NeXTstep Connectivity

Executive Summary

At NeXT, we believe the mission of computing in the 1990s is to improve group productivity and collaboration–Interpersonal Computing. To succeed, Interpersonal Computing requires computer platforms which integrate powerful networks and robust communication tools. For this reason, NeXT has made networking and connectivity a cornerstone of its design. The result is a flexible solution that can share information and services with mixed networks and multiple platforms.

As a standard UNIX® workstation, NeXT™ adheres to industry standards and multivendor connectivity. (For a detailed list of standards supported by NeXT, see *NeXT and Open Systems Standards*, in the NeXT White Paper Library.) From the start, NeXT built compatibility into every computer. In doing this we had an advantage. Since NeXT computers were designed more recently than the architectures of other major manufacturers, NeXT could observe which standards were accepted and provide true value to users. NeXT incorporated into its design technologies actually embraced by our key markets. Our view is simple:

Use standards whenever possible.

Develop new technologies when users are dissatisfied with current industry offerings, or when current offerings limit important kinds of user functionality.

And make NeXT's new technologies coexist in a heterogeneous world.

This document discusses key industry connectivity standards that are incorporated into all NeXT systems. It also highlights many commercial products which make it easy to connect NeXT computers to any existing network, including: SNA, LU6.2, Token-Ring, X.25, X.400, AFS, Apple EtherTalk, Novell NetWare, UNIX, and more.

But first we want you to know our bias: The ultimate standards-based computer would be a perfect clone of whatever computer system had the largest market share. This product would bring no surprises and certainly no additional value to users. NeXT computers were never conceived to offer merely a cheaper version of yesterday's technology. NeXT's goal is to provide the finest possible computing environment to enable our users to work creatively and collaboratively.

In today's heterogeneous computing environment, the NeXT system is designed to fit in just as well as it stands out. We hope you agree that NeXT developed the right balance between relying on broadly accepted industry standards and innovating to improve the value and functionality available to users.

I. NeXT BUILT-IN HARDWARE

Ethernet Hardware

Every NeXT computer includes built-in hardware support for two types of Ethernet cable: thin (10Base2) and twisted-pair (10BaseT).

Regardless of the Ethernet cable option you choose, adding a NeXT computer to the network is a simple task: simply connect the computer to the network and turn it on. NeXTstep™ automatically senses which type of Ethernet wiring you have used and correctly configures itself. It's that easy.

Thin Ethernet Cable

Thin Ethernet coaxial cables consist of a single wire surrounded by an insulator and a shield. With a network based on thin Ethernet cables, your equipment needs are minimal. All you need to do is to string cables, attach terminators, and plug in your computer. If cable installation is not logistically difficult, then this solution may be best for you. Thin Ethernet is ideal for small networks.

Hardware Specifications:

- Thin Ethernet (10Base2 compatible) at 10 MB/second.

A Short Introduction to Networking Equipment

A wide variety of networking solutions and configurations exist because connectivity needs vary tremendously across organizations. This section describes some of the equipment available to configure your network or add NeXT computers to it. The equipment described below can be obtained from suppliers who can also assist you in determining the best configuration to suit your needs.

By incorporating the right type of networking equipment, you can interconnect networks based on different communications architectures and communicate over a wide variety of transmission media.

Concentrators permit you to position machines closer together on a network cable than is otherwise possible. Concentrators, simply stated, allow you to connect many machines at one point on the network. If you use a twisted-pair cable, you need a concentrator.

Repeaters copy individual bits between cable segments.

Bridges store and forward frames (Ethernet "packets") between local networks.

Routers connect networks together (LAN-to-LAN, LAN-to-WAN, WAN-to-WAN).

Gateways store and forward packets between dissimilar networks, typically translating between protocols.

For local networking, repeaters used to extend a network or a bridge can be used to combine two thin Ethernet networks.

If the Ethernet network containsdifferent types of cables, you could install a repeater, bridge, or router, running, for example, thin cable into one end of your equipment, and using twisted-pair cable thereafter. You can also join thin or twisted-pair Ethernet cable to an existing thick-coaxial Ethernet cable.

To build more complex networks having heavier traffic, you can use routers or gateways. Both can create subnets, which are logical divisions of a network into smaller 'subnetworks.' Dividing a network into smaller subnets provides better administrative control than a single large network. Network performance is also improved significantly.

If you need to extend your network beyond a single building a range of solutions is available, depending on the distance over which you need to extend the network. If buildings are located close together, you can install fiber optic or broadband cable between them. Fiber optic transceivers installed between buildings allow you to extend the range of your network to approximately 1.5 miles at Ethernet speeds (and farther if you add additional transceivers). Since you cannot readily string wires through city streets, fiber optic transceivers are most useful in a campus-like setting.

Telephone lines provide convenient ways to build wide-area networks. WANs can be built using both dial-up analog lines and leased digital lines. Standard IP-based network protocols can be run across the phone lines (both dial-up and leased); in addition, the UNIX UUCP facility and the UNIX tip command can provide remote access across phone lines using non-IP protocols.

Communication speeds across telephone lines range from the very slow (300 baud or less) to the very fast (1 megabit per second and faster), depending on the equipment used to connect to the lines. Current standards for asynchronous communication protocols permit data rates up to 56Kb/sec over normal analog voice-grade phone lines, depending on the support provided by the modem being used. Digital data-grade phone lines (typically leased) provide up to 1Mb/sec and beyond, depending on the service used.

Twisted-Pair Ethernet Cable

In a twisted-pair Ethernet configuration, cables connect each computer to a central hub. Cabling consists of two pairs of wires: one pair for transmitting and one for receiving data. The wires in each pair are twisted together—'twisted pair. '

To operate this network, you must purchase and maintain the network hub equipment, which can be costly. However, you can use existing telephone wiring, which reduces overall cost since it reduces the total amount of new cabling needed. If your computers are widely dispersed around a building, or you have an existing twisted-pair network, this solution may be best for you.

Hardware Specifications:

- Twisted-pair Ethernet (10BaseT compatible) at 10MB/sec

Disk Drives

3.5-inch 2.88 MB Floppy Disk Drive

A versatile 3.5-inch 2.88 MB floppy disk drive is standard on every NeXT computer. This drive can read, write, and format UNIX disks in 720 KB, 1.44 MB, or 2.88 MB formats.

In addition, this drive reads, writes, and initializes MS-DOS disks, and automatically transfers files from DOS-to-UNIX or UNIX-to-DOS whenever files are copied or moved between UNIX and DOS file systems.

In NeXTstep Release 3, NeXT provides support for Macintosh floppy and hard disks. These disks automount and appear in the browser like DOS disks do in NeXTstep Release 2.0. By default, only the data forks of Macintosh files are visible; resource forks are accessible as hidden files or directories. Because of hard-

ware limitations, only the 1.4 MB Macintosh floppy disk format are supported by NeXTstep 3.0. A facility is provided to initialize Macintosh disks via the Workspace Manager and to associate a Macintosh file with its application.

Hardware Specifications:

- 2.88 MB formatted capacity using extended density (ed) floppy disks
- 3.5-inch third-height form factor
- Compatible with DOS-formatted 1.44 MB and 720 KB disks
- Compatible with 1.44 MB Macintosh formatted disks

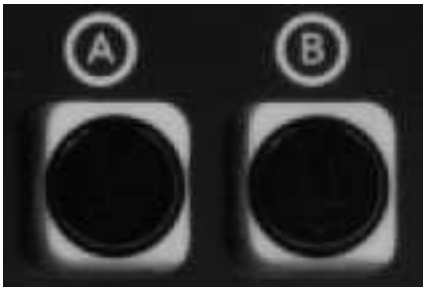
CD-ROM Drive

A NeXT CD-ROM drive is available which works with all models of NeXT computers. This drive reads ISO 9660 formatted CD-ROM disks and, with the release of NeXTstep 3.0, supports the RockRidge standard and a NeXT-specific UNIX CD-ROM format. The external drive connects to NeXT computers with a SCSI cable. An internal model of this drive is available for NeXTcube™ and NeXTdimension™ systems.

Hardware Specifications:

- 5.25-inch half-height form factor
- 540 MB capacity
- ISO 9660 standard format
- 1.5 MB/sec maximum transfer rate

Serial Port Hardware



Each NeXT computer has two built-in serial ports to which you can attach data modems, fax modems, PostScript® printers, and other serial devices. The NeXT serial ports can also be used to connect MIDI devices. NeXT systems using the Motorola 68040 processor support hardware-based flow control on the serial ports, using the RTS and CTS control signals. 68040-based systems support RS-423 serial devices directly; with an appropriate cable, RS-232C devices are also supported. 68030-based systems support differential RS-422 devices.

Data Modems

Most asynchronous serial modems are compatible with NeXT computers. A few of these are:

- Fastcomm 9696 FDX
- Hayes Smartmodem 2400
- Hayes Smartmodem 9600 V.32
- Microcom QX/V.32c MNP Class 9 mode (SX Mode)
- Telebit T2500

This list is far from being an exhaustive survey of compatible modems.

Fax Modems

Using a NeXT computer, users no longer have to first print out documents on a laser printer and then scan them into a fax machine. Because computer-generated materials are imaged and faxed directly by the computer, NeXT faxes contain no scanning distortion. For this reason, faxes sent by NeXT computers to conventional fax machines have remarkably improved print quality and clarity, corresponding to output from 200 dot per inch PostScript printers.

Every NeXT system supports sending and receiving standard Group 3 Fax. Users simply attach a compatible fax modem, which can be registered as a shared device on a network. In addition, NeXTstep Release 3 supports the Group 4 Fax compression standard. NeXT also includes a FaxReader application as a bundled NeXTstep application.

Using a fax modem together with the faxing facilities built into every NeXT computer, you can read and save incoming faxes and can send faxes to many people. Incoming faxes can be received by multiple people. For example:

- Faxes may be sent to people on distribution lists but may have personalized and individualized cover sheets for each recipient.
- Incoming faxes sent to a fax server may be viewed by multiple users.
- Faxes may be scheduled to be sent at a specific time.

Commercial applications are available which allow users to convert fax bitmaps into editable text.

Fax modems compatible with NeXT computers must either comply with the Class 2 fax modem communications standard or come with custom driver software for NeXT computers.

Graphics Tablets

Graphics tablets can be attached to any NeXT computer for applications as diverse as forms-based data entry, technical illustration, CAD or cartography. A stylus provides precise control over cursor move-

ment allowing the illustration or the tracing of drawings using natural, free hand motion. Graphics tablets must be compatible with the SummaSketch I (MM I) and use a 12-by-12 inch format. Graphics tablets are attached to a NeXT computer's B serial port.

Null-Modem Connections (Terminal, Macintosh, PC)

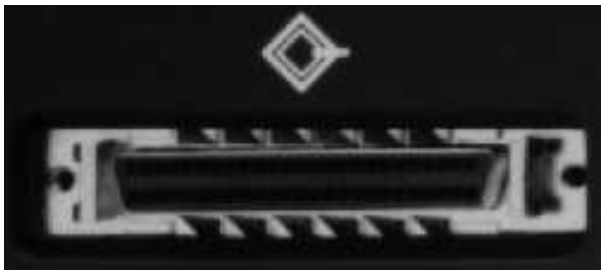
As many as two external terminals can be connected to the NeXT computer via NeXT's serial ports using a null-modem cable. These devices can be PCs, Macintoshes, or terminals supported by the UNIX **termcap** facility. Files can be transferred from the Macintosh or PC to the NeXT computer using several different public domain software tools described in the *Serial Port Software* section of this guide. Commercial applications offer file translation beyond basic file transfer capabilities provided by public domain software. These tools are described in the *Networks, Networking and Connectivity* section of this guide.

Hardware Specifications:

- Two RS-423 serial ports (miniDIN-8 connectors)

SCSI-1 and SCSI-2

Every NeXT computer comes with SCSI device support allowing users to attach additional hard, floppy, optical, and cartridge disk drives, CD-ROM drives, tape backup units, image scanners, and other devices supporting this standard. Multiple external SCSI devices can be daisy-chained.



NeXT computers implement the SCSI-1 protocol using a SCSI-2 connector. When the SCSI-2 protocol is fully defined, NeXT will implement and support it. Until then, NeXT will be compatible with all existing SCSI-1 devices. NeXT also provides cables connecting SCSI-1 and SCSI-2 connectors.

Hardware Specifications:

- SCSI-2 connector with transfer rate of 4.8 MB/sec (burst rate)
- SCSI-2 to SCSI-1 cable (50-pin to 50-pin)

Digital Signal Processor

All NeXT computers include a digital signal processor (DSP) port providing direct input/output to the Motorola DSP56001 chip on the NeXT computer's CPU board. This port can accept digital input from laboratory equipment, analog-to-digital converters, or CD-quality audio devices. Several commercial suppliers offer external devices for analog-to-digital conversion and live sound, music or video input. Details on these products is found in the *Software and Peripherals Catalog*.

Hardware Specifications:

- Proprietary DSP port for Motorola DSP 56001

Non-NeXT Printers

You can connect any standard PostScript printer to either NeXT serial port via a null-modem cable. Printers are selected via the PrinterManager application. *Section III* of this guide provides a partial listing of PostScript printers compatible with NeXTstep Release 3. The ability to download fonts from a computer to any connected printer is also supported.

In addition to NeXT printers and generic PostScript printers, NeXT provides PostScript print rasterization for several popular printers in NeXTstep Release 3, effectively turning these printers into PostScript devices:

- Epson LQ510
- IBM ProPrinter 24P
- HP DeskJet 500

A NeXT computer can print to PostScript-compatible printers attached to other UNIX computers on Ethernet networks, as well as PostScript printers on Ethertalk networks.

Adobe's newest release of PostScript, Postscript Level 2, is integrated into the Window Server in NeXTstep 3.0. The PostScript interpreter, whether printing or drawing on screen, accepts PostScript Level 2 language calls.

Of particular importance is the way color is managed in NeXTstep 3.0. Thanks to PostScript Level 2, the NeXT Color Panel defaults to device-independent

colors. Device-independent color will not affect on-screen drawing, but it will allow PostScript Level 2 printers (including NeXT's own) to take advantage of device-independent color specification which minimizes the difference between the color seen on the screen and the color produced by the printer. In NeXTstep Release 3 this feature is emulated when PostScript jobs are printed on an older, Level 1 PostScript printer.

II. BUNDLED SOFTWARE

Ethernet Software

Standard UNIX

NeXT computers include a rich suite of communications tools. NeXT's system software is BSD 4.3 compatible UNIX and supports the standard TCP/IP communications protocol and the standard suite of UNIX utilities (such as rlogin, rsh, rcp, FTP, TELNET, and TN3270). Included in this protocol suite is the Simple Mail Transfer Protocol (SMTP), the most popular mail transport mechanism available today as well as the Berkeley UNIX **sendmail** mail delivery system.

Network File System

NeXT licensed the Network File System (NFS® 4.0) from Sun Microsystems. NFS enables NeXT computers to share files with other computers connected to an Ethernet network, and to act as file servers (by publishing all or part of their directory structures to other machines on the network) and clients (by mounting directory structures from other machines). NFS networks may contain a mix of UNIX workstations from other vendors (Sun, DEC, HP, IBM, SGI, and others), MS-DOS PCs running TCP/IP and NFS software, minicomputers, IBM mainframes running TCP/IP and NFS, and Macintosh computers with Ethernet cards and NFS software, together with other NeXT computers.

Network Information Service

Network Information Service (NIS, formerly called Yellow Pages) is Sun Microsystems' distributed administrative database. NeXT computers can partici-

Generic PostScript Printers

Printers compatible with NeXTstep 3.0 include:

APS-PS PIP with APS-6-108
APS-PS PIP with APS-6-80
APS-PS PIP with LZR 1200
APS-PS PIP with LZR 2600
AST TurboLaser-PS
Adobe LaserJet II Cartridge
Agfa-Compugraphic 9400P
Agfa Matrix ChromaScript
Agfa TabScript C500 PostScript Printer
Apple LaserWriter
Apple LaserWriter II NT
Apple LaserWriter II NTX v47.0
Apple LaserWriter II NTX v51.8
Apple LaserWriter Personal NT
Apple LaserWriter Plus v38.0
Apple LaserWriter Plus v42.2
Canon LBP-4 PS-2
Canon LBP-8IIIR PS-1
Canon LBP-8III PS-1
Canon LBP-8 Mark IIIT
Canon PS-IPU Color Laser Copier
Colormate PS
Dataproducts LZR-2665
Dataproducts LZR 1260
EPSON EPL-7500
Fujitsu RX7100PS
HP LaserJet IID PostScript
HP LaserJet IIID PostScript
HP LaserJet IIIP PostScript
HP LaserJet IIISi PostScript
HP LaserJet III PostScript
HP LaserJet IIP PostScript
IBM 4019 17 fontsI
BM 4019 39 fonts
IBM 4216-020
IBM 4216-030
Linotronic 100
Linotronic 200 v47.1
Linotronic 200 v49.3
Linotronic 300 v47.1
Linotronic 300 v49.3
Linotronic 330-RIP 30
Linotronic 330
Linotronic 500
Linotronic 530-RIP 30
Linotronic 530
Monotype Imagesetter
OcéColor G5242 PostScript Printer
Oki OL830-PS
Oki OL840-PS
Panasonic KX-P4455
QMS-PS 2200
QMS-PS 2210
QMS-PS 2220
QMS-PS 800
QMS-PS 800 Plus
QMS-PS 810
QMS-PS 810 Turbo v. 51.7
QMS-PS 820
QMS-PS 820 Turbo
QMS ColorScript 100
QMS ColorScript 100 Model 10
QMS ColorScript 100 Model 20
QMS ColorScript 100 Model 30
QMS PS Jet
QMS PS Jet Plus
Qume ScripTEN
Ricoh PC Laser 6000-PS
Scantext 2030-51
Schlumberger 5232 Color PostScript Printer
Shinko Color CHC-746PSJ PostScript Printer
Silentwriter2 290
Silentwriter2 Model 90
Silentwriter LC 890
Silentwriter LC 890XL
TI 2115 13 fonts
TI 2115 35 fonts
TI OmniLaser 2108
TI microLaser PS17
TI microLaser PS35
TI microLaser XL PS17
TI microLaser XL PS35
UNISYS AP9210 17 Fonts
UNISYS AP9210 39 Fonts
Unisys AP9415
Varityper 4200B-P
Varityper 4300P
Varityper Series 4000-5300
Varityper Series 4000-5330
Varityper Series 4000-5500
Varityper VT-600P
Varityper VT-600W

pate in a network as NIS clients or servers. NeXT computers can use the same mechanism as the rest of the network (through standard UNIX flat files, or as a client of NIS, for example). Or NeXT's NetInfo™ (see *Section VI*, below for a description) can provide administrative data for the NeXT computers on the network. One common configuration is to have a mixed network running both NetInfo for the easier to administer NeXT computers and NIS to maintain compatibility with older and more cumbersome technologies.

Berkeley Internet Name Domain

The Berkeley Internet Name Domain service (BIND) is a wide-area distributed name lookup service that allows your local computer to determine the Internet address of computers on distant networks. A NeXT computer can be a client (or server) of the domain name service. To communicate with other networks on the Internet, you can make your NeXT computer a client of the BIND.

Novell Netware Client

Novell NetWare supports NeXT systems using NeXTstep Release 2. For these systems, NetWare version 3.11 with the NFS NetWare Loadable Module (NLM) is required. NetWare 3.11 also provides client support for DOS, OS/2, Windows, and Macintosh systems.

NeXTstep Release 3 includes Novell client software giving NeXT computers access to files and PostScript printers on Novell networks running NetWare 286 or 386. Novell file servers appear in the NeXT Browser much like NFS servers do on systems running NeXTstep Release 2.1. PostScript printers also appear in the standard NeXT Print Panel.

EtherTalk Client

Apple EtherTalk connectivity is available for systems running NeXTstep Release 2.1 using commercial products such as Cayman Systems' GatorBox. NeXTstep Release 3 includes EtherTalk client software for all NeXT systems, making every NeXT computer a network-ready EtherTalk client. A NeXT computer can share files with an AppleShare server by connecting to an Ethernet based Apple network (EtherTalk). EtherTalk servers appear in the FileViewer in the same manner as NFS and Novell servers. Thanks to NeXT's implementation of EtherTalk in NeXTstep Release 3, NeXT and Apple computers can share networked printers.

Macintosh Floppy Disks

NeXTstep Release 3 provides support for Macintosh floppy and hard disks. These disks automount and appear in the browser in the same manner that DOS disks do in NeXTstep Release 2.1. By default, only the data forks of Macintosh files are visible, although resource forks are accessible as hidden files or directories. Because of hardware limitations, only 1.4 MB Macintosh floppy disks are supported in NeXTstep Release 3. A facility is provided to initialize Macintosh disks in the Workspace, and for associating a Macintosh file with its host application (i.e., setting the file type and creator).

SNA

NeXT system software includes a TN3270 terminal emulator. TN3270 permits a full-screen, full-duplex terminal connection from a UNIX workstation to an IBM mainframe running VM/CMS. TN3270 interprets and generates 3270 control streams and maps 3270 commands from the host into appropriate sequences to control the user's terminal screen. TN3270 runs inside a NeXT Terminal window.

ISDN provides the ability to extend a network of NeXT computers via circuit-switched B-channel (64 kbps) ISDN service. NeXTstep Release 3 supports ISDN for U.S., French and Japanese markets.

Phone Kit

NeXT's Phone Kit™ provides an Applications Programming Interface (API) to telephone voice and data functions available through ISDN interface hardware. The API allows quick construction of telephone utility applications such as answering machines and speed-dialers. Voice function over both ISDN and analog lines are accessed via this common API. The features supported over ISDN are a superset of those supported over standard telephone service.

Distributed Objects

NeXTstep's Release 3 provides a distributed object facility enables applications and processes to send Objective C language messages to each other within a single machine or across TCP/IP networks. This facility includes extensions to the NeXT Compiler for the Objective C language and an interprocess/inter-machine message delivery mechanism. NeXT will publish the API for distributed objects and encourage application developers and other software platforms to interoperate with NeXT objects.

The NeXT Database Kit

The NeXT Database Kit™ permits the easy development of applications that need to access flatfile, relational, and other kinds of databases or to integrate databases quickly and easily into custom applications. The Database Kit consists of palettes of Interface Builder™ objects for displaying information and allowing users to construct, access and update databases.

The Database Kit allows developers to integrate multiple databases into a single application, and port applications across different databases. The Database Kit also supports European character sets in the same manner as the underlying databases. NeXTstep Release 3 provides built-in adapters for Oracle, SYBASE®, and Teradata databases. Adapters for other databases can be developed easily.

Every NeXT computer bundles SYBASE and Oracle client libraries and Oracle SQL*Net.

Managing a Network of NeXT Computers

A significant amount of data is required to administer a UNIX-based computer, particularly one on a network. Information about user accounts, access permissions, file systems, and peripheral devices must be accessible by all relevant devices on the network. Many, many hours are usually required, for example, simply to boot and install a typical UNIX workstation such as those from Sun, HP, DEC or IBM, using the traditional tools available, which require specialized UNIX expertise.
As long as NeXT computers are administered as stand-alone devices, local configuration files are sufficient and need not be accessed by users. Unlike Suns and most other UNIX workstations, stand-alone NeXT computers can be installed by end-users in a few minutes without ever accessing those files.
Once, however, a UNIX workstation is added to a network, configuration files must be shared among all relevant devices. Each time that a new computer is added to a network, the file containing information about every other computer on the network must be modified. As the network grows larger and larger, the management of administrative data using traditional ASCII flat files becomes extremely difficult given the number of files which need to be updated every time the configuration of one device changes.
The solution to the problem of managing information about the network is to centralize all relevant administrative information in a database available to all machines on the network. This database allows multiple computers to share administrative data, and it simplifies administration of the data because network administrators do not need to worry about maintaining consistency among the configuration files for all of the systems on the network. NetInfo, NeXT's solution, is based on this approach.
NetInfo is a network management tool allowing administrative information to be shared among many computers on a network. It consists of protocols, library routines, application programs, and data designed to make network administration easier. These programs enable relatively inexperienced users to set up stand-alone computers and modify networks, and allow advanced users to manage network and system administration configuration details. How? NetInfo was *designed* to be easier to use than other existing network system administration tools.
A suite of applications (collectively called *Manager* applications) provides a friendly interface to the most common network administration tasks. These flexible applications allow you to design your network to meet very specific organizational requirements. NetInfo allows for a sensible and flexible delegation of local and central network management responsibilities, and allows you to establish many separate local 'domains' (groups of machines). For example, you could set up a hierarchical network based on your company's organization so that you would share some resources with small sets of users while making other resources globally available. A printer could be shared among four individuals; a single mail server could route electronic mail to an entire company.
A NetInfo network consists of one or more NetInfo servers and any number of NetInfo client computers. A NetInfo server provides storage for as well access to the NetInfo database. The server manages administrative network information such as user accounts, group membership, recognized hosts and fax modem information.
NetInfo servers are a smart addition to a network because they allow multiple computers to share the same administrative data without managing the process of keeping information consistent across the network. Servers also simplify administration—you enter information into the centralized database rather than update individually each machine on the network. NetInfo databases may be administered from any computer on the network.
NetInfo administration is based on the concept of domains. A NetInfo domain is a collection of administrative information. For example, a NetInfo domain can contain the administrative information for a single computer, a department, or even an entire company. NetInfo domains are designed for groups of machines that need to be administered together, often along organizational lines—small work groups, departments, or divisions.
NetInfo is part of the standard NeXTstep software suite. NetInfo source code is available for compilation and use on non-NeXT computers by contacting NeXT.

RockRidge CD-ROM Filesystem

CD-ROM support in NeXTstep Release 3 includes the new RockRidge standard. This standard is backwards-compatible with ISO9660 and HighSierra formats supported in NeXTstep Release 2. Rockridge also allows executable files, mixed-case filenames, UNIX symbolic links, and directory hierarchies deeper than eight levels.

Serial Port Software

NeXT computers support standard UNIX serial line communications tools such as UUCP, tip, and cu. In addition, many public domain utilities are available, including Kermit, Xmodem, Ymodem and Umodem. Tip allows you to log on to a remote system as a remote terminal. UUCP provides access to a worldwide UNIX network over which you can transfer files, execute jobs on a remote machine, and send and receive mail.

To connect to another host through a serial port, you can also use one of several commercially available terminal emulator packages. For serial port data transfer between a NeXT Computer and another host, you can use the Kermit application (available in the public domain) versions of which exist for virtually every popular desktop computer manufactured during the past decade.

MIDI Time Code Synchronization

NeXTstep Release 3 includes a new MIDI driver that allows parsing and synchronizing events to MIDI Time Code (MTC). Graphics, sound, music, or other events can be synchronized to work in concert with external devices such as video and audio tape recorders.

III. COMMERCIAL PRODUCTS

If you intend to use your NeXT computer as a stand-alone system all you need to do is to plug in its cables, turn it on, and, without further work or configuration, it runs.

Frequently, however, users need to ensure that their NeXT computers operate in heterogeneous environments, connected to other systems. The following section describes solutions which make it possible for NeXT computers to interoperate with other computers on many kinds of networks.

Other Unix Workstations

NeXT computers are standard UNIX workstations, and as such, easily network with other UNIX workstations. The specific software tools included with every NeXT computer are described earlier, in sections concerning *Standard UNIX, NFS, BIND, NIS, and Networking Hardware*. Additional information concerning specialized commercial products providing connections to other UNIX platforms and windowing systems is described throughout this guide.

X Window Systems

Three commercial versions of the MIT X Window System are available for NeXT computers. These versions differ in their approach to integration within the NeXTstep windowing environment.

Cub'X takes over the NeXT window server and allows the user to switch back and forth between a display screen completely devoted to X or to a standard NeXTstep workspace; the user dynamically switches from NeXTstep to Cub'X with a simple movement of the mouse. X and NeXTstep windows do not cohabit the same display screen at the same time.

Both White Pine's eXodus and Pencom's co-Xist provide X/Motif windows within NeXTstep windows. No switching between environments is needed; eXodus and co-Xist, running in NeXTstep windows, behave like any other NeXTstep applications.

Public domain versions of the X Window System are also under development by universities.

Co-Xist by Pencom Software

Co-Xist provides full X-Window System Version 11 Release 4 (X11R4) client and server capabilities, giving NeXT users access to X-Windows-based applications without sacrificing the benefits of the NeXTstep environment.

A fully supported X-Window display system for the NeXT computers, co-Xist provides color support (including NeXTdimension), rootless windows, cut-and-paste text capabilities, network transparency, and support for popular window managers. OSF/Motif 1.1 and the complete X and Motif documentation in Digital Librarian format are also available.

For more information:
Pencom Software
1-800-736-2264 or (512)-343-1111

Cub'X-Window by Cub'X Systems

Cub'X-Window is an X11R4 server for monochrome and 16 bit color NeXT computers. It links NeXT computers and X-Window workstations over a network. Its impressive speed allows users to run X11 applications on full-screen display, with no differences from standard workstations. Cub'X-Window is available with different window managers and toolkits, and includes OSF Motif 1.1.3.

NeXTstep and X-Window environments are situated in two parallel virtual screens on the monitor. Users switch from one to the other by a simple mouse move to the right or left border of the screen. Text copy-and-paste functions allow for rapid exchange between both worlds. Using the Grab function, users can take pictures of the X-Window screen for use in the NeXTstep screen. Cub'X-Window can also run without NeXTstep as a stand-alone X-Window server on the NeXT workstation.

For more information:
Cub'X Systémes
France +33-146-93-29-25

eXodus by White Pine Software

eXodus is an X-Window System display server that allows users to access remote X clients. eXodus features include a Client Launch Facility which allows users to create, edit, and remove user-defined scripts. Users can also copy graphics by regions from the eXodus screen to the NeXT pasteboard.

eXodus has many other built-in features, including the ability to print graphics and support for the Motif window manager.

For more information:
White Pine Software
(603)886-9050

PCs

A NeXT computer can access the services offered by MS-DOS PC's in four different ways: by a serial line connection, by using thin- or twisted-pair Ethernet, by connecting an external floppy disk drive with a format different than the internal drive offered by NeXT, and, finally by using PC emulation software.

FLOPPY DISK PRODUCTS

DaynaFILE by Dayna Communications, Inc.

DaynaFILE is an external SCSI floppy disk drive that contains two different devices: a 5.25-inch drive (360 KB and 1.2 MB) and a 3.5-inch drive (720 KB and 1.44 MB).

For more information:
Dayna Communications, Inc.
(801) 531-0600

Floppyworks

FloppyWorks is file transfer software that allows NeXT users to share information with Macintosh and PC users. FloppyWorks users can read, write, and format Macintosh (1.44 MB only), MS-DOS, and NeXT 3.5-inch disks using the internal 3.5-inch floppy disk drive or external floppy disk drives such as DIT's CubeFloppy 2.9 or CubeFloppy Plus.

FloppyWorks also reads and writes files from Macintosh-formatted cartridge drives and can access both resource and data forks of Macintosh files. Character filters translate end of line characters in ASCII file transfers, avoiding problems such as compiler errors in source code and abnormal appearance of ASCII files.

For more information:
Digital Instrumentation Technology, Inc.
(505) 662-1459

PLI SuperFloppy 2.8 by Peripheral Land, Inc.

This floppy disk drive is fully compatible with the 2.88 MB floppy standard and can work with floppy disks from any NeXT computer as well as from any MS-DOS, OS/2, or UNIX-based computer system. For systems running NeXTstep Release 2, Macintosh file support is also available. The drive connects directly to the SCSI port on all NeXT computers. Cables are not included.

For more information:
Peripheral Land, Inc.
(415) 657-2211 or 1-800-288-8754

CubeFloppy 2.9 and FloppyWorks by Digital Instrumentation Technologies (DIT)

CubeFloppy 2.9 is an external 3.5 inch floppy disk drive. The drive reads and writes UNIX and MS-DOS 720 KB, 1.44 MB, and 2.88 MB disks. In conjunction

with FloppyWorks software, the CubeFloppy 2.9 will also read and write Macintosh 1.44 MB disks for systems running NeXTstep Release 2.

For more information:
DIT
(505) 662-1459

PC EMULATION

SoftPC 2.0 by Insignia Solutions, Inc.

SoftPC is a software solution for running any off-the-shelf or custom MS-DOS application. Being IBM PC AT compatible, SoftPC provides AT-class compatibility and performance for NeXT computers without having to add any hardware. The application handles EGA-quality graphics, and offers LIM expanded memory and the ability to run programs that use an 80287 math coprocessor.

NeXT computer users can run DOS and NeXT software side-by-side and copy and paste information between windows. In addition, they can share files between DOS and NeXTstep, and PC applications can use NeXT peripheral devices such as modems, printers, and floppy disk drives. For PC users who want to access NeXT applications and data, SoftPC protects an existing investment in PC software and training.

For more information:
Insignia Solutions, Inc.
(408) 522-7600

ETHERNET CONNECTIVITY

Lan Workplace for DOS V4.0 by Novell

LAN WorkPlace for DOS v4.0 provides DOS and Microsoft Windows 3.0 users with access to NeXT systems and to other network resources using the TCP/IP protocol suites. Its ease of use, low memory consumption, high performance, and reliability make LAN WorkPlace the ideal choice for users who want fast, concurrent access to NetWare servers and TCP/IP network resources.

LAN WorkPlace for DOS includes a complete set of TCP/IP networking applications for both Windows and conventional DOS users providing fast and full-featured implementations of File Transfer Protocol (FTP) and TELNET. LAN WorkPlace for DOS supports a wide variety of network interface adapters for popular topologies, including 3Com, Western Digital/SMC, IBM Token Ring, Novell Ethernet, and ARCnet. It supports TCP/IP and NetWare SPX/IPX concurrently on a single adapter.

For more information:
Novell, Inc.
(408)479-8989

Netware NFS V1.1 by Novell

Novell's NetWare NFS software transparently integrates NeXT systems with the NetWare v3.11 environment. NetWare NFS contains several Netware Loadable Modules (NLMs) that allow the NetWare server to provide Network File System (NFS) file service and Line Printer Daemon (LPD) print service to NeXT users.

Netware NFS gives NeXT users NetWare access from their native environment. NeXT users access files from the NetWare server just as they would from a traditional NFS server, and are able to print to NetWare printers.

NetWare NFS brings NFS into the heterogeneous NetWare networking world. NeXT workstations can use NetWare NFS to share files with other NetWare client systems such as DOS, OS/2, Windows, and Macintosh.

For more information:
Novell, Inc.
(408)479-8989

PathWay Access for DOS by The Wollongong Group

PathWay Access provides full status TCP/IP for IBM PCs, PS/2s, and compatibles running DOS or the Windows 3.0 operating system. IBM PCs, PS/2s and compatibles running this product can communicate with NeXT computers on a standard TCP/IP network. The TCP/IP kernel includes TCP, UDP, IP, and ICMP support and RFC-compliant NetBIOS. PathWay Access applications include TELNET, with support for third-party terminal emulation; FTP file transfer, client and server; and the r-series commands rcp, rsh, and rlogin.

The product includes driver support for a wide variety of Ethernet and Token Ring interfaces using industry standard device drivers. Ethernet interfaces include the following standard device drivers: NDIS, ODI, and PDS; Token Ring interfaces include NDIS and ASI.

For more information:
The Wollongong Group

in California (415)962-7100
outside California, 1-800-872-8649

PathWay Client NFS for DOS by The Wollongong Group

PathWay Client NFS for DOS provides full-status TCP/IP and NFS client capabilities for IBM PCs, PS/2s, and compatibles running DOS or the Windows 3.0 operating system. The TCP/IP kernel includes TCP, UDP, IP, and ICMP support, and RFC-compliant NetBIOS. The Client NFS applications include the ability to share files stored on the NFS server with other DOS users as well as with any other NFS client systems. Printer sharing is possible using the LPR network printing standard. The necessary server-side software, which provides user authentication services, is included.

The product includes support for a wide variety of Ethernet and Token Ring interfaces using industry-standard device drivers. Ethernet interfaces include the following standard device drivers: NDIS, ODI, and PDS. Token Ring interfaces include NDIS and ASI. All device drivers are included with the package.

For more information:
The Wollongong Group
in California (415)962-7100
outside California, 1-800-872-8649

PC-NFS by Sun Microsystems

PC-NFS provides TCP/IP as well as NFS client support for PCs connected to an Ethernet. A variety of standard UNIX programs, such as FTP and TELNET is included. Mounted NFS volumes appear as logical DOS disk drives on the PC.

For more information:
Sun Microsystems
1-800-334-7866

PC/TCP Plus for DOS by FTP Software, Inc.

PC/TCP Plus for DOS is a full-featured implementation of the industry-standard TCP/IP suite of protocols. IBM PCs and compatibles running this product can communicate with NeXT machines on a standard TCP/IP network. Applications include file transfer, terminal emulation, remote login, electronic mail, a full set of network utilities, and InterDrive, an NFS implementation for DOS clients.

PC/TCP Plus runs on Ethernet, StarLAN, Token Ring, X.25, SLIP, and PPP, and supports over 40 different network interface cards. It is fully compatible with NetWare, LAN Manager, VINES, and most other network operating systems.

For more information:
FTP Software, Inc.
(617)246-0900

BANYAN VINES

Banyan VINES

Banyan Virtual Networking Software (VINES) is a multiuser, multitasking network operating system for Intel-based PCs and Wang servers. Banyan's TCP/IP option gives NeXT users full access to Banyan VINES resources. Additional VINES options provide a SMTP Mail Gateway for VINES servers and more.

For more information:
Banyan Systems
(508) 898-1000

MACINTOSH

Connecting NeXT and Macintosh computers can be accomplished by using Ethernet thin or twisted-pair cabling together with products such Cayman's GatorBox to bridge an AppleTalk and Ethernet network, or through serial port connections and file translation. The Ethernet solution is simple, fast, and does not require purchasing additional hardware. It does, however, require a Macintosh equipped with an Ethernet card and software providing TCP/IP or NFS services. A GatorBox solution involves the purchase of additional hardware, but will allow you to connect Macintosh computers that cannot install Ethernet cards (any LocalTalk or AppleTalk computer will work). Exchanging data over a serial line connection is certainly the least expensive alternative and offers the added benefit of translating file formats.

FLOPPY DISK PRODUCTS

Floppyworks

FloppyWorks is file transfer software that allows NeXT users to share information with Macintosh and PC users. FloppyWorks users can read, write, and format Macintosh (1.44 MB only), MS-DOS, and NeXT 3.5-inch disks using the internal 3.5-inch floppy disk drive or external floppy disk drives such as DIT's CubeFloppy 2.9 or CubeFloppy Plus.

FloppyWorks also reads and writes files from Macintosh-formatted cartridge drives and can access both resource and data forks of Macintosh files. Character

filters translate end of line characters in ASCII file transfers, avoiding problems such as compiler errors in source code and abnormal appearance of ASCII files.

For more information:
Digital Instrumentation Technology, Inc.
(505) 662-1459

PLI SuperFloppy 2.8 by Peripheral Land Inc.

This floppy disk drive is fully compatible with the 2.88 MB floppy standard and can work with floppy disks from any NeXT computer as well as from any MS-DOS, OS/2, or UNIX-based computer system. For systems running NeXTstep Release 2.1, Macintosh file support is also available. The drive connects directly to the SCSI port on all NeXT computers. Cables are not included.

For more information:
Peripheral Land, Inc.
(415) 657-2211 or 1-800-288-8754

SERIAL LINE CONNECTIVITY

MacLink Plus/PC by Data Viz, Inc.

MacLink Plus/PC is a file transfer solution that works across a null modem cable. The package comes with NeXT and Macintosh software, including a library of file translators for NeXT and Macintosh files, built-in communications, and a cable. Macintosh users with a SuperDrive can also use this product to transfer MS-DOS files to a NeXT computer.

For more information:
Data Viz, Inc.
(203) 268-0030

MAC EMULATION

Executor-MSW

Executor-MSW is an inexpensive, Macintosh emulator tailored to run the Macintosh version of Microsoft Word 4.00D. Perfect for mixed environments of NeXT and Macintosh computers, Executor-MSW allows you to continue to use Word as your text editor of choice.

Executor-MSW supports cut-and-paste and the services menu, both in ASCII and Rich Text Format. Executor-MSW comes bundled with HFS_XFer, a program that allows you to copy data to and from Macintosh-formatted, high-density floppy disks. The current version does not support printing. Purchasers of the current version are entitled to a free upgrade when print support is available.

For more information:
Abacus R&D, Inc.
(505) 766-9115

Executor-XL

Executor-XL is an inexpensive Macintosh emulator that runs the Macintosh version of Microsoft Excel 3.0. Perfect for mixed environments of NeXT and Macintosh computers, Executor-XL allows the use of Microsoft Excel.

Executor-XL comes bundled with HFS_XFer, a program that allows you to copy data to and from Macintosh-formatted, high-density floppies.

For more information:
Abacus R&D, Inc.
(505) 766-9115

XGator by Cayman Systems

XGator uses the X protocol to place a remote Macintosh screen on a NeXT computer, turning a Macintosh into an X client for standard X servers, including the NeXTstation. XGator, which runs on the Macintosh, lets any standard X server connect over TCP/IP to a Macintosh and display a full bit-mapped representation of the Macintosh desktop.

The X terminal or workstation controls the Macintosh using its own keyboard and mouse. XGator gives X terminal or workstation users full remote operation of the Macintosh.

For more information:
Cayman Systems, Inc.
1-800-473-4776 or (617)494-1999

LOCALTALK SOLUTIONS

The products described below bridge Apple LocalTalk and NeXT Ethernet networks.

GatorBox CS by Cayman Systems, Inc.

The GatorBox CS LocalTalk-Ethernet gateway connects an entire network of Macintosh computers to Ethernet, allowing them to share files with other Macintosh computers, print to LocalTalk-based printers, and to log on to UNIX machines on Ethernet. It includes sophisticated routing capabilities such as IP tunneling to connect remote AppleTalk networks over TCP/IP-only backbones, and zone and device filtering for managing large networks.

With 2 MB of memory, the GatorBox CS performs reliably in high-traffic networks and recovers from network failures quickly and without interven-

tion. The GatorBox CS comes with GatorShare CS, software that lets Macintosh users share files with or store files from any machine on Ethernet running NFS. GatorPrint CS, GatorShare's printing component, lets UNIX computer users print to PostScript devices on LocalTalk.

For more information:
Janet Lill, Cayman Systems, Inc.
(617) 494-9270

GatorMail by Cayman Systems, Inc.

GatorMail serves as a bridge between NeXTmail™ and either QuickMail or Microsoft Mail. It features seamless mail exchange, aliasing, and enclosures, and allows QuickMail or Microsoft Mail users to send mail to remote sites over TCP/IP networks.

For more information:
Janet Lill, Cayman Systems, Inc.
(617) 494-9270

GatorShare by Cayman Systems, Inc.

GatorShare provides transparent file sharing between NeXT and Macintosh computers. Using the AppleShare interface, Macintosh users can store files on and retrieve them from a NeXT computer. GatorShare runs on the GatorBox and translates between AppleShare and NFS.

For more information:
Janet Lill, Cayman Systems, Inc.
(617) 494-9270

ETHERNET SOLUTIONS

The products described below configure an Apple Macintosh correctly for Ethernet connectivity.

NFS/Share by InterCon Systems Corporation

NFS/Share lets Macintosh computers access remote NFS servers. It supports AppleSingle/AppleDouble file formats, Sun Microsystems NIS, and SNMP. NFS/Share can be used independently or in conjunction with TCP Connect II.

For more information:
InterCon Systems Corporation
(703) 709-9890

PathWay Access for Macintosh by The Wollongong Group

PathWay Access for the Macintosh provides a TCP/IP-based application for file transfer and terminal emulation. Macintosh computers running this product can communicate with NeXT computers on a standard TCP/IP network. The TELNET terminal services include emulation of all Digital Equipment Corporation VT100, 220, 240, 320, 330, and 340 terminals, with Regis graphics and mouse support, and IBM 3278 Model 2, 3, 4, and 5 terminal emulation. The FTP file transfer capability allows the user to see both the local and remote file systems and to easily copy files between them.

The Macintosh computer can be attached to LocalTalk, Ethernet, or Token Ring networks. PathWay Access includes Apple Computer's MacTCP for TCP/IP connectivity.

For more information:
The Wollongong Group
in California (415)962-7100
outside California, 1-800-872-8649

PathWay Client NFS for Macintosh by The Wollongong Group

PathWay Client NFS for Macintosh provides Macintosh users with NFS file sharing capabilities using industry-standard NFS servers. The Client NFS software resides on the Macintosh and requires no additional gateway hardware. An LPR Server that runs in the background with Multifinder is included. UNIX and other LPR clients can print to the Apple LaserWriter through a background task, eliminating the need to connect the LaserWriter directly to the UNIX machine.

Network interfaces include Apple and all compatible Ethernet adapters along with LocalTalk. Client NFS relies on Apple Computer's MacTCP for TCP/IP connectivity. MacTCP is included with PathWay Client NFS.

For more information:
The Wollongong Group
in California (415)962-7100
outside California, 1-800-872-8649

TCP Connect II by InterCon Systems Corporation

TCP Connect II provides TCP/IP protocol support for Macintosh computers on Ethernet or LocalTalk. This support includes file transfer, terminal emulation, and mail transfer with NeXT computers; emulation of a variety of DEC, Tektronix, and IBM terminals; and support for TELNET, FTP, electronic mail, NNTP, SNMP, and FINGER network protocols.

For more information:
Intercon Systems Corporation
(703) 709-9890

NCSA Telenet

NCSA Telenet is public domain TCP/IP software for Macintosh computers. It provides remote login support through TELNET and file transfer through FTP. NCSA Telenet software provides TCP/IP support for Macintosh computers on Ethernet or LocalTalk. This support allows remote login and file transfers from a Macintosh computer and any NeXT computer. It is a free program, available from the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign.

uShare by IPT

NeXT machines can now become powerful servers for Macintosh computers. uShare is fully AppleShare compatible and allows Macintosh users to work as if connected to an AppleShare server with the additional processing power and worldwide networking ability of NeXT machines. NeXT users maintain full access to both Macintosh and UNIX files. All information is stored on the file server using the UNIX file system, including password protection.

uShare also provides bi-directional print spooling. The uShare Print Spooler allows Macintosh computers to print to NeXT printers and NeXT computers to print to AppleTalk printers.

For more information:
Information Presentation
Technologies, Inc.
1-800-233-9993 or (805) 541-3000

IBM MAINFRAME

Many customers want the application development advantage, advanced productivity tools and multimedia mail features unique to NeXT, together with access to critical applications running on their legacy mainframes.

There exist a number of applications which provide NeXT users with 3270 terminal emulation within the NeXTstep environment, allowing NeXTstep applications and IBM Mainframe applications to exist side-by-side.

3270Vision by Conextions, Inc.

3270Vision is an integrated NeXTstep application that connects NeXT computers to IBM mainframes over a variety of network configurations and protocols. It supports concurrent terminal sessions with up to 64 IBM hosts on SNA (over SDLC, Coax, or Token Ring) and TCP/IP (over Ethernet, SLIP, or X.25) networks. Designed as a distributed application, 3270Vision keeps the network topology, protocols, and media transparent to its end users when it communicates with various TCP/IP and Coax Gateways on the network.

In addition, 3270Vision provides IBM 3278/79 and 3290 Information Display Station emulation, including Extended Attributes and Color support. 3290 Information Display combines up to four 3270 sessions in a single window. Copy-and-paste functions, which combine regular and scissor text selections with custom filtering, provide seamless integration of mainframe data into Lotus Improv, WordPerfect, and other NeXTstep applications. An API is provided for developing custom front ends.

For more information:
Conextions, Inc.
(508) 689-3570

3270Vision Coax-5 by Conextions, Inc.

3270Vision Coax (Coax-5) connects multiple NeXT computers to an IBM mainframe in a traditional SNA network. 3270Vision Coax software conforms to a distributed application architecture and includes Coax Gateway (server) and 3270Vision (client) modules.

Hardware Coax Adapter connects NeXTstation's SCSI port to an IBM 3174 or 3274 Terminal Controller and provides mainframe connectivity over SDLC line, Token Ring LAN, or IBM Block Multiplexer Channel. Each Coax Adapter can support up to five 3270 terminal sessions.

For more information:
Conextions, Inc.
(508) 689-3570

3270Vision Coax GW by Conextions, Inc.

Coax Gateway software supports an IBM Distributed Function Terminal (DFT) protocol and provides multiple NeXT computer users on the network with concurrent mainframe access. Coax Gateway can support up to seven Coax Adapters on a single SCSI cable.

3270Vision emulates IBM 3278/79 models 2, 3, 4, and 5, and 3290 Information Display Station, including extended attributes and color. It provides seamless integration of mainframe resources into NeXTstep operating environments.

For more information:
Conextions, Inc.
(508) 689-3570

InSession 3270 by Avatar Corporation

InSession 3270 provides IBM 3270 connectivity for NeXT computers, offering NeXT users the powerful combination of the NeXT user interface and the

IBM mainframe. With InSession 3270, users can access multiple host sessions, transfer files, and copy and paste data from the host into NeXT applications for further manipulation.

InSession 3270 includes terminal emulation software and a SCSI-attached device that, when connected to a NeXT computer, provides a coaxial connection to the 3270 environment. A Programmer's Toolkit API is available for custom application development and includes software modules that create the link between NeXT Interface Builder objects and InSession 3270.

For more information:
Avatar Corporation
1-800-282-3270

IBM MIDRANGE COMPUTERS

Series II and Series III Twin Access by Andrew Corporation

Series II and Series III Twin Access provide local or remote IBM 5250 terminal and printer emulation for NeXT computers. They connect NeXT computers and a variety of popular ASCII printers and peripherals to IBM AS/400 or system/3X. The Twin Access Series II is expandable for connection of up to seven devices. Twin Access Series III is a single port, non-expandable unit.

With local or remote attachment, TwinAccess uses standard serial async device interfaces. In conjunction with Communicae software from Active Ingredients, Inc., a NeXT computer can access midrange IBM computers locally or remotely using standard telephone modems.

For more information:
Andrew Corporation
(512) 314-3000

Communicae by Active Ingredients

Communicae is a communications package that simulates DEC VT220 and Tektronix 4010/4014 terminal emulation and standard file transfer protocols. It supports all documented VT100 features. It also offers many other features, such as a special IBM extended character set and built-in support for Hayes modems.

For more information:
Active Ingredients
(617) 576-2000

TOKEN RING

8209 LAN Bridge by IBM

The 8209 LAN Bridge physically connects Ethernet and Token Ring networks. In order for computers on the LANs to communicate with one another, they must run compatible network protocols such as TCP/IP or NetBIOS. In addition, the 8209 LAN Bridge must be ordered with module #6035, which provides Ethernet functionality.

For more information:
Contact your local IBM dealer.

DEC VAX

Communicae by Active Ingredients

Communicae is a high-performance communications package for NeXT computers that offers DEC VT220 terminal emulation, and standard file transfer protocols. It can be used as a virtual terminal logged into the NeXT computer itself, or to log into remote information services and mainframe systems by way of the serial ports or Ethernet connections.

Communicae supports all documented VT100 features. Xmodem, Ymodem, and Kermit file transfer protocols are supported, as well as "paced" ASCII text transfers.

For more information:
Active Ingredients
(617) 576-2000

Microphone II For the NeXT by Software Ventures

MicroPhone II for the NeXT brings telecommunications to everyone. It features a powerful Pascal-like script engine for automating all communications activities. The application offers two innovative tools to harness its scripting power: Watch me, the program's automatic script recorder, lets users record communications actions for later replay; the script editor provides a scrolling list of commands for creating a script, eliminating the problems of typing errors.

MicroPhone II features terminal emulation for TTY, VT100, and VT102, and includes file transfer protocols for Text, ASCII, Xmodem, Ymodem, and Zmodem.

For more information:
Software Ventures Corporation
(415) 644-3232

SuiteTalk by SuiteSoftware

SuiteTalk is a transparent communications runtime environment for applications that use the client/server model for distributed processing. Client and server applications can pass messages without knowl-

edge of the network protocols in use, the physical destination of the messages, or the destination's hardware platform, operating system, or DBMS characteristics.

Transparent communication through SuiteTalk allows developers to quickly create applications using generic code and eliminates the many details required to distribute processes across heterogenous hardware/software networks. The SuiteTalk environment currently supports VAX/VMS and various UNIX platforms running TCP/IP or DECnet.

For more information:
Suite Software
(619) 698-7550

GRAPHICS TERMINALS

Communicae by Active Ingredients

Communicae is a high-performance communications package for NeXT computers that offers Tektronix 4010/4014 terminal emulation, and standard file transfer protocols. It can be used as a virtual terminal logged into the NeXT computer itself, or to log into remote information services and mainframe systems by way of the serial ports or Ethernet connections.

Communicae's Tektronix emulation supports zoom and pan scrolling, and can create Encapsulated PostScript (EPS) files from the host's graphic output. Xmodem, Ymodem, and Kermit file transfer protocols are supported, as well as "paced" ASCII text transfers.

For more information:
Active Ingredients
(617) 576-2000

WANG

Wang VS TCP Interconnect

VS TCP Interconnect is Wang's implementation of the TCP/IP architecture for Wang VS. The Wang VS TCP Interconnect consists of TCP/IP, TELNET, Simple Mail Transfer Protocol (SMTP) and File Transfer Protocol (FTP). VS TCP Interconnect is similar in functionality and concept to Wang Open System Network (WOSN). When properly configured, WOSN and VS TCP Interconnect can coexist on the same system. TCP/IP provides ease of use through Wang OFFICE and other standard interfaces, and allows use of both X.25-based Wide Area Networks and Local Area Networks using 802.3.

For more information:
Wang Laboratories, Inc.
1-800-835-9264

MACSoft VS Gateway

MacSoft VS Gateway provides file transfer and conversion between NeXT and Wang workstations through the Wang VS TC-IOP ports. MacSoft VS Gateway will transfer files to NeXT systems in standard NeXT file types (including RTF, TIFF and EPS).

WIDE AREA & SWITCHED NETWORKS

Many customers want the capability to interface to Wide-Area Networking. The more common long haul circuits use common carrier services of the telephone company. X.25 had become a standard for digital communications across most of Europe; ISDN is becoming a standard internationally for both voice and data communications.

ISDN

Hayes ISDN System Adapter by Hayes Microcomputer Products

The Hayes ISDN System Adapter enables high-speed networking for the NeXT computer through ISDN. An external multimedia adapter with integrated voice and data capabilities, Hayes ISDN System Adapter supports high-speed throughput; the Hayes Standard AT Command Set interface for ISDN allows for TCP/IP connectivity using Marble Teleconnect.

With support for both AT&T and Northern Telecom ISDN central office switches and an architecture designed to support National ISDN 1 specifications, the Hayes ISDN System Adapter gives NeXT users access to today's high-speed telecommunication technology and a path for keeping current as ISDN technology grows and develops.

For more information:
Hayes Microcomputer Products, Inc.
(415) 974-5544

Hayes DSP-Basic Rate ISDN Interface for NeXT

The Hayes DSP-Basic Rate ISDN Interface for NeXT connects to the NeXT DSP port and enables ISDN access' using both of the ISDN "B channels" for data or voice. The adapter is capable of running each channel at 64 KB clear-channel, full-duplex.

For more information:
Hayes Microcomputer Products, Inc.
(415) 974-5544

ANDREW FILE SYSTEM (AFS)

For large installations where NFS is not practical or efficient, Transarc Corporation provides a complete implementation of the AFS distributed file system for NeXT computers. It can also operate cooperatively with other AFS servers and clients.

AFS 3 by Transarc Corporation

AFS 3 is a distributed file system that offers location-independent resource sharing in a distributed environment. It implements a single-image file space for all users with no location dependencies. Management tools include a file server monitor, utilities for automatic account creation and quota management, and mechanisms for updating large numbers of servers and clients.

AFS maintains performance in large computing environments and across wide-area configurations using a caching/callback mechanism that substantially reduces network traffic. For security, the application uses Kerberos authentication and access control lists. AFS replication and on-line backup techniques result in minimal interruption of file services.

For more information:
Transarc Corporation
(412) 338-4400

FAX MODEMS

DoveFax for the NeXT by Dove Computer

The DoveFax combines a 9600 bps fax modem with a 2400 bps Hayes-compatible data modem. Features include full background send and receive, auto receive and retry, and customizable cover pages. In addition, an automatic activity log reports fax activity.

The DoveFax takes advantage of NeXTmail to notify users when a fax is received and to distribute incoming faxes. It supports fine and standard resolutions, a preview option, and on-screen display of faxes with a magnification option. The DoveFax for NeXT features Display PostScript® imaging to ensure the best possible quality of fax documents.

For more information:
Dove Computer Corporation
(919)763-7918

FaxMaster 96/24 X by HSD Microcomputer

HSD's FaxMaster 96/24 X is a combination fax and data modem that is fully integrated with the NeXTstep operating system. Every FaxMaster comes bundled with a free copy of HSD's optical character recognition software, OCR Servant.

Because the FaxMaster driver is built into the NeXT operating system, it's able to unlock the NeXT computer's multiple options for fax handling. Faxes can be sent or received from any computer on a network. Incoming faxes can be viewed in a sharper enhanced mode or with a 200 percent zoom for reading smaller fonts or details. Received faxes can then be saved to a hard disk, converted to ASCII text with OCR Servant, or forwarded to any other NeXT computer on a network. For outgoing faxes, the NeXT's exclusive Display Postscript system generates clear and clean fax images.

For more information:
HSD Microcomputer U.S., Inc.
1-800-828-5522 or (415)964-1400

Neuron Fax Modem by Neuron

The Neuron Fax 1414 is an integrated fax and data modem that supports Group III and V.17 standards for fax communication, and V.32 bis, V.42, V.42 bis and MNP5 standards for data communication. It achieves effective data rates up to 57,600 bps. Bundled software includes Synapse, a sophisticated VT100 and VT52 emulator, Neuron FAX/Data driver, which automatically switches between fax and data modes, and Easy-Mail, a one-step application that provides a UUCP connection to the Internet through commercial carriers.

The Neuron FAX 1414+ includes all features of the Neuron Fax 1414 plus front panel programming and support for four-wire leased line systems. It achieves effective data rates of 76,800 bps.

For more information:
Neuron, Inc.
1-800-727-7538 or (609)452-1100

POTS

At The Beep by SES Computing

At The Beep is a software and hardware product for the NeXT computer. It features an easy-to-use NeXTstep interface and stores announcements and messages as sound files. Version 1.2 features a substantial price reduction along with new remote control features, a phone book based dialing system, and optional Caller ID.

At The Beep, Version 1.2 uses a new, more highly integrated telephone interface. The Caller ID option allows the system to display the phone number for each message, or, if the caller is listed in your phone book, the name of the caller.

For more information:
SES Computing
(512) 219-9468

Call Link by SQuest

Call Link is an automated phone answering system which goes beyond traditional voice mail systems. It connects to the NeXT computer and is capable of receiving messages for multiple users. Callers are presented with a set of menus and commands that are controlled from a touch tone phone. Call Link can fax a file using a fax modem and can also execute functions that are added by the user.

The Call Link software includes User and Manager programs. The User program reads incoming voice mail, records the user's salutation, and selects the user's preferences. The Manager application adds users to the voice mail system, sets disk quotas, adds scripts and programs, and creates the incoming message action menus.

For more information:
SQuest Inc.
(604) 253-5797

mix by i•link GmbH

mix is both a 2400 bps full-duplex data modem and a 9600 bps send and receive Group III fax modem. With the help of the NeXT computer's built-in Digital Signal Processor, it can also be used as an advanced telephone answering machine and voice mail system. mix uses digital storage for announcements and incoming messages, and automatically switches incoming calls to fax, modem, or telephone and answering machine.

mix is easier to use than conventional hardware machines, providing both functionality and a high level of integration. The mix hardware doesn't use a serial port and doesn't need a power supply.

For more information:
i•link GmbH
Germany +49 30 781 70 55

Voilà by The Cube Route

Voilà is a multiuser voice mail service and more: users can create, send, receive, and convert between voice mail, fax, and NeXTmail over the telephone, utilizing the same phone line for commands and for incoming and outgoing voice, fax, and data.

Each user can create a custom-tailored Voilà environment visually, programming and enhancing Voilà using drag-and-drop, object-oriented metaphors. Voilà is hardware-independent and runs on all NeXT telephone interface hardware. Objects to support new hardware can be easily added.

Bundled with The Minimal Hardware, a simple telephone interface for the NeXT computer, Voilà provides inexpensive and powerful access to the telephone network.

For more information:
SQuest Inc.
(604) 253-5797

X.25

Morning Star X.25(SCSI) by Morning Star Technologies, Inc.

Morning Star CCITT X.25 software allows UNIX systems to exchange data with public and private packet-switching networks, and permits remote async terminals connected to a network to log on to the UNIX host using X.29 protocols though a SCSI gateway. Morning Star X.25 supports line speeds of up to 64 Kbps. Morning Star X.25 is certified on Telenet and Tymnet systems, and as the transport medium on the U.S. DDN. It is also currently running on Datapac and Transpac, which require no certification.

For more information:
Morning Star Technologies, Inc.
(614) 451-1883

Morning Star X.25(serial) by Morning Star Technologies, Inc.

Morning Star X.25 software runs in user space on the NeXT computer, allowing it to connect to public and private X.25 networks. The software is 1980, 1984, and 1988 CCITT-compliant and supports a socket interface to the X.25 packet level, an X.29 interface for incoming calls, a PAD interface for outgoing calls, and an IP interface that allows the routing of IP packets over the X.25 software.

The software uses the NeXT computer's serial ports or the Morning Star SnapLink SCSI communications adapter for the physical connection to the network.

For more information:
Morning Star Technologies, Inc.
(614) 451-1883

INTERNET PROTOCOL OVER SERIAL LINES

Serial Line Internet Protocol (SLIP) and Point to Point permit NeXT computer users to access remote networks transparently through serial line (dialup) connection using the standard Internet Protocol.

Marble Teleconnect by Marble

Marble Teleconnect enables a NeXT computer to run the TCP/IP protocol suite over any serial communications connection, including direct connections, modem connections over standard telephone lines, or connections over ISDN lines. NeXT users now have transparent access to all the resources of a LAN at a remote location.

Marble Teleconnect can connect to any computer system that implements the SLIP protocol, such as Sun®, DEC, and other UNIX platforms. It also provides connections to gateways and routers from vendors such as Xylogics, cisco systems, and Telebit, and can connect directly to the worldwide Internet through services such as CERFnet and PSInet.

For more information:
Marble Software Products
(408) 436-7299

Morning Star PPP by Morning Star Technologies, Inc.

Morning Star PPP software supports async and synchronous PPP and SLIP. The software runs in user space on the NeXT computer, allowing it to connect to another PPP site over dial-up telephone lines or to an IP network provider using a PPP point-of-presence. Existing TCP/IP applications like TELNET and rlogin operate over the PPP software transparently.

The software uses the computer's serial ports or the Morning Star SnapLink SCSI communications adapter for the physical connection to the modem.

For more information:
Morning Star Technologies, Inc.
(614) 451-1883

TrueLink by Lorienne

TRUELINK is a TCP/IP bridge between Ethernet networks, through the serial line, using 300 to 38,000 baud modems. It comes with easy-to-use installation software and is compatible with NetInfo. TRUELINK cuts down the real connection time on null traffic, but keeps the virtual connection to allow future reconnections.

For more information:
Lorienne
France +33 1 49 85 03 76

BULLETIN BOARD SYSTEMS

Coconet Host by Coconut Computing

The COCONET HOST is a multiuser, graphics-based conferencing and electronic bulletin board system for NeXT computers. It supports electronic mail, live chat, live multiuser conferencing, message bases, group and private file transfers, and the ability to display bitmap and vector graphics on-line, even while users are connected over modems.

One copy of the NeXTstep-based COCONET Access Program (CAP) is included with all COCONET HOST packages. The CAP may be freely distributed to your users. An MS-DOS CAP is also available for IBM-compatible computers, providing PC users with a graphical interface to a NeXT computer running the COCONET HOST. Available first quarter 1992.

For more information:
Coconut Computing, Inc.
(619) 456-2002

POSTSCRIPT IMAGESETTERS

LASERBEAM by GECOS GmbH

LASERBEAM connects NeXT computers to high-resolution PostScript imagesetters with TCP/IP capability. Imagesetters can be integrated into the NeXT spool system, allowing the user to send 10 MB print jobs to the connected imagesetter.

LASERBEAM is an easy-to-use application that allows imagesetter control through the NeXT PrintManager. Furthermore, it offers integrated PostScript code to set up the imagesetter for output and an integrated time-management system to control every job sent to the imagesetter.

For more information:
GECOS GmbH
Germany +49 07121 62 89 80

CONNECTING TO NON-NeXT OR NON-UNIX MAIL SYSTEMS

"Out of the box" NeXTstep-based systems can exchange mail with any other UNIX machine. Most PC mail applications available today use UNIX SMTP as the mail transport mechanism, just like NeXTstep. No bridge is needed between these applications and NeXTmail. However, for some computers, including the Macintosh, one needs a software bridge to translate the message from one protocol to another. Commercially available solutions permit electronic mail across other platforms and protocols, as described below.

GatorMail by Cayman Systems, Inc.

GatorMail is an easy-to-use bridge between NeXTmail and CE Software's QuickMail or Microsoft Mail. This software runs on a Cayman GatorBox. (The *Macintosh* section of this guide provides additional information.)

Soft•Switch SMTP Gateway by Soft•Switch

The Soft•Switch SMTP Gateway enables a multivendor/multiprotocol Soft•Switch enterprise electronic mail network to participate in an SMTP TCP/IP network. The various mail systems connected to Soft•Switch appear as native SMTP systems connected to a node in an SMTP TCP/IP network. NeXT workstation users can now exchange electronic mail with the over 50 different mail systems that can be connected to Soft•Switch.

Soft•Switch SMTP Gateway works with the other components of the Soft•Switch product line to support multivendor connectivity and document translation, mail network management, and mail-enabled applications. Gateways and other components are supported by multiple operating system environments.

For more information:
Soft•Switch, Inc.
(215) 640-9600

Worldtalk 400 by Touch Communications

Worldtalk 400 is a message integration system that provides connectivity between NeXT computers and multivendor PC-, LAN-, and host-based e-mail systems. Available on multiple X.400 platforms, it extends the reach of enterprise-wide X.400 backbones to the PC/LAN electronic messaging community. Gateways currently supported are cc:Mail, Lotus Notes, MHS (e.g. Da Vinci eMail), Microsoft Mail, SMTP (e.g. NeXTmail), and QuickMail.

Based on the CCITT X.400 standard, Worldtalk 400 provides seamless messaging connectivity across multiple PC/LAN-based e-mail systems. Current X.400 MTAs supported are Marben X.400 on a 386 Interactive UNIX platform and HP X.400 on the multiuser RISC HP-UX/9000 Series 800 platform. Support for additional X.400 MTA platforms is in development.

For more information:
WorldTalk Corporation, Inc.
(408) 374-2500

Special Features of NeXTmail

NeXTmail uses standard UNIX Simple Mail Transfer Protocol (SMTP) to deliver true multimedia electronic messages. NeXTmail allows you to send and receive rich text, Encapsulated PostScript or TIFF images, documents, entire applications, CD-quality or CODEC-encoded sound, or entire directories as part of any mail message. Every message, regardless of content, uses SMTP as the transport mechanism. Various networks and mail gateways can automatically support full multimedia NeXTmail sent between distant NeXT computers.

In addition, NeXT computers can send and receive standard ASCII text mail from any other UNIX-based computer, as well as any PC, Macintosh, mainframe, or minicomputer that uses SMTP or offers a SMTP gateway. Because of the current absence of an accepted multimedia mail interoperability standard, the multimedia extensions of NeXTmail cannot be utilized by non-NeXTstep-based systems.

In NeXTstep Release 3 NeXTmail supports integrated encryption, enabling users to protect the contents of mail messages. The sender has the option of encrypting each mail message with the FEE public-key encryption method. Before sending a message, the recipient's public key is obtained from a database of known users or public aliases (or the user is prompted in the case of recipients whose keys are unknown). After the encrypted message arrives on the host computer, the recipient must provide the private key before he can read the mail message. These messages remain decrypted once the private key has been used. This encryption system provides security for the entire body of the message. (Note: this scheme does not provide authentication of the sender, nor does it provide encryption of the mailbox itself. Also, messages are only encrypted to a single user or a single public alias, not private aliases.)

NETWORKING HARDWARE PRODUCTS

This section contains a partial listing of networking hardware for thinnet and twisted-pair Ethernet networks. Many alternatives exist for the products listed below.

THICK-ETHERNET CONNECTIONS

Cabletron's MR-2000C Repeater connects a full-length thick Ethernet Cable to a full-length thin Ethernet segment allowing a NeXT computer to be attached to a thick (10Base 2) Ethernet network.

HUBS AND REPEATERS (MULTIPORT 10 BASET)

Hubs that work with NeXT computers equipped with 10 BASE T are required to have link integrity support. Link integrity provides a constant awareness of network integrity and allows for quick determination of faulty or disconnected 10BASE T links.

The following companies make 10 BASE T hubs that support link integrity. More information on each solution is provided at the end of this section:

- 5-slot Concentrator by David Systems, Inc.
- 10 BASE-T line card by BICC Data Networks
- 10-BASE-T non-intelligent hub by Cabletron Systems, Inc.
- 10-BASE T intelligent hub by Cabletron Systems, Inc.
- 12-slot Concentrator by David Systems, Inc.
- 2310, Multiport 10 BASE T Box by Synoptics Communications, Inc.
- 2800, Multiport 10 BASE T Box by Synoptics Communications, Inc.
- 4300 Multiport Repeater by Codenoll Technology Corp.
- Access One by Ungerman-Bass.
- Asanté 10T Hub by Asanté Technologies, Inc.
- Crossbow by Fibermux Corp.
- EtherNext Series 4000 by NetWorth, Inc.
- ExpressNet Hub by David Systems, Inc.
- Lan One by Du Pont Electronics
- Link Builder by 3Com Corporation
- StarLan 10 by AT&T Information Systems
- System 3000 by Synoptics Communications, Inc.
- VolksNet hub by David Systems, Inc.

TWISTED-PAIR HUBS AND REPEATERS

This section provides a partial listing of twisted-pair hubs and repeaters. Given the large number of compatible solutions providers, the list is meant to be illustrative rather than complete.

Asanté 10T Hub

For more information:
Asanté Technologies
(408) 734-4844, Fax (408) 734-4864

BICC Data Networks

- Ether Connect System (ECS) and a 10 BASE T line card, Model #1201-2

For more information:
BICC Data Networks
(508) 898-2422, Fax (508) 898-3739

Cabletron Systems, Inc.

- 10-BASE T non-intelligent hub, Model #MRX (Supports 12 workstations)
- 10-BASE T intelligent hub with management, Model MRXI (supports 12 workstations)

For more information:
Contact Cabletron Systems, Inc.
(603) 322-4616

Codenoll Technology Corp

- 4300 Multiport Repeater (15 card slots) uses Model 4818 (3 port 10 BASE T card) and Model 3311 fiber module

For more information:
Codenoll Technology Corp.
(914) 965-6300, Fax (914) 965-9811

David Systems, Inc.

- VolksNet hub (supports 12 10 BASE T ports)
- ExpressNet Hub (supports 12 10 BASE-T ports with network management)
- David Systems 12-slot Concentrator
- David Systems 5-slot Concentrator
- Both Concentrators use their twisted-pair module card, each of which supports 12 twisted-pair ports.

For more information:
David Systems, Inc.
(408) 720-8000

Synoptics Communications, Inc.

- 2800, Multiport 10 BASE T Box 12 port
- 2310, Multiport 10 BASE T Box 36 port with network management
- System 3000, 12-132 10 BASE T ports with optional network management
- All units are modular.

For more information:
Synoptics Communications, Inc.
(415) 960-1100

NETWORK MANAGEMENT TOOLS

3Com Corporation

- Link Builder 4-slot (36 nodes) or 12-slot (132 nodes) box MultiConnect Repeater, 15 modules; each module has three ports. Has a network management option.

For more in
formation:
3Com Corporation
(408) 764-5000 or 1-800-638-3266

AT&T Information Systems

- StarLan 10: Has a network management option.

For more information:
AT&T
1-800-247-1212

Du Pont Electronics

- Lan One, Model CON-001-M (rack mountable) Needs:
- Power Supply, Model CPS-003
- Multiport repeater module, Model MPR-020
- Ethernet twisted-pair module, Model ETM-001 (supports 12 ports)
- Fiber-optic module, Model EDM-001

For more information:
Du Pont Electronics
(919) 248-5000, Fax (919)248-5550

Fibermux Corp.

- Crossbow, Model FX6600 (10-slot wiring hub)
- Crossbow, Model FX6604 (4-slot wiring hub)
- Crossbow, Model FX6602 (2-slot wiring hub)
- Card that can be used:
- 10 BASE T Card, Model CC6613Z (10 RJ45s)
- 10 BASE T Card, Model #CC6610Z (8 RJ45s & 2 Fiber connections)
- Network Management Module, Model CC6682Z (1 RS-232 port and 2 10 BASE T Ports)
- Network Management Module, Model CC6681Z (1 RS-232 port and 2 fiber-optic ports)

For more information:
Fibermux Corp.
(818) 709-6000, Fax (818) 709-1556

NetWorth, Inc.

EtherNext Series 4000

For more information:
NetWorth, Inc.
(214) 869-1331, Fax (214) 556-0841

Ungermann-Bass, Inc.

Access One: Has network management option.

For more information:
Ungermann-Bass, Inc.
(408) 496-0111, Fax (408) 970-9300

SERIAL LINE SOLUTIONS

Serial Solutions by BenaTong

Modems, lab instruments, and data-acquisition systems often communicate serially and usually require custom software protocols. While UNIX programmers may know how to use the serial ports and the protocols necessary to control them, in-house developers and programmers migrating from the DOS or Mac worlds can spend weeks trying to figure out how to make them work.

Serial Solutions puts an Objective C wrapper around all of the low-level UNIX serial drivers and makes the serial ports look like any other class in Objective C. By eliminating the necessity of learning the UNIX system internals, Serial Solutions saves countless hours of programming.

For more information:
BenaTong
(614) 276-7859

SLAT-1Communications Interface by UNINET Peripherals

The SLAT-1 Communications Interface provides asynchronous serial and Centronics parallel port expansion on the SCSI bus of a NeXT workstation. It uses no internal slots and does not require new device drivers.

SLAT-1 supports 57.6 K baud and beyond and provides full modem support and full hardware flow control. No kernel rebuilding is necessary.

For more information:
UNINET Peripherals, Inc.
(714) 546-1100

SnapLink Communications Adapter by MorningStar Technologies, Inc.

SnapLink provides a simple, flexible solution for most data communication applications. This single device operates as an asynchronous serial port expansion device or high speed synchronous communications link for most UNIX-based computer systems supporting a SCSI interface. SnapLink can also be combined with PPP or X.25 gateway software.

For more information:
Morning Star Technologies, Inc.
(614) 451-1883

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