Series 32000®

GENIX V.3™ Product Overview

REVISION RECORD

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PREFACE

The *Product Overview* describes the software and documentation available for the GENIX V.3™ operating system as packaged for a *Series 32000*® computer. This manual is intended for users who are interested in buying a *Series 32000* computer with the GENIX V.3 operating system or upgrading their existing operating system to the GENIX V.3 system.

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Chapter 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

The *Product Overview* describes the software and documentation available for the GENIX V.3™ system as packaged for the *Series 32000®* Computer. Topics covered include the following:

- Overview of the GENIX V.3 operating system.

- Structure and components of the GENIX V.3 operating system: kernel, shell, and file system.

- Benefits of the GENIX V.3 operating system: power, portability, compatibility, flexibility, and standardization.

- Contents of the GENIX V.3 operating system.

- Descriptions of the new features for the GENIX V.3 operating system.

- Descriptions of each GENIX V.3 utilities package.

- Descriptions of some selected additional software products for use with the GENIX V.3 system.

- Summary of available documentation.

- Descriptions of features in the GENIX V.3 system.

1.2 AUDIENCE

The audience for this document includes current and potential users of the GENIX V.3 system. In particular, this document is directed toward users who are interested in buying a *Series 32000* Computer with the GENIX V.3 operating system or upgrading their existing operating system to the GENIX V.3 system. Terms you must know are explained as they are introduced. If you do not understand other terms, see the Glossary or a computer dictionary. Most features are described in general terms; however, some features are aimed at a more sophisticated audience. These features require understanding concepts in communications, networking, or programming for which explanations are beyond the scope of this document.

Chapter 2

SOFTWARE

2.1 OVERVIEW OF GENIX V.3

The job of an operating system is to allocate the resources of the computer. Some operating systems process only one request at a time, thereby restricting the resources of the computer to one user (or one task or process) at a time. The GENIX V.3 system allows many processes to appear to be running simultaneously. For example, it can be sending output to several printers, running a spreadsheet program, updating a data base, sending electronic mail to another computer, and accepting input from several terminals, all at the same time. This is known as multitasking or multiprogramming. This multitasking ability also allows many users to interact with the system simultaneously. This is called multiuser mode or time-sharing.

The design of the GENIX V.3 system makes it easy to manipulate files and the input and output of commands. The hierarchical file system structure allows for easy adding, deleting, and moving of files within a structure set up by the user. Commands can take their input from either a terminal or a file, and the output of commands can be directed to a file or to a peripheral device as well as to the terminal. In addition, the output of one command can be directed (piped) to be the input of another command, so users can build their own specialized functions easily.

The user interface—the shell—of the GENIX V.3 system is a command interpreter that recognizes and interprets commands entered by the user. In addition, the shell is a programming language that can be used to create custom applications and functions.

The GENIX V.3 system product consists of both software and documentation. It provides a base on which many additional products (called add-on products) are built. Some of these additional products address the areas listed below:

- program development (e.g., compilers, interpreters, run-time libraries, and support tools for C and Pascal).

- networking (e.g., NPACK NETWORK)

- text processing (e.g., DOCUMENTER'S WORKBENCH Software)

The remainder of this chapter gives an overview of the key elements of the GENIX V.3 system, the benefits of using the GENIX V.3 system, the packaging of the software for the GENIX V.3 system, a description of the features added for the GENIX V.3 system, and a list of some additional products that can be used with the GENIX V.3 system.

2.2 KEY ELEMENTS OF THE GENIX V.3 SYSTEM

The GENIX V.3 system includes the following key elements:

- the GENIX V.3 operating system kernel

- the shell command interpreter and programming language

- the file system

- various user and system commands

The kernel, shell, and file system are discussed in more detail in the following sections. The various user and system commands are contained in the Utilities packages described in Appendix A.

2.2.1 The Kernel

The GENIX V.3 operating system kernel (comprising from 5 to 10 percent of the software provided with the system) is the basic resident software on which the entire system relies. It is the only part of the system permanently resident in memory. The job of the operating system kernel is to control user processes and manage system resources.

The kernel executes the shell, overseeing the execution of user programs (or commands) while controlling access to the file system. These programs seem to execute simultaneously because of the system's ability to share the processor among all the programs. Actually, each program is scheduled to use the processor for a short period of time to the exclusion of all other programs. As mentioned in Section 2.1, the ability to run several programs simultaneously is called multitasking or multiprogramming.

The kernel, using this multiprogramming ability, provides a multiuser capability that lets many people use the system simultaneously. And each of these users can be running several programs at once.

2.2.2 The Shell

The shell command interpreter allows the user to communicate with the GENIX V.3 system. Besides providing the user interface to the kernel and interpreting operating system commands, the shell can be used as a programming language. The user can quickly write custom "shell procedures" to do simple or complex tasks. Because shell procedures are easy to create and use, much of the drudgery associated with programming is eliminated. The shell allows users to enhance and build on GENIX V.3 system capabilities and to adapt the operating system to many user applications without using a compiler or link editor.

2.2.3 The File System

The GENIX V.3 file system consists of a set of directories and files arranged in a tree-like structure. The file system is built up in a hierarchical way from the root (/) directory which contains certain standard subdirectories including: **bck, bin, boot, dev, dgn, etc, install, lib, lost+found, mnt, tmp,** and **usr.** These standard directories are necessary for the correct operation of the system. The root directory may contain other directories, including those users structure to suit their needs.

Some of the features of the file system are:

- Simple and consistent naming conventions. File and directory names are formed and referenced using the same conventions. References to files and directories may be expressed with either the full path name (*e.g., /usr/local/bin/program1*) or with a name (*e.g., bin/program1*) relative to the current directory in which a user is working (*e.g., /usr/local*). This allows frequent references to logically related files to be made more simply if this is preferable.

- Automatic file space allocation and deallocation that is invisible to users.

- Facilities for creating, accessing, copying, moving, and processing files, directories, or sets of these in a simple, uniform, and natural way.

- Flexible directory and file protection modes that allow all combinations of read, write, and execute access. You can control these access modes independently for the owner of each file or directory, for a group of users (such as all members of a project), and for all other users. The file protection modes are set automatically when a file is created, but can be changed from the shell or under program control by the owner of the file.

- Locking files or records within files. This capability is especially useful for programs reading or updating data bases. For more information about this topic (such as read and write locks or advisory and mandatory locking) see the sections on File and Record Locking features in the sections for the GENIX V.3 system in Appendix C.

- Sharing files, transparently, among computers. Each computer on a network has control over what local resources other computers can access and what remote resources its users can access. (This feature is available as part of the Remote File Sharing Utilities product; see Section 2.5.1.)

- Input/output routines treat each physical input/output device the same, from interactive terminals to main memory. This allows uniform file and device input and output.

- Mountable and unmountable file systems and volumes allow users easy access to additional disk space.

- File linking across directories of the same file system. This allows one file to have many names, which means a file can "exist" in the various directories where it might be needed without actually existing in multiple copies.

2.3 BENEFITS OF THE GENIX V.3 SYSTEM

This section describes how the GENIX V.3 system differs from most operating systems. Some systems offer some of these features, but the GENIX V.3 system offers them all. These benefits are organized under the topics: power, portability, compatibility, flexibility, and standardization.

2.3.1 Power

- GENIX V.3 systems are multitasking (described earlier); this enables many tasks to be accomplished simultaneously.

- GENIX V.3 systems are multiuser systems; this enables many users to accomplish their work simultaneously, as well as share programs and data.

- Each user can run several tasks simultaneously.

- The GENIX V.3 system is designed so applications can be added to it easily without modifying the source code. Particular examples of this include the addition of new devices (terminals, printers, plotters, etc.) and new communications protocols (using the Networking Support Utilities product; see Section 2.5.2).

- Files can be shared transparently among computers, yet access is carefully controlled by system administrators. (See Section 2.5.1.)

2.3.2 Portability

- The GENIX V.3 system runs on computers ranging from microprocessors to the largest mainframes. This is because it can be changed to work on new computer hardware more easily than other operating systems. This portability has been made possible because most of the operating system is written in the high-level language C.

- The GENIX V.3 system environment is portable. Once you have learned to use the GENIX V.3 system, you can use different computer hardware that runs the GENIX V.3 operating system without learning a lot of new things. The applications software, training, documentation, and your knowledge and expertise with the GENIX V.3 system can be applied immediately to make you productive on your new hardware.

- Working together, the combination of commands, languages, and libraries of programs make it easy to develop and maintain new application programs or systems of programs. (Examples include text processing and data base management systems, and applications for medical suppliers, retailers, or other markets.) Once these applications are developed, they are ported easily to new versions of the GENIX V.3 system, or to GENIX V.3 systems running on a variety of computer hardware.

- The Terminal Information Utilities package allows user programs to produce output on many different types of terminals. This package provides the programmer with features such as window control, highlighting, scrolling, multiple terminals, and access to special

keys. This package works with a database describing hardware features and escape sequences used by different terminals. Thus, the programmer can write terminal-independent applications that use the terminal-dependent specifications in a common database.

2.3.3 Compatibility

⊚ Source code written to run on a given release of the system is compatible across *Series 32000* computers. (See Section 2.3.5 for efforts to broaden source-code compatibility.)

⊚ Object code written to run on a given release of the system is compatible among *Series 32000* computers at the application level.

⊚ When a new release of the GENIX V.3 system is issued, every effort is made to ensure that object code for application products will continue to work on the new software release.

2.3.4 Flexibility

⊚ The flexible shell command language lets you tailor the user interface to meet the needs of specific users, and each user can have a different interface.

⊚ The GENIX V.3 system treats all files alike, unlike other systems that have many types of files. This means you access files identically from any program or command.

⊚ A practical (hierarchical) file system structure lets you organize files in a way that makes it easy for you to find them again.

⊚ On-line self-help facilities are useful to beginners and experienced users.

⊚ Input/output routines treat each physical input/output device the same, from interactive terminals to main memory. This allows uniform file and device input and output.

⊚ Providing new networking interfaces is simplified by using the STREAMS facilities (see Section 2.5.2).

2.3.5 Standardization

⊚ Vendors and industry standards groups such as /usr/group, ANSI (American National Standards Institute) X3J11, and IEEE (Institute of Electrical and Electronic Engineers) P1003 are developing standards for system and subroutine calls and for defining a base system and extensions. These standards will make it easier to develop applications that can be run on many different computers that run the GENIX V.3 operating system.

⊚ The GENIX V.3 system supports a Transport Interface based on the the Transport Service Definition (Level 4) of the International Organization for Standardization (ISO) Reference Model for Open Systems Interconnection (OSI). This interface defines how to access the services of a transport protocol. (For more information, see Section 2.5.3.)

2.4 GENIX V.3 SYSTEM SOFTWARE PACKAGING

The software for GENIX V.3 on a *Series 32000* computer consists of the standard Utilities packages and the products listed below. Standard Utilities packages are delivered with the GENIX V.3 system; optional products are available separately. See Appendix A for a description of each.

The list notes if a package or product is new for the GENIX V.3 system. See Section 2.5 for information about the new features in these packages and products (and the new features in existing packages).

- Basic Networking Utilities

- Directory and File Management Utilities

- Editing Utilities

- Essential Utilities (in addition to many commands, this package includes the operating system kernel, device drivers, and field-upgrade utilities)

- Graphics Utilities

- Help Utilities

- Inter-Process Communication (IPC) Utilities

- Line Printer (LP) Spooling Utilities

- Networking Support Utilities (new for the GENIX V.3 system)

- Performance Measurement Utilities

- Remote File Sharing Utilities (new for the GENIX V.3 system)

- Security Administration Utilities (domestic customers only)

- Spell Utilities

- System Administration Utilities

- System Header Files (new for the GENIX V.3 system)

- Terminal Filters Utilities

- Terminal Information Utilities

- User Environment Utilities

- GNX Utilities

- Extended Software Generation Utilities

- System Configuration Utilities

- Advanced C Utilities

- Source Code Control Utilities

- Stream-based Ethernet Utilities

2.5 NEW FEATURES FOR THE GENIX V.3 SYSTEM

This section lists and then describes new features of the GENIX V.3 system. The description of each feature includes which package or product it is in and where you can find out more information about it.

- Remote File Sharing

- STREAMS Mechanism and Tools

- Transport Interface

- Media-Independent **uucp**

- Listener

- Executable Shared Libraries

- Shared Libraries Generation

- Command Syntax Standard

- Signal Mechanism Enhancements

- Improved Terminal Support Facilities

    — Terminal Information Utilities Enhancements

- New Documentation

- Additional Features

    — Help Facility Extensions

    — **crash** Command Changes

    — Encryption Mechanisms Repackaged

    — New Header Files and Definitions

2.5.1 Remote File Sharing

The Remote File Sharing feature lets you share files, directories, devices, and named pipes transparently among computers that are linked by a network. The administrator of each computer on the network controls which local resources are available to other computers and which remote resources local users can access.

Sharing is done at the directory level. When you share a directory, you are sharing its entire contents: files, subdirectories, named pipes, and special devices (like printers and typesetters). With Remote File Sharing, you can share data files of interest to several departments of your business, a letter-quality printer or typesetter that no one department could fully utilize by itself, and more.

This feature is provided by the Remote File Sharing Utilities product and requires the Networking Support Utilities product and a networking product. Initially, Remote File Sharing will be available using the Universal Receiver Protocol (URP) on *Series 32000* Computers that are connected via the NPACK NETWORK; however, Remote File Sharing was designed to be media and protocol independent. Therefore, as the GENIX V.3 system becomes available on other computers and workstations, and as other networks become available that conform to the Transport Interface (a feature that is described later), you will be able to share files transparently across a wide variety of computer systems and networks.

For more information, see the Remote File Sharing chapter of the *Administrator's Guide*.

2.5.2 STREAMS Mechanism and Tools

STREAMS is a general, flexible facility and a set of tools for development of communication and networking services within the GENIX V.3 system. It provides a uniform mechanism for program development, ranging from networking applications to individual device drivers.

STREAMS defines standard interfaces for character input/output within the GENIX V.3 operating system kernel, and between the kernel and the rest of the GENIX V.3 system. This standard interface and mechanism enables modular, portable program development and easy integration of network services. These interfaces have been used in the development of protocol modules and device drivers for the GENIX V.3 system. STREAMS provides a broad framework that does not impose any specific network architecture. Its user interface is consistent and compatible with the existing character input/output mechanism, so both STREAMS and character input/output mechanisms are available to the programmer. This modularity allows the following functionality:

- User-level programs (commands such as **uucp**) can be independent of underlying protocols and communications media so the programs need not be changed when new media or protocols between systems become available.

- Network architectures and higher-level protocols can be independent of underlying protocols, drivers, and media.

- Higher-level services can be created by selecting and connecting lower-level services and protocols.

In addition to the standard interfaces, STREAMS provides a set of software tools that help you build modules and drivers.

Two new documents have been written describing how to use STREAMS: the *STREAMS Primer* and the *STREAMS Programmer's Guide* (see Figure 3-4 in Chapter 3, Documentation).

This feature is provided by the Networking Support Utilities product.

2.5.3 Transport Interface

The GENIX V.3 system supports a Transport Interface based on the Transport Service Definition (Level 4) of the International Organization for Standardization (ISO) Reference Model for Open Systems Interconnection (OSI). The transport service supports two modes of transfer. The first mode is circuit-oriented and transports data over an established connection in a reliable, sequenced manner. The second mode is message-oriented and supports data transfer in self-contained units with no logical relationship required among units.

The Transport Interface defines how a user accesses the services of a transport protocol. The protocol module is called a Transport Provider; an example of a Transport Provider is the Universal Receiver Protocol (URP).

Applications programs access the Transport Provider by using the Transport Interface routines in the new Network Services Library. These routines support access to a Transport Provider in a media and protocol-independent manner. The Transport Provider uses kernel-level routines to send the information to the desired physical device. By using the Transport Interface, applications programs will be able to access other Transport Providers which may be available in the future.

Two applications that currently use the Transport Interface are Remote File Sharing and the **uucp** command. Remote File Sharing is implemented in the kernel, so it accesses the STREAMS-based Transport Provider protocol modules directly; however, because the **uucp** command is an application program, it calls routines in the Network Services Library. In turn, these routines access the Transport Provider.

A new document, the *Networking Guide*, describes how to use the Transport Interface.

This feature is provided by the Networking Support Utilities product.

2.5.4 Media-Independent uucp

The version of **uucp** that is supplied with the Basic Networking Utilities package will continue to provide queued file transfer services to other GENIX V.3 systems via direct-connect and dial-up methods. In addition, if you install the Networking Support Utilities product, because **uucp** has been enhanced to work with networks that are compatible with the Transport Interface, **uucp** can send files to other systems over any Transport Provider that conforms to this interface.

Other new capabilities include: the ability to define, within a **Sysfiles** file, different or multiple **Systems, Devices,** and **Dialers** files; and the ability to define, within a **Devconfig** file, STREAMS-based transport providers for **cu** and **uucp** services.

While you are installing the Basic Networking Utilities software you can indicate which, if any, Transport Providers are available. If new Transport Providers become available, no changes are needed to the Basic Networking Utilities software to accommodate the underlying media or protocols. You need only register the Basic Networking Utilities service with the Listener of the new Transport Provider (see the **nlsadmin**(1M) manual page in the *Administrator's Reference Manual*) and follow the steps described in the Basic Networking Procedures in the *Administrator's Guide*.

2.5.5 Listener

For each Transport Provider on a system, there is an active user-level program called a Listener. The purpose of the Listener is to receive requests for network services from another system, interpret which network service is needed, and initiate a process that has been designated to provide the requested network service. The Listener then drops out of the communications path and continues to listen for new service requests.

For more information about the Listener, see the *Networking Guide* and the *Administrator's Guide*.

This feature is provided by the Networking Support Utilities product.

2.5.6 Executable Shared Libraries

A Shared Library is a library of routines that is accessed dynamically at run-time rather than having those routines combined with an application program at load-time. The end user of an application that was built like this benefits in several ways:

- The application program may occupy less space on disk.

- When it is running, the application program occupies less space in memory.

- When routines in a shared library are changed, the new, improved versions are accessible without recompilation of the programs that access them. For example, by improving the performance of one routine, the performance of every application that uses that routine will be improved immediately.

A shared library that contains most commonly-used routines from the C Library is part of all GENIX V.3 systems. Most GENIX V.3 system commands use routines from this library, and so do any applications that were built with them. When you use the commands and applications built using these shared libraries, these routines will be accessed without any special action on your part. In addition, if the Networking Support Utilities product is installed, the shared Networking Services Library will be used.

2.5.7 Shared Libraries Generation

The Advanced Programming Utilities product provides the programmer with the ability to build a library of routines that is accessed dynamically at run-time rather than having those routines combined with an application program at load time. The end user of the application can benefit in several ways (see Section 2.5.6).

To make your own shared libraries, you will need two separately available products: C Programming Language Utilities (Issue 4) and Advanced Programming Utilities. (For more information on these products, see Section B.3.)

For more information about generating Shared Libraries, see Chapter 8 in the *Programmer's Guide*.

2.5.8 Command Syntax Standard

A new shell function, **getopts** (an enhanced version of the **getopt** command), is consistent with and supports the applicable rules (Rules 3-10) of the GENIX V.3 system command syntax standard. (The standard is described on the **intro**(1) manual page of the *User's Reference Manual*.) Use of **getopts** in place of the command **getopt** is strongly encouraged, because beginning with the next major GENIX V.3 system release, the **getopt** command will no longer be supported. Therefore, to assist in the conversion of affected shell scripts, both a conversion command, **getoptcvt** (see the **getopts**(1) manual page in the *User's Reference Manual*), and hand conversion procedures are provided (see the *Release Notes*).

2.5.9 Signal Mechanism Enhancements

A new set of system calls provides an improved mechanism to manage signals. These new calls allow a programmer to establish critical sections of code that will not be interrupted by a set of signals. These signals are not discarded, but are held until released at the end of the critical section. These signal-handling system calls are compatible in name and calling sequences with the BSD 4.1 (Berkeley) version of the GENIX V.3 system.

For more information, see the **sigset**(2) manual page in the *Programmer's Reference Manual.*

2.5.10 Improved Facilities for Supporting Terminals

These improvements are in two areas.

- **Terminal Information Utilities**

    The Terminal Information Utilities package (often called **curses/terminfo**) has the following new features:

    — support for filters, soft labels, and new AT&T terminals and printers: PT505, 513BCT, 4424, 4426, 4410/5410, 4415/5420, 4418/5418, 4425/5425, 5310, 5320, 5620

    — new commands: **captoinfo** converts **termcap** entries to **terminfo** entries; **infocmp** compares two **terminfo** entries or prints entries in several formats (for example, **infocmp** —I *termtype* prints out the description of the terminal *termtype* from the **terminfo** database)

    — new options to the **tput** command to initialize and reset a terminal

    — a version of the **terminfo** compiler, **tic**, that is from 50 to 100 times faster and does much better error checking than the previous version

    — comprehensive, new documentation on the **curses**(3X) and **terminfo**(4) manual pages in the *Programmer's Reference Manual* and in Chapter 10 of the *Programmer's Guide*

2.5.11 New Documentation

A new *Programmer's Guide* consolidates the contents of two previously existing documents (the *Programming Guide* and the *Support Tools Guide*) and adds new material. It describes how to use many of the GENIX V.3 system's programming tools by presenting different program development scenarios. It also contains chapters that give details about important GENIX V.3 system programming tools, such as Inter-Process Communication and new information for the Terminal Information Utilities package and the Executable Shared Libraries feature.

The new *STREAMS Primer*, provided with the Networking Support Utilities product, presents an overview of STREAMS and is required reading for programmers who will be using STREAMS. Two other new networking support documents are supplied: the *STREAMS Programmer's Guide*, and the *Networking Guide*.

The *Administrator's Guide* has been updated to include information for administering the Remote File Sharing feature and media-independent **uucp.**

For more information about documentation for the GENIX V.3 operating system, see Chapter 3.

2.5.12 Additional Features (help, crash, header files, encryption)

Some other changes for the GENIX V.3 system are described below.

- **Help Facility Extensions**

  Descriptions and examples of many more commands, terms, and symbols have been added. For information about using the Help Facility, see the **help**(1) manual page in the *User's Reference Manual* or enter the **help** command.

- **Crash Command Changes**

  In addition to providing debugging support for the new operating system features included in the GENIX V.3 system, the user interface to **crash** has been changed extensively to make it easier to use. The syntax of all the functions has been standardized so that similar functions share similar syntax. There is a **help** function within **crash,** a number base converter, a memory search function, and a disassembler capability. The **crash**(1M) manual page in the *Administrator's Reference Manual* describes the details of the extensively-changed **crash** command.

- **New Header Files and Definitions**

  New header files and new definitions were added to **/usr/include:**

  unistd.h   This new header file contains definitions for symbolic constants introduced and used throughout the *1984 /usr/group Standard* publication. (For more information, see the **unistd**(4) manual page in the *Programmer's Reference Manual.*)

  limits.h   This new header file contains definitions for commonly used values that vary for different implementations of the GENIX V.3 system. (For more information, see the **limits**(4) manual page in the *Programmer's Reference Manual.*)

sys/stat.h   New definitions were added to this header file to make it easier for programmers to write portable code. (For more information, see the stat(5) manual page in the *Programmer's Reference Manual*.)

● **Encryption Mechanisms Repackaged**

This release introduces several changes in the implementation of the encryption mechanisms. In particular, because of changes to the text editors that are part of the Editing Utilities and Essential Utilities packages, these editors have been removed from the Security Administration Utilities package. (For a description of these packages, see Appendix A.)

NOTE: The Security Administration Utilities package has restricted distribution and is sold within the United States.

2.5.13 Other Information

For other information related to this release, refer to the references listed with the description of each new feature and see the *GENIX V.3 Utilities Notes*.

2.6 ADDITIONAL SOFTWARE PRODUCTS

This section lists some of the software products, available from both NSC and other vendors, that work with the GENIX V.3 system on the *Series 32000* Computer.

In this section, such add-on products are divided into the following areas: general, programming, networking, data base management, and other applications.

2.6.1 General

● Source Code Provision

2.6.2 Programming

● Advanced Programming Utilities (Issue 1)

● C Programming Language Utilities (Issue 4)

2.6.3 Networking

● NPACK NETWORK (additional hardware required)

2.6.4 Other Applications

- DOCUMENTER'S WORKBENCH Software

Chapter 3

DOCUMENTATION

3.1 INTRODUCTION

The following documents are included in the GENIX V.3 system release.

PUBLICATION NUMBER	MANUAL TITLE
424510771-110	Administrator's Guide
424510771-120	Programmer's Guide
424510771-130	User's Guide
424510771-140	Networking Guide
424510771-150	STREAMS Primer
424510771-151	STREAMS Programmer's Guide
424510771-210	Administrator's Reference Manual
424510771-220	Programmer's Reference Manual
424510771-230	User's Reference Manual
424510771-310	Documentation Roadmap
424510771-320	Product Overview
424510771-410	GENIX V.3 Utilities Notes
424510771-420	Networking Support Utilities Notes
424510771-430	Remote File Sharing Utilities Notes
419510771-001	Assist Software Rel. 1.0 User's Manual
419510771-002	Source Code Release Notes

Appendix A

DESCRIPTION OF GENIX V.3 SYSTEM UTILITIES PACKAGES

A.1 INTRODUCTION

This appendix describes the contents of each Utilities package available for the GENIX V.3 system as packaged for the *Series 32000* Computer. A package is standard and delivered with GENIX V.3 unless its description notes that it is part of an optional product (available at extra cost). If the package is new for GENIX V.3, a reference is given to the section "New Features for GENIX V.3" of Chapter 2, Software, where the features of that package are described.

In addition to the other references given at the end of each package's description, see the manual pages that describe the commands in the package. For the commands that are described in the *User's Reference Manual*, the Index to Utilities at the end of the *User's Reference Manual* lists which manual pages are in each package. Commands for programming and administration are described in the *Programmer's Reference Manual* and the *Administrator's Reference Manual*, respectively.

Each *Series 32000* Computer is delivered with a common portion of the GENIX V.3 system, referred to as the Essential Utilities, loaded onto the hard disk. A backup copy of the Essential Utilities is also provided on the floppy disks labeled the "Core Pack."

NOTE: When you first start using your *Series 32000* Computer, the GENIX V.3 operating system may not be loaded onto the hard disk. To load it, follow the procedures described in the *GENIX V.3 Utilities Notes*. It is already loaded onto the hard disk if the first line of the greeting message after you log in says:

GENIX V.3 System NSC Series 32000

The remainder of the Utilities packages are provided on floppy disks; they can be loaded onto the hard disk and removed as needed by following the instructions in your *Operator Manual*. For details of how to use these Utilities packages, see your *User's Guide*, *User's Reference Manual*, *Administrator's Reference Manual*, or *Administrator's Guide*.

A.2 BASIC NETWORKING UTILITIES

The Basic Networking Utilities package enables your GENIX V.3 system to communicate with other GENIX V.3 systems. You can:

- transfer files and send electronic mail to other GENIX V.3 systems
- interactively communicate with others using GENIX V.3 systems or non-GENIX V.3 systems
- execute a restricted set of commands on a remote system without logging in
- call and log in to a remote system

- call a remote terminal and allow the user of the terminal to log in on your GENIX V.3 system

For information about using this package, see Chapter 8 of the *User's Guide* and the Basic Networking Utilities manual pages in the *User's Reference Manual*. For information about administering this package, see Chapter 9 of the *Administrator's Guide* and the Basic Networking manual pages in the *Administrator's Reference Manual*.

A.3 DIRECTORY AND FILE MANAGEMENT UTILITIES

The Directory and File Management Utilities package consists of more than twenty-five commands that provide enhanced file and directory manipulation capabilities. With these commands, you can do the following tasks:

- search directories or files

- compare the contents of directories or files

- manipulate the contents of files

For more information, see the *User's Guide* and the Directory and File Management manual pages in the *User's Reference Manual*.

A.4 EDITING UTILITIES

The Editing Utilities package provides three related editors based on a consistent set of text editor commands: two line editors (**edit** and **ex**) and a screen editor (**vi**). The **edit** editor is mainly for novice users. The **ex** editor is an advanced version of **edit** and is for experienced users. The **vi** editor is intended for all users who have terminals with screens. It allows the user to view several lines of the file at one time and move the terminal's cursor directly to any position in the file.

For more information, see Chapters 5 and 6 of the *User's Guide* and the Editing Utilities manual pages in the *User's Reference Manual*.

A.5 ESSENTIAL UTILITIES

The Essential Utilities package comes loaded onto the hard disk, as discussed on the first page of this appendix. This package consists of the operating system kernel, the minimum set of device drivers (Console, Contty, Floppy Disk, Hard Disk, and Ports), the field-upgrade utilities, and over 90 commonly-used and essential GENIX V.3 commands, including the commands to invoke the System Administration Menus.

For additional information about the software in the Essential Utilities package and how to use it, see your *User's Guide*, the Essential Utilities manual pages in your *User's Reference Manual* and *Administrator's Reference Manual*, and your *GENIX V.3 Utilities Notes*.

A.6 GRAPHICS UTILITIES

The Graphics Utilities package provides numerical and graphical commands used to construct and edit numerical data plots and hierarchical charts.

For more information, see the Graphics Utilities manual pages in the *User's Reference Manual*.

A.7 HELP UTILITIES

The Help Utilities package is an interactive, menu-driven facility that provides a variety of information about the GENIX V.3 system:

- information for beginners

- general information about the GENIX V.3 system

- a list of terms and symbols and their definitions

- a means of identifying GENIX V.3 system commands by their function

- information about specific GENIX V.3 system commands with descriptions, options, and examples that demonstrate some typical uses

In addition, an administrator can add, change, or delete information and monitor the use of the Help Utilities package.

For more information, type **help** on your GENIX V.3 system, or see the Help Utilities package manual pages in the *User's Reference Manual*.

A.8 INTER-PROCESS COMMUNICATION (IPC) UTILITIES

The Inter-Process Communication (IPC) Utilities package permits cooperating processes to share data and communicate with each other. It contains system calls for obtaining, controlling, and performing operations on the three types of IPC facilities:

- messages

- semaphores

- shared memory

In addition, there are commands to check the status of, and remove, IPC facilities.

For more information, see Chapter 9 of the *Programmer's Guide* and the Inter-Process Communication Utilities manual pages in the *User's Reference Manual* and the *Programmer's Reference Manual*.

NOTE: In order to save space in memory, do not install this package unless you will be using the software it provides.

A.9 LINE PRINTER (LP) SPOOLING UTILITIES

The Line Printer (LP) Spooling Utilities package allows the temporary storing (spooling) of data until it can be printed.

With LP spooling, print requests can be entered at a terminal and the printing can take place without tying up the terminal. Also, spooling enables many users to share a printer, or several printers, efficiently. The commands in this package can perform the following functions:

- customizing the system so that it will spool to a pool of line printers

- grouping printers into logical classes to maximize the throughput of the printers

- queuing print requests, thus allowing a print request (job) to get printed on the next available printer in that class

- canceling print requests, so a job that is no longer needed will not be printed

- starting and stopping the LP spooling software from processing requests

- changing the configuration of printers

- finding the status of the LP scheduler

- restarting any printing that was not completed if the system was powered down

For information about using this package, see Chapter 3 of the *User's Guide* and the Line Printer Spooling manual pages in the *User's Reference Manual*. For information about administering this package, see Chapter 7 of the *Administrator's Guide* and the Line Printer Spooling manual pages in the *Administrator's Reference Manual*.

A.10 NETWORKING SUPPORT UTILITIES

The Networking Support Utilities product (new for GENIX V.3) supplements the Essential Utilities by extending system capabilities to support networking applications. The product includes standard STREAMS protocol modules (for use by applications), a network utility that monitors network service requests (the Listener), and the version of the sharable Network Services Library required by applications developers when they compile programs that use routines in that library.

This product is required to take advantage of the following features of GENIX V.3: Remote File Sharing, STREAMS Mechanisms and Tools, the NSC Transport Interface, Media-Independent uucp, and the Listener.

For more information about these new features, look under the name of the feature in Section 2.5. You will find additional information in the *STREAMS Primer*, *STREAMS Programmer's Guide*, *Networking Guide*, and the Networking Support Utilities manual pages in the *Programmer's Reference Manual*.

NOTE: This package must be installed only on systems with at least two megabytes of memory.

A.11 PERFORMANCE MEASUREMENT UTILITIES

The Performance Measurement Utilities package provides commands that examine data collected about system usage. This data can be used to analyze the performance of the system and determine load balancing and system tuning strategies.

To make the best use of these tools, follow the strategies outlined in Chapter 6 of the *Administrator's Guide*. This chapter covers the following topics:

- finding and fixing performance problems

- tuning the kernel for minimum overhead and the disk subsystem for maximum throughput

- workload analysis and housekeeping techniques for reducing peak load and estimating capacity

- descriptions of the performance tools in this package

- definitions of tunable parameters, with suggestions of how to set them

The performance tools measure and display the following kinds of information:

- processor utilization

- buffer and file access activity

- terminal device activity

- disk input/output activity

- system calls

- process switching

- swapping activity

- queue activity

- inter-process communication (IPC) activity

For more information, in addition to Chapter 6 of the *Administrator's Guide*, see the Performance Measurement Utilities manual pages in the *User's Reference Manual* and the *Administrator's Reference Manual*.

A.12 REMOTE FILE SHARING UTILITIES

The Remote File Sharing Utilities product (new for GENIX V.3) provides the facilities needed to share remote files transparently among computers. It requires the Networking Support Utilities product and a Transport Provider (such as the NPACK NETWORK).

For more information about the Remote File Sharing feature, see Section 2.5. You will find additional information in Chapter 10 of the *Administrator's Guide* and in the Remote File Sharing Utilities manual pages in the *Programmer's Reference Manual* and *Administrator's Reference Manual*.

NOTE: This package must be installed only on systems with at least two megabytes of memory.

A.13 SECURITY ADMINISTRATION UTILITIES

The Security Administration Utilities package provides an encryption mechanism for protecting information stored in the computer. Using the facilities of this package gives additional protection beyond that obtained through login ids, passwords, and permission modes. When this package has been installed, the encryption mechanism is available by using the **crypt** command, as well as in the editors **ed, edit, ex,** and **vi.**

For more information, see the Security Administration Utilities and **ed**(1), **edit**(1), **ex**(1), and **vi**(1) manual pages in the *User's Reference Manual.*

NOTE: The Security Administration Utilities package has restricted distribution and is sold within the United States.

A.14 SPELL UTILITIES

The Spell Utilities package contains a program, **spell,** that checks for misspelled words in a file. It does this by comparing all the words in a file against another file that contains a dictionary. The performance of **spell** can be monitored by reviewing a file that contains a history of misspelled words. The dictionary can be modified if a misspelled word goes undetected or if there are words you would like to add to the dictionary.

For more information, see the the Spell Utilities manual pages in the *User's Reference Manual.*

A.15 SYSTEM ADMINISTRATION UTILITIES

The System Administration Utilities package contains system administration commands intended to be used by someone with responsibility for managing the hardware, software, and users on your GENIX V.3 system. For more information, see the *Administrator's Guide* and the System Administration Utilities manual pages in the *Administrator's Reference Manual.*

A.16 SYSTEM HEADER FILES

The System Header Files contain information about the GENIX V.3 system that is used only in a program development environment. You install them only while you are installing the separately available C Programming Language Utilities product or another language product.

A.17 TERMINAL FILTERS UTILITIES

The Terminal Filters Utilities package allows a variety of terminals to print formatted output from the **nroff** and **man** (manual page) text formatters.

A terminal filter is a program that takes the incoming data and changes it so it will appear as it should on that particular terminal. The package contains filters that handle special functions for the DASI 300, 300S, and 450 terminals and the Hewlett-Packard 2621 and 2640 series of terminals. For example, these filters convert requests for italic or bold fonts into sequences of characters, backspaces, underlines, or overstrikes, as appropriate for the font on that terminal. Other filters include one that does pagination for the Tektronix 4014 terminal, one that interprets Greek and other special characters from **nroff** text formatter output, and one that archives files onto a Hewlett-Packard 2645A terminal's cartridge tape drivers.

For more information, see the Terminal Filters Utilities manual pages in the *User's Reference Manual*.

A.18 TERMINAL INFORMATION UTILITIES

The Terminal Information Utilities package contains routines (**curses**) and a database (**terminfo**) that allow programmers to write programs to manipulate screens (and parts of screens, such as function keys and soft labels) of video display terminals.

The **terminfo** database contains descriptions of over 150 terminals. The terminals are described by giving a set of terminal capabilities and by describing how operations that provide each capability are performed. The **curses** library is a collection of routines with the major function of "cursor optimization," that is, minimizing the number of characters that need to be sent to your screen and the cursor movements that place them there. **Curses** uses the **terminfo** database to obtain the specific information about the characteristics of a terminal so that it can best optimize its performance. Through **curses**, a terminal screen can be scrolled, cleared, or divided into separate windows. In addition, **curses** can produce output on more than one terminal at once.

Additional commands in this package allow you to convert previously developed **termcap** data bases into **terminfo** entries, compare two **terminfo** entries, print **termcap** or **terminfo** entries in several formats, and compile **terminfo** entries into a form required by the **terminfo** data base. General users can take advantage of these facilities when they run applications programs or by writing shell programs that use the **tput** command.

For more information, see the material in Section 2.5.10. You will find additional information in Chapter 10 of the *Programmer's Guide* and the Terminal Information Utilities manual pages in the *User's Reference Manual, Programmer's Reference Manual*, and *Administrator's Reference Manual*.

A.19 USER ENVIRONMENT UTILITIES

The User Environment Utilities package consists of commands that can be used to do the following things:

- perform mathematical calculations

- write shell programs

- check or change the executing environment of commands

- schedule commands to be executed at a later time

- interact with more than one shell layer from any single terminal, switching at will between layers, just as if you were logged in from several terminals simultaneously.

For more information, see the *User's Guide* and the User Environment Utilities manual pages in the *User's Reference Manual*.

Appendix B

ADDITIONAL SOFTWARE PRODUCTS

B.1 INTRODUCTION

This appendix describes some of the additional software products, available from NSC that work with the GENIX V.3 system on the *Series 32000* Computer. These add-on products are divided into the following areas: general, programming, networking, and other applications.

B.2 GENERAL

B.2.1 Source Code Provision

The Source Code Provision product consists of all *Series 32000* Computer source code corresponding to the GENIX V.3 system. It is available to customers who have a source license. (When customers pay the binary license fee, they do not receive the source code for the GENIX V.3 system.) The source code product includes the following:

- kernel, standard device drivers (listed in Appendix A under Essential Utilities), field upgrade utilities and all the Utilities packages listed in Appendix A (including the Remote File Sharing Utilities and Networking Support Utilities products)

- Advanced Programming Utilities (Issue 1.0)

- C Programming Language Utilities (Issue 4.0)

- process accounting software and manual pages

B.3 PROGRAMMING

B.3.1 Advanced Programming Utilities (Issue 1)

This new product contains three Utilities packages:

- Advanced C Programming Utilities package, which contains the commands **cb, cflow, ctc, ctcr, ctrace, cxref, lint** and **regcmp**, and several varieties of the C Library

- Extended Software Generation Utilities package, which contains the commands **lex, mcs, sdb, yacc** and **mkshlib** (used to generate shared libraries; new for the GENIX V.3 system), and several libraries

- Source Code Control System Utilities (SCCS) package, which contains commands that enable a user to handle version control of large, constantly changing projects without taking up much disk space (by storing the original file and each set of changes to it)

For more information, see the *Programmer's Guide* and the appropriate manual pages in the *Programmer's Reference Manual*.

B.3.2 C Programming Language Utilities (Issue 4)

The C Programming Language Utilities product provides two Utilities packages (C Programming Utilities and Software Generation Utilities) that contain a compiler and a set of software tools designed to aid in generating C language programs.

For more information, see the *Programmer's Guide* and the appropriate manual pages in the *Programmer's Reference Manual*.

B.4 NETWORKING

B.4.1 NPACK NETWORK

The NSC NPACK NETWORK connects devices on a one megabit per second network using standard phone wiring and standard modular telephone jacks. This local area network provides simple, reliable connections (logical and physical) between computers and their peripherals.

The logical aspect of an NSC NPACK NETWORK connection is established and maintained via network software and firmware within each device involved in the connection.

The physical aspect of an NSC NPACK NETWORK connection consists of NSC NPACK NETWORK hardware and the transmission medium of the network: standard 24-gauge building telephone wire. The network is baseband oriented and uses the carrier sense multiple access with collision detection (CSMA/CD) contention method described in the IEEE 802.3 Standard.

The following basic networking concepts govern the operation of an NSC NPACK NETWORK:

- Peer Oriented: All devices on the network are recognized as equals with regard to access to network services and the order of servicing network devices. Requests for network services are handled on a first-come, first-served basis with no need for a single centralized point of network control.

- Network Names: Devices on the network are connected with reliable, point-to-point connections known as *virtual circuits*. Each device is assigned a *name*. That name can then be used to identify that device on the network for all subsequent network operations.

- Communicating via a Session: Establishing a connection between two network names and the subsequent use of that connection to communicate is known as a *session*. Sessions are equivalent to the reliable, point-to-point, two-way connections that exist in traditional telecommunications networks.

B-2

- Communicating via Datagrams: The network also supports a connectionless form of communication called *datagrams*. Datagrams do not require a pre-established point-to-point virtual circuit to communicate over the network. Datagrams are transmitted only once, and acknowledgement or retransmission of a datagram is not the responsibility of the network.

For more information, see the *NPACK NETWORK Introduction* (contact AT&T for ordering information).

B.5 OTHER APPLICATIONS

B.5.1 DOCUMENTER'S WORKBENCH Software

The GENIX V.3 system is compatible with AT&T's DOCUMENTER'S WORKBENCH Software (DWB). This software is available from National Semiconductor under the name, "Tools For Documenters."

DOCUMENTER'S WORKBENCH Software contains four kinds of tools that help users produce documents:

- text processors (such as **nroff** and **troff**) that are used to format text

- macro packages (such as **mm** and **man**) that prepare documents for formatting by one of the DWB text processors

- preprocessors that prepare special kinds of text such as pictures, tables, and mathematical expressions

- postprocessors that prepare documents for handling by a particular output device, such as a printer or phototypesetter

Appendix C

FEATURES ADDED IN THE GENIX V.3 SYSTEM

C.1 INTRODUCTION

This appendix lists and describes the features that were added from System V, Release 2.0 and System V, Release 2.1. This information was taken from the *Product Overview* for System V, Release 2.1. Features for GENIX V.3 are described in Section 2.5.

C.2 FEATURES ADDED FROM SYSTEM V, RELEASE 2.0

- Self-Configuration
- Dynamic Disk Partitioning
- File System Hardening
- Bad Block Handling
- System Administration Menus
- Advisory File and Record Locking
- Shell Enhancements

C.3 FEATURES ADDED FROM SYSTEM V, RELEASE 2.1

- Demand Paging
- Mandatory File and Record Locking
- Improved Floating Point Performance
- AT&T Teletype 5425 Buffered Display Terminal Support
- New and Restructured Documentation

C.4 DESCRIPTIONS OF FEATURES ADDED IN SYSTEM V, RELEASE 2.0

C.4.1 Self-Configuration

This feature enables peripheral drivers to be kept on the hard disk instead of permanently in the GENIX V.3 system kernel. Whenever the system is booted, this feature automatically detects any new hardware and retrieves the corresponding driver. The driver is installed without relinking the kernel, thus greatly simplifying application interfacing. This feature helps to make efficient use of memory because the system can be configured according to an individual's immediate needs. Self-Configuration also provides the means to list specific hardware/software information on demand.

C.4.2 Dynamic Disk Partitioning

This feature allows disk partitioning information to be kept on disk (hard or floppy) instead of in the kernel. This feature also supports changing the disk partitions when the operating system is restored. With this support, a user can upgrade the integral hard disk to one of the optional hard disks without a corresponding software change. Dynamic Disk Partitioning gives the user the flexibility to partition a hard disk to suit current needs.

C.4.3 File System Hardening

This feature gives the *Series 32000* Computer file system additional protection if there is a power outage, system crash, removal of floppy during update, etc. File System Hardening is done through ordered writes to the disk, frequent disk buffer flushings, detection of corrupt file systems when mounting, and automatic sanity flag checking on all file systems to ensure integrity.

C.4.4 Bad Block Handling

This feature automatically detects and avoids defective disk blocks on the hard disk(s). The feature also corrects the defect when possible.

C.4.5 System Administration Menus

The System Administration Menu command (**sysadm**) and associated subcommands are menu-driven commands that simplify the job of system administration. Some of the tasks supported by System Administration Menus include installation and removal of software, floppy and hard disk formatting, backup of the hard disk, setting and changing system passwords, and changing a user's login and password.

C.4.6 Advisory File and Record Locking

If this feature has been invoked, users are notified when they access a file if it is already in use; however, they are not prevented from editing or running other commands on the file. This feature was augmented in Release 2.1 by the Mandatory File and Record Locking feature, described later in this appendix.

C.4.7 Shell Enhancements

Job control, implemented in GENIX V.3 system as the shell layer manager, **shl**, gives the user the flexibility to select the feature only when needed. The shell layer manager lets the user set up several independent environments, each a separate shell process called a "layer." Each layer executes a different program (process) simultaneously, using the same terminal for input and output. The user can control and observe the progress of each of these simultaneous processes. When the shell layer manager is terminated, all programs under control of the manager are terminated automatically.

The GENIX V.3 system shell layer manager works with standard terminals without special hardware. This strategy differs from those job control implementations that require special hardware and hardware drivers.

C.5 DESCRIPTIONS OF FEATURES ADDED IN SYSTEM V, RELEASE 2.1

C.5.1 Demand Paging

Demand paging allows the GENIX V.3 system to execute processes that exceed the address space of main memory. In general, virtual memory management is transparent to the user and has little impact on performance or reliability.

C.5.2 Mandatory File and Record Locking

This feature allows a process to lock a file (or one or more contiguous blocks of a file) for exclusive use by that process. (This follows the full functionality of the interface defined by the /usr/group standards group.) If a file or record is locked, then access to it by another process is restricted according to the type of lock on it. If a process has a *read lock* on a file, then other processes can read the locked file, but not write to it. If a process has a *write lock* on a file, other processes can neither read nor write that file. Mandatory file and record locking is enforced by the system calls used to access files, whereas advisory file and record locking (Release 2.0) relies on cooperating processes to enforce the record locking protocol.

C.5.3 Improved Floating Point Performance

The operating system and many commands were compiled with Issue 3 of the C Programming Language Utilities. This significantly increases the speed of floating point operations, depending on the hardware you are running.

C.5.4 AT&T Teletype 5425 Buffered Display Terminal Support

The **terminfo** database was updated to include the AT&T Teletype 5425 Buffered Display Terminal.

GLOSSARY

This Glossary defines some of the words and phrases used in this document. The emphasis is on words that have a special meaning with respect to the GENIX V.3 system.

add-on product products that NSC markets for use with the GENIX V.3 operating system.

boot to start the operating system, so called because the kernel must bootstrap itself from secondary storage into memory.

command 1. an instruction to the shell, usually to run a program as a child process (commands are usually found in **/bin** or **/usr/bin**). 2. by extension, any executable file, especially a utility program (commands may be found anywhere; they are searched for according to the value of the shell environment variable **PATH**).

device 1. a file that is not a plain file or a directory. For example, a tape drive is a device and so is the null device. 2. an input-output unit, either physical or virtual, that appears in the file system as a special file.

directory a file that comprises a catalog of file and directory names; the organizing principle of the file system, a directory consists of entries that specify further files (including directories), and constitutes a node of the directory tree.

execute informally, to run a program.

file 1. in general, a potential source of input or destination for output. 2. a directory entry; several directories may have files with the same name.

file system 1. a collection of files that is accessible via some path from the root directory of the file system. 2. the collection of all files on a computer. 3. the part of the kernel that deals with file systems.

filter a program that reads data from standard input, transforms it in some way, and writes the results to standard output.

GENIX V.3 system the name of a family of operating systems (for example, GENIX V.3 System), not an acronym for anything; a trademark of NSC, the word GENIX V.3 should be used as an adjective, for example, "GENIX V.3 system," "GENIX V.3 software."

kernel the GENIX V.3 system proper; code resident in memory that implements the system calls.

library	an archive of object files from which the link editor may select functions and data as needed.
operating system	the program for managing the resources of the computer. It takes care of such things as input/output procedures, process scheduling, and the file system, removing this burden from user programs.
program	1. an executable file. 2. a process.
redirection	feature that allows you to reassign standard input and standard output to files or other devices.
shell	1. the program (called **sh**) that acts as the interface between the user and the GENIX V.3 operating system; it causes other programs to be executed on command; the shell is usually started on a user's behalf when the user logs in. 2. by analogy, any program started upon logging in.
standard input	the place from which a program expects to receive its input, usually a terminal; however, see "redirection."
standard output	the place to which a program writes its results, usually a terminal; however, see "redirection."
system calls	1. the set of system primitive functions through which all system operations are allocated, initiated, monitored, manipulated, and terminated. 2. the system primitives invoked by user processes for system-dependent functions, such as I/O, process creation, etc.
Utilities package	a group of programs that performs related functions; examples of packages are Directory and File Management, Performance Measurement, and Line Printer Spooling.

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