delimiters" on page A-6.

Quoting

Reserved characters are characters such as < > | & ? and * that have a special meaning to the shell. "Shell Reserved Characters and Words" on page A-34 lists all the shell reserved characters. To use a reserved character literally (that is, without its special meaning), quote it with one of the three shell quoting conventions, as shown in Figure 4-5:

Quoting Convention	Action
\	(backslash) Quotes a single character.
' '	(single quotes) Quote a string of characters (except the ' itself).

Figure 4-5 (Part 1 of 2). Shell Quoting Conventions

Quoting Convention	Action
" "	(double quotes) Quotes a string of characters (except $, `, and \).

Figure 4-5 (Part 2 of 2). Shell Quoting Conventions

Using the Backslash

To quote a single character, place a \ (backslash) immediately before that character:

```
$ echo \?
?
$ _
```

This command returns a single ? character.

Using Single Quotes (' ')

When you enclose a string of characters in single quotes, the shell takes every character in the string (except the ' itself) literally.

The following example shows how single quotes can be used in the arguments for a command:

```
$ echo x'>'y+0
x>y+0
$ _
```

The `echo` command returns the string `x>y+0` because the single quotes remove the special meaning of the > reserved character.

You also can use single quotes when you assign values to variables. For information about using single quotes with variables, see "Single Quotes in Variable Assignments" on page A-7.

Using Double Quotes (" ")

Double quotes provide a special form of quoting. Within double quotes, the reserved characters $, ` (grave accent), and \ keep their special meanings. The shell takes literally all other characters within the double quotes. Double quotes are most frequently used in variable assignments. For more information about using double quotes with variables, see "Double Quotes in Variable Assignments" on page A-7.

Matching Patterns

The shell gives you five different ways to match character patterns, as shown in Figure 4-6:

Pattern-Matching Character	Action	Example
*	Matches any string, including the null string.	th* matches th, theodore, and thermohaline.
?	Matches any single character.	304?b matches 304Tb, 3045b, 304Bb, or any other string that begins with 304, ends with b, and has one character in between.
[...]	Matches any one of the enclosed characters.	[A G X]* matches all file names in the current directory that begin with A, G, or X.

Figure 4-6 (Part 1 of 2). Shell Pattern-Matching Characters

Pattern-Matching Character	Action	Example
[.-.]	Matches any character between the enclosed pair, including the pair.	[T-W]* matches all file names in the current directory that begin with T, U, V, or W.
[!...]	Matches any single character except one of those enclosed.	[!abyz]* matches all file names in the current directory that begin with any character except a, b, y, or z.

Figure 4-6 (Part 2 of 2). Shell Pattern-Matching Characters

Naming Files with Pattern-Matching

Commands often take file names as arguments. To use several different file names as arguments to a command, you can type out the full name of each file, as the next example shows:

```
$ wc first.t second.t third.t fourth.t fifth.t
$ _
```

However, if the file names have a common pattern (in this example, the .t suffix), the shell can match that pattern, generate a list of those names, and automatically pass them to the command as arguments.

The * matches any string of characters. In the following example, the name of every text file in this directory includes the suffix .t. (This directory contains the same five files shown in the previous example: first.t . . . fifth.t.)

```
$ wc *.t
```

The *.t matches any file name that begins with a string and ends with .t. The shell passes every file name that matches this pattern as an argument for **wc**.

Thus, you do not have to type (or even remember) the full name of each file in order to use it as an argument. Both commands (**wc** with all file names typed out, and **wc *.t**) do the same thing—they pass all files with the `.t` suffix in the directory as arguments to **wc**.

Note: There is one exception to the general rules for pattern-matching. When the first character of a file name is a period, you must match the period explicitly. For example, `echo *` displays the names of all files in the current directory that do not begin with a period. The command `echo .*` prints all file names that begin with a period.

This restriction prevents the shell from automatically matching the relative directory names . ("dot," which stands for the current directory) and .. ("dot dot," which stands for the parent directory). For an explanation of relative directory names, see "Using Relative Directory Names (. and .. Notation)" on page 3-21.

If a pattern does not match any file names, the shell returns the pattern itself as the result of the matching operation. For example, if the current directory does not contain any file names that end with `.c`, the command `echo *.c` returns `*.c`.

Example of Using Pattern-Matching Characters

You can use the **echo** command to learn how the shell interprets pattern-matching characters. The following example is based on a directory that contains the following files:

```
part1
part2
part3
pre.txt
post.txt
```

```
$ echo *
part1  part2  part3  pre.txt  post.txt
$ echo *.*
pre.txt  post.txt
$ echo part?
part1  part2  part3
$ echo ????.???
post.txt
$ echo *[1357]
part1  part3
$ echo [a-o]*
[a-o]*
$ echo [!abc]*
part1  part2  part3  pre.txt  post.txt
$ _
```

Each **echo** command in the example uses one or more pattern-matching characters in its argument, and returns different information about the files in the directory. Notice that `echo [a-o]*` does not return any file names because none of the file names in this directory begin with one of the lowercase letters `a` through `o`.

Writing and Running Shell Procedures

Besides running commands from the command line, the shell can read and run commands contained in a file. Such a file, called a ***shell procedure*** or ***shell script***, is a program that you can use alone or as a part of a program written in another programming language, such as C, BASIC, or FORTRAN.

Even if you do not usually write programs in other languages, you may find that shell procedures are easy to develop, and that using them can make your work on the AIX system more efficient. If you do develop programs routinely, shell procedures provide a quick way to try out program segments before you code and compile them, and to build program development tools.

In either case, because a shell procedure is an ordinary text file that does not have to be compiled, it is relatively easy to create and maintain.

Note: Some AIX commands or programs are shell procedures. As you become more familiar with writing shell procedures, you may want to study the ones supplied with the system for ideas.

Look first at **/etc/rc** (the procedure that runs automatically when you start the system), and at any of the files containing shell commands that are located in **/bin**, **/usr/bin**, and **/usr/lib/acct**.

Writing and Running a Shell Procedure

1. Use a text editor to create a file of shell and AIX Operating System commands.
2. Use the **chmod** command to give the file **x** (execute) status.

Writing a Shell Procedure

The first step in writing a shell procedure is to create a file of the commands you need to accomplish a task. Create this file as you would any text file—with **ed** or another editing program.

Shell procedures can contain any system command (described in *AIX Operating System Commands Reference*) or shell command (described under "Shell Control Commands" on page A-22 and **sh** in *AIX Operating System Commands Reference*).

For detailed information about using the features of the shell to write procedures, refer to Appendix A, "Using Advanced Shell Features—A Reference."

Running a Shell Procedure

If you intend to use a shell procedure regularly, you should incorporate the **chmod** command to give it **x** (execute) status. For example, the command `chmod g+x reserve` gives execute status to the file named `reserve` for any user in the group (**g**).

After you give the file **x** status, run the procedure by simply entering its name. Enter the path name if the procedure file is not in your current directory.

For details about the **chmod** command, see "Changing Permissions—The chmod (Change Mode) Command" on page 3-55 or **chmod** in *AIX Operating System Commands Reference.*

If you intend to use the procedure only a few times and then discard it, you do not have to give it execute status. However, to run a procedure that does not have execute status, you first must run the shell command (**sh**).

For example, if the procedure `reserve` does not have execute status, use the command `sh reserve` to run it. If the procedure file is not in your current directory, use its path name rather than its simple file name.

Example of Creating a Shell Procedure

The following example shows every step required to create the simple shell procedure named `lss`:

```
$ ed
a
# lss: list, sorting by size
ls -s | sort
.
w lss
q
$ chmod +x lss
$ _
```

Following is an explanation of each step in the creation of `lss`:

`ed`

Starts the **ed** line editor.

`a`

Causes **ed** to add text to the buffer.

```
#: list, sorting by size
```

Comment line describing the purpose of the procedure.

```
ls -s | sort
```

Enters the text (commands) of the procedure itself.

(period) Stops the editor from adding text to the buffer. The period must be entered in the first position on a line by itself.

```
w lss
```

Writes (copies) the text from the buffer into the file `lss`.

```
q
```

Quits (ends) the editing session.

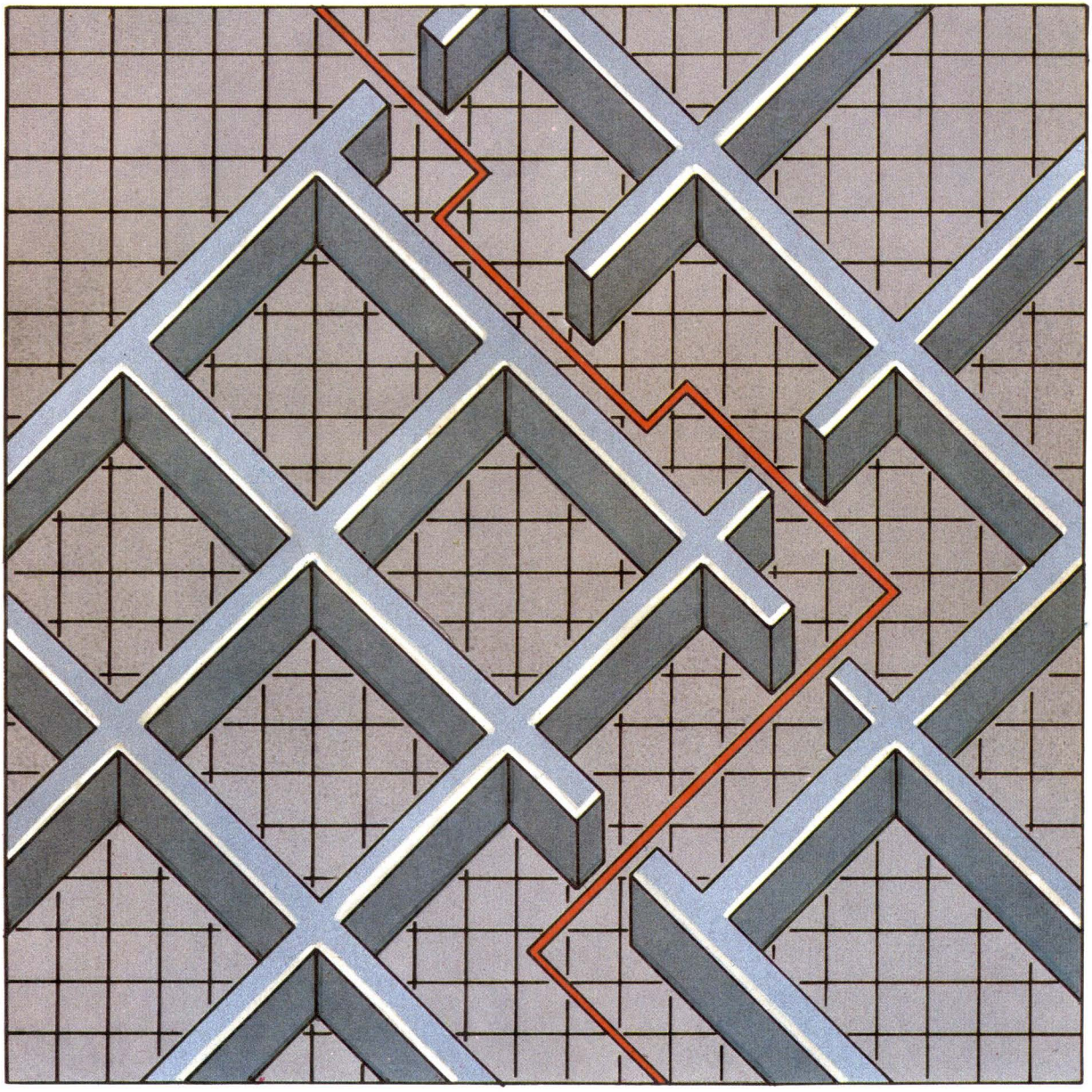
```
chmod +x lss
```

Gives execute status (**+x**) to the file `lss` for all classes of users.

The `lss` procedure first finds the size, in blocks, for each entry in a directory (`ls -s`). Output from the **ls** command is then piped to the **sort** command (`| sort`). The `sort` command then arranges its standard input according to size, and writes the size and name of each file to standard output. To run the `lss` procedure, simply enter `lss`.

Shell procedures are especially useful for routine tasks because they enable you to execute multiple commands by entering only the name of the procedure.

Chapter 5. Sending and Receiving Mail



CONTENTS

About This Chapter

This chapter tells you how to use the electronic mail system. It provides an overview of the operation of the mail system and how to address messages for local or remote delivery. It also gives instructions to help you:

- Compose and send messages to other users
- Receive and read messages from other users
- Organize the messages that you receive
- Change the mail program to your preferences.

Before you can use the mail system, it must be installed and running on your operating system. For local mail delivery only, you need only install the operating system (see *Installing and Customizing the AIX Operating System*). See *IBM RT PC Managing the AIX Operating System* for information to configure the mail system to communicate across a network or a Basic Networking Utilities (BNU) link. Reference information about the mail system is in:

- *AIX Operating System Communications Guide*:
  - **mail** command
  - **sendmail** command
- *AIX Operating System Technical Reference*:
  - **sendmail.cf** configuration file

Understanding the Mail System

The AIX Operating System mail system is a series of programs that allows you to create, send and receive messages to and from other people on your computer or on other computers connected to your computer. It is similar in concept (although not in how it works) to delivery of letters through a national postal system. The following paragraphs use that similarity to help you become familiar with the parts of the mail system and how you can use them in your daily communications.

Parts of the Mail System

Note: The following paragraphs describe the operation of the mail system as it is initially installed. Both you and the person responsible for the operation of the mail system can change the operation of the mail system. See "Changing Mail to Meet Your Needs" on page 5-62 for changes that you can make to the operation of the mail system. *IBM RT PC Managing the AIX Operating System* describes the changes that the person responsible for the mail system can make.

Figure 5-1 on page 5-6 shows the major parts of the mail system. These parts work together to help you write, send, receive and organize your daily correspondence. Understanding the role of each of these parts will help you use the mail system to handle your correspondence most effectively.

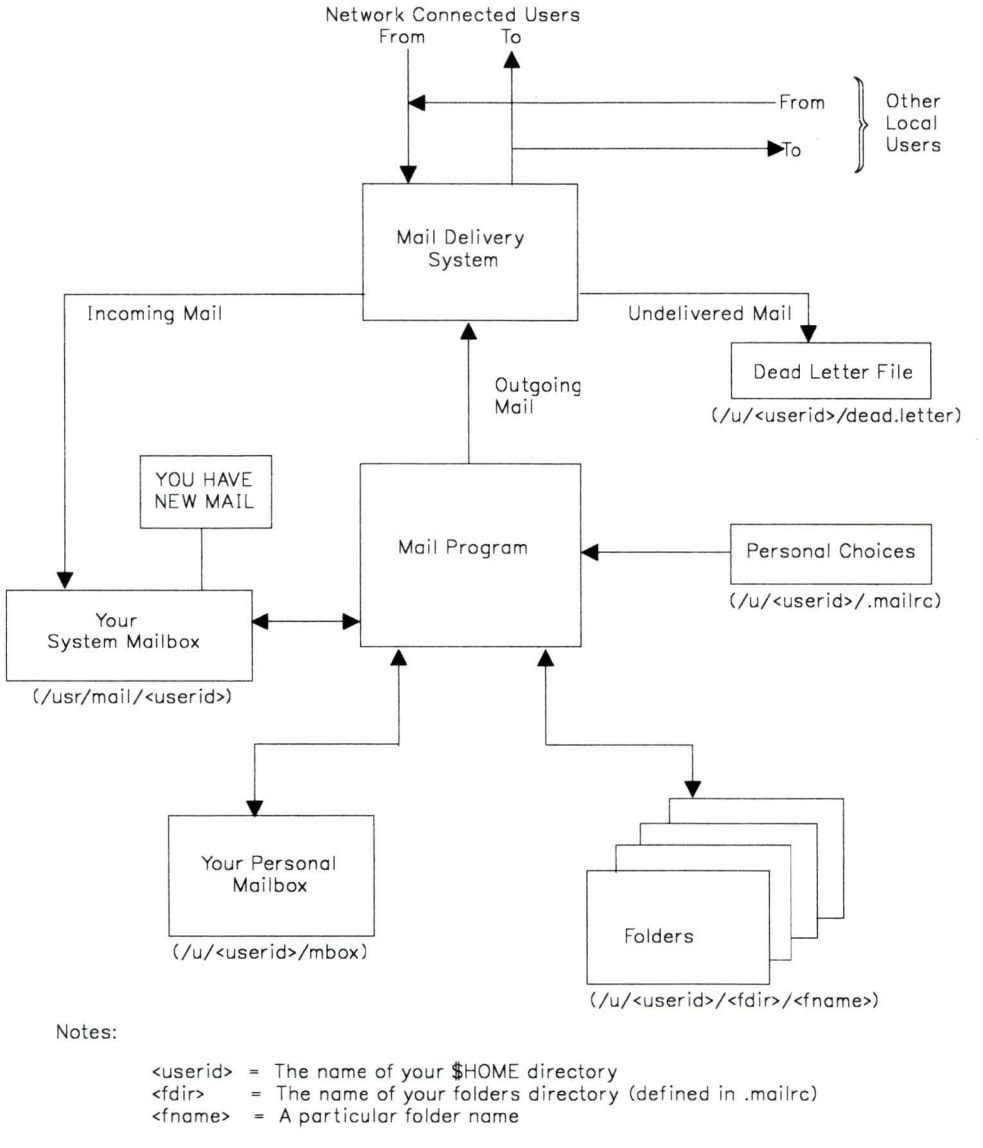


Figure 5-1. Parts of the Mail System

Delivery System

The delivery system is a set of programs that routes mail to the correct system mailbox. You can send and receive system mail without knowing how to use the delivery system programs.

For example, imagine an ordinary letter being sent from one person to another through a post office. In this case, the sender and receiver of the letter don't worry about details like which trucks carry the mail, or which personnel sort the mail. All the sender has to do is address the letter correctly, and the letter will be delivered. If the letter cannot be delivered, the sender will be notified of that fact.

Likewise, to use the AIX Operating System mail system, you don't need to know all the details about how the mail is delivered. Once the delivery system is set up (see *IBM RT PC Managing the AIX Operating System* for information about managing the mail system), you need only be concerned about writing, sending and receiving messages. If you provide the proper address, as described in "Addressing Mail" on page 5-11, the delivery system either delivers your message or notifies you if the message can't be delivered.

The dead.letter File

Note: Do not use **dead.letter** to store messages. The content of this file changes frequently. Use the **mail** editor **~d** command (see "Resending Undelivered Messages" on page 5-61) to retrieve the contents of **dead.letter**.

When the delivery system cannot deliver a message that you sent, it places the message in the file **dead.letter** in your **$HOME** directory. If **dead.letter** does not exist, the delivery system creates the file; otherwise it adds the message to the file. In addition, the delivery system displays a message to indicate that the message could not be delivered. Reasons for delivery failure include:

User unknown
: The user ID specified in the address of the message is not a defined user ID or alias on the specified system.

Host unknown
The host and/or domain portion of the address of the message is not correct. This can be either a syntax error, or a bad host or domain name.

The system also uses **dead.letter** to save partially completed messages when you exit the **mail** editor with the **~q** command. In this case, the previous content of **dead.letter** is replaced with the partially completed message.

System Mailbox

The ***system mailbox*** is similar in concept to the postal mailbox into which the post office delivers letters addressed to a particular person. In the AIX Operating System mail system, the system mailbox is a file assigned to a particular user. The file is created when mail arrives for a user ID; it is deleted when all messages have been removed from the file. However, you can specify that the file not be deleted (see "Changing Mail to Meet Your Needs" on page 5-62). A separate system mailbox can exist for each user ID defined in **/etc/passwd**. The mail system keeps all system mailboxes in the directory **/usr/mail**. Each system mailbox is named by the user ID associated with it. For example, if your user ID is `mark`, then your system mailbox is **/usr/mail/mark**.

When mail arrives for your user ID, the mail system puts the mail in your system mailbox. If you are logged on when the mail arrives, the mail system writes a message to your terminal. If you are not logged on, the mail system writes the message to your terminal when you next log on. If you do not change it, the message is:

```
[YOU HAVE NEW MAIL]
```

Use the **mail** command (see "Receiving Mail" on page 5-25) to read and remove messages from your system mailbox. Do not use the system mailbox to store messages; store messages in your personal mailbox and in folders.

Personal Mailbox

The ***personal mailbox*** is similar in concept to an in-basket in an office. You put mail in the in-basket after you have received it but before you have filed it. The personal mailbox is a working storage place for mail that still requires action.

In the mail system, the personal mailbox is a file assigned to a particular user. The mail system creates the file with the name *$HOME*/**mbox** (where *$HOME* is the user's login directory) when the user receives mail from his or her system mailbox. For example, if your home directory is `/u/george`, the mail system creates the file `/u/george/mbox` as your personal mailbox. The system deletes this file when all messages are removed from the personal mailbox.

When you use the **mail** program to view mail in your system mailbox (see "Receiving Mail" on page 5-25), **mail** automatically puts all messages that you have read but did not delete into your personal mailbox. The messages remain in your personal mailbox until you move them to a folder or delete them. See "Receiving Mail" on page 5-25 for information about handling the contents of your personal mailbox.

Folders

Folders provide a way to save messages in an organized fashion. You can create as many folders as you need. Name each folder with a name that pertains to the subject matter of the messages that it contains, similar to file folders in an office. Using the **mail** program, you can put a message into a folder from:

- Your system mailbox
- Your personal mailbox
- The **dead.letter** file
- Another folder.

Like the mailboxes, each folder is a text file. The mail system puts each folder in the directory that you specify in your **.mailrc** file

(see "Creating and Using Folders" on page 5-71 for information about creating and using folders). You must create this directory before using folders to store messages. Once the directory exists, **mail** creates the folders in that directory as needed.

Personal Choices

The mail system allows you to modify the way it operates to suit your needs. These choices include:

- What information to include in message headings
- Whether to forward incoming mail to another user ID
- How you want the messages handled
- Other characteristics pertaining to your terminal.

Refer to "Changing Mail to Meet Your Needs" on page 5-62 and to "Forwarding Your Mail" on page 5-28 for information about specifying these, and other, personal choices.

Mail Program

The **mail** program allows you to create, send, and receive messages to communicate with other users connected to your system (either directly or through a network). It includes a line-oriented editor (described in "Using the Mail Editor" on page 5-49) for creating messages and provides a command-oriented interface for processing the contents of your system mailbox, your personal mailbox, any folders you may have, and **dead.letter**. "Sending Mail" on page 5-23 describes how you use **mail** to create and send a message. "Receiving Mail" on page 5-25 describes how to use **mail** to process the contents of any mailbox or folder.

Addressing Mail

Using **mail**, you can send messages and files to another user on your local system, on another system connected to your system in a network, or on another system connected to another network that has a connection to your network. The command always has the following form to start composing a message to another user:

```
$ mail address
```

However, you must supply a different form of the *address* parameter depending upon where the person receiving the message is. The concept is similar to how you might address a note to a fellow worker in an office.

For example, to send a note to someone in your department (a small department of 6 to 8 people), you might simply write his (or her) name on the envelope and put it in the mail system:

```
Hal
```

However, if Hal is in another department, you may have to provide more information on the envelope:

```
Hal
Payroll
```

If Hal is in another plant, you may need even more information to ensure that the message gets to him:

```
Hal
Payroll
Gaithersburg
```

Addressing of messages with **mail** operates in a similar fashion, as the next few sections show.

Addressing for Users on Your Local System

To send a message to a user on your local system (i.e. to someone whose login ID appears in **/etc/passwd** on your system), use the login ID for the address:

```
$ mail login_ID
```

For example, if user `hal` is on your system, use the following command to create and send a message to `hal`:

```
$ mail hal
```

This command activates **mail**, allows you to create a message to `hal`, and then tries to send the message to a local user ID of `hal`. If the message is delivered successfully, you receive no notification. If `hal` is not on your system, the mail system returns an error message, and puts the unsent message in your system mailbox.

Addressing for Users on Your Network

To send a message to a user on another system connected to your system through a network, you must know the name of the other system in addition to the login ID (on the other system) of the person to whom you are sending the message. Refer to "Determining the Name of Another System" on page 5-13 to find out the name of the other system and whether you can directly address the other system. If you can directly address the other system, use the login ID of the recipient, followed by `@` (*at* sign), followed by the name of the remote system as the address for sending the message:

```
$ mail user_ID@system_name
```

For example, if user `hal` is on system `zeus`, use the following command to create and send a message to `hal`:

```
$ mail hal@zeus
```

This command activates **mail**, allows you to create a message to `hal`, and then tries to send the message to user ID `hal` on system

zeus. If the message is delivered successfully, you receive no notification. If hal is not a user on zeus, you receive no error message but the mail system returns the undelivered message to your system mailbox, together with an explanation of why it could not be delivered.

Determining the Name of Another System

The name of the system for mail routing is determined by a configuration file on that system. By convention, the name is often set to the node name of that system, but it may be defined differently in the configuration file. To find out the node name of another system, use the **uname -a** command on the other system. Contact the person responsible for the mail system on the other system to find out the name defined in the configuration file on that system. See *IBM RT PC Managing the AIX Operating System* for more information about the configuration file.

In addition, your local system must have access to information that defines the other system on the network. To determine if your local system has this information, use the **host** command. For example, to find out if your system has routing information for system zeus, use the following command:

```
$ host zeus
```

If your system responds with a message like the following, it has the proper information and you can send a message to that system:

```
zeus is 192.9.200.4   (300,11,310,4)
```

If your system does not have information about the requested system, it responds with the following message:

```
zeus: unknown host
```

If you receive this message, the requested system name:

- May not be correct (check your typing)

- May be on your network, but not defined to your system (contact the person responsible for setting up your network, or refer to *IBM RT PC Managing the AIX Operating System*)
- May be on another network and require more detailed addressing to define it (see "Addressing for Users on a Different Network")
- May not be connected to a network that is connected to your network.

You may also receive that message if the network is not operating and your local system depends on a remote system to supply network addresses.

Addressing for Users on a Different Network

If the network to which your system is connected is also connected to other networks, you can send mail to users on those networks. If the networks use a central database of names, you do not need any additional information to send mail to users on the connected networks. Use the same addressing as for users on your local network:

```
$ mail user_ID@system_name
```

This type of addressing works well when the nature of the network allows a central database of names to be maintained. However, for networks that span large, unrelated local networks in widespread locations, a central database of names is not possible. To send mail to someone in such a network, more addressing information is needed. The address must be in the following format:

```
$ mail user_ID@system_name.domain_name
```

The additional information in this format is the ***domain name***. This information defines the remote network, relative to your local network, within the defined structure for the larger group of interconnected networks.

This information may be as simple as an added network name. For example, if your local network (named `olympus` for this example) is connected to a second network (named `valhalla`), you could use the following command to send a note to user `kelly` at system `odin` on the second network:

```
$ mail kelly@odin.valhalla
```

Similarly, user kelly could respond to user `hal` on `zeus`, with the following command:

```
$ mail hal@zeus.olympus
```

Frequently, however, the domain name is more than another network name. It becomes the path through the logical arrangement of domains in the network through which your message must travel. It does *not* represent the actual route that the message travels, only the position of the destination network in the interconnected network structure.

The largest and most common example of this type of interconnection is a network of business, government and educational institutions called Arpanet. At the highest structural level of this network it divides into several large domains, including:

- COM for commercial entities
- EDU for educational institutions
- GOV for government agencies
- ARPA for miscellaneous groups
- BITNET for connection to the BITNET network
- CSNET for connection to the CSNET network.

Figure 5-2 on page 5-16 shows a high-level view of some parts of the Arpanet network, showing detail for some imaginary branches to illustrate the domain name concept.

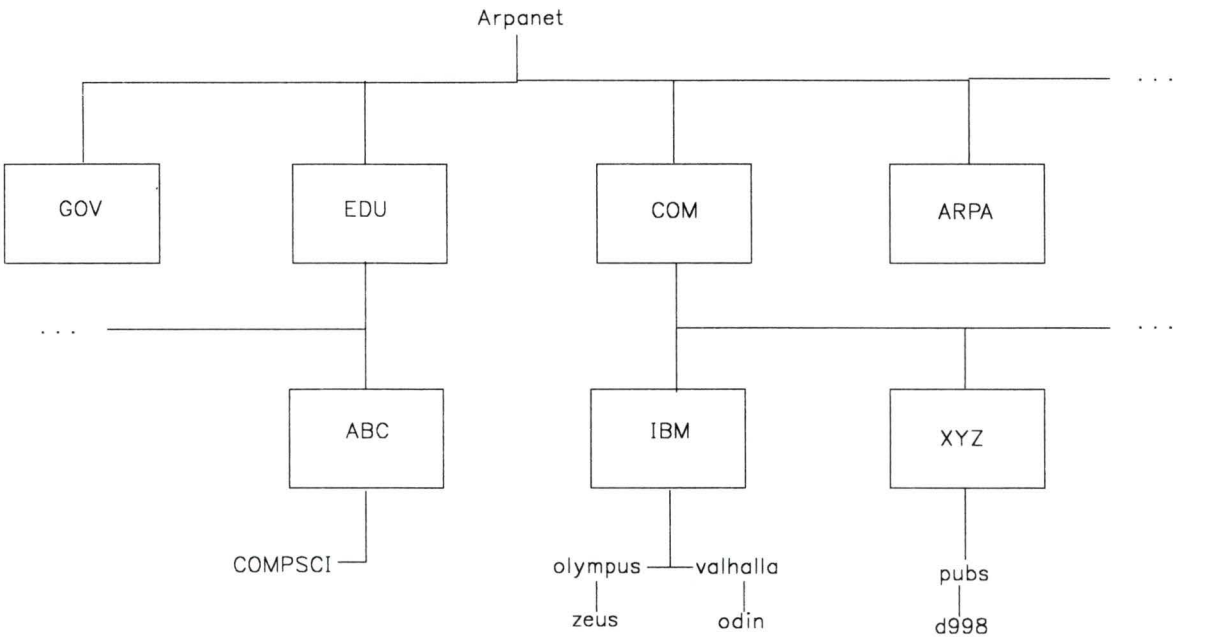


Figure 5-2. General Arpanet Structure with Example Connections

In this example, the domain pubs is connected to the larger domain XYZ and is not directly connected to olympus as was valhalla in the previous example. Therefore, use the following command to send a note to user kelly at system odin from system d998:

```
$ mail kelly@odin.valhalla.IBM
```

Similarly, user kelly responds to user cath on d998, with the following command:

```
$ mail cath@d998.pubs.XYZ
```

Each of these addresses specifies only that part of the address needed to reach the destination from the domain COM. The routing programs at that domain recognize the domains IBM and XYZ. However, someone at COMPSCI sending a message to cath must use the following command:

```
$ mail cath@d998.pubs.XYZ.COM
```

This example shows the complete address for user `cath` in the example network.

Addressing for Users Connected with a uucp Link

To send a message to a user on another system connected to your system by the Basic Networking Utilities (BNU), referred to as **uucp** in this chapter, you must know the name of the other system and the physical route to that other system in addition to the login ID (on the other system) of the person to whom you are sending the message. The person responsible for connecting your system to the other system should be able to provide the proper routing information to address the other system.

Addressing When Your Computer Has a uucp Link

If your local computer has a **uucp** connection that can be used to reach the remote site, use the following format to address a message:

```
$ mail uucp_route!user_ID
```

The variable parameter *user_ID* is the user ID on the remote system of the person that is to receive the message. The variable parameter *uucp_route* describes the physical route that the message must follow along the **uucp** network to reach the remote system. If your system is connected to the remote system without any intermediate **uucp** systems between, then this parameter is just the name of the remote system. If your message must travel through one or more intermediate **uucp** systems before reaching the desired remote system, this parameter is a list of each of the intermediate systems, starting with the nearest system and proceeding to the farthest system, separated by ! (exclamation mark).

For example, if your local system has a **uucp** link to a system called `merlin` and there are no other **uucp** systems between your system and `merlin`, use the following command to send a message to `ken` on that system:

```
$ mail merlin!ken
```

However, if the message must travel through systems `arthur` and `lancelot` (in that order) before reaching `merlin`, use the following command to send the message:

```
$ mail arthur!lancelot!merlin!ken
```

Addressing When the uucp Link is on Another Computer

In a local area or wide area network environment, one of the systems on the network may have a **uucp** connection to a remote **uucp** system. You can use that **uucp** connection to send a message to a user on that remote **uucp** system. Use the following command format to send a message:

$ mail @*systemA*:@*systemB*.UUCP:*user_ID*@*systemC*

This format sends mail first to *systemA*, then to *systemB* which routes it on a **uucp**link to *systemC*. The .UUCP addition to the address for *systemB* indicates that the **uucp** mailer at that system handles the routing of the message to *systemC*. The system addresses in this format are in the addressing format described in "Addressing for Users on Your Network" on page 5-12 and "Addressing for Users on a Different Network" on page 5-14. Notice that in this format, you are not sending mail to a user at any of the intermediate systems, so no user ID precedes the @ in the domain address.

Figure 5-3 on page 5-19 shows an example network that uses domain addressing for much of the mail, but has a **uucp** link that routes mail to systems `depta` and `deptb`. The system `deptb` is connected to another system, `deptc` by a local area network. The following commands illustrate addressing using this example network.

For `kelly` at `odin` to send messages to `fred` at `depta`, `dick` at `deptb` and `bill` at `deptc`, she would use the following commands:

```
$ mail @odin.UUCP:fred@depta
$ mail @odin.UUCP:@depta.UUCP:dick@deptb
$ mail @odin.UUCP:@depta.UUCP:@deptb:bill@deptc
```

These people respond with the following commands:

```
$ mail @depta.UUCP:kelly@odin
$ mail @deptb.UUCP:@depta.UUCP:kelly@odin
$ mail @deptb.UUCP:@depta.UUCP:kelly@odin
```

Similarly, cath at d998 can send mail to the same people using the following commands:

```
$ mail @odin.UUCP.valhalla.IBM:fred@depta
$ mail @odin.UUCP.valhalla.IBM:@depta.UUCP:dick@deptb
$ mail @odin.UUCP.valhalla.IBM:@depta.UUCP:@deptb:bill@deptc
```

These people respond with the following commands:

```
$ mail @depta.UUCP:@odin:cath@d998.pubs.XYZ
$ mail @deptb.UUCP:@depta.UUCP:@odin:cath@d998.pubs.XYZ
$ mail @deptb.UUCP:@depta.UUCP:@odin:cath@d998.pubs.XYZ
```

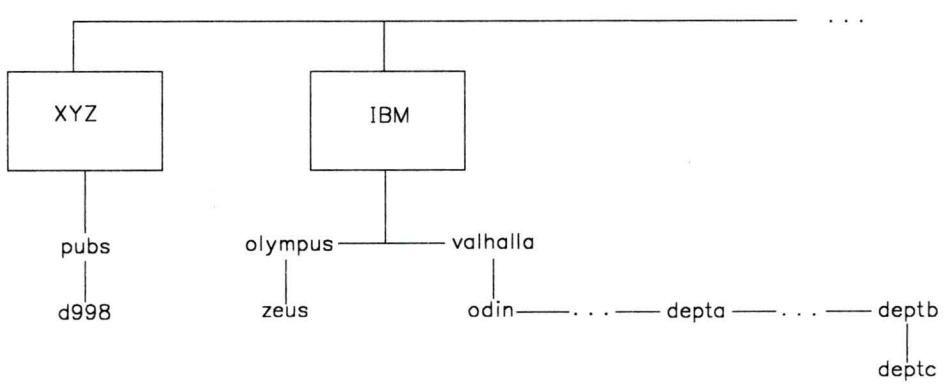


Figure 5-3. Example of uucp Connection on a Network

Creating Aliases and Distribution Lists

If you send mail on a large network or often send the same message to a large number of people, entering long addresses for each receiver can become tedious. To simplify this process you can create an alias or a distribution list:

alias A name that you define that can be used in place of a user address when addressing mail.

distribution list
A name that you define that can be used in place of a group of user addresses when addressing mail.

Aliases and distribution lists are used the same way and defined in similar ways; the only difference is the number of addresses defined for an alias (one address) and a distribution list (more than one address).

Defining an Alias or Distribution List

To define an alias or a distribution list that you can use when sending mail, edit the file **.mailrc** in your home (login) directory. This file contains many commands that **mail** reads when you start it from the command line. These commands are discussed in "Changing Mail to Meet Your Needs" on page 5-62. To define an alias, add a line in the following format to **.mailrc**:

```
alias name user_addr
```

To define a distribution list, add a line in the following format to **.mailrc**:

```
alias name user_addr1 user_addr2 ... user_addrn
```

In this format the variable parameter *name* can be any alphanumeric string that you choose. It should be short and easy to remember, but it cannot be the same as any of the other defined aliases in this file. Duplicate names are redefined to match the last definition in this file.

Note: If you define a *name* that is the same as a user ID on your system (as listed in **/etc/passwd**), you will not be able to send mail to that user ID. The alias name takes precedence over any defined user IDs.

The variable parameters *user_addr*x can be any address that can be used with the mail command as defined in "Addressing Mail" on page 5-11. For example, to define an alias for user `cath` using the alias name `catherine`, you might use the following entry in **.mailrc**:

```
alias catherine @deptb.UUCP:@depta.UUCP:@odin:cath@d998.pubs.XYZ
```

With this line in **.mailrc**, you can send mail to user `cath` with the command:

```
$ mail catherine
```

Similarly, to define a distribution list that sends a common message to a group of people, you might use the following entry in **.mailrc**:

```
alias dept geo anne mel@gtwn mark@mark.austin
```

With this line in **.mailrc**, you can enter the following command:

```
$ mail dept
```

To send the same message to users `geo` and `anne` on the local system, to `mel` on system `gtwn`, and to `mark` on system `mark` in sub-domain `austin`.

In addition, you can use a previously defined alias in a distribution list. Therefore, you could add the first alias above to the distribution list to include user `cath` in the distribution list:

```
alias dept geo anne mel@gtwn mark@mark.austin catherine
```

You can also define aliases that are longer than one line by adding another line that defines the same alias. The second definition is added to the first; it does not replace the first definition. For example, the following entries define the same distribution list `dept` as in the previous example:

```
alias dept geo anne mel@gtwn
alias dept mark@mark.austin catherine
```

Sending Mail

Use the mail system to send information to another user. The other user need not be logged onto the system when you send the information. You can use the **mail** command in one of two ways to send information. For short messages or letters that do not require a lot of formatting and editing, use the **mail** command's built-in editor to both compose and send the message. For larger letters, use your favorite editor to create the letter and then send the resulting file using the **mail** command.

Composing and Sending a Message

The **mail** command provides a simple, line-oriented editor for entering messages. See "Using the Mail Editor" on page 5-49 for information about using this editor. Use the following procedure to use this editor to compose and send a message.

Composing and Sending a Message

1. Enter the **mail** command on the command line followed by the address of the person, or persons, to receive the message.

   `Mail` *address*

   The system places the cursor on a new line and waits for input from the keyboard.

2. Type the message (see "Using the Mail Editor" on page 5-49 for information about using the built-in editor).

3. When you are finished with the message, enter an END OF TEXT character on a line by itself. The system adds appropriate header information and sends the message. The command line prompt appears again.

For example, use the following command to compose and send a message to user amy on system zeus on a local network:

```
Mail amy@zeus
```

Sending a File

Use the **mail** command to send any text file to another user. The file may be a letter you have written using your favorite editor, a source file for a program you have written or any other file in text format. Use the following procedure to send a text file to another user.

Sending a File

To send a text file to another user, enter the **mail** command on the command line followed by the address of the person, or persons, to receive the message and then redirect standard input to come from the text file that you want to send.

```
Mail address < filename
```

The system reads the input file, *filename*, adds appropriate header information and sends the message. The command line prompt appears again.

For example, use the following command to send the file letter to user amy on your local system:

```
Mail amy < letter
```

Receiving Mail

When mail arrives for you from another user, the mail system puts the mail in your system mailbox. If you are logged on, it also sends a message to your terminal periodically to tell you that new mail has arrived. If you are not logged on, a message is sent to your terminal the next time that you log on. If you do not change it, the message is:

```
[YOU HAVE NEW MAIL]
```

Receiving a Message

1. Enter the **mail** command without parameters:

   ```
   $ mail
   ```

   The system displays a listing of the messages in your system mailbox.

2. Use the **t** command to display the text of a particular message.

3. Use the **q** command to exit the mailbox and return to the command line. The **mail** program saves the messages that you read in your personal mailbox if you did not delete them.

More Detailed Information

Use the **mail** command without parameters to view content of your system mailbox. If no mail is in your system mailbox, the mail system responds with the message:

```
No mail for user_id
```

For example, if your user ID is `carol`, the following sequence occurs if no mail is in your system mailbox.

```
$ mail
No mail for carol
$
```

If there is mail in your mailbox when you enter the **mail** command, the mail system displays a listing of the messages in your system mailbox. The listing shows information about who sent the message, when it was received, how large the message is, and what the subject is (if included in the message). For example, user geo, enters the **mail** command and receives the following display:

```
Mail   Type ? for help.
"/usr/mail/geo": 2 messages 2 new
>N  1 amy      Thu Sep 17 14:36  13/359 "Dept Meeting"
 N  2 amy      Thu Sep 17 16:28  13/416 "Meeting Delayed"
&
```

The first line is the **mail** program banner. It indicates that you can enter a ? (question mark) to get the help screen. The second line indicates the name of the mailbox file being used (**/usr/mail/geo** is the system mailbox for user geo), the number of messages in the mailbox and their status. The following lines list information for each message in the mailbox. One line describes one message. The information about each message is arranged in fields, as shown in Figure 5-4.

From this listing you can look at, save, reply to, or delete any of the messages. Refer to "Processing Messages in a Mailbox" on page 5-33 for a description of what you can do while in the mailbox.

Type **q** at the **&** prompt to exit the mailbox.

Field	Content
Pointer	The > in this field for a particular message indicates that the message is the ***current message*** in the mailbox. The current message is the default message for mailbox commands if no other message number is specified (see "Processing Messages in a Mailbox" on page 5-33).
Status	A one-letter indicator of the status of the message: **M** Indicates that the message will be stored in your personal mailbox. **N** Indicates that the message is a new message. **P** Indicates that the message will be held (preserved) in your system mailbox. **U** Indicates that the message is an unread message. The message has been listed in the mailbox before, but you have not looked at the content of the message. **R** Indicates that you have read the message. ***** Indicates that you have saved or written the message to a file or folder. No indicator indicates that the message is unresolved.
Message Number	An integer that mailbox commands use to refer to the message (see "Processing Messages in a Mailbox" on page 5-33).
Address	The address of the person that sent the message.
Date	The date the message was received, including day of the week, month, date and time.
Size	Size of the message in number of lines and number of characters, including heading information.
Subject	The contents of the `Subject:` field of the message (if the message has one).

Figure 5-4. Mailbox Information

Forwarding Your Mail

If you are going to be away from your normal network address for an extended period of time, you may want to have your network mail sent to another network address while you are away. Sending your incoming mail to a different address (or addresses) is called ***forwarding***. The new address may be the address of a co-worker who will handle your messages while you are away, or it may be the network address where you will be working while away from your normal address. When you choose to forward your network mail, you do not receive a copy of any incoming mail in your mailbox. All mail goes directly to the address or addresses that you indicate. Use the following procedure to forward your incoming network mail to another address.

Forwarding Incoming Mail

1. Ensure that you are in your home directory:

   ```
   $ cd
   ```

2. Create a file called **.forward** that contains the network address or addresses (one address per line) to which you want to forward your incoming mail.

More Detailed Information

Note: The file **.forward** does not appear in a simple listing of the files in your home directory. Use the **li -a** command to see all files that begin with a dot (.).

You tell the mail system to forward your incoming mail by creating a file in your home directory called **.forward**. This file must contain the network address or addresses to which you want to forward your incoming mail. If the file contains more than one address, each address must be on a line by itself. The following procedure explains how to create that file:

1. Use the **cd** command with no parameters to ensure that you are in your home directory. The following command sequence illustrates that action for the user ID geo:

```
$ cd
$ pwd
/u/geo
$
```

2. While in your home directory, create a file called **.forward** that contains the network address or addresses that are to receive your forwarded network mail. This file must contain valid addresses. If it is a null file (zero length), your mail is not forwarded and is stored in your mailbox. If it contains addresses that are not valid, you do not receive the mail, but the sender receives an error message and the mail is put in **dead.letter** in the sender's home directory.

   As an example of creating a **.forward** file, the following command sequence uses the **cat** command to create that file. (Note that the entry **END OF FILE** indicates the End of File character, frequently **Ctrl-D**, entered on a line by itself.) In this case, incoming mail will be forwarded to user mark on the local system and to user amy on system zeus.

```
$ cat > .forward
mark
amy@zeus
END OF FILE
$
```

Once this file exists, you will receive no more mail. All mail is sent to the address(es) in **.forward**. When you return to your normal network address, remove this file to resume receiving mail:

```
$ rm .forward
```

Looking at Your Personal Mailbox

Messages that you have read but do not delete are saved in your personal mailbox. Use the **mail -f** command to view the contents of your personal mailbox.

Looking at Your Personal Mailbox

1. Enter the **mail** command with the **-f** flag:

   ```
   $ mail -f
   ```

   The system displays a listing of the messages in your personal mailbox.

2. Use the **t** command to display the text of a particular message.

3. Use the **q** command to exit the mailbox and return to the command line.

More Detailed Information

Use the **mail -f** command to view the content of your personal mailbox. If the personal mailbox does not yet exist, the system responds with an error message:

/u/*userid*/mbox: No such file or directory

If the personal mailbox exists but is empty, the mailbox handler becomes active, and displays a mailbox header similar to:

```
Mail   Type ? for help.
"/u/geo/mbox": 0 messages
&
```

Enter the **q** command to return to the command line.

If there is mail in your personal mailbox when you enter the **mail -f** command, the mail system displays a listing of the messages in your personal mailbox. The listing shows information similar to that shown when you look at your system mailbox (see "Receiving Mail" on page 5-25).

From this listing you can look at, save, reply to, or delete any of the messages. Refer to "Processing Messages in a Mailbox" on page 5-33 for a description of what you can do while in the mailbox.

Type **q** at the **&** prompt to exit the mailbox.

Looking at a Mail Folder

Use the **mail -f** command to view the contents of a defined mail folder. See "Creating and Using Folders" on page 5-71 for information to create a folder.

Looking at a Mail Folder

1. Enter the **mail** command with the **-f** flag and the name of the folder using a plus sign (+) to indicate the folder name:

   ```
   $ mail -f +folder
   ```

   The system displays a listing of the messages in the indicated folder.

2. Use the **t** command to display the text of a particular message.

3. Use the **q** command to exit the folder and return to the command line.

More Detailed Information

Use the **mail -f** command to view the content of a mail folder. For example, to view the contents of the defined folder `status` in your folder directory (defined in **.mailrc**), use the following command:

```
$ mail -f +status
```

If the folder does not yet exist, the system responds with an error message:

/u/*userid*/letters/*folder*: No such file or directory

If the folder exists but is empty or contains information that is not in the correct format, the mailbox handler becomes active, and displays a mailbox header similar to:

```
Mail  Type ? for help.
"/u/geo/letters/reports": 0 messages
&
```

Enter the **q** command to return to the command line.

If there is mail in the folder when you enter the **mail -f** command, the mail system displays a listing of the messages in the folder. The listing shows information similar to that shown when you look at your system mailbox (see "Receiving Mail" on page 5-25).

From this listing you can look at, save, reply to, or delete any of the messages. Refer to "Processing Messages in a Mailbox" for a description of what you can do while in the mailbox.

Type **q** at the **&** prompt to exit the mailbox.

Processing Messages in a Mailbox

You can use the **mail** command to process the contents of:

- Your system mailbox
- Your personal mailbox
- Any mail folder that you have created.

Using this program you can read, delete, store and respond to messages you receive through the mail system. The following paragraphs explain how to perform these tasks.

Using Mailbox Commands

When the **mail** program is processing a mailbox it displays the ***mailbox prompt*** to indicate that it is waiting for input. The mailbox prompt is the character & that appears at the beginning of a new line:

```
&
```

When this prompt appears, you can enter any of the mailbox commands described in this chapter or in *AIX Operating System Commands Reference.*

Specifying Groups of Messages

Many mailbox commands operate on a message or group of messages. You can specify the message(s) using information is displayed in the listing of the contents of the mailbox, such as message number or sender. Use the **h** command ("Displaying the Contents of a Mailbox" on page 5-40) to display the listing. Commands that allow groups of messages use the parameter *message_list* in the command format in this chapter. For example, the format of the **f** command (display information about messages) appears as:

```
& f message_list
```

In this format *message_list* can be one of the following:

- One or more message numbers separated by spaces

  ```
  & f 1 2 4 7
  ```

- A range of message numbers indicated by the first and last numbers in the range separated by a dash

  ```
  & f 2-5
  ```

  is the same as,

  ```
  & f 2 3 4 5
  ```

- One or more addresses separated by spaces to apply the command to messages received from those addresses,

  ```
  & f amy geo@zeus
  ```

  The characters entered for an address do not need to exactly match the address. They must only be contained in the address field of the messages in either upper or lower case. Therefore, the request for address `amy` matches all of the following addresses (and many others):

  - `amy`
  - `AmY`
  - `amy@zeus`
  - `hamy`

- A string, preceded by a slash, to match against the `Subject:` field of the messages,

  ```
  & f /meet
  ```

  Applies the command to all messages whose `Subject:` field contains the letters `meet` in upper or lower case. The characters entered for a match pattern do not need to exactly match the `Subject:` field. They must only be contained in the `Subject:` field of the messages in either upper or lower case. Therefore, the request for subject `meet` matches all of the following subjects (and many others):

  - `Meeting on Thursday`
  - `Come to meeting tomorrow`
  - `MEET ME IN ST. LOUIS`

Specifying File or Folder Names

Many mailbox commands allow you to specify a file or folder name to be used with the command. Commands that allow a file or folder name use the parameter *fname* in the command format in this chapter. For example, the format of the **file** command (change mailbox files) appears as:

`& file` *fname*

In this format, *fname* is one of the following:

- The pathname of the new mailbox relative to the current directory. For example, if the current directory is your home directory, use the following command to change to your personal mailbox:

  ```
  file mbox
  ```

  The program changes to that mailbox and displays a list of the contents of that mailbox.

- The absolute pathname of the new mailbox. For example, if your user ID is `george` use the following command to change to your system mailbox:

  ```
  file /usr/mail/george
  ```

- The shorthand form of a folder name in your directory defined for folders (see "Creating and Using Folders" on page 5-71 for information about using folders). For example, if you define your folder directory as `letters`, use the following command to change to the folder `reports`:

  ```
  file +reports
  ```

  The + is a shorthand form for the full pathname of the folder directory. Therefore, this command performs the same function as if it had been entered:

  ```
  file /u/george/letters/reports
  ```

Looking at a Mailbox

To start the **mail** program with one of the main types of mailboxes, see the following procedures:

Mailbox	See Description
System Mailbox	"Receiving Mail" on page 5-25
Personal Mailbox	"Looking at Your Personal Mailbox" on page 5-30
Folders	"Looking at a Mail Folder" on page 5-32

Leaving the Mailbox

You can leave the mailbox and return to the operating system using one of two commands:

- Use the **q** command to leave the mailbox and return to the operating system. When you leave the mailbox, all messages that you marked to be deleted are removed from the mailbox and cannot be recovered. For example, the following command processes the mailbox commands and returns you to the operating system:

  ```
  & q
  ```

- Use the **x** command to leave the mailbox and return to the operating system *without changing the original contents of the mailbox.* The program ignores any requests to delete messages. For example, the following command returns you to the operating system without changing the content of the mailbox:

  ```
  & x
  ```

Getting Help

While using **mail** to look at a mailbox, display a summary of many mailbox commands by entering the **?** command:

```
& ?
```

You can also display a list of all mailbox commands (with no explanation of what they do) by entering the **l** command:.

```
& l
```

Finding the Name of the Current Mailbox

Although the **mail** command displays the name of the current mailbox when it is started, you may lose track of what the current mailbox is. Use the **file** command without parameters to find out the name of the current mailbox. When you enter this command, it responds with the name of the current mailbox, the number of messages and whether any messages have been marked to be deleted. For example, if the current mailbox is `/u/george/mbox`, the following sequence occurs when you enter the **file** command:

```
& file
/u/george/mbox: 2 messages 1 deleted
&
```

This message indicates that `/u/george/mbox` contains two messages and that one of those messages will be deleted when you finish with this mailbox.

Changing Mailboxes

Note: When you change mailboxes, any messages that you marked to be deleted are deleted when you leave that mailbox. If you return to that mailbox, the deleted messages cannot be recovered.

Once the program is started with one mailbox, use the **file** command to change to another mailbox. The format of this command is:

`file` *fname*

Refer to "Specifying File or Folder Names" on page 5-35 for an explanation of the *fname* parameter.

Reading a Message from a Mailbox

To look at a message, enter the number of that message at the mailbox prompt (**&**). Pressing **Enter** only at the mailbox prompt displays the current message. If the mailbox listing is:

```
Mail  Type ? for help.
"/usr/mail/geo": 2 messages 2 new
>N  1 amy      Thu Sep 17 14:36  13/359 "Dept Meeting"
 N  2 amy      Thu Sep 17 16:28  13/416 "Meeting Delayed"
&
```

pressing **Enter** displays the message `Dept Meeting`, because message number 1 is the current message (indicated by the > in the first column). Entering the number 2 displays the message `Meeting Delayed`:

```
&2
Message  2:
From geo Thu Sep 17 14:38 CDT 1987
Received: by zeus
        id AA00716; Thu, 17 Sep 87 14:38:53 CDT
Date: Thu, 17 Sep 87 14:38:53 CDT
From: amy
Message-Id: <8709171938.AA00716@zeus>
To: geo
Subject: Meeting Delayed
Status: R


The department meeting scheduled for 1:30 PM tomorrow
has been postponed to 3:30 PM.  It will still be held
in the planning conference room.

EOF:_
```

The EOF: prompt indicates that **pg** is being used to display the message. See "Controlling the Display Scroll" on page 5-67 to change this option. Press **Enter** to return to the mailbox prompt.

Looking at the Next Message

Use the **n** command to look at the next message in the mailbox. The next message then becomes the current message. For example, if the current message is message number 6, then the following command displays message number 7 and makes message number 7 the current message:

```
& n
```

Looking at More Than One Message

Note: When displaying more than one message at a time, be sure to include the **set crt** command in your **.mailrc** file (see "Changing Mail to Meet Your Needs" on page 5-62). You can also enter this command at the mailbox prompt. If you do not use this command, the displayed messages scroll up and off the screen without pausing for you to read them.

To display more than one message in succession, use the **t** command with a list or range of message numbers. The format for this command is:

```
& t message_list
```

Refer to "Specifying Groups of Messages" on page 5-34 for an explanation of the *message_list* parameter.

Displaying the Contents of a Mailbox

When the **mail** program starts, it lists what is currently in the mailbox that it is using (as described in "Receiving Mail" on page 5-25). You can see this list again by using the **h** command. This command is useful to help you keep track of messages in the mailbox as you perform actions on them. Messages that you delete are not shown in the listing.

Only a certain number (about 20) of messages can be listed at a time. The actual number is determined by the terminal type being used, and by the **set screen** command (see "Controlling the Display Scroll" on page 5-67). If the mailbox contains more than that number of messages, information about only the first group of messages will be displayed. To see information about the rest of the messages, use the **h** command with a number that is in the next range of message numbers (21 to 40 in this case).

For example, suppose the mailbox contains 25 messages and the current list shows messages numbered 1 through 20. The following command displays information about messages numbered 21 through 25:

```
& h 21
```

To return to the first group of messages, enter the following command:

```
& h 1
```

You can also change the group of messages by displaying any of the messages in the desired group. For example, if you display

message number 5, then the first group of messages becomes the current group of messages. Using the **h** command shows information about messages 1 through 20.

Displaying Information About Selected Messages

If you have a large number of messages in your mailbox, you may want to display the heading information only about groups of messages. Use the **f** command with a list or range of message numbers. The format for this command is:

`& f` *message_list*

Refer to "Specifying Groups of Messages" on page 5-34 for an explanation of the *message_list* parameter.

Deleting and Recalling Messages

Use the **d** command to delete messages from a mailbox. The format of this command is:

`& d` *message_list*

Note: If you delete a message and either change to another mailbox or quit the mailbox (with the **q** command), the deleted message cannot be recalled.

Once a message is deleted, but *before leaving* the current mailbox, you can recall that message ("undelete" it) with the **u** command. The format of this command is:

`& u` *message_list*

Refer to "Specifying Groups of Messages" on page 5-34 for an explanation of the *message_list* parameter.

Entering **d** without a message list deletes the current message. Entering **u** without a message list recalls the last deleted message. You can also use the **dt** command to delete the current message and automatically display the next message. For example, if the

current message is message number 4, then the following command deletes message 4 and displays message 5:

```
& dt
```

Saving Messages in a File or Folder

You can add the contents of a message to a file or folder using one of two commands. One command includes the message headings in the file or folder; the other command adds only the text of the message to the file or folder. Both of these commands add information to the end of an existing file, or create a new file. They do not destroy information currently in the file.

Use the **s** command to save a message including heading information to a file or folder. The format of this command is:

& s *message_list fname*

Use the **w** command to save a message without heading information (text of the message only) to a file or folder. The format of this command is:

& w *message_list fname*

Refer to "Specifying Groups of Messages" on page 5-34 for an explanation of the *message_list* parameter. Refer to "Specifying File or Folder Names" on page 5-35 for an explanation of the *fname* parameter.

For example, the following command saves messages 1, 2, 3 and 4 with their heading information to a file called notes in the current directory:

```
& s 1-4 notes
"notes" [Appended] 62/1610
```

As an additional example, if message number 6 contains the following information:

```
From root Fri Sep 11 12:55 CDT 1987
Received: by zeus
        id AA00549; Fri, 11 Sep 87 12:55:25 CDT
Received: by thor
        id AA00178; Fri, 11 Sep 87 12:57:15 CDT
Date: Fri, 11 Sep 87 12:57:15 CDT
From: su@thor.8d33
Message-Id: <8709111757.AA00178@thor>
To: geo@zeus
Status: RO


Please change your password.
```

Use the following command to save the entire message to a folder called `admin` in your folder directory (defined as `/u/george/letters` in your **.mailrc** file):

```
& s 6 +admin
"/u/george/letters/admin" [New file] 14/321
```

Use the following command to save the text only to a file called `text` in the current directory:

```
& w 6 text
"text" [New file] 12/30
```

The file `text` contains the following:

```
Please change your password.
```

Editing a Message

You can use your favorite editor to add information to a note in your mailbox. When you leave the editor, you return to the mailbox prompt to continue processing the messages in the mailbox.

Two mailbox commands allow you to activate one of two editors to edit the text of a message:

Command	Function
e [*message_number*]	This command activates the **e** editor, or other editor that you define (see "Changing Mail to Meet Your Needs" on page 5-62).
v [*message_number*]	This command activates the **vi** editor, or other editor that you define (see "Changing Mail to Meet Your Needs" on page 5-62).

For each of these commands, *message_number* is the number of the message that you want to edit. If you do not specify a message number, **mail** activates the editor using the current message.

Creating a Message

While using the **mail** command to process a mailbox, you can create a new message by activating the **mail** editor (see "Using the Mail Editor" on page 5-49 for information about using the editor). Use one of three commands to activate the editor from the mailbox prompt depending upon the purpose of the message:

Command	Function
R	Respond to the sender of a message.
r	Respond to the sender and all others who received copies of a message.
m	Create a new message independent from any received messages.

Responding to the Sender Only

Use the **R** command to send a response message to the originator of a message. This command creates a new message addressed to the sender of the selected message and with a `Subject:` field that refers to the selected message. Then it activates the **mail** editor to allow you to enter text into the new message. The format of this command is:

`& R` [*message_number*]

The parameter *message_number* is the message number of the message to which you want to reply. If you do not specify a message number, **mail** creates a reply to the current message.

For example, suppose message number 4 is as follows:

```
From root Thu Sep 17 14:45 CDT 1987
Received: by zeus
        id AA00731; Thu, 17 Sep 87 14:44:59 CDT
Received: by thor
        id AA00614; Thu, 17 Sep 87 14:47:53 CDT
Date: Thu, 17 Sep 87 14:47:53 CDT
From: amy@thor
Message-Id: <8709171947.AA00614@thor>
To: geo@zeus
Subject: Department Meeting
Cc: mark@zeus, mel@gtwn
Status: RO


Please plan to attend a department meeting tomorrow
at 1:30 PM in the planning conference room.
```

In this case, you would type the following things to reply message to amy@thor (**bold** indicates text that you enter; other text is echoed by the program):

```
& R 4
To:  amy@thor
Subject: Re:  Department Meeting

I'll be there.
[EOT]
```

When you enter the **EOT** (**Ctrl-D** on many terminals), the program sends the message to amy@thor and returns you to the mailbox prompt.

Responding to the Sender and Recipients

Use the **r** command to respond to the originator of a message, and send a copy of your response to everyone on the `Cc:` list. The **r** command creates a new message that is addressed to the sender of the selected message and copied to the people on the `Cc:` list. The `Subject:` field of the new message refers to the selected message. The **r** command also activates the **mail** editor so you can enter text into the new message. The format of this command is:

`& r` [*message_number*]

The parameter *message_number* is the number of the message to which you want to reply. If you do not specify a message number, **mail** creates a reply to the current message.

For example, using message number 4 in the previous example, the following sequence occurs to generate a reply message to `amy@thor` as well as `mark@zeus` and `mel@gtwn` (**bold** indicates entered text; other text is echoed by the program):

```
& r 4
To:  amy@thor
Cc:  mark@zeus mel@gtwn
Subject: Re:  Department Meeting
```

I'll be there.
[EOT]

When you enter the **EOT** (**Ctrl-D** on many terminals), the program sends a copy of the message to all addressees and returns you to the mailbox prompt.

Creating a New Message

Use the **m** command to create a new message while processing a mailbox. The format for this command is:

`& m` *address*

The *address* parameter is any proper user address as described in "Addressing Mail" on page 5-11. This command starts the **mail**

editor to create a new message as described in "Sending Mail" on page 5-23.

Listing Defined Aliases

While processing a mailbox you can get a listing of the aliases that are defined for this **mail** session by entering the **a** command. The format for this command is:

```
& a
```

This command displays all aliases and their corresponding addresses, one alias per line. Refer to "Addressing Mail" on page 5-11 for information about defining an alias to be used as an address.

Using the Mail Editor

The **mail** command provides a line-oriented editor for composing messages. This editor allows you to enter each line of the message and then press **Enter** to get a new line to enter more text. You cannot change a line once you have entered it. However, before pressing **Enter**, you can change information on that one line by using the **Backspace** and **Delete** keys to erase the information, and then type in the correct information.

Starting the Mail Editor

You can start the **mail** editor in one of two ways. From the command line you can start the editor to compose and send a message to another user as described in "Composing and Sending a Message" on page 5-23:

`mail` *address*

You can also use the **mail** editor to compose a reply to mail that you receive using the **R**, **r** or **m** commands, as described in "Receiving Mail" on page 5-25.

Sending the Message

When the editor is active and it contains some message text that you have entered, you can send that message and end the editor with the following procedure.

Sending the Message

1. Press **Enter** to get the cursor at the beginning of a new line.
2. Enter an END OF TEXT character (**Ctrl-D** on many terminals). The system sends the message and returns you to either the mailbox handling program or to the operating system command line, depending upon where you were when you started the editor.

You can change the editor to allow a . (period) to be used as an additional END OF TEXT character in the above procedure as described in "Changing Mail to Meet Your Needs" on page 5-62.

Quitting without Sending the Message

When the editor is active, you can use the following procedure to quit the editor without sending the message.

Quitting the Editor

1. Press **Enter** to get the cursor at the beginning of a new line.
2. Enter `~q`. The system saves the message in **dead.letter** and returns you to the operating system command line.

You can also quit the editor using the **INTERRUPT** key sequence (**Alt-Pause** on the console keyboard). This method also saves the message in **dead.letter** unless you press **INTERRUPT** before pressing **Enter** on the first line of text.

Quitting the Editor without Saving

1. Press **Break**. The system responds with the prompt:

   ```
   (Interrupt -- one more to kill letter)
   ```

2. Press **Break** again. The system ends the **mail** program. If you have entered text, the system displays the message:

   ```
   (Last Interrupt -- letter saved in dead.letter)
   ```

   It then returns you to the command line.

Getting Help

While using the **mail** editor to create a message, you can display a summary of the editor commands by entering the key sequence,

```
~?
```

on a line by itself.

Using the Escape Character (~)

The editor includes many control commands that allow you to perform other operations on the message. Each of these commands must be entered on a new line, and each begins with the special *escape* character ~ (tilde). You can change this escape character to any other character by including the **set escape** command in your **.mailrc** file (see "Changing Mail to Meet Your Needs" on page 5-62). To start a new line in your message with the escape character, use two escape characters together. For example, the following message entered as:

```
This is a tilde (~) and this is two tildes (~~).  However,
~~ results in sending only one tilde.
```

is sent as the following message:

```
This is a tilde (~) and this is two tildes (~~).  However,
~ results in sending only one tilde.
```

Displaying a Message

To look at lines of the message that you have entered (or that have been read from another file), use the ~**p** command. When you enter this command on a line by itself in the **mail** editor, the editor displays the contents of the message including the header information for the message. The text scrolls up from the bottom of the display. If the message is larger than one screen and you have not set the page size for your terminal (see **stty** in *AIX Operating System Commands Reference*), the text scrolls off the top of the screen until it displays the last screen of the message, followed by the **mail** editor's (Continue) prompt. To look at the content of large messages, use the **mail** editor commands to view the message with your favorite editor as described in "Changing a Message."

Changing a Message

You cannot change information on a line once you have pressed the **Enter** key and gone on to the next line. You can, however, change the content of your message before sending it by editing the message with another editor. The following paragraphs describe how to activate different editors from the **mail** editor.

Using a Different Editor

To change information that you have already entered, you can activate a different editor *without leaving the* **mail** *editor*. Once you have activated a different editor, you can use it to change the message, or add new information to the message. When you leave the different editor, you return to the **mail** editor to continue composing, or to send, your message.

Enter the following key sequences on a new line in the **mail** editor to activate one of the different editors to edit the text of the current message:

~e This sequence activates the **e** editor, or other editor that you define.

~v This sequence activates the **vi** editor, or other editor that you define.

When you save the message and quit the different editor, you return to the **mail** editor. You can then continue to compose the message, or use one of the other **mail** editor commands to process the message.

Defining a Different Editor

The **mail** editor allows you to define two different editors to use when changing a message from within the **mail** program. You define either or both editors with the **set** command in your **.mailrc** file as shown in the following table. If you do not define these editors in **.mailrc**, **mail** tries to use the editors shown as the **Default** in the table.

set Command	**Usage**
`set EDITOR=`*pathname*	This command in your **.mailrc** file defines the editor that you activate with the **~e** key sequence. The value of *pathname* must be the full pathname to the editor program that you want to use. **Default: /usr/bin/e**
`set VISUAL=`*pathname*	This command in your **.mailrc** file defines the editor that you activate with the **~v** key sequence. The value of *pathname* must be the full pathname to the editor program that you want to use. **Default: /usr/bin/vi**

For example, the following entry in your **.mailrc** file defines the **ed** editor for use with the **~e** key sequence:

```
set EDITOR=/bin/ed
```

Reformatting the Message

Note: Do not use the **fmt** command if the message contains imbedded messages or preformatted information from external files (see "Including Another Message" on page 5-60). This command reformats the heading information in imbedded messages and may change the format of preformatted information.

After you have entered the message and before sending it, you may want to reformat the message to improve its appearance. Use the ~| key sequence along with the **fmt** shell program to reformat the message. Enter the following command on a new line to reformat the message:

```
~| fmt
```

This command uses the **fmt** command to change the appearance of the message by reflowing the information for each paragraph within defined margins (a blank line must separate each paragraph).

Checking for Misspelling

If you have the *text formatting* set of programs installed on your system, you can use the **spell** program to check your message for misspelled words with the following procedure:

Checking for Misspelling

1. Write the message to a temporary file. For example, to write the message to the file `spellchk`, use the following command:

   ```
   ~w spellchk
   ```

2. Run the **spell** program using the temporary file as input. For example, the following command uses the temporary file `spellchk` as input to the **spell** program:

   ```
   ~! spell spellchk
   ```

   The **spell** program responds with a list of words that are not in its list of known words, followed by an ! (exclamation point) to indicate that you have returned to the **mail** program.

3. Examine the list of words to determine if you need to use an editor to correct any of them (see "Changing a Message" on page 5-52).

4. Erase the temporary file. The following command erases the temporary file in the preceding example:

   ```
   ~! rm spellchk
   ```

Changing the Heading

The heading of the message contains routing information and a short statement of the subject. You must specify at least one recipient of the message, but the other information is not required. The information in the heading may include the following:

`To:` This field contains the address or addresses to which the message is to be sent.

`Subject:` This field contains a short summary of the topic of the message.

`Cc:` This field contains the address or addresses of persons that are to receive copies of the message. This field is included as part of the message sent to all who receive the message.

`Bcc:` This field contains the address or addresses of persons that are to receive "blind" copies of the message. This field is *not* included as part of the message sent to all who receive the message.

You can set up **mail** to automatically ask you for the information for these fields by putting commands in your **.mailrc** file (see "Changing Mail to Meet Your Needs" on page 5-62). If you have not changed **.mailrc** or if you need to change the information that you entered in these fields, use the commands described in the following paragraphs to change the information in these fields.

Editing the Heading Information

To add to or change information in more than one of the heading fields, use the **~h** command. When you enter this command on a new line, the system displays each of the four heading fields, one at a time. You can view the content of each field, delete information from that field (using the **Backspace** key) or add information to that field when the field and its contents are displayed. Pressing **Enter** saves any changes to that field and displays the next field and its contents. When you press **Enter** for the last field (`Bcc:`), you return to the editor.

For example, when composing a message, enter the **~h** command to change the `Subject:` and `Cc:` fields:

```
~h                    (Enter)
To: mark@austin_
```

The system responds with the contents of the `To:` field (`mark@austin`) and places the cursor at the end of that field. You could edit or add to this field at this time, but this information is

correct. Press **Enter**. The system responds with the contents of the Subject: field:

```
Subject: Fishng Trip_
```

Note: If you have changed this field before, the cursor may not be at the end of the field.

In this case, we want to correct the misspelling in the indicated subject. The cursor is at the end of the subject field. Press the **Cursor Left** key seven times to position the cursor under the n in Fishng. Retype the rest of the subject to correct it to Fishing Trip. Press **Enter**. The system responds with the contents of the Cc: field:

```
Cc: mel@gtwn_
```

To add another person to the copy list, ensure that the cursor is at the end of the list, type a space, and then type the address of the new person. For example:

```
Cc: mel@gtwn geo@austin
```

This entry expands the copy list to two persons. When you have completed the copy list, press **Enter**. The system responds with the contents of the Bcc: field. Press **Enter**. The system responds with the (Continue) prompt and returns you to the **mail** editor at the current end of the message.

Adding to the To: List

Use the **~t** command to add one or more addresses to the To: list. For example, the To: list for a message may contain the following address:

```
To: mark@austin
```

To add to this list, use the following command:

```
~t geo@austin mel@gtwn
```

This command changes the To: list to:

```
To: mark@austin geo@austin mel@gtwn
```

You cannot use the ~**t** command to change or delete the contents of the To: list.

Setting the Subject: Field

Use the ~**s** command to set the Subject: field to a particular phrase or sentence. Using this command replaces the previous contents (if any) of the Subject: field. For example, the Subject field for a message may contain the following phrase:

```
Subject: Vacation
```

To change the Subject: field, use the following command:

```
~s Fishing Trip
```

This command changes the Subject: field to:

```
Subject: Fishing Trip
```

You cannot append to the Subject: field with this command.

Adding to the Cc: List

Use the ~**c** command to add one or more addresses to the Cc: list. For example, the Cc: list for a message may contain the following addresses:

```
Cc: mark@austin amy
```

To add to this list, use the following command:

```
~c geo@austin mel@gtwn
```

This command changes the Cc: list to:

```
Cc: mark@austin amy geo@austin mel@gtwn
```

You cannot use the ~**c** command to change or delete the contents of the Cc: list.

Adding to the Bcc: List

Use the ~**b** command to add one or more addresses to the Bcc: list. For example, the Bcc: list for a message may contain the following address:

```
Bcc: mark@austin
```

To add to this list, use the following command:

```
~b geo@austin mel@gtwn
```

This command changes the Bcc: list to:

```
Bcc: mark@austin geo@austin mel@gtwn
```

You cannot use the ~**b** command to change or delete the contents of the Bcc: list.

Including Information from Another File

You can include information from other files in the message you are currently writing. This allows you to include data, such as a schedule, from another file. Use the ~**r** command to read the contents of a file into the current message. The format of this command is:

~r *filename*

For example, to read the contents of file schedule and append that information to the current end of the message, use the following command:

```
~r schedule
```

Including Another Message

Note: To use the commands ~**m** and ~**f** that include other messages within your message, you must enter the editor from the mailbox (using either the **r**, **R** or **m** mailbox commands). See "Receiving Mail" on page 5-25 for information about using the mailbox commands.

You can include another message within the current message for reference purposes, or to forward the other message to another user.

Use the ~**m** command to include another message in the current message for reference purposes. This command reads the indicated message and appends it to the current end of the message. The included message is indented one tab character from the normal left margin of the message. The format of this command is:

~m *numlist*

Use the ~**f** command to include another message in the current message to forward the message to another user. This command reads the indicated message and appends it to the current end of the message, but *does not indent* the appended message. Also use this command to append messages for reference whose margins are too wide to imbed with the ~**m** command. The format of this command is:

~m *numlist*

In the preceding formats, the parameter *numlist* is a list of integers that refer to valid message numbers in the mailbox or folder currently being handled by **mail**. You can enter simple ranges of numbers also. For example, the following commands imbed the indicated messages if those message numbers exist in the current mailbox or folder:

Command	Result
`~m 1`	Appends message number 1 to the current end of the message being written. Message number 1 is indented one tab from the left margin.
`~m 1 3`	Appends message number 1 and then message number 3 to the current end of the message being written. Both messages are indented one tab from the left margin.
`~f 1-4`	Appends message numbers 1, 2, 3 and 4 to the current end of the message being written. These messages are aligned with the left margin (not indented).

Resending Undelivered Messages

When **mail** cannot deliver a message that you send, it places that message in a file named **dead.letter** in your home (login) directory. This file can also contain a partial letter that was saved when you quit using the **~q** command from the **mail** editor. To read the contents of **dead.letter**into the current message, use the **~d** command.

```
~d
```

This command appends the contents of **dead.letter** to the current end of the message and responds with the `(Continue)` prompt. You can then continue to add to, or send, the message.

Changing Mail to Meet Your Needs

The person responsible for managing your system defines the initial configuration of the **mail** program, You may alter the way the **mail** program operates to meet your personal requirements. The characteristics of a **mail** session that you can change include:

- Whether **mail** prompts for the subject of a message
- Whether **mail** prompts for users to get a copy of a message
- If any aliases or distribution lists are defined
- How many lines are displayed when reading messages
- What information is listed in messages
- Whether a folder directory is selected for storing messages in
- Whether a log file is set up to record outgoing messages
- Whether different editors can be used for entering messages
- How to exit the **mail** editor
- How **mail** stores messages.

The system manager uses the file **/usr/lib/Mail.rc** to define the initial configuration. This file contains **mail** commands that perform the tasks mentioned above. Although the initial configuration can meet the needs of most users, you can easily alter it by creating a file in your home (login) directory with the name **.mailrc**. Commands in this file override similar commands in **/usr/lib/Mail.rc** when you run **mail**.

Another way of executing **mail** commands that are stored in a file is by using the **source** command. When reading mail, you can issue this command from the **mail** command line as follows:

`& source` *pathname*

where *pathname* is the path and file containing the **mail** commands. Commands in this file override the previous settings of any similar commands for the duration of the current session. You may also alter the characteristics of the current **mail** session by entering commands at the mailbox prompt (**&**).

Commands For Customizing Mail

There are four **mail** commands that alter the characteristics of the **mail** session. These are **set**, **unset**, **alias**, and **ignore**.

The set and unset Commands

The **set** command and its inverse, the **unset** command, are used in conjunction with ***options***. Use the **set** command to enable options, and the **unset** command to disable options. You can also use the **set** command to assign a value to an option.

The format for using the **set** command to enable options is:

`set [`*option_list*`]`

The *option_list* may be one or more options that you want to enable. Entering **set** without the *option_list* shows what options are already enabled. Refer to the section "Checking Mail Characteristics" on page 5-65 to see when to use **set** with no *option_list*.

The format for the **unset** command is:

`unset` *option_list*

You must include the *option_list* with the **unset** command.

For example, to cause **mail** to prompt for a subject field, use the following entry:

```
set ask
```

To also cause **mail** to prompt for a copy-to field, use the following entry:

```
set ask askcc
```

To suppress both of these prompts, use this entry:

```
unset ask askcc
```

The format for using the **set** command to assign a value to an option is:

`set` *option=value*

An example of a ***valued option*** is shown in the following entry:

```
set toplines=10
```

With this entry in your **.mailrc** file, the **top** command displays only the first ten lines of a message. (See "Controlling the Display Scroll" on page 5-67.)

The alias Command

Use the **alias** command in your **.mailrc** file to define alias names and distribution lists. The **alias** command allows you to send messages without entering long addresses or long lists of addresses. The section "Creating Aliases and Distribution Lists" on page 5-20 describes how to use the **alias** command.

You can define a distribution list with the **alias** command that includes your own address. If you send a message using the distribution list, however, the mail system does not normally send a copy to your mailbox. Use the following **set** command to enable sending a copy to yourself also:

```
set metoo
```

With this entry in **.mailrc**, anytime you send a message using an alias name that includes you, a copy of the message will be put in your mailbox.

The ignore Command

Use the **ignore** command to define what information is listed in message headers. The message headers are the fields like `To:` and `From:` at the tops of messages. Refer to "Controlling What Information is Displayed" on page 5-69 to see how to use the **ignore** command.

Checking Mail Characteristics

The characteristics of a **mail** session are determined by many commands and options. Commands in **.mailrc** and **/usr/lib/Mail.rc** affect each **mail** session. So do any commands you entered during the current session. You can avoid confusion by reviewing the characteristics of a mail session as described in this section.

Before running **mail**, you can use the **pg** command to view **/usr/lib/Mail.rc** and see what **mail** commands are in it. You can also look at your **.mailrc** file.

When reading your mail, use the **set** command without any arguments to list all of the options that are currently enabled. From this list you can also see if a folder directory is selected, and if a log file is set up to record outgoing messages. For example, using the **set** command from the mailbox prompt (**&**) could produce a display as follows:

```
& set
ask
metoo
toplines        10
&
```

You can see from this list that two options are enabled: **ask** and **metoo**. Notice that there is no **askcc** entry in the list. This indicates that the **askcc** option is not enabled. You can also see that the **toplines** option has been assigned the value 10.

Two other commands from the **mail** command line provide current command settings. The **ignore** command with no arguments lists

all header fields that are not included when you use a **t** or **p** command to display a message. The **alias** command without any arguments lists all alias names that are currently defined.

The information listed by the **set**, **ignore**, and **alias** commands includes system default settings, settings from the file **/usr/lib/Mail.rc**, settings from your **.mailrc** file, and any settings you made during the current **mail** session.

Prompting for a Subject Field

When you start **mail** to begin writing a message to another user, the program may or may not ask you for a `Subject:` field with a prompt similar to:

```
Subject:
```

If this prompt appears you can fill in a summary of the subject matter of the message, and that summary is included at the start of the message that you send. Whether this prompt appears or not is determined by the presence of the `ask` option. To enable the subject prompt, enter the following line in your **.mailrc** file:

```
set ask
```

To prevent **mail** from displaying this prompt, either delete the `set ask` statement from **.mailrc**, or enter the following line in **.mailrc**:

```
unset ask
```

Prompting for a Copy-To Field

You can set up **mail** so that when you send a message, **mail** prompts you for the names of other users whom you want to receive copies of the message. This prompt is similar to the following:

```
Cc:
```

This prompt appears if the **askcc** option is set in the system file **/usr/lib/Mail.rc** or in your **.mailrc** file as shown below:

```
set askcc
```

To suppress this prompt, either delete the `set askcc` entry from your **.mailrc** file, or include the following entry in **.mailrc**:

```
unset askcc
```

Changing How Mail Displays a Message

You can set several options from your **.mailrc** file to control how much information **mail** displays at different times. You can also put the **ignore** command in your **.mailrc** file to keep header fields from being displayed.

The following sections show you how to use **mail** commands to control display functions.

Controlling the Display Scroll

Each message in your mailbox has a one-line heading in the message list. If you have more than 24 messages, the first headings from the message list scroll past the top of your screen whenever you display the message list. The **set screen** command controls how many lines of the list are displayed at a time. For example, with the following entry in **.mailrc**:

```
set screen=20
```

the **h** command displays 20 message headers, then waits for you to press the **Enter** key before displaying the next 20 headers.

A similar situation occurs when you display a long message. If you display a message with more than 24 lines, then the first lines of the message scroll past the top of the screen. You can use the **pg** program from within **mail** to browse through long messages if you include the **set crt** command in **.mailrc**.

The **set crt** command has the following form:

```
set crt=n
```

The value for *n* determines how many lines a message must be before the **pg** program is started. The **pg** program is invoked whenever you read messages with more than this many lines.

For example, if you use the **t** command to read a long message, only one screen (or ***page***) is displayed. The page is followed by a colon prompt to let you know that there are more pages. Press the **Enter** key to display the next page of the message. After the last page of the message is displayed, there is a prompt similar to the following:

```
EOF:
```

At this prompt, or the colon prompt, you can enter any valid **pg** command. You can display previous pages, search the message for character strings, or quit reading the message and return to the mailbox prompt (**&**). Refer to *AIX Operating System Commands Reference* for more information about the **pg** program.

The **top** command lets you scan through messages to get more information without reading entire messages. You control how many lines of a message are displayed with the **top** command by setting the **toplines** option as follows:

```
set toplines=n
```

In this command, *n* is number of lines, starting from the top and including all header fields, that are displayed with the **top** command.

For example, if user amy has the following line in her **.mailrc** file:

```
set toplines=10
```

When Amy runs **mail** to read her new messages, she receives the following display:

```
Mail  Type ? for help.
"/usr/mail/amy": 2 messages 2 new
>N  1 george   Wed Jan  6  9:47  11/257 "Dept Meeting"
 N  2 mark     Wed Jan  6 12:59  17/445 "Project Planner"
&
```

Now Amy uses the **top** command to browse through her messages as shown in the following dialogue (what Amy enters is in bold type):

```
& top 1
Message 1:
From george Wed Jan 6 9:47 CST 1988
Received: by zeus
        id AA00549; Wed, 6 Jan 88 9:47:46 CST
Date: Wed, 6 Jan 88 9:47:46 CST
From: george@zeus
Message-Id: <8709111757.AA00178>
To: amy@zeus
Subject: Dept Meeting

Please plan to attend the department meeting on Friday
at 1:30 in the planning conference room.  We will be

&
```

The message was not displayed completely because **toplines** was set to ten, so only lines 1 (the `Received:` field) through 10 (the second line of the message body) were displayed. The first line, `From george Wed Jan 6 9:47 CST 1988`, is always present and does not count in the **toplines** option.

Controlling What Information is Displayed

Every message has several header fields at the top. These header fields are normally displayed when you read a message. However, you can use the **ignore** command to suppress the display of header fields when a message is read with a **t** or **p** (lowercase) command. The format for the **ignore** command is:

`ignore` [*field_list*]

The optional *field_list* can consist of one or more field names that you want to *ignore* when you display a message. For example, if Amy includes the following line in her **.mailrc** file:

```
ignore date from to
```

and the file **/usr/lib/Mail.rc** has the line:

```
ignore received message-id
```

the result of using the **t** command is shown below:

```
& t 1
Message 1:
From george Wed Jan 6 9:47 CST 1988
Subject: Dept Meeting

Please plan to attend the department meeting on Friday
at 1:30 in the planning conference room.  We will be
discussing the new procedures for using the project
planning program developed by our department.

&
```

Many fields do not appear in the display. To display these fields, use a **T** or **P** (uppercase) command or the **top** command. You can enter the **ignore** command without any arguments at the **mail** command line to get a list of the currently ignored header fields.

You can set the **quiet** option so that when you display a message, the message number is not displayed first. To do this, put the following entry in **.mailrc**:

```
set quiet
```

With the **quiet** option in **.mailrc**, the **mail** banner is not displayed when you start **mail**. The banner is the line that shows the name of the **mail** program.

Another option that suppresses the **mail** banner is shown below:

```
set noheader
```

If you put this command in **.mailrc**, the list of messages in your mailbox is not displayed when you start **mail**. The only response you will get is the mailbox prompt (**&**). You can get a list of messages by using the **h** command.

Combining the delete and print Commands

After you read a message you can delete it with the **d** command and display the next message with the **p** command. You can also combine these commands by entering the following line in your **.mailrc** file:

```
set autoprint
```

This command causes the **d** command to delete the current message and display the next one.

Creating and Using Folders

As you read mail messages pertaining to different subjects, you can store them in appropriate folders (mail system files) and read them again during later **mail** sessions. You can create new folders during a **mail** session as necessary, but a directory for storing them must exist before defining any new folders. Since a folder directory is just a normal directory used for storing folders, you can create a new folder directory from within **mail** by using the **mkdir** shell command as follows:

```
& !mkdir pathname
```

You must select a folder directory before storing any messages in it. To select a folder directory, set the **folder** option from the **mail** command line as follows:

```
& set folder=pathname
```

You can also include the **set folder** command in **.mailrc** so that when you invoke **mail**, the folder directory is already selected.

As you read messages, you can append them to any folder or place them into new folders within the selected folder directory. In this

manner, you can sort your new messages into folders like in a file cabinet. For example, upon logging in, user george sees that he has new mail. He enters the **mail** command and receives the following display:

```
Mail   Type ? for help.
"/usr/mail/george": 2 messages 2 new
>N  1 amy      Tue Dec 14 13:24  32/947 "New Utilities"
 N  2 mark     Wed Dec 15 15:47  16/417 "Project Schedule"
&
```

After reading the first message, George sees that it documents some fancy new shell procedures that Amy has written. George decides that it should go into a special folder he uses to collect such things. George has the following **set folder** command in his **.mailrc** file so that the folder directory where that folder is kept is already selected:

```
set folder=/u/george/doc
```

George uses the **save** command to append the new message to the special folder procedures by using a + symbol to indicate the folder name as follows:

```
& save 1 +procedures
```

He receives the message:

```
"/u/george/doc/procedures" [Appended] 32/947
```

George can access all messages saved in the procedures folder as described in "Looking at a Mail Folder" on page 5-32.

The second message is a project schedule. There is no folder yet for keeping project schedules, so George decides to create one. He also wants to put the folder into a directory where he has other files concerning the project. George selects this directory by entering the following command:

```
& set folder=/u/george/projectX
```

and the new folder can be created with the **save** command as follows:

```
& save 2 +schedules
```

The message:

```
"/u/george/projectX/schedules" [New File] 16/417
```

indicates that a new folder has been created.

Keeping a Record of Messages Sent

The **mail** command can automatically make a copy of any messages you send and store them in a specified file that can be read later. Since the header information is also stored, recording outgoing messages is a useful way of logging when important information was sent to others. Normally **mail** does not keep any record of messages sent.

To enable this option, place a **set record** command in **.mailrc** as shown below:

```
set record=pathname
```

Here the *pathname* indicates the file relative to your home (login) directory. The **mail** commands do not create directories, so any directories included in the *pathname* must already exist before using this command. Putting this command in your **.mailrc** file guarantees that copies of all of your messages will go to the same place.

If Amy has the following lines in her **.mailrc** file:

```
set record=letters/mailout
set folder=letters
```

a copy of the messages she sends out is put into the file /u/amy/letters/mailout.

Amy can read the recorded messages with **mail** as follows:

```
$ mail -f +mailout
```

because the folder `mailout` is in the folder directory selected by the **set folder=letters** command in her **.mailrc** file.

If you set up a file to record outgoing messages, you should read the file periodically with **mail** and delete all of the unnecessary messages. Otherwise, the file will grow and eventually use up all of your storage space.

Selecting a Different Editor

The standard **mail** editor is good for entering short messages, but it does not allow you to alter text after you press the **Enter** key. An alternative is to use another editor to create a file and use **mail** to send the file. However, the file will still exist after it has been sent. You can set up **mail** so that you can use any editor on your system to enter a message from within **mail**, and the message will not be left in a file when you exit **mail**.

Use the **set** command with the following valued options to define two different editors:

```
set EDITOR=e_pathname
set VISUAL=v_pathname
```

In the first entry, *e_pathname* is the full pathname of the editor you want to activate with the **~e** escape sequence or the **e** command. In the second entry, *v_pathname* is the full pathname of the editor you want to activate with the **~v** escape sequence or the **v** command.

If user Amy includes the following line in her **.mailrc** file:

```
set EDITOR=/bin/ed
```

she can call up her favorite editor (from **/bin/ed**) by using the **~e** escape sequence from within the standard **mail** editor.

When Amy is finished entering her message, she exits from her favorite editor and returns to the standard **mail** editor. She can then type the **EOF** sequence to exit **mail** and send the message.

As Amy reads her mail she can edit messages to add information to them. Using the **e** command from the mailbox prompt (**&**) also invokes the editor specified in the **set editor** command. After she exits the editor, she returns to the **mail** command line where she can save the message to a folder.

Defining How to Exit the Mail Editor

When you enter the **mail** command to send a message, you invoke the **mail** editor. From the **mail** editor you can compose your message. You can exit from the **mail** editor in one of two ways. One method is to type the **EOF** character.

Another method is to enter a period on a line by itself. This period does not appear in the message. To enable this method, place the following line in **.mailrc**:

```
set dot
```

After you exit the **mail** editor, the message is sent, and you return to the system prompt.

If you reply to a message when reading your mail, you also invoke the **mail** editor. The **set dot** command allows you to exit from the **mail** editor, but you return to the mailbox prompt (**&**). From there you can exit **mail** with a **quit** command, an **exit** command, or with the **EOF** character.

Defining How Mail Stores Messages

The **mail** program has several defaults for how messages are stored when you exit. You can set three options in **.mailrc** to change how **mail** stores messages. These options are the **append** option, the **hold** option, and the **keepsave** option. This section describes how these options change the way **mail** stores messages.

Normally, **mail** adds messages to a mailbox at the top of the mailbox. You can cause **mail** to append messages to the end of the mailbox by putting the following entry in **.mailrc**:

```
set append
```

Messages are stored in different places when you exit **mail**, depending on how you exit. You can exit **mail** in three ways. One way to exit **mail** is to enter the **exit** command. Use the **exit** command to return all messages to the mailbox you are reading. The mailbox will have the same messages the next time you read it. Another way to exit is to enter the **quit** command. Use the **quit** command to dispose of files as described in the following paragraphs. The third way to exit **mail** is to enter the **EOF** character. Using the **EOF** character is the same as using the **quit** command.

As you read messages from a mailbox, you can delete them, save them, or leave them unresolved. If you do not read a message, it remains in the mailbox, no matter how you exit **mail**.

Messages that are deleted are not saved anywhere if you exit **mail** with a **quit** command. However, if you exit with an **exit** command, deleted messages remain in the mailbox.

An ***unresolved message*** is one that you have read, but did not delete or save. If you exit **mail** with a **quit** command, any unresolved messages are stored in a file called **mbox** in your home (login) directory. You can cause **mail** to leave unresolved messages in the mailbox you are reading, instead of storing them in **mbox**, by putting the following entry in **.mailrc**:

```
set hold
```

The **hold** option has no effect on deleted messages.

Instead of using the **set hold** option, you can use the **hold** command to specify that a message remain in the mailbox when you exit with the **quit** command. For example, if you read message 3, but you are not sure if you want to delete it, mark it with the **hold** command:

```
& hold 3
```

The message remains in the mailbox instead of going to **mbox**. You can wait until the next time you read the mailbox to decide how to dispose of it.

If you set the **hold** option in **.mailrc**, you can use the **mbox** command to mark messages so that they are stored in **mbox** when you exit with the **quit** command. For example, if you are reading new mail, you can mark messages that you read, but not disposed of, by using the **mbox** command:

```
& mbox 1 3 5-7
```

This example marks messages 1, 3, 5, 6, and 7 so that they are stored in **mbox** instead of remaining in the system mailbox with any unread messages or other unresolved messages.

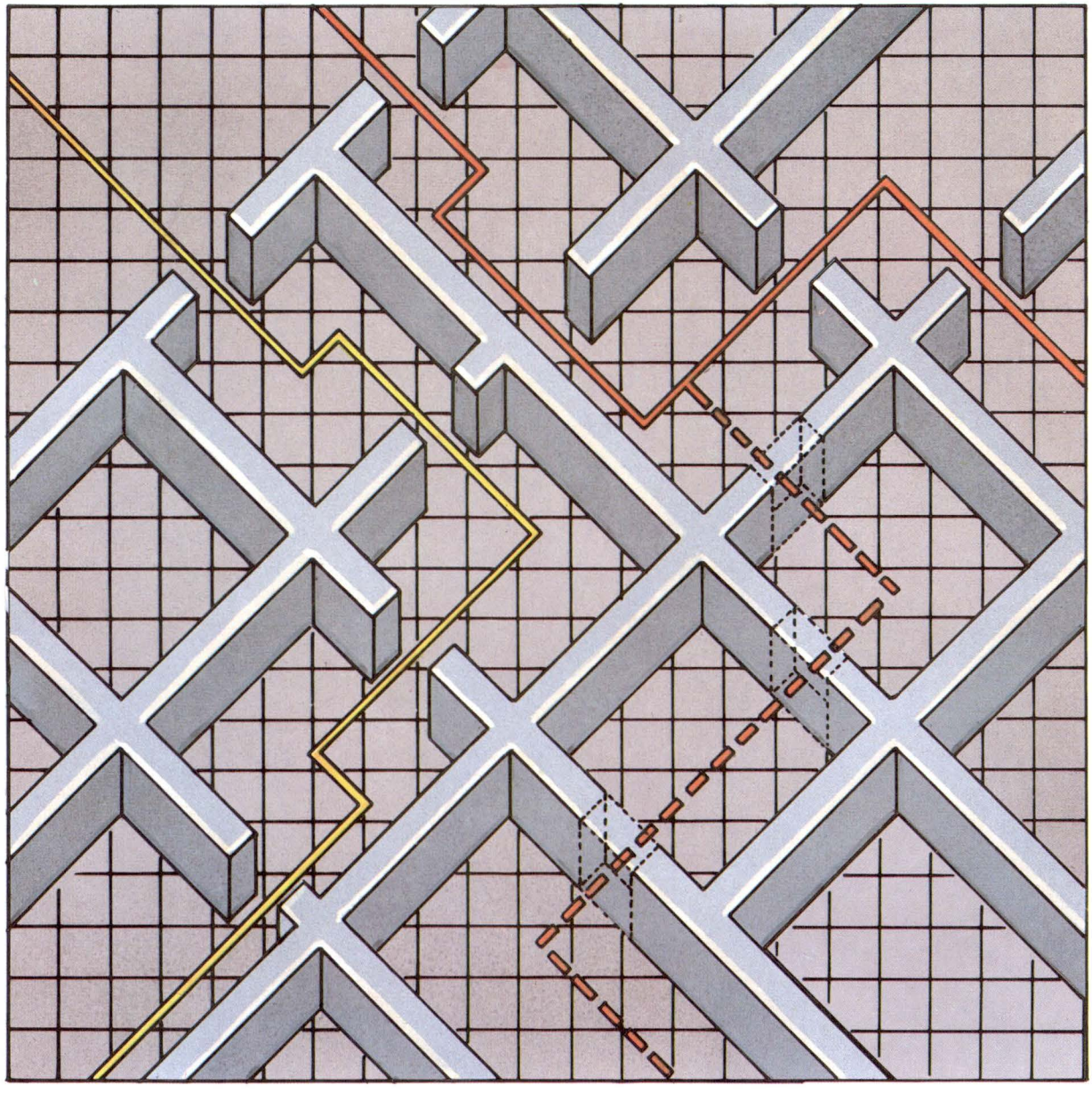
If you save a message with a **save** or **write** command, **mail** deletes the message from the mailbox when you exit with the **quit** command. To keep the saved message in the mailbox, use the **set keepsave** command in **.mailrc**:

```
set keepsave
```

Now **mail** handles messages that you save just like unresolved messages. The **set hold** option causes them to be held in the mailbox. Without the **set hold** option, they are stored in **mbox**.

If you exit **mail** with the **exit** command, all messages remain in the mailbox, no matter what options are set. Also, if you save any messages, the messages remain in the files where you saved them, even if you use the **exit** command.

Chapter 6. Using Local Communications Facilities



CONTENTS

About This Chapter

This chapter shows you how to create a simple communication facility for your local system.

Using this simple local facility, you can:

- Send and receive messages
- Conduct on-line conferences.

You perform these tasks using commands from both the AIX Base System Program and the Multi-User Services facility.

Note: The Base System Program is an integral part of AIX, so its commands are installed when you install AIX. The Multi-User Services commands that you need are in the Inter-workstation Commands component of the Base System Program. You must install this component in addition to the AIX operating system. Refer to *Installing and Customizing the AIX Operating System* for information about this operation.

Using the information in this chapter, you can create a facility for local communications. You can then communicate among local systems using the **write** command in the Base System Program, and the **who**, **mesg**, and **confer** commands in the Inter-workstation commands component of Multi-User Services.

The communications described in this chapter are of two types:

messages The sender and the receiver are both logged in on the system.

conferences Messages are sent back and forth by a pre-arranged protocol.

The rest of this chapter discusses the specific tasks you can perform on a local communication facility. You can:

- Determine who can currently receive messages.
- Send messages to a user logged in on the system.
- Receive or reject messages when you are logged in on the system.
- Participate in an on-line conference.

The following chapters contain information about local and remote communication facilities:

- To send mail to a user on a local or a remote system, refer to Chapter 5, "Sending and Receiving Mail."
- To use Base System Program commands to connect to and communicate with a remote communication facility, refer to Chapter 7, "Creating a Remote Communications Facility."
- To use the Basic Networking Utilities commands to communicate with a remote system, refer to Chapter 8, "Using the Basic Networking Utilities."
- To communicate with a remote system using TCP/IP, refer to Chapter 9, "Using the Interface Program for use with TCP/IP."
- To communicate with a remote system using ATE, refer to Chapter 10, "Using Asynchronous Terminal Emulation (ATE)."

Ask your system administrator which of these facilities is available for your use.

For more detail about the commands mentioned here, see *AIX Operating System Commands Reference.*

Determining Who Can Receive Messages (who)

To receive messages, a recipient must be logged in on the local system when the message is sent. You can determine who is logged in by using the **who** command.

who Displays the user name and work station of all users who are currently logged in, and shows the date and hour each current session began.

who -u Additionally, displays the number of hours and minutes since there was activity at a work station, and provides the process ID number of each user. Activity for less than one minute is indicated by a . (dot).

Determining Who Is Logged In

1. Type **who** following the prompt on the command line.

   ```
   who
   ```

   If system user `bjh` logged in at `7:43` from work station `tty0` and `jmc` logged in from work station `tty1` at `9:27`, the system displays the following:

   ```
   bjh   tty0   Feb 8   07:43
   jmc   tty1   Feb 8   09:27
   ```

2. Type **who -u** for more extensive information. If `bjh` has been inactive for an hour and two minutes, and `jmc` has been inactive for less than a minute, the system displays the following:

   ```
   bjh   tty00   Feb 8   07:43   01:02   17
   jmc   tty01   Feb 8   09:27     .     28
   ```

   The numbers 17 and 28 are process IDs.

Sending Messages (write)

You can send a message to anyone currently logged in on the local system by issuing the **write** command in the following form:

write *username*

This establishes a connection to the specified user. The system sends the recipient an alerting sound and a line indicating that you are sending a message. You also receive an alerting sound indicating that the connection is established. When you hear this sound, you can type your message, press **Enter**, and issue an end-of-file (**EOF**) signal to mark the end of the message and break the connection.

Note: On an RT PC console, the **EOF** signal is the **Ctrl-D** sequence. However, the **EOF** signal that you send at the end of a message depends upon the configuration of your keyboard. Refer to the information you received with your system if **Ctrl-D** does not produce an **EOF** symbol on the recipient's screen.

If the person to whom you sent the message is not currently logged onto the system, the following message is displayed on the screen of your work station:

```
user is not logged on
```

If you receive this message, you can still communicate with the individual by sending a note to the recipient's mail box. The recipient will see the note the next time he or she logs in. See "Sending Mail" on page 5-23 for information about sending mail messages.

Note: At some sites, you may be able to use the **write** command to send a message to users on remote systems. Ask your system manager whether the **write** command runs on remote as well as local systems.

The following quick reference box shows you how to send a message, using `me` as the sender and `bjh` as the recipient.

Sending a Message

1. Enter **write** *username* on the command line following the prompt, like this:

   ```
   write bjh
   ```

   This sends an alerting sound (the ASCII BEL character) and the following notice, which is displayed on the screen, to `bjh's` system:

   ```
   message from me tty1 Feb 8 10:32:45
   ```

   You also receive an alerting sound, indicating that the connection is established and that you can enter your message.

2. Type the message. When you have finished typing the text, press the **Enter** key, which signals the system to send the message.

3. Use the **EOF** signal to tell `bjh` that your message is complete and instruct the system to terminate the connection. On the RT PC console, use **Ctrl-D** to produce the **EOF** symbol.

If `bjh` answers your message, the system displays the following:

```
message from bjh (tty0) [Feb 8 10:33:03]
```

Having a Conversation

If you expect to have a conversation with another user—sending messages back and forth—both of you should agree on a symbol to use to indicate that a message is complete. For example, you might both end your messages with the letter **o** for "over". Do *not* use the **Ctrl-D** sequence, which will terminate the connection.

You should also agree on a different symbol, such as **oo** for "over and out", to identify the end of the conversation. When the conversation is over, use the EOF signal to break the connection. If you use the **Ctrl-D** sequence at any other time during the conversation, you or the user with whom you are conversing must re-establish the connection by again issuing the **write** command.

Retaining a Local Connection

After opening a connection to a specified user, you can continue to send messages to that user until you issue the EOF signal (**Ctrl-D**). In between messages to the original recipient, you can also send messages to other users on the system by prefixing the write command with an exclamation point, like this:

!write *username*

Note: The ! is the shell escape symbol. If you are already running one process started by a specific command, prefixing an exclamation point to a second command tells the shell to execute that second process while the first process continues to run. For example, entering `!write user2` instructs the shell to send a message to `user2` even though you are still conversing with `user1`.

When you use the **!write** command, you *must* end the message to the second user with **Ctrl-D**. You cannot connect with two users simultaneously unless you are participating in an on-line conference (see "Conducting an On-Line Conference (confer)" on page 6-15).

You can also execute AIX commands other than **write** from this shell by preceding that command with !. For example, if you are communicating with another user and need to examine a file mentioned in the conversation, you can enter **!pg***filename* to display the contents of that file.

Retaining a Connection

1. First, contact the user with whom you want to communicate:

   ```
   write amy
   ```

2. After receiving the alerting sounds indicating that the connection is established, enter your message, but do not use **Ctrl-D** after pressing **Enter**.

   You can continue to communicate with amy simply by continuing to type your messages and pressing **Enter**. Do not use **Ctrl-D** until you want to break the connection.

3. While conversing with amy, you can also send a message or a file to another user on the system by entering the **!write** command:

   ```
   !write bjh
   ```

   Type your message to bjh, press **Enter**, and then use **Ctrl-D** to break the connection to bjh.

4. You can now continue your conversation with amy simply by typing the text of the message and pressing **Enter**. You do not have to issue the **write** command again because the connection established in step 1 is still open.

5. When you are ready to break the connection to amy, send your final message and then use **Ctrl-D**.

Sending a Long Message

If you want to send a long message, you can create a file to contain the text and then send that file as the message.

Sending a Long Message

1. Create a file, using the text editor of your choice.
2. Write the text.
3. Use the **write** command to send the message, and enter the user name of the recipient, a < (less than symbol), and the name of the file.

   For example, to send a message file named `letter.jmc` to `bjh`, enter the following:

   ```
   write bjh < letter.jmc
   ```

4. If you want to terminate the connection, use **Ctrl-D**. You can also make the final entry in the file an **EOF** signal if you are sure that you want to break the connection after sending the file.

System Errors

Sometimes the system cannot send a message. There are a number of reasons for such a failure; for example, the recipient may not be logged on. If, however, the failure is the result of a system error, the following message appears on your screen:

`cannot write to` *user_name* `on` *system_name*

Receiving Messages (mesg)

Unless you specify otherwise, the system automatically sends you all the messages directed to you by other users of the system.

Sometimes, however, receiving a message on your display can interrupt your current work, so you may occasionally prefer not to receive messages. You use the **mesg** command to turn off the message facility, to turn it back on again, and to check the current message status of your work station.

The procedure that starts up the message facility is included as part of the AIX operating system; this ***start-up procedure*** contains a default value that lets you receive messages. If you prefer not to receive messages at any time, you can change this default so that you do not have to enter the **mesg** command each time you want to turn the message facility off or on.

Using the mesg Command

You use the **mesg** command in the following ways:

- to check the current status of the message facility on your workstation
- to turn off the message facility, thereby rejecting messages
- to turn the message facility back on, thereby again receiving messages.

To check the current status of the message facility, you enter the **mesg** command by itself, without any options. To turn off the message facility and reject incoming messages, you enter the command with the **n** option, called a flag in the command line. To turn the message facility back on so you can receive messages, enter the command with the **y** flag.

mesg Indicates the current message status of your work station. The system displays either `is y`, which means that you can receive messages, or `is n`, which means that you cannot receive a message.

mesg n Prevents incoming messages from appearing on your display, except under the following conditions:

- A person with superuser authority sends the message.
- The sender uses the **mail** command and sends the message to your mail box. See "Receiving Mail" on page 5-25.

mesg y Permits incoming messages to appear on your display.

Checking and Changing Your Message Status

1. Check your message status by entering **mesg** following the prompt on the command line:

   ```
   mesg
   ```

   If you can receive messages, the system displays the following:

   ```
   is y
   ```

2. To change the setting, enter `mesg y` or `mesg n`. For example, to reject messages, enter the following:

   ```
   mesg n
   ```

- You can type **mesg y** or **mesg n** without first checking your message status.
- When you change the setting to `msg n`, someone attempting to contact you through this facility receives the message `Permission denied`.

Changing the mesg Start-Up Procedure

The shell start-up procedure included with the AIX operating system contains a default value that lets you receive messages. If you prefer not to receive messages, you can change this default.

To change the default value so that you do not receive any messages, add a `mesg n` notation to the file named **.profile** in your login directory.

Note: When you log in on an RT PC, the system automatically places you in a personalized directory called your login or "home" directory. This directory was created for you when your account was set up on the RT PC. For detailed information about directories, refer to Chapter 3, "Using the File System."

Modifying Your Message Start-up Procedure

Enter the following command to move to your login directory :

```
cd
```

To edit the file named **.profile**, enter the following:

```
ed .profile
```

The system displays the contents of your **.profile** file on the screen, with the last line of the file as your current line.

Press **Enter** to start a new line, and then enter the letter `a` to append new text to the file. On the new line produced by the `a` command, enter the following:

```
mesg n
```

On the line following `mesg n`, which is now the last line of the file, enter a period (.). On the new line following the period, enter the letter `w`.

When you are ready to save the file and exit from it, enter the letter `q`.

- Adding **mesg n** to your personal **.profile** overrides the default value in the shell start-up procedure so that you no longer automatically receive messages.
- You can turn the message facility on during a particular session by entering the **mesg y** command. When you log out, however, the message facility is turned off, and it remains off until you enter **mesg y** again.

Conducting an On-Line Conference (confer)

The **confer** command issues a conference call to invited participants. Unless you enter the command followed by a tilde (**confer** ~), the conference is "on the record," and the system sends a transcript of the proceedings to each participant.

Following is an explanation of the commands you use to set up and join an on-line conference.

Command	Action
confer (*username*)	Issues a call to invited participants to join an on-line conference, which will be on the record. This means that the system records the conference and then sends a transcript of the proceedings to each participant. For the conference to occur, each participant must accept the conference call by issuing the **joinconf** command.
confer ~	Issues a call to invited participants to join an on-line conference, which will be "off the record." This means that the system does not make a transcript of the proceedings. For the conference to occur, each participant must accept the conference call by using the **joinconf** command.
joinconf *caller's username*	Used by invited participants to accept a conference call.

For more information on **confer**, see *AIX Operating System Commands Reference.*

Arranging a Conference

One person must issue a conference call, and the other participants must then actively accept the invitation.

Unless you give the conference a specific name, the system assigns your user name as the conference name. If you have called a previous conference, the system adds a number to the conference name.

For example, suppose user `jmc` has called one conference without assigning a name to it. The system accordingly names the conference `jmc`. If `jmc` then calls another one, the system names the second conference `jmc-1`.

Arranging a Conference

- Use the following format to issue a conference call:

  `confer` *username*

1. User `jmc` invites users `bjh`, `chr`, and `doc` to a conference using the following command:

   ```
   confer bjh chr doc
   ```

2. Each invited participant who is online hears two alerting sounds and receives the following notice:

   ```
   Please 'joinconf' jmc
   ```

- Use the following format to accept and join a conference call:

  `joinconf` *caller's username*

1. Each user invited to participate in the `jmc` conference enters the following response:

   ```
   joinconf jmc
   ```

2. Each user then receives notice that the others have joined the conference:

   ```
   bjh has joined
   chr has joined
   doc has joined
   ```

Holding a Conference

To avoid confusion, participants should agree in advance on the procedures they will follow during the conference. Following is a list of standard on-line conference procedures:

- Only one person at a time may take the floor.
- Each participant ends his or her comments with a predetermined end-signal and then yields the floor.

  Following are two standard end-signals:

  - End each comment with the letter **o** (over).
  - End each conversation (group of comments on the same topic) with **oo** (over and out).
- The other participants wait for an end-signal before requesting the floor.
- Each participant who leaves the conference must follow the established withdrawal procedure.

Participating in a Conference

1. To take the floor, press **Enter** once.

   If you are successful, your name appears in [ ] (brackets) so everyone knows you have the floor.

   ```
   [jmc]
   ```

2. When your name appears in brackets, type your comments.
3. When you have finished your comments, type an end-signal, such as **o** (over).
4. Press **Enter** once to yield the floor.

   Another participant may then request the floor.

Contending for the Floor

Often, several participants may try to take the floor at the same time.

- If you and another participant try to take the floor simultaneously, it is possible that neither of you will be successful. In that case, neither name will appear in brackets.

  If no other person successfully claims the floor at that time, press **Enter** again to repeat your request.

- If several people try to claim the floor at the same time, the last name to appear in brackets represents the successful participant.

  The other participants should immediately yield by pressing **Enter**.

Withdrawing from a Conference

If you want to withdraw from a conference, you must be excused by the other participants. In the following example, you are chr, a participant who wants to leave the conference.

Withdrawing from a Conference

1. Take the floor by pressing **Enter** once.

   If this is successful, your name appears in [ ] (brackets).

   ```
   [chr]
   ```

2. Press the **EOF** control key (**Ctrl-D**).

   The other participants see your name in brackets, followed by the word BYE.

   ```
   [chr] BYE
   ```

   The system then displays a prompt that lets you accept or change the transcript decision made at the beginning of the conference. To accept the original decision, press **Enter**. To change the decision, enter the letter that appears in **( )**. See "Getting a Transcript" on page 6-21.

3. Each participant must excuse you by entering **! excuse** *your username*, or you will continue to receive conference comments on your screen. For this example, each participant enters:

   ```
   !excuse chr
   ```

   You continue to see the request for transcript information, while the other participants see who has excused you. For example:

   ```
   jmc has excused chr
   ```

Getting a Transcript

As you withdraw from a conference, you respond to a prompt to confirm or change the transcript request specified when the conference was called.

The prompt offers you the opposite choice of the original decision. For example, if the conference was `on the record`, you see the following:

```
Transcript (n)
```

This means that you will receive a transcript of the proceedings unless you specify otherwise.

- To change the original transcript decision, enter the letter in parentheses. In the above example, you instruct the system not to send a transcript if you enter the letter **n**.

- To accept the original decision, press **Enter**. In the example above, this confirms that you want a transcript.

If you request a transcript, it is sent to your **dead.letter** file, where it is identified by the conference name.

- To view the transcript, use the **pg** (page) command to display the contents of the **dead.letter** file.

  Refer to "Displaying Files—The pg (page) Command" on page 2-7 for information about using the **pg** command.

- To print a copy of the transcript, use the **print** command to print the contents of the **dead.letter** file.

  Refer to "Printing Files—The print Command" on page 2-12 for information about using this command.

Note: Do not use **dead.letter** to store messages because the content of this file changes frequently.

Refer to Chapter 5, "Sending and Receiving Mail" on page 5-1 for additional information about the **dead.letter** file.

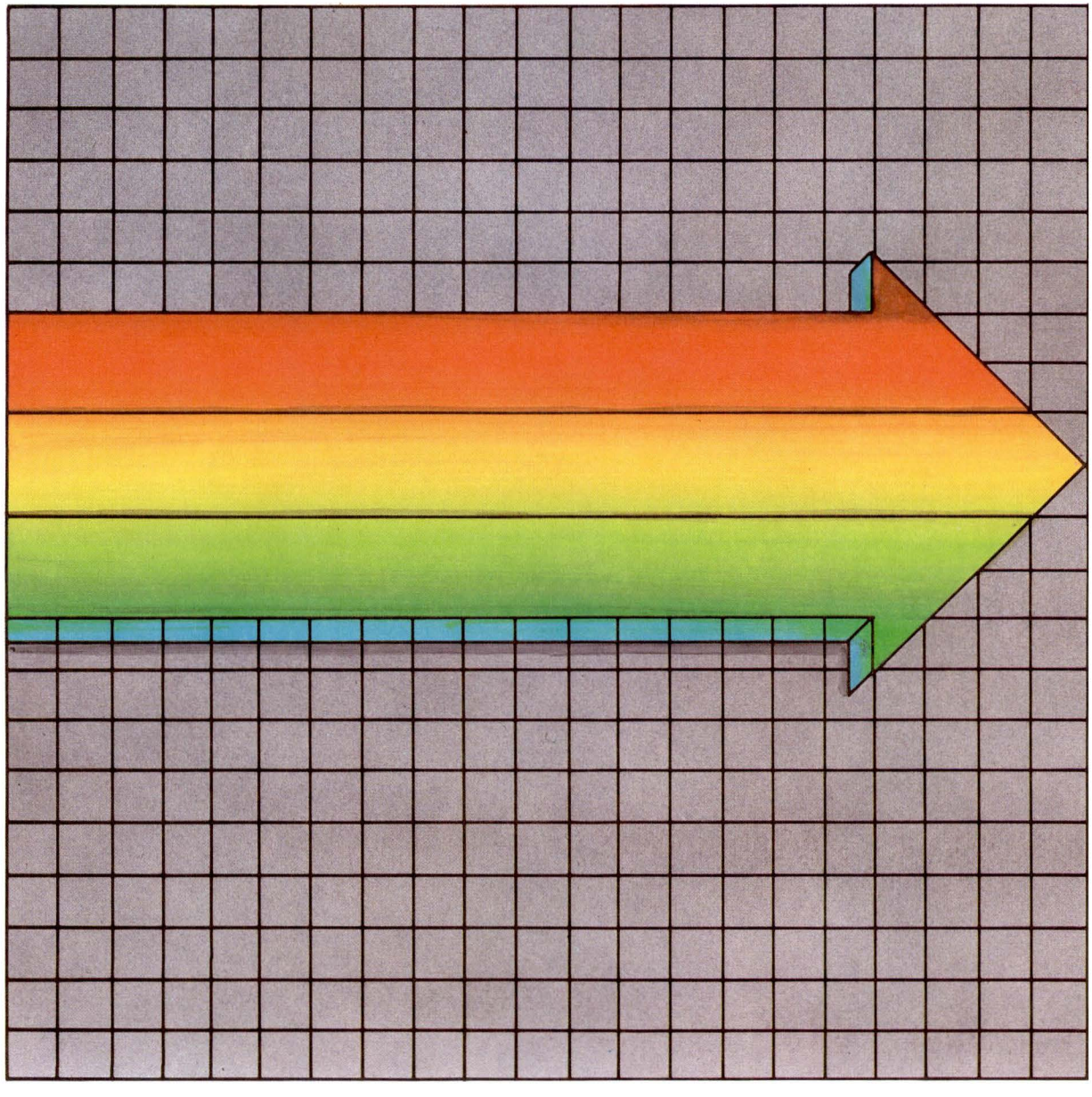
Closing the Conference

Usually the conference leader stays until the end of the conference, but if the leader must leave, another participant can give the closing command.

1. All the other participants ask to be excused. As each request is granted, the system breaks the connection to that user.

2. The last participant presses the **EOF** control key (**Ctrl-D**) to end the conference.

Chapter 7. Creating a Remote Communications Facility



CONTENTS

About This Chapter

This chapter describes how you can create a remote system communication facility using a command that is an integral part of the AIX Base System Program. This command is installed when you install AIX.

You can create a remote communication facility to:

- Make a connection to a remote system, using the **connect** command.

The **connect** command discussed in this chapter is different from the ATE **connect** command discussed in "Making a Connection (ATE connect)" on page 10-16. We refer to the command in this chapter as **connect**, and to the ATE command as ATE **connect** or **connect** (ATE).

Preparing to Establish a Remote Connection

You can establish a connection to a remote computer system with the **connect** command.

Once you are logged into the remote system, you can work on that system just as if you were directly connected, performing the following types of operations:

- Return (escape) to the local system prompt to run a command.
- Run commands on the remote system.
- Copy a text file to the remote system.
- Get a transcript of your session.
- Exit from the remote system.

Providing Program Information

Before you can establish a connection with a remote computer system, you must provide the **connect** program with the following:

- Information that defines the characteristics of the remote connection
- Information that defines the physical devices your system uses for the connection.

To do this, you must write two blocks of code, called stanzas, and add them to the **/usr/lib/INnet/connect.con** file.

Connect Stanza

This stanza describes the connection. It is wise to select a stanza name that identifies the system to which the connection is made because you may need other stanzas to describe other connections.

Before you begin, collect the following information about the local and remote system:

system name
Name by which the system is recognized.

login name Name that will be used to log in to the system.

password Identifying word that protects login security.

address Telephone number that remote systems use to call the system.

No address is needed if the connection is a direct one via a cable or a modem. (In some files, a direct connection is called a permanent connection.) If the telephone number needs a prefix for dialing purposes, include the prefix in the address.

type of connection
May be direct or through a modem. Leave this blank if the connection is direct.

If the connection is made through a modem, both systems must use the same type of connection.

line speed May be 110, 300, 1200, 2400, 9600, or 19,200 bits per second.

Must be the same for both systems.

parity May be even, odd, any, or none.

Must be the same for both systems.

Physical Device Stanza

The second stanza you must consider, placed at the end of the file, identifies characteristics of the physical devices used in the connection. A physical device stanza is needed when the connection is through an autodialer, such as a a modem. The same characteristics must be used for all the connections described in the file.

For a modem, this stanza must include the following:

- Name of the dialer
- Device
- Modem speed.

Setting Up a Stanza

A sample file, named **connect.con.t**, comes with the program.

The following procedures show how to edit the sample file to include a connect stanza for each connection you want, and a physical device stanza that describes the device characteristics.

You need superuser authority to edit this file.

Setting Up a Connect Stanza

1. Copy the **/usr/INnet/connect.con.t** sample file into a file named **/usr/INnet/connect.con**.

2. Read the **connect.con** file into a text editor.

3. Find the stanza headed by this comment: `* connect stanza` . The sample stanza looks like this:

```
* connect stanza
remote:
     type = terminal
     use = modem
     address = "T5551234"
```

4. Change the stanza so it describes the system name, type, use (connection device), and address of the remote system.

5. Find the stanza at the end of the file headed by this comment: `*stanza for information common to the above stanzas`. This is the stanza on physical device characteristics. The sample stanza looks like this:

```
*stanza for information common to the above stanzas
   modem:
     connect = name
     device = /dev/tty0

     speed = 1200
```

6. If you use an autodialer, rather than a direct connection cable, change the stanza so it describes the connection device (use), device name (connect), and line speed of the physical device used to make the connection.

7. Save the **connect.con** file.

For example, you may want to set up a local workstation to function as a `terminal` on remote `SYSTEMB`. If we assume the remote system is dialed on phone number `5553333` by a `Hayes_1200`

modem, and that the modem uses device file /dev/tty0 and a 1200 bits/second transmission, the stanza would look like this:

```
* connect stanza
 systemb:
     type = terminal
     use = modem
     address = "T5553333"
* stanza for information common to the above stanzas
  modem:
     connect = Hayes_1200
     device = /dev/tty0

     speed = 1200
```

- You can name the **connect** stanza with any name appropriate to your file system. However, we recommend that you develop a naming strategy for **connect** stanzas, such as the name of the remote system.

- The T prefix of the address indicates that the address will be transmitted as a tone dialing sequence. Pulse (rotary) dialing is assumed if you delete the T.

- The address must be enclosed in double quotation marks (" ").

- To use the **connect** features, the information required by the **connect** program must be configured on your system. To see your system configuration, check the **connect.con** file or consult your system manager.

- For detailed information on what you can define in a **connect.con** file, see *AIX Operating System Technical Reference.*

Connecting to a Remote System (connect)

To use the **connect** program, you must know the name of the **connect** stanza for the remote system.

The following sections describe how to start and stop a **connect** session, and how to use **connect** subcommands to transfer small files and keep a transcript of the session.

Making a Connection

Before your computer system can successfully initiate a **connect** session with a remote system, the following conditions must occur:

- Your port must be disabled.
- The port on the remote system must be enabled.

Check with your system manager and the system manager at the remote system to ensure that the port on the remote system is enabled.

For information on enabling and disabling ports, see *Managing the AIX Operating System.*

Making a Connection

1. Enter the **connect** command with the name of the **connect** stanza:

   ```
   $ connect systemb
   ```

2. The **connect** program displays a message telling you the device **connect** is using and the address of the remote terminal.

   ```
   Using /dev/tty0...trying T8885359...
   ```

   Here `/dev/tty0` is the name of the device that **connect** is using to make the connection, and `T8885359` is the address of the remote device, in this case a telephone number.

   If **connect** succeeds in making the connection, it adds the word `connected` to the message.

   ```
   Using /dev/tty0...trying T8885359...connected
   ```

3. Once a connection is established, you can log in to the remote system with a valid login name and password. (On some systems, you may have to press **Enter** more than once before the login screen appears.)

- If you are using a modem to link to the remote system, be sure the modem is switched on and connected to a phone line.
- The AIX Operating System distinguishes between lowercase and uppercase characters (that is, it is case sensitive), so be sure to determine exactly how the stanza name is spelled in the **connect.con** file.
- After the connection is made, the **connect** program displays a message describing the escape sequence you use to get the login prompt on the remote system. For information about escape sequences, see "Using Connect Subcommands" on page 7-11.

- If **connect** is not successful, it displays a brief message explaining the reason why the connection was not made. See *Messages Reference* for information about these messages.

- If you see the message `connected` but you do not get a `login:` prompt, the connection is not complete. See your system manager for help in completing the connection.

Once you are logged in to the remote system, you can work on that system just as if you were directly connected. To exit from the **connect** program and return to the local system, follow these steps:

- Escape to the local prompt (see "Using Connect Subcommands").

- Then quit the **connect** program (see "Ending a connect Session" on page 7-18).

Using Connect Subcommands

If you want to issue **connect** subcommands while you are connected to the remote system, you must first escape to the local **connect** prompt by using the **connect** escape sequence.

Escaping to the Local Prompt

1. Press **Ctrl-V u Ctrl-M**.

   The **connect** program presents the `LOCAL:` prompt.

2. Enter a **connect** subcommand.

   The **connect** program performs the subcommand, displays the message `BACK TO REMOTE`, and returns you to the remote system.

3. Either enter another command for the remote system, or press **Enter** to get the remote system prompt ($).

Subcommands

The **connect** program subcommands you can use after the local system prompt follow:

! Signals to the **connect** program that a local system command follows. Use an **!** (exclamation point) in front of every local system command that you give at the LOCAL: prompt while you are in a **connect** session. If you do not do this, the **connect** program tries to run the command. You do not need an ! in front of **connect** subcommands given at the LOCAL: prompt. See "Running a Local Command" on page 7-13 for examples.

i*filename* Sends a local file to a remote file. For this subcommand to work, you must previously have used the **cat** command while the BACK TO REMOTE prompt appears to indicate where the file should go, and then have escaped to the LOCAL: prompt to give this subcommand. See "Copying Text Files to the Remote System" on page 7-14 for the complete procedure.

t*filename* Transcribes a record of a connect session in the local system file you specify. To disable the transcript function, use a - (minus sign) after the **t**. To re-enable the transcript function, use a + (plus sign) after the **t**. See "Keeping a Transcript File" on page 7-15.

q Ends (quits) the remote session.

Additional Information about connect Subcommands

- Enter the escape key sequence by pressing the following keys in the specified order:

  1. Press the **Ctrl** and **V** keys simultaneously, and then release them.

  2. Press the **u** key, then release the key.

3. Press the **Ctrl** and **M** keys simultaneously, and then release them.

   Your site may use a different escape key sequence. If **Ctrl-V u Ctrl-M** does not work, ask your system manager for the current escape sequence.

- The system manager can also change the `LOCAL:` prompt string, so the prompt on your display screen may differ from the prompt in this guide.

Running a Local Command

To run a command on the local system while you are in a **connect** session, use the **!** subcommand to enter the local command at the `LOCAL:` prompt.

Running a Local Command

- Enter `!`, followed by the command.

For example, to display information about the files in the local current directory, enter the following:

```
!ls -l
```

The system displays this type of information:

```
total 2
-rw-r--r-- 1 root root   80 Feb 123 14:54 testfile

BACK TO REMOTE
```

- Be sure to type an exclamation point (**!**) immediately preceding the command that you want to run on the local system. Without the **!**, the **connect** program interprets your entry as a command, and it usually generates a message to indicate that it cannot interpret and run that command.

Copying Text Files to the Remote System

You can copy a text file from the local to the remote system.

The procedure uses the AIX **cat** command on the remote system, followed by the the **i connect** subcommand at the LOCAL: prompt.

Copying a Text File to the Remote System

1. While you are logged into the remote system, enter the **cat** command, followed by the name of the file to which you want the local file copied:

   ```
   BACK TO REMOTE
   cat > newfile
   ```

   This command tells the remote system to copy its standard input into the file newfile.

2. Press **Ctrl-V u Ctrl-M** to escape to the LOCAL: prompt.

3. Enter the **i** subcommand with the full path name of the text file you want to copy. For example, to copy testfile, enter the following:

   ```
   LOCAL: itestfile
   ```

   The system displays this message:

   ```
   Including file :'testfile'
   ```

   The contents of testfile appear on the display screen and are transferred into newfile on the remote system.

4. Press **EOF** after transmission is complete. On the RT PC, use **Ctrl-D**.

- After you enter the **cat** command, the remote system waits for input.

- Copying a large file with **connect** can tie up your system for a long time because the file contents are displayed as the copy task is performed.

  You may prefer to use one of the other communication systems discussed in this book, such as the Basic Networking Utilities (BNU) program, described in Chapter 8, "Using the Basic Networking Utilities" on page 8-1, to copy large files to a remote system.

Keeping a Transcript File

You can use the **t** (transcript) subcommand to keep a record of the remote **connect** session. This transcript is written to a local file that you specify.

The transcript file contains a record of the commands that you enter on the remote system and the remote system's response to those commands. It does not include the local commands that you issue at the LOCAL: prompt during the **connect** session.

The transcript function is enabled (turned on) with the **t** subcommand. After this function is enabled, you can turn it off and on during the remote **connect** session. The transcript function for a remote **connect** session ends when the session is ended.

The quick references boxes in this section illustrate how to perform the following types of operations:

- Enable the transcript function during a remote **connect** session.
- Turn the transcript function off and on during the remote session.
- View the contents of the transcript file after the remote session ends.

Enabling the Transcript Function

1. At the LOCAL: prompt, enter the **t** subcommand with the name of the file in which the record is to be stored:

   ```
   LOCAL: tmyrecord
   ```

2. The system displays the following message:

   ```
   Transcription into file 'myrecord' enabled

   BACK TO REMOTE
   ```

   and begins keeping a record of the remote **connect** session in myrecord.

Disabling the Transcript Function

Enter the following at the LOCAL: prompt:

```
t-
```

Re-Enabling the Transcript Function

Enter the following at the LOCAL: prompt:

```
t+
```

Use the AIX **pg** command to view the contents of the transcript file.

Viewing the Contents of the Transcript File

1. End the remote **connect** session.
2. Enter the following at the local AIX prompt:

```
$ pg myrecord
```

Ending a connect Session

Use the **q** subcommand to end a **connect** session. The **q** subcommand performs the following operations:

- Stops processes associated with the **connect** program
- Returns you to the command line in your working directory on the local system.

Ending a connect Session

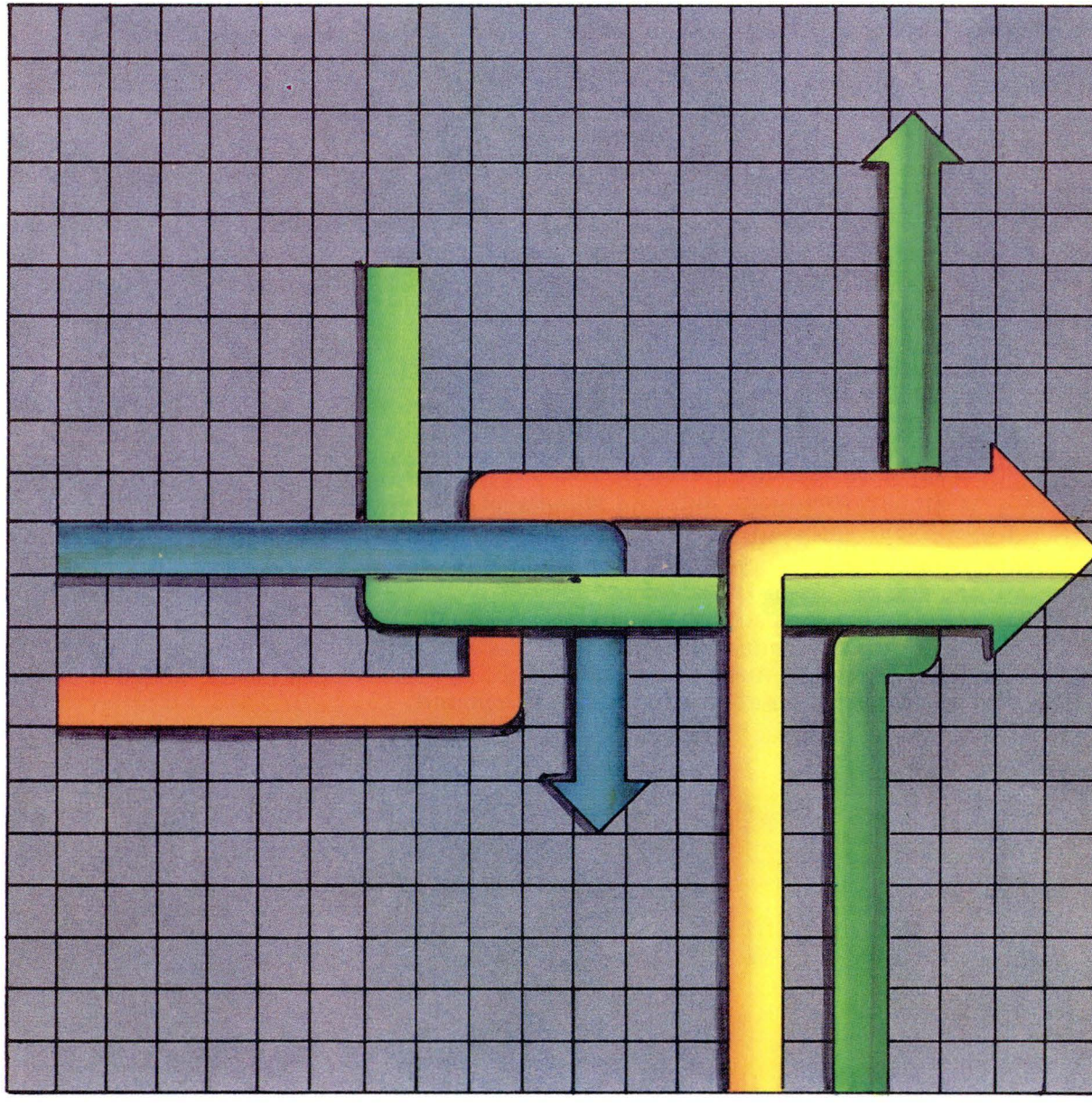
1. Log off the remote system and escape to the `LOCAL:` prompt.
2. Enter `q` at the `LOCAL:` prompt.

   The system displays this message:

   ```
   connection terminated.
   ```

   and the local AIX prompt ($) appears on your display screen.

Chapter 8. Using the Basic Networking Utilities



CONTENTS

About This Chapter

This chapter explains how to use the Basic Networking Utilities (BNU) program, which is part of the Extended Services facility of the AIX operating system. You use the various components of the BNU program to communicate with computers other than the RT PC at which you are currently working.

The BNU program consists of commands, processes, and a supporting database composed of files that contain information necessary to establish connections to remote computer systems.

The BNU commands enable you to perform the following types of operations:

- Connect to remote systems over a hardwired line or over a telephone network, using a modem
- Run commands on a remote system
- Send and receive files locally, or transmit files between the local system and a remote system
- Get status information about the remote connection or the file transfer

BNU commands are also used to manage network-related tasks such as installing and maintaining the BNU software. For information about these operations, see *Managing the AIX Operating System.*

Introduction to The Basic Networking Utilities Program

The BNU program, which is actually a group of programs and files, functions as an AIX ***background process***. This means that once a BNU task is running, you can use your work station for other jobs.

In addition to communicating within a local system, BNU enables two UNIX-based computer systems to communicate in three different ways:

- over a hardwired line
- over a telephone line
- over an IBM Token Ring Network, or an Ethernet[1] network, running TCP/IP.

BNU has two communication features:

Call-out Sends files and commands to another system.

Call-in Receives files and commands sent from another system.

You can have both types of communication features on your system if you have a line dedicated to BNU.

The following figure illustrates, in a simplified way, the setup of a BNU network.

---

1 Ethernet is a registered trademark of Xerox Corporation.

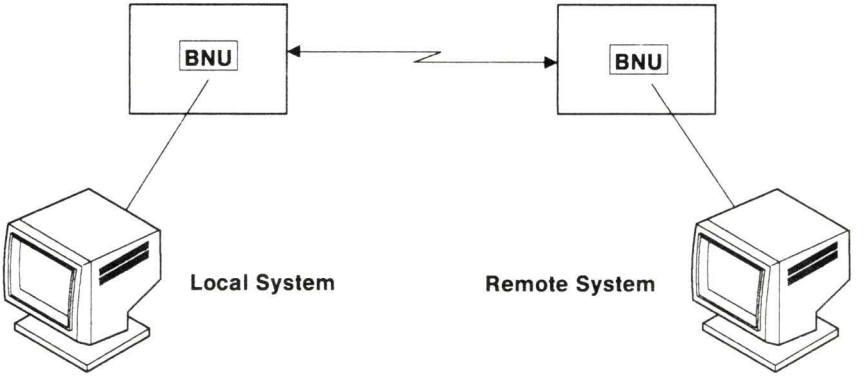


Figure 8-1. BNU Communications

Identifying Compatible Systems (uuname)

In order for a local system to communicate with a remote system using BNU, the remote system must meet the following criteria:

- It must have a UNIX-based operating system, like AIX.
- It must be connected to your local system.

Note: You can use BNU to communicate between an RT PC and a non-UNIX-based operating system, but such communications may require additional hardware or software. The remote systems that you can access with the BNU commands are identified when BNU is installed; these systems are listed in a file called **Systems**, which is stored in the directory **/usr/adm/uucp**. For information about this file, see *Managing the AIX Operating System.*

Use the BNU command **uuname** to identify compatible remote systems with which you can communicate using the BNU program.

Form of the uuname Command

To identify the systems with which you can communicate using the BNU program, issue the **uuname** command in the following form:

uuname [*option*]

When you invoke **uuname**, your local system (the computer at which you are currently working) displays the names of the remote systems that you can access with the BNU commands. These names (which were assigned to the computers when they were installed) will appear in a list like the following:

```
venus
merlin
hera
zeus
research
cad
archives
```

The entries your system displays in response to the **uuname** command are the names your system manager has assigned to the computers linked by BNU.

Option Used with the uuname Command

You can use one option, called a ***flag*** in the command format, with the **uuname** command.

This is the **-l** flag, which displays the name of your local system.

Identifying Compatible Systems

Use the form **uuname** [*option*].

- Identify Remote Systems

  1. Type the **uuname** command on the command line following the prompt:

     ```
     uuname
     ```

  2. Press the **Enter** key.

     The names of the systems you can access with BNU commands appear on your display:

     ```
     arthur
     hera
     server
     engg
     ```

- Identify Local System

  1. To find out the name of your local system, add the **-l** flag to the **uuname** command:

     ```
     uuname -l
     ```

  2. Press the **Enter** key.

     The name of your system appears on the display:

     ```
     tempest
     ```

For additional information about the **uuname** command, refer to *AIX Operating System Commands Reference.*

Communicating with a Remote System

BNU has several commands that enable you to communicate with computers other than the RT PC at which you are currently working. Using these commands, you can:

- Connect, over a hardwired asynchronous line, to another RT PC; to another computer running under a UNIX-based operating system like AIX; or possibly to a non-UNIX system, if you have the proper hardware and software
- Connect, over a telephone line, to a remote system or a remote terminal, using modems at both ends of the connection.

You can make remote connections over both a hardwired line and a telephone line using the BNU command **cu**. The command **ct**, on the other hand, is used only to connect to a remote terminal over a telephone line, using a modem.

Connecting to a Remote Computer (cu)

The **cu** command enables you to connect with a specified remote computer, log in to it, and then perform tasks on it while you remain physically working at your local computer. You are thus logged in on both systems at the same time, and you can switch back and forth between the two computers, performing tasks on both concurrently.

If the remote system is running under the AIX Operating System, you can issue regular AIX commands on the remote computer to change directories, list directory contents, view files, send files to the print queue, and so on. You can also use special **cu** "local commands" both to issue AIX commands on your local system and to perform tasks such as transferring ASCII files between the two systems. You preface these commands, which are discussed in "Using the cu Local ~Commands" on page 8-17, with a tilde (~).

For example, suppose you want to transfer a copy of a file from your local system to a remote system for printing. While the first file is printing, you want to edit a second file on the remote system

and then send a copy of that file over to your local computer. Following is an overview of the steps you would perform in an operation of this kind:

1. While logged on to your own workstation, connect to a specific remote system and then log in to that system.

2. Issue the appropriate local tilde (~) command to transfer the file from the local to the remote system for printing.

3. Issue the AIX **pr** command on the remote system to display the file on the screen, or **print** to print the file. You can also issue any other AIX command on the remote computer, such as **cd** to change to a different directory, **li** to list the contents of a directory, **pg** to examine the file, and so on.

4. Now you can edit another file on the remote computer while the first file is printing. Because the communication link remains open, you can also move easily between the local and the remote systems, checking the status of a job in progress on your local system, monitoring the printing job on the remote system, and so on.

5. When you have finished editing the second file on the remote system, use the appropriate local ~command to send a copy of the updated file back to your local computer. You can then continue with other tasks on both your local computer and the remote system.

Form of the cu Command

To connect to a remote computer, issue the **cu** command in the following form:

cu [*options*] *system_name*

This form of the command enables you to connect to a remote system over a hardwired line. If your system manager has set up BNU so that you can communicate with remote systems over a telephone line, this version of the **cu** command also enables you to connect to a remote system using a modem.

Note: For BNU to connect two systems over a telephone line using the **cu** [*options*] *system_name* form of the command, both systems must be attached to modems, and both systems must be set up for this type of communication. For information about customizing the files in the BNU supporting database for remote communications, see *Managing the AIX Operating System.*

Occasionally, you may need to communicate with a remote computer that does not support BNU. You can use a version of the **cu** command to establish such a connection under the following conditions:

- The remote computer must run under a UNIX-based operating system such as AIX.
- Both the local and the remote system must be connected to working modems.
- You must know the telephone number of the remote modem and have a valid login on that system.

Under these circumstances, you can connect to the remote computer using the following form of the **cu** command:

cu [*options*] *telno*

where *telno* is the telephone number of the remote modem.

In general, however, you will probably find that the form of the **cu** command that connects you to a specified system is sufficient for your work.

Options Used with the cu Command

You may issue the **cu** command with a number of options, called flags in the command format. Many of these flags perform specialized communications functions, and their default values are set when BNU is installed and and customized.

Under certain conditions, however, you may need to specify the following two flags:

-s*speed*
-l*line*

Specify Transmission Speed (-s*speed*)

The -s*speed* flag sets the rate at which data is transmitted to the remote system. The default transmission speed is generally "Any," which instructs BNU to use the rate appropriate for the default (or specified) transmission line. Most modems operate at 300, 1200, or 2400 baud, while most hardwired lines are set to 1200 baud or higher. When transferring data (such as a file) between a local and a remote computer, you may occasionally need specify a 300-baud transmission speed (the lower baud rate results in less interference on the line).

Note: You should *not* have to set the transmission rate as an ordinary practice. The default rate, set when BNU is installed and customized for your site, should be sufficient for most of your work with the **cu** command. Refer to *Managing the AIX Operating System* for additional information about this feature of BNU.

Specify Transmission Line or Device (-l*line*)

The -l*line* flag specifies the name of a device to be used as the line of communication between the local and the remote system. The default device is generally a hardwired asynchronous line, or a telephone line associated with an automatic dialer such as a modem. If your site has a number of lines of communication between local and remote computers, you may occasionally want to specify a particular device, or line, for your **cu** link.

Note: Under ordinary circumstances you should *not* have to specify a line or device. The default device established when BNU is installed should be sufficient. However, if you want to connect to a remote computer and are not certain of the system name, you can issue the **cu** command with the **-l** flag and a variation of the standard device name **tty** (for example, **tty1** or **ttyab**). Check with your system manager for the device names used at your site.

You must also specify the remote system with which you want to connect, using one of the following:

system_name (hardwired or modem connection to recognized system)

telno (modem connection to unrecognized system)

Remote System Name (*system_name*)

The *system_name* entry is the name of the remote system, recognized by BNU, with which you want to establish a connection. This is the assigned name of the system, such as `gumby`, `homer`, `phoebus`, and so on. BNU establishes this connection either over a hardwired line, or over a telephone line using a modem, depending on how your system manager has set up communications between your local system and the specified remote system.

Number of Modem on an Unrecognized System (*telno*)

The *telno* entry is the telephone number you want to use to establish a remote connection, using a modem. In this case, the remote system is an AIX or other UNIX-based computer that has not been set up to communicate with your local system through BNU. The *telno* entry can be either a local or a long-distance telephone number.

For detailed information about the **cu** command, refer to *AIX Operating System Commands Reference* and to *Managing the AIX Operating System.*

Note: When you work through any of the examples in this book, such as the sample entries in the following quick reference box, remember that the word "enter" means to type the indicated entry and then press the **Enter** key.

Connecting to a Remote System

Use the form **cu** [*options*] *system_name*.

1. To connect to a remote system named `hera` while sitting at your local workstation, enter the following:

   ```
   cu hera
   ```

   The system displays the following message:

   ```
   Connected
   ```

   and the screen displays the login prompt for the remote system.

   Note: When connecting to some remote systems, you may need to press **Enter** one or more times before the remote system displays its login prompt.

2. Log in on the remote system.

   You are now logged in to and ready to work concurrently on both your local system and the remote system `hera`. You can issue any AIX command on the remote system simply by entering that command following the prompt.

3. To display the contents of a directory called `/usr/pubs/msg` on system `hera`, enter the following:

   ```
   li /usr/pubs/msg
   ```

   You can issue commands on the local system by prefixing each command with a tilde. See "Using the cu Local ~Commands" on page 8-17.

Most of the time you will connect to a remote system using the system name, as in the preceding quick reference box. However, you may occasionally need to connect to a remote system whose name you do not know.

In that case, you can issue the **cu** command and connect with a remote system by specifying the name of the device (the hardwired line that actually connects your computer with the specified remote computer).

The standard device name is prefixed by **tty**. Most hardwired communication lines have names that are variations of the **tty** device name, such as **tty0**, **tty1**, and so on.

When you issue **cu** with the name of a device, you must include the name of the device, or line, preceded by the **-l** flag.

Connecting to a Named Device

Use the form **cu** -l*line*.

1. To connect with a remote system using a hardwired device named **tty2**, enter the following:

   ```
   cu -l tty2
   ```

   The system displays the `Connected` message.

   Note: When connecting to some remote systems, you may need to press **Enter** one or more times before the remote system displays its login prompt.

2. When the remote system displays its login prompt, log in and begin your work. Remember that the connection to your local system is still open, so you can perform tasks on both systems concurrently.

You can also use the **cu** command to connect, via a modem, to a remote computer that is not set up to communicate with your system through BNU. The remote system must be attached to a modem that can answer the telephone, and you must have a valid login on the remote computer.

Connecting to a Remote System via a Modem

Use the form **cu** [*options*] *telno*.

- Local Area Connection

  1. To connect to a remote system whose telephone number is 461-1492, type the following:

     ```
     cu 4611492
     ```

  2. Press **Enter**

  3. After the system displays the `Connected` message, press the **Enter** key.

     Note: When connecting to some remote systems, you may need to press **Enter** one or more times before the remote system displays its login prompt.

  4. When the remote system displays its login prompt, log in and begin your work.

- Long-Distance Connection

  1. To connect to a remote system whose telephone number is 1-612-223-1612, where dialing 9 is required to get an outside dial tone, and you want to transmit data at 300 baud, type the following:

     ```
     cu -s300 9=16122231612
     ```

  2. After the system displays the `Connected` message, press the **Enter** key until the login prompt appears, and log in on the remote system.

Using the cu Local ~Commands

Once you have issued **cu**, connected to the remote system, and logged in to it, you can issue regular AIX commands on either the remote system or the local system. You can also issue special **cu** commands on the local system to transmit ASCII files between the two computers.

When you are logged in to a remote computer using a **cu** link, you issue AIX commands on the remote computer simply by typing the command at the prompt. For example, to list the contents of a directory on the remote system, you would use the AIX command **li**.

However, suppose you want to display the contents of a directory on your local computer while linked to a remote system through the **cu** command. In that case, you must type a tilde (~) and an exclamation point (!) preceding **li** to indicate that BNU should execute the command on your local system. You would therefore issue the **li** command like this:

```
~!li
```

Note: As soon as you type the ~ and ! (or %, which is used with three local commands), the system displays the name of your local computer in this form: ~[*system_name*]!. You then type the appropriate command. The complete entry requesting a list of the contents of your current working directory on local system `hera` would therefore look like this:

```
~[hera]!li
```

Following is a list of some of the local ~commands you may use with the **cu** command:

~.
~!
~!*cmd*
~%**cd** *directory_name*
~%**take** *from* [*to*]
~%**put** *from* [*to*]

Terminate Remote Connection (~.)

The ~. (tilde period) characters instruct BNU to log you off the remote computer and then terminate the remote connection. In general, however, you should always use the **Ctrl-D** sequence to log off the remote system. Then type ~. at the prompt and press **Enter** to terminate the remote connection.

Note: Entering the ~. characters always terminates the **cu** process. In some cases where you are connected to the remote system over a telephone line using a modem, however, ~. does not always successfully log you off the remote system. For this reason, it is generally a good idea to use **Ctrl-D** for the actual logoff sequence.

Escape to Local System (~!)

The ~! (tilde exclamation point) sequence returns you to the local system after you have been working on the remote system. Type ~! at the prompt and press **Enter**. Then, when you want to return to the remote system, use the **Ctrl-D** sequence to leave the local computer and work on the remote system. Once you have established the **cu** connection, toggle back and forth between the two computers by entering ~! (to go from remote to local) and **Ctrl-D** (to go from local to remote).

Execute *cmd* **Locally** (~!*cmd*)

The ~!*cmd* sequence tells BNU to execute the command on the local system. Once you have established the **cu** link, you can run commands on your local computer only by typing a tilde and an exclamation point before the name of the command.

Change Local Directory (~%**cd** *directory_name*)

The ~%**cd** *directory_name* command changes your local working directory from the current directory to the directory specified with the *directory_name* entry.

Copy from Remote to Local (~%**take** *from* [*to*])

The ~%**take** *from* [*to*] command "takes" a specified file, copying it from the *remote* system to a specified file on the local system. If you do not type a name for the file on the local system (the *to* entry), the command copies the specified file from the remote to the local system under the same file name. Remember that with the ~%**take** command, the source file is on the remote computer.

Copy from Local to Remote (~%**put** *from* [*to*])

The ~%**put** *from* [*to*] command "puts" a specified file, copying it from the *local* system to the remote system. Again, if you do not enter a target file name, the command copies the file to the remote system under the same file name. Note that in the case of the ~%**put** command, the source file is on the local computer.

Note: You can transfer only ASCII files with the ~%**take** and ~%**put** commands. Use the **uucp** command, discussed in "Sending and Receiving Files (uucp)" on page 8-38, to transfer other types of files. In addition, neither ~%**take** nor ~%**put** checks to ensure that the system transfers the file(s) without errors. For the most reliable file transfers, use the **uucp** command.

Running Commands on Your Local Computer

Use the form ~!*cmd* to run an AIX command on your local system.

- View a File

  1. Issue **cu** and log in on the remote system.

  2. To display the contents of the file `status10` in the `/usr/msg/memos/` directory on your local computer `venus`, enter the following:

     ```
     ~!
     ```

     The system responds with the following prompt:

     ```
     ~[venus]!
     ```

     Now enter the command name and the name of the file (in this case, the complete path name of the file):

     ```
     ~[venus]!pg /usr/msg/memos/status10
     ```

- Open a Virtual Terminal

  1. After issuing **cu** and logging in on the remote system, open a virtual terminal on your local computer `hera`. Type the following:

     ```
     ~!
     ```

     When the system responds with the name of your local computer, enter the following to open a shell:

     ```
     ~[hera]!open sh
     ```

  2. Press **Enter**.

Changing Directories on Your Local System

Use the form ~%**cd** to change from one directory to another directory on your local computer.

1. Enter **cu** and log in on the remote system.

2. Now change from your current local working directory /usr/msg to directory /adm/msg, also on your local system zeus. Type the following:

   ```
   ~%
   ```

   The system responds with the name of your local system, prompting you to enter the command:

   ```
   ~[zeus]%
   ```

3. Enter the **cd** command and the name of the directory following the ~[zeus]% prompt:

   ```
   cd /adm/msg
   ```

You can also transfer files between the local and the remote system during a **cu** connection.

Note: When you use the ~%**put** and ~%**take** commands to transfer files, make sure that the target directory (the one to which you are copying the source files) already exists on the specified system. Unlike the **uucp** command, these **cu** local ~ commands do not create intermediate directories during file transfers.

Making a Remote-Local Transfer

Use the form ~%**take** *from* [*to*] to copy a file from a remote system to your local system.

- Copy to Same File Name

  1. Enter the **cu** command and then log in on the remote system.

  2. To transfer a copy of the file `/u/amy/test1` from the remote system to your local system, enter the following:

     ```
     ~%take /u/amy/test1
     ```

     where `/u/amy` is also the name of an existing directory on your local system. This command copies the file to the local system under the same file name, `test1`.

- Copy to Different File Name

  1. Enter **cu** and log in on the remote system.

  2. To copy the file `u/amy/test1` from the remote to the local system under a different file name, enter the following:

     ```
     ~%take /u/amy/test1 /usr/dev/amy/tmptest
     ```

Making a Local-Remote Transfer

Use the form ~%**put** *from* [*to*] to copy a file from your local system to a remote system.

- Copy to Same File Name

  1. Enter the **cu** command and then log in on the remote system.

  2. To copy the file /usr/pubs/geo/ch2a from the local system to the remote system to which you are connected, enter the following:

     ```
     ~%put /usr/pubs/geo/ch2a
     ```

     where /usr/pubs/geo is also the name of an existing directory on the remote system. This command copies the file to the remote system under the same file name, ch2a.

- Copy to Different File Name

  1. After executing **cu** and logging on to the remote system, copy the file /usr/pubs/geo/ch2a from the local to the remote system under a different file name:

     ```
     ~%put /usr/pubs/geo/ch2a /u/geo/part2
     ```

  2. Press **Enter**.

Additional Information about the cu Command

- Issue **cu** and press the **Enter** key. The system displays the message Connected. Then press **Enter** again. When the remote system displays its login prompt, log in and begin your work.

- Do not use the *system_name* flag in conjunction with the **-l***line* flag. You can use the **-s***speed* flag with either **-l** or *system_name*, but you cannot use all three flags in the same command line. If you do, **cu** connects to the first available line

for the requested system name, ignoring the specified line and speed.

- You can issue **cu** to connect system X to system Y, log on to system Y, and then issue **cu** again on system Y to connect to system Z. You then have one local computer, system X, and two remote computers, systems Y and Z.

  You can run AIX commands on system Z simply by logging in and issuing the command. You can run commands on system X by prefixing the command with a single tilde (~*cmd*). You can also run commands on system Y by prefixing the command with two tildes (~~*cmd*).

  In general, a single tilde causes the specified command to be executed on the original local computer, and two tildes cause the command to be executed on the next system on which you executed **cu**.

- Remember that the ~! sequence takes you from the remote system to the local system. To return to the remote system from the local computer, use the **Ctrl-D** sequence.

For more information about the **cu** command, refer to *AIX Operating System Commands Reference*.

Connecting a Remote Terminal to an RT PC Using a Modem (ct)

The **ct** command enables a user on a remote ASCII terminal, such as an IBM 3161 or a DEC VT100, to communicate with an RT PC over a telephone line attached to a modem at each end of the connection. The user on the remote terminal can then log in and work on the RT PC.

A user on the local system issues **ct** with the appropriate telephone number to call the modem attached to the remote terminal. When the connection is established, **ct** issues an AIX login prompt that is displayed on the remote terminal screen. The user on the remote terminal enters his or her AIX login name at the prompt, and AIX opens a new shell. The user at the remote terminal then proceeds to work on the RT PC just like a local user.

Note: In order to establish a **ct** connection, the user on the remote terminal generally contacts a user on the RT PC (with a regular phone call) and asks that user to issue the command. If such connections occur regularly at your site, however, your system manager may prefer to set up BNU in such a way that a specified local system automatically issues **ct** to one or more specified terminals at certain designated times. Refer to *Managing the AIX Operating System* for information about customizing BNU for use at your site.

The **ct** command is useful in the following situations:

- When a user working offsite needs to communicate with an RT PC under strictly supervised conditions. Because the local system contacts the remote terminal, the user on that terminal does not need to know the telephone number of the local system. Additionally, the RT PC user issuing **ct** can monitor the work of the remote user.

- When the cost for the telephone connection should be charged either to the local site, or to a specific account on the calling RT PC. Assume that the user on the remote terminal has the appropriate access permissions and can make outgoing calls on the attached modem. That user can call the specified RT PC, log in, and issue the **ct** command with the phone number of the remote terminal but *without* the **-h** flag. The local system hangs up the initial link so that the remote terminal is free for an incoming call, and then calls back to the terminal. This process is similar to making a collect call.

When you issue **ct** to connect to a remote terminal, you will find the following features of the command useful under certain circumstances:

- You can instruct **ct** to continue dialing the number until the connection is established or a set amount of time has elapsed.

- You can specify more than one telephone number at a time to instruct **ct** to continue dialing each modem until a connection is established over one of the lines.

Normally, **ct** dials the number specified in the command line, reaches the modem attached to the remote terminal, and displays the AIX login prompt. If there are no free lines, however, **ct** displays a message to that effect and asks if you want to wait for one.

If you reply "no," **ct** hangs up. If you reply that you do want to wait for a free line, **ct** prompts for the number of minutes to wait. The command continues to dial the remote system at one-minute intervals until the connection is established or the specified amount of time has elapsed.

Form of the ct Command

To connect to a remote terminal, issue the **ct** command in the following form:

```
ct [options] telno
```

Options Used with the ct Command

You may issue the **ct** command with a number of options, called flags in the command format. Following are several of these options:

-w*n*
-s*speed*
-h

You must also enter the telephone number of the remote terminal:

telno

Specify Wait Time (-w*n*)

The **-w***n* flag enables you to specify the maximum amount of time that **ct** "waits" for a line. You type the command and then the **-w** flag, followed immediately by the amount of time, which you enter as minutes (`-w5`). The **ct** command then dials the remote modem at one-minute intervals until either the connection is established, or the specified number of minutes has passed.

Entering this flag on the command line suppresses the messages that **ct** normally displays if it cannot make the connection. Instead of asking whether to wait for a free line and then prompting for the wait time, **ct** continues to dial for the specified amount of time when you issue the command with the **-w***n* flag.

No Hangup (-h)

Normally, **ct** hangs up on the current call in order to respond to a call coming in to your modem from another modem. The **-h** flag instructs **ct** not to break the current connection in order to answer an incoming call.

Specify Transmission Rate (-s*speed*)

The **-s***speed* flag enables you to specify the rate at which **ct** transmits data. The default speed is 1200 baud. Enter this flag when you want to connect to a remote terminal using a modem set to another baud rate, such as 300 baud (often used to transfer files) or 2400 baud (for high-speed transmissions).

For detailed information about the **ct** flags, refer to *AIX Operating System Commands Reference*

Specify Telephone Number (*telno*)

You must specify the phone number of the remote modem. You can enter a local or a long-distance number, and you can specify secondary dial tones such as 9 for an outside line, or an access code.

Use an equal sign (=) following a secondary dial tone (9=), and an appropriately placed minus sign (-) for delays (687-5092). Telephone numbers may contain up to 31 characters, and may include digits from 0 to 9, minus and equal signs, asterisks (*), and pound signs (#).

For detailed information about the **ct** flags, refer to *AIX Operating System Commands Reference.*

Connecting to a Remote Terminal

Use the form **ct** [*options*] *telno.*

- Dial Internal Number

  1. To dial a modem attached to a remote terminal with the internal telephone number 7-6092, type the following:

     ```
     ct 76092
     ```

  2. Press **Enter**.

     The system responds:

     ```
     Allocated dialer at 1200 baud
     Confirm hang_up? (y to hang_up)
     ```

     Press `y` to hang up any other phone lines currently in use and establish your **ct** connection. Press `n` to cancel the command.

- Dial External Local Number

  1. To dial a modem attached to a remote terminal with a local telephone number, specifying 9 for an outside line and a two-minute wait for the modem line:

     ```
     ct -w2 9=6340043
     ```

  2. Press **Enter**

- Dial Long-Distance Number

  1. To dial a modem on a remote terminal with a long-distance number, specifying an outside line and a five-minute wait:

     ```
     ct -w5 9=15023597824
     ```

  2. Press **Enter**.

For additional information about the **ct** command, refer to *AIX Operating System Commands Reference.*

Running Remote Commands (uux)

The **uux** command enables you to run a command on a designated remote system while continuing with other work on your local system.

The command first gathers various files from the designated systems, if necessary. It then runs a specified AIX command on a designated system. (If the specified command does not exist on the designated system, the **uux** command will not execute.) If the command you issue on the designated system produces some type of output, such as the **cat** or **diff** command, you can instruct **uux** to place that output in a specified file on any specified AIX system.

Note: You can use the **uux** command on any AIX system configured to run the specified command. For security reasons, however, certain sites may restrict the use of particular commands. Some systems, for example, may permit access only to the **mail** command.

Form of the uux Command

You can enter the **uux** command in either of the the following forms:

- **uux** [*options*] "*commandstring* > *destination_name*"
- **uux** [*options*] *commandstring* \{*destination_name*\}

Options Used with the uux Command

You may issue the **uux** command with a number of options, called flags in the command format. Following are three of these flags:

-n
-z
-j

No Notification Message (-n)

Normally, the **uux** command notifies you through the mail system about whether the command executed successfully on the designated system. The **-n** flag instructs **uux** not to send you this notification.

Failure Message Only (-z)

The **-z** flag instructs **uux** to notify you only if the command fails to execute successfully on the designated system. In that case, **uux** sends you notification about the failure through the mail.

Note: The **-n** flag and the **-z** flag are mutually exclusive; you may use one or the other with **uux**, but not both.

Display Job ID (-j)

The **-j** flag tells **uux** to display the job identification number of the process that is running the remote command. You can use this *jobid* with the BNU command **uustat** to check the status of the remote command, or use it with the **uustat -k** ("kill") flag to terminate the remote command before it finishes executing.

Note: Refer to "Getting Status Information about BNU Jobs (uustat)" on page 8-57 for information about the **uustat** command.

For a complete list of the flags available with the **uux** command, refer to *AIX Operating System Commands Reference.*

You must also enter the name of the command you want to run on the remote system. In addition, you must also specify the system and file in which you want to store the output of the remote command.

Name of Remote Command (*commandstring*)

This name, represented by the *commandstring* entry, may be any AIX command accepted by the designated system.

To specify the system on which you want to run the command, type the name of the system, an exclamation point (!), and the command name:

system_name!*commandstring*

The section "Additional Information about the uux Command" on page 8-35 contains examples of this usage.

Name of Destination System and File (*destination_name*)

The *destination_name* entry indicates the system and file in which you want to store the output of the remote command.

Suppose, for example, that you want a listing of all the files in a certain directory on a remote system. Rather than having the AIX command **ls** simply display the file names on the remote system, you can specify that you want the **uux** command to place the directory listing in a file on your own computer by entering the appropriate destination name.

Note: The *destination_name* is the path name to the location in which you want to store the output of the executed command. For information about path names, refer to "Path Names Used with BNU Commands" on page 8-33.

You can type the destination name in either one of two ways:

- "*commandstring* > *destination_name*"
- *commandstring* \{*destination_name*\}

Notice the set of double quotation marks (" ") in the first form. If you use the > (greater than) symbol to direct the output of the remote command to the destination name, then you must type one double quotation mark (") before the name of the command, and another double quotation mark (") following the destination name: ". . . > . . .".

If you use the second form, you must type a backslash, a left brace (also called a curly bracket), the destination name followed by a second backslash, and a right brace: \{. . .\}. You need to include

the backslashes because the left and right braces are special characters to the shell command interpreter.

See "Additional Information about the uux Command" on page 8-35 for examples of these forms.

Running a Remote Command

1. To concatenate two files and direct the output to a third file, enter the **uux** command in either of the following forms:

   ```
   uux "zeus!cat zeus!/u/amy/f1 hera!/usr/amy/f2
   > zeus!/u/amy/catout"
   ```

   or

   ```
   uux zeus!cat zeus!/u/amy/f1 hera!/usr/amy/f2
   \{zeus!/u/amy/catout\}
   ```

2. Press **Enter**.

   Either form of **uux** executes the `cat` command, which is stored on system `zeus`. The `cat` command combines the file `f1`, located in the directory `/u/amy` on `zeus`, with the file `f2`, located in `/usr/amy` on system `hera`. The command places the new file on system `zeus` under the file name `catout` in the directory `/u/amy`.

Path Names Used with BNU Commands

Path names used with BNU commands are essentially the same as path names used with AIX operating system commands, but BNU path names often include the name of the remote system.

- *Full pathname.* A full path name lists all the directories along the route from the root directory to a specific directory or file, ending with the name of the final directory or file. By convention, the elements in a path name are separated by slashes (/).

- *Relative pathname.* A relative (or partial) path name lists the route to a specific directory or file relative to the current directory. If you are working in a directory named `/usr/bin/lgh/reports`, then typing `month8` without a leading slash identifies the file called `/usr/bin/lgh/reports/month8`. You may always use relative path names with the **cu**, **uucp**, and **uux** commands, and with the name of the source file in the **uuto** command.

  Note: Relative path names may not always work with all commands. If you are having trouble accessing a file with a relative path name, re-issue the command using the full path name to the file.

- *~user pathname.* The tilde (~) is a short-hand way of identifying part of a path name. In this case, *~user pathname* refers to the login directory of the person identified as *user.*

- ~**uucp**/*filename.* In this case, the entries preceding the file name refer to the public directory on the designated system. BNU uses this directory, named **/usr/spool/uucppublic**, for sending and receiving information. The ~**uucp** entry is a short-hand way of specifying the public directory.

- *System_name!pathname.* This is the syntax BNU uses to identify the path to a file on another system. The following example identifies the file `new` in the directory `research` on a system named `merlin`:

  ```
  merlin!/research/new
  ```

- *System_name!system_name!pathname.* This is the path name to a file on another system that goes through one or more other intermediate systems. In the following example, the path name specifies the file `cells` in directory `research` on system `merlin`, which is reached first through system `zeus` and then through system `venus`.

  ```
  zeus!venus!merlin!/research/cells
  ```

Additional Information about the uux Command

- If you request a command that the remote system cannot run, you will receive a mail message to that effect from the remote system.

- To run commands on more than one system, type the information on separate command lines:

```
uux merlin!print /reports/memos/charles
uux zeus!print /test/examples/exampl
```

- In addition to the two forms of the destination name that you can use with the **uux** command, you can also represent your local system in several different ways.

  For example, enter the following to run the **diff** command, which is on your local system hera, to compare the file /u/f1 on system venus with the file /u/f2 on system merlin. Specify that the output of the **diff** command should be placed in the file /u/f3 on your local computer:

```
uux "hera!diff venus!/u/f1 merlin!/u/f2 > hera!/u/f3"
```

  You can also enter the destination name in the following form:

```
uux hera!diff venus!/u/f1 merlin!/u/f2 \{hera!/u/f3\}
```

  These examples used the name of the local system, hera, followed by an exclamation point. You can also represent the local system using just an exclamation point, as in the following example:

```
uux "!diff venus!/u/f1 merlin!/u/f2 > !/u/f3"
```

  Both the system name and the exclamation point are optional. Following is the easiest way to represent the local system:

```
uux "diff venus!/u/f1 merlin!/u/f2 > /u/f3"
```

  Of course, in any of these examples, you can enter the destination path name using the \{. . .\} sequence.

Note: The output file must be writeable, which means that the permission for the file allows you to place data in it. If you are uncertain about the permission status of a specific target output file, direct the results of the command to the public directory, **/usr/spool/uucppublic**.

- When specifying the destination for the output of a command, you may use a full name, or a path name preceded by ~*user*. In this case, replace the *user* entry with a login name that refers to the user's login directory.

- When specifying the path name for a file you want to use as the source in running commands such as **diff** or **cat**, you may include the following shell pattern-matching characters, which the remote system can interpret:

  ?
  *
  [(left bracket)
  ] (right bracket)

  Enclose these characters either between two slashes (\ . .\), or between a pair of quotation marks (" . "), so the local shell cannot interpret the characters before **uux** sends the command to the remote system.

  Do not use pattern-matching characters in destination names.

- If you use the following shell characters, place either \ . .\ or " . ." around the individual character or the entire command string:

  < (less than)
  > (greater than)
  ;
  |

  Do not use the shell redirection characters (< < and > >) because they do not work in the BNU program.

- The exclamation point representing a remote system in BNU syntax has another meaning in c shells (**csh**). When using a

BNU command such as **uux** running in a c shell, you must place a backslash (\) before the exclamation point.

For example, to get the first field from each line of the password file on remote system `hera` and place the output in the file `passw.cut` in the public directory on your local system, use either of the following forms:

```
uux "cut -f1 -d: hera\!/etc/passwd > ~uucp/passw.cut"
```

or

```
uux cut -f1 -d: hera\!/etc/passwd \{~uucp/passw.cut\}
```

Remember that ~**uucp**/ is a short-hand way of specifying the public directory, **/usr/spool/uucppublic**.

For additional information about the **uux** command, see *AIX Operating System Commands Reference.* For information about how the **uux** command works, see *Managing the AIX Operating System.*

Sending and Receiving Files (uucp)

In general, you will probably use BNU primarily to send and receive files. The BNU command **uucp** and its options enable you to copy one or more *source_files* from one UNIX system (such as an RT PC running under the AIX operating system) to one or more *destination_files* on another UNIX system that supports BNU.

You can use **uucp** to copy files between and among systems in the following ways:

- within your local system
- between a local system and a remote system
- between two remote systems.

Form of the uucp Command

The **uucp** command has the following form:

uucp [*options*] *source_file(s) destination_name*

Options Used with the uucp Command

You may enter **uucp** with one or more options, which are called flags in the command format. Following are several of these available flags:

-d
-f
-j
-m
-n*user*
-s*file*

Create Intermediate Directories (-d)

The **-d** flag, which is on by default, creates any intermediate directories needed to copy a source file to a destination file on a remote system. For example, instead of first creating a directory and then copying a file to it, you can simply enter **uucp** with the destination path name, and the BNU Program will create the required directory.

No Intermediate Directories (-f)

The **-f** flag instructs **uucp** not to create any intermediate directories during the file transfer. Use this flag if the destination directory already exists and you do not want the BNU Program to write over it.

Display Job ID (-j)

The **-j** flag tells **uucp** to display the job identification number of the transfer operation. You can use this *jobid* with the **uustat** command to check the status of the transfer, or use it with **uustat -k** ("kill") to terminate the transfer before it is completed.

Note: Refer to "Getting Status Information about BNU Jobs (uustat)" on page 8-57 for information about the **uustat** command.

Mail Message to Sender (-m)

The **-m** flag sends you a mail message when the source file is successfully copied to the destination file on a remote computer. The message goes to your mail box, **/usr/mail/***username*. The **mail** command does not send a message for a local transfer.

Notify Recipient (-n*username*)

The **-n***username* flag notifies the recipient on the remote system identified by the *username* entry that a file has been sent. Again, the mail system does not send a message for a local transfer.

You must also specify the name of the source file that you're copying to another system, as well as the name of the destination

file on the target system (that is, the file into which you're copying the source file).

Path Name of Source File (*source_file*)

The *source_file* entry is the path name of the file that you want to send or receive. For detailed information about path names used with the BNU Program, refer to "Path Names Used with BNU Commands" on page 8-33.

Path Name of Destination File (*destination_name*)

The *destination_name* entry is the path name of the file (or directory) to which the copy is being sent. Again, see "Path Names Used with BNU Commands" on page 8-33 for detailed information about path names.

For information about other **uucp** options, see *AIX Operating System Commands Reference.*

Additional Information about the uucp Command

- A file path name may contain the following shell pattern-matching characters:

  ?
  *
  [(left bracket)
  ] (right bracket)

  See "Matching Patterns" on page 4-23 for information about using these characters.

- If you are working in a c shell (**csh**) or a Bourne shell (**sh**) on your local system and want to copy multiple files from a local directory to a directory on a remote system, you can use shell pattern-matching characters in the path name of the source file.

Be sure to place a backslash immediately following the name of the remote system:

```
uucp out* hera\!~uucp/OF1
```

You can send files to the public directory on the remote system, as in the example, or to a specified directory. BNU creates the destination directory (OF1 in the example) if it does not already exist.

- While working in a c shell on your local system, you can also copy multiple files from a remote system to a local directory . Use one of the following forms:

  ```
  uucp zeus\!/u/amy/out'*' ~uucp
  ```

  or

  ```
  uucp "zeus\!/u/amy/out*" ~uucp
  ```

  In the first example, the pattern-matching character * in the path name of the source files is enclosed in single quotation marks. In the second example, the entire path name of the source files is enclosed in double quotation marks. In both examples, the multiple source files are copied to the public directory on the local system.

- Sending files to arbitrary destination names on other systems, or getting files from arbitrary source names on other systems, often fails because of security restrictions. Such failures will occur unless the files give read or write permission to the user and/or group, or to others.

  Note: When **uucp** transfers a file, it gives read and write permissions to that file to the owner, the group, and all others. To change these permissions, use the **chmod** command, discussed in *AIX Operating System Commands Reference.* Refer also to "Changing Permissions—The chmod (Change Mode) Command" on page 3-55, and to the discussion on permissions in *Managing the AIX Operating System.*

- You can use **uucp** to transfer your own protected files, as well as files in protected directories that you own.

The sections that follow discuss the procedures for local and and remote file transfers.

Local Transfers

In a local transfer, the BNU command **uucp** works almost exactly like **cp**, the AIX **copy** command. You can copy a file into another file in the same directory, or from one directory into another directory.

Note: See *AIX Operating System Commands Reference* for information about the **cp** command.

In order to use **uucp** to transfer files, you must know the path name of the source file (the original location in which the file is stored), as well as the destination name (the file or directory in which you want to place the copy of the file).

For information about BNU path names, refer to "Path Names Used with BNU Commands" on page 8-33.

Transferring a Single File Locally

Use the form **uucp** *source_file(s) destination_name.*

- Copy Within the Same Directory

  1. To copy the file `prog.b` into the file `prog.c`, which is located in same directory on your local system, type the following:

     ```
     uucp prog.b prog.c
     ```

  2. Press **Enter**.

     If the file `prog.c` does not exist, **uucp** creates it.

- Copy to Another Directory

  1. To copy the `jones` file into a new directory named `clients` on your local system, type the following:

     ```
     uucp /usr/bin/work/jones /usr/bin/clients
     ```

  2. Press **Enter**.

     The system creates the **clients** directory and then copies the `jones` file into it. The new path name of the `jones` file is `/usr/bin/clients/jones`.

Transferring Multiple Files Locally

Use the form **uucp** *source_file(s) destination_name.*

1. To copy several files at the same time from different directories on your local system to a new local destination, type the following:

   ```
   uucp listing /clients/smith /usr/sales/tom
   ```

2. Press **Enter**.

   In this case, the `listing` file is in the current working directory, and the `smith` file is in a directory called `/clients`. This command copies both files into an existing directory called `/usr/sales/tom`.

Remote Transfers

To transfer a file to a remote system, add the name of the remote system, with an exclamation point, to the path name of the target destination file that will receive the copy. Use the following form:

system_name!

In general, files transferred from a local to a remote system are placed in the public directory on the remote computer. The full name of this directory is **/usr/spool/uucppublic**, but you can use a tilde (~) and the name of the command (~**uucp**) as a short-hand way of specifying this directory.

Sending Files to a Remote System

You can send files to a remote system directly, or through one or more intermediate systems.

Sending Files Directly to a Remote System

Use the following form:

uucp [*options*] *source_file(s) system_name!destination_name*

1. To send a copy of your file called `/meteors` to the file `/solar/stats` in the public directory on the remote system `galaxy`, type the following at the prompt:

   ```
   uucp /meteors galaxy!~uucp/solar/stats
   ```

2. Press **Enter**.

   Remember that the `~uucp` entry preceding the name `/solar/stats` is a short-hand method of specifying the public directory. You can also enter the full destination path name:

   ```
   galaxy!/usr/spool/uucppublic/solar/stats
   ```

Sending Files through Intermediate Systems

Use the following form:

uucp [*options*] *source_file(s) system_name*!*destination_name*

To send files through intermediate systems, add the name of each remote system followed by an exclamation point, like this:

system_name!

1. To send a copy of /meteors to the file /solar/stats on system galaxy! by way of the intermediate system milkyway!, type the following:

   ```
   uucp /meteors milkyway!galaxy!~uucp/solar/stats
   ```

2. Press **Enter**.

   BNU routes the transfer from your system through system milkyway! and then to the public directory on system galaxy!.

Receiving Files from a Remote System

You can receive files directly from a remote system, or through one or more intermediate systems. This operation works only if **uucp** has write permission in the directory that receives the files.

Receiving Files from a Remote System

Use the following form:

uucp [*options*] *system_name*!*source_file(s) destination_name*

1. To request that **uucp** gets the file `/cells/type1` from system `biochem!` and stores it in a file called `/drmsg/research` on your local system, type:

   ```
   uucp biochem!/cells/type1 /drmsg/research
   ```

2. Press **Enter**.

For additional information about the **uucp** command, refer to *AIX Operating System Commands Reference* and *Managing the AIX Operating System*.

Another Method for Transferring and Handling Files (uuto, uupick)

In addition to the **uucp** command, BNU has another command that enables you to copy files from one AIX system to another AIX system. The **uuto** command actually uses **uucp** to transfer the specified file(s), but **uuto** makes the whole process easier for both the sender and the recipient.

The **uuto** command sends a specified file or files from one system to a specific user ID on another system. The command places the copied file(s) in the public directory on the recipient's computer, and the system notifies the recipient that a file has arrived.

Once the file is in the BNU public directory, the user issues the **uupick** command, which displays a message that file *name* has arrived from system *name*. The user then enters one of the **uupick** options for handling the file, such as deleting it or moving it to another directory.

Following is an overview of the way in which you can use the **uuto** and **uupick** commands to send and receive a file:

1. The sender issues the **uuto** command to copy one or more files to a specific user ID on another AIX system.

2. The **uucp** command then sends the file(s) to the BNU public directory, **/usr/spool/uucppublic**. In this case, **uucp** also creates (if it doesn't already exist) an additional directory called **receive**, plus the directory */user/system*. The full path name to the copied file is therefore

   `/usr/spool/uucppublic/receive/`*user_ID/system/file*

   The **rmail** command then notifies the recipient that a file (or files) has arrived.

3. The recipient issues the **uupick** command.

4. The **uupick** command searches the public directory for files sent to the recipient and notifies the recipient about each file it locates.

5. Using a series of **uupick** options, the recipient saves or deletes each file.

You can also use the **uuto** and **uupick** commands to transfer files to a specific ID within the local system. Again, **uuto** places the copied file(s) in the BNU public directory on the local system.

More information on **uuto** and **uupick** follows. Refer also to *AIX Operating System Commands Reference.*

Sending Files to a Specific ID (uuto)

The **uuto** command copies one or more source files from one AIX system to a specific user on another AIX system. The command stores the file in the public directory on the destination system until the specified user issues the **uupick** command to locate and handle the file.

Form of the uuto Command

The **uuto** command has the following form:

uuto [*options*] *file_name destination_name*

Options Used with the uuto Command

The following options, called flags in the command format, are available for use with the **uuto** command:

-m
-p

Mail Message to Sender (-m)

The **-m** flag notifies you, the sender, when the **uuto** command has successfully copied the source file(s) to the specified user ID on the specified system.

Copy File to Spool Directory (-p)

The **-p** flag sends the source file(s) to the spool directory on your local system before actually transferring the copy of the file(s) to the public directory on the specified system. Without this flag, **uuto** copies the source file(s) directly to **/usr/spool/uucppublic/receive/***user_ID/system /file(s).*

You must also type the name of the file you want to send to the specified user, and the path name to the destination of the file transfer.

Path Name of Source File (*file_name*)

The *file_name* entry is the path name of the source file. This may be a simple file name if the file you are sending is in the directory from which you are issuing the **uuto** command. Otherwise, give the complete path name of the file.

Path Name of Destination (*destination_name*)

The *destination_name* is the path name to the specific location to which you want to copy the source file. This path name *must* include the user identification of the person to whom you are sending the file. The *destination_name* has the following form:

system!user_ID

where *system* is the name of the remote computer. When copying a file from one location to another location on your local system, the *destination_name* can be simply the name of the user to whom you are sending the file.

Sending Files to a Specific User ID

Use the form **uuto** [*options*] *file_name destination_name.*

1. To send a file called `/usr/bin/data/private` to a user with the ID `monique` on remote system `venus`, type the following:

   ```
   uuto /usr/bin/data/private venus!monique
   ```

2. Press **Enter**.

   The **uuto** command copies the file and sends it to the public directory on system `venus`. The **rmail** command then sends user `monique` a mail message that the file has arrived. Monique issues the **uupick** command to locate and handle the transferred file.

   For more information about using **uupick**, see "Locating Files for a Specific ID (uupick)" on page 8-52.

Additional Information about the uuto Command

- If you use **uuto** for a transfer within the local system, omit the system name in the command format.

  Instead of typing `uuto /usr/research/file1 zeus!amy`, you can send this file to user `amy` by entering `uuto /usr/research/file1 amy`. This form works only if you and `amy` are both on system `zeus`. No mail message is sent to the recipient in a local transfer of this kind.

Locating Files for a Specific ID (uupick)

When **uuto** copies a file or files to your user ID, BNU places the file(s) in the public directory on your local system under the name **/usr/spool/uucppublic/receive/***user_ID/system /file(s)*, and **rmail** notifies you that the file has arrived.

When you receive this message, issue the **uupick** command to complete the transfer and handle the file(s).

Form of the uupick Command

Following is the form of the **uupick** command:

uupick

File-Handling Options Used with the uupick Command

As you can see from its form, **uupick** does not have command flags. It does, however, have options that enable you to handle the file(s) sent to you with **uuto**.

Following is a list of the **uupick** user options; notice that the option is *not* preceded by a hyphen:

asterisk (*)
new-line (carriage return)
a [*dir*]
d
m [*dir*]
p
q or **Ctrl-D**
!*command*

After notifying you that a file has been sent from *system*, the **uupick** command displays a question mark (?) as a prompt. This indicates that you can now enter one of the file-handling options.

Display Options (*)

Typing an asterisk following the **?** prompt instructs **uupick** to display all the file-handling options.

Next File (new-line)

Pressing the **Enter** key signals **uupick** to move on to the next file in the directory.

Move All Files (**a** [*dir*])

The **a** [*dir*] option enables you to move all your **uuto** files currently in the public directory into a specified directory on your local or a remote system. The default is your current directory (that is, the directory you were in when you issued the **uupick** command). You can use either a full path name or a relative path name to specify the directory.

Delete File (d)

The **d** option enables you to delete the specified file.

Move Specified File (**m** [*dir*])

The **m** [*dir*] option enables you to move a specified file to a specified directory. Again, the default is your current directory, and you may use either full or relative path names.

Display File (p)

The **p** option enables you to display ("print") the contents of the specified file on the screen of your workstation.

Quit uupick (**q** or **Ctrl-D**)

The **q** option enables you to leave the **uupick** command without actually doing anything about the file(s) in the public directory. You can also use the **Ctrl-D** key sequence to quit the command.

Run Specified Command (**!***command*)

The **!***command* option enables you to leave the **uupick** command and return to the AIX prompt to run a specified AIX command. After the command executes, the system automatically returns to **uupick** so you can continue handling the **uuto** files in the public directory.

Receiving and Handling Your Files

Use the **uupick** command and the appropriate user options to receive and handle the files sent by **uuto** to the public directory on your local system.

Receiving Your Files

Use the form **uupick**.

1. When you receive a mail message that a file has been sent to you from a certain system, enter **uupick** following the prompt on the command line.

   ```
   uupick
   ```

   When you receive the file, a message appears in this form:

   ```
   from system system_name: [file file_name]
   [dir directory_name]
   ?
   ```

   For example, if amy on system zeus sends you a file named info, you receive the following message:

   ```
   from system zeus: file info
   ?
   ```

2. Following the **?** prompt, enter a **uupick** user option indicating how you want to handle the file.

   Continue until you have taken care of all the files, or use either the **q** option or **Ctrl-D** to stop reviewing files.

- To display the list of **uupick** user options that are available for handling your file(s), type an asterisk (*) below the **?** prompt.

Options for Handling Your Files

Following are the options that you can use to handle the files sent to you with the **uuto** command. Remember that you can use these options only after you have issued the **uupick** command and the **?** prompt appears on your screen.

Option	Action
d	Delete the file.
m [*dir***]**	Move the file to directory *dir*. The default moves the file to the current directory.
a [*dir***]**	Move all files to directory *dir*. The default moves the files to the current directory.
p	Display the contents of the file on screen.
q (or Ctrl-D)	Quit without handling any files.
!*command*	Escape to the shell to run *command* and then return to **uupick**.
*****	Display all options.
new-line (carriage return)	Go to the next file.

Handling Your Files

1. Enter an asterisk (*) on the line below the **?** prompt for a list of options available to handle your files in the public directory:

   ```
   ?
   *
   ```

   The system displays the following:

   ```
   usage [d] [m dir] [a dir] [p] [q] [cntl d] [!cmd] [*]
   [new-line]
   ```

2. Enter the appropriate option, or use the **q** option or the **Ctrl-D** sequence to leave the **uupick** command.

Determining the Status of BNU Jobs

BNU has two commands that enable you to get information about the status of a particular operation: **uustat** and **uulog**.

The **uustat** command reports the status of various BNU operations, including the following:

- File transfers initiated with the **uucp** command (discussed in "Sending and Receiving Files (uucp)" on page 8-38)
- Commands invoked with the **uux** command that are running on designated systems (discussed in "Running Remote Commands (uux)" on page 8-30)
- Files copied with the **uuto** command (discussed in "Another Method for Transferring and Handling Files (uuto, uupick)" on page 8-48).

The system manager uses the **uulog** command to combine individual log files into a single main log file. The command also displays the contents of the log file, which contains information about activities performed by the **uucico** or **uuxqt** programs.

Note: You do not invoke **uucico** or **uuxqt** directly. Instead, you issue **uucp**, which then invokes **uucico**; or you issue **uux**, which invokes **uuxqt** For information about these programs, and about the **uulog** command, refer to *Managing the AIX Operating System.*

Getting Status Information about BNU Jobs (uustat)

The **uustat** command displays information about the progress of various jobs initiated with BNU commands. This command is particularly useful in monitoring file transfers requested with the **uucp** and **uuto** commands, and command executions requested with the **uux** command.

Note: Refer to "Sending and Receiving Files (uucp)" on page 8-38, "Another Method for Transferring and Handling Files (uuto,

uupick)" on page 8-48, and "Running Remote Commands (uux)" on page 8-30 and for information about these commands.

In addition, **uustat** gives you limited control over jobs that you have queued to run on a remote computer. Not only can you check the general status of BNU connections to other systems and the progress of BNU file transfers and command executions, but you can also use **uustat** to cancel copy requests invoked with the **uucp** command.

Form of the uustat Command

The **uustat** command has the following form:

uustat [*options*]

The status reports generated by **uustat** are displayed on your workstation screen in this basic form:

jobid date/time status system_name user_ID size file

Options Used with the uustat Command

You may enter **uustat** with one or more options, which are called flags in the command format. Following are some of the available flags, which are mutually exclusive:

-a
-k *jobid*
-m
-q
-r *jobid*

You can also use either or both of the following flags with **uustat**:

-n*user*
-s*file*

Display All Jobs in Queue (-a)

The **-a** flag instructs **uustat** to display information about all the jobs in the "holding" queue, regardless of the user who issued the original BNU command.

Note: For information about the BNU queues, refer to "Additional Information about the uustat Command" on page 8-62.

Cancel Job (-k *jobid*)

The **-k** *jobid* flag cancels ("kills") the BNU process specified by the *jobid*. This is useful, for example, when you want to cancel a file transfer or copy request, a remote printing job, and so on.

You can cancel a job only if you are the user who issued the original BNU command specified by the *jobid*. (A system administrator with superuser authority can also cancel BNU requests.)

Note: For additional information about canceling a BNU job, see the description of the **uustat** command in *AIX Operating System Commands Reference*.

Most Recent Attempt (-m)

The **-m** flag reports on the status of your most recent attempt to communicate with another computer through the BNU facility.

For example, the status is reported as SUCCESSFUL if the BNU request executed; if the job was not completed, BNU reports an error message, such as LOGIN FAILED.

Jobs Currently in Queue (-q)

The **-q** flag lists the jobs currently queued for each computer. These jobs are either waiting to execute, or in the process of executing. If a status file exists for the computer, BNU reports its date, time, and the status information. Once the process is completed, BNU removes the job listing from the current queue.

Rejuvenate Specified Job (-r *jobid*)

The -**r** *jobid* flag "rejuvenates" the BNU process specified by the job identification number. This flag enables you to mark files in the holding queue with the current date and time, thus ensuring that the cleanup operation does not delete these files until the job's modification time reaches the end of the allotted period.

Note: For information about the BNU queues, refer to "Additional Information about the uustat Command" on page 8-62. For information about cleaning up BNU queues, refer to the discussions of the **uucleanup** command in *AIX Operating System Commands Reference* and in *Managing the AIX Operating System.*

Jobs on Specified System (-s*system*)

The -s*system* flag reports the status of all BNU requests that users have entered to run on the computer specified by the *system* entry.

Jobs Requested by Specified User (-u*user_ID*)

The -u*user_ID* flag reports the status of all BNU requests that have been entered to run by the user specified in the *user_ID* entry.

Note: You can use both the -s*system* and the -u*user_ID* flags with the **uustat** command to get a status report on all BNU requests entered by a specified user on a specified system.

For detailed information about the options available with the **uustat** command, refer to *AIX Operating System Commands Reference.*

Determining the General Status of BNU Jobs

Use the form **uustat** [*options*].

- All Jobs in the Holding Queue

  1. To display the status of all BNU jobs in the holding queue, type the following after the prompt:

     ```
     uustat -a
     ```

  2. Press **Enter**.

     Refer to "Additional Information about the uustat Command" on page 8-62 for a sample of the output generated by this command.

- All Jobs in the Current Queue

  1. To report the status of all the BNU jobs either currently executing or queued to run on each system, type the following:

     ```
     uustat -q
     ```

  2. Press **Enter**.

     Sample output for this example is shown in "Additional Information about the uustat Command" on page 8-62.

Determining the Status of Specific Jobs

Use the form **uustat** [*options*].

- All Jobs in Holding Queue for Specified System

  1. To report the status of all jobs in the holding queue for a specified system, enter the following, including the *system* name:

     ```
     uustat -s venus
     ```

  2. Press **Enter**.

     See "Additional Information about the uustat Command" for the sample output for this command.

- All Jobs Requested by Specific User

  1. To report the status of jobs requested by a specified user, enter the following, including the *user_ID*:

     ```
     uustat -u amy
     ```

  2. Press **Enter**.

     Sample output for this example is shown in "Additional Information about the uustat Command."

Additional Information about the uustat Command

- The **uustat** command produces information about the status of various requests that users have issued with one of the BNU commands. The type of information that **uustat** displays depends on the flag you enter with it.

  Because the **-q** and **-a** flags produce different types of listings, this chapter distinguishes between the two types of information by referring to the output of the **uustat -q** command as the

"current" queue, and the output of the **uustat -a** command as the "holding"queue.

The current queue lists the BNU jobs either queued to run or currently executing on one or more remote systems. The holding queue lists all jobs that have not executed during a set period of time.

Note: After the set time period has elapsed, the entries in the holding queue are deleted either manually, with the BNU **uucleanup** command, or automatically, with the file **/usr/spool/cron/crontabs/uucp**, which is started by the daemon **/etc/cron**. For detailed information about cleaning up BNU queues, refer to the discussions of the **uucleanup** command in *AIX Operating System Commands Reference* and *Managing the AIX Operating System.*

- When you enter the **uustat -a** command to examine the status of all BNU jobs in the holding queue, the system displays the following type of output:

```
heraC3113   11/06-17:47 S hera   amy 289   D.venus471afd8
zeusN3130   11/06-09:14 R zeus   geo 338   D.venus471bc0a
merlinC3120 11/05-16:02 S merlin amy 828   /u/amy/tt
merlinC3119 11/05-12:32 S merlin msg rmail amy
```

The first field is the job ID of the operation, which is followed in the second field by the date and time that the BNU command was issued. The third field is either an S or an R, depending on whether the job is to send or receive a file.

The fourth field is the name of the system on which the command was entered, followed by the *user_ID* of the person who issued the command in the fifth field.

The sixth field is the size of the file, or, in the case of a remote execution like the last entry in the example, the name of the remote command. When the size is given, as in the first three lines of the example output, the file name is also displayed.

The file name can be either the name given by the user, as in the `/u/amy/tt` entry, or a name that BNU assigns internally to

data files associated with remote executions, such as D.venus471afd8.

- When you issue the **uustat -q** command to report the status of all the BNU jobs either currently executing or queued to run on each computer, the system displays the following type of output:

```
merlin   2C       09/12-09:14   SUCCESSFUL
hera     4C       09/12-10:02   NO DEVICES AVAILABLE
zeus     1C  (2)  09/12-10:12   CAN'T ACCESS DEVICE
```

  This output tells how many command (**C.**) files are waiting for each system. The date and time refer to the last time BNU tried to communicate with that system, and the message at the end of the line reports the status of each interaction. The number in parentheses (2) in the third line of this example indicates that the file has been in the queue for two days.

- When you enter the **uustat -s***system* command, BNU displays the following type of output for the specified system:

```
arthurC3114 11/06-16:50 S arthur  daemon 427 D.venus471994d
arthurN3219 11/05-10:12 S arthur  msg    278 D.hera471eac5
```

- The **uustat -u***user_ID* command produces output similar to that produced by the **-s** flag.

- The **-k** *jobid* flag cancels a process *only* when that job is still on the local computer. Once the BNU facility has moved the request to a remote computer for execution, you cannot use this flag to kill the remote job.

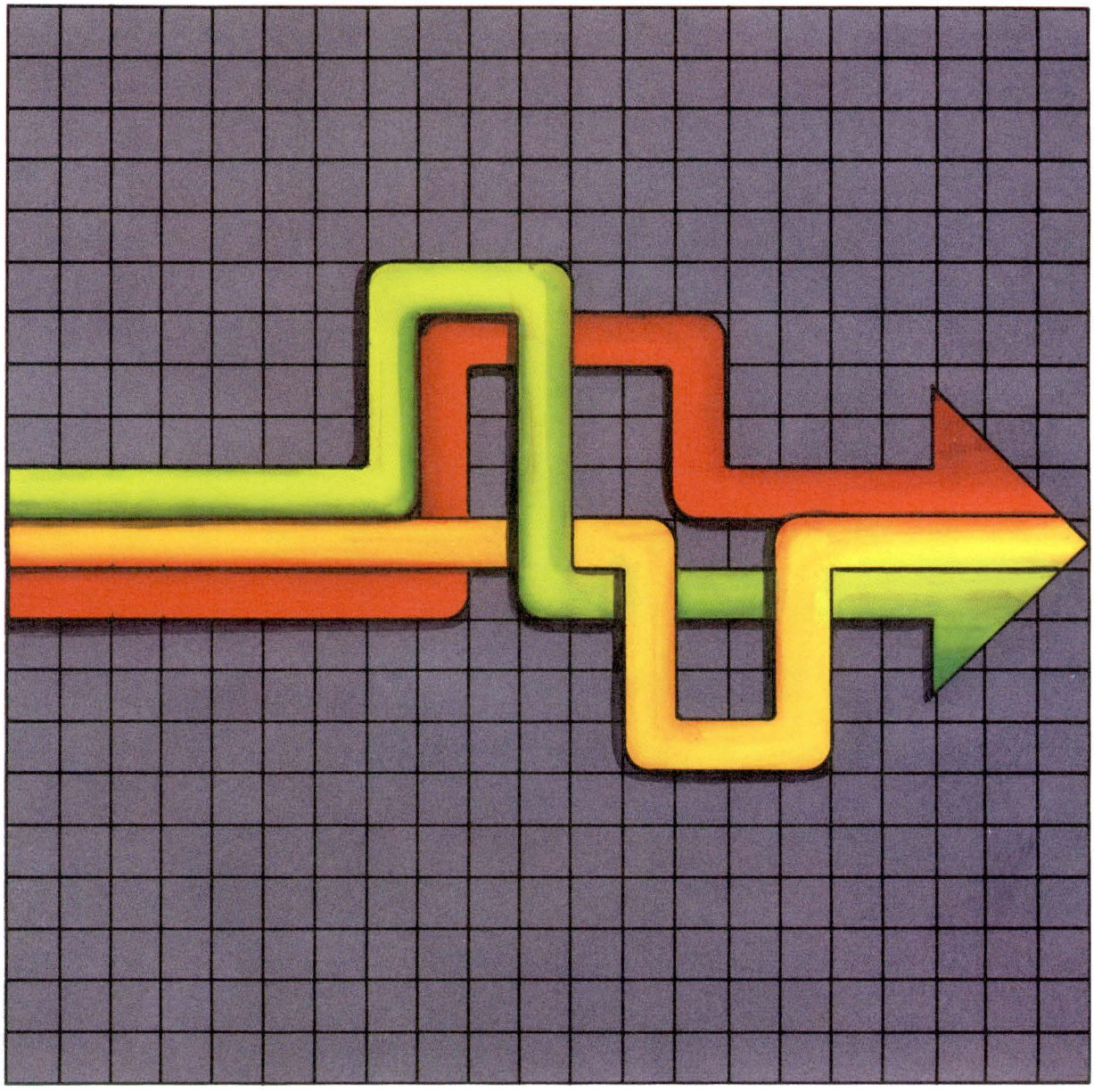
- Issuing **uustat** without any flags displays the status information for your personal BNU jobs (that is, for all the BNU commands that you have issued since the last time the holding queue was cleaned up).

- In a status report, a number in parentheses next to the number of a command file (a **C.** file) or an execute file (an **X.** file) represents the age in days of the oldest **C.** or **X.** file for that system.

The "retry" field indicates how many times the local system has tried to communicate with a specified remote system since the last successful BNU connection.

For more information about the **uustat** command, refer to *AIX Operating System Commands Reference* and *Managing the AIX Operating System.*

Chapter 9. Using the Interface Program for use with TCP/IP



CONTENTS

About This Chapter

This chapter shows you how to use a network, such as Ethernet or Token-Ring, to communicate from one RT workstation to another, or from an RT workstation to another system. You do this with the Interface Program for use with TCP/IP (Transmission Control Protocol/Internet Protocol).

TCP/IP, which is provided with AIX, must be installed as a separate facility. The hardware and software needed for the network must also be installed, if not done previously.

If you need information about either of these procedures, see *Installing and Customizing the AIX Operating System* and *Interface Program for use with TCP/IP.*

Before You Begin

If your system has not been customized for the network, follow the instructions in Appendix A of the manual *Interface Program for use with TCP/IP* after the installation of TCP/IP and the network is complete.

Customizing the system for the network includes the following tasks:

- Using the **devices** command to add the network device (including terminals), configure ports for TELNET (the protocol that opens the connection to the system), and record the correct interrupt level
- Modifying several files
- Defining routes, if needed, using the **route** command.

Overview of TCP/IP

TCP/IP provides the commands you need to perform the following tasks:

- Transfer files between two RT systems, or between an RT system and another system
- Log in remotely to another RT system or to another system.

This chapter discusses a few of the basic commands you need to perform the tasks listed above. For more information on commands, file formats, and network management tasks that are not discussed here, see *Interface Program for use with TCP/IP* and *Managing the AIX Operating System.*

Requesting Information about Remote Systems (ping)

To determine the status of the network and various remote systems, use the **ping** command.

One useful form of the **ping** command is the following:

ping -s *system_name*

The *system_name* entry is the name of the remote system. The **ping -s** form of the command displays a message like the following that tells you the remote system is on the network and functional:

```
Ping system_name:      128.142.31.111 responding
```

There are additional options available that are of interest to system programmers and network managers. See *Interface Program for use with TCP/IP*.

Transferring Files (ftp)

You can transfer files between two RTs, or between an RT and another type of system, with the **ftp** command. This transfer operation includes the following steps:

1. The **ftp** command makes a connection to the other system.
2. Once the connection is made, you issue subcommands that instruct the system to transfer the file or files.

   See "Subcommands for ftp" on page 9-8 for information about these subcommands.

The **ftp** command has the following basic form:

ftp *system_name*

The **ftp** command makes a connection to another system so files can be transferred. This is the interface to the File Transfer Protocol (FTP).

The *system_name* entry is the name of the system you want to reach. This may be another RT, or another type of system to which you have a connection. (A remote system is sometimes called the host computer.) If you do not specify a *system_name* on the command line, you must use the **open** subcommand inside the **ftp** program to make a connection with a remote system.

When you see the `ftp>` prompt, give the subcommands that you need to make the file transfer.

The **ftp** command has flags that can be specified on the command line for more complex operations. For full details on those flags and the **ftp** subcommands, see *Interface Program for use with TCP/IP*.

Note: Remember that the word "enter" in an example means to type the indicated entry and then press the **Enter** key.

Making the ftp Connection

1. Enter **ftp** *system_name* after the $ on the command line. If you want to reach a system named host2, enter:

   ```
   ftp host2
   ```

   When the connection is made, the system displays the following:

   ```
   Connected to host2.
   ```

   and prompts for a login name:

   Name(host2:*local user_name*)

2. To log into the remote system with your local system name, press **Enter**. For example, if you used smith on the local system, press **Enter** when you see the following:

   ```
   Name(host2:smith)
   ```

   To log into the remote system with a different user name, type the name after the displayed information and press **Enter**. To log in as sam, add the name as shown:

   ```
   Name(host2:smith) sam
   ```

3. When prompted, type a valid password and press **Enter**. The prompt for the previous example is:

   ```
   Password(host2:sam)
   ```

4. The prompt changes to ftp>. You now can enter any **ftp** subcommand. See the list of subcommands and the steps for transferring files that follow.

Subcommands for ftp

The following **ftp** subcommands let you transfer files and perform related tasks, such as changing the type of file transfer, displaying information, and changing directory and file names. For more information on the **ftp** command itself, refer to the *Interface Program for use with TCP/IP.*

![*command* **[***parameters***]]**
Invokes an interactive shell on the local host. An optional command, with one or more optional parameters, can be given with the shell command.

$ *macroname* **[***parameters***]**
Executes the specified macro, previously defined with the **macdef** command. Parameters are not expanded. See the **macdef** subcommand for further information.

? [*subcommand***]**
Displays a message describing the subcommand. If you do not specify *subcommand*, **ftp** displays a list of known subcommands.

account [*password***]**
Sends a supplemental password that a remote host other than an RT system may require before granting access to its resources. If the password is not supplied with the command, the user is prompted for the password. The password does not appear on the screen.

append *localfile* **[***remotefile***]**
Appends a local file to a file on the remote host. If the remote file name is not specified, the local file name is used, altered by any setting made with the **ntrans** or **nmap** subcommand. **append** uses the current values for **form**, **mode**, **struct**, and **type** while appending the file. For more information on each of these subcommands, see their individual descriptions, which follow.

ascii Sets the file transfer type to network ASCII. This is the default. File transfer may be more efficient with binary-image transfer. Refer to the **binary** subcommand description.

bell Sounds a bell after the completion of each file transfer.

binary Sets the file transfer type to binary image. This can be more efficient than an ASCII transfer.

bye Ends the File Transfer session and exits **ftp**. Same as **quit**.

case Sets a toggle for the case of file names. When **case** is on, remote file names are changed from uppercase to lowercase when written in the local directory. The default is off (uppercase remote file names are written in uppercase in the local directory).

cd *remotedirectory*
Changes the working directory on the remote host to the specified directory.

cdup Changes the working directory on the remote host to the parent of the current directory.

close Ends the File Transfer session, but does not exit **ftp**. Defined macros are erased. Same as **disconnect**.

cr Strips the carriage return character from a carriage return/linefeed sequence when receiving records during ASCII-type file transfers. (**ftp** terminates each ASCII-type record with a carriage return/linefeed during file transfers.) This conforms with the AIX single linefeed record delimiter. Records on non-AIX remote hosts may have single linefeeds imbedded in records. To distinguish these imbedded linefeeds from record delimiters, set **cr** to off. **cr** toggles between on and off.

delete *remotefile*
Deletes the specified remote file.

debug [on | off]
Prints each command sent to the remote host, preceded by the string `-->` when **debug on** is specified. Use the **debug off** subcommand to stop the debug record keeping.

dir [*remotedirectory***][***localfile***]**
Writes a listing of the contents of the *remotedirectory* to the file *localfile*. If *directory* is not specified, **dir** lists the contents of the current remote directory. If *localfile* is not specified or is `-`, **dir** displays the listing on the local terminal.

disconnect See **close**.

form *format* Specifies the form of the file transfer. The only form available is `file`.

get *remotefile* **[***localfile***]**
Copies the remote file to the local host. If *localfile* is not specified, the remote file name is used locally and is altered by any settings made by the **case**, **ntrans**, and **nmap** subcommands. **ftp** uses the current settings for **type**, **form**, **mode**, and **struct** while transferring the file. For additional information, refer to the description of each of these subcommands.

glob Toggles file name expansion (globbing) for **mdelete**, **mget**, and **mput**. If globbing is off, file name parameters for these subcommands are not expanded. Globbing for **mput** is done locally in the same way as for the **csh** command. For **mdelete** and **mget**, each file name is expanded separately at the remote machine and the lists are not merged. The expansion of a directory name may be different than the expansion of a file name, depending on the remote host and the **ftp** server. To preview the

expansion of a directory name, use the **mls** subcommand:

```
mls remotefilename -
```

To transfer an entire directory subtree of files, transfer a **tar** archive of the subtree in binary form, rather than using **mget** or **mput**.

hash Toggles hash sign (#) printing. When **hash** is on, **ftp** displays one hash sign for each data block (1024 bytes) transferred.

help [*subcommand***]**
Displays help information. Refer to the **?** subcommand.

lcd [*directory***]** Changes the working directory on the local host. If you do not specify a directory, **ftp** uses your home directory.

ls [*remotedirectory***] [***localfile***]**
Writes an abbreviated file listing of a remote directory to a local file. If *remotedirectory* is not specified, **ftp** lists the current remote directory. If *localfile* is not specified or is **-**, **ftp** displays the listing on the local terminal.

macdef *macroname*
Defines a subcommand macro. Subsequent lines up to a null line (two consecutive linefeeds) are saved as the text of the macro. Up to 16 macros containing at most 4096 characters for all macros can be defined. Macros remain defined until redefined or a **close** is executed.

$ and \ are special characters in **ftp** macros. A $ followed by one or more numbers is replaced by the corresponding macro parameter on the invocation line (refer to the **$** subcommand). A $ followed by an `i` indicates that the macro is to loop, with `$i` being replaced by consecutive parameters on each

pass. The first macro parameter is used on the first pass, the second parameter is used on the second pass, and so on. A \ prevents special treatment of the next character. Use the \ to turn off the special meanings of $ and \.

mdelete *remotefiles*
Expands *remotefiles* at the foreign host and deletes the indicated remote files.

mdir [*remotedirectories localfile***]**
Expands *remotedirectories* at the foreign host and writes a listing of the contents of the *remotedirectories* to the *localfile*. If the *remotedirectories* parameter contains a pattern-matching character, **mdir** prompts for a *localfile* if none is specified. If the *remotedirectories* parameter is a list of remote directories, separated by blanks, the last argument in the list must be either a local file name or a -. If *localfile* is **-**, **mdir** displays the listing on the local terminal. If interactive prompting is on (refer to the **prompt** subcommand), **ftp** prompts the user to verify that the last parameter is a local file and not a remote directory.

mget *remotefiles*
Expands *remotefiles* at the foreign host and copies the indicated remote files to the current directory on the local host. Refer to the **glob** subcommand for more information on file name expansion. The remote file names are used locally and are altered by any settings made by the **case**, **ntrans**, and **nmap** subcommands. **ftp** uses the current settings for **type**, **form**, **mode**, and **structure** while transferring the files. Refer to the description of each of these subcommands for additional information.

mkdir [*remotedirectory***]**
Creates the directory *remotedirectory* on the foreign host.

mls [*remotedirectories localfile*]
Expands *remotedirectories* at the foreign host and writes an abbreviated file listing of the indicated remote directories to a local file. If the *remotedirectories* parameter contains a pattern-matching character, **mls** prompts for a *localfile* if none is specified. If the *remotedirectories* parameter is a list of remote directories, separated by blanks, the last argument in the list must be either a local file name or a -. If *localfile* is -, **mls** displays the listing on the local terminal. If interactive prompting is on (refer to the **prompt** subcommand), **ftp** prompts the user to verify that the last parameter is a local file and not a remote directory.

mode [*modename*]
Sets file transfer mode. The only mode available is **stream**.

mput [*localfiles*]
Expands *localfiles* at the local host and copies the indicated local files to the foreign host. Refer to the **glob** subcommand for more information on file name expansion. The local file names are used at the foreign host and are altered by any settings made by the **ntrans** and **nmap** subcommands. **ftp** uses the current settings for **type**, **form**, **mode**, and **structure** while transferring the files. Refer to the description of each subcommand for additional information.

nmap [*inpattern outpattern*]
Sets or unsets the file name mapping mechanism. If no parameters are specified, file name mapping is turned off. If parameters are specified, source file names are mapped for **mget** and **mput** operations and for **get** and **put** operations when the destination file name is not specified. This subcommand is useful when the local and foreign hosts use different file-naming conventions or

practices. Mapping follows the pattern set by *inpattern* and *outpattern*.

inpattern is the template for incoming file names, which may have already been processed according to the **case** and **ntrans** settings. The template variables $1 through $9 can be included in *inpattern*. All characters in *inpattern* other than $ and protected $s (that is, \$) define the values of the template variables. For example, if the *inpattern* is `$1.$2` and the remote file name is `mydata.dat`, the value of $1 is `mydata` and the value of $2 is `dat`.

outpattern determines the resulting file name. The variables $1 through $9 are replaced by their values as derived from *inpattern* and the variable $0 is replaced by the original file name. Additionally, the sequence [*seq1*,*seq2*] is replaced by the value of *seq1* if *seq1* is not null; otherwise, it is replaced by the value of *seq2*. For example, the subcommand:

```
nmap $1.$2.$3 [$1,$2].[$2,file]
```

would yield `myfile.data` from `myfile.data` or `myfile.data.old`, `myfile.file` from `myfile`, and `myfile.myfile` from `.myfile`. Spaces can be included in *outpattern*, as in: `nmap |sed "s/*$//" > $1`. Use the backslash (\) character to prevent the special meanings of $, [,], and , in *outpattern*.

ntrans [*inchars* **[***outchars***]]**

Sets or unsets the file name character translation mechanism. If no parameters are specified, character translation is turned off. If parameters are specified, characters in source file names are translated for *mget* and *mput* operations and for *get* and *put* operations when the destination file name is not specified. This subcommand is useful when the local and foreign hosts use different file naming conventions or practices. Character translation follows the pattern set by *inchars* and *outchars*. Characters in a source file name matching

characters in *inchars* are replaced by the corresponding characters in *outchars*. If the string *inchars* is longer than the string *outchars*, characters in *inchars* are deleted if they have no corresponding character in *outchars*.

open *host* [*port*]
Establishes a connection to the FTP server at the specified *host*. If the optional port number is specified, **ftp** will attempt to connect to a server at that port. If the auto-login feature is set (that is, `-n` was not specified on the command line), **ftp** will attempt to automatically log the user in to the FTP server.

prompt Toggles interactive prompting. If interactive prompting is on (the default), **ftp** will prompt for verification before retrieving, sending, or deleting multiple files during **mget**, **mput**, and **mdelete** operations. Otherwise, **ftp** will act accordingly on all files specified.

proxy [*subcommand*]
Executes an **ftp** command on a secondary control connection. This subcommand allows **ftp** to simultaneously connect to two remote FTP servers for transferring files between the two servers. The first **proxy** subcommand should be an **open** to establish the secondary control connection. Enter the subcommand `proxy ?` to see the other **ftp** subcommands that are executable on the secondary connection. The following subcommands behave differently when prefaced by **proxy**:

- **open** will not define new macros during the auto-login process.
- **close** will not erase existing macro definitions.
- **get** and **mget** transfer files from the host on the primary connection to the host on the secondary connection.

- **put**, **mput**, and **append** transfer files from the host on the secondary connection to the host on the primary connection.

File transfers require that the FTP server on the secondary connection must support the PASV (passive) instruction.

put *localfile* **[***remotefile***]**
Stores a local file on the remote host. If you do not specify *remotefile*, **ftp** uses the local file name to name the remote file, and the remote file name is altered by any settings made by the **ntrans** and **nmap** subcommands. **ftp** uses the current settings for **type**, **form**, **mode**, and **structure** while transferring the files. Refer to the description of each subcommand for additional information.

pwd Displays the name of the current directory on the foreign host.

quit Ends the file transfer session and exits **ftp**. A synonym for **bye**.

quote *string* Sends the specified *string* verbatim to the foreign host. Quoting commands that involve data transfers can produce unpredictable results.

recv *remotefile* **[***localfile***]**
Copies the remote file to the local host. A synonym for **get**.

remotehelp [*subcommand***]**
Requests help from the remote FTP server.

rename *source destination*
Renames a file on the foreign host.

reset Clears the reply queue. This command resynchronizes the command/reply sequencing between the local **ftp** process and the remote FTP server. **reset** can be used to resynchronize when a

remote server violates the FTP command/reply rules.

rmdir *remotedirectory*
Removes the directory *remotedirectory* at the foreign host.

runique Toggles creating unique file names for local destination files during **get** and **mget** operations. If unique local file names is off (the default), **ftp** overwrites local files. Otherwise, if a local file has the same name as specified for a local destination file, **ftp** modifies the specified name of the local destination file with `.1`. If a local file is already using the new name, **ftp** appends the postfix `.2` to the specified name. If a local file is already using this second name, **ftp** continues incrementing the postfix until it either finds a unique file name or reaches `.99` without finding a unique name. If **ftp** cannot find a unique name, **ftp** reports an error and the transfer does not take place. Note that **runique** does not affect local file names generated from a shell command.

send *localfile* **[***remotefile***]**
Stores a local file on the remote host. A synonym for **put**.

sendport Toggles the use of FTP PORT instructions. By default, **ftp** uses a PORT instruction when establishing a connection for each data transfer. When the use of PORT instructions is disabled, **ftp** does not use PORT instructions for data transfers. The PORT instruction is useful when dealing with FTP servers that ignore PORT instructions while incorrectly indicating they have been accepted.

status Displays current status of **ftp**.

struct [*structure***]**
Sets data transfer structure type. The only structure supported is `stream`.

sunique Toggles creating unique file names for remote destination files during **put** and **mput** operations. If unique remote file names is off (the default), **ftp** overwrites remote files. Otherwise, if a remote file has the same name as specified for a remote destination file, the remote FTP server modifies the name of the remote destination file. Note that the remote server must support the STOU instruction.

tenex Sets the file transfer type to that needed for TENEX machines.

type [*typename*]
Sets the file transfer **type** to *typename*. If *typename* is not specified, the current type is printed. The default type is network ASCII; the type **binary** can be more efficient.

user *username* [*password*] [*account*]
Identifies the local user as *username* to the remote FTP server. If *password* or *account* is not specified and the remote server requires it, **ftp** prompts for it locally. If *account* is required, **ftp** sends it to the remote server after the remote login process completes. Note that, unless auto-login is disabled by specifying `-n` on the command line, this process is done automatically for the initial connection to the remote server.

verbose Toggles verbose mode. When verbose mode is on (the default), **ftp** displays all responses from the remote FTP server. Additionally, **ftp** displays statistics on all file transfers when the transfers complete.

Using ftp Subcommands

When the `ftp>` prompt appears, you are logged in to the remote system and can transfer files or do other tasks related to file transfer.

1. Type the subcommand for file transfer or a related task, adding any required file or path name. Then press **Enter**.
2. Continue entering subcommands until all the work is finished.

   One possible sequence is given in the next quick reference box.
3. To exit **ftp**, enter the **quit** subcommand.

   ```
   quit
   ```

Before you transfer any files, you may want to issue other subcommands. The example in the quick reference box that follows shows a typical sequence that changes the type of file transfer from the default (ASCII), and puts a file into a specific directory on the remote system.

Sample Sequence for File Transfer

1. Change the file transfer type to binary by entering:

   ```
   binary
   ```

2. Check to see which working directory you are in on the remote system by entering the **pwd** command.

   ```
   pwd
   ```

3. Change the remote working directory by entering the **cd** subcommand. For example, to change to the `projects` directory, enter the following:

   ```
   cd projects
   ```

4. Transfer one file from the local to the remote system by entering the **put** subcommand. For example, to transfer the `/blue` file to `/u/sam/blue`, you would enter the following:

   ```
   put /blue /u/sam/blue
   ```

File names must follow the conventions used by the **sh** command.

For more information about transferring files, consult *Interface Program for use with TCP/IP.*

Using a Remote Login (telnet)

You can log into another system with which you have a connection using the **telnet** command. The **telnet** command implements the TELNET protocol, which opens a connection to the system.

Using a remote login consists of using the following:

1. The **telnet** command, which logs into a remote system.
2. Subcommands, which you enter to manage the remote session.

Defining the Local and the Remote Consoles

If you plan to communicate from an RT console at your local system to another RT console at the remote system, skip this section. You are now ready to give the **telnet** command.

If you want to communicate with a system that does not have an RT console, you must define the local and the remote console in a language that both understand:

1. Change the environment variable **EMULATE** by entering `EMULATE=`*value*`;export EMULATE` after the system prompt.

   If **EMULATE** = `vt100`, the **telnet** program emulates a DEC VT100 terminal. If **EMULATE** = `3270`, the **telnet** program emulates a 3270 terminal. If **EMULATE** = `none`, is not defined, or has a value other than `vt100` or `3270`, you see an RT display.

2. If **EMULATE** = `vt100` or e sure the value of **TERM** in the remote login connection also is `vt100`.

   You can check this by using the **env** command after the connection is open, and change it by entering `TERM=vt100` following the system prompt.

You are now ready to give the **telnet** command.

The **telnet** command has the following basic form:

telnet *system_name*

The command provides an interface to the TELNET protocol so you can log on to the system you specify.

The *system_name* entry is the name of the system where you want to log in. If you omit the system name (sometimes called a host), you can use the **open** subcommand to create a connection after you enter the **telnet** program.

Logging Into and Using a Remote System

1. Type **telnet** or **telnet** *system_name* after the prompt on the command line. If you do not specify a remote system on the command line, you can use the **open** subcommand, explained in the following list of subcommands.

   For example, to enter **telnet** and open a connection to *syst2*, enter:

   ```
   telnet syst2
   ```

   When the command is accepted, several lines of message text appear on the display, ending with the login prompt.

2. When prompted, type your login name and press **Enter**.

3. When prompted again, type your password and press **Enter**.

   When the system prompt appears, you are logged in to the remote system and can transmit text or do related tasks, using the **telnet** subcommands.

4. Type the text you want to send.

   If you want to receive status or help information, or perform some related task, use the correct subcommand, as listed in the following section. Before entering each subcommand, press **Ctrl-t**.

5. To close the connection and exit from the program, use **Ctrl-t**, and then enter the letter `q`. If you are at the `telnet>` prompt, you can also press **Ctrl-d** to close the connection and exit.

Subcommands for telnet

The following list is a subset of the **telnet** subcommands. For a complete list, refer to *Interface Program for use with TCP/IP.*

Before entering each subcommand, type **Ctrl-t**. **Ctrl-t** is an escape sequence that tells the program that non-text information follows. Otherwise, the program would interpret subcommands as text.

For each of the subcommands, you only need to type enough letters to uniquely identify the command. (For example, **q** is sufficient for the **quit** command.)

? [*command***]** Requests help on **telnet**. Without arguments, **telnet** prints a help summary. If a *command* is specified, **telnet** prints help information for just that command.

close Closes the TELNET connection and returns to **telnet** command mode.

display [*argument***]**
Displays all of the **set** and **toggle** values if no *argument* is specified; otherwise, lists only those values that match *argument.*

emulate *terminaltype*
Overrides terminal type negotiation with the specified *terminaltype.* Possible choices are:

? Prints help information.

3270 Emulates a 3270 terminal.

none Specifies no emulation.

vt100 Emulates a DEC VT100 terminal.

All output received from the remote host is processed by the specified emulator. The initial terminal type to emulate can be specified through

the **EMULATE** environment variable or the **-e** flag to the **telnet** command.

mode *type* — Specifies the current input mode. When *type* is **line**, the mode is line-by-line. When *type* is **character**, the mode is character-at-a-time. Permission is requested from the remote host before entering the requested mode, and if the remote host supports it, the new mode is entered.

open *host* [*port*] — Opens a connection to the specified *host*. The host specification can be either a host name or an Internet address in dotted decimal form. If no *port* is given, **telnet** attempts to contact a TELNET server at the default port.

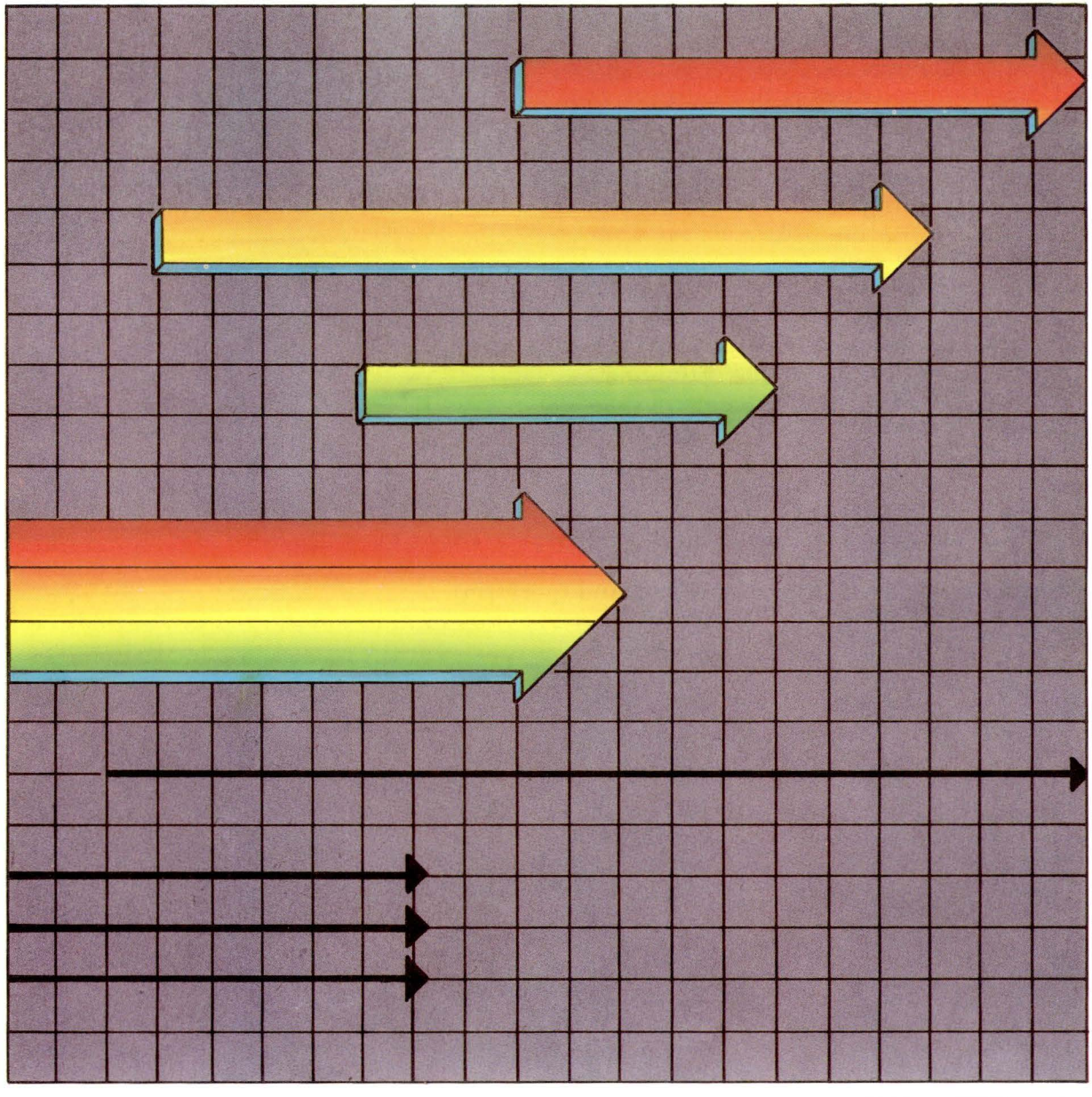
quit — Closes a TELNET connection and exits the **telnet** program. A **Ctrl-d** in command mode also closes the connection and exits.

status — Shows the status of **telnet**, including the current mode and the currently connected remote host.

z — Opens a shell on the local host. The shell started is the one specified by the **SHELL** environment variable. When the shell is exited using the local **end-of-file** sequence (**Ctrl-d** by default), **telnet** returns to the remote session.

The **telnet** command also has three additional subcommands, **send**, **set**, and **toggle**, which are described in *Interface Program for use with TCP/IP*.

Chapter 10. Using Asynchronous Terminal Emulation (ATE)



CONTENTS

About This Chapter

This chapter explains the procedures you follow to communicate between an RT PC and a remote computer system using Asynchronous Terminal Emulation (ATE).

The ATE facility must be configured and customized for your particular site before you can use it for remote communications. Included in this chapter is an overview of the prerequisite tasks so you can check to be sure the system is ready to use.

Note: Although customization and configuration are prerequisites for using ATE, some tasks, like giving port commands, require superuser authority, and others require some data processing experience. Refer to *Managing the AIX Operating System* for a detailed discussion about customizing ATE, and for information about configuring ports.

To install ATE, use the ATE diskette that comes with AIX. For more information, see *Installing and Customizing the AIX Operating System.*

Overview of Asynchronous Terminal Emulation (ATE) Tasks

Before you can use ATE, you must learn the basic ATE tasks and understand the commands on the main menus that perform these tasks.

You perform the tasks described in this chapter to establish a connection and log on to a terminal on another system (such as a data base service). You can then give commands, use files, and run programs on that system. Figure 10-1 illustrates the basic setup of the ATE type of communication, in which the RT PC emulates a remote terminal.

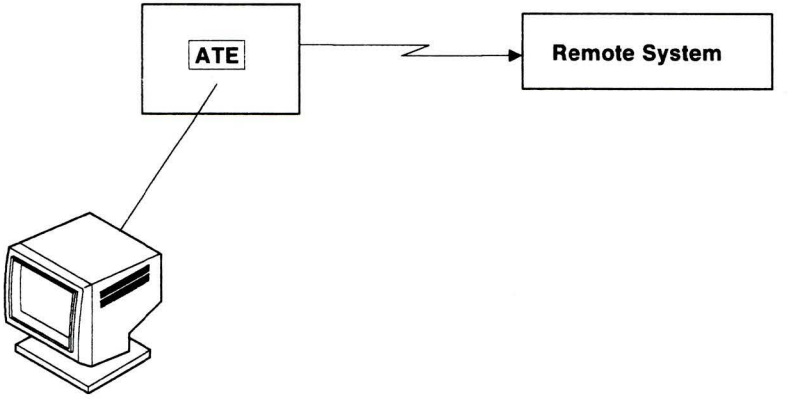


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Figure 10-1. Basic Setup of ATE Communications

From the Unconnected Main Menu, which appears when you start the ATE program, you can establish a connection to another terminal in two different ways:

- Make a direct connection.
- Use a dialing directory and make a telephone connection.

You can also check to be sure the settings for your local system and for the connection are correct, and change the settings for the current session, if necessary.

Tasks related to establishing a connection and changing settings are described in "Unconnected Main Menu" on page 10-6.

Once a connection is made, you can display the Connected Main Menu and select commands to perform the following operations:

- Send a file.
- Receive a file.
- Interrupt a session with a break signal.
- Terminate a connection.

These tasks are described in "Connected Main Menu" on page 10-7.

As you perform the above tasks, you may need to perform one of the following operations:

- Get help.
- Enter an operating system command.
- Leave (quit) ATE.

These last three tasks start from commands found on both of the main menus.

The following pages provide an overview of the main menus, and discuss how to use menus and control keys.

Unconnected Main Menu

The Unconnected Main Menu, shown in Figure 10-2, displays any time you use the **ate** command, provided that Asynchronous Terminal Emulation is installed.

```
Node: Evelyn            UNCONNECTED MAIN MENU

     COMMAND        DESCRIPTION

     Connect        Make a connection
     Directory      Display a dialing directory

     Help           Get help and instructions
     Modify         Modify local settings
     Alter          Alter connection settings
     Perform        Perform an Operating System Command
     Quit           Quit the program

     The following keys may be used during a connection:
         ctrl b  start or stop recording display output
         ctrl v  display main menu to issue a command
     Use ctrl r  to return to a previous screen at any time

Type the first letter of the command and press Enter.
>
```

OL157005

Figure 10-2. Unconnected Main Menu

With the Unconnected Main Menu you can perform the following tasks:

- Make an asynchronous connection to a remote computer.
- Display and use a phone directory to make a connection.
- Request help information.
- Request the Modify Menu to change variables that pertain to your local terminal (for the current session).

- Request the Alter Menu to change variables that affect data transmission (for the current session).
- Run an operating system command (some, like port commands, require superuser authority).
- Stop using Asynchronous Terminal Emulation.

To view the Connected Main Menu, give the **connect** command from the Unconnected Main Menu. Then use the **Ctrl-V** control key.

Connected Main Menu

The Connected Main Menu, shown in Figure 10-3, contains the commands you need to transmit files.

```
Node: Evelyn              CONNECTED MAIN MENU

     COMMAND        DESCRIPTION

     Send           Send a file over the current connection
     Receive        Receive a file over the current connection
     Break          Send a break signal over the current connection
     Terminate      Terminate the connection

     Help           Get help and instructions
     Modify         Modify local settings
     Alter          Alter connection settings
     Perform        Perform an Operating System Command
     Quit           Quit the program

     The following keys may be used during a connection:
         ctrl b  start or stop recording display output
         ctrl v  display main menu to issue a command
     Use ctrl r  to return to a previous screen at any time

Type the first letter of the command and press Enter.
>
```

OL157006

Figure 10-3. Connected Main Menu

With the Connected Main Menu you can perform these tasks:

- Send a file to a remote system.
- Receive a file from a remote system.
- Interrupt a connection with a break signal.
- Terminate a connection.
- Request help information.
- Request the Modify Menu to change variables that pertain to your local terminal (for the current session).
- Request the Alter Menu to change variables that affect data transmission (for the current session).
- Run an operating system command (some, like port commands, require superuser authority).
- Stop using Asynchronous Terminal Emulation.

Giving Commands

To give a command, type the first letter of the command after the > (prompt) at the bottom of the menu and press **Enter**. Notice that the menu prompt is a different symbol than the shell prompt, $.

For example, to display a dialing directory, type the first letter of the **directory** command and press **Enter**:

```
d
```

Do *not* try to enter values by using cursor movement keys to mark the command in the menu. The system interprets the cursor movement keys as typed input and fails to recognize the command. If you use cursor movement keys, the following error message appears:

```
062-003  The 'command-name' command is not valid.
         Enter the first letter of a command from
         the list on the menu.
```

If you see the above message, press **Enter** to redisplay the menu. Then try the command again.

Using Control Keys

Three control keys appear on both the Unconnected and the Connected Main Menus. These control keys do not function until a connection is made to a remote system by giving the **connect** command.

To use a control-key combination, hold the **Ctrl** key while you press the named letter key.

The functions of the control keys follow:

Ctrl-B Starts or stops saving data displayed on your screen during a connection. This control key has a switch or toggle effect. The first time you use **Ctrl-B** you save

data. The next time you use it, you stop saving data. This key combination does not function while you are transferring files.

Data is saved in the default file, unless you request a specific file. Changing the default file is discussed in *Managing the AIX Operating System.*

If you press **Ctrl-B** when there is no connection, you receive an error message.

```
062-003  The 'command-name' command is not valid.
         Enter the first letter of a command from
         the list on the menu.
```

Since control characters do not normally display, the command name may be blank.

Ctrl-V Displays the Connected Main Menu so you can issue a command. Use this control key to display the Connected Main Menu after the **connect** command makes a connection.

If you press **Ctrl-V** from the Unconnected Main Menu and then press **Enter**, you receive message 062-003 (above).

Ctrl-R This sequence returns you to the previously displayed screen. The actual screen you see depends on the screen in use when you pressed the key combination.

You can use **Ctrl-R** to stop a file transfer in progress.

Using Ctrl-R from the Unconnected State

When you are not connected, using the **Ctrl-R** sequence produces the following results:

Where You Are:	When You Use Ctrl-R:
Unconnected Main Menu	Ignored.
Directory Menu	Unconnected Main Menu returns.
Help Menu	Unconnected Main Menu returns.
Modify Menu	Unconnected Main Menu returns.
Alter Menu	Unconnected Main Menu returns.
During a perform	Displays the message: Press any key.
During a quit	Ignored.
Making a connection	Terminates the connection. The menu you were using returns: Unconnected Main Menu or the Directory Menu.

Using Ctrl-R from the Connected State

When you are connected, using the **Ctrl-R** sequence produces the following results:

Where You Are:	When You Use Ctrl-R:
Connection Screen	Displays the message: `Disconnect (y/n)?` If you choose yes, either the Unconnected Main Menu or the Directory Menu appears, depending on which one you used to make the connection. If you choose no, the connection screen returns.
Connected Main Menu	Connection screen returns.

Help Menu	Connection screen returns.
Modify Menu	Connection screen returns.
Alter Menu	Connection screen returns.
During a perform	Displays the message: `Press any key`
During a quit	Ignored.
During a terminate	Ignored.
During a break	Ignored.
During a send	Connection screen returns.
During a receive	Connection screen returns.

Prerequisite Tasks

Before you use the ATE program, you should check the settings of the local system, the connection, and the ports. You must know the following:

- Characteristics of the remote port
- Characteristics of the local port
- Settings for your local system
- Settings needed to connect to a remote system.

At the remote system, as a minimum you must know the transmission rate, the file transfer protocol, the bit length (per character), the parity, and which remote port is ready to receive calls. Someone at the remote system can check these and other characteristics for you so you can make your local port compatible.

At the local port, as a minimum you must be sure that the transmission rate, the file transfer protocol, the parity, and the bit length are the same as those of the remote system, and know which local call-out port is configured for the task you need.

You can check and change the settings of your local system for the current session by using the **modify** command. These settings include the following:

- Naming the file that captures incoming data
- Adding linefeeds at the end of each line of incoming data
- Setting echo mode
- Emulating a DEC VT100
- Writing incoming data to a capture file
- Establishing a transmitter on/off signal (Xon/Xoff).

When you leave ATE, the settings for the current session disappear, and the values in the default file are in effect the next time you start ATE.

See *Managing the AIX Operating System* for more information about modifying local settings.

You can check and change the connection settings for the current session by using the **alter** command. These settings include the following:

- Bit length per character
- Number of stop bits
- Parity
- Transmission rate
- Device name of port
- Modem dialing prefix
- Modem dialing suffix
- Wait before redialing
- Number of redial attempts
- File transfer protocol
- Pacing character or integer

When you leave ATE, the settings for the current session disappear, and the values in the default file are in effect.

See *Managing the AIX Operating System* for more information about the **alter** command.

If a port is ready to receive calls, it is ***enabled***. If a port is ready to call out, it is ***disabled***. You can change the port configuration

with the **devices** command. Remember that changing the port configuration requires superuser authority.

See *Managing the AIX Operating System* for more information about using ports.

Starting ATE

To start the ATE program, type **ate** after the $ (system prompt) and press **Enter**:

```
$ate
```

The **ate** command displays the first of two main menus, the Unconnected Main Menu, from which you establish a connection to another terminal. See "Unconnected Main Menu" on page 10-6.

Making a Connection (ATE connect)

Before you begin, review the list of prerequisite tasks and make sure that the configuration is complete. Remember that checking and changing the port configuration requires superuser authority, and that if you leave ATE after you change local settings or connection settings, the changes disappear.

The ATE **connect** command makes a connection between your terminal and a remote system with the method you select:

- Manual dialing
- Automatic dialing
- Direct connection.

The **connect** command is given from the Unconnected Main Menu, which appears when you start the program.

Manual Dialing

Manual dialing means that you dial the number yourself over a telephone line.

Dialing Manually

1. Be sure all the prerequisite tasks are complete. See "Prerequisite Tasks" on page 10-13.

2. Invoke ATE by entering the following on the command line:

   ```
   ate
   ```

   (Remember, entering a command means that you type the command, then press **Enter**. In this case, you should type `ate`, then press **Enter**.)

3. If you do not need to change the current settings, skip this step. To change settings for the current session, use the **modify** or the **alter** command when the Unconnected Main Menu appears.

4. To make the connection, enter the letter **c**.

   ```
   >c
   ```

5. When the following prompt appears, press **Enter** to signal that you want to dial manually:

   ```
   Type the phone number of the connection for
   auto dialing, or the name of the port for direct
   connect, and press Enter.  To manually dial a
   number, just press Enter.  To redial the last
   number (0), type 'r' and press Enter.
   >
   ```

6. Dial the telephone number when message 062-007 appears.

For information about changing local settings, see *Managing the AIX Operating System.*

- The prompt for dialing the telephone number appears as message 062-007. You can read more about this message in *IBM RT PC Messages Reference.*

  ```
  062-007  Please dial a telephone number to make the
           requested connection.
  ```

- If you hear a busy signal and want to end the connection request, press **Ctrl-R**.

- No connection is established if the line is busy, or if the party doesn't answer, or if you used an unrecognized number. The following message appears after 45 seconds:

  ```
  062-009  The 'connect' command cannot complete because
           the line was busy, or the modem did not detect
           a carrier signal.  Make sure the number is
           correct and try again, or try the same
           number later.
  ```

  Check the number and try again.

- Message 062-009 also appears if you use the **Ctrl-R** control keys. This stops a connection from being established. If you pressed **Ctrl-R** by mistake, try again.

Automatic Dialing

Automatic dialing means that you use a modem to dial a number over a telephone line.

Dialing Automatically

1. Be sure all the prerequisite tasks are complete. See "Prerequisite Tasks" on page 10-13.

2. Invoke ATE by entering the following on the command line:

   ```
   ate
   ```

3. If you do not need to change the current settings, skip this step.

   When the Unconnected Main Menu appears, use the **modify** or the **alter** command to change settings for the current session.

   See *Managing the AIX Operating System* for information about changing local settings.

4. To make the connection, enter **c** *telephonenumber* and [*portname*] on the command line.

   ```
   >c 5551111 tty6
   ```

- Your modem instruction book should tell you how to format the number, perhaps by including spaces or dashes.

- Although the example above contains a port name, the [ ] (brackets) in the instruction indicate that a port name is optional.

  Refer to *Managing the AIX Operating System* for information about port names.

- If you give the ATE **connect** command without a telephone number or port name, the following prompt appears:

  ```
  Type the phone number of the connection for auto dialing,
  or the name of the port for direct connect, and press
  ```

Options: 50, 75, 110, 134, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, or 19200.

length Number of bits that make up a character.

Options: 7 or 8.

stop Stop bits that signal the end of a character.

Options: 1 or 2.

parity Checks whether a character was successfully transmitted to or from a remote system.

For example, if you select even parity, when the number of 1 bits in the character is odd, the parity bit is turned on to make an even number of 1 bits.

Options: 0 = none, 1 = odd, 2 = even.

echo Determines whether typed characters display locally.

Options: 0 = off (no echo), 1 = on (echo).

linefeed Adds a linefeed character at the end of each line of date coming in from a remote system.

The linefeed character is similar in function to the carriage return and newline characters.

Options: 0 = off (no linefeed), 1 = on.

```
Enter.  To manually dial a number, just press Enter.  To
redial the last number (0), type 'r' and press Enter.  >
```

Type the telephone number to dial automatically:

```
>5551111
```

Press **Enter**.

Direct Connection

You can make a direct connection if you have a link to another system.

Making a Direct Connection

1. Be sure all the prerequisite tasks are complete. See "Prerequisite Tasks" on page 10-13.

2. Invoke ATE by typing the following on the command line and pressing the **Enter** key:

   ```
   ate
   ```

3. If you do not need to change the current settings, skip this step.

   When the Unconnected Main Menu appears, use the **modify** or the **alter** command to change settings for the current session.

   See *Managing the AIX Operating System* for information about changing local settings.

4. To make the connection, type **c** *portname* on the command line.

   ```
   >c tty6
   ```

5. Press **Enter** twice.

   The login prompt appears.

- Before you can make a connection to another computer, you must disable your port so that no one else can log into your system while you are trying to make a connection. To do this, someone with superuser authority must use the **pdisable** command.

  If you do not disable your system login, an error message appears. You must also be certain that the port of the other computer is ready to receive calls.

- If you give the ATE **connect** command without typing the port name, the following prompt appears:

```
Type the phone number of the connection for
auto dialing, or the name of the port for
direct connect, and press Enter.  To manually
dial a number, just press Enter.  To redial the
last number (0), type 'r' and press Enter.
>
```

Type the port name on the command line and press **Enter**.

Displaying a Dialing Directory (directory)

The **directory** command displays a dialing directory. You can establish a connection to a remote computer by selecting one of the directory entries from the displayed directory. The information in this section tells you how to do this.

If you need to create a dialing directory, refer to "Creating a Dialing Directory File" on page 10-25.

The **directory** command must be given from the Unconnected Main Directory.

Displaying a Dialing Directory

1. Type **d** *filename*

   ```
   >d bulletin_bds
   ```

2. Press **Enter**.

Additional Information about the directory Command

- If you gave the **directory** command without typing the *filename*, the following prompt appears:

  ```
  Type the file name of the directory you want
  to display and press Enter.  To use the current
  directory (/usr/lib/dir), just press Enter.
  >
  ```

  If you see this prompt, type the name of the directory you want to display, unless the file name is inside the **( )**. Press **Enter**.

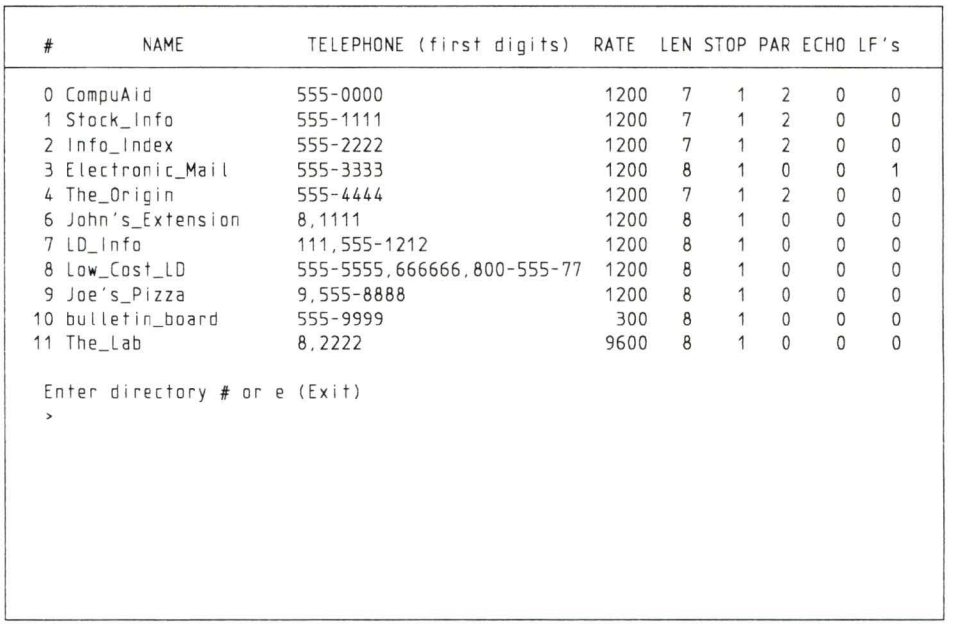
  To use the current directory (the one displayed in parentheses), just press **Enter**.

- Asynchronous Terminal Emulation comes with a sample dialing directory called **/usr/lib/dir**. The first time you use the

directory command the sample directory appears. After that, the last directory you used becomes the current directory.

Selecting a Telephone Number from a Directory

After displaying a directory, you select the entry to which you want to establish a connection by responding to a prompt. Figure 10-4 shows a dialing directory.



```
#        NAME            TELEPHONE (first digits)  RATE  LEN STOP PAR ECHO LF's

 0 CompuAid              555-0000                  1200   7    1   2    0    0
 1 Stock_Info            555-1111                  1200   7    1   2    0    0
 2 Info_Index            555-2222                  1200   7    1   2    0    0
 3 Electronic_Mail       555-3333                  1200   8    1   0    0    1
 4 The_Origin            555-4444                  1200   7    1   2    0    0
 6 John's_Extension      8,1111                    1200   8    1   0    0    0
 7 LD_Info               111,555-1212              1200   8    1   0    0    0
 8 Low_Cost_LD           555-5555,666666,800-555-77 1200  8    1   0    0    0
 9 Joe's_Pizza           9,555-8888                1200   8    1   0    0    0
10 bulletin_board        555-9999                   300   8    1   0    0    0
11 The_Lab               8,2222                    9600   8    1   0    0    0

Enter directory # or e (Exit)
>
```

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Figure 10-4. Dialing Directory

1. Type the number of the entry you want (0 through 19).
2. Press **Enter**.

Creating a Dialing Directory File

This section tells you how to create a dialing directory to use with the **directory** command. For information on how to use the directory that you create, see "Displaying a Dialing Directory (directory)" on page 10-23.

A dialing directory file is similar to a page in a telephone book. Each file contains telephone numbers for remote systems you can call with Asynchronous Terminal Emulation.

Sample Dialing Directories

To help you create dialing directory files, Asynchronous Terminal Emulation comes with a sample dialing directory **/usr/lib/dir**. See "Dialing Directory File Format" on page 10-26.

Creating a Directory from the Model

1. Select a unique name for your dialing directory file. This name must be a string of 40 characters or less. The file can be in any directory that has write permission.
2. Copy the sample directory to your new directory file, using the **cp** command.
3. Using your favorite AIX text editor, replace the sample entries with those you want in your directory, completing the information in each of the eight fields. (See "Dialing Directory File Format" on page 10-26.)
4. Save the new file.

- If you need to give a directory write permission, use the **chmod** command.
- See *AIX Operating System Commands Reference* for instructions on using the **cp** and the **chmod** commands.

- Limit the file to 20 entries, numbered from 0 through 19. The ATE program only uses the first 20 entries in a dialing directory; if you add more than 20 entries, it ignores the extra entries.

- If you are using INed[1], refer to *INed* for help in creating files.

An alternate way to create a new directory follows:

Creating a Directory without the Model

1. Create a new file with any AIX text editor.

2. Enter each telephone number on a separate line.

   Each entry must include the eight fields described in the next section, with at least one space between each field. Do not exceed the maximum number of characters in each field.

   Two sample entries follow:

```
CompuAid       555-0000 1200 7 1 2 0 0
Stock_Info     555-1111 1200 7 1 2 0 0
```

3. Save the file.

Dialing Directory File Format

Figure 10-5 on page 10-27 shows the sample directory you copy to use as a model.

[1] INed is a trademark of INTERACTIVE Systems Corporation.

```
CompuAid          555-0000                          1200 7 1 2 0 0
Stock_Info        555-1111                          1200 7 1 2 0 0
Info_Index        555-2222                          1200 7 1 2 0 0
Electronic_Mail   555-3333                          1200 8 1 0 0 1
The_Origin        555-4444                          1200 7 1 2 0 0
John's_extension  8,1111                            1200 8 1 0 0 0
LD_Info           111,555-1212                      1200 8 1 0 0 0
Low_Cost_LD       555-5555,666666,800-555-7777      1200 8 1 0 0 0
Joe's_Pizza       9,555-8888                        1200 8 1 0 0 0
bulletin_board    555-9999                           300 8 1 0 0 0
The_Lab           8,2222                            9600 8 1 0 0 0
```

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Figure 10-5. Sample Dialing Directory

A description of each field follows:

name Name that identifies a telephone number.

Options: Any combination of 20 characters or less. Use the _ (underscore) instead of a blank between words in a name. An example is `data_bank`.

number Telephone number to be dialed.

Options: A telephone number of 40 digits or less.

Consult your modem user's guide for a list of acceptable digits and characters. For example, if you must dial 9 to access an outside line, include a 9 and a , (comma) before the telephone number.

```
9,5551111
```

Only the first 26 characters (including digits, commas, and dashes) display in the Directory Menu.

rate Transmission or bit rate (bits per second). Determines the number of characters transmitted per second. Select a bit rate that is compatible with the capability of the communication line you are using.

Sending a File (send)

The **send** command on the Connected Main Menu sends a file from your local system to a remote system, if a connection is established. Before you can send the file, you must prepare the remote system to receive it, as follows:

Preparing a Remote System to Receive a File

To send a file to another RT PC using **xmodem** protocal:

1. Make sure that your local system is disabled and the RT PC remote system is enabled. Someone with superuser authority must do this.
2. Make a connection to the other RT PC by entering the **connect** command:

   `c` *devicename*
3. When the login prompt appears, enter:

   loginname
4. When the password prompt appears, enter the password (if any). If there is no password, just press **Enter**.
5. Give the **xmodem** command on the other system by entering:

   `xmodem -r` *filename*

After you have set up the remote computer to receive the file, you must perform the following steps to send the file to the remote system.

Sending a File to a Remote System

1. Press **Ctrl-V** to display the Connected Main Menu.
2. Enter **s** *filename* on the command line, using the name of the file you want to send.

   For example, to send a file named `myfile`, enter:

   ```
   >
   s myfile
   ```

- If you give the **send** command without typing the *filename*, the following prompt appears:

  ```
  Type the name of the file you wish to send
  and press Enter.  To use the last file
  name (    ), just press Enter.
  >
  ```

  If you see this prompt, type the name of the file you want to send, unless the file name is inside the **( )**. Press **Enter**.

Receiving a File (receive)

The **receive** command stores incoming data from a remote system in the file that you designate. You must enter this command from the Connected Main Menu.

Before you can receive the file, you must send it from the remote system.

Sending a File from a Remote System (xmodem)

To send a file from another RT PC using the **xmodem** protocol:

1. Make sure that your local port is disabled and that the RT PC remote port is enabled. A superuser must do this.
2. Make a connection to the other RT PC by entering the **connect** command:

   `c` *devicename*
3. When the login prompt appears, enter:

   loginname
4. When the password prompt appears, enter the password (if any). If there is no password, just press **Enter**.
5. Give the **xmodem** command on the other system by entering:

   `xmodem -s` *filename*

After you have sent the file from the remote system, you perform the following steps to receive it:

Receiving a File from a Remote System

1. Press **Ctrl-V** to display the Connected Main Menu.
2. Enter **r** *filename* on the command line.

   For example, to store data in a file called `infile`, enter:

   ```
   >r infile
   ```

- If you give the **receive** command without typing the *filename*, the following prompt appears:

  ```
  Type the name of the file you wish to store
  the received data in and press Enter.  To
  use the last file name (    ), just press Enter.
  >
  ```

  If you see this prompt, type the name of the file in which you want to store the incoming data, unless the file name is inside the **( )**. Press **Enter**.

  To use the file name displayed in parentheses, just press **Enter**.

Interrupting a Session (break)

The **break** command sends a break signal to the remote system to which your terminal is connected. The break signal interrupts current activity on the remote computer.

Warning: THIS SIGNAL MAY DISCONNECT THE CURRENT SESSION. YOU MAY LOSE DATA.

This command must be given from the Connected Main Menu.

Interrupting a Session

1. Type **b** on the command line.

   ```
   >b
   ```

2. Press **Enter**.

Terminating a Session (terminate)

The **terminate** command stops a **connect** session and returns you to the Unconnected Main Menu. This command must be given from the Connected Main Menu.

Ending a Session

1. Type **t** on the command line.

   ```
   > t
   ```

2. Press **Enter**.

Getting Help (help)

The **help** command displays a description of each command for which you request help, and provides instructions for using the command.

You may request **help** from either the Unconnected Main Menu or the Connected Main Menu for all the commands that appear on that menu. Help may be requested for several commands at the same time.

To access the general help screen, type **h** and press **Enter**.

Viewing a Help Message

1. Type **h** [*commandinitial*] on the command line.

   For example, to receive help on the **receive** and **terminate** commands, type:

   ```
   >
   h r t
   ```

2. Press **Enter**.

- Help information for each command displays individually, in the order requested. As you finish reading each help message, press **Enter** to view the next command description.
- The brackets [ ] indicate that you may type as many command initials as you wish. Following is a list of the valid command initials.

Initial	Command
c	connect
d	directory
s	send
r	receive
b	break
t	terminate
m	modify
a	alter
p	perform
q	quit

Running an Operating System Command (perform)

The **perform** command lets you run an AIX sell command from Asynchronous Terminal Emulation.

You can give the **perform** command from either the Unconnected Main Menu or the Connected Main Menu.

Running a Shell Command from ATE

1. Type **p** *shellcommand*

   For example, to display the data in `cheerfile` using the **cat** shell command, type:

   ```
   >
   p cat cheerfile
   ```

2. Press **Enter**.

- If you give the **perform** command without typing the name of the shell command, the following prompt appears:

  ```
  Type an operating system command and press Enter.
  >
  ```

  If you see this prompt, type the name of the command you want to run. Press **Enter**.

Note: For information on the **cat** command, see *AIX Operating System Commands Reference.*

Leaving ATE (quit)

The **quit** command exits the Asynchronous Terminal Emulation program and returns you to the operating system.

Leaving the ATE Program

1. Type **q** on the command line.

```
>
q
```

2. Press **Enter**.

The system prompt appears, indicating that you may give any shell command.

```
$
```

Appendix A. Using Advanced Shell Features—A Reference

CONTENTS

About This Appendix

This appendix explains the advanced features of the shell. Many of the features covered in this appendix can be used either on the command line (to affect how an individual command runs) or in shell procedures (programs).

Please note two important differences between this appendix and the previous chapters:

- This appendix is not for the novice computer user. Unless you have experience with computer programming, you probably should skip this material until you are thoroughly familiar with both the AIX system and the earlier chapters of this book.

- This appendix is more like reference material, less like training material. It is organized according to the features of the shell, not according to the jobs you do with those features.

If you work through this appendix from first to last, you should have a general understanding of what you can do with the shell. However, this appendix probably will be most useful when you use it as reference material—when you have a unique job to do and need to understand what shell features can help you do it.

Shell Variables

Like variables in other programming languages, ***shell variables*** are names to which you can assign values. For example, you can assign the value `U. S. A.` to the variable `place` with the following statement:

```
$ place='U. S. A.'
$ _
```

From then on, you can use the variable `place` just as you would use its value. To display the value of a variable, type a $ (dollar sign) before the name of the variable. In the following example, the **echo** command displays the value of `place`:

```
$ echo $place
U. S. A.
$ _
```

The shell provides two kinds of variables:

- ***User-defined variables*** (names to which you assign a ***character string***—one or more characters—as a value). Generally, user-defined variables can be set on the command line or in a shell procedure.
- ***Positional parameters*** (variables in shell procedures that refer to values on the command line).

User-Defined Variables

A ***user-defined variable*** is a name to which you assign a specific string value (one or more characters). The name is a sequence of 52 ACSII letters, the 10 ASCII digits, the ASCII underscore, and all extended character. The name cannot begin with an ASCII digit. To create a user-defined variable, use an assignment statement of the form *name=value*. Then, to use the value of the variable, type a $ before the name of the variable. You can use user-defined variables both on the command line and in shell procedures. One special type of user-defined variable, the ***keyword arguments***, can

be used only on the command line. (Keyword arguments are explained under "Keyword Arguments" on page A-8.)

In the following example, the statement `s=stringofletters` creates the variable `s`:

```
$ s=stringofletters
$ echo $s
stringofletters
$ echo s
s
$ _
```

The command `echo $s` returns the value of `s`. The command `echo s` simply returns the character `s` because a $ does not precede the variable name `s`.

One convenient use for shell variables is as a short notation for long path names. For example, if you routinely use files in the directory `$HOME/personal/correspond/from`, you can assign that path name to the variable name `from`:

```
$ from=$HOME/personal/correspond/from
$ _
```

With this value for the variable `from`, you can use `$from` instead of entering the path name, for example:

```
$ cp tom_5_10_85 $from
$ _
```

Multiple Assignments

You can make more than one variable assignment on a single command line:

```
$ t=text  d=data
$ _
```

In the following example, the shell gives `b` the value `abc`:

```
$ a=$b  b=abc
$ _
```

Then, because b already has a value (since the shell makes that assignment first), the assignment a=$b gives a the same value (abc). Even if the value of b changes, the value of a remains abc.

Using Braces as Delimiters

Use braces { } to separate the name of a variable from any characters that follow immediately. If the character immediately following the variable name is a letter, underscore, or digit, braces are required. In the following example, the purpose of the **echo** command is to display the two strings fun and ction without a space between them.

```
$ a='Form follows fun'
$ echo "${a}ction"
Form follows function
$ _
```

The braces indicate that the enclosed a is a variable name and that its value should be followed immediately by the string ction. (Compare this use of braces with the use described under "Using { } (Braces)" on page 4-21.)

Quoting in Variable Assignments

Certain characters (summarized under "Shell Reserved Characters and Words" on page A-34) have special meanings to the shell. In variable assignments, you may need to use these characters literally—that is, without their special meanings. To use a special character literally, you must ***quote*** it (using the same quoting conventions described under "Quoting" on page 4-21). The shell takes literally all characters enclosed in single quotes (') except for the single quote itself. Within double quotes, shell takes blanks, tabs, semicolons, and new-lines literally, but substitutes the values for variable names.

Note: In variable assignments, you do not need to quote the special pattern-matching characters (* ? [...]), because pattern-matching does not apply in this context.

Single Quotes in Variable Assignments: In the following example, the value assigned to the variable `stuff` is enclosed in single quotes:

```
$ stuff='echo $ ?  $ *; ls * |  wc'
$ _
```

The value of the variable `stuff` is the literal string `echo $ ?  $ *; ls * | wc`. The shell does not run any of the commands (`echo`, `ls`, or `wc`) and does not give the reserved characters (`$ ?  * |`) their special meanings.

Double Quotes in Variable Assignments: Within double quotes ("), the reserved characters $, ` (grave accent), and \ keep their special meanings. The shell takes literally all other characters within the double quotes.

In the following example, the first line of assignments gives values to the variables `h`, `o`, `c`, and `e`, and the second line gives a value to the variable `e`:

```
$ h=hydrogen  o=oxygen  c=carbon
$ e="Three elements:  $h; $o; $c"
$ echo $e
Three elements:  hydrogen; oxygen; carbon
$ _
```

Because the value of `e` is enclosed in double quotes, the shell takes literally the blanks and semicolons in the string. At the same time, the $ keeps its special meaning, and causes the shell to substitute the values of the variables `h`, `o`, and `c`. Thus, the command `echo $e` returns the value of `e` with the substituted values of `h`, `o`, and `c`.

To quote the $, `, or \ characters within double quotes, place a \ (backslash) immediately before the character. See "Command Substitution" on page A-13 for an explanation of grave accents (`) and how they work in quoted strings.

Variable Substitution and Quoted Blanks: Ordinarily, the shell interprets blanks between words on a command line as delimiters (separators) between a command and its arguments (and between the arguments themselves). However, after the shell substitutes the value of a variable, it still takes quoted blanks literally (that is, blanks are not reinterpreted as delimiters, even though the string is no longer enclosed in quotes). For example, the following lines assign the same value to `$first` and `$second`:

```
$ first='a string with embedded blanks'
$ second=$first
$ _
```

Compare the assignment in this example with the assignment `first=a string with embedded blanks` (the same string without the quotes). The shell would read `first=a` as a keyword argument (see "Keyword Arguments"), `string` as the command name, and `with`, `embedded`, and `blanks` as arguments to `string`.

Keyword Arguments

The variables that affect a command are called the ***environment*** of the command. The environment can include variables called ***keyword arguments***—variables you set on the command line when you enter the command. In the following example, the keyword argument assigns the value `fred` to the variable name `user` and that assignment becomes part of the environment of the `echo` command:

```
$ user=fred echo $user
fred
$ _
```

Note: The variable assignment in this example affects only the environment of the command, not the environment of the shell from which the command is run.

Keyword arguments usually precede the command name. However, if you set the **-k** flag, the shell takes all arguments of the form *variable*=*value* as keyword arguments:

```
$ set -k usr=fred command black=green tree=frog
$ _
```

(For more information about using keyword arguments, see "The export Command" on page A-14. For more information about shell flags, see "Shell Flags" on page A-31.)

Positional Parameters

A ***positional parameter*** is a name that refers to a string in a particular position on the command line. The positional parameter $0 refers to the first string on the command line (usually the name of a command), $1 refers to the second string (the first argument to the command), and so on. When you run a command, the shell creates a positional parameter for each string on the command line up to $9.

Positional parameters allow a shell procedure to take information from the command line (for example, to assign a value to a variable each time the procedure runs). For example, in the following procedure, the **echo** command displays the second argument on the command line (the value of positional parameter $3):

Note: The line that begins with the # character is a comment, not a functional part of the procedure.

```
# posparm3 procedure--demonstrate how pos. parameters work
echo $3
```

Note: To follow this example on your system, first use an editor to create the posparm3 file and then give the file execute status with the **chmod** command (chmod +x posparm3).

You can enter posparm3 with more than two arguments (character strings). The procedure returns only the value of positional parameter $3. In the following example, the posparm3 procedure has five arguments:

```
$ posparm3 Bob Jones Dept. 546 Accounting
Dept.
$ _
```

Each time you run this procedure, you can use different arguments.

The shell automatically creates positional parameters for arguments in positions up to $9. To use arguments in positions numbered higher than 9, you can use the $* notation described under "The shift Command" on page A-15, or a **for** loop, described in "for—Looping Over a List" on page A-25.

How the Shell Uses Variables

"Shell Variables" on page A-4 describes the different types of shell variables. This section explains first, how the shell ordinarily uses variables, and second, how you can control the way the shell treats variables.

Parameter Substitution

As explained under "User-Defined Variables" on page A-4, the shell substitutes the value of a variable (or parameter) for the name of the variable when you type a $ before the name. In the following example, `echo` returns the value of variable `p`:

```
$ p=45ABA54
$ echo $p
45ABA54
$ _
```

If a variable is not set (does not have a value assigned), the shell ordinarily substitutes the null string for the name of the variable. (For example, if `q` does not have a value, then `echo $q` returns nothing to the display.) However, with the notation `${variable-string}`, you can cause the shell to return a string (rather than the null) when a variable does not have a value to substitute. In the following example, variable `q` does not have a value:

```
$ echo ${q-x}
x
$ _
```

Since `q` does not have a value, `echo` returns `x` (the default string).

If you use any special characters in a default string, quote them with the usual shell quoting conventions. In the following example, `echo` returns * if variable `q` is not set:

```
$ echo ${q-'*'}
*
$ _
```

You can also use the value of another variable as a default string. For example, the following echo command returns the value of $1 if q is not set:

```
$ echo ${q-$1}
$ _
```

If $1 is not set, the shell returns the null string.

The notation ${variable=string} actually assigns a value to a variable that is not set. In the following example, if q is not set, the shell assigns it the value 12B1:

```
$ echo ${q=12B1}
$ _
```

Note: The ${variable=string} notation does not work for positional parameters.

If an appropriate default string does not exist, you can use the following notation:

```
$ echo ${q?message}
12B1
$ _
```

The shell substitutes the value of q if it has one. If q does not have a value, the shell returns the word message and ends the procedure.

If a procedure can run only with certain parameters set, you can use the : command to determine whether those parameters have values. The following line begins a procedure that must have three variables set before it can run:

```
:${user?} ${acct?} ${bin?}
```

The : command does nothing until the shell evaluates its parameters. If any of its parameters (user, acct, and bin in this example) are not set, the : command causes the shell to abandon the procedure.

Command Substitution

When you enclose a command in ` ` (grave accents), the shell replaces the name of the command with the standard output of that command. For example, if the current directory is /u/fred/bin, then the following assignments are equivalent:

```
d=`pwd`

d=/u/fred/bin
```

Within ` ` (grave accents), the shell quoting conventions explained under "Quoting" on page 4-21 apply, with one exception: you must use the \ (backslash) to quote a ` (grave accent).

When ` ` (grave accents) appear in strings that are enclosed in double quotes (" . . . ` command name ` . . ."), they are not quoted, as explained under "Double Quotes in Variable Assignments" on page A-7). That is, the shell reads them as reserved characters for command substitution. In the following example, double quotes cause the shell to take literally the blanks and ? character in the value assigned to the variable where:

```
$ where="Where am I?  `pwd`"
$ echo $where
Where am I?  usr/fred/bin
$ _
```

The shell substitutes the standard output of pwd (the current directory) for `pwd`.

Within double quotes, a command or reserved character enclosed in ` ` (grave accents) retains its special meaning, even though it is part of a quoted string. When grave accents appear in strings enclosed in single quotes (' . . . ` command name ` . . . '), the shell takes literally the grave accents and any commands or reserved characters they enclose. (For more information on using single quotes, see "Single Quotes in Variable Assignments" on page A-7.)

The export Command

With the **export** command, you can set user-defined variables to apply to any subsequent commands (rather than setting the keyword argument for each command when you enter it). This process, called ***marking the arguments for export***, is useful if, for example, you want the same user-defined variables to be part of the environment for several different commands. In the following example, after values are assigned to variable names `user` and `box`, the `export` command marks the variables `user` and `box` for export:

```
$ user=jason box=square
$ export user box
$ echo $user $box
jason square
$ _
```

The subsequent `echo` command displays the values of `user` and `box`.

To get a list of the variables currently marked for export, enter `export`.

If you want the value of a variable to remain constant, declare it ***readonly***. In the following example, the variables `user` and `box` are declared `readonly`:

```
$ readonly user box
$ _
```

After this declaration, the values of `user` and `box` cannot be changed by a subsequent variable assignment.

To get a list of all variables declared **readonly**, simply enter `readonly`. Once you declare a variable readonly, you can change its value only by deleting the variable and then re-creating it. To delete the variable, use the shell **unset** command (described under **sh** in *AIX Operating System Commands Reference*). If you do not delete the variable, it is automatically deleted when you log out.

The shift Command

The **shift** command, used with positional parameters, shifts arguments to the left one string at a time. For example, the **shift** command discards the value of positional parameter $1, replaces $1 with $2, replaces $2 with $3, and so on. The **shift** command does not shift the $0 positional parameter (the name of the procedure). With each shift, the positional parameter with the highest number becomes ***unset***—that is, there is no longer an argument in that position. An argument can cause the **shift** command to shift more than one string at a time. For example, `shift 2` causes **shift** to move two strings at a time.

To demonstrate the **shift** command, the following procedure uses three shell features that have not yet been introduced in this book.

- The **while** statement means *as long as a specified condition exists.*
- The **test** command determines whether or not a condition exists. In the following example, the command `test $# != 0` means *test for a positional parameter that is not 0.*
- The control command pair **do** and **done** create a ***loop***—a series of commands to be repeated until a specified condition changes. In the example, the commands inside the loop are **echo**, which displays the values of all the positional parameters, and **shift**, which shifts the positional parameters to the left one at a time.

Thus, the procedure displays the values of the positional parameters, shifts the arguments to the left, displays their values again, and so on, continuing until only the $0 positional parameter (the one that refers to **echo**) remains. (The line that begins with the # character is a comment, not a functional part of the procedure.)

Note: To follow this example on your system, first use an editor to create the file `ripple` and then give the file execute status with the **chmod** command (for example, `chmod +x ripple`).

```
#          ripple command
while test $# != 0
do
          echo $1  $2  $3  $4  $5  $6  $7  $8  $9
          shift
done
```

To run the `ripple` command, enter `ripple` *string1 string2 string3 . . .*:

```
$ ripple 1 2 3 4 5 6 7 8 9
1 2 3 4 5 6 7 8 9
2 3 4 5 6 7 8 9
3 4 5 6 7 8 9
4 5 6 7 8 9
5 6 7 8 9
6 7 8 9
7 8 9
8 9
9
$ _
```

At most, the `echo` command in `ripple` displays the values of nine arguments.

To pass more than nine arguments from the command line to a procedure, use the $* notation. For example, in the `ripple` procedure, the `echo` command could be written `echo $*`:

```
#          ripple command
while test $# != 0
do
          echo $*
          shift
done
```

If there are nine or fewer arguments, these two versions of the **echo** command produce the same result. However, if there are more than nine arguments, only the command `echo $*` accesses all of them.

You can also use a **for** loop to pass additional arguments to the shell. See "for—Looping Over a List" on page A-25 for more information on using a **for** loop.

The set Command

The shell automatically assigns positional parameters from command line arguments. However, you can assign values to positional parameters from within shell procedures with the **set** command.

In the following example, the **set** command is one line from a shell procedure:

```
set   abc  def  ghi
```

This **set** command first makes these assignments:

```
abc  =  $1
def  =  $2
ghi  =  $3
```

Second, it unsets (clears) the remaining positional parameters (from $4 on), even if they were set before (for example, if there were arguments to the invoking command). The **set** command cannot assign a value to $0, which always refers to the name of the shell procedure.

The read Command

Like the ` (grave accents) used in command substitution, the **read** command lets you assign values to variables indirectly. The **read** command takes a line from its standard input (usually the keyboard) and assigns words from that line, one by one, to named variables. In the following example, the **read** command assigns words to three named variables, `first`, `init`, and `last`:

```
read first init last
```

With the input line `B. T. Andover`, the **read** command produces the same results as would the following variable assignments:

```
first=B. init=T. last=Andover
```

If there are excess words on the input line (that is, if there are more words than there are variables), they are assigned to the last variable that you specified.

Special Shell Variables

The shell program uses several special variables. The shell sets some of these variables, and you can set or reset all of them. Following is a partial list of the special variables and a brief description of how the shell uses each one. (For a complete list of the shell variables, see **sh** in *AIX Operating System Commands Reference*.)

MAIL The path name of the file where your mail is deposited. You must set **MAIL**, and this is usually done in the file **.profile** in your login directory. (When you login, you receive an announcement of any mail in your standard mail file, whether **MAIL** is or is not set.)

HOME The name of your login directory. If you use the **cd** (change directory) command without arguments, **cd** changes the current directory to the value of **HOME**. (In shell procedures, you can use **HOME** to avoid having to use full path names—something that is especially helpful if the path name of your login directory changes.) **HOME** is set by the **login** command.

PATH A list of directories that contain commands. When the shell runs a command, it searches a list of directories for a file of that name that can be run. If **PATH** is not set, the shell searches the current directory, `/bin`, and `/usr/bin`. When **PATH** is set, its value is an ordered list of directory names separated by colons, as shown in the following example:

```
PATH=:/u/fred/bin:/bin:/usr/bin
```

This **PATH** tells the shell to search the current directory (specified by the null string before the first : [colon]), `/u/fred/bin`, `/bin`, and `/usr/bin`, in that order. Thus, the **PATH** variable lets you have a personal directory of commands that you can access regardless of your current directory. Usually, **PATH** is set in the **.profile** file.

NLCTAB The variable that specifies the path name of the file containing the current collating table. If this is not specified, and a definition is contained in **NLFILE**, the definition **NLFILE** is used. Otherwise, the path nameused is **etc/nls/ctab/default**.

NLFILE The variable that specifies the path name of a text file containing configuration information that describes extended character configuration information. For more information, see Overview of International Character Support in *Managing the AIX Operating System*

CDPATH The variable that tells the shell where to search for the argument to a **cd** command whenever that argument is not null and does not begin with /, ., or ... The value of **CDPATH** is an ordered list of directory path names separated by colons.

A null character anywhere in the list represents the current directory. If the list begins with a colon, a null character is assumed to be before the colon. Initially, **CDPATH** is not set, which means that the shell searches only the current directory. In the following example, the **cd** command is set to search the current directory first, and then to search the home directory:

```
CDPATH=:$HOME
```

Usually **CDPATH** is set in your **.profile** file. If the **cd** command changes to a directory that is not a descendant of the current directory, the shell writes the full path name of the new directory on the diagnostic output.

PS1 The variable that specifies the primary prompt string—the string that the shell displays when it is ready to accept a command. The standard primary prompt string is $ (a dollar sign followed by a blank). PS1 is usually set in the file `$HOME/.profile`. If PS1 is not set, shell uses the standard primary prompt string. To change the primary prompt string, edit `$HOME/.profile` and perform one of the following actions:

- Change the value of PS1 (if it is set).
- Add the line `PS1=`*string* (where string is the primary prompt string you choose).

PS2 The variable that specifies the secondary prompt string—the string that the shell displays when it requires more input after a new-line (that is, after you press **Enter**). The standard secondary prompt string is > (a > symbol followed by a blank). PS2 is usually set in the file `$HOME/.profile`. If PS2 is not set, shell uses the standard secondary prompt string. To change the secondary prompt string, edit `$HOME/.profile` and either: (1) change the value of PS2 or (2) add the line `PS2=`*string*.

IFS The variable that specifies what characters can be used as internal field separators (IFS); these are the characters the shell uses during blank interpretation. The shell initially sets **IFS** to include the blank, tab, and new-line characters.

? The exit status (return code) of the last command run, given as a decimal string. Most commands return a zero exit status if they complete successfully, and a nonzero exit status otherwise.

The number of positional parameters, given as a decimal string.

$ The process number of the current shell, given as a decimal string. All existing processes have unique process numbers.

! The process number of the last process run in the background, given as a decimal string.

- The current shell flags.

Shell Control Commands

You may want a shell procedure to do one thing under certain conditions, and another thing when those conditions change (or are never met). For example, you may want part 1 of a procedure to run if the procedure receives `yes` as input, and part 2 to run if the procedure receives `no` as input. With input `yes`, control of the procedure goes to part 1. With input `no`, control goes to part 2.

The shell provides the following six ***control commands***, or command pairs, that let you pass control to various parts of a procedure or control how a procedure ends:

- **break** and **continue** (loop control)
- **case** (multiway branch)
- **exit** and **trap** (process ending control)
- **for** (looping over a list)
- **if** (structured conditional branch)
- **while** and **until** (conditional looping)

This section lists the control commands in alphabetical order.

break and continue—Loop Control

The **break** command ends a **while**, **until**, or **for** loop. The **continue** command starts the next instance of a loop. Both **break** and **continue** work only when they are used between **do** and **done**.

In the following example, the **case** command compares input from the keyboard (entered in response to the prompt `Please enter data`) with the three strings, `"did"`, `" "`, and `*`. (The lines that begin with # are comments, not functional parts of the procedure.)

```
#This procedure is interactive; 'break' and 'continue'
#commands are used to allow the user to control data entry.
while true
do
        echo "Please enter data"
        read response
        case "$response" in
              "done")    break          #no more data
                         ;;
              " ")       continue
                         ;;
              *)
                         process the data here
                         ;;
        esac
done
```

If the entered data match done, the **break** command ends the loop and causes the procedure to start again after done (the end of the enclosing loop). If the entered data match " " (a space), the **continue** command causes the procedure to start again at the **while** (or **until** or **for**) that begins this enclosing loop. If the entered data match *, the procedure processes the data and then completes normally (**esac** ends the **case** statement).

The **break** command exits from the innermost enclosing loop and causes the procedure to start again after the next (unmatched) **done**. To restart the procedure more than one level up from the loop containing **break**, use break *n*, where *n* specifies the number of levels.

The **continue** command causes the procedure to start again at the nearest enclosing **while**, **until**, or **for** (that is, the one beginning the innermost loop containing the **continue**). To restart at any loop other than the innermost enclosing one, use continue *n*, where *n* specifies how many loops (levels) up the **continue** is to operate.

case—The Multiway Branch

With the **case** command, you can create multiway branches. The following example shows the general format for the **case** command:

```
case string in
   pattern) command list;;
   .
   .
   .
   pattern) command list;;
esac
```

The shell attempts to match `string` with each `pattern` in turn. When the shell finds a `pattern` that matches `string`, it runs the command list following that `pattern`. The shell matches only one pattern (that is, if more than one `pattern` in the list matches `string`, the shell runs the command list after the first matching pattern, and then ends the `case` command.

The `;;` (double semicolon) symbol causes the shell to break out of the **case** procedure. It is required after all but the last command list. You can use the standard shell pattern-matching characters with **case**. (Pattern-matching characters are described under "Matching Patterns" on page 4-23.)

The exit and trap Commands

With the **exit** and **trap** commands, you can control the way a process ends (terminates). The **exit** command ends a process before the process reaches end-of-file. If **exit** has an argument, it sets the exit status of the process to the value of that argument. For example, the command `exit 0` in a procedure causes the exit status of that procedure to be 0 (that is, successful). If the argument is omitted, **exit** uses the exit status of the last command that ran.

Ordinarily, an interrupt signal from the keyboard ends a shell procedure. The **trap** command can be set to do any routine tasks necessary to make the termination of a process orderly. In the following example, the **trap** command is set to remove temporary files when signal 2 (interrupt from the keyboard) is received:

```
trap 'rm /tmp/ps$ $; exit' 2
```

The **exit** command is required. Without the **exit**, the procedure would start again at the point where the interrupt was received.

for—Looping Over a List

With the **for** command, you can perform an operation for each of several files, or run a command for each of several arguments. The next example shows the general format of a shell **for** command:

```
for variable in word list
do
        command list
done
```

A word list is a series of strings separated by blanks. The shell runs commands in the command list once for each word in the word list; `variable` takes each word in the word list in turn as its value.

In the following **for** command, the shell runs **wc** for each of the files `top`, `middle`, and `bottom`:

```
for counts in top middle bottom
do
    wc $counts >> countfile
done
```

Each time **wc** runs, its output is directed to a file named `countfile`.

After it is evaluated the first time, the word list is fixed. The **for** command ends when there are no more words in the word list.

You can use the **for** command without the `in word list` statement. In this case, the current positional parameters are used instead of the word list. This feature is convenient if you need to write a command that performs the same command list for an unknown number of arguments.

if—The Structured Conditional Branch

The **if** command can be used with or without an **else** clause. The following example includes an **else** clause:

```
if command list 1
then
      command list 2
else
      command list 3
fi
```

In this example, the shell runs *command list 1.* If the exit status of *command list 1* is zero, the shell runs *command list 2.* If the exit status of *command list 1* is not zero, the shell runs *command list 3.* The word **fi** marks the end of the **if** command.

while and until—Conditional Looping

Following is an example of the general format for the **while** command:

```
while command list 1
do
         command list 2
done
```

The shell runs *command list 1.* If *command list 1* is successful, the shell runs *command list 2.* The shell repeats this sequence until *command list 1* is not successful, and then ends the loop.

The **until** command causes the shell to run a loop as long as the first command list is **not** successful (that is, **until** and **while** test for opposite conditions). In the next example, the shell runs *command list 1* and then checks its exit status (successful or unsuccessful):

```
until command list 1
do
         command list2
done
```

If *command list 1* is not successful, the shell runs *command list 2*. The shell repeats this sequence until *command list 1* is successful, and then ends the loop.

Inline Input (Here) Documents

The shell commands and procedures usually read their input from the keyboard or from a file (as is explained under "Redirecting Input and Output" on page 4-8). A command in a procedure also can read its input from data contained in the procedure file (***inline input***). The inline input portion of a procedure file is often called a ***here*** document.

A here document begins with the << symbol and ends with a specified string, as the following example shows:

```
for i
do
        grep $i <<!
        ted   abc123
        fred  def456
        tom   ghi789
        sam   jkl198
        frank mn0765
        bill  pqr432
!
done
```

When the string that follows << (in this example, !) appears on a line by itself, it marks the end of the here document. In this example, the shell takes the data between <<! and ! as the standard input for **grep**.

The shell substitutes the values of any variables or parameters in the here document before it makes the data available as input to a command. To prevent the shell from substituting the value of specific variables, quote the $ reserved character with a \. To prevent the shell from substituting the values of all variables in a here document, quote the end marking string (! in the previous example) with a \ (backslash).

Standard Error and Other Output

Generally, when a command starts, three files are already open: ***standard input***, ***standard output***, and ***standard error***. If you want to redirect standard input or standard output (for example, cause a command to take its input from a file rather than from the keyboard), you can use the procedures explained under "Redirecting Input and Output" on page 4-8. However, if you want to redirect standard error (or other) output, you must use the methods explained in this section. The methods in this section can also be used to redirect standard input and standard output.

A number, called a ***file descriptor***, is associated with each of the files a command ordinarily uses:

File	File Descriptor	Device
standard input	0	keyboard
standard output	1	display
standard error	2	display

Figure A-1. Standard File Descriptors

To redirect standard error output, type a 2 (the file descriptor number) before one of the output redirection symbols (> and >>) and a file name after the symbol. For example, the following command adds standard error output from the **cc** command to the file ERRORS:

```
$ cc testfile.c 2>>ERRORS
$ _
```

Commands may produce output besides standard output and standard error. With the method just described for redirecting standard error output, you can redirect output associated with any file descriptor from 0 through 9. For example, if *cmd* writes output to file descriptor 9, you can redirect that output to the file savedata with the following command:

```
$ cmd 9>savedata
```

If a command produces output to several different file descriptors, you can redirect each one independently, as the following example shows:

```
$ cmd > standard     2> error     9> data
$ _
```

The command *cmd* directs standard output to file descriptor 1, standard error to file descriptor 2, and output for a data file to file descriptor 9.

AIX commands generally use only file descriptors 0, 1, and 2. For more information about using file descriptors to redirect input and output, see **sh** in *AIX Operating System Commands Reference.*

Shell Flags

The shell provides two different types of flags:

- ***Set flags***. These flags, which are put into effect by the ***set*** command, alter the way the shell runs.
- ***Command line flags***. These flags, which are entered on the command line, alter the way the shell starts. Command line flags cannot be set with the **set** command.

Set Flags

To put a set flag into effect, enter `set -`*f* (where *-f* is the name of one or more flags preceded by a hyphen). In the following example, the **set** command turns on the **x** and **v** flags.

```
set -xv
```

To remove a set flag, enter `set +`*flag* (where *+flag* is the name of one or more flags preceded by a plus sign):

```
set +xv
```

Following is a list of set flags that often are useful in shell procedures.

Flag	Explanation
-e	Causes the shell to exit immediately if any command exits with nonzero exit status.
-u	Causes the shell to treat an unset variable as an error. This flag can be used to perform a global check on variables.
-t	Causes the shell to exit after reading and running the commands on the remainder of the current input line.

-n Prevents the shell from running commands in a procedure. For example, to check a procedure for syntax errors without running the commands, enter `set -nv` at the beginning of the file.

-k Causes the shell to treat all arguments on the command line of the form *variable=value* as keyword arguments. When **-k** is not set, only arguments of this type that appear before the command name are treated as keyword arguments.

In addition to these set flags, there are two others—the **x** and **v** flags—that are useful for debugging shell procedures. The **x** and **v** flags are usually set from the keyboard.

Flag	Explanation
-x	Causes the shell to print commands and their arguments as they are run. The **-x** flag does not print shell control commands, such as **for**, **while**, **case**, and **if**. **Note:** The **-x** flag traces only the commands that are run, while the **-v** flag causes the shell to print each line of input until a syntax error is found.
-v	Causes the shell to print input lines as they are read. This flag is helpful in finding syntax errors. The commands on each input line are run after that input line is printed, unless the **-n** flag is also in effect.

Command Line Flags

The following list contains descriptions of the four shell command line flags. These flags are specified on the command line and cannot be turned on with the **set** command.

Flag	Explanation
-i	Starts an interactive shell. (If this flag is specified or if both input and output are connected to the display station, the shell is interactive.)
-s	Causes the shell to read commands from standard input. (If this flag is specified, or if input is not redirected, the shell reads commands from standard input.) The shell output is written to file descriptor 2. When you log in to the system, your initial shell operates as if the **-s** flag is turned on.
-c	Causes the shell to read commands from the first string following the flag. Remaining arguments are ignored. Double quotes should be used to enclose a multiword string in order to allow for variable substitution.
-r	Starts the restricted shell. In the restricted shell, certain commands are not available. For example, the **cd** command produces an error message, and you cannot set PATH. For more information on the restricted shell, see **sh** in *AIX Operating System Commands Reference.*

Shell Reserved Characters and Words

Syntactic

|	pipe symbol
&&	'AND' symbol
||	'OR' symbol
;	command separator
;;	case delimiter
&	background commands
( )	command grouping
<	input redirection
< <	input from a here document
>	output creation
> >	output append

Figure A-2. Shell Reserved Characters and Words—Syntactic

Patterns

*	match any character(s) including none
?	match any single character
[...]	match any of the enclosed characters

Figure A-3. Shell Reserved Characters and Words—Pattern-Matching

Substitution

${...}	substitute shell variable
` ... `	substitute command output

Figure A-4. Shell Reserved Characters and Words—Substitution

Quoting

[\]	quote the next character
'...'	quote the enclosed characters except for ' (the single quote itself)
"..."	quote the enclosed characters except for the $, `, [\], and "

Figure A-5. Shell Reserved Characters and Words—Quoting

Reserved Words

if then else elif fi
case in esac
for while until do done
{ } [ ] test

Figure A-6. Shell Reserved Characters and Words—Reserved Words

Appendix B. Creating and Editing Files with ed

CONTENTS

About This Appendix

This appendix explains how to create, edit (modify), display, and save text files with **ed**, a line editing program. If your system has another editing program, you may wish to learn how to do these tasks with that program.

A good way to learn how **ed** works is to try the examples in this appendix on your AIX system. Since the examples build upon each other, it is important for you to work through them in sequence. Also, to make what you see on the screen consistent with what you see in this guide, it is important to do the examples just as they are given.

In the examples, everything you should type is shaded in blue (for example, `1,3t5`). When you are told in the text to ***enter*** something, you should type all of the information for that line and then press the **Enter** key.

Note: A line editing program allows you to work with the contents of a file one line at a time. Regardless of what text is on the screen, you can edit only the ***current*** line. If you have experience with a screen editing program, you should pay careful attention to the differences between that program and **ed**. For example, with the **ed** program, you cannot use the **Cursor Up** and **Cursor Down** keys to change your current line.

Understanding Text Files and the Edit Buffer

A ***file*** is a collection of data stored together in the computer under an assigned name. You can think of a file as the computer equivalent of an ordinary file folder—it may contain the text of a letter, a report, or some other document, or the source code for a computer program. File names can be up to 14 characters long and can contain letters, numbers, periods, commas, underscores, and some other characters.

The ***edit buffer*** is a temporary storage area that holds a file while you work with it—the computer equivalent of the top of your desk. When you work with a text file, you place it in the edit buffer, make your changes to the file (edit it), and then transfer (copy) the contents of the buffer to a permanent storage area.

The rest of this appendix explains how to create, display, save, and edit (modify) text files.

Creating and Saving Text Files

To follow this procedure, you must be logged in to your AIX system and have the **$** (shell) prompt on your screen.

To Create and Save a Text File

1. At the $ (shell) prompt, enter:

   ed *filename*

   Where *filename* is the name of the file you want to create or edit.

2. When you receive the ?*filename* message, enter:

   a

3. Enter your text.

4. To stop adding text, enter a . (period) at the start of a new line.

5. Enter:

   w

   to copy the contents of the edit buffer into the file *filename*.

6. Enter:

   q

   to end the **ed** program.

Starting the ed Program

To start the **ed** program, enter a command of the form `ed` *filename* after the $ (shell) prompt. (In place of *filename*, enter the name you want to assign to the file.)

In the following example, the **ed afile** command starts the **ed** program and indicates that you want to work with a file named **afile**:

Note: If you intend to work through the examples, start with this one.

```
$ ed afile
?afile
-
```

The **ed** program responds with the message `?afile`, which means that the file does not now exist. You can now use the **a** (append) subcommand (described in the next section) to create `afile` and put text into it.

Entering Text—The a (Append) Subcommand

To put text into your file, enter `a`. The **a** subcommand tells **ed** to add, or append, the text you type to the edit buffer. Type your text, pressing **Enter** at the end of each line. When you have entered all of your text, enter a . (period) at the start of a new line.

Note: If you do not press **Enter** at the end of each line, the **ed** program automatically moves your cursor to the next line after you fill a line with characters. However, **ed** treats everything you type before you press **Enter** as one line, regardless of how many lines it takes up on the screen; that is, the line ***wraps around***.

The following example shows how to enter text into the file `afile`:

```
a
The only way to stop
appending is to type a
line that contains only
a period.
.
-
```

If you stop adding text to the buffer and then decide you want to add some more, enter another **a** subcommand. Type the text and then enter a period at the start of a new line to stop adding text to the buffer.

If you make errors as you type your text, you can correct them before you press **Enter**. Use the **Backspace** key to erase the incorrect character(s). Then type the correct characters in their place.

Displaying Text—The p (Print) Subcommand

Use the **p** (print) subcommand to display the contents of the edit buffer. To display a single line, use the subcommand *n***p** (where *n* is the number of the line):

```
2p
appending is to type a
-
```

To display a series of lines, use the *n*,*m***p** subcommand (where *n* is the starting line number and *m* is the ending line number):

```
1,3p
The only way to stop
appending is to type a
line that contains only
-
```

To display everything from a specific line to the end of the buffer, use the *n*,**$p** subcommand (where *n* is the starting line number and

$ stands for the last line of the buffer). In the following example, 1,$p displays everything in the buffer:

```
1,$p
The only way to stop
appending is to type a
line that contains only
a period.
.
```

Note: Many examples in the rest of this appendix use **1,$p** to display the buffer's contents. In these examples, the **1,$p** subcommand is optional, but convenient—it lets you verify that the subcommands in examples work as they should. Another convenient **ed** convention is **,p**, which is equivalent to **1,$p**—that is, it displays the contents of the buffer.

Saving Text—The w (Write) Subcommand

The **w** (write) subcommand ***writes***, or copies, the contents of the buffer into a file. You can save all or part of a file under its original name or under a different name. In either case, **ed** replaces the original contents of the file you specify with the data copied from the buffer.

Saving Text Under the Same File Name

To save the contents of the buffer under the original name for the file, enter w:

```
w
78
```

The **ed** program copies the contents of the buffer into the file named **afile** and displays the number of characters copied into the file (78). This number includes blanks and characters such as **Enter** (sometimes called ***newline***) which are not visible on the screen.

The **w** subcommand does not affect the contents of the edit buffer. You can save a copy of the file and then continue to work with the contents of the buffer.

The stored file is not changed until the next time you use **w** to copy the contents of the buffer into it. As a safeguard, it is a good practice to save a file periodically while you work on it. Then, if you make changes (or mistakes) that you do not want to save, you can start over with the most recently saved version of the file.

Note: The **u** (undo) subcommand restores the buffer to the state it was in before it was last modified by an **ed** subcommand. The subcommands that **u** can reverse are: **a**, **c**, **d**, **g**, **G**, **i**, **j**, **m**, **r**, **s**, **t**, **v**, and **V**.

Saving Text Under a Different File Name

Often, you may need more than one copy of the same file. For example, you could have the original text of a letter in two files—one to keep as it is, and the other to be revised.

If you have followed the previous examples, you have a file (named **afile**) that contains the original text of your document. To create another copy of the file (while its contents are still in the buffer), use a subcommand of the form `w` *filename*, as the following example shows:

```
w bfile
78
_
```

At this point, **afile** and **bfile** have the same contents; since each is a copy of the same buffer contents. However, because **afile** and **bfile** are separate files, you can change the contents of one without affecting the contents of the other.

Saving Part of a File

To save part of a file, use a subcommand of the form *n*,*m***w** *filename*, where:

n is the beginning line number of the part of the file you want to save.

m is the ending line number of the part of the file you want to save (or the number of a single line, if that is all you want to save).

filename is the name of a different file (optional).

In the following example, the **w** subcommand copies lines 1 and 2 from the buffer into a new file named **cfile**:

```
1,2w cfile
44
-
```

Then **ed** displays the number of characters written into **cfile** (44).

Leaving the ed Program – The q (Quite) Subcommand

Warning: You lose the contents of the buffer when you leave the **ed** program. To save a copy of the data in the buffer, use the **w** subcommand to copy the buffer into a file before you leave the **ed** program.

To leave the **ed** program, enter the q (quit) subcommand:

```
q
$ _
```

The **q** subcommand returns you to the $ (shell) prompt.

If you have changed the buffer, but have not saved a copy of its contents, the **q** subcommand responds with ?, an error message. At that point, you can either save a copy of the buffer (with the **w**

subcommand) or enter `q` again (which lets you leave the **ed** program without saving a copy of the buffer).

Note: You can log out from the **ed** program by pressing **END OF FILE**. If you have changed the buffer since you last saved it, the system displays the ? error message.

Loading Files into the Edit Buffer

Before you can edit a file, you must load it into the edit buffer. You can load a file either at the time you start the **ed** program or while the program is running.

To Load Files into the Edit Buffer

`ed` *filename*

This starts **ed** and loads the file *filename* into the edit buffer.

OR

`e` *filename*

When **ed** is running, this loads the file *filename* into the buffer, erasing any previous contents of the buffer.

OR

n`r` *filename*

When **ed** is running, this reads the named file into the buffer after line *n*. (If you do not specify *n*, **ed** adds the file to the end of the buffer.)

Using the ed (Edit) Command

To load a file into the edit buffer when you start the **ed** program, simply type the name of the file after the command **ed**. The **ed** command in the following example invokes the **ed** program and loads the file `afile` into the edit buffer:

```
$ ed afile
78
-
```

The **ed** program displays the number of characters that it read into the edit buffer (78).

If **ed** cannot find the file, it displays *?filename*. To create that file, use the **a** (append) subcommand (described under "Entering Text—The **a** (Append) Subcommand" on page B-6) and the **w** (write) subcommand (described under "Saving Text—The **w** (Write) Subcommand" on page B-8).

Using the e (Edit) Subcommand

Once you start the **ed** program, you can use the **e** (edit) subcommand to load a file into the buffer. The **e** subcommand replaces the contents of the buffer with the new file. (Compare the **e** subcommand with the **r** subcommand, described under "Using the **r** (Read) Subcommand" on page B-14, which adds the new file to the buffer.)

Warning: When you load a new file into the buffer, the new file replaces the buffer's previous contents. Save a copy of the buffer (with the **w** subcommand) before you read a new file into the buffer.

In the following example, the subcommand `e cfile` reads the file `cfile` into the edit buffer, replacing `afile`:

```
e cfile
44
e afile
78
-
```

The `e afile` subcommand then loads `afile` back into the buffer, deleting `cfile`. The **ed** program returns the number of characters read into the buffer after each **e** subcommand (44 and 78).

If **ed** cannot find the file, it returns *?filename*. To create that file, use the **a** (append) subcommand, described under "Entering Text—The **a** (Append) Subcommand" on page B-6, and the **w** (write) subcommand, described under "Saving Text—The **w** (Write) Subcommand" on page B-8.

You can edit any number of files, one at a time, without leaving the **ed** program. Use the **e** subcommand to load a file into the buffer. After making your changes to the file, use the **w** subcommand to save a copy of the revised file. (See "Saving Text—The **w** (Write) Subcommand" on page B-8 for information about the **w** subcommand.) Then use the **e** subcommand again to load another file into the buffer.

Using the r (Read) Subcommand

Once you have started the **ed** program, you can use the **r** (read) subcommand to read a file into the buffer. The **r** subcommand adds the contents of the file to the contents of the buffer. The **r** subcommand does not delete the buffer. (Compare the **r** subcommand with the **e** subcommand, described under "Using the **e** (Edit) Subcommand" on page B-13, which deletes the buffer before it reads in another file.)

With the **r** subcommand, you can read a file into the buffer at a particular place. For example, the `4r cfile` subcommand reads the file `cfile` into the buffer following line 4. The **ed** program then renumbers all of the lines in the buffer. If you do not use a line number, the **r** subcommand adds the new file to the end of the buffer's contents.

The following example shows how to use the **r** subcommand with a line number:

```
1,$p
The only way to stop
appending is to type a
line that contains only
a period.
3 r cfile
44
1,$p
The only way to stop
appending is to type a
line that contains only
The only way to stop
appending is to type a
a period.
-
```

1,$p displays the four lines of afile. Next, the 3 r cfile subcommand loads the contents of cfile into the buffer, following line 3, and shows that it read 44 characters into the buffer. The next 1,$p subcommand displays the buffer's contents again, letting you verify that the **r** subcommand read **cfile** into the buffer after line 3.

If You Are Working the Examples

If you are working the examples on your AIX system, do the following before you go to the next section:

1. Save the contents of the buffer in the file cfile. Enter:

   ```
   w cfile
   ```

2. Load afile into the buffer. Enter:

   ```
   e afile
   ```

Displaying and Changing the Current Line

The **ed** program is a ***line editor***. This means that **ed** lets you work with the contents of the buffer one line at a time. The line you can work with at any given time is called the ***current line***, and it is represented by the symbol . (called *dot*). To work with different parts of a file, you must change the current line.

To Display the Current Line

To display the current line, enter:

```
p
```

OR

To display the line number of the current line, enter:

```
.=
```

Note: You cannot use the **Cursor Up** and **Cursor Down** keys to change the current line. To change the current line, use the **ed** subcommands described in the following sections.

To Change Your Position in the Buffer

- To set your current line to line number *n*, enter:

  n

- To move the current line forward through the buffer one line at a time:

  Press **Enter**

- To move the current line backward through the buffer one line at a time, enter:

  -

- To move the current line *n* lines forward through the buffer, enter:

  .+*n*

- To move the current line *n* lines backward through the buffer, enter:

  .-*n*

Finding Your Position in the Buffer

When you first load a file into the buffer, the last line of the file is the current line. As you work with the file, you usually change the current line many times. You can display the current line or its line number at any time.

To display the current line, enter p:

```
p
a period.
_
```

The **p** subcommand displays the current line (`a period.`). Because the current line has not been changed since you read `afile` into the buffer, the current line is the last line of the buffer.

Enter `.=` to display the line number of the current line:

```
.=
4
-
```

Since `afile` has four lines, and the current line is the last line in the buffer, the **.=** subcommand displays `4`.

You also can use the `$` (the symbol that stands for the last line in the buffer) with the `=` subcommand to determine the number of the last line in the buffer:

```
$=
4
-
```

The **$=** subcommand is an easy way to find out how many lines are in the buffer.

Note: The **ed** $ symbol has no relationship to the $ (shell) prompt.

Changing Your Position in the Buffer

You can change your position in the buffer (change your current line) in one of two ways:

- Specify a line number (an absolute position).
- Move forward or backward relative to your current line.

To move the current line to a specific line, enter the line number; **ed** displays the new current line. In the following example, the first line of **afile** becomes the current line:

```
1
The only way to stop
-
```

To move the current line forward through the buffer one line at a time, press **Enter**, as the following example shows:

```
appending is to type a

line that contains only

a period.

?
-
```

Notice that when you try to move beyond the last line of the buffer, **ed** returns **?**, an error message. You cannot move beyond the end of the buffer.

To set the current line to the last line of the buffer, enter `$`.

To move the current line backward through the buffer one line at a time, enter - (hyphens) one after the other.

```
-
line that contains only
-
appending is to type a
-
The only way to stop
-
?
-
```

When you try to move beyond the first line in the buffer, you receive the ? message. You cannot move beyond the top of the buffer.

To move the current line forward through the buffer more than one line at a time, enter .*n* (where *n* is the number of lines you want to move):

```
.2
line that contains only
_
```

To move the current line backward through the buffer more than one line at a time, enter: `.-`*n* (where *n* is the number of lines you want to move):

```
.-2
The only way to stop
_
```

Locating Text

If you do not know the number of the line that contains a particular word or another string of characters, you can locate the line with a ***context search***.

To Make a Context Search

- To search forward, enter:

  /string to find/

- To search backward, enter:

  ?string to find?

Searching Forward Through the Buffer

To search forward through the buffer, enter the string enclosed in // (slashes):

```
/only/
line that contains only
-
```

The context search (**/only/**) begins on the first line after the current line, then locates and displays the next line that contains the string **only**. That line becomes the current line.

If **ed** does not find the string between the first line of the search and the last line of the buffer, then it continues the search at line 1 and searches to the current line. If **ed** searches the entire buffer without finding the string, it displays the ? error message:

```
/random/
?
-
```

Once you have searched for a string, you can search for the same string again by entering //. The following example shows one search for the string only, and then a second search for the same string:

```
/only/
The only way to stop
//
line that contains only
-
```

Searching Backward Through the Buffer

Searching backward through the buffer is much like searching forward, except that you enclose the string in question marks (??):

```
?appending?
appending is to type a
-
```

The context search begins on the first line before the current line, and locates the first line that contains the string appending. That line becomes the current line. If **ed** searches the entire buffer without finding the string, it stops the search at the current line and displays the message ?.

Once you have searched backward for a string, you can search backward for the same string again by entering ??.

Changing the Direction of a Search

You can change the direction of a search for a particular string by using the / and ? search characters alternately:

```
/only/
line that contains only
??
The only way to stop
-
```

If you go too far while searching for a character string, it is convenient to be able to change the direction of your search.

Making Substitutions—The s (Substitute) Subcommand

Use the **s** (substitute) subcommand to replace a ***character string*** (a group of one or more characters) with another. The **s** subcommand works with one or more lines at a time, and is especially useful for correcting typing or spelling errors.

To Make Substitutions

- To substitute *newstring* for *oldstring* at the first occurrence of *oldstring* in the current line, enter:

  `s/`*oldstring*`/`*newstring*`/`

- To substitute *newstring* for *oldstring* at the first occurrence of *oldstring* on line number *n*, enter:

  n`s/`*oldstring*`/`*newstring*`/`

- To substitute *newstring* for *oldstring* at the first occurrence of *oldstring* in each of the lines *n* through *m*, enter:

  n`,`*m*`s/`*oldstring*` /`*newstring*`/`

Substituting on the Current Line

To make a substitution on the current line, first make sure that the line you want to change is the current line. In the following example, the `/appending/` (search) subcommand locates the line to be changed. Then the `s/appending/adding text/p` (substitute) subcommand substitutes the string `adding text` for the string `appending` on the current line. The print (**p**) subcommand displays the changed line.

```
/appending/
appending is to type a
s/appending/adding text/
p
adding text is to type a
-
```

Note: For convenience, you can add the **p** (print) subcommand to the **s** subcommand (for example, `s/appending/adding text/p`). This saves you from having to type a separate **p** subcommand to see the result of the substitution.

A simple **s** subcommand changes only the first occurrence of the string on a given line. To learn how to change all occurrences of a string on the line, see "Changing Every Occurrence of a String" on page B-26.

Substituting on a Specific Line

To make a substitution on a specific line, use a subcommand of the form *n*`s/`*oldstring*`/`*newstring*`/`, where *n* is the number of the line on which the substitution is to be made. In the following example, the **s** subcommand moves to line number 1 and replaces the string `stop` with the string `quit` and displays the new line:

```
1s/stop/quit/p
The only way to quit
-
```

The **s** subcommand changes only the first occurrence of the string on a given line. To learn how to change all occurrences of a string on the line, see "Changing Every Occurrence of a String" on page B-26.

Substituting on Multiple Lines

To make a substitution on multiple lines, use a subcommand of the form *n,m*s/*oldstring* /*newstring*/, where *n* is the first line of the group and *m* is the last. In the following example, the **s** subcommand replaces the first occurrence of the string to with the string TO on every line in the buffer.

```
1,$s/to/TO/
1,$p
The only way TO quit
adding text is TO type a
line that contains only
a period.
-
```

The 1,$p subcommand displays the contents of the buffer, which lets you verify that the substitutions were made.

Changing Every Occurrence of a String

Ordinarily, the **s** (substitute) subcommand changes only the first occurrence of a string on a given line. However, the **g** (global) operator lets you change every occurrence of a string on a line or in a group of lines.

To make a global substitution on a single line, use a subcommand of the form *n*s/*oldstring*/ *newstring*/. In the following example, 3s/on/ON/gp changes each occurrence of the string on to ON in line 3 and displays the new line:

```
3s/on/ON/gp
line that cONtains ONly
-
```

To make a global substitution on multiple lines, specify the group of lines with a subcommand of the form *n,m*s/*oldstring*/ *newstring*/g. In the following example, 1,$s/TO/to/g changes the string TO into the string to in every line in the buffer:

```
1,$s/TO/to/g
1,$p
The only way to quit
adding text is to type a
line that cONtains ONly
a period.
-
```

Removing Characters

You can use the **s** (substitute) subcommand to remove a string of characters (that is, to replace the string with "nothing"). To remove characters, use a subcommand of the form `s/`*oldstring*`//` (with no space between the last two / characters).

In the following example, **ed** removes the string `adding` from line number 2 and then displays the changed line:

```
2s/adding//
text is to type a
-
```

Substituting at Line Beginnings and Ends

Two special characters let you make substitutions at the beginning or end of a line:

Special Substitution Characters

^ (circumflex) Makes a substitution at the beginning of the line. (To get the ^ character, press **Shift-6**.)

$ (dollar sign) Makes a substitution at the end of the line. (In this context, the $ character does not stand for the last line in the buffer.)

To make a substitution at the beginning of a line, use the **s/^/***newstring* subcommand. In the following example, one **s** subcommand adds the string `Remember,` to the start of line number

1. Another **s** subcommand adds the string `adding` to the start of line 2:

```
1s/^/Remember, /p
Remember, The only way to quit
2s/^/adding/p
adding text is to type a
-
```

To make a substitution at the end of a line, use a subcommand of the form `s/$/`*newstring*. In the following example, the **s** subcommand adds the string `Then press Enter.` to the end of line number 4:

```
4s/$/  Then press Enter./p
a period.  Then press Enter.
-
```

Notice that the substituted string includes two blanks before the word `Then` to separate the two sentences.

Using a Context Search

If you do not know the number of the line you want to change, you can locate it with a context search. See "Locating Text" on page B-21 for more information on context searches.

For convenience, you can combine a context search and a substitution into a single subcommand: */string to find*`/s/`*oldstring/newstring/*.

In the following example, **ed** locates the line that contains the string `, The` and replaces that string with `, the`:

```
/, The/s/, The/, the/p
Remember, the only way to quit
-
```

Also, you can use the search string as the string to be replaced with a subcommand of the form */string to find*`/s//`*newstring/*. In the following example, **ed** locates the line that contains the string

cONtains ONly, replaces that string with contains only, and prints the changed line:

```
/cONtains ONly/s//contains only/p
line that contains only
_
```

Deleting Lines—The d (Delete) Subcommand

Use the **d** (delete) subcommand to remove one or more lines from the buffer. The general form of the **d** subcommand is *starting line,ending line*d. After you delete lines, **ed** sets the current line to the first line following the lines that were deleted. If you delete the last line from the buffer, the last remaining line in the buffer becomes the current line. After a deletion, **ed** renumbers the remaining lines in the buffer.

To Delete Lines from the Buffer

- To delete the current line, enter:

  ```
  d
  ```

- To delete line number *n* from the buffer, enter:

  ```
  nd
  ```

- To delete lines numbered *n* through *m* from the buffer, enter:

  ```
  n,md
  ```

Deleting the Current Line

If you want to delete the current line, simply enter `d`. In the following example, the `1,$p` subcommand displays the entire contents of the buffer, and the `$` subcommand makes the last line of the buffer the current line:

```
1,$p
Remember, the only way to quit
adding is to type a
line that contains only
a period.  Then press Enter.
$
a period.  Then press Enter
d
-
```

The **d** subcommand then deletes the current line (in this case, the last line in the buffer).

Deleting a Specific Line

If you know the number of the line you want to delete, use a subcommand of the form *n*d to make the deletion. In the following example, the 2d subcommand deletes line 2 from the buffer:

```
2d
1,$p
Remember, the only way to quit
line that contains only
-
```

The 1,$p subcommand displays the contents of the buffer, showing that the line was deleted.

Deleting Multiple Lines

To delete a group of lines from the buffer, use a subcommand of the form *n*,*m*d, where *n* is the starting line number and *m* is the ending line number of the group to be deleted.

In the following example, the 1,2d subcommand deletes lines 1 through 2:

```
1,2d
1,$p
?
-
```

The `1,$p` subcommand displays the ? message, indicating that the buffer is empty.

If you are following the examples on your AIX system, you should restore the contents of the buffer before you move on to the next section. The following example shows you how to restore the contents of the buffer:

```
e afile
?
e afile
78
-
```

This reads a copy of the original file `afile` into the buffer.

Moving Text—The m (Move) Subcommand

Use the **m** (move) subcommand to move a group of lines from one place to another in the buffer. After a move, the last line moved becomes the current line.

To Move Text

Enter a subcommand of the form *x,ymz* where:

x is the first line of the group to be moved.
y is the last line of the group to be moved.
z is the line the moved lines are to follow.

In the following example, the `1,2m4` subcommand moves the first two lines of the buffer to the position following line 4:

```
1,2m4
1,$p
line that contains only
a period.
The only way to stop
appending is to type a
-
```

The `1,$p` subcommand displays the contents of the buffer, showing that the move is complete.

To move a group of lines to the top of the buffer, use 0 as the line number for the moved lines to follow. In the next example, the `3,4m0` subcommand moves lines 3 through 4 to the top of the buffer:

```
3,4m0
1,$p
The only way to stop
appending is to type a
line that contains only
a period.
-
```

The 1,$p subcommand displays the contents of the buffer, showing that the move has been made.

To move a group of lines to the end of the buffer, use $ as the line number for the moved lines to follow:

```
1,2m$
1,$p
line that contains only
a period.
The only way to stop
appending is to type a
_
```

Changing Lines of Text—The c (Change) Subcommand

Use the **c** (change) subcommand to replace one or more lines with one or more new lines. The **c** subcommand first deletes the line(s) you want to replace and then lets you enter the new lines, just as if you were using the **a** (append) subcommand. When you have entered all of the new text, type a . (period) on a line by itself. The general form of the **c** subcommand is *starting line, ending line*c.

To Change Lines of Text

1. Enter a subcommand of the form:

   n,*m*c

   where:

   n is the number of the first line of the group to be deleted.
   m is the number of the last line of the group (or the only line) to be deleted.

2. Type the new line(s), pressing **Enter** at the end of each line.

3. Enter a period on a line by itself.

Changing a Single Line

To change a single line of text, use only one line number with the **c** (change) subcommand. You can replace the single line with as many new lines as you like.

In the following example, the **2c** subcommand deletes line 2 from the buffer, and then you can enter new text:

```
2c
appending new material is to
use the proper keys to create a
.
1,$p
The only way to stop
appending new material is to
use the proper keys to create a
line that contains only
a period.
-
```

The period on a line by itself stops **ed** from adding text to the buffer. The `1,$p` subcommand displays the entire contents of the buffer, showing that the change has been made.

Changing Multiple Lines

To change more than one line of text, give the starting and ending line numbers of the group of lines to be with the **c** subcommand. You can replace the group of lines with one or more new lines.

In the following example, the `2,3c` subcommand deletes lines 2 through 3 from the buffer, and then you can enter new text:

```
2,3c
adding text is to type a
.
1,$p
The only way to stop
adding text is to type a
line that contains only
a period.
-
```

The period on a line by itself stops **ed** from adding text to the buffer. The `1,$p` subcommand displays the entire contents of the buffer, showing that the change has been made.

Inserting Text—The i (Insert) Subcommand

Use the **i** (insert) subcommand to insert one or more new lines into the buffer. To locate the place in the buffer for the lines to be inserted, you can use either a line number or a context search. The **i** subcommand inserts new lines before the specified line. (Compare the **i** subcommand with the **a** subcommand, explained under "Entering Text—The **a** (Append) Subcommand" on page B-6, which inserts new lines after the specified line.)

To Insert Text

1. Enter a subcommand of one of the following types:

   *n*i

   Where *n* is the number of the line the new lines will be inserted above.

   /*string*/i

   Where *string* is a group of characters contained in the line the new lines will be inserted above.

2. Enter the new lines.

3. Enter a period at the start of a new line.

Using Line Numbers

If you know the number of the line where you want to insert new lines, you can use an insert subcommand of the form *n*i (where *n* is a line number). The new lines you type go into the buffer before line number *n*. To end the **i** subcommand, type a . (period) on a line by itself.

In the following example, the `1,$p` subcommand prints the contents of the buffer. Then the `4i` subcommand inserts new lines before line number 4.

```
1,$p
The only way to stop
adding text is to type a
line that contains only
a period.
4i
--repeat, only--
.
1,$p
The only way to stop
adding text is to type a
line that contains only
--repeat, only--
a period.
-
```

After `4i`, you enter the new line of text and type a period on the next line to end the **i** subcommand. A second `1,$p` subcommand displays the contents of the buffer again, showing that the new text has been inserted.

Using a Context Search

Another way to specify where the **i** subcommand inserts new lines is to use a context search. With a subcommand of the form */string*`/i`, you can locate the line that contains *string* and insert new lines before that line. When you finish inserting new lines, type a period on a line by itself.

In the following example, the `/period/i` subcommand inserts new text before the line that contains the string `period`:

```
/period/i
and in the first position--
.
1,$p
The only way to stop
adding text is to type a
line that contains only
--repeat, only--
and in the first position--
a period.
_
```

The 1,$p subcommand displays the entire contents of the buffer, showing that the **i** subcommand has inserted the new text.

Copying Lines—The t (Transfer) Subcommand

With the **t** (transfer) subcommand, you can copy lines from one place in the buffer and insert the copies elsewhere. The **t** subcommand does not affect the original lines. The general form of the **t** subcommand is *starting line, ending linetline to follow.*

To Copy Lines

Enter a subcommand of the form:

n,mtx

Where:

n is the first line of the group to be copied.
m is the last line of the group to be copied.
x is the line the copied lines are to follow.

To copy lines to the top of the buffer, use 0 as the line number for the copied lines to follow. To copy lines to the bottom of the buffer, use $ as the line number for the copied lines to follow.

In the following example, the `1,3t4` subcommand copies lines 1 through 3, and inserts the copies after line 4:

```
1,3t4
1,$p
The only way to stop
adding text is to type a
line that contains only
--repeat, only--
The only way to stop
adding text is to type a
line that contains only
and in the first position--
a period.
_
```

The `1,$p` subcommand displays the entire contents of the buffer, showing that **ed** has made and inserted the copies, and that the original lines are not affected.

Using System Commands from ed

Sometimes you may find it convenient to use a system command without leaving the **ed** program—perhaps to use one of the commands covered in Chapter 3, "Using the File System" on page 3-1. Use the ! character to leave the **ed** program temporarily.

To Use a System Command from ed

Enter:

!*command name*

In the following example, the `!ls` command temporarily suspends the **ed** program and runs the **ls** (list) system command (a command that lists the files in the current directory):

```
!ls
afile
bfile
cfile
!
-
```

The **ls** command displays the names of the files in the current directory (`afile`, `bfile`, and `cfile`), and then displays another ! character. The **ls** command is finished, and you can continue to use **ed**.

You can use any system command from within the **ed** program. You can even run another **ed** program, edit a file, and then return to the original **ed** program. From the second **ed** program, you can run a third **ed** program, use a system command, and so forth.

Ending the ed Program

This completes the introduction to the **ed** program. To save your file and end the **ed** program, do the steps in the following box:

Saving a File and Ending ed

1. Enter:

   ```
   w
   ```

2. Enter:

   ```
   q
   ```

For a full discussion of the **w** and **q** subcommands, see "Saving Text—The **w** (Write) Subcommand" on page B-8 and "Leaving the **ed** Program – The **q** (Quite) Subcommand" on page B-10 respectively.

For information about other features of **ed**, see **ed** in *AIX Operating System Commands Reference.*

For information about printing the files you create with **ed**, see Chapter 2, "Displaying and Printing Files."

Figures

Glossary

access. To obtain data from or put data in storage.

access permission. A group of designations that determine who can access a particular AIX file and how the user may access the file.

account. The log in directory and other information that give a user access to the system.

activity manager. A collection of system-supplied tasks allowing users to manage their activities. Provides the ability to list current activities (Activity List) and to begin, cancel, hide, and activate activities.

All Points Addressable (APA) display. A display that allows each pel to be individually addressed. An APA display allows images to be displayed that are not made up of images predefined in character boxes. Contrast with *character display*.

allocate. To assign a resource, such as a disk file or a diskette file, to perform a specific task.

alphabetic. Pertaining to a set of letters a through z.

alphanumeric character. Consisting of letters, numbers and often other symbols, such as punctuation marks and mathematical symbols.

American National Standard Code for Information Interchange (ASCII). The code developed by ANSI for information interchange among data processing systems, data communications systems, and associated equipment. The ASCII character set consists of 7-bit control characters and symbolic characters.

American National Standards Institute. An organization sponsored by the Computer and Business Equipment Manufacturers Association for establishing voluntary industry standards.

application. A program or group of programs that apply to a particular business area, such as the Inventory Control or the Accounts Receivable application.

application program. A program used to perform an application or part of an application.

argument. Numbers, letters, or words that change the way a command works.

ASCII. See *American National Standard Code for Information Interchange.*

asynchronous transmission. In data communications, a method of transmission in which the bits included in a character or block of characters occur during a specific time interval. However, the start of each character or block of characters can occur at any time during this interval. Contrast with *synchronous transmission.*

attribute. A characteristic. For example, the attribute for a displayed field could be blinking.

audit. To review and examine the activities of a data processing system mainly to test the adequacy and effectiveness of procedures for data privacy and data integrity.

audit class. A list of events that defines which actions taken by a user are to be audited. The list is defined in the user database by the person who administrates the system.

audit event. A user action on the system which can be recorded.

audit trail. For systems running in controlled access mode, a collection of events that could compromise system security recorded in the order in which they occurred.

authentication. In computer security, a process used to verify the user of an information system or protected resources.

authorize. To grant to a user the right to communicate with, or make use of, a computer system or display station.

auto carrier return. The system function that places carrier returns automatically within the text and on the display. This is accomplished by moving whole words that exceed the line end zone to the next line.

backend. The program that sends output to a particular device. There are two types of backends: friendly and unfriendly.

background process. (1) A process that does not require operator intervention that can be run by the computer while the work station is used to do other work. (2) A mode of program execution in which the shell does not wait for program completion before prompting the user for another command.

backup copy. A copy, usually of a file or group of files, that is kept in case the original file or files are unintentionally changed or destroyed.

backup diskette. A diskette containing information copied from a fixed disk or from another diskette. It is used in case the original information becomes unusable.

bad block. A portion of a disk that can never be used reliably.

base address. The beginning address for resolving symbolic references to locations in storage.

base name. The last element to the right of a full path name. A filename specified without its parent directories.

batch printing. Queueing one or more documents to print as a separate job. The operator can type or revise additional documents at the same time. This is a background process.

batch processing. A processing method in which a program or programs process records with little or no operator action. This is a background process. Contrast with *interactive processing.*

binary. (1) Pertaining to a system of numbers to the base two; the binary digits are 0 and 1. (2) Involving a choice of two conditions, such as on-off or yes-no.

bit. Either of the binary digits 0 or 1 used in computers to store information. See also *byte.*

block. (1) A group of records that is recorded or processed as a unit. Same as *physical record.* (2) In data communications, a group of records that is recorded, processed, or sent as a unit. (3) A block is 512 bytes long. (4) A logical block is 2048 bytes long.

block file. A file listing the usage of blocks on a disk.

block special file. A special file that provides access to an input or output device is capable of supporting a file system. See also *character special file.*

bootstrap. A small program that loads larger programs during system initialization.

bps. Bits per second.

branch. In a computer program an instruction that selects one of two or more alternative sets of instructions. A conditional branch occurs only when a specified condition is met.

breakpoint. A place in a computer program, usually specified by an instruction, where execution may be interrupted by external intervention or by a monitor program.

buffer. (1) A temporary storage unit, especially one that accepts information at one rate and delivers it at another rate. (2) An area of storage, temporarily reserved for performing input or output, into which data is read, or from which data is written.

burst pages. On continuous-form paper, pages of output that can be separated at the perforations.

byte. The amount of storage required to represent one character; a byte is 8 bits.

call. (1) To activate a program or procedure at its entry point. Compare with *load.*

callouts. An AIX kernel parameter establishing the maximum number of scheduled activities that can be pending simultaneously.

cancel. To end a task before it is completed.

carrier return. (1) In text data, the action causing line ending formatting to

be performed at the current cursor location followed by a line advance of the cursor. Equivalent to the carriage return of a typewriter. (2) A keystroke generally indicating the end of a command line.

case sensitive. Able to distinguish between uppercase and lowercase letters.

character. A letter, digit, or other symbol.

character display. A display that uses a character generator to display predefined character boxes of images (characters) on the screen. This kind of display cannot address the screen any less than one character box at a time. Contrast with *All Points Addressable display.*

character key. A keyboard key that allows the user to enter the character shown on the key. Compare with *function keys.*

character position. On a display, each location that a character or symbol can occupy.

character set. A group of characters used for a specific reason; for example, the set of characters a printer can print or a keyboard can support.

character special file. A special file that provides access to an input or output device. The character interface is used for devices that do not use block I/O. See also *block special file.*

character string. A sequence of consecutive characters.

character variable. The name of a character data item whose value may be assigned or changed while the program is running.

child. (1) Pertaining to a secured resource, either a file or library, that uses the user list of a parent resource. A child resource can have only one parent resource. (2) In the AIX Operating System, child is a *process* spawned by a parent process that shares resources of parent process. Contrast with *parent.*

C language. A general-purpose programming language that is the primary language of the AIX Operating System.

class. Pertaining to the I/O characteristics of a device. AIX devices are classified as block or character.

close. (1) To end an activity and remove that window from the display.

code. (1) Instructions for the computer. (2) To write instructions for the computer; to *program.* (3) A representation of a condition, such as an error code.

code segment. See *segment.*

collating sequence. The sequence in which characters are ordered within the computer for sorting, combining, or comparing.

color display. A display device capable of displaying more than two colors and the shades produced via the two colors, as opposed to a monochrome display.

column. A vertical arrangement of text or numbers.

column headings. Text appearing near the top of columns of data for the purpose of identifying or titling.

command. A request to perform an operation or run a program. When parameters, arguments, flags, or other operands are associated with a command, the resulting character string is a single command.

command interpreter. A program that sends instructions to the kernel; also called an interface.

command line. The area of the screen where commands are displayed as they are typed.

command line editing keys. Keys for editing the command line.

command name. (1) The first or principal term in a command. A command name does not include parameters, arguments, flags, or other operands. (2) The full name of a command when an abbreviated form is recognized by the computer (for example, print working directory for pwd).

command programming language. Facility that allows programming by the combination of commands rather than by writing statements in a conventional programming language.

communications adapter. A hardware feature that enables a computer or device to become part of a data communications network.

compile. (1) To translate a program written in a high-level programming language into a machine language program. (2) The computer actions required to transform a source file into an executable object file.

compress. (1) To move files and libraries together on disk to create one continuous area of unused space. (2) In data communications, to delete a series of duplicate characters in a character string.

computer virus. A program that can vandalize your files, although it usually does its defined task. It can spread itself to other files and directories on the system.

concatenate. (1) To link together. (2) To join two character strings.

condition. An expression in a program or procedure that can be evaluated to a value of either true or false when the program or procedure is running.

configuration. The group of machines, devices, and programs that make up a computer system. See also *system customization.*

configuration file. A file that specifies the characteristics of a system or subsystem, for example, the AIX queueing system.

consistent. Pertaining to a file system, without internal discrepancies.

console. (1) The main AIX display station. (2) A device name associated with the main AIX display station.

constant. A data item with a value that does not change. Contrast with *variable.*

context search. A search through a file whose target is a character string.

control block. A storage area used by a program to hold control information.

control commands. Commands that allow conditional or looping logic flow in shell procedures.

control program. Part of the AIX Operating System system that determines the order in which basic functions should be performed.

controlled cancel. The system action that ends the job step being run, and saves any new data already created. The job that is running can continue with the next job step.

copy. The action by which the user makes a whole or partial duplicate of already existing data.

coupler. A device connecting a modem to a telephone network.

crash. An unexpected interruption of computer service, usually due to a serious hardware or software malfunction.

current directory. The directory that is active, and can be displayed with the **pwd** command.

current line. The line on which the cursor is located.

current working directory. See *current directory.*

cursor. (1) A movable symbol (such as an underline) on a display, used to indicate to the operator where the next typed character will be placed or where the next action will be directed. (2) A marker that indicates the current data access location within a file.

cursor movement keys. The directional keys used to move the cursor.

customize. To describe (to the system) the devices, programs, users, and user defaults for a particular data processing system.

cylinder. All fixed disk or diskette tracks that can be read or written without moving the disk drive or diskette drive read/write mechanism.

daemon. See *daemon process.*

daemon process. A process begun by the root or the root shell that can be stopped only by the root. Daemon processes generally provide services that must be available at all times such as sending data to a printer.

data block. See *block.*

database. A collection of information used for a specific purpose.

data communications. The transmission of data between computers, or remote devices or both (usually over long distance).

data link. The equipment and rules (protocols) used for sending and receiving data.

data stream. All information (data and control information) transmitted over a data link.

debug. (1) To detect, locate, and correct mistakes in a program. (2) To find the cause of problems detected in software.

default. A value that is used when no alternative is specified by the operator.

default directory. The directory name supplied by the operating system if none is specified.

default drive. The drive name supplied by the operating system if none is specified.

default value. A value stored in the system that is used when no other value is specified.

delete. To remove. For example, to delete a file.

dependent work station. A work station having little or no standalone capability, that must be connected to a host or server in order to provide any meaningful capability to the user.

device. An electrical or electronic machine that is designed for a specific purpose and that attaches to your computer, for example, a printer, plotter, disk drive, and so forth.

device driver. A collection of routines that control the interface between I/O device adaptes and the operating system. The primary components of an IBM RT device driver are the device head, device handler, and

device manager. Collection of routines that act as an intermediary between device drivers and virtual machines for complex interfaces. For example, supervisor calls from a virtual machine are examined by a device manager and are routed to the appropriate subordinate device drivers.

device name. A name reserved by the system that refers to a specific device.

diagnostic. Pertaining to the detection and isolation of an error.

diagnostic aid. A tool (procedure, program, reference manual) used to detect and isolate a device or program malfunction or error.

diagnostic routine. A computer program that recognizes, locates, and explains either a fault in equipment or a mistake in a computer program.

digit. Any of the numerals from 0 through 9.

directory. A type of file containing the names and controlling information for other files or other directories.

disable. To make nonfunctional.

discipline. Pertaining to the order in which requests are serviced, for example, first-come-first-served (fcfs) or shortest job next (sjn).

disk I/O. Fixed-disk input and output.

diskette. A thin, flexible magnetic plate that is permanently sealed in a protective cover. It can be used to store information copies from the disk or another diskette.

diskette drive. The mechanism used to read and write information on diskettes.

display device. An output unit that gives a visual representation of data.

display screen. The part of the display device that displays information visually.

display station. A device that includes a keyboard from which an operator can send information to the system and a display screen on which an operator can see the information sent to or received from the computer.

Distributed Services(DS). A licensed program that allows you to share files with other RT systems in a network. You can mount the file systems located on other RT systems to create file trees that are independent of the file systems.

dump. (1) To copy the contents of all or part of storage, usually to an output device. (2) Data that has been dumped.

dump diskette. A diskette that contains a dump or is prepared to receive a dump.

dump formatter. Program for analyzing a dump.

EBCDIC. See *extended binary-coded decimal interchange code.*

EBCDIC character. Any one of the symbols included in the 8-bit EBCDIC set.

edit. To modify the form or format of data.

edit buffer. A temporary storage area used by an editor.

editor. A program used to enter and modify programs, text, and other types of documents and data.

effective group ID. The current group ID, but not necessarily the user's own ID. For example, a user logged in under a particular group ID may be able to change to another group ID. The ID to which the user changes becomes the effective group ID.

effective user ID. The current user ID, but not necessarily the user's login ID. For example, a user logged in under a login ID may change to another user's ID The ID to which the user changes becomes the effective user ID until the user switches back to the original login ID.

emulation. Imitation; for example, when one computer imitates the characteristics of another computer.

enable. To make functional.

encrypt. To scramble data or convert data to a secret code, masking the meaning of the data to any unauthorized recipient.

enter. To send information to the computer by pressing the **Enter** key.

entry. A single input operation on a work station.

environment. The settings for shell variables and paths set associated with each process. These variables can be modified later by the user.

error-correct backspace. An editing key that performs editing based on a cursor position; the cursor is moved one position toward the beginning of the line, the character at the new cursor location is deleted, and all characters following the cursor are moved one position toward the beginning of the line (to fill the vacancy left by the deleted element).

escape character. A character that suppresses the special meaning of one or more characters that follow.

exit value. A numeric value that a command returns to indicate whether it completed successfully. Some commands return exit values that give other information, such as whether a file exists. Shell programs can test exit values to control branching and looping.

expression. A representation of a value. For example, variables and constants appearing alone or in combination with operators.

extended binary-coded decimal interchange code (EBCDIC). A set of 256 eight-bit characters.

feature. A programming or hardware option, usually available at an extra cost.

field. (1) An area in a record or panel used to contain a particular category of data. (2) The smallest component of a record that can be referred to by a name.

FIFO. See *first-in-first-out.*

file. A collection of related data that is stored and retrieved by an assigned name.

file name. The name used by a program to identify a file. See also *label.*

filename. In DOS, that portion of the file name that precedes the extension.

file specification (filespec). The name and location of a file. A file specification consists of a drive specifier, a path name, and a file name.

file system. The collection of files and file management structures on a physical or logical mass storage device, such as a diskette or minidisk.

filetab. An AIX kernel parameter establishing the maximum number of files that can be open simultaneously.

filter. A command that reads standard input data, modifies the data, and sends it to standard output.

first-in-first-out (FIFO). A named permanent pipe. A FIFO allows two unrelated processes to exchange information using a pipe connection.

first level interrupt handler (FLIH). A routine that receives control of the system as a result of a hardware interrupt. One FLIH is assigned to each of the six interrupt levels.

fixed disk. A flat, circular, nonremoveable plate with a magnetizable surface layer on which data can be stored by magnetic recording.

fixed-disk drive. The mechanism used to read and write information on fixed disk.

flag. A modifier that appears on a command line with the command name that defines the action of the command. Flags in the AIX Operating System almost always are preceded by a dash.

font. A family or assortment of characters of a given size and style.

foreground. A mode of program execution in which the shell waits for the program specified on the command line to complete before returning your prompt.

format. (1) A defined arrangement of such things as characters, fields, and lines, usually used for displays, printouts, or files. (2) The pattern which determines how data is recorded.

formatted diskette. A diskette on which control information for a particular computer system has been written but which may or may not contain any data.

free list. A list of available space on each file system. This is sometimes called the free-block list.

free-block list. See *free list.*

full path name. The name of any directory or file expressed as a string of directories and files beginning with the root directory.

function. A synonym for procedure. The C language treats a function as a data type that contains executable code and returns a single value to the calling function.

function keys. Keys that request actions but do not display or print characters. Included are the keys that normally produce a printed character, but when used with the code key produce a function instead. Compare with *character key.*

generation. For some remote systems, the translation of configuration information into machine language.

Gid. See *group number.*

global. Pertains to information available to more than one program or subroutine.

global action. An action having general applicability, independent of the context established by any task.

global character. The special characters * and ? that can be used in a file specification to match one or more characters. For example, placing a ? in a file specification means any character can be in that position.

global search. The process of having the system look through a document for specific characters, words, or groups of characters.

global variable. A symbol defined in one program module, but used in other independently assembled program modules.

graphic character. A character that can be displayed or printed.

group name. A name that uniquely identifies a group of users to the system.

group number (Gid). A unique number assigned to a group of related users. The group number can often be substituted in commands that take a group name as an argument.

hardware. The equipment, as opposed to the programming, of a computer system.

header. Constant text that is formatted to be in the top margin of one or more pages.

header label. A special set of records on a diskette describing the contents of the diskette.

here document. Data contained within a shell program or procedure (also called *inline input*).

hexadecimal. Pertaining to a system of numbers to the base sixteen; hexadecimal digits range from 0 (zero) through 9 (nine) and A (ten) through F (fifteen).

highlight. To emphasize an area on the display by any of several methods, such as brightening the area or reversing the color of characters within the area.

history file. A file containing a log of system actions and operator responses.

hog factor. In system accounting, an analysis of how many times each command was run, how much processor time and memory it used, and how intensive that use was.

home directory. (1) A directory associated with an individual user. (2) The user's current directory on login or after issuing the **cd** command with no argument.

I/O. See *input/output.*

ID. Identification.

IF expressions. Expressions within a procedure, used to test for a condition.

imbedded message. A message that is included within, and surrounded by, the text of another message.

indirect block. A block containing pointers to other blocks. Indirect blocks can be single-indirect, double-indirect, or triple-indirect.

informational message. A message providing information to the operator, that does not require a response.

initial program load (IPL). The process of loading the system programs and preparing the system to run jobs. See *initialize.*

initialize. To set counters, switches, addresses, or contents of storage to zero or other starting values at the beginning of, or at prescribed points in, the operation of a computer routine.

inline input. See *here document.*

i-node. The internal structure for managing files in the system. I-nodes contain all of the information pertaining to the node, type, owner, and location of a file. A table of i-nodes is stored near the beginning of a file system.

i-number. A number specifying a particular i-node on a file system.

inodetab. An kernel parameter that establishes the size of the table in memory for storing copies of i-nodes for all active files.

input. Data to be processed.

input device. Physical devices used to provide data to a computer.

input file. A file opened by a program so that the program can read from that file.

input list. A list of variables to which values are assigned from input data.

input redirection. The specification of an input source other than the standard one.

input-output device number. A value assigned to a device driver by the guest operating system or to the virtual device by the Virtual Resource Manager. This number uniquely identifies the device regardless of whether it is real or virtual.

input-output file. A file opened for input and output use.

input/output (I/O). Pertaining to either input, output, or both between a computer and a device.

input/output subsytem. That part of the VRM comprised of processes and device managers that provides the mechanisms for data transfer and I/O device management and control.

interactive processing. A processing method in which each system user action causes response from the program or the system. Contrast with *batch processing.*

interface. A shared boundary between two or more entities. An interface might be a hardware component to link two

devices together or it might be a portion of storage or registers accessed by two or more computer programs.

interleave factor. Specification of the ratio between contiguous physical blocks (on a fixed-disk) and logically contiguous blocks (as in a file).

interrupt. (1) To temporarily stop a process. (2) In data communications, to take an action at a receiving station that causes the sending station to end a transmission. (3) A signal sent by an I/O device to the processor when an error has occurred or when assistance is needed to complete I/O. An interrupt usually suspends execution of the currently executing program.

IPL. See *initial program load.*

job. (1) A unit of work to be done by a system. (2) One or more related procedures or programs grouped into a procedure.

job queue. A list, on disk, of jobs waiting to be processed by the system.

justify. To print a document with even right and left margins.

kbuffers. An AIX kernel parameter establishing the number of buffers that can be used by the kernel.

K-byte. See *kilobyte.*

kernel. A part of the AIX Operating System which participates in the control of computer functions such as input/output, management and control of hardware and software, and scheduling of user processes.

kernel parameters. Variables that specify how the kernel allocates certain system resources.

key pad. A physical grouping of keys on a keyboard (for example, numeric key pad, and cursor key pad).

keyboard. An input device consisting of various keys allowing the user to input data, control cursor and pointer locations, and to control the dialog between the user and the display station

keylock feature. A security feature in which a lock and key can be used to restrict the use of the display station.

keyword. One of the predefined words of a programming language; a reserved word.

keyword argument. One type of variable assignment that can be made on the command line.

kill. An AIX Operating System command that stops a process.

kill character. The character that is used to delete a line of characters entered after the user's prompt.

kilobyte. 1024 bytes.

kprocs. A kernel parameter establishing the maximum number of processes that the kernel can run simultaneously.

label. (1) The name in the disk or diskette volume table of contents that identifies a file. See also *file name.* (2) The field of an instruction that assigns a symbolic name to the location at which the instruction begins, or such a symbolic name.

left margin. The area on a page between the left paper edge and the leftmost character position on the page.

left-adjust. The process of aligning lines of text at the left margin or at a tab setting such that the leftmost character in the line or filed is in the leftmost position. Contrast with *right-adjust.*

library. A collection of functions, calls, subroutines, or other data.

line editor. An editor that modifies the contents of a file one line at a time.

linefeed. An ASCII character that causes an output device to move forward one line.

link. A connection between an i-node and one or more file names associated with it.

literal. A symbol or a quantity in a source program that is itself data, rather than a reference to data.

load. (1) To move data or programs into storage. (2) To place a diskette into a diskette drive, or a magazine into a diskette magazine drive. (3) To insert paper into a printer.

loader. A program that reads run files into main storage, thus preparing them for execution.

local. Pertaining to a device directly connected to your system without the use of a communications line. Contrast with *remote.*

log. To record; for example, to log all messages on the system printer. A list of this type is called a log, such as an error log.

log in. To begin a session at a display station.

log in shell. The program, or command interpreter, started for a user at log in.

log off. To end a session at a display station.

log out. To end a session at a display station.

logical device. A file for conducting input or output with a physical device.

login name. The ID the user uses to log in.

login user ID. An ID number that the system assigns to the user at log in time. It remains the same for the duration of the session. The system uses this ID to trace all user actions to their source.

loop. A sequence of instructions performed repeatedly until an ending condition is reached.

mailbox. An area designated for storage of mail messages directed to a specific system user.

main storage. The part of the processing unit where programs are run.

maintenance system. A special version of the AIX Operating System which is loaded from diskette and used to perform system management tasks.

major device number. A system identification number for each device or type of device.

mapped files. Files on the fixed-disk that are accessed as if they are in memory.

mask. A pattern of characters that controls the keeping, deleting, or testing of portions of another pattern of characters.

matrix. An array arranged in rows and columns.

maxprocs. A kernel parameter establishing the maximum number of processes that can be run simultaneously by a user.

memory. Storage on electronic chips. Examples of memory are random access memory, read only memory, or registers. See *storage.*

menu. A displayed list of items from which an operator can make a selection.

message. (1) A response from the system to inform the operator of a condition which may affect further processing of a current program. (2) Information sent from one user in a multi-user operating system to another.

minidisk. A logical division of a fixed disk.

minor device number. A number used to specify various types of information about a particular device, for example, to distinguish among several printers of the same type.

mode word. An i-node field that describes the type and state of the i-node.

modem. See *modulator-demodulator.*

modulation. Changing the frequency or size of one signal by using the frequency or size of another signal.

modulator-demodulator (modem). A device that converts data from the computer to a signal that can be transmitted on a communications line, and converts the signal received to data for the computer.

module. (1) A discrete programming unit that usually performs a specific task or set of tasks. Modules are subroutines and calling programs that are assembled separately, then linked to make a complete program. (2) See *load module.*

mount. To make a file system accessible.

mountab. An kernel parameter establishing the maximum number of file

systems that can be mounted simultaneously.

multiprogramming. The processing of two or more programs at the same time.

multivolume file. A diskette file occupying more than one diskette.

multi-user environment. A computer system that provides terminals and keyboards for more than one user at the same time.

IBM AIX/RT Network File System (NFS). A licensed program that allows you to share files with other computers in one or more networks that have a variety of machine types and operating systems. You can mount file systems located on network servers and use remote files as if they were on your workstations by creating file trees that are independent of the file systems.

nest. To incorporate a structure or structures of some kind into a structure of the same kind. For example, to nest one loop (the nested loop) within another loop (the nesting loop); to nest one subroutine (the nested subroutine) within another subroutine (the nesting subroutine).

network. A collection of products connected by communication lines for information exchange between locations.

new-line character. A control character that causes the print or display position to move to the first position on the next line.

node. An individual element of a full pathname. Nodes are separated by slashes (/).

null. Having no value, containing nothing.

null character (NUL). The character hex 00, used to represent the absence of a printed or displayed character.

numeric. Pertaining to any of the digits 0 through 9.

object code. Machine-executable instruction, usually generated by a compiler from source code written in a higher level language. consists of directly executable machine code. For programs that must be linked, object code consists of relocatable machine code.

octal. A base eight numbering system.

online. Being controlled directly by, or communicating directly with, the computer, or both.

open. To make a file available to a program for processing.

operating system. Software that directs and controls the hardware and software in the computer system in which the operating system resides, by providing services such as resource allocation, scheduling, input/output control, and data management.

operation. A specific action (such as move, add, multiply, load) that the computer performs when requested.

operator. A symbol representing an operation to be done.

output. The result of processing data.

output devices. Physical devices used by a computer to present data to a user.

output file. A file that is opened by a program so that the program can write to that file.

output redirection. The specification of an output destination other than the standard one.

overflow condition. A condition that occurs when part of the output of an operation exceeds the capacity of the intended storage unit.

override. (1) A parameter or value that replaces a previous parameter or value. (2) To replace a parameter or value.

overwrite. To write output into a storage or file space that is already occupied by data.

owner. The user who has the highest level of access authority to a data object or action, as defined by the object or action.

pad. To fill unused positions in a field with dummy data, usually zeros or blanks.

page. A block of instructions, data, or both.

page space minidisk. The area on a fixed disk that temporarily stores instructions or data currently being run. See also *minidisk.*

pagination. The process of adjusting text to fit within margins and/or page boundaries.

paging. The action of transferring instructions, data, or both between real storage and external page storage.

parallel processing. The condition in which multiple tasks are being performed simultaneously within the same activity.

parameter. Information that the user supplies to a panel, command, or function.

parent. Pertaining to a secured resource, either a file or library, whose user list is shared with one or more other files or libraries. Contrast with *child.*

parent directory. The directory one level above the current directory.

partition. See *minidisk.*

password. A string of characters that, when entered along with a user identification, allows an operator to sign on to the system.

password security. A program product option that helps prevent the unauthorized use of a display station, by checking the password entered by each operator at sign-on.

path name. See *full path name* and *relative path name.*

pattern-matching character. Special characters such as * or ? that can be used in search patterns. Some used in a file specification to match one or more characters. For example, placing a ? in a file specification means any character can be in that position. Pattern-matching characters are also called wildcards.

permission code. A three-digit octal code, or a nine-letter alphabetic code, indicating the access permissions. The access permissions are read, write, and execute.

permission field. One of the three-character fields within the permissions column of a directory listing indicating the read, write, and run permissions for the file or directory owner, group, and all others.

phase. One of several stages file system checking and repair performed by the **fsck** command.

physical device. See *device.*

physical file. An indexed file containing data for which one or more alternative indexes have been created.

physical record. (1) A group of records recorded or processed as a unit. Same as *block.* (2) A unit of data moved into or out of the computer.

PID. See *process ID.*

pipe. To direct the data so that the output from one process becomes the input to another process.

pipeline. A direct, one-way connection between two or more processes.

pitch. A unit of width of typewriter type, based on the number of times a letter can be set in a linear inch. For example, 10-pitch type has 10 characters per inch.

platen. The support mechanism for paper on a printer, commonly cylindrical, against which printing mechanisms strike to produce an impression.

pointer. A logical connection between physical blocks.

port. (1) To make the programming changes that allow a program running on one type of computer to run on another type of computer. (2) A part of the system unit or remote controller where cables for display stations and printers are attached.

position. The location of a character in a series, as in a record, a displayed message, or a computer printout.

positional parameter. A shell facility for assigning values from the command line to variables in a program.

print queue. A file containing a list of the names of files waiting to be printed.

printout. Information from the computer produced by a printer.

priority. The relative ranking of items. For example, a job with high priority in the job queue will be run before one with medium or low priority.

priority number. A number that establishes the relative priority of printer requests.

privileged instructions. System control instructions that can only run in the processor's privileged state (VRM mode). Privileged instructions usually manipulate virtual machines or the memory manager; they typically are not used by application programmers. See *privileged state.*

privileged state. A hardware protection state in which the processor can run privileged instructions.

privileged user. The account with superuser authority.

problem determination. The process of identifying why the system is not working. Often this process identifies programs, equipment, data communications facilities, or user errors as the source of the problem.

problem determination procedure. A prescribed sequence of steps aimed at recovery from, or circumvention of, problem conditions.

procedure. See *shell procedure.*

process. (1) A sequence of actions required to produce a desired result. (2) An entity receiving a portion of the processor's time for executing a program. (3) An activity within the system begun by entering a command, running a shell program, or being started by another process.

process accounting. An analysis of the use each process makes of the processing unit, memory, and I/O resources.

process ID (PID). A unique number assigned to a process that is running.

profile. (1) A file containing customized settings for a system or user (2) Data describing the significant features of a user, program, or device.

program. A file containing a set of instructions conforming to a particular programming language syntax.

prompt. A displayed request for information or operator action.

propagation time. The time necessary for a signal to travel from one point on a communications line to another.

protocol. In data communications, the rules for transferring data.

protocol procedure. A process that implements a function for a device manager. For example, a virtual terminal manager may use a protocol procedure to interpret the meaning of keystrokes.

qdaemon. The daemon process that maintains a list of outstanding jobs and sends them to the specified device at the appropriate time.

queue. A line or list formed by items waiting to be processed.

queued message. A message from the system that is added to a list of messages

stored in a file for viewing by the user at a later time. This is in contrast to a message that is sent directly to the screen for the user to see immediately.

quit. A key, command, or action that tells the system to return to a previous state or stop a process.

quote. To mask the special meaning of certain characters; to cause them to be taken literally.

random access. An access mode in which records can be read from, written to, or removed from a file in any order.

readonly. Pertaining to file system mounting, a condition that allows data to be read, but not modified.

recovery procedure. (1) An action performed by the operator when an error message appears on the display screen. Usually, this action permits the program to continue or permits the operator to run the next job. (2) The method of returning the system to the point where a major system error occurred and running the recent critical jobs again.

redirect. To divert data from a process to a file or device to which it would not normally go.

reference count. In an i-node, a record of the total number of directory entries that refer to the i-node.

relational expression. A logical statement describing the relationship (such as greater than or equal) of two arithmetic expressions or data items.

relational operator. The reserved words or symbols used to express a relational condition or a relational expression.

relative address. An address specified relative to the address of a symbol. When a program is relocated, the addresses themselves will change, but the specification of relative addresses remains the same.

relative addressing. A means of addressing instructions and data areas by designating their locations relative to some symbol.

relative path name. The name of a directory or file expressed as a sequence of directories followed by a file name, beginning from the current directory.

remote. Pertaining to a system or device that is connected to your system through a communications line. Contrast with *local.*

reserved character. A character or symbol that has a special (non-literal) meaning unless quoted.

reserved word. A word that is defined in a programming language for a special purpose, and that must not appear as a user-declared identifier.

reset. To return a device or circuit to a clear state.

restore. To return to an original value or image. For example, to restore a library from diskette.

right adjust. The process of aligning lines of text at the right margin or tab setting such that the rightmost character in the line or file is in the rightmost position.

right justify. See right align.

right margin. The area on a page between the last text character and the right upper edge.

right-adjust. To place or move an entry in a field so that the rightmost character of the field is in the rightmost position. Contrast with *left-adjust.*

root. Another name sometimes used for superuser.

root directory. The top level of a tree-structured directory system.

root file system. The basic AIX Operating System file system, which contains operating system files and onto which other file systems can be mounted. The root file system is the file system that contains the files that are run to start the system running.

routine. A set of statements in a program causing the system to perform an operation or a series of related operations.

run. To cause a program, utility, or other machine function to be performed.

run-time environment. A collection of subroutines and shell variables that provide commonly used functions and information for system components.

scratch file. A file, usually used as a work file, that exists until the program that uses it ends.

screen. See *display screen.*

scroll. To move information vertically or horizontally to bring into view information that is outside the display screen boundaries.

second level interrupt handler (SLIH). A routine that handles the processing of an interrupt from a specific adapter. An SLIH is called by the first level interrupt handler associated with that interrupt level.

sector. (1) An area on a disk track or a diskette track reserved to record information. (2) The smallest amount of information that can be written to or read from a disk or diskette during a single read or write operation.

security. The protection of data, system operations, and devices from accidental or intentional ruin, damage, or exposure.

security-relevant. Pertaining to the protection of the data, operations, and devices contained in a system.

segment. A contiguous area of virtual storage allocated to a job or system task. A program segment can be run by itself,

even if the whole program is not in main storage.

separator. A character used to separate parts of a command or file.

sequential access. An access method in which records are read from, written to, or removed from a file based on the logical order of the records in the file.

server. A program that handles protocol, queuing, routing, and other tasks necessary for data transfer between devices in a computer system.

session. The period of time during which programs or devices can communicate with each other.

session records. In the accounting system, a record of time connected and line usage for connected display stations, produced from log in and log out records.

set flags. Flags that can be put into effect with the shell set command.

shared printer. A printer that is used by more than one work station.

shell. See *shell program.*

shell procedure. A series of commands combined in a file that carry out a particular function when the file is run or when the file is specified as an argument to the sh command. Shell procedures are frequently called shell scripts.

shell program. A program that accepts and interprets commands for the operating system (there is an AIX shell program and a DOS shell program).

shell prompt. The character string on the command line indicating the the system can accept a command (typically the $ character).

shell script. See *shell* procedure.

shell variables. Facilities of the shell program for assigning variable values to constant names.

size field. In an i-node, a field that indicates the size, in bytes, of the file associated with the i-node.

software. Programs.

sort. To rearrange some or all of a group of items based upon the contents or characteristics of those items.

source diskette. The diskette containing data to be copied, compared, restored, or backed up.

source program. A set of instructions written in a programming language, that must be translated to machine language compiled before the program can be run.

special character. A character other than an alphabetic or numeric character. For example; *, +, and % are special characters.

special file. Special files are used in the AIX system to provide an interface to input/output devices. There is at least one special file for each device connected to

the computer. Contrast with *directory* and *file*. See also *block special file* and *character special file*.

spool file. (1) A disk file containing output that has been saved for later printing. (2) A file used in transmitting data among devices.

standalone shell. A limited version of the shell program used for system maintenance.

standalone work station. A work station that can be used to preform tasks independent of (without being connected to) other resources such as servers or host systems.

standard error. The place where many programs place error messages.

standard input. The primary source of data going into a command. Standard input comes from the keyboard unless redirection or piping is used, in which case standard input can be from a file or the output from another command.

standard output. The primary destination of data coming from a command. Standard output goes to the display unless redirection or piping is used, in which case standard output can be to a file or another command.

stanza. A group of lines in a file that together have a common function. Stanzas are usually separated by blank lines, and each stanza has a name.

statement. An instruction in a program or procedure.

status. (1) The current condition or state of a program or device. For example, the status of a printer. (2) The condition of the hardware or software, usually represented in a status code.

storage. (1) The location of saved information. (2) In contrast to memory, the saving of information on physical devices such as disk or tape. See *memory*.

storage device. A device for storing and/or retrieving data.

string. A linear sequence of entities such as characters or physical elements. Examples of strings are alphabetic string, binary element string, bit string, character string, search string, and symbol string.

su. See *superuser*.

subdirectory. A directory contained within another directory in the file system hierarchy.

subprogram. A program invoked by another program, such as a subshell.

subroutine. (1) A sequenced set of statements that may be used in one or more computer programs and at one or more points in a computer program. (2) A routine that can be part of another routine.

subscript. An integer or variable whose value refers to a particular element in a table or an array.

subshell. An instance of the shell program started from an existing shell program.

substring. A part of a character string.

subsystem. A secondary or subordinate system, usually capable of operating independently of, or synchronously with, a controlling system.

superblock. The most critical part of the file system containing information about every allocation or deallocation of a block in the file system.

superuser (su). The user who can operate without the restrictions designed to prevent data loss or damage to the system (User ID 0).

superuser authority. The unrestricted ability to access and modify any part of the operating system associated with the user who manages the system. The authority obtained when one logs in as **root**.

symbolic link. Type of file that contains the path name to another file or directory; it functions as a pointer to the other file or directory. See *link*.

synchronous. Occurring in a regular or predictable sequence.

synchronous transmission. In data communications, a method of transmission in which the sending and receiving of characters is controlled by timing signals. Contrast with *asynchronous transmission*.

system. The computer and its associated devices and programs.

system call. A request by an active process for a service by the system kernel.

system customization. A process of specifying the devices, programs, and users for a particular data processing system.

system date. The date assigned by the system user during setup and maintained by the system.

system dump. A copy of memory from all active programs (and their associated data) whenever an error stops the system. Contrast with *task dump*.

system management. The tasks involved in maintaining the system in good working order and modifying the system to meet changing requirements.

system parameters. See *kernel parameters*.

system profile. A file containing the default values used in system operations.

system unit. The part of the system that contains the processing unit, the disk drives, and the diskette drives.

system user. A person, process, or other resource that uses the facilities of a computer system.

systems network architecture (SNA). A set of rules for controlling the transfer

of information in a data communications network.

target diskette. The diskette to be used to receive data from a source diskette.

task. A basic unit of work to be performed. Examples are a user task, a server task, and a processor task.

task dump. A copy of memory from a program that failed (and its associated data). Contrast with *system dump.*

TCB. *See trusted computing base.*

terminal. An input/output device containing a keyboard and either a display device or a printer. Terminals usually are connected to a computer and allow a person to interact with the computer.

text. A type of data consisting of a set of linguistic characters (for example, alphabet, numbers, and symbols) and formatting controls.

text application. A program defined for the purpose of processing text data (for example, memos, reports, and letters).

text editing program. See *editor* and *text application.*

texttab. A kernel parameter establishing the size of the text table, in memory, that contains one entry each active shared program text segment.

trace. To record data that provides a history of events occurring in the system.

trace table. A storage area into which a record of the performance of computer program instructions is stored.

track. A circular path on the surface of a fixed disk or diskette on which information is magnetically recorded and from which recorded information is read.

transfer. To move data from one location to another in a computer system or between two or more systems.

transmission control characters. In data communications, special characters that are included in a message to control communication over a data link. For example, the sending station and the receiving station use transmission control characters to exchange information; the receiving station uses transmission control characters to indicate errors in data it receives.

trap. An unprogrammed, hardware-initiated jump to a specific address. Occurs as a result of an error or certain other conditions.

tree-structured directories. A method for connecting directories such that each directory is listed in another directory except for the root directory, which is at the top of the tree.

trojan horse. A program that can vandalize your files, although it performs, or appears to perform, its defined task.

truncate. To shorten a field or statement to a specified length.

trusted communications path. A secure path to the system, invoked with a key sequence and used when entering or changing security-relevant information in the system. For example, you use a atrusted commuications path when changing passwords or logging in to the system.

trusted computing base. The total of all components, both software and hardware, that protect the data in a system.

trusted shell. A modified command interpreter that provides a restricted environment to perform administrative tasks in a secure manner.

typematic key. A key that repeats its function multiple times when held down.

typestyle. Characters of a given size, style and design.

Uid. See *user number.*

update. An improvement for some part of the system.

user. The name associated with an account.

user account. See *account.*

user ID. See *user number.*

user list. A list containing the user identification and access levels of all operators who are allowed to use a specified file or library.

user name. A name that uniquely identifies a user to the system.

user number (Uid). A unique number identifying an operator to the system. This string of characters limits the functions and information the operator is allowed to use. The Uid can often be substituted in commands that take a user's name as an argument.

user profile. A file containing a description of user characteristics and defaults (for example, printer assignment, formats, group ID) to be conveyed to the system while the user is signed on.

utility. A service; in programming, a program that performs a common service function.

valid. (1) Allowed. (2) True, in conforming to an appropriate standard or authority.

value. (1) In Usability Services, information selected or typed into a pop-up. (2) A set of characters or a quantity associated with a parameter or name. (3) In programming, the contents of a storage location.

variable. A name used to represent a data item whose value can change while the program is running. Contrast with *constant.*

verify. To confirm the correctness of something.

version. Information in addition to an object's name that identifies different

modification levels of the same logical object.

virtual device. A device that appears to the user as a separate entity but is actually a shared portion of a real device. For example, several virtual terminals may exist simultaneously, but only one is active at any given time.

virtual machine. The hardware-independent portion (kernel, shells, libraries, and other subsystems) of the AIX Operating System and user applications.

virtual machine interface (VMI). A standard software interface between the kernel and the VRM.

virtual resource manager (VRM). A portion of the AIX Operating System that provides various services, interfaces, and runtime routines, through which AIX controls the IBM RT hardware and peripherals.

virtual resources. See *virtual resource manager.*

virtual storage. Addressable space that appears to be real storage. From virtual storage, instructions and data are mapped into real storage locations.

virtual terminal. Any of several logical equivalents of a display station available at a single physical display station.

Volume ID (Vol ID). A series of characters recorded on the diskette used to identify the diskette to the user and to the system.

VRM. See *virtual resource manager.*

wildcard. See *pattern-matching characters.*

word. A contiguous series of 32 bits (4 bytes) in storage, addressable as a unit. The address of the first byte of a word is evenly divisible by four.

work file. A file used for temporary storage of data being processed.

work station. A device at which an individual may transmit information to, or receive information from, a computer for the purpose of performing a task, for example, a display station or printer. See *programmable work station* and *dependent work station.*

working directory. See *current directory.*

wrap around. Movement of the point of reference in a file from the end of one line to the beginning of the next, or from one end of a file to the other.

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The IBM AIX/RT Family

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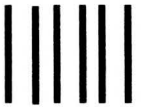

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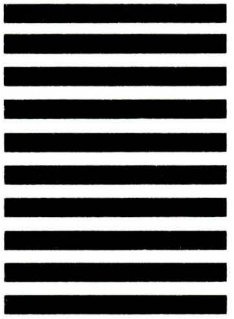

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for the

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Summary of Changes

This Technical Newsletter contains changes that reflect updates to the IBM RT AIX Operating System for version 2.2.1.

Perform the following:

Remove Pages	Insert Update Pages
i to 3-62	i to 3-20
5-73 to 5-74	5-73 to 5-74
9-1 to 9-16	9-1 to 9-26
X-1 to X-52	X-1 to X-56

Note: Please file this cover letter at the back of the manual to provide a record of changes.

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