

---

# NCR WaveLAN

## In this report:

Analysis .....	-102
Characteristics.....	-103

## Product Summary

### Editor's Note

In September 1990, NCR announced the WaveLAN wireless local area network, which supports existing, wired NetWare networks. In May 1991, NCR fulfilled a promise made at the debut of WaveLAN and announced a Micro Channel Architecture version of the product.

### Description

Based on spread-spectrum frequency technology, WaveLAN functions as a wireless local area network. WaveLAN consists of a wireless LAN Network Interface Card (NIC) with an integrated radio transceiver and software for Micro Channel and AT-compatible PCs. WaveLAN supports Microsoft OS/2 LAN Manager, 3Com 3+Open, IBM LAN Server, and Novell NetWare.

WaveLAN supports a data rate of 2M bytes per second and operates over the 915MHz transmission band, which does not require customer site licensing in the United States. When equipped with the Micro Channel adapter, WaveLAN provides wireless

communications for NCR's System 3000, IBM's PS/2, and compatible systems.

### Strengths

WaveLAN affords users considerable flexibility in placing PCs in the most effective locations, eliminating the costs and time required to move wired LANs. By adding WaveLAN boards to servers, users can connect with existing Novell networks. The spread spectrum technology upon which WaveLAN is based offers a high degree of security.

### Limitations

In a typical office environment, the working range for WaveLAN spans 100 to 800 feet.

### Competition

BICC, Motorola.

### Vendor

NCR Corp.  
1700 Patterson Boulevard  
Dayton, OH 45479  
(513) 445-5000

### Price

\$1,390 for the network interface card and \$90 for the optional DES security feature.

---

—By Barbara Callahan  
Associate Editor

# Analysis

---

## Product Strategy

NCR is positioning WaveLAN as another representation of its commitment to delivering "early-to-market, value-added technology solutions for desktop computing." NCR has targeted the workstation environment for its high-performance PCs and for its WaveLAN wireless LAN.

NCR created WaveLAN to build flexibility into LAN configurations. The company believes its wireless LAN is ideal for users who frequently add or reconfigure PCs or networks, as well as for those who confront physical or regulatory limitations on cabling. For short-term situations, such as on-site visits by accountants or regulators, NCR offers WaveLAN as a solution to communications needs. The company also promotes WaveLAN as a method for journalists to set up ad hoc systems to cover news events.

Although WaveLAN is a quick and easy approach to local area networking, the system supports the same industry standards as traditional wired LANs and can transfer files transparently between the wireless and wired LANs. NCR is basing its strategy on the concept that anything a wired LAN can do, WaveLAN can do, too, but without the complications and expense of cable.

---

## Competitive Position

When a technology arrives on the scene that spares the user time and money, everyone sits up and takes notice. The idea of stringing LANs without string, so to speak, is certainly appealing. The concept of spread-spectrum technology, upon which NCR based WaveLAN, is not new, having originated during World War II for military applications. The technology entered the commercial mainstream in 1985 when the FCC designated certain bandwidths for commercial transmission via radio waves. As a harbinger of things to come,

AT&T, now the parent company of NCR, helped to develop spread-spectrum technology.

NCR is not the only company supporting wireless LANs. In 1990, Motorola coined the term Wireless In-Building Networks (WINs) to describe its forthcoming application that would operate over the Digital Termination band, which covers frequencies ranging from 18GHz to 19GHz. In February 1991, Motorola announced its wireless Ethernet LAN, Altair, which can connect a maximum of 32 devices.

Altair differs from WaveLAN primarily in its microwave technology. Altair also requires an FCC license, which WaveLAN does not. In addition, Altair is based on proprietary technology that is incompatible with many network management packages. To ensure security, Altair incorporates data encoding, but WaveLAN handles security needs through its spread-spectrum technology. For optimized WaveLAN security, users must purchase the DES security feature for \$90.

BICC offers the InfraLAN wireless LAN, based on infrared light. Unlike WaveLAN, which supports Ethernet and token-ring, and Altair, which supports Ethernet, BICC supports only token-ring. InfraLAN operates with minimal interference, but it does not support transmission through walls or partitions.

---

## Decision Points

Making the decision to cable or not to cable involves many factors. A wireless LAN, such as WaveLAN, does not lock a user into a rigid arrangement that requires the skill of a Houdini to change. WaveLAN eliminates the need for trained personnel to install or move networks. Also, the structure does not dictate the placement of equipment. In a building with existing cabling, administrators must either go with the status quo or spend a great deal of money to change it. The flexibility offered by wireless LANs is probably their greatest attraction.

NCR is committed to making life easier for the workgroup at the desktop level, and WaveLAN certainly achieves that goal. Frequently, local area network workgroups must be assembled quickly to perform short-term tasks, such as field auditing. The installation of cable for such a purpose would be economically unfeasible.

## Company Profile NCR Corp.

### **Corporate Headquarters**

1700 S. Patterson Boulevard  
Dayton, OH 45479  
(513) 445-5000

### **In Canada**

NCR Canada Ltd.  
6865 Century Avenue  
Mississauga, ON L5N 2E2  
(416) 826-9000

### **Officers**

*Chairman and Chief Executive Officer:* Charles E. Exley, Jr.  
*President:* Gilbert P. Williamson

### **Company Background**

*No. of Employees:* 60,000 worldwide

Founded in 1884, the company was known as National Cash Register until 1926 when it assumed its present corporate name. NCR designs, develops, manufactures, and markets business information processing systems and services worldwide. Production and development takes place at 20 engineering

and manufacturing centers and six system engineering facilities. NCR's products are sold through a network of 1,100 offices in 120 countries.

For the first quarter of 1991, ending March 31, NCR reported that revenue rose 8 percent to approximately \$1.369 billion from approximately \$1.265 billion for the first quarter in 1990. Net income amounted to about \$46 million or about \$0.70 per share. Earnings dropped 4 percent after the company absorbed costs of almost \$7 million incurred from battling AT&T's takeover.

Despite the effort and resources expended by NCR in fending off AT&T

during a highly visible five-month battle, AT&T acquired NCR in May 1991 for approximately \$7.48 billion or \$110 per share. Operating as a unit of AT&T, NCR retains its name and its world headquarters in Dayton, OH.

NCR is an active participant in the LAN marketplace, supporting token-ring, Ethernet, and AT&T's Starlan. The company continues to enhance WaveLAN, a wireless LAN introduced in 1990, and is producing internetworking devices under the Open Network System (ONS) logo. Network management takes place through NCRNet Manager.

WaveLAN's support of NetWare, Micro Channel Architecture, DOS and OS/2, token-ring, and Ethernet is also a very good reason to choose this product. To further standardization of wireless LANs, NCR is chairing the IEEE 802.11 committee, which is developing standards in this area.

## Characteristics

### **Technology Overview**

The radio transmission method incorporated into WaveLAN is based on spread-spectrum technology, which "spreads the information to be transmitted across a wider band of radio frequencies, enabling data to be moved faster and protecting the data from interception

or interference. Spreading data across the bandwidth occurs through the addition of extra, but redundant, bits to the signal. The additional bits are called chips, the number of which determines the extent of the signal's spread.

Only an authorized receiver knows the spreading pattern and can "unspread" the information and put it back into its proper form. Since spread-spectrum signals appear simply as noise, except to authorized receivers, transmission is virtually immune to interception by an unauthorized agent. For this same reason, spread spectrum resists interference from other signals, electronic devices, and other wireless data transmissions.

The Federal Communications Commission (FCC) limits commercial spread-spectrum installations to a power level of one watt, which restricts transmission to approximately 800 feet. This distance limitation suits workgroup-level LANs in offices, retail environments, factories, and educational settings. Over longer distances, users can extend spread-spectrum LANs by connecting one or more wireless LANs to a wired backbone LAN. The use of network identification in the transmission protocol allows multiple WaveLANs to be installed within range of each other.

---

## Specifications

The hardware for WaveLAN consists of a network interface card (NIC) for an IBM PC AT, network drivers, installation tools, and an external omnidirectional antenna module with a five-foot coaxial cable.

Some features of WaveLAN include:

- 2M bps data rate
- Compatibility with PC AT platforms
- Operation on MS-DOS and Novell NetWare
- Media access protocol—Ethernet variety (CSMA/CA)
- Working range of 100 to 800 feet in an office environment
- Omnidirectional antenna
- Optional DES encryption socket for enhanced security
- Optional boot ROM socket
- Capability to connect to a wired backbone
- Frequency of 902MHz to 928MHz
- Spread-spectrum modulation technique—DQPSK
- Selectable I/O address

- Remote boot address

Network Utilities, an optional software package, enables users to monitor and diagnose WaveLAN networks. One package is required for each WaveLAN network, and the number of users is not restricted.

---

## Distribution

In May 1991, NCR announced agreements with six distributors to market WaveLAN to organizations in the United States and internationally. The distributors are Arrow Electronics, ATV, GBC Distributors, Ingram Micro, Vitek Systems Distribution, and Wyle Labs Electronics Marketing Group. NCR selected these distributors because of their experience with networking and existing relationships with Novell.

---

## Pricing

NCR charges \$1,390 for the network interface card and \$90 for the optional DES security feature. ■



---

# Network General LAN and WAN Testers

---

**In this report:**

Analysis .....	-102
Characteristics.....	-105
Pricing.....	-113

**Product Summary****Editor's Note**

Network General has an extensive and well-regarded line of local area network testers that it is actively enhancing. The company enhanced its Series 300 Laptop Sniffer with the Toshiba 3200SX platform, replacing the 286-based 3200. The Series 700 Sniffer runs on an IBM PS/2 Model P70 platform and uses an Intel 80386 processor. The 16/4 Token-Ring Sniffer replaces the former 4M bps product.

**Description**

Network General's Sniffer analyzer is a LAN and WAN protocol analyzer.

**Strengths**

The Sniffer analyzer captures every bit and every frame, but it can be instructed to capture selectively. It translates embedded protocol information into English at all protocol levels.

**Limitations**

Some users have found the learning curve with the Sniffer analyzer to be rather steep, though other LAN users can pick up its operation fairly quickly.

**Competition**

Digilog, Tekelec, Novell, Hewlett-Packard.

**Vendor**

Network General Corp.  
4200 Bohannon Drive  
Menlo Park, CA 94025  
(415) 688-2700

**Price**

Prices for the Sniffer analyzer start at \$12,500.

**GSA Schedule**

Yes.

---

—By Charles A. Haggerty  
Associate Editor

# Analysis

## Product Strategy

Network General was founded in May 1986 and began public trading in February 1989. The company currently employs 140 people, both in the field and at its headquarters in Menlo Park, CA. Over 1,200 separate customers now own more than 3,700 Network General units. Customers include AT&T, Chrysler Corp., Citibank, Hughes Aircraft, NYNEX, Pacific Telesis, and Westinghouse Corp.

Network General's keystone is its software-based Sniffer analyzer line of network analysis products. Network General has targeted the top 6 percent (approximately 50,000 installed LANs) of total LAN users as its primary market. The company commissioned a market study in 1988 that showed that only 10 percent of this potential \$732 million, high-end LAN market had been addressed. The company's officers decided Network General could make its mark in this as-yet untapped market by a threefold strategy.

Network General has committed itself to developing and marketing LAN and WAN analysis products that span all the principal and most popular physical connection technologies and protocols. The company believes that this distinguishes it from its competitors, which, Network General asserts, focus too exclusively on specific topologies and protocols while ignoring many others in a multivendor environment. Network General, in comparison, addresses the broad LAN testing needs of users who typically use diverse, multivendor LANs.

In addition, Network General has undertaken an extensive educational effort to alert the market to the complexities of network integration and growth.

Finally, the company has allied itself with a number of networking and computer industry firms in order to work closely with companies that are developing new applications. Companies with

which Network General has formed alliances include Microsoft, Hughes LAN Systems, SynOptics, Apple, Banyan Systems, and Network Computing Devices.

## Competitive Position

Network General has carefully researched its market segment and has targeted LAN managers, network hardware and software developers, and LAN field service engineers. Key sectors include the data processing, financial services, telecommunications, government, education, and manufacturing and industrial markets.

The company's strength in this market is probably a combination of technical excellence and a very wide range of products. The latter is what really gives the company its competitive edge: It is the only significant test equipment vendor that focuses primarily on LAN measurement and testing tools. Network General was capable of establishing itself in the market so quickly because it addressed eight major LAN technologies: 16M bps and 4M bps token-ring, Ethernet, Arcnet, Starlan, IBM PC Network, LocalTalk, X.25 (HDLC), and IBM SNA (SDLC). Of course, Network General no longer has the LAN test equipment market to itself, but it is fair to say that it dominates the field in terms of number of products offered.

Spider Systems offers its SpiderAnalyzer and SpiderMonitor lines of PC-based test equipment. The SpiderMonitor P220 and SpiderAnalyzer P320 support Ethernet/IEEE and token-ring LAN testing and sell for \$10,500. The SpiderMonitor K220 sells for \$8,600, while the portable Spider-Probe B130 costs \$3,450. All these models have a memory capacity of 640K bytes. Among the protocols they support are TCP/IP, AppleTalk, LAT, IPX, Novell NetWare, ISO, XNS, DECnet, and SNA.

Tekelec's ChameLAN 100 is a portable protocol analyzer that supports FDDI testing and has a memory capacity of 13M to 28M bytes. It supports TCP/IP, ISO, and DECnet. The ChameLAN 100 costs \$37,500.

## Sales and Distribution

Network General sells its products to end users in the United States through 12 independent manufacturers' representative organizations. More than ►

## Company Profile Network General Corporation

### Corporate Headquarters

4200 Bohannon Drive  
Menlo Park, CA 94025  
(415) 688-2700

### Officers

*President, CEO, and  
Chairman of the Board:*

Harry J. Saal

*COO and CFO:* Roger C.  
Ferguson

*Executive VP, Research  
and Development:* Leonard  
J. Shustek

*Vice President, Sales:* Mo-  
rey R. Schapira

*Vice President European  
Sales:* Tom Orr

### Company Background

Founded in 1986, Network General designs, develops, and markets networking diagnostic equipment. Starting with its base product, the Sniffer Network Analyzer, the company has marked each year since its inception with many offerings addressing a wide variety of LAN and WAN protocols and topologies. *LAN Magazine* named the Sniffer analyzer the LAN Diagnostic Product of the Year in 1987, 1988, 1989, and 1990. The Sniffer analyzer received the "Editor's Choice" designation in 1987 from *PC Magazine*. The Laptop Sniffer analyzer was named one

of the R&D 100 by *Research and Development Magazine* in 1989.

Network General estimates that its share of all network analysis products in the U.S. is approximately 45 percent. It estimates that its international market share is approximately 40 percent.

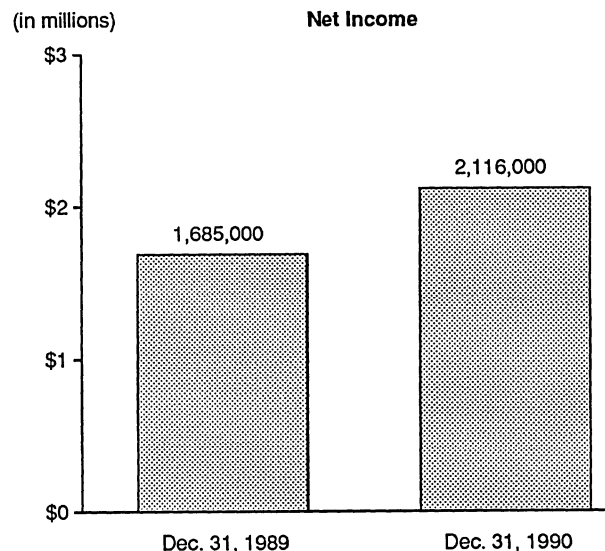
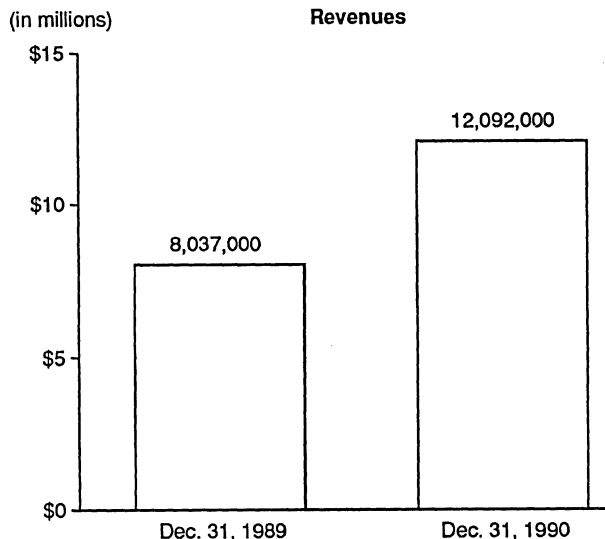
### Financial Profile

The accompanying graphs show recent financial activity for Network General.

### Market Statement

"Network General's strategy is threefold. First, it is the only company dedicated to developing and marketing network analysis products that span all the principal and most popular physical connection technologies and communications protocols . . . . With this strategy, Network General addresses the broad needs of customers who employ diverse, multinetworking technologies, driven by application needs.

"Second, Network General has taken the industry lead in educating the marketplace to the problems, issues, and complexities of network integration and growth, expansion into advanced



technologies, maintenance, and performance optimization. The company believes the clear dissemination of these challenges is crucial to reaching the productivity promises of seamless, transparent networked communication.

"And third, Network General has established cooperative relationships with many networking and computer industry leaders—positioning the company on the forefront of network applications and technology development."

---

► *(Analysis continued)*

90 sales representatives market and sell the Sniffer analyzer line through these relationships. Outside the U.S., the company uses 24 international distributors to market, sell, and service its products in Europe, Asia, Canada, and Australia. Network General maintains licensing agreements with a number of firms under which custom versions of the Sniffer analyzer software are developed by Network General. The company has licensing agreements with the following companies:

- Data General
- 3Com
- SynOptics
- Datapoint
- Research Machines
- Micro Technology

These companies either use the Sniffer analyzer technology for their own networks or market their version of the Sniffer analyzer to their customers.

---

### Decision Points

By concentrating primarily on local area network test equipment, a relatively small company such as Network General can focus its resources on a clearly defined market and meet the needs of the users in that market. This is what Network General has done, and it has paid off handsomely for the company. It has paid off for users, too. It would be a rare LAN network manager who could not find a Network General solution addressed to his or her specific topology, protocol, or requirement.

The Sniffer analyzer interprets all the protocols at each layer of the major network protocols currently in use in the marketplace. Also, users can add new protocols to the Sniffer analyzer's capabilities without any hardware changes. In fact, the Sniffer analyzer is self-contained, requiring no configuration or modification. The left-to-right menu presentation on the screen is different from other vendors' displays and, in fact, seems more logical than the more typical top-to-bottom format. The menu selection currently being used is kept in the center of the screen, the next higher level is on the

left, and the next lower and more detailed level is on the right. The Sniffer analyzer connects easily to the network via transceiver cable. With the Ethernet Sniffer analyzer, a DB-15 Ethernet transceiver connector or a ThinWire connector can be used.

Some users have reported a significant initial learning curve with the Sniffer analyzer (*PC Week*, February 13, 1989). One user wrote to Datapro in January 1991 about the Sniffer and had the following comments:

"The Sniffer captures to RAM only. If you want to monitor the performance of your LAN for long periods of time, you need to purchase an optional piece of software called No Brainer software from a company called Smart Key . . . at (800) 748-4499 in Midvale, UT.

"While using the Compaq 386 Portable with the Sniffer software, a "special" Sniffer network adapter board is required. No big deal except that, if you want that portable to work on a 3Com Ethernet LAN as a workstation, you must use a separate adapter card; 3Com drivers cannot be loaded to the Sniffer board, and vice versa. Although when in Sniffer mode, the user can exit to DOS and load applications.

"Sniffer is challenging to learn. I've had to call the company several times for help."

In response, Network General points to one of its major customers, a large midwestern insurance company with a private SNA network linking data centers in its headquarters with others in the East and Southeast. This network uses the Sniffer to obtain English-language interpretation of network packets. The complete decode allowed the administrator to see which polls were going out and, as a result, quickly determine if a network device is not functioning. According to this user, the Sniffer WAN Analyzer reduced troubleshooting from days to minutes.

Another important benefit of the Sniffer WAN Analyzer for this customer has been its consistent, easy-to-learn interface. Because the insurance company already relies on the Token-Ring Sniffer for LAN troubleshooting, having the same interface for the WAN Analyzer, according to this user, "means that the learning curve for utilizing the device is very steep and provides instant results and instant benefits."

# Characteristics

---

## Product History

**Models:** This report covers the following Network General test equipment and software products:

- Token-Ring Sniffer
- Ethernet Sniffer
- Series 500 Portable 386 Sniffer
- Series 300 Laptop Sniffer
- Series 700 Sniffer Network Analyzer
- PA-1301 IBM Token-Ring Software
- PA-1302: Novell Software
- PA-1303: XNS Software
- PA-1304: TCP/IP Software
- PA-1305: Sun Software
- PA-1306: ISO Software
- PA-1307: DECnet Software
- PA-1308: Nestar Software
- PA-1309: Banyan VINES Software
- PA-1310: AppleTalk Software
- PA-1311: X Windows Software for DECnet or TCP/IP

**Date Announced:** Series 300: 1988; Series 500: 1988.

**Distribution:** Network General sells its products directly and through independent manufacturers' representatives.

---

## Characteristics

The Sniffer product line supports the seven major LAN topologies: Ethernet, 4M bps and 16M bps token-ring, Starlan, Arcnet, LocalTalk, and IBM PC Network (broadband). Hardware platforms range from lightweight laptops to portables and features English-language decoding of the most popular protocols: OS/2, LAN Manager, Banyan VINES, Novell NetWare, TCP/IP, IBM SNA, DECnet, Sun NFS, X Windows, and AppleTalk.

### Series 300 Laptop Sniffer Analyzer

The Series 300 Laptop Sniffer analyzer is a complete, single-network base unit with the Sniffer analyzer's proprietary menuing, capture, analysis, and display control

software. The optional software packages may be installed at the factory or added by the user on an as-needed basis.

The Series 300 has an 85-key, full-function keyboard, including 10 function keys and a numeric pad. It has a 10.25-inch, gas plasma, orange monochrome display with three intensity levels. The monitor supports a dual text/graphics mode, and it has a video port for an external color graphics adapter (CGA), enhanced graphics adapter (EGA) monitor, or VGA monitor.

The Series 300 has 5M bytes of random access memory, of which 3.944M bytes can be used for captured frames. The Series 300 Laptop Sniffer analyzer has an Intel 80386 12MHz processor and the MS-DOS v3.20 operating system. It uses a 3.5-inch, 1.44M-byte diskette drive and a 40M-byte hard drive with an average seek time of 25 ms.

In May 1990, Network General enhanced its Series 300 Laptop Sniffer with the Toshiba 3200SX platform. This replaces the 286-based 3200. Current users can upgrade to the 3200SX platform for \$8,500.

### Series 500 Portable 386 Sniffer Analyzer

The Series PA-500 includes a Compaq Portable 386 PC with a Sniffer analyzer Add-On Interface module and the Sniffer analyzer's proprietary menuing, capture, analysis, and display control software. The optional software packages can be installed at the factory or added by the user as needed.

The Series MS-500 includes the Sniffer analyzer Add-On Interface Module, which is installed on the user's own Compaq Portable 386 terminal. The Series MS-500 also includes the Sniffer analyzer's proprietary menuing, capture, analysis, and display control software. These are supplied on diskettes and are installed on the hard disk drive of the user's Compaq. Optional protocol interpreter software modules, also on diskettes, may be installed on the user's hard disk.

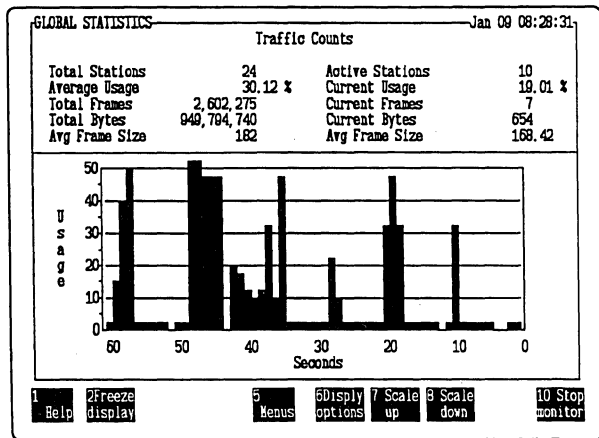
The Series 500 Portable 386 Sniffer analyzer uses an Intel 80386 20MHz processor and an MS-DOS v3.31 operating system. It uses a 3.5-inch, 1.44M-byte diskette drive and a 40M-byte hard drive with a seek time of less than 30 ms. The unit has 6M bytes of random access memory; a 10M-byte upgrade is available as an option.

The Series 500 Portable 386 Sniffer analyzer has a 91-key, full-function keyboard, including 12 programmable keys and a numeric pad. The display screen is a 10-inch plasma screen with adjustable brightness. The monitor supports a dual text/graphics mode, and it has a video port for an external color graphics adapter (CGA) monitor.

### Add-On Interface Modules

Multiple network capability is available for the PA-500 and the MS-500 Sniffer analyzer by using additional Sniffer analyzer add-on interface modules. Each module attaches to the back of the Sniffer analyzer and may be "swapped" to adapt the equipment to different networks. The necessary additional software is included

Figure 1.  
Global Network Statistics



This is a sample of the Sniffer analyzer display showing the total number of stations, the percentage currently in use, the current number of frames, average frame size, and other parameters.

when an interface module is purchased as an add-on to the system-level or the module/software-level configuration. The user installs the software on the computer's hard disk.

### Packaging Options

With the single-network module configuration, the user can purchase an additional Series IM-500 add-on interface module for each additional LAN type being tested. This gives the user access to a second circuit board position in each snap-on module; thus, the module may be used for another auxiliary function, such as a modem or a driver card. The Sniffer analyzer can be switched from one LAN type to another by interchanging modules.

With the two-network module configuration, users can take advantage of the two-slot structure of the Compaq Portable 386 snap-on module by having two network interface cards in the same module. This arrangement eliminates the need to change snap-on modules to select between LANs, since selection is accomplished through the menu. Any two supported networks can be combined.

Another optional feature is the PA-9203, which upgrades memory from 6M bytes to 10M bytes of random access memory (RAM).

### Tests Performed

The Sniffer analyzer has two basic modes of operation: monitoring and analysis. In the monitoring mode, the Sniffer analyzer provides realtime statistical summations of traffic on a network. These summaries can be both tabular and graphic. They can also be by station or by Ethertype. The Sniffer analyzer's operations can run in the foreground or background.

In the analysis mode, the Sniffer analyzer captures network traffic and also displays and interprets the content of captured frames. Options permit the user to perform filtering, searching, and interpretation procedures. See Figure 1 for an example of how the Sniffer analyzer provides a graphic display of global network statistics.

The menuing system is characterized by the following features:

- Multilevel menu display
- Three visible windows
- Five levels of depth
- Synchronous scrolling
- Function-key menuing with on-screen, dynamic indication
- On-line Help key

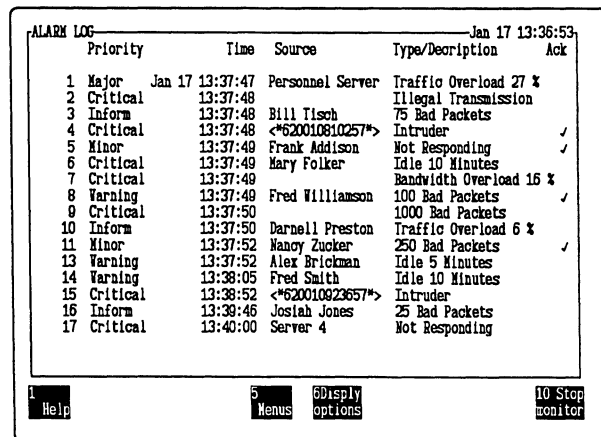
### Monitoring Specifications

The Sniffer analyzer can relay alarm conditions on a network-wide basis as well as individually for each station (see Figure 2). Each level of alarm is marked by a distinctive color; these are visible when used with an external color monitor.

The following statistics are monitored:

- Network Statistics
- Error Statistics
- Ethertype Statistics
- Frame Size Statistics
- Station Statistics

Figure 2.  
Alarms Status Screen



Alarms can be activated when certain thresholds are exceeded, and users can configure the Sniffer analyzer to signal alarms that are network-wide or that apply to individual stations. The priority levels, shown in the left column of this figure, are user defined.

**Table 1. Protocols**

---

PA-1301	SNA, SMB, RPL, NETBIOS, LLC
PA-1302	NCP, SAP, NETBIOS, XNS, SPX, IPX, RIP, Echo, Error, AFRP, LLC
PA-1303	SMB, XNS, Courier, SPP, IDP, PEP, RIP, Echo, Error
PA-1304	SMB, NETBIOS, FTP, TFTP, Telnet, SMTP, RUNIX, DNS, TCP, UDP, IP, GGP, ICMP, LLC, ARP, RARP, SNAP, TRLR
PA-1305	ND, NFS, YP, PMAP, MOUNT, RPC
PA-1306	X.400, FTAM, VTP, ACSE, ISO Presentation, ISO Session, SMB, TP, CLNS, ES-IS Routing, LLC, ISODE, CMOT, SNMP
PA-1307	DAP, NICE, SMB, CTERM, FOUND, SCP, NSP, DRP, MOP, LAT
PA-1308	Nestar, SMB, XNS, SPP, IDP, FRP, LLC
PA-1309	StreetTalk, MAIL, SMB, Matchmaker, IPC, SPP, RTP, ARP, ICP, IP, FRP, LLC
PA-1310	AFP, PAP, ASP, ADSP, NBP, ATP, ZIP, RTMP, Echo, KSP, AARP, DDP, SNAP, LLC, LAP
PA-1311	X Windows, DECwindows
PA-1312	X.25, PAD, SNDTCP, QLLC, PPP, HDLC

---

Sniffer analyzer monitoring tracks traffic history for the network. Intervals can be set between five seconds and one hour. Traffic history can also be localized to a specific station.

Active station tests determine whether a remote station is active by sending it a frame of one of the following protocol types: XNS Echo, DECnet MOP Loop, IEEE 802.2 Test, or NETBIOS Remote Status.

### Analysis Specifications

In the analysis mode, the Sniffer analyzer captures Ethernet traffic in realtime and displays the content of each frame in English-language text. The user can display Ethernet traffic in a variety of formats: a summary view, a detail view, and a hexadecimal view. Among the window viewing options, users can zoom in on an active window and move between zoomed views. Data is scrolled synchronously in all windows, and hexadecimal bytes are highlighted corresponding to selected detail.

Other display features include the following:

- Jumping to frame number or to marked or trigger frame
- String search, either a summary or detailed text search
- Pattern search, involving complex, logically related patterns
- Symbolic names, with user-defined names filed for network addresses
- Manufacturer's identification

The frame capture rate operates in either the normal mode (during periods of normal traffic load) or the high-speed mode (when network traffic becomes extremely high). With Ethernet LANs, the normal capture rate is 3,100 frames per second. In the high-speed mode, the

Sniffer captures 14,880 frames per second. The high-speed mode uses the buffer memory to capture more data. Capture rate with token-ring networks operates only in the normal mode.

### TeleSniffer Analyzer

The TeleSniffer Analyzer Remote Control is operated from an auxiliary IBM PC or compatible. A telephone line and modem are used to connect the PC's serial ports and those of the Sniffer analyzer. Operating data rates are up to 19.2K bps, depending on the modem.

The dialog mode on the TeleSniffer analyzer allows two-way communication between the Sniffer analyzer operator and a remote PC. Password and callback protection is included.

### SniffMaster I

SniffMaster I central monitoring is a separate software package for Sun Microsystems' workstations. It enables LAN managers to use a single workstation to analyze problems within a distributed LAN. All information from multiple segments monitored by a Sniffer analyzer is relayed in realtime to SniffMaster I. Each segment is then displayed in an independent window.

---

### Software

The following section describes the various software packages available with the Network General Sniffer analyzer. In addition to protocols decoded by these optional protocol interpreter suites, each Sniffer analyzer can interpret the low-level protocols of the network to which it is attached (see Table 1).

### PA-1301 IBM Suite

PA-1301 interprets frames in four families of higher level protocols used by IBM networks. PA-1301 may be installed in a Sniffer analyzer unit equipped for connection to the IBM Token-Ring (4M and 16M bps), IBM PC Net-

## Network General Protocols

The protocols supported by the Network General Sniffer analyzer software suites are described in the following paragraphs.

**AARP.** The AppleTalk Address Resolution Protocol matches the hardware destination address corresponding to a higher level protocol address.

**ACSE.** The Association Control Service Element protocol is an intermediate application-level protocol used in ISO to support a number of more specific application protocols.

**ADSP.** The AppleTalk Data Stream Protocol is a connection-oriented protocol that provides a reliable, full-duplex, byte-stream service between any two sockets on an AppleTalk Internet. This ensures an in-sequence, duplicate-free delivery of data.

**AFP.** The AppleTalk Filing Protocol is a presentation-level protocol for access to remote files.

**AFRP.** The Arcnet Fragmentation Protocol breaks up and reassembles network-layer packets so they are acceptable to the data-link protocol and the underlying physical medium.

**ARP.** The Address Resolution Protocol is used to find a node's DLC address from its IP address.

**ASP.** The AppleTalk Sessions Protocol is a general protocol that is built on ATP (see next entry). It provides session, establishment, maintenance, and tear-down along with request sequencing.

**ATP.** AppleTalk Transaction Protocol provides a loss-free transaction service between sockets, allowing exchanges between two sockets. In these exchanges, one client requests the other to perform a task and report the result.

**CLNS.** Connectionless Network Service Protocol.

**CMOT.** Common Management and Information Services Protocol (CMIP) over TCP. When used with the Sniffer analyzer, this requires PA-1306, the ISO Protocol suite.

**Courier.** A member of the XNS family, Courier is a presentation-level protocol that delivers data to such applications-layer protocols as XNS Printing, XNS Filing, and XNS Clearinghouse.

**CTERM.** Command Terminal is a protocol for communicating with generic, intelligent terminals.

**DAP.** Data Access Protocol is the DECnet protocol that provides remote file access.

**DDP.** Datagram Delivery Protocol extends the service of the LAP protocol to include an internet of

interconnected AppleTalk networks. It can address packets to sockets within a node.

**DECwindows.** The X Windows protocol run over DECnet.

**DNS.** Domain Name Service is a protocol used for finding information about network addresses. It uses a database distributed among different name servers.

**DRP.** DECnet Routing Protocol moves packets from source nodes, through routers, through wide area networks, and to end nodes. In the DNA scheme, "routing" corresponds to the OSI model's "Network" layer.

**Echo.** A member of the XNS family, Echo is a request/response protocol that verifies the existence of a host.

**Error.** A member of the XNS family, Error is a protocol by which a station reports that it has received a defective packet and is discarding it.

**ES-IS Routing.** End System-to-Intermediate System Routing. This is a protocol within the ISO family that is used to exchange routing information between gateways and hosts.

**FOUND.** Foundation Services is a protocol for primitive terminal-handling services.

**FRP.** Fragmentation Protocol breaks up and reassembles network-layer

packets so they are acceptable to the data-link protocol and the physical medium.

**FTAM.** File Transfer, Access, and Management is an ISO protocol.

**FTP.** File Transfer Protocol is based on TCP/IP for file transfer.

**GGP.** Gateway-to-Gateway Protocol is used to exchange routing information among IP gateways.

**HDLC.** High-Level Data Link Control Protocol is a widely implemented protocol as the logical link layer for an X.25 network. On IBM networks, the corresponding protocol is called SDLC. The synchronous Sniffer Analyzer interprets LAPB, the subset of HDLC used to provide link-level support for X.25.

**ICMP.** Internet Control Message Protocol is used to report difficulties in datagram transmission.

**ICP.** Internet Control Protocol broadcasts notification of errors and note changes in network topology.

**IDP.** A member of the XNS family, Internet Datagram Protocol delivers a single packet and an independent entity to an internet address, without regarding other packets or the response of the addressee.

**IP.** Internet Protocol is a network-level protocol responsible for end-to-end forwarding and control of long-packet fragmentation.



**IPC.** Interprocess Communication Protocol is a transport-level protocol that provides reliable message service and unreliable datagram service.

**IPX.** Internet Packet Exchange is a network-level protocol that corresponds to the Xerox IDP.

**ISO Presentation.** ISO 8823.

**ISO Session.** ISO 8327.

**ISODE.** ISO Development Environment provides an envelope for the delivery of upper level ISO packets over TCP/IP. When used with the Sniffer analyzer, ISODE also requires PA-1311, the X Windows suite.

**KSP.** Kiewit Stream Protocol is a transport protocol that resembles TCP.

**LAP.** Link Access Protocol is the logical-link protocol for AppleTalk. There are two variants: ELAP for Ethernet and LLAP for LocalTalk.

**LAT.** Local Area Transport protocol transports multiplexed terminal traffic to and from shared hosts for Digital Equipment Corporation computers.

**LLC.** Logical Link Control is a protocol that connects control and multiplexing to subsequent embedded protocols.

**MAIL.** This is a protocol for transmitting messages in the VINES distributed electronic mail system.

**Matchmaker.** This protocol is used by the VINES service that provides

high-level, program-to-program communication and remote procedure calls. Matchmaker can also provide data translation as necessary. Matchmaker is descended from the XNS Courier protocol.

**MOP.** Maintenance Operations Protocol provides network maintenance services, such as uploading, downloading, remote testing, and problem diagnosis.

**MOUNT.** This protocol is used during initiation of a remote user's access to a network disk, including access checking and account validation.

**NBP.** NETBIOS Protocol is used in AppleTalk networks to let users refer to network services and sockets by character names. A 3Com version is also available.

**NCP.** NetWare Core Protocol is Novell's application-level protocol for exchanging commands and data between file servers and workstations. It is sometimes termed NetWare File Service Protocol, or NFSP.

**ND.** Network Disc Protocol. When used with the Sniffer analyzer, this protocol also requires PA-1306, the ISO suite.

**Nestar.** Nestar handles user requests to manage the network disks. Commands are unseen by the user and transparent to a user application.

**NETBIOS.** Network Basic I/O System is a protocol implemented by the IBM PC LAN Program. There

are certain other NET- BIOS implementations that differ from the IBM version, and these differences are reflected in the Network General software suites.

**NFS.** Network File System is the high-level protocol used for communicating requests and responses between network clients and NFS servers.

**NICE.** Network Information and Control Exchange is the DECnet protocol for network management.

**NSP.** Network Services Protocol provides reliable message transfer over virtual circuits. It establishes and destroys logical links, error control, flow control, and segmentation and reassembly of messages.

**PAD.** The Packet Assembler/Disassembler Protocol provides buffering between traffic at a terminal or similar character-oriented device and the block-oriented communications of an X.25 network. The protocol between the terminal and PAD device is described in X.28, and between the PAD device and the X.25 link in recommendation X.29.

**PAP.** Printer Access Protocol uses "exactly once" commands (ATP XO) to create a stream-like service for communicating between user stations and the Apple LaserWriter or similar stream-based devices.

**PEP.** A member of the XNS family, Packet Exchange Protocol delivers a request and response pair. PEP's reliability is greater than IDP's but less than that of SPP.

**PMAP.** Port Mapper is a protocol for mapping RPC program numbers to TCP/IP port numbers.

**PPP.** Point-to-Point Protocol is a link-level protocol that bypasses X.25 for communication between systems that are directly connected, running any of a variety of protocols directly over HDLC.

**RARP.** Reverse Address Resolution Protocol.

**RIP.** Routing Information Protocol is used to exchange routing information among gateways and end systems.

**RPC.** Remote Procedure Call is a protocol for activating functions on a remote station and retrieving the result. When used with the Sniffer analyzer, it also requires PA-1305, the Sun suite.

**RPL.** Remote Program Load is a protocol used by IBM on the IEEE 802.5 Token-Ring network to download initial programs into networked stations.

**RTMP.** Routing Table Maintenance Protocol is used in AppleTalk networks to allow bridges or internet routers to discover routes to the various internet networks.

**RTP.** Routing Update Protocol distributes network topology information.

**RUNIX.** Remote UNIX is a protocol for handling remote requests over the network to a UNIX host.

**SAP.** Service Advertising Protocol is used by NetWare servers to broadcast servers' names and locations and to send a response to any station that queries it.

**SCP.** Session Control Protocol is used to establish virtual circuits based on NSP packets and on Digital NFP packets.

**SDLC.** Called High-Level Data Link Control Protocol except on IBM networks, where it is called SDLC, this is a widely implemented protocol as the logical link layer for an X.25 network. The synchronous Sniffer analyzer interprets LAPB, the subset of HDLC used to provide link-level support for X.25

**SMB.** The Server Message Block is a family of application-level commands for LAN servers. It was developed by Microsoft for use with the IBM PC LAN Program. It is also frequently used in other environments.

**SMTP.** Simple Mail Transfer Protocol is used to exchange electronic mail messages.

**SNA.** Systems Network Architecture is IBM's name for its family of commands within a common protocol.

**SNAP.** Sub-Network Access Protocol is also sometimes called Sub-Network Access Convergence Protocol.

**SNMP.** Simple Network Management Protocol. When used with the Sniffer analyzer, this also requires PA-1306, the Sun suite.

**SPP.** A member of the XNS family, Sequenced Packet Protocol is a virtual-circuit connection-oriented protocol.

**SPX.** A member of the XNS family, Sequential Packet Exchange is Novell's version of the Xerox SPP.

**StreetTalk.** This protocol is used by Banyan VINES to maintain a distributed directory of the names of network resources.

**TCP.** Transmission Control Protocol is a connection-oriented, byte stream protocol that provides end-to-end communications using datagrams sent over IP.

**Telnet.** Telnet is a protocol for transmitting character-oriented terminal data.

**TFTP.** Trivial File Transfer Protocol is a simple protocol used to exchange files between stations on a network.

**TP.** Transport Protocol.

**TRLR.** Trailer Format Protocol is a variation of IP in which the protocol headers follow rather than precede the user data.

**UDP.** User Datagram Protocol transmits diagrams over IP.

**VTP.** Virtual Terminal Protocol is an ISO protocol.

**XWIN.** This is the protocol for managing high-resolution workstation graphics. When used with the Sniffer analyzer, it also requires PA-1311, X Windows.

**X Windows.** This MIT-developed protocol permits a task's graphic display to be treated independently of the task itself thanks to a display server. The rest of the application's work is handled by a process that acts as a remote client of the end user's display server.

**X.25.** The CCITT developed versions in 1980 and 1984 of recommendation X.25, including extensions for OSI addressing and the ISO DDN facility and diagnostic fields.

**X.400.** This is the CCITT's 1984 protocol for electronic mail. One level (P1) is for addressing the message's outer envelope. The other level (P2) is for the inner addressing and contents.

**XNS.** The Xerox Network Systems Protocol. It comprises such protocols as Courier, IDP, PEP, RIP, Echo, and Error.

**YP.** Yellow Pages (also called NIS) is a high-level protocol used for requests and responses regarding the availability of network hosts, services, and directories from a read-only network database.

**ZIP.** Zone Information Protocol maintains an internet-wide mapping of networks to zone names for the benefit of routers. It is also a resource for the name-binding protocol to determine which networks belong to a given zone.

work (broadband), Ethernet, or Starlan. While IBM uses these protocols on LANs connected by the IBM Token-Ring, they may also be found on networks connected by other media.

#### **PA-1302 Novell Suite**

The PA-1302 interprets the protocols used by Novell's NetWare family, which includes an operating system for file servers as well as services in support of remote users on a variety of media. This suite can be installed on

Sniffer analyzer systems for the Ethernet, Arcnet, Starlan, IBM Token-Ring, or IBM PC (broadband) Network.

#### **PA-1303 XNS Suite**

PA-1303 interprets frames from the network, transport, and presentation layers, where it handles the protocols of Xerox Network Systems (XNS). Several vendors have developed application-layer protocols that run on top of these Xerox protocols, and so PA-1303 interprets SMB, a protocol used in Microsoft Networks, and the IBM

OS/2 LAN Manager. This suite can be installed in a Sniffer analyzer equipped for connection to an Ethernet Starlan, IBM Token-Ring, or IBM PC (broadband) Network.

#### **PA-1304 TCP/IP Suite**

PA-1304 interprets the protocols that form the TCP/IP family. It also interprets other protocols used with them. Although TCP/IP usually runs on Ethernet, its protocols are also found on other networks. PA-1304 can be installed in a Sniffer analyzer system for Ethernet, Arcnet, Starlan, IBM Token-Ring, and IBM PC (broadband) Network environments.

PA-1304 is required to be installed if users wish to operate the PA-1305 Sun suite.

#### **PA-1305 Sun Suite**

PA-1305 interprets the protocols that support Sun Microsystems' Network File System (NFS). NFS allows users to mount directories of files that are located on other machines. These files can be treated as if they were locally available through the client's UNIX operating system.

The NFS is composed of a modified UNIX kernel, a set of library routines, and a collection of utilities used by machines that play the role of the server. PA-1305 interprets frames passed to it by the TCP/IP or UDP protocols; it therefore requires PA-1304 be used with it.

#### **PA-1306 ISO Suite**

PA-1306 interprets the family of protocols built on the recommendations of the International Organization for Standardization. PA-1306 decodes all layers above the physical layer (Layer 1), including Ethernet, Starlan, IBM PC Network (broadband), and IBM Token-Ring. It also decodes Microsoft SMBs, X.40, and FTAM.

#### **PA-1307 DECnet Suite**

PA-1307 decodes eight protocols defined in Phase IV of Digital's Digital Network Architecture (DNA). It also decodes certain other protocols that are used in DECnet systems, such as LAT. PA-1307 can be installed with Starlan, IBM PC (broadband) Network, and IBM Token-Ring networks. PA-1307 does not fully decode some protocols that occur in DECnet installations. These include LAVC (Ethertype 6007), Bridge Management (8038), and LAST (8041).

#### **PA-1308 Nestar PLAN Suite**

PA-1308 interprets protocols used with the Nestar PLAN series of network disk servers. In this type of network, each PC workstation installs a device driver that lets the user mount and use an arbitrary number of virtual disks. Each disk appears as an additional drive on the local machine, but, in fact, it is located on a network server. A Nestar server is a dedicated 6800-based machine that runs under a proprietary operating system

supporting a superset of DOS. PA-1308 may be installed in a Sniffer analyzer equipped for either of the media commonly used with Nestar servers: Arcnet or the IBM Token-Ring.

#### **PA-1309 Banyan VINES Suite**

PA-1309 interprets protocols in the VINES series developed by Banyan Systems. VINES links personal computers to file servers on a LAN. Typically, user stations are PCs running under DOS. VINES runs over a variety of physical media, including Ethernet, Arcnet, Starlan, and the IBM Token-Ring. PA-1309 can be installed in any Sniffer analyzer equipped for these.

#### **PA-1310 AppleTalk Suite**

PA-1310 interprets frames in both Phase I and Phase II of the AppleTalk protocol family. These protocols link personal computers to each other and to external gateways, file servers, printers, and the like. The personal computers are usually made by Apple, though this is not mandatory.

The AppleTalk protocols are commonly used over Apple's own LocalTalk wiring or Ethernet. The software can also be encapsulated within packets transmitted by another protocol, such as TCP/IP.

PA-1310 can be installed in any Sniffer analyzer equipped for Ethernet. It can also be installed in any Sniffer analyzer that uses PA-1304, the TCP/IP suite. The Sniffer analyzer then interprets AppleTalk frames passed to it by UDP.

#### **PA-1311 X Windows Suite**

PA-1311 interprets the protocol that transmits information between X Windows clients and servers and is independent of lower level frames that carry its messages. PA-1311 cannot be used alone; it must be installed with either PA-1304 (the TCP/IP suite), so that it will interpret frames passed to it by TCP, or with PA-1307 (the DECnet suite), so that it will interpret frames passed to it by Digital's network services protocol (NSP).

#### **PA-1312 X.25 Protocol Interpreter Suite**

PA-1312 decodes certain protocols commonly used above X.25. It also identifies several other higher level protocols transmitted over X.25, and it passes packets to the appropriate protocol interpreter suites for display.

PA-1312 can be installed in any Sniffer Network Analyzer equipped with a network interface card for synchronous serial communications using HDLC by way of an RS-232 or V.35 interface or with a network interface card for Ethernet, token-ring (at 16M bps or 4M bps), Starlan, or PC Network.

PA-1312 interprets the Packet Assembler/Disassembler protocol, layer three of the 1980 and 1984 versions of CCITT recommendation X.25 (including the 1984 extension for OSI addressing), and the ISO and DDN facility and diagnostic fields.

The interpreter recognizes numerous higher level embedded protocols and, when installed, passes

frames to the appropriate protocol interpreter suite. Protocols interpreted in this way include SNA (with PA-1301 for IBM), ISO TP and CLNP (with PA-1306), IP (with PA-1307 for TCP/IP), DRP (with PA-1307 for DECnet), XNS (with PA-1303 for XNS), DDP (with PA-1310 for XNS), and NCP (with PA-1302 for Novell NetWare).

## Recent Enhancements

### Hardware

#### Series 700 Sniffer

The Series 700 is a complete single-network base unit. Its proprietary menu and capture analysis, as well as its display control software, is fully integrated and ready to operate. Optional protocol suites can be installed when the equipment is manufactured or can be added later.

The Series 700 runs on an IBM PS/2 Model P70 platform and uses an Intel 80386 20MHz processor. The Series 700 operates with the IBM PC-DOS Version 4.0 operating system, uses a 60M-byte hard disk, and has a memory capacity of 4M bytes of RAM; 3M bytes may be typically used for captured frames. The Series 700 has a full-size, 101-key keyboard that includes 12 function keys and a numeric pad. The display is a 10.75-inch gas plasma orange monochrome with a 16-level grayscale. A video port is available for an external VGA color monitor.

The Series 700 Sniffer Network Analyzer provides diagnostic capabilities to help maintain, troubleshoot, fine-tune, and expand a network. Features include seven-layer protocol decoding and statistical traffic displays in realtime.

The Series 700 Sniffer supports token-ring (16M bps and 4M bps). Protocol interpreter suites are available for a number of widely used protocols, such as the following:

- IBM (SNA, NETBIOS, OS/2 LAN Manager)
- Novell NetWare
- XNS/MS-Net
- TCP/IP (including SNMP)
- ISO
- Sun NFS
- DECnet
- Banyan VINES
- AppleTalk
- X Windows

#### 16/4 Token Ring Sniffer

All Network General's token-ring Sniffer analyzers are now being shipped as 16/4M bps units, replacing the former 4M bps-only product. Current 4M bps Sniffer owners can upgrade to a 16/4M bps model for \$2,500.

The 16/4 Token Ring Sniffer Network Analyzer helps the user to maintain, troubleshoot, fine-tune, and expand a network. Users can uncover a wide range of problems and pinpoint their origins. In addition, the 16/4 can collect and capture frames while a ring is beaconing (that is, when a major fault has occurred on the network). This helps the user isolate and solve problems at critical times. The user can select the rate of either 16M bps or 4M bps.

The 16/4 Token Ring supports the same network types and the same protocols as the Series 700, described above. It runs on the IBM PS/2 Model P70 platform or on the Series 500 Compaq Portable 386 and the Series 300 Toshiba 3200SX.

#### Watchdog Network Monitor

In April 1990, Network General introduced its Watchdog Network Monitor. This is a LAN monitor that follows activity on Ethernet and 16M/4M bps token-ring networks, oversees LAN and workstation traffic, and provides network and station alarms.

### Software

#### Sniffer WAN/Synchronous Analyzer

Network General's Sniffer WAN/Synchronous Analyzer is a software and half-card enhancement designed for the Sniffer Protocol Analyzer. It supplies the Sniffer with the capability to decode synchronous protocols and with X.25 packet filtering capabilities. Like Network General's other Sniffer products, the WAN/Synchronous Analyzer runs on the Compaq Portable 386 or Toshiba laptop.

The Sniffer WAN/Synchronous Analyzer lets users employ the same machine to detect problems on both LANs and WANs. It runs decoding programs for X.25 traffic and tests HDLC or SDLC packets, as well as Network General's other decode programs. The Sniffer WAN/Synchronous Analyzer has an adapter with RS-232-C and V.35 interfaces.

After users capture a sample of traffic in the unit's 5M-byte buffer, they can select the type of report they wish. The Sniffer subjects the test sample to all protocol suites in its memory. If the Sniffer encounters a protocol in the test sample not in its memory, it will generate a message to that effect in its report.

## Physical Specifications

Physical specifications for the Series 300 Laptop Sniffer analyzer and the Series 500 Portable 386 Sniffer analyzer are given in the following table.

Model	H x W x D (in.)	Weight (lb.)
Series 300	4.0 x 14.5 x 15.5	19
Series 500	9.8 x 16.0 x 10.5	20

---

## **Pricing**

Pricing for the Network General Sniffer analyzer will vary depending on customer requirements and configuration. Prices start at \$12,500 and range up to \$24,000. Current Laptop Sniffer users can upgrade from the

Toshiba 3200 platform to the 3200SX platform for \$8,500. The Watchdog Network Monitor costs \$1,995 for the Ethernet version, and \$2,695 for the token-ring version. ■



# Network Software Associates PC-to-Host and LAN Gateway Products

## In this report:

Analysis .....	-102
Characteristics.....	-105
Support.....	-108

## Product Summary

### Editor's Note

Since our last report, Network Software Associates (NSA) has continued to unveil innovative products for IBM network communications. The Elite software family is NSA's newest and most advanced series of SNA connectivity products for IBM PC/XT/ATs, PS/2s, laptops, and compatibles. Another new product is AdaptX25 Controller, a cost-effective connectivity product that integrates the higher user-interface layers of SNA with the lower layers of the international OSI architecture.

### Description

NSA's software and hardware products provide IBM networking communications—allowing PCs to communicate with mainframes in SNA and SAA environments.

### Strengths

NSA continues to enhance its comprehensive product line with innovative software. NSA products are link independent; they provide unsurpassed flexibility for end users who use multiple link types in their LANs.

### Limitations

No significant limitations found.

### Competition

Attachmate, Barr Systems, Digital Communications Associates (DCA), and Novell.

### Vendor

Network Software Associates, Inc.  
39 Argonaut  
Laguna Hills, CA 92656  
(717) 768-4013

### Price

Contact NSA for complete pricing information.

### GSA Schedule

Yes.

—By *Donna Horsley*  
*Staff Writer*

# Analysis

---

## Product Strategy

A recognized leader in IBM network communications, NSA is committed to the integration of SNA and OSI technologies and following the direction of key IBM offerings such as the 3174, the PS/2, OS/2, token-ring, and NetView. NSA strategy also includes developing products that enable DOS applications through products such as Microsoft's Windows 3.

NSA has created an expansive product line that provides multiprotocol host access from local PCs, remote PCs, and LANs. The company's products run on all major operating environments—from DOS to Windows to OS/2—and conform to IBM's SNA and SAA architectures.

### AdaptSNA Connectivity Software Products

AdaptSNA is NSA's first-generation family of SNA connectivity software package for the IBM PC/XT/AT and compatibles, PS/2s, and laptops. Link independent, AdaptSNA products work with the majority of adapter boards on the market and communicate in a wide variety of link environments, including SDLC, AutoSync, Coax/DFT, async, X.25, NETBIOS LAN, Novell NetWare IPX/SPX LAN, and 802.2 token-ring LAN. The AdaptSNA series comprises six products: AdaptSNA RJE, AdaptSNA APPC, AdaptSNA APPC+ 3270, AdaptSNA APPC Developer's Kit, AdaptSNA 3270, and AdaptSNA LU0.

### Elite Connectivity Software Products

Introduced in 1990, Elite software is NSA's latest and most advanced series of SNA connectivity products for the IBM PC/XT/AT and compatibles, PS/2s, and laptops. It comprises three software products: 3270/Elite and 3270/Elite Plus for DOS environments and DynaComm/Elite for Windows 3 environments.

Elite products conform to IBM's device-independent SAA and, like Adapt SNA software,

are link independent. Elite lets users communicate over the majority of physical links, including SDLC or AutoSync PC-to-host communications; coax connections via an IBM 3174 or 3274 DFT cluster controller; LAN-to-host connectivity using NETBIOS; Novell NetWare IPX/SPX or IEEE 802.2 token-ring; dial-up async PC-to-host connections via AdaptAsync solutions; or dial-up async to an X.25 PDN via AdaptX25. Elite software can be used with almost any SDLC board, modem, coax board, or LAN board on the market.

### Gateway and Controller Products

NSA offers four multiprotocol SNA gateway and controller products for PC-to-host communications: AdaptSNA LAN Gateway, 802.2 Token-Ring Connectivity, AdaptAsync Controller, and AdaptX25 Controller. These products provide user workstations with a wide range of SNA protocols, including interactive 3270, cooperative processing LU 6.2/APPC, batch Remote Job Entry, and user-defined LU0.

The products' software is link independent—fitting regardless of the connection. Users can migrate applications from one link type to another link type without modifying the application or retraining workstation users.

---

## Competitive Position

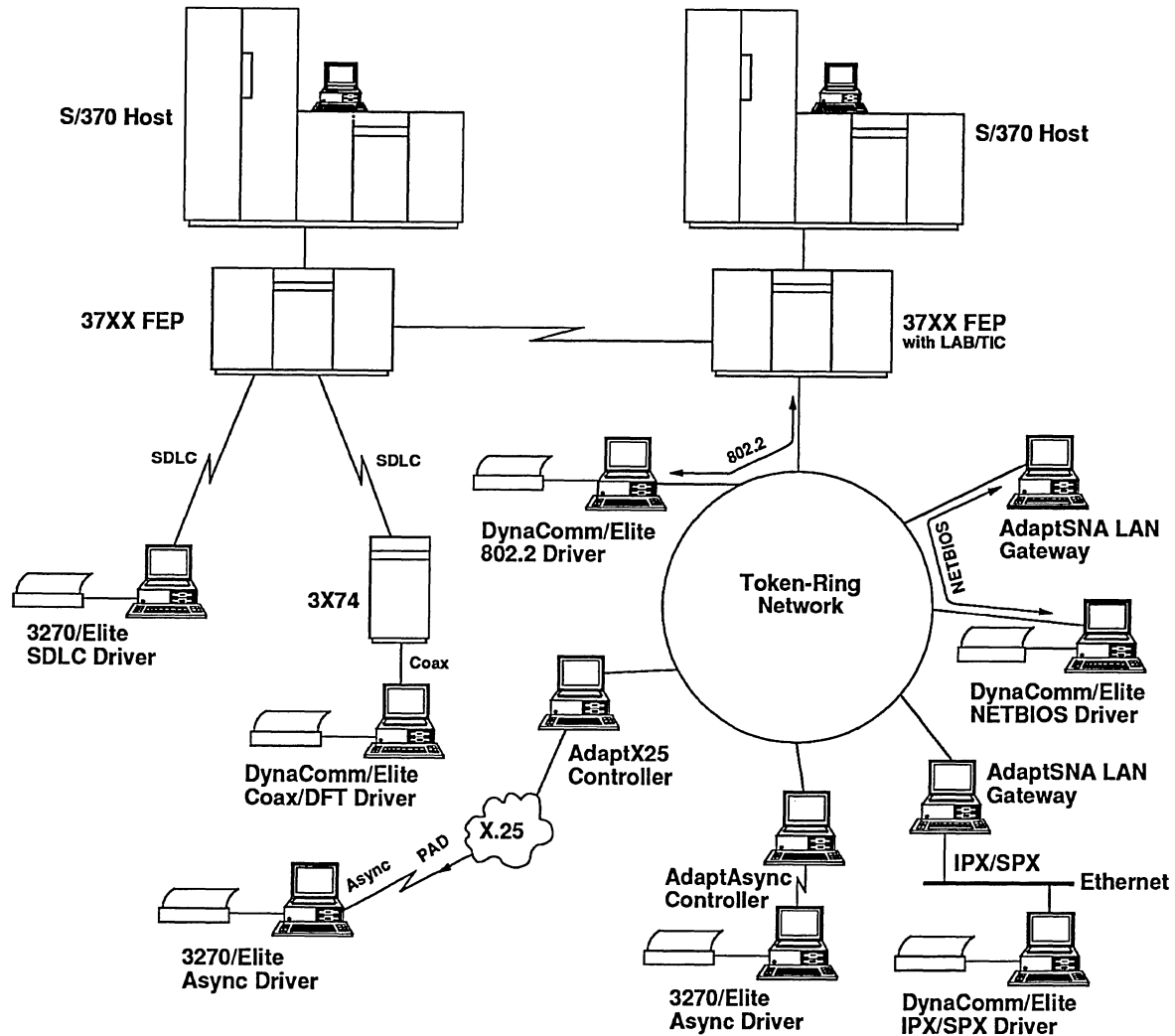
In the crowded network connectivity market, NSA earns moderate profits and popularity. NSA's focus on product innovation and joint venture activities has enabled the company to successfully compete with strong companies like Attachmate, Barr Systems, and Digital Communications Associates (DCA).

NSA provides extensive experience in APPC that is unmatched by the competition. When compared to NSA's AdaptSNA APPC software, DCA's APPC products are less comprehensive and are limited to local area network functions; Attachmate has no APPC program.

NSA is one of only a few companies to offer an RJE package for PCs. Barr Systems provides an RJE package; however, NSA's AdaptSNA RJE is superior in function. NSA's RemoteTalk is the only PC-to-PC remote control software on the market that communicates over a high-speed SDLC board and sync modems.



*Figure 1.  
Typical Elite Connectivity*



*Introduced in 1990, Elite software is NSA's latest and most advanced series of SNA connectivity products for IBM PCs, XTs, ATs; laptops; and compatibles. Elite software conforms to IBM's device-independent SAA and is link independent.*

In terms of 3270 emulation, NSA's 3270/Elite is a DFT 3270 emulator that uses the lowest amount of memory in the market. Without compromising its high-functionality features, 3270/Elite software provides 65K bytes of workstation memory; competing vendors provide more than 100K bytes.

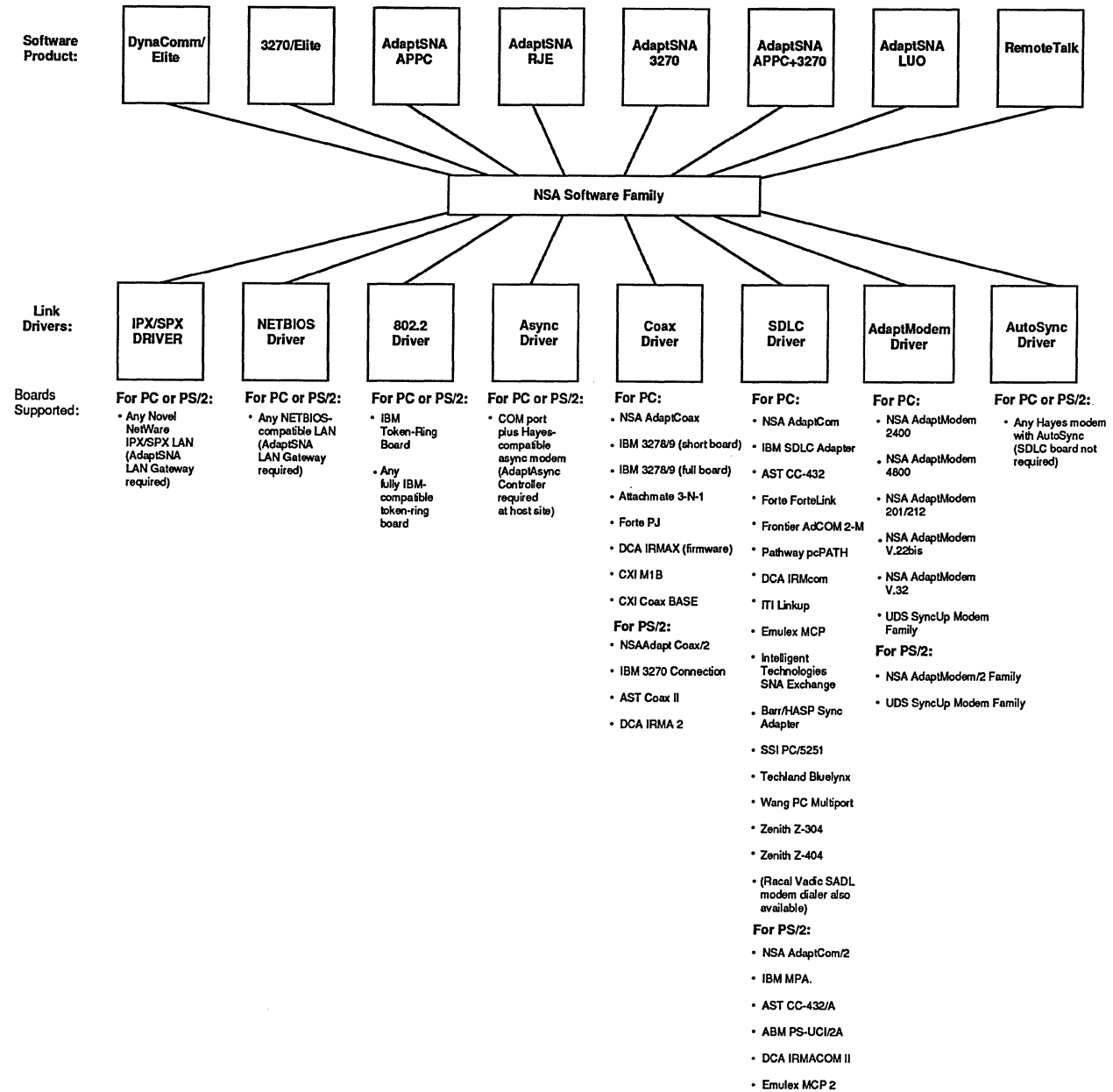
For SNA LAN-to-host gateway connectivity, NSA's AdaptSNA Gateway is the most powerful, most flexible SNA LAN-to-host gateway on the market. NSA also provides the leading SNA communications software for Microsoft Windows 3 users with DynaComm/Elite, which was created in a codevelopment agreement with Future Soft Engineering.

## Decision Points

### Link Independence

NSA provides flexibility for customers using multiple link types in their networks. NSA software works with all popular brands of adapter boards over all common PC-to-host and LAN-to-host data links, including SDLC, coax, AutoSync, X.25, NETBIOS, IPX/SPX, and 802.2. Such link independence protects users' hardware investments.

**Figure 2.**  
**Link-Independent Structure of NSA Connectivity Software**



**Comprehensive SNA Communications Software**

NSA is one of the few companies to offer an RJE package for PCs. AdaptSNA RJE software (for PC-DOS or OS/2 environments) is time and cost efficient, transferring either text or binary files to and from the mainframe.

NSA has extensive experience in APPC, dating back to 1985 when the company released AdaptSNA APPC, the first APPC software on the

market for PCs. AdaptSNA APPC+ 3270, one of NSA's later offerings, is ideal for companies migrating from 3270 to APPC. With it, users can perform host inquiries using 3270 emulation, then use APPC to initiate a file transfer, and then go back to 3270 mode to continue other inquiries—all without logging off the host.

With 3270/Elite, NSA provides advanced functionality and low-memory benefits. The DFT 3270 emulator uses 65K bytes of workstation memory functionality without compromising the

features of an advanced technology DOS-based 3270 emulator. DynaComm/Elite—developed in a codevelopment agreement with Future Soft Engineering—is the leading SNA communications software for Microsoft Windows 3 users. It extends Windows 3 capabilities beyond DOS to the world of SNA 3270 PC-to-host connectivity.

For SNA LAN-to-host gateway connectivity, NSA's AdaptSNA Gateway is powerful, versatile, and cost effective. The software is used on Ethernet, Arcnet, or token-ring LANs running either NETBIOS or Novell NetWare IPX/SPX.

---

### Company Profile

Network Software Associates, a privately held company headquartered in Laguna Hills, CA, sold approximately 15,000 of its networking products in 1990. Its software for IBM network communications is found in *Fortune* 1000 companies including AT&T, Boeing Computer Services, VISA USA, BMW of North America, and Bell Canada.

Established in 1980 as a consulting firm, NSA was chartered to customize software products for its clients. Gradually, NSA began producing off-the-shelf products, which now account for most of the company's revenue. In recent years, NSA has also fostered joint ventures with IBM, Future Soft Engineering, Pansophic Systems, and Systems Center.

NSA's comprehensive SNA communications product line is primarily the result of the company's aggressive R&D department, whose core staff had been working together even before NSA's establishment. The company was the second (IBM was the first) to implement SNA communications on a minicomputer in 1977. Today, NSA is recognized for being the first to deliver the following applications: cooperative processing LU6.2/APPC facilities for PCs; an applications-independent LU0 communications package for PCs; multiprotocol SNA support (APPC, 3270, RJE, and LU0) for coaxial 3274-based PC-to-host links; software products that work with all popular brands of hardware boards; RJE functionality under OS/2; a four-protocol SNA gateway (APPC, 3270, RJE, and LU0) for NETBIOS LANs; and SNA communications for users of Windows 3 that supports complete Windows functionality including Multiple Document Interface and Dynamic Data Exchange.

NSA is led by Isaac Kong, president and CEO, and employs 65 persons. The company's revenue comes primarily from direct sales; however, NSA recently entered the international market, selling its products overseas through distributors and VARs. A small segment of NSA sales also comes from the company's Federal Systems Division, which markets to the federal government.

The company is "reasonably profitable," according to an NSA spokesperson. International product sales represent 11 percent of total NSA sales.



## Characteristics

**Models:** Software products—AdaptSNA RJE, AdaptSNA APPC, AdaptSNA APPC+3270, AdaptSNA APPC Developer's Kit, AdaptSNA 3270, AdaptSNA LU0, AdaptSNA LAN Gateway, 802.2 Token-Ring Connectivity, AdaptAsync Controller, AdaptX25 Controller, 3270/Elite, DynaComm/Elite, RemoteTalk.

**Date Announced:** AdaptSNA 3270—1983; AdaptSNA RJE—1984; AdaptSNA APPC—1985; AdaptSNA APPC+3270—1986; AdaptSNA LU0—1987; RemoteTalk—1987; 802.2 Token-Ring Connectivity—1988; AdaptAsync Controller—1988; AdaptSNA LAN Gateway—1989; AdaptSNA APPC Developer's Kit—1990; 3270/Elite, DynaComm/Elite—1990; AdaptX25 Controller—1991.

**Date First Installed:** AdaptSNA 3270—1983; AdaptSNA RJE—1984; AdaptSNA APPC—1985; AdaptSNA APPC+3270—1986; AdaptSNA LU0—1987; RemoteTalk—1987; 802.2 Token-Ring Connectivity—1988; AdaptAsync Controller—1988; AdaptSNA LAN Gateway—1989; AdaptSNA APPC Developer's Kit—1990; 3270/Elite, DynaComm/Elite—1990; AdaptX25 Controller—1991.

**Number Installed:** 15,000 units in 1990.

**Distribution:** NSA's products are sold directly to end users and through international distributors. The company does not sell its products through OEMs.

## Models

The company's individual products and their general specifications are as follows.

## Software

**AdaptSNA RJE:** This software product emulates an IBM 3770 RJE workstation with additional IBM 8100 emulation facilities. It transfers either text or binary files up to 19,200 bps over dial-up, leased, point-to-point, and multidrop lines. It is available for PC-DOS or OS/2 applications.

For operation, AdaptSNA RJE requires an IBM PC/XT/AT or compatible, PS/2, or laptop; 256K bytes of RAM; a 360K-byte or 720K-byte diskette; and a monochrome monitor. It allows multiple concurrent datastreams between the host and PC, without the overhead associated with suspension and resumption. It concurrently supports the following IBM-defined devices: one console, two printers, two punches, one reader, and two exchange devices. It provides a complete set of link drivers, allowing a choice in selection of the physical link. AdaptSNA RJE features include background mode, DOS hot key, soft keys, printers, help facility, file name, compression and compaction, automatic recovery, unattended operation, and API.

**AdaptSNA APPC:** This software product allows an IBM PC/XT/AT or compatible, PS/2, or laptop with DOS 3.0 to communicate with other micros, minis, and mainframes on a peer-to-peer basis without the need for terminal emulation. It transfers files up to 19,200 bps over dial-up, leased, point-to-point, and multidrop lines.

AdaptSNA APPC software includes the following features: IBM-defined Basic Conversation Verbs, which allow the PC transaction program to converse with a partner program; IBM-defined Mapped Conversation Verbs, which eliminate the need for transaction programs to be concerned with any specialized datastream formatting; and Control Verbs, which allow the PC transaction program to probe beyond IBM-defined Return Codes to determine specific information about the APPC conversation and the physical link. The software also provides APPC/PC support (its transaction programs written with IBM's APPC/PC are compatible), link configuration, and the ASSIST learning facility.

**AdaptSNA APPC+3270:** This product provides both APPC and 3270 communications concurrently over the same host connection. It combines the features of AdaptSNA and AdaptSNA 3270, which is described later.

**AdaptSNA APPC Developer's Kit:** This package includes two copies of AdaptSNA APPC (including ASSIST), one copy of Adapt SNA APPC+3270, source code samples, in-depth technical reference documentation, and PC-to-PC testing link drivers.

AdaptSNA APPC Developer's Kit users, with two connected PCs, can experiment with the supplied PC

testing link drivers, the sample programs, and the ASSIST file transfer program and also write their own APPC transaction programs and thoroughly test them. Users can migrate to PC-to-host or LAN-to-host connectivity after developing and testing programs in the PC-to-PC environment. With the kit's AdaptSNA APPC+3270, users can start an APPC conversation and then switch to 3270 mode to analyze the conversation.

**AdaptSNA 3270:** This is a multisession 3270 emulator for interactive 3270 PC-to-host or LAN-to-host communications that has PC-DOS and OS/2 applications. It provides IBM PC/XT/AT or compatibles, PS/2, or laptop emulation of an IBM 3278/9 display station with one or two 3287 printers. It requires a minimum of 256K bytes of RAM for operation.

AdaptSNA 3270 supports transfers of text and binary files at data rates up to 19,200 bps over dial-up, leased, point-to-point, and multidrop lines. It supports PU type 2 and LU types 1/2/3 in any IBM VTAM environment. The software package provides the following features: multiple screen sessions, multiple printers, link configuration, APIs, file transfer, DOS hot key, Memory Miser hot key, print-to-disk capability, print spooling, a keyboard, and automatic recovery.

**AdaptSNA LU:** This product provides direct program-to-program communications between two computers. It supports transfer rates up to 19,200 bps over dial-up, leased, point-to-point, and multidrop lines. It operates on an IBM PC/XT/AT or compatible, PS/2, or laptop with DOS 3.0. Features include LUO verbs, link configuration, and the ASSIST learning facility.

**AdaptSNA LAN Gateway:** This is a gateway connection used on Ethernet, Arcnet, or token-ring LANs running either NETBIOS or Novell NetWare IPX/SPX. Its components include a PC/XT/AT or PS/2 on a LAN equipped with a host communications board that runs the Gateway Control Program (GCP). The GCP allows a maximum of 128 workstations on the LAN to concurrently communicate to the host through AdaptSNA LAN Gateway. The GCP allows users to connect any workstation to any LU and allows any workstation to run multiple host sessions concurrently.

AdaptSNA LAN Gateway includes both the downstream and upstream links that are supported by most popular hardware boards. The downstream link—either NETBIOS or IPX/SPX—connects the AdaptSNA LAN Gateway to the LAN through a standard LAN adapter board. The upstream link is used to connect the Gateway to an IBM 37XX Front-End Processor (FEP), which is in turn connected to the host. The FEP views the Gateway as a single PU type 2 device, so it occupies a single NCP Port. The upstream link can function in various ways: a direct SDLC link to the FEP; a remote SDLC link using an SDLC adapter and a synchronous modem; a remote synchronous link using a Hayes Auto-Sync modem, which does not require an SDLC board; and an 802.2 upstream link onto another token-ring LAN to which the FEP is also connected.

The GCP provides a full range of network management and security functions: dynamic information on the configuration, performance, and statistics of the Gateway; audit trail of all workstation access that is stored in a system log file; and gateway access rights that are enforced with a password system, providing both global and user passwords.

**802.2 Token-Ring Connectivity:** This is a LAN-to-host connectivity product involving the direct token-ring connection without the need for a PC gateway. Using any IBM TIC and the 802.2 protocol, the following IBM systems can be connected directly to a token-ring: IBM 3174 cluster controller, IBM 37XX FEP, IBM 9370 mainframe, and IBM AS/4000 mainframe.

Its workstations communicate with the host at full token-ring speeds, with each workstation operating as a separate PU and allowing direct addressing by the host. For users needing a direct TIC connection without assigning separate PUs to each workstation, the Adapt-SNA LAN Gateway can optionally be added to the users' TIC-connected token-ring. NSA workstation software can also be used to communicate through an IBM OS/2 EE 1.2 Communications Manager Gateway or an IBM Personal Communications/3270 Gateway. In doing so, the workstation uses the 802.2 protocol in conjunction with any of the NSA workstation software.

**AdaptX25 Controller:** This system uses a dedicated PC or PS/2 to receive the X.25 transmission from the communicating PC workstation and in turn present the host system with the SDLC-formatted data. It runs NSA's X.25 Control Program (XCP), which performs X.25-to-SDLC conversions, controls PC access to the system, displays LU and active line status information, and provides other network management and security features. (The host views the AdaptX25 Controller as an IBM 3X74 cluster controller.)

AdaptX25 Controller can operate as an IBM PC/XT/AT, PS/2, or compatible computer configured with an IBM ARTIC co-processor board, which forms the X.25 downstream link to the PDN. The ARTIC connection provides up to 32 concurrent Switched Virtual Circuits (SVCs) for incoming PC workstation communications. The system can be accessed by hundreds of PC workstations. SVCs are dynamically accessed by workstations on an as-needed, dial-in basis. Multiple AdaptX25 Controllers are used for more than 32 concurrent workstations. AdaptX25 Controller's upstream link to the host can be SDLC or token-ring.

**3270/Elite:** This product allows an IBM PC/XT/AT or compatible, PS/2, or laptop to emulate an IBM 3278 Model 2 display station or a 3279 Model 2A or 2B display using LU type 2. It emulates an IBM 3287 printer and also emulates a 3274 Model 51C or 3174 Model 51R cluster controller when used over SDLC or AutoSync. It requires 256K bytes of RAM, 9360K-byte or 720K-byte diskette drive, and a monochrome adapter and monitor. It operates at speeds up to 19,200 bps over dial-up, leased, point-to-point, and multidrop lines.

It supports one LU for a terminal session and a second LU for a printer session. 3270/ElitePlus allows up to five concurrent host sessions.

3270/Elite includes the following features: a DOS hot key, CUA configuration, OS/2EE Status Line, file transfer, background transfer, print-to-disk capabilities, IBM keyboard layouts, keyboard mapping, user-defined keyboard, APIs, translation tables, color, and logon.

**DynaComm/Elite:** This product extends Windows 3 capabilities to SNA 3270 PC-to-host connectivity. It allows an IBM PC/XT/AT or compatible, PS/2, or laptop to run Microsoft Windows 3 and emulates an IBM 3278 Model 2/3/4/5 display station or IBM 3287 DSC printer. When used over SDLC, it also emulates a 3274 Model 51C or 3174 Model 51R cluster controller. It provides SDLC speeds up to 9600 bps in Windows 3 standard mode and up to 4800 bps in Windows 3 enhanced mode. It supports up to five concurrent LUs.

DynaComm/Elite contains a Multiple Document Interface (MDI), a Communication Front-End Development System, and Dynamic Data Exchange (DDE). The product provides the following features: file transfer, print-to-disk capabilities, flash keypad, keyboard layout editor, keyboard remapper, font sizing, Operator Information Area, a search facility, a settings file, mouse-sensitive areas, a color editor, diagnostics, and Windows help facilities.

**RemoteTalk:** This PC-to-PC remote control product communicates over an SDLC or Hayes AutoSync link at up to 19,200 bps. RemoteTalk allows a remote PC to access and control a PC attached to a LAN over an SDLC or AutoSync link. It also allows a PC on a LAN to access and control another PC on the LAN using the LAN's transmission media via the NETBIOS or 8.0.2 protocol. It interconnects any two IBM PC/XT/ATs or compatibles, PS/2s, or laptops. Features include remote control, file transfer, hot key, message exchange, password protection, data compression, data accuracy, batch command processing, idle timer, and help facility.

## Hardware

**AdaptModem Series:** This series includes seven hardware options that incorporate an integrated synchronous modem and an SDLC adapter on one board. AdaptModem plugs into a full-sized expansion slot on any IBM PC/XT/AT or compatible or PS/2 computer. Each board's modem conforms to either Bell or CCITT standards and includes complete auto dial/auto answer capabilities. The SDLC portion of each board includes all the circuitry necessary to interface to an SDLC connection.

Adapt Modem 2400 is a Bell 201C-compatible 2400 bps modem with SDLC adapter for AT bus PCs and PS/2s. Adapt Modem/2 2400 is a Bell 201C-compatible 2400 bps modem with SDLC adapter for MCA PS/2s. Adapt Modem 4800 is a Bell 208A/B-compatible 4800 bps modem with SDLC adapter for AT

bus PCs and PS/2s. AdaptModem/2 2400/4800 is a Bell 201/208-compatible modem with SDLC adapter for MCA bus PS/2s and runs at 2400 or 4800 bps. AdaptModem 201/212 is a dual-function sync/async modem with SDLC adapter and CCITT V.22b support for AT bus PCs, and SDLC at 600/1200/2400 bps; async at 300/600/1200/2400 bps. AdaptModem V.32 is a dual-function sync/async modem with SDLC adapter and CCITT V.32 support for AT bus PCs, and SDLC and async up to 9600 bps. AdaptModem/2 V.32 is a dual-function sync/async modem with SDLC adapter and CCITT V.32 support for MCA bus PS/2s, and SDLC and async up to 9600 bps.

**AdaptCom Series:** AdaptCom boards are SDLC adapters for IBM PC/XT/ATs or compatibles and PS/2 computers. Each AdaptCom board is designed for communications applications that incorporate a separate external synchronous modem. AdaptCom hardware is available in two versions—AdaptCom is a half-slot SDLC board for an AT bus, and AdaptCom/2 is a full-slot SDLC board for an MCA bus.

**AdaptCoax Series:** These are plug-in boards that connect IBM PC/XT/AT and PS/2 computers via coaxial cable to an IBM 3274 DFT cluster controller with configuration D or T or an IBM 3174 DFT controller. The cluster controller is connected to a host via a local channel attachment or a remote link. AdaptCoax hardware is available in two versions—AdaptCoax is a half-slot coax board for an AT bus, and AdaptCom/2 is a full-slot coax board for an MCA bus.

**AdaptAsync Board:** This co-processor board is used in the AdaptAsync Controller. It allows multiprotocol SNA

PC-to-host communications using asynchronous lines and asynchronous modems. It is configured with a standard PC or PS/2, adding an AdaptAsync board and adding the AdaptAsync Control Program. Each AdaptAsync board incorporates eight asynchronous RS-232 ports that connect to local or remote PC AT, PS/2, or laptop computers. Up to four AdaptAsync boards can be plugged into the AdaptAsync Controller for a total of 32 ports. For growth beyond 32 ports, multiple AdaptAsync controllers can be configured.

**ARTIC Board:** This device allows the use of IBM's ARTIC co-processor board. The ARTIC SDLC Subsystem is used for SDLC host links at 64K bps via AdaptSNA workstation software or via upstream links from the AdaptSNA workstation software or via upstream links from the AdaptSna LAN Gateway, AdaptAsync Controller, or AdaptX25 Controller.

---

## Support

**Phone Support:** Registered users of NSA products can receive free telephone support by calling (714) 768-4013.

**Warranty:** NSA hardware products are warranted for a full year; software warranties expire after 90 days.

**Maintenance:** NSA offers customers the option to enter its Extended Support Program (ESP). With ESP, users can telephone NSA's support team for priority advice and hands-on support for questions or problems. ■

---

# NetWorth Local Area Networking Products

---

## In this report:

Analysis .....	-102
Characteristics.....	-103
Pricing .....	-104

## Product Summary

### Editor's Note

NetWorth offers 10BASE-T hardware that features a clean, uncluttered design.

### Description

A line of adapter cards, hubs, and concentrators conforming to the IEEE 10BASE-T standard for 802.3 CSMA/CD networks.

### Strengths

Simple yet complete line of 10BASE-T hardware, offering a high degree of modularity. Network management hardware and software are also offered.

### Limitations

No provisions for internetworking integrated into system. Prices slightly higher than some of the competition.

### Competition

David Systems, SynOptics, BICC.

### Vendor

NetWorth, Inc.  
8101 Ridgepoint Drive  
Irving, TX 75063  
(214) 869-1331

### Price

EtherNext 4000 10BASE-T Host Module in single-slot Satellite Command Center: \$2,390.  
Five EtherNext 4000 10BASE-T Host Modules and one Network Management Module in Network Command Center six-slot chassis: \$13,665.

### GSA Schedule

Through distributors and resellers.

---

—By *John Krick*  
Associate Editor

# Analysis

---

## Product Strategy

NetWorth is one of the many firms that have clustered around the 10BASE-T standard, providing adapter cards, concentrators, network management hardware and software, and other equipment for the unshielded twisted-pair (UTP) 802.3 specification that has proven so popular. NetWorth estimates that it ranks fourth in this market, behind SynOptics, Cabletron, and David Systems. NetWorth, like most of these other companies, started in another segment of the data communications industry and saw the 10BASE-T UTP standard as a perfect opportunity to reposition itself when earlier products began to approach obsolescence.

While the 10BASE-T market has exploded to the point where an eventual shakeout is a certainty, NetWorth looks like a good bet to survive. The company's product line is compact and tightly focused, appears to be well designed, and is complete, offering everything needed for an unshielded twisted-pair installation. A point in its favor for the network builder is its scalability and simplicity. While some companies in the 10BASE-T concentrator market have delivered giant chassis capable of holding every sort of networking and internetworking hardware, these firms have unwisely neglected the low end where most network hardware sales reportedly take place. While it is true that the network with fewer than 10 nodes hardly needs an intelligent hub-based architecture, there is a vast middle ground of networks that does not need a concentrator box that will accommodate over a hundred twisted-pair subnetworks, but does have a substantial number of nodes. NetWorth offers products that serve the needs of this middle ground quite adequately, yet allow for rapid growth as well.

---

## Competitive Position

As noted above, the 10BASE-T market has been virtually exploding over the last year, and NetWorth, like several other 10BASE-T companies, has experienced sales growth that has matched the growth of the market. In the year ended September 30, 1990, NetWorth sales increased 146 percent.

Competition in this market is stiff, and at least some vendors, such as David Systems, have been able to offer lower prices for hubs with functionality similar to the NetWorth products. More competition is coming to this market every day as more and more companies begin to offer 10BASE-T hardware. Recently, Arcnet vendors like Standard Microsystems and Thomas-Conrad have been turning to 10BASE-T in the hope of finding an alternative to eroding Arcnet sales.

---

## Decision Points

NetWorth can provide all of the equipment needed for a small- to medium-size network that has no need for extensive internetworking capabilities. While some may see this as a limitation, such networks abound in the real world. In fact, most local area networks, if we are to believe the many surveys, are small and isolated.

While those with a requirement to bridge their LANs either locally or remotely can turn to other vendors to supply the necessary hardware, this lack points up the next step NetWorth should take with the EtherNext product line. A local bridge to fit the Series 4000 chassis would seem to be a logical addition to NetWorth's offerings.

---

## Company Profile

NetWorth is a privately held company based in Irving, TX, a suburb of Dallas. Founded in 1984 as an engineering consulting firm, NetWorth began shipping vLAN, its first line of LAN hardware, in 1986. The company shipped its first 10BASE-T products in 1989. Networth employs approximately 85 people.



# Characteristics

**Model:** EtherNext 10BASE-T networking equipment.

**Date of Announcement:** EtherNext 4000: September 1990.

**Date First Installed:** EtherNext 4000: November 1990.

**Number Installed:** Approximately 100,000 EtherNext nodes.

**Distribution:** Resellers and distributors.

## Architecture

NetWorth builds adapter cards and concentrators that adhere to the 10BASE-T subsection of the IEEE 802.3 standard. 802.3 describes a 10M bps Carrier Sense Multiple Access with Collision Detection (CSMA/CD) network similar to Ethernet. CSMA means that in order to transmit data on the network, a workstation must first "listen" to the line. If the line is free, the station then goes ahead with its transmission. If it detects the presence of traffic from another station, it waits a random period of time before again attempting to transmit. Subsections of the 802.3 standard pertain to the various media commonly used with these networks. The newest subsection, 10BASE-T, describes 10M bps transmission on the unshielded twisted-pair copper wire also used for telephone wiring. 10BASE-T mandates a star



*The EtherNext 4000 Network Command Center is a six-slot chassis. It is shown here with five UTPM12 10BASE-T modules and an NMM01 Network Management Module installed.*

topology in which a concentrator acts as the central hub of a network segment.

## Hardware

### Network Interface Cards

**UTP8 8-Bit Network Interface Card:** The UTP8 is a 10BASE-T adapter card for the 8-bit IBM PC bus. It features an RJ45 modular jack for unshielded twisted-pair (UTP) wiring, as well as the standard Attachment Unit Interface (AUI) 15-pin D connector for connection of Ethernet or 802.3 transceivers of any type.

**UTP16 16-Bit Network Interface Card:** Similar to the UTP8, but designed for the 16-bit IBM PC AT bus, the UTP16 has RJ45 and AUI connectors for unshielded twisted-pair and transceiver attachment, respectively.

**UTPPS2 Micro Channel Network Interface Card:** The UTPPS2 is designed for the Micro Channel bus used in the IBM PS/2 Model 50 and above. It supports the software addressing features of the Micro Channel bus and allows eight I/O address and eight interrupt line choices to allow maximum flexibility when attaching other peripherals. The UTPPS2 includes RJ45 and AUI connectors for unshielded twisted-pair and coaxial connection, respectively.

**UTPMAC Macintosh II Network Interface Card:** This is a 32-bit adapter card for the Macintosh II NuBus and works in all models of the Macintosh II. It includes both RJ45 and AUI connectors.

### Hubs, Concentrators, and Concentrator Modules

**MHUB09 MicroHub UTP:** The MicroHub is a miniature 10BASE-T hub with 9 RJ-45 connectors for unshielded twisted-pair wiring. Workstations can be located up to 328 feet (100 meters) from the hub, or by enabling the MicroHub's Extended Distance feature, up to 656 feet (200 meters) from the hub when using data grade cable. The MicroHub automatically disconnects jabbering hubs and reconnects them when the problem is resolved. An uplink switch is provided that allows the ninth port to be attached to another network segment.

**MHUB09-B MicroHub with BNC:** This hub is identical to the MicroHub described above except that the ninth port is equipped with a BNC connector for connection to thin coaxial Ethernet network segments.

**CHAS06 Network Command Center (NCC):** This is a six-slot concentrator chassis that can hold up to six 10BASE-T host modules or five 10BASE-T host modules and one Network Management Module. The NCC contains five separate backplanes so that five independent Ethernet networks can be attached. Modules can

be "hot swapped" while the unit is powered up, so that the entire network does not have to be brought down to perform maintenance on a single segment. The NCC can be rack mounted.

**CHAS03 Department Command Center (DCC):** The DCC is identical to the NCC described above, but it only has three slots.

**CHAS01 Satellite Command Center (SCC):** Similar to the three-slot and six-slot concentrators described above, the SCC holds only a single 10BASE-T host module.

**UTPM12 10BASE-T Host Module:** This is a 12-port repeater for 802.3 networks. It is equipped with 12 RJ45 modular connectors for attachment of workstations, servers, concentrators, and other repeaters. LEDs for each port indicate collisions, partitioning, and link status.

**UTPM12-T Telco 10BASE-T Host Module:** This module is identical to the UTPM12 module described above except that, instead of 12 RJ45 connectors, it is equipped with a standard 50-pin AMP connector for attachment to standard telco punchdown blocks or patch panels.

**UTPM12-S Smart 10BASE-T Host Module:** This is a dual-function module that acts as both a 12-port 802.3 repeater and a network management module that monitors and controls all other modules in the same concentrator. A serial port is included for out-of-band signaling associated with network management.

**NMM01 Network Management Module (NMM):** The NMM is an intelligent network management device designed to monitor and control host modules that reside in the same concentrator chassis. It features a single RJ45 connector to connect to 10BASE-T networks and both BNC and AUI connectors for attachment to thin or thick coaxial segments. In-band (over the network) communication reports network management statistics to the EtherManager software. Out-of-band network management communication is also enabled by the inclusion of a serial port. A two-segment alphanumeric LED display reports status and performance information locally.

**AUI01 AUI Adapter:** The AUI Adapter is a transceiver that allows any Ethernet or 802.3 card with the industry-standard, 15-pin, D-style Attachment Unit Interface (AUI) to connect to unshielded twisted-pair wiring.

**FTP01 Fiber-to-Twisted Pair Adapter:** The FTP01 adapter connects fiber optic media to a 10BASE-T concentrator. It includes one RJ45 connector for 10BASE-T unshielded twisted-pair (UTP) and a single pair of ST-type connectors (Receive and Transmit) for fiber optic connection. LEDs indicate link status, fiber receive traffic, and UTP wire receive traffic.

## Software

**NMAN01 EtherManager Network Management Software:** This software works with Network Management Modules or Smart 10BASE-T Host Modules to allow management of all network components. Administrators can review vital network statistics, graphically display the status and topology of concentrators, configure backup links, and set alarm thresholds. EtherManager can be configured to automatically dial a digital pager, through a modem connection to a commercial paging service, to report network problems to an administrator.

## Support

### Installation

EtherNext 10BASE-T equipment is designed for simple installation, but resellers and distributors can provide assistance if necessary.

### Warranty

NetWorth warrants all of its products for one year.

### Maintenance/Support

Maintenance and support are provided by resellers and distributors.

## Equipment Prices

		<b>Purchase Price (\$)</b>
UTP8	8-bit Network Interface Card	349
UTP16	16-bit Network Interface Card	399
UTPPS2	Micro Channel Network Interface Card	449
UTPMAC	Macintosh II Network Interface Card	449
AUI01	AUI Adapter	249
FTP01	Fiber-to-Twisted Pair Adapter	665
UTPM12	EtherNext 4000 10BASE-T Host Module	1,995
UTPM12-T	EtherNext 4000 10BASE-T Host Module with 50-pin Telco connector	1,995
UTPM12-S	EtherNext 4000 Smart 10BASE-T Host Module	2,995
NMM01	Network Management Module	2,395
CHAS01	Satellite Command Center single-slot chassis	395
CHAS03	Department Command Center three-slot chassis	995
CHAS06	Network Command Center six-slot chassis	1,295
NMAN01	EtherManager Network Management Software	2,395

# Norton-Lambert Close-Up and LYNC

## In this report:

Analysis .....	-102
Characteristics.....	-104
Pricing.....	-106

## Product Summary

### Editor's Note

Close-Up/LAN was introduced in 1989 to address remote communications within LANs and WANs.

### Description

LYNC is a general purpose PC communications program. Close-Up is an integrated communication system that provides three functions: remote communications; terminal communications; and automated communications. Close-Up/LAN addresses LAN and WAN environments.

### Strengths

- LYNC offers data encryption; document, spreadsheet, and database transfer via electronic mail; ASCII-to-binary file conversion.
- Close-Up allows novice users to learn quickly via pull down menus; and contains communications options such as automated unattended file transfers for experienced users.
- Close-Up/LAN allows PCs on a LAN to share screens and keyboards, and provides access to remote resources.

### Limitations

- LYNC is command driven; supports only four protocols.

- Close-Up and Close-Up/LAN lack on-line help; Close-Up/LAN does not have built-in file transfer.

### Competition

- LYNC—ProComm Plus, Crosstalk XVI, Smartcom II, PC-TALK III.
- Close-Up—Carbon Copy Plus 5.0, CO/Session 3.0, CO/Compute 2.1.
- Close-Up/LAN—NetRemote.

### Vendor

Norton-Lambert  
P.O. Box 4085  
Santa Barbara, CA 93140  
(805) 964-6767  
In Canada:  
Keating Technologies  
505 Hood Road, Unit 22  
Markham, ON L3R 5Z6  
(416) 479-0230

### Price

Ranges from \$195 for LYNC to \$1,495 for Close-Up/LAN.

### GSA Schedule

Yes.

# Analysis

## Product Strategy

LYNC, Norton-Lambert's first product, is a general-purpose asynchronous communications package used for file and data transfer applications between a PC and virtually any other PC, mini-computer, or mainframe. The package encrypts and decrypts data as it is sent, and thus can be used to send sensitive spreadsheets, databases, and word processing files to local or remote systems. LYNC is also used to send files via electronic mail services.

Norton-Lambert introduced Close-Up in 1986. Close-Up, an integrated communication system, provides three functions:

- remote communications connecting PCs to PCs;
- terminal communications connecting PCs to timeshare services, information utilities, electronic mail systems, and bulletin boards; and
- automated communications allowing unattended file transfer.

Close-Up/LAN extends Close-Up's PC-to-PC remote communications to include both the local area network (LAN) and wide area network (WAN) environments. It runs on either the Novell IPX or NETBIOS network transport protocols, and allows multiple users on a network to share screens, keyboards, and network protocols.

## Applications

Close-Up is used by many software and computer vendors (including Novell, 3Com, IBM, Lotus, Ashton-Tate, Hewlett-Packard, Digital Equipment, and Tektronix) to provide customer support. Using Close-Up, support staff members dial a customer's PC and, once connected, diagnose the customer's problems by working together on the customer's screen. The support staff can type and execute

commands on the customer's screen from the remote PC, freeze the customer's keyboard and/or screen, and upload/download files to and from support.

Companies such as PIP Printing and Merrill Lynch use Close-Up to train and support franchises without having to travel from location to location. Close-Up is also used to communicate with electronic mail, bulletin boards, and information services, and to access minicomputers and mainframes.

Close-Up/LAN is often used in classrooms to allow students to view the instructor's monitor, and to allow the instructor to view students' work. The instructor's keyboard is active, so if a student sends a message for help (via the dialog window), the instructor can assist him/her without leaving the PC.

Close-Up/LAN can also be used as a work-group communications tool. A company official or LAN administrator can view screen after screen on the LAN, assisting some users, while simply monitoring others. Employees can join in on a conference, linked together on-screen, regardless of the distance involved. One user can bring up a spreadsheet on the screen for all members to view. With live keyboards, viewers can adjust the data on the screen, and play out what-if scenarios. Network resources are available to all users, regardless of distance. Printers, CD-ROMs, high speed processors (80386s) and IRMA-type connections to mainframes are all accessible to linked users.

Close-Up/LAN can be integrated with Close-Up. For instance, a user can communicate from a PC at home to his/her PC in the office using both products. At home, the user dials up a PC with a modem on the office LAN using Close-Up. The PC on the LAN has Close-Up/LAN installed. The user would then execute Close-Up/LAN to run through the network to access his/her PC. A report created on the PC at home could be sent to any printer connected to the LAN.

## Competitive Position

LYNC competes with Datastorm Technologies' ProComm Plus, Crosstalk Communications/DCA's Crosstalk XVI, Hayes Smartcom II, and Headlands Communications Corporation's PC-TALK III. Unlike its competitors, LYNC offers

on-line tutorials, encryption when sending electronic mail messages and xmodem protocols, and allows spreadsheet, word processing, database, and program files to be sent through electronic mail systems.

Close-Up competes with remote communications programs such as Meridian Technology's Carbon Copy Plus 5.0, and Triton Technologies' CO/Compute 2.1 and CO/Session 3.0. Close-Up is the only package that includes a script language for automating remote sessions. Unlike Carbon Copy Plus, Close-Up does not support HGC, EGA, MCGA, and VGA monitors.

Close-Up/LAN competes with Brightwork's NetRemote product on a one-to-one connection. NetRemote, however, does not support one-to-many, many-to-one, or many-to-many connections. In fact, at this time, no other product contains all the functionality that Close-Up/LAN provides.

---

## Decision Points

### LYNC

*Installation:* Installing LYNC is as simple as inserting the program disk into the computer and typing "LINSTALL." The installation program asks the user to designate the computer and specify the COM port and modem. LYNC allows the user to save the program under whatever name he/she wishes. Total installation time is less than 10 minutes.

*Data Encryption:* Users sending messages or files via electronic mail have the option to encrypt their data before sending it. The receiver specifies a secret keyword to decrypt the information. The file size remains intact after the encryption/decryption process.

*File Transfer:* LYNC supports spreadsheet, database, and word processing file transfer through electronic mail systems such as CompuServe, MCI, EasyLink, ITT, and RCA. The program also converts files from binary to ASCII when sending, and vice-versa when saving.

*Error Protection:* LYNC provides precise error detection and automatic correction protocols. This

feature protects the data from being lost or altered regardless of the degree of telephone line noise.

*Automatic Communications:* LYNC can be programmed to automatically look up and dial phone numbers and log-on to telex and electronic services—a user need only provide the password. The program can also automatically dial, log-on, and send or save files at any time during the day or evening, taking advantage of lower phone charges.

*Primary Applications:* LYNC is best suited for applications where file and data transfer between different systems need to occur, such as between a system running CP/M and one running DOS.

### Close-Up

*Installation:* Close-Up comes preinstalled for IBM PCs or compatibles. In a matter of seconds, users can change the default settings of the software from a menu. The Customer/Terminal software automatically determines and sets the parity and data bits for every computer with which it communicates. Total installation time is approximately five minutes.

*Record and Playback:* This feature allow users to record the screen as it changes. The recording is saved to a disk and can be played back later. For example, in a support situation, support calls can be recorded and later used as a tool to train new personnel. Remote transactions can also be recorded for legal or tax purposes.

*Snapshots:* Snapshots of screens (black/white or color) can be taken and saved to a disk, and then edited for use in presentations.

*Graphics:* Close-Up will run realtime color graphics (CGA) programs. Graphics created on the user computer can be viewed simultaneously on the support computer if both are using compatible graphics adapters.

*Disable Screen and Keyboard:* This feature lets the user's screen or keyboard be selectively disabled, allowing the user's computer code to be modified without anyone seeing confidential work.

*Error Protection:* Close-Up uses Norton-Lambert's fast sliding window error-checking and correcting protocol to protect data. Every keystroke and screen is checked for transmission errors. Phone line noise problems are completely eliminated.

*Phone Book:* This feature allows users to store phone numbers of frequently called computer sites. By entering a name, Close-Up will automatically look up the number and dial it.

*Time and Billing:* A built-in time and billing system, Transaction Log, keeps track of connect time and dates for billing or tax purposes.

*File Transfer Security:* Security features include multiple passwords, dial back numbers and initial command lines. Password protection is also included for file transfer.

*Primary Applications:* Close-Up allows vendor and company support personnel to walk remote users through operation problems. Close-Up is also used by employees who need to communicate with their office from home or the road. Close-Up also allows PCs to access a minicomputer or mainframe.

### Close-Up/LAN

*Installation:* Close-Up/LAN comes preconfigured on one disk. During the installation process, Close-Up/LAN determines whether the Novell IPX or NETBIOS protocol is being used, so users do not have to specify which drivers to activate. Installation time is approximately five minutes.

*Ease of Use:* Close-Up/LAN uses point-and-shoot menus that novices can easily learn. More complex features such as unattended file transfers are also easily learned.

*Dialog Window:* A pop-up window, executed by a hot key, allows two or more users to communicate. This feature allows LAN users to have a "conference call" without leaving their PCs. The dialog window can be moved by using the arrow keys.

*Distributed Processing:* All resources, such as CD-ROMs, printers, and high speed processors, are available to users regardless of the distance involved. A shared communications server can be

created by attaching an inexpensive PC with a modem to the network, allowing everyone on the LAN to run communications programs and terminal emulators.

*Primary Applications:* Close-Up/LAN aids PC trainers by allowing several students to view the instructor's monitor, and by allowing the instructor to view students' work. Other applications include technical support personnel assisting users located at remote sites; expanding the use of network resources by supporting remote users; workgroup conferencing; and providing all LAN users access to minicomputers and mainframes.

---

### Company Profile

Norton-Lambert, a privately held company founded in 1980, introduced the concept of remote communications to the industry with the introduction of LYNC. Initially, LYNC supported remote communications for CP/M users. Soon, LYNC Remote supported other operating systems as well, and became the program of choice for programmers and technicians.

In 1986, Norton-Lambert introduced Close-Up to handle remote features. Close-Up/LAN was added in 1989 to expand Close-Up's utility into LAN and WAN environments. Norton-Lambert plans to continue to improve the Close-Up and Close-Up/LAN products with innovative features as the market demands them.

## Characteristics

**Models:** LYNC Version 5.0; Close-Up Version 3.00A; Close-Up/LAN.

**Date Announced:** LYNC—1980; Close-Up—May 1986; Close-Up/LAN—February 1989.

**Date First Installed:** LYNC—1980; Close-Up—May 1986; Close-Up/LAN—April 1989.

**Number Installed:** Information not available.

**Distribution:** Norton-Lambert's products are distributed directly, via retail stores, PC mail order houses, and distributors.

---

## Models

### LYNC

LYNC, an integrated communications package, is divided into two separate modes: TERM and LYNC. TERM mode is used to communicate with computers that are not using the LYNC program. TERM mode is used to communicate with MCI Mail, NewsNet, Dow Jones, CompuServe, Knowledge Index, telex services, Official Airline Guide, mainframe computers, minicomputers, microcomputers, xmodem protocol computers, and bulletin board services.

LYNC mode is used to communicate with computers that are running LYNC. LYNC guarantees that 100 percent of the data will be preserved when any type of file is transferred between computers, even ones with different disk formats and different operating systems.

### Close-Up Version 3.00A

Close-Up, an integrated communications system, provides three functions.

**Remote Communications:** Close-Up connects two PCs and provides the same functionality as if both people were working at the same PC. An application running on one PC can be viewed on the second PC. Both computers—their screens and keyboards—are linked as one. All keystrokes entered on either PC are displayed in the same position on both screens.

**Background Terminal Communications:** Close-Up supports background terminal communications while simultaneously running an application in the foreground. Background Terminal allows users to interface with telex, electronic services, personal computers, minicomputers, mainframe computers, and bulletin boards.

**Automated Communications:** Close-Up allows automatic file transfers at any predetermined time. Files can be transferred during off hours when phone rates are lower and computers are not in use.

Close-Up consists of two packages—Close-Up Customer/Terminal Program and Close-Up Support/ACS Program.

**Close-Up Customer/Terminal Program** consists of two integrated programs.

**Customer** handles remote communications, and always runs in the background. Applications on a PC running the Customer program can be viewed and co-controlled by a PC running the Support program.

**Terminal** is a background program that allows communication with timeshare, information utility, electronic mail, and bulletin board computers.

**Close-Up Support/ACS** consists of two integrated programs.

**Support** handles remote operations. The Support program acts as a terminal or window to the customer's screen. Application programs are never run on a PC running Close-Up Support.

**Automated Communications System (ACS)** automates commands such as sending and fetching files, entering keystrokes into a remote computer, and running an applications program concurrently with Support/ACS. ACS uses Task Files to schedule file transfers. Task Files allow a user with no programming knowledge to design sophisticated procedures. The ACS program also provides a log of all activity.

### Close-Up/LAN

Close-Up/LAN extends the Close-Up program into the LAN market by supporting the NETBIOS and Novell IPX network transport protocols. The LAN program supports every combination of multiple station monitoring operation, including one-to-one, one-to-many, many-to-one, and many-to-many. During installation, Close-Up/LAN determines which protocol is being used.

Viewer and Host are the two programs within Close-Up/LAN. The Viewer program is similar to the Support program in Close-Up; the Host program is similar to the Customer program in Close-Up. Both Viewer and Host are TSR (memory resident) programs, and both support multiple simultaneous connections.

**Close-Up/Viewer** provides access to the resources of up to 16 PCs running the Host TSR. A viewer can have multiple printers, located throughout a WAN, printing simultaneously. The viewer can disable the keyboard and screen of the host, a capability ideal for classroom instruction.

**Close-Up/Host** allows users to maintain privacy with options that disconnect viewers from the host PC, require a password, or set up a private mode so that only designated viewers can access the host PC. The Host user can initiate or terminate the connection, and can request help from a viewer instead of waiting for one to call. The Host's set-up menu includes parameters that allow viewers to view the Host PC's screen but disable the remote control. A total of 16 hosts can connect to one or more viewers.

---

## Environment

### Computers Supported

**LYNC:** IBM PC/XT/AT and compatibles.

**Close-Up and Close-Up/LAN:** IBM PC/XT/AT, PS/2s, and compatibles.

### Operating System

**LYNC:** MS-DOS, PC-DOS, CP/M-80, MP/M-80, CP/M-86, MP/M-86, CCP/M, Apple DOS, Concurrent PC-DOS, TurboDOS, Z-DOS, or Novell NetWare.

**Close-Up:** MS-DOS or PC-DOS 2.0 or higher.

**Close-Up/LAN:** Novell NetWare, IBM PC Local Area Network Program, and 3Com 3+.

### Memory Required

**LYNC:** 64K bytes.

**Close-Up:** 48K (Customer Text only); 60K (Customer Terminal and Text only); 67K (Customer Terminal and Graphics); 134K (Support).

**Close-Up/LAN:** 66K to 76K (Viewer); 25K to 50K (Host).

**Monitors:** Color, black/white, and monochrome.

### Modems

**LYNC:** Hayes Smartmodem 300, 1200, or 2400 bps; Anchor Signalman, Volksmodem, or Express; Bizcomp; Cermetek; Datec; Novation; Prometheus; Racal-Vadic; U.S. Robotics Courier 2400.

**Close-Up:** Hayes Smartmodem and compatibles; user-defined; or high-speed modems.

**Close-Up/LAN:** Uses the LAN's network cabling.

**Media:** 5.25-inch and 3.5-inch diskettes are available.

**Software:** All popular application programs supported.

---

## Communications

**Addressable Ports:** COM1 and COM2 supported.

### Transmission Rates

**LYNC:** 75 to 19,200 bps.

**Close-Up:** 300 to 38.4K bps.

### Local Area Network Support

**LYNC and Close-Up:** Compatible with all popular PC networks.

**Close-Up/LAN:** Runs on any NETBIOS- or IPX-compatible network.

### Topology

**Close-Up/LAN:** Ethernet, Token Ring, ARCnet, and star.

### Protocols

**Close-Up/LAN:** Supports NETBIOS and IPX.

**Transmission Protocol:** Asynchronous.

### User Interface

**LYNC:** Command-driven, includes an installation program, and is user installable.

**Close-Up:** Provides pull-down menus.

**Close-Up/LAN:** Preconfigured for quick installation; uses point-and-shoot menus.

### Foreground and Background

**Close-Up:** Close-Up Support can run in the foreground or background; connection to a Close-Up customer and an applications program can run concurrently.

**Close-Up/LAN:** Users can toggle between multiple LAN connections and standalone PC applications.

### Remote Printing

**Close-Up:** Data can be sent to print to the Customer PC, the Support PC, or both; print-spooling can be executed at the Support PC with an option to print to the Customer PC.

**Close-Up/LAN:** Users can send output to any printer on the LAN or WAN; information can be sent to several different locations simultaneously.

### Security

**LYNC:** File transfers, direct or via electronic mail, are encrypted.

**Close-Up:** Multiple passwords, dial-back numbers, and initial command lines; password protection is also included for file transfer.

**Close-Up/LAN:** Three levels of password security are included.

---

## Support

**Phone Support:** Telephone support is available by calling (805) 964-6767 between 7 a.m. and 4 p.m. Pacific time. There is no support charge.



**Bulletin Board:** Norton-Lambert has an evaluation system users can call into for general product information, helpful hints, and Norton-Lambert news.

**Warranty:** The software is warranted for 90 days.

**Maintenance:** None.

**Upgrades:** A nominal fee is charged for upgrades based on the user's current software version.

---

## **Pricing**

Software Prices are as follows: LYNC—\$195; Close-Up Support/ACS—\$245; Close-Up Customer/Terminal—\$195. Close-Up LAN is priced according to the number of users. The 2-user price is \$395; the 8-user price is \$795; the 16-user price is \$995; the 32-user price is \$1,295; and the 64-user price is \$1,495. ■



# Novell NetWare Lite

## Product Enhancement

Novell has released an entry-level, peer-to-peer network operating system dubbed NetWare Lite that supports up to 25 users. A peer-to-peer network operating system allows each user to make files available to all other users. In effect, each workstation can also act as a server. Printers connected to any workstation can also be accessed by all users.

At \$99 per workstation, NetWare Lite offers a strong challenge to the several peer-to-peer LAN operating systems already on the market, and provides a major enticement to potential buyers with its full file compatibility with NetWare v3.11 and v2.2. NetWare Lite network segments can also attach directly to NetWare v2.2 or v3.11 segments and servers since NetWare Lite uses the standard Novell IPX/SPX transport protocol. NetWare Lite operation is similar to the other versions of NetWare, and the full-screen menu facility will appear familiar to experienced NetWare users. NetWare Lite is compatible with popular interface cards from 3Com; Western Digital; Standard Microsystems; and Eagle Technologies, the company that has taken over the former Novell hardware product line.

A copy of NetWare Lite must be purchased for each workstation to be connected. The complete NetWare Lite system is contained on two 5.25-inch disks, or one 3.5-inch diskette, and installation of the system is very simple. Only one manual is

included with the package. Novell Lite users can choose from several configuration options—while the network supports peer-to-peer operation in which each machine can share files with every other machine, it also allows the creation of dedicated server machines and client-only machines.

Memory usage is quite low. A client-only configuration uses only 25K bytes of RAM. A dedicated server or client and server configuration uses 50K bytes.

NetWare Lite is compatible with Windows 3.0 and with all versions of MS-DOS from 3.x through 5.0, as well as Digital Research DR DOS 6.0. Apropos of the Novell/Digital Research merger expected to be finalized early in the fourth quarter, the two companies are offering a limited-time promotional offer under which a copy of DR DOS 6.0 is included with each purchase of NetWare Lite.

NetWare Lite is equipped with a message transmission facility for communication between users. Network management features include automatic logging of network activity and errors, and network management tasks can be performed from any workstation. Access to shared resources can be restricted if necessary, and password security is provided. A single password allows users access to all shared resources.

NetWare Lite is expected to begin shipping early in the fourth quarter. Foreign-language versions for French-, Italian-, Spanish-, and German-speaking users are expected to be available in early 1992. ■



---

# Novell NetWare Network Operating Systems

---

## In this report:

Analysis .....	-102
Characteristics.....	-105
Pricing.....	-114

## Product Summary

### Editor's Note

Novell's announced intention to acquire Digital Research and its alliance with IBM for resale of NetWare are two of the highlights of an exciting year for the network operating system giant. Novell has also taken several steps in recent months to streamline the NetWare product line and to reposition NetWare for the future.

### Description

A family of multitasking LAN operating systems and associated application, management, and interconnectivity software.

### Strengths

Nearly complete dominance of the network operating system market, coupled with a complete product line offering connectivity to all industry-standard platforms. NetWare installation procedures have been greatly simplified in the latest releases.

### Limitations

No significant limitations.

### Competition

Microsoft LAN Manager, IBM LAN Server, Banyan VINES.

### Vendor

Novell, Inc.  
122 E. 1700 S.  
Provo, UT 84601  
(801) 379-5900  
In Canada:  
Novell Canada, Ltd.  
4100 Young Street  
Suite 104  
Willowdale, ON M2P 2B5

### Price

Novell NetWare Version 2.2 for five users costs \$895. The 100-user version costs \$5,495. NetWare Version 3.11 starts at \$3,495 for 20 users. The 250-user version costs \$12,495.

### GSA Schedule

No.

---

—By John Krick  
Associate Editor

# Analysis

## Product Strategy

The latest big news about Novell in a year of big news about Novell is the intended merger between Novell and Digital Research, Inc. (DRI). Digital Research was one of the pioneers of the microcomputer industry, first coming to prominence in the late 1970s with its CP/M operating system. CP/M was overtaken by MS-DOS after the debut of the IBM PC in the early 1980s, but the design of DOS was heavily influenced by CP/M. Now, ironically, the tables have turned, and DRI is promoting a DOS clone called DR DOS. DR DOS is touted as a more capable operating system than MS-DOS with better memory management and file handling capabilities. Novell's bid to buy DRI, if approved by DRI stockholders, will give Novell the capability to build a tightly integrated client-server network operating system. Rather than being constrained by whatever future moves Microsoft may make with MS-DOS, Novell could now attain the lofty heights that only Microsoft commanded before—the position of a full system software supplier to the microcomputer industry. Perhaps most interesting is the fact that the impetus that first pushed Microsoft to those heights is now behind Novell—IBM.

## NetWare + Big Blue

In February, Novell made a significant alliance with IBM for resale of NetWare—in blue boxes—to IBM customers. The industry weeklies were rife with speculation about the meaning of this new alignment, especially in the context of the much-publicized “cooling off” of the relationship between IBM and Microsoft. The Novell-Digital Research merger can only strengthen Novell's position as a serious challenger to Microsoft's dominance.

Whether IBM will totally abandon its OS/2 LAN Server product to embrace NetWare remains to be seen. IBM is almost certainly looking to maximize profits in the LAN segment by whatever

means it can. In a world populated by *Fortune* 500 firms that are filled with both NetWare LANs and large-scale IBM computers, reaching an understanding with Novell makes eminently good sense. For Novell, having IBM-sanctioned access to Big Blue's accounts will undoubtedly have an enormous effect on Novell's revenue. Some analysts went as far as predicting a doubling of income for the next year, even before the Digital Research deal was announced. Speculation has already begun that IBM may have in mind the adoption of DR DOS as its standard OS for the PC. If that happened, Novell earnings would certainly be propelled into the stratosphere.

Beyond the immediate gains for both companies, it is certain that Novell is interested in positioning NetWare for the environments of the future. Along with the IBM NetWare resale deal, the company also announced its intention to produce a version of NetWare that runs on top of the OS/2 operating system, and another version for IBM's UNIX-based RISC System/6000.

That Novell should want to develop a NetWare that runs under OS/2 may seem problematic to the casual observer, especially in view of the fact that the conventional wisdom holds OS/2 to be a dead issue. A moment's thought about what Novell stands to gain from undertaking such development might convince the doubtful that the decision is based on strong business sense. Novell now markets and maintains a rich selection of IBM connectivity software that is necessary to attach NetWare LANs to the whole range of large IBM systems. NetWare running under OS/2 will no longer require these products as the IBM OS/2 Communications Manager will handle all of that.

## A Leaner, Meaner Product Line

Early this year, Novell also announced two new versions of its NetWare product—including a major consolidation of its midrange and entry-level products that streamlines the Novell line and ends stratification. NetWare Version 2.2 combines the features of four earlier versions of NetWare—SFT NetWare, Advanced NetWare v2.15, NetWare ELS Level I, and NetWare ELS Level II—into one consistent product. A new version of its high-end product, formerly NetWare 386, now dubbed NetWare Version 3.11, was also released with many new connectivity options that allow NetWare

**Table 1. NetWare Features Summary**

	NetWare 2.2	NetWare 3.11
DOS 3.x Support	Yes	Yes
DOS 4.0 Support	Yes	Yes
Windows 3.0 Support	Yes	Yes
OS/2 v1.3 Support	Yes	Yes
Macintosh Support	Yes	Yes*
NFS UNIX Support	No	Yes*
OSI FTAM Support	No	Yes*
SPX/IPX	Yes	Yes
NETBIOS	Yes	Yes
DOS Named Pipes	Yes	Yes
OS/2 Named Pipes	Yes	Yes
TCP/IP	No	Yes
AppleTalk	Yes	Yes*
Dynamic Configuration	No	Yes
Workgroup Management	No	Yes
Password Encryption	Yes	Yes
Async. Remote Bridge (COM1/COM2)	Yes	Yes
Resource Accounting	Yes	Yes
Enhanced Security	Yes	Yes
SFT Level I & II	II	II
UPS Monitoring	Yes	Yes
NetWare Name Service	Yes*	Yes*
NetWare Remote Management Facility	No	Yes
Bus Support	MCA, ISA	MCA, ISA, EISA
Users Configurations	5, 10, 50	20, 100, 250
Topologies Supported	100+	~15
Add-on LAN Drivers Supported	Yes	Yes
Internetworking	Yes	Yes
Maximum Disk Storage (1)	2GB	32TB
Maximum File Size (1)	256MB	4GB
Maximum Number of Open Files	1,000	100,000

(1) All maximums may not be supported concurrently. Subject to availability of hardware technology.

\*Available separately.

LANs to participate in multiple platform, multiple protocol environments.

Among these new options, three stand out: NetWare for Macintosh v3.0, NetWare NFS, and NetWare FTAM. These options provide connectivity to three sets of protocols that are achieving

much wider acceptance in the industry—the Macintosh/AppleTalk, TCP/IP, and OSI/GOSIP environments, respectively.

On the hardware side of the house, Novell has almost completely exited from the market in the

## Company Profile Novell, Inc.

### Corporate Headquarters

122 E. 1700 S.  
Provo, UT 84601  
(801) 379-5900

### In Canada

Novell Canada, Ltd.  
4100 Young Street  
Suite 104  
Willowdale, ON M2P 2B5  
(416) 224-2464

### Officers

*Chairman & CEO:* Raymond J. Noorda  
*Executive VP of Sales:* James C. Bills  
*Executive VP Marketing and Sales:* Darrell Miller

### Company Background

Novell's NetWare, considered the industry's de facto standard for PC LAN network operating systems, is another of the computer industry's remarkable success stories.

Novell began its corporate existence as Novell Data Systems in late 1979. A pair of entrepreneurs, George Canova and Jack Davis, founded the firm with \$500,000 in seed money from Safeguard Scientific Inc. They planned to develop a line of intelligent terminals to

compete against similar products from Sperry Corp.

Not long after Novell Data Systems was formed, however, came the Apple computer and the advent of the microcomputer industry. As a viable product, the intelligent terminal was clearly doomed. Novell Data Systems scrapped its plans for terminals and began development of an eight-bit, CP/M-based microcomputer, the Nexus I. By the time the Nexus I was shipped in 1981, however, the microcomputer industry had been changed forever by the introduction of the IBM Personal Computer.

By 1982, Novell Data Systems was in serious trouble. Both founders had left the company, and Safeguard Scientific, the original investors, had assumed control. Only about 20 employees remained, from a high of well over 100. The company's product line consisted of CP/M-based microcomputers and printers, which had been made virtually obsolete by the DOS-based IBM PC and its growing legion of imitators.

There was one interesting product, though. Novell Data Systems' management had given a short-term programming assignment to a development firm called the Superset Group to improve

past year, selling off whatever it could—most notably its Macintosh-specific items acquired from Kinetics and Excelan. The popular FastPath LocalTalk-to-Ethernet router went to Shiva, and adapter cards for attaching PCs to LocalTalk went to Farallon. Shiva and Farallon are both strong players in the rapidly expanding Macintosh connectivity arena.

## Competitive Position

### NetWare vs LAN Manager

NetWare remains the clear leader in network operating systems and will probably remain so for some time to come. The LAN segment of the computer industry, however, is perhaps the most volatile part of a volatile industry. Microsoft's LAN Manager, originally positioned as a NetWare killer, has failed to make much of a dent in the industry leader's sales. Now, with Novell's recent alliance with IBM and its proposed acquisition of Digital Research, LAN Manager's position and its future have become even more uncertain.

Despite the fact that many in the industry scoff at LAN Manager's slow penetration in the network market, it has gathered backing of a sort that ensures that it will not go away. Certainly the computer industry has seen some notable strategic failures over the years, but if a product that IBM, AT&T/NCR, Digital Equipment Corp., Hewlett-Packard, and many others have championed were to fail completely, that would be an unprecedented occurrence. A gradual advance by LAN Manager seems to be a much more likely scenario. That advance probably would not entail a corresponding decline in sales of NetWare.

The LAN market, by all projections, is going to continue to expand quite rapidly through the first half of the nineties. That expansion will almost certainly allow plenty of room for the growth of both network operating systems.

## Decision Points

At this point, Novell NetWare remains the premier choice in network operating systems. It is almost as



the CP/M operating system for Novell Data Systems' microcomputers. The Superset Group, consisting of four Brigham Young University graduates, developed ShareNet, a LAN operating system that linked IBM PCs running DOS and Z80-based microcomputers running CP/M for resource sharing. ShareNet became the basis for NetWare.

Unwilling to liquidate the firm, the Safeguard Scientific management team recruited Ray Noorda, an industry veteran with a reputation as a corporate turnaround specialist. Noorda concentrated on the network software,

now called NetWare, discarding most of the unsuccessful hardware products. In January 1983, the company was incorporated as Novell, Inc. Noorda's decision to concentrate on LAN software as the cornerstone of the company's business would turn a floundering microcomputer maker into a LAN industry giant.

From 1983 to 1987, Novell's annual sales virtually doubled each year. Novell became a publicly owned company in February 1985 and now employs over 1,500 people. The company attributes much of its success to its "PC-centric" vision of computing: that the personal computer will increasingly

become the center of the computing environment and the window to other computing resources. It is certainly ironic that the PC revolution, which nearly caused Novell's demise in 1982, is primarily responsible for Novell's success today.

In December 1990, Novell reported record revenues for the fiscal year ended October 28, 1990. Revenues for 1990 were \$497 million, up from \$422 million in fiscal 1989. Net income for the year was \$94.3 million, up 94 percent from the \$48.5 million reported in 1989. Earnings for 1990 came in at \$1.36 per share, reflecting a two for one stock split that occurred in July. By this reckoning,

fiscal 1989 earnings of \$1.46 per share, are now calculated to have been \$0.73 per share.

Novell chairman and CEO, Raymond J. Noorda, wrote in his introduction to the 1990 Annual report: "We expect to continue to meet our business objectives of serving customer needs and accelerating the growth of network computing. We are building creative partnerships with others in our industry, while also working at many levels to simplify our business. For the customers, these strategies combine to further the maturity, reliability, and utility of network computing."

if the question of what network operating system to employ on a LAN of any size has to be posed as: NetWare—or something else. There are fewer and fewer alternatives out there these days. Despite the fact that new entry-level network operating systems keep appearing (WEB Corp.'s WEB network operating system is a case in point), a larger number are disappearing. At the high end, the choice is between LAN Manager and NetWare. At the low end between NetWare and Artisoft's LANtastic? WEB? Hayes' LANstep?

All but the most cost-conscious of small network builders seem to choose an entry-level version of NetWare. The availability of so many options for growth and interconnectivity could be the reason. The consolidation of NetWare products into NetWare v2.2 should make Novell even more attractive to the small user.

The large user faced with the task of connecting to diverse computing resources—especially the IBM SNA environment—probably already has a substantial number of NetWare LANs in his or her organization. The new relationship between Novell and IBM could bring substantial benefits for such

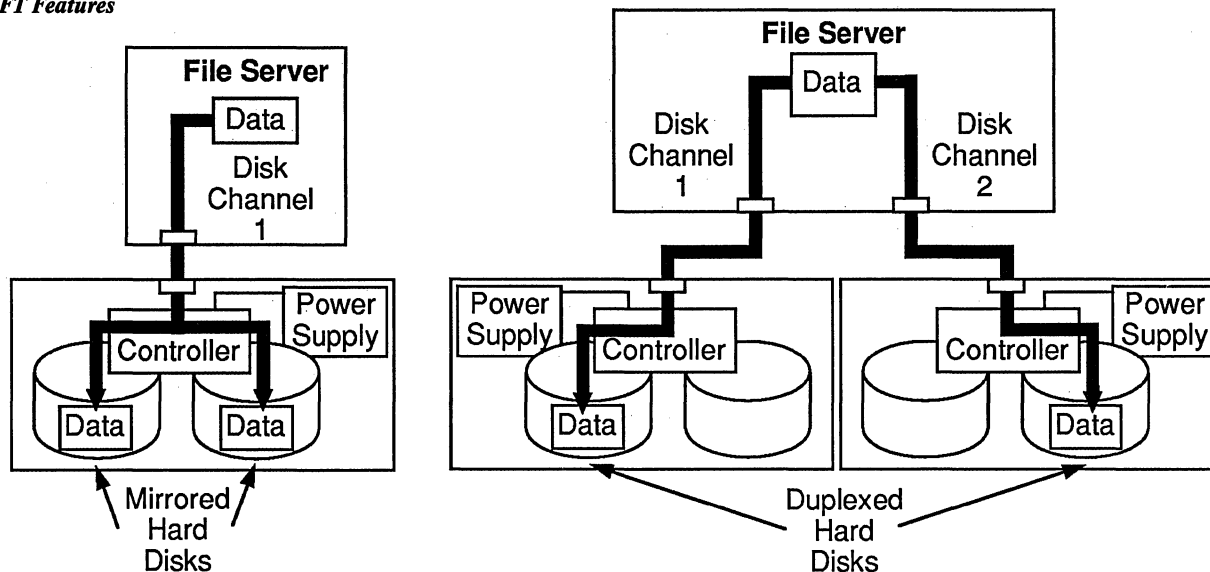
corporate users. For those users who may have been considering a change to Microsoft LAN Manager because of IBM's support, the waters have become a great deal muddier in recent months. Such users might want to reconsider any large investment in LAN software, at least until they are sure of the direction that the two major players—and IBM—will finally take.

## Characteristics

**Model:** Novell NetWare Version 3.11, Novell NetWare Version 2.2, and various supporting programs.

**Date of Announcement:** Novell NetWare Version 3.11: February 1991; Novell NetWare Version 2.2: March 1991.

Figure 1.  
SFT Features



*Disk Mirroring (left) and Disk Duplexing (right) are two of the System Fault Tolerant (SFT) features previously available only in the high-end SFT NetWare and now offered in all versions of NetWare v2.2. Disk mirroring duplicates any disk write actions to a second, identical disk to ensure that a complete backup of critical information always exists. Disk duplexing provides the same kind of redundancy, but also adds duplicate disk controller circuitry for additional protection.*

**Date First Installed:** Novell NetWare Version 3.11:  
March 1991; Novell NetWare Version 2.2: March 1991.

**Number Installed:** Approximately 900,000 NetWare  
networks of all types installed worldwide.

**Distribution:** Dealers, distributors, VARs, and OEMs.

## Architecture

Novell NetWare is a multitasking, server-based network operating system that supports all network topologies—Ethernet, token-ring, Arcnet, and broadband. NetWare supports multivendor hardware and applications through its Integrated Computing Architecture, which allows seamless integration of diverse computing environments such as DOS, OS/2, UNIX, Macintosh, and the IBM Systems Network Architecture (SNA). All common transport protocols are also supported, including NETBIOS, TCP/IP, and AppleTalk, as well as Novell's own Internetwork Packet Exchange (IPX), originally derived from the Xerox XNS protocol.

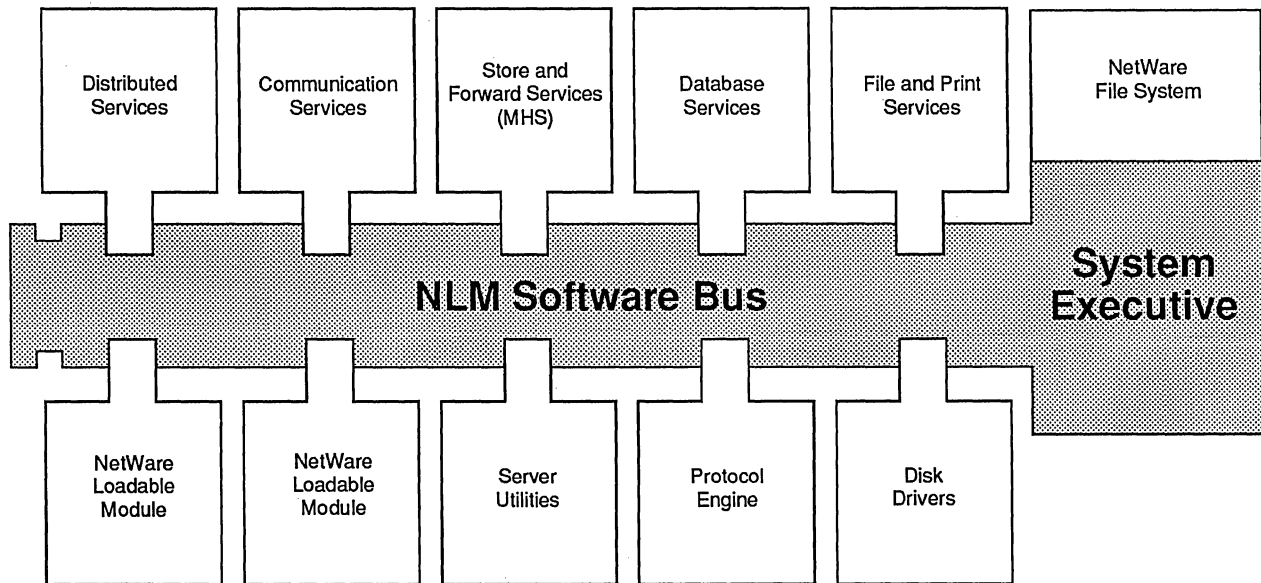
Novell has optimized NetWare for use as a server operating system by incorporating many design features traditionally associated with larger computing environments. It is built around a multitasking kernel capable of supporting the demands of multiuser network operation. It uses a method of driving the disk read head called "elevator seeking" that assigns priority to read requests based on the current position of the read head to minimize head movement and provide the

fastest response. It also uses disk caching in which frequently accessed data is kept in RAM on the server, and also employs a "read-ahead" capability that caches data in anticipation of future read requests. A background write scheme allows disk writes to take place when no other disk activity is in process, thus speeding read access times. NetWare also can address multiple hard disk channels simultaneously, so that several reads can take place at once. File Allocation Tables (FATs) for files larger than 2M bytes are indexed by NetWare to reduce search time.

NetWare uses several methods to ensure the reliability of disk operations. Read-after-write verification, duplication of directory structures and FATs, and Hot Fix disk error correction are standard, while System Fault Tolerant (SFT) features, such as disk mirroring and duplexing and Transaction Tracking System (TTS) rollback capability, can be implemented at the network builder's discretion.

NetWare security is implemented at several levels—password, account, file, directory, and internet-network security are all provided. System administrators set up user profiles that specify resources and rights available to each user, as well as dates, times, and locations from which a user can log on. Passwords are encrypted before they pass over the network cabling and are stored on the server in encrypted format. Security features are supported for all client workstations regardless if their native operating system is DOS, Windows, OS/2, or UNIX.

Figure 2.  
NetWare v3.11 NLM Architecture



This illustration shows the modular architecture of NetWare v3.11, in which the NetWare Loadable Modules (NLMs) are loaded on top of the core System Executive. This modular construction allows software modules to be loaded and unloaded from memory without bringing down the server. Network managers can also easily upgrade modules or add new ones. Third-party developers can build modules of their own using the NetWare CLIB system calls.

## Software

**NetWare v3.11:** NetWare Version 3.11 is the high-end NetWare product—a 32-bit multitasking operating system designed for Intel 80386- and 80486-based hardware platforms. NetWare v3.11 is built around a central kernel called the System Executive. All network services, server-based applications, and server utilities are implemented as modular pieces that can be added to or removed from the system without bringing the server down. These NetWare Loadable Modules (NLMs) access system functions using the C-Library (CLIB). In addition to the NLMs supplied with the NetWare v3.11 NOS, including the OS/2 File Requester, the NetWare Print Server, and MHS store-and-forward message services, NLMs are available for Apple Macintosh connectivity, the Sun Network File System (NFS), and OSI FTAM file transfer. Access to CLIB function calls allows third-party vendors to offer NLMs for their own server-based applications such as database management systems.

NetWare v3.11 requires at least 4M bytes of RAM in the server. Memory requirements increase as additional NLMs are added.

**NetWare v2.2:** NetWare Version 2.2 is a new product that combines the features of (and replaces) four older versions—SFT NetWare, Advanced NetWare Version 2.15, NetWare ELS Level I, and NetWare ELS Level II. NetWare v2.2 is available in versions for 5, 10, 50, and 100 users, but all these sizes offer identical features.

NetWare v2.2 supports the System Fault Tolerance (SFT) Level II features previously available only in the high-end SFT NetWare product. SFT Level II features include disk mirroring; disk duplexing; and the Transaction Tracking System, which insures the integrity of files by providing a rollback capability that is in effect whenever a write operation is performed. Any event that could interrupt a transaction, such as a system crash, will cause all files to be "rolled back" to their status before the transaction began.

**NetWare Print Server:** Included with all versions of NetWare, the NetWare Print Server allows access to up to 16 printers attached to file servers, dedicated print servers, external bridges, or workstations. The NetWare Print Server can service print queues on up to eight file servers simultaneously, and it offers flexible configuration options: multiple printers can service a single queue, a single printer can service multiple queues, or one printer can service one queue. NetWare Print Server requires 384K bytes of RAM on a nondedicated machine such as a file server or external bridge. A dedicated print server needs 256K bytes of RAM. A hard disk is not required on a print server.

**NetWare Backup VAP:** Included with NetWare v2.2, the NetWare Backup VAP resides on a server or external bridge that is equipped with a tape drive. Multiple servers can be backed up from a centrally located server console. Administrators can specify times for automatic backups to occur, and either full or selective backups

can be performed. Full backups close all files and disable logins across the network when performed. Selective backups of directories and files can take place while the network is in operation. Open files are simply skipped over, and the backup process is invisible to users.

## NetWare Services

**NetWare for Macintosh v3.0:** Available in 20- and 100-user versions, NetWare for Macintosh v3.0 allows Macintosh users to access NetWare v3.11 servers using the Macintosh Chooser and AppleShare client software. Files stored on NetWare servers are represented by icons in the Macintosh Graphical User Interface. PC applications that share a format with their Macintosh counterparts—Aldus PageMaker, Microsoft Word and Excel, WordPerfect, and others—can share files without translation. Files from other PC applications can be converted using third-party translation utilities. This version also allows PCs to share Apple LaserWriter and ImageWriter printers through NetWare print queues. NetWare for Macintosh v3.11 is the first NetWare/Macintosh product to support the AppleTalk Filing Protocols directly on the NetWare server. Version 3.11 thus offers increased speed over earlier versions, including v2.2 described in the following paragraph, which use a Service Protocol Gateway (SPG) to allow Macs to access the NetWare File System. NetWare for Macintosh supports AppleTalk Phase I and Phase II and AppleTalk routing.

**NetWare for Macintosh v2.2:** Included with NetWare v2.2, NetWare for Macintosh v2.2 is implemented as a Value-Added Process on the NetWare server. It shares most of the features of NetWare for Macintosh v3.0 described in the previous paragraph.

**NetWare Requester for OS/2:** Included with NetWare v3.11 and NetWare v2.2, the NetWare Requester for OS/2 allows OS/2 workstations to access NetWare servers. OS/2 application servers running distributed applications such as Microsoft SQL Server, Oracle Server for OS/2, and Lotus Notes, can also be accessed by NetWare-attached OS/2 and DOS workstations. The NetWare Requester for OS/2 supports Named Pipes for DOS and OS/2, NETBIOS, and Novell's SPX/IPX transport protocols. The NetWare Requester for OS/2 supports Microsoft and IBM OS/2 Standard Edition and IBM OS/2 Extended Edition.

**NetWare NFS:** NetWare NFS allows UNIX workstations that use the Sun Microsystems Network File System (NFS) to connect to Novell NetWare v3.11 servers using the TCP/IP protocols bundled with NetWare v3.11. NetWare NFS is implemented through several NetWare Loadable Modules (NLMs):

- NFS Server NLM allows UNIX workstations to access NetWare servers using the UNIX Mount command and supports authentication, file attribute and

filename mapping, file locking, permissions mapping, and remote system administration.

- UNIX Namespace NLM provides native UNIX file attributes and naming conventions so that UNIX clients can transparently access all NetWare files and share files across all environments supported by NetWare including OS/2 and Macintosh.
- Line Printer Daemon (LPD) NLM allows UNIX clients to access NetWare print queues.
- File Transfer Protocol Daemon (FTP) NLM allows access to FTP, the standard TCP/IP file transfer protocol.
- Lock Manager NLM supports file and record locking in the NFS environment.

NetWare NFS requires a minimum of 5M bytes of RAM on the server and 3M bytes of free hard disk space on the volume on which NetWare NFS is installed.

**NetWare FTAM v1.1:** NetWare FTAM is a server implementation of the OSI File Transfer and Management protocol that allows file transfer between NetWare servers and any third-party OSI FTAM client system including U.S. GOSIP, U.K. GOSIP, and MAP 3.0 FTAM clients. FTAM filenames follow UNIX naming conventions. NetWare FTAM requires at least 6M bytes of RAM (depending on network operating system configuration and number of workstations supported) and 1M byte of free hard disk space. The server must be connected to an IEEE 802.2-compliant network. NetWare FTAM requires NetWare v3.11 with the Streams and CLIB NLMs installed.

**NetWare for VMS:** NetWare for VMS allows Digital Equipment Corp. VAX minicomputers to act as servers in NetWare networks. PC files can be stored on the VAX, allowing users to take advantage of the large storage capacity of the VAX, as well its dependable security and backup features. NetWare for VMS also offers transparent file sharing between PC users and VMS users, with automatic file format translation. PC users can access the VAX/VMS print queues.

## NetWare IBM Connectivity Products

**NetWare for SAA:** NetWare for SAA is Novell's product for connecting NetWare LANs to the IBM Systems Application Architecture (SAA), IBM's evolving communications environment that embraces its entire product line, from microcomputers to mainframes. Built around a module called the Communications Executive, NetWare for SAA is the first in a new series of Communications Services products. Both the Communications Executive and NetWare for SAA are implemented as NetWare Loadable Modules (NLMs). NetWare for SAA supports up to 64 display, printer, or Advanced Program-to-Program Communications (APPC) host sessions. NetWare for SAA can be run in what Novell calls an "integrated configuration," that is, on a server with

other network applications, or in a "dedicated configuration," as the only application on a server dedicated to the Communication Executive.

**NetWare SNA Gateway:** The NetWare SNA Gateway offers four different host connection options—coaxial, CoaxMux, remote, and token-ring—allowing up to 97 LAN-attached PCs to communicate with an SNA mainframe or midrange computer.

- Coaxial option supports up to five display and printer sessions.
- CoaxMux supports up to 40 display and printer sessions over a single coaxial connection.
- Remote option supports up to 128 display and printer sessions on up to 97 workstations through a synchronous modem connection to a 37XX front-end processor. In the U.S., speeds of up to 56K bps are supported; 64K bps is supported where possible.
- Token-Ring option supports up to 128 display and printer sessions on up to 97 token-ring-attached workstations. The host connection can be through a 3174, 3270, 3275, 3745, 9370, or AS/400 token-ring attachment.

**NetWare SNA Gateway ELS:** NetWare SNA Gateway ELS is an entry-level gateway that allows up to 16 LAN-attached PCs to communicate with an SNA mainframe or midrange computer. Two connection options are supported: coaxial and remote.

- Coaxial supports up to five host display and printer sessions.
- Remote supports up to 16 display and printer sessions through a modem connection to a 37XX front-end processor at speeds up to 19.2K bps.

**NetWare 3270 LAN Workstation for DOS:** 3270 LAN Workstation is terminal emulation software used with either of the NetWare SNA Gateways or with NetWare for SAA. Up to five sessions per workstation are supported.

**NetWare 3270 CUT Workstation:** The NetWare 3270 CUT (Control Unit Terminal) Workstation is software that allows a standalone PC to emulate an IBM 3278 or 3279 display terminal for communication with an IBM mainframe via coaxial connections to the host or a cluster controller. It supports a single host session and one DOS session, and requires an IBM PC, PS/2, or compatible with at least one disk drive, and a coaxial adapter such as the IBM 3270 Convertible Adapter or the DCA IRMA Convertible.

**NetWare 3270 Multi Workstation:** NetWare 3270 Multi Workstation allows a standalone PC, PS/2, or compatible to emulate an IBM DFT terminal for up to five 3278/9 display and 3287 printer sessions, and one DOS session. The PC can be connected to the IBM host via coaxial, SDLC, or token-ring connections, and a token-ring

server option is also offered that allows any workstation on a token-ring LAN to access the five sessions. Only one workstation at a time can access them, however, and Novell recommends this product for customers who need to connect to an IBM host on an infrequent basis and cannot justify the purchase of a full-function LAN gateway. NetWare 3270 Multi Workstation requires 256K bytes of memory and an appropriate interface card for coaxial, SDLC, or token-ring attachment.

**NetWare 3270 Vector Graphics Option:** The NetWare 3270 Vector Graphics Option adds graphics capability to one host display session by emulating an IBM 3179 G color graphics terminal. It runs with either the NetWare 3270 LAN Workstation connected through the NetWare SNA Gateway, or with the NetWare 3270 Multi Workstation. Mainframe graphics applications such as GDDM 4.0, SAS/GRAPH, DISSPLA, and TELLAGRAF are supported.

**NetWare 5250 Gateway Version 2:** The NetWare 5250 Gateway is software that allows LAN access to the IBM AS/400 and System/3X midrange environments by turning a PC or PS/2 into a gateway server. The 5250 Gateway can be used in either dedicated or nondedicated modes. The nondedicated mode allows the NetWare 5250 LAN Workstation software to run on the same PC. A PC or PS/2 used as a gateway requires a twinax adapter card for local connection or an SDLC card for remote connection to the IBM midrange host.

**NetWare 5250 LAN Workstation:** Used with the 5250 Gateway previously described, the NetWare 5250 LAN Workstation allows LAN-attached PCs to emulate IBM 3180, 3196, 5251 5291, and 5292 displays, as well as several types of IBM printers. Up to five concurrent display and printer sessions and one DOS session per workstation are supported, and users can switch to a DOS session using a "hotkey."

**NetWare LU6.2 Tools:** The NetWare LU6.2 Tools are a set of programming examples and reference materials to aid programmers in creating LU6.2 peer-to-peer applications to run on Novell's SNA Gateway products and NetWare for SAA. They support coaxial, SDLC, and token-ring connections to multiple IBM hosts.

**NetWare 3270 Tools:** NetWare 3270 Tools provides four APIs—the NetWare 3270 High Level Language API (HLLAPI), NetWare 3270 IBM Low-Level API, NetWare 3270 API, and NetWare 3270 IRMAR Compatibility API (CAPI). Sample programs, source code, API drivers, reference manuals, and a powerful command processor are also included.

### **NetWare TCP/IP Connectivity Products**

**LAN WorkPlace for DOS v4.0:** LAN WorkPlace for DOS allows DOS and Windows users to access any systems that use the industry-standard TCP/IP protocols. LAN

WorkPlace clients can connect to TCP/IP hosts on the same network segment or, through TCP/IP routers, to hosts on another segment. LAN WorkPlace for DOS supports most standard TCP/IP utilities including the File Transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP), and UNIX Remote Copy (rcp). It includes remote command execution using the UNIX remote shell (rsh) and remote execute (rexec) commands. LAN WorkPlace for DOS can run under Microsoft Windows 3.0 and is shipped with Windows-ready modules that support Telnet terminal emulation and FTP file transfer. LAN WorkPlace for DOS requires a minimum of 512K bytes of RAM. Additional memory is required to run LAN WorkPlace under Microsoft Windows.

**LAN WorkPlace for OS/2:** LAN WorkPlace for OS/2 is similar to the DOS version previously described, but takes advantage of the multitasking capabilities of OS/2 to allow multiple sessions to TCP/IP hosts to run concurrently on a single workstation. If used in conjunction with the NetWare Requester for OS/2, LAN WorkPlace for OS/2 users can also access NetWare servers.

**LAN WorkPlace for Macintosh:** LAN WorkPlace for Macintosh performs functions similar to the other LAN WorkPlace products previously described, but uses all the features of the Macintosh user environment. Up to eight sessions can be run in separate windows simultaneously. Macintoshes require at least 1M byte of RAM to run LAN WorkPlace for Macintosh, and can be connected to a TCP/IP Ethernet network in two ways—over LocalTalk via a LocalTalk-to-Ethernet router such as the Shiva FastPath, or through a direct Ethernet connection using an adapter card. The Macintosh operating system must be Version 6.02 or greater, and both the AppleShare client software and NetWare for Macintosh must be running.

**LAN WorkPlace for DOS Developer's Toolkit:** This is a C language runtime programming library used to write distributed applications that run on TCP/IP networks. The Socket Library API, based on the Berkeley 4.1 BSD socket library, supports the Lattice and Microsoft C compilers. The NETBIOS API allows developers to write distributed applications that use the IBM NETBIOS interface for network communications. The Telnet API is used in development of networked terminal emulation programs. The LAN WorkPlace for DOS Developer's Toolkit requires an IBM PC, PS/2, or compatible with 512K bytes of RAM, DOS 3.1 or higher, and the LAN WorkPlace TCP/IP driver set.

**LAN WorkPlace for OS/2 Developer's Toolkit:** Similar to the Developer's kit for DOS previously described, the LAN WorkPlace for OS/2 Developer's Toolkit provides the Socket Library API and the NETBIOS API. It requires an 80286-based or greater PC or PS/2 running OS/2, a network adapter card with NDIS drivers, and a separate adapter if the NetWare Requester for OS/2 is run.

**TCPort Developer's Kit:** The TCPort Developer's Kit allows development of distributed Macintosh applications that run on TCP/IP networks. It includes two TCP/IP transport systems—Novell TCPort and Apple MacTCP—as well as the 4.3 BSD socket library API that allows developers to work in a familiar UNIX programming environment. Also included are the NETBIOS API that supports the industry-standard IBM LAN communication protocol and the Telnet API that enables network operation of terminal emulation programs. The TCPort Developer's Kit requires a Macintosh with at least 1M byte of RAM; at least one 800K-byte diskette drive; and a connection to an Ethernet network, either direct, using an Ethernet adapter card, or through a LocalTalk gateway such as the Shiva FastPath.

### NetWare X.25/Wide Area Network Products

**NetWare X.25 Gateway:** The NetWare X.25 Gateway runs in an IBM PC, PS/2, or compatible and provides multiple NetWare workstations with access to a public or private X.25 packet-switching network. The X.25 Gateway uses a synchronous modem and supports line speeds from 1200 bps to 64K bps, but speeds of 56K bps and higher usually require a CSU/DSU connection to the X.25 network. A basic ASCII TTY terminal emulator is included, but the X.25 gateway also supports a number of full-featured emulation packages from third-party vendors. The X.25 Gateway supports two transport protocols—Novell SPX/IPX and IBM NETBIOS. Running SPX/IPX, the gateway supports up to 97 users and 97 virtual circuit sessions. Using NETBIOS, it supports 97 users and up to 254 virtual circuit sessions. Depending on the capabilities of the terminal emulation software used, a single user can run up to eight simultaneous sessions.

**NetWare Link/X.25:** NetWare Link/X.25 connects a NetWare network to up to 11 remote networks over a single line using multiplexed virtual X.25 circuits. It supports only an external router configuration.

**NetWare Link/64:** An entry-level solution for LAN-to-LAN connectivity over wide area facilities, NetWare Link/64 allows connection to remote networks via synchronous communication lines and supports speeds from 9600 bps to 64K bps.

**NetWare Link/T1:** Supporting speeds from 9600 bps to 2.048M bps, NetWare Link/T1 is designed to enable high-speed, synchronous LAN-to-LAN communications.

### Other NetWare Communications Products

**NetWare MHS:** NetWare MHS, or Message Handling Service, is the server-based, store-and-forward messaging component of NetWare. Not an electronic mail application itself, MHS provides the transport mechanisms for such applications, including modem control, protocol handling, and error checking. Beyond simple

electronic mail, developers can use MHS as the transport for any application that requires communication between network nodes, including Electronic Data Interchange (EDI) and workgroup software. MHS runs in a dedicated server on a NetWare network and requires 300K bytes of RAM. Since MHS can be booted over the network, it can run in a diskless workstation. MHS can also run on a DOS co-processor board in a NetWare file server. A standalone version of MHS for DOS and an MHS Developer's Kit that contains several programming tools and documentation are also offered.

**NetWare Asynchronous Remote Router:** Although Novell refers to this product as a "router," it is actually a bridge. It can connect NetWare LANs to one or more remote networks over asynchronous dial-up lines at speeds up to 9600 bps. It requires an IBM PC AT or compatible based on an Intel 80286 or greater, and 512K bytes of RAM to run on a dedicated machine in real mode. On a nondedicated machine, such as a file server, 640K bytes of RAM are required to run in real mode, 1M byte to run in protected mode. Novell cautions against using a file server as a router if line speeds of over 1200 bps are used. Slower file server performance can result from such a configuration. The NetWare Asynchronous Remote Router can use the COM1 or COM2 serial ports of a PC, or can support up to eight serial ports on add-in adapter cards.

**NetWare Access Server:** The NetWare Access Server allows up to 15 remote users to dial in to a NetWare network for access to files, applications, electronic mail, and gateways to mainframes and minicomputers. The NetWare Access Server requires a dedicated 386 or higher PC. It divides the CPU into a number of virtual 640K-byte machines, depending on the amount of memory available.

**NetWare Asynchronous Communications Server (NACS):** The NetWare Asynchronous Communications Server (NACS) allows up to 16 workstations to dial in to or out from a NetWare LAN. NACS runs on an IBM PC, PC AT, or compatible, turning it into a communications server through which pooled modems can be accessed.

### **NetWare Database Products**

**NetWare Btrieve:** Included with all versions of NetWare, NetWare Btrieve is a key-indexed record management system implemented as a client-server application. Btrieve is composed of two modules—a server-based Record Manager and a Requester for the client workstation. Under NetWare v3.11, Btrieve is implemented as a NetWare Loadable Module that can be loaded or unloaded at the server at any time. Running under NetWare v2.2, Btrieve is implemented as a Value-Added Process (VAP). NetWare Btrieve can support

custom application front ends written in a variety of programming languages including C, Pascal, Basic, and Cobol. Over 25 libraries for various compilers are included.

**NetWare SQL:** NetWare SQL, based on Novell's Btrieve, is a high-performance Structured Query Language (SQL) relational database engine. NetWare SQL supports the DOS, Windows, and OS/2 environments, and allows a choice of two versions of the SQL Requester: one that performs data conversion and formatting on the client workstation, and one that performs these tasks on the server. The workstation version of the Requester requires more memory on each workstation, but speeds network application performance. NetWare SQL supports many popular front ends including Lotus 1-2-3, and developers can build their own front ends to NetWare SQL using a programming language and the XQL APIs, or using a third-party development tool. NetWare SQL is offered in two versions: A Value-Added Process (VAP) version for NetWare v2.x, and a NetWare Loadable Module (NLM) version for NetWare v3.x.

**Btrieve v5.10 Developer's Kits:** Available in versions for DOS, OS/2, and Microsoft Windows, the Btrieve Developer's kits include tools to build Btrieve distributed applications for NetWare networks. Included are a Record Manager component for client workstations; language interfaces for C, Pascal, Cobol, Basic, Fortran, APL, and Assembler; developer utilities for file creation and manipulation; and a programmer's manual with API documentation.

**XQL v2.11:** XQL is a developer's kit for NetWare SQL that can be used to create distributed applications for the NetWare XQL server. Available in versions for DOS or OS/2, it requires DOS v3.1 or greater, or OS/2 Standard or Extended Edition v1.x, and either C, Pascal, Basic, or Cobol. Fourteen different compilers are supported for these languages. Programmers can use XQL to call subroutines from any of these languages and to embed SQL statements in C code. XQL also supports stored SQL statements on the server, which reduces the amount of time both the workstation and the server spend processing SQL calls and thus reduces network traffic.

**Xtrieve PLUS v4.01a:** Xtrieve PLUS is a menu-driven relational browser that works with Btrieve and NetWare SQL and allows users quick access to data stored in Btrieve files for the creation of reports. Statistical analysis, sorting, and data import and export are all supported within Xtrieve. Users can customize the menu and command files and build macros for their own Xtrieve environment. Xtrieve is available in versions for DOS and OS/2 workstations.

**Report Executive:** The Report Executive is an optional utility for Xtrieve PLUS that is available only to developers who are including Xtrieve PLUS in their applications.



The Report Executive uses less memory space than the report generator included with Xtrieve and can be loaded independently of the Xtrieve application.

### NetWare Network Management Products

**NetWare Name Service:** NetWare Name Service allows users access to multiple servers with a single login. Administrators can organize servers in logical groups called domains. Users can then access resources transparently from several servers. Changes made to the user environment are automatically made to all servers in the domain. When a user logs in to a domain, a login script called a profile is executed that establishes the network environment appropriate to his or her workgroup. When changes need to be made to the configuration of that workgroup environment, an administrator can make those changes to a single domain profile, rather than changing the login scripts for each user.

**NetWare Remote Management Facility:** The NetWare Remote Management Facility (RMF) allows administrators to manage remote network segments from any location over internetwork connections or asynchronous lines. RMF is implemented as a set of NetWare Loadable Modules and thus can be run only on NetWare v3.x. The RCONSOLE virtual console utility allows any file server console command to be entered from a remote workstation. Network managers can troubleshoot and maintain remote networks, and even install a NetWare 3.x at the remote site using RMF. RMF provides a utility called RSETUP that allows the administrator to build the basic network operating system for a remote site on a 1.2M-byte diskette and send it to that site. When this basic system is installed at the remote site, the administrator can complete the setup process over the internetwork communications links.

**LANalyzer Network Analyzer:** The LANalyzer Network Analyzer is a network monitoring and troubleshooting tool that can be used to record network activity, diagnose network problems, and assess performance on both Ethernet and token-ring networks. The LANalyzer consists of hardware and software components that are installed in an IBM PC AT or compatible. It provides nine receive channels for analysis of incoming network data, including one global channel and eight user-definable channels. Ready-to-use test suites can be loaded to provide predefined troubleshooting tests for Ethernet, token-ring, NetWare, AppleTalk, DECnet, NFS, TCP/IP, and OSI. LANalyzer versions are offered for Ethernet and for token-ring, and a Starlan adapter kit is also available for the Ethernet version.

**LANtern Network Monitor for Ethernet:** The LANtern Network Monitor is a hardware network management device based on a Motorola 68020 CPU with 1M byte of memory, expandable to 2M bytes. It reports statistical data and problem indications to an SNMP network management console. It can be used with most third-party

SNMP network management packages at the console and communicates with the console over the network or over an out-of-band serial channel, which can be connected remotely over phone lines. The LANtern Network monitor works with all types of Ethernet networks—coaxial, twisted-pair, or broadband—and can also monitor network segments separated from it by bridges or routers. Its operation is independent of the protocol in use on the network.

**LANtern Services Manager:** LANtern Services Manager is a network management software package based on the Simple Network Management Protocol (SNMP). It communicates with the LANtern Network Monitor devices previously described both over the network and through an out-of-band serial channel. LANtern Services Manager runs under Microsoft Windows 3.0 and automatically generates a graphical network map showing all connected devices. Network performance statistics are delivered in spreadsheet-ready formats and are supplied for each connected station. User-definable alarm thresholds allow tailoring of the alarm system to the needs of the specific site, and alarms can be delivered across the network or to remote locations via an automatic dial-out capability.

**NetWare Care:** NetWare Care is a network management and diagnostic application that monitors and displays configuration changes, error conditions, and performance data. It can generate a graphic map of the network showing every node, its address, its type (server, workstation, etc.), and the name of its user. Performance statistics can be graphed and printed. Two versions of NetWare Care are available—Level I for local connections only, and Level II, which provides management capabilities over an internetwork, through NetWare IPX routers.

### NetWare Programming Languages

**C Network Compiler/386:** C Network Compiler/386 is based on the WATCOM C Compiler, an ANSI C-compliant compiler, and allows the development of NetWare v3.11 NetWare Loadable Modules (NLMs) for use on 80386-based servers. It includes an editor, a full-screen debugger, a linker, the NetWare API library, and the NetWare Btrieve library. The Graphics library supports MDPA, CGA, EGA, MCGA, VGA, and Hercules standards. The C Network Compiler/386 allows developers to embed SQL statements within C code to access NetWare SQL from database applications. Express C, a fast C compiler for prototyping and debugging, is also included. An application design tutorial that includes information about network application development and source code for Btrieve and NetWare API calls is also supplied.



**Network C for DOS:** Network C for DOS offers features similar to the C Network Compiler/386 previously described, but runs on any 80X86-based machine and is primarily intended for the development of client applications.

**NetWare C Interface for DOS:** The NetWare C Interface for DOS is a set of compiled libraries that allow NetWare system calls to be used in C source code for four popular C compilers—Novell/WATCOM, Borland, Microsoft, and Lattice. Documentation, program examples, and C source code are also included.

**NetWare System Calls for DOS:** NetWare System Calls for DOS provides instructions for making NetWare system calls in Intel 80X86 assembler code. Descriptions of each system call, parameters, programming examples, and commentary are included.

**NetWare RPC:** NetWare RPC is a package of development tools for creating Remote Procedure Calls (RPCs). RPCs enable the creation of process-to-process communications by an extension of the concept of the procedure call used in programming. A program, during its operation, can call a block of code outside the main body of the program that may be a subroutine or a system function. Remote Procedure Calls enable the calling and called programs to reside on different machines. NetWare RPC consists of an RPC compiler, a network library, RPC extensions, and server control procedures. NetWare RPC was developed by NetWise Corp. Two versions of NetWare RPC are offered—NetWare RPC for DOS, which requires the NetWare v2.1 or greater network operating system, and NetWare RPC/386 for the NetWare/386 v3.0 or greater (i.e., NetWare v3.11) system.

---

## Support

### Installation, Maintenance, and Support

**Novell Support Organization (NSO):** The Novell Support Organization program certifies third-party service organizations to perform installation, on-site service, and hot line support. The requirements for membership in the program include staffing by Certified NetWare Engineers (CNEs) and maintenance of hot line and on-site call response times, among others. Current NSO members include BancTec, Bell Atlantic/CGI, Digital Equipment, Federal Technologies, Hewlett-Packard, Intel, Intelogic Trace, Prime, Unisys, and Xerox.

**Novell Technical Services:** Novell Technical Services provides telephone technical support directly to Novell users on a support incident basis. A support incident is defined as the resolution of one specific NetWare-related problem regardless of the number of calls required to resolve it. Support incidents are offered in two forms—Front Line Incidents, which are single incidents

purchased at the time of the call; and Prepaid Incidents, which are multiple incidents purchased ahead of time.

**NetWire Information Service:** The NetWire Information Service is a 24-hour NetWare bulletin board offered on the CompuServe Information Service. It includes NetWare user forums, message boards, file libraries for download, compatibility directories, and a calendar of Novell training courses and other events. CompuServe users can access NetWire by typing GO NOVELL.

**NetWare UpDate:** NetWare UpDate, along with NetWare UpGrade, replaces the former NetWare Assurance program. NetWare UpDate is a subscription service for users of the most current versions of NetWare that provides all updates, patches, fixes, and enhancements for a period of one year. Users not at the current version of their NetWare product must purchase NetWare UpGrade described in the following paragraph.

**NetWare UpGrade:** NetWare UpGrade allows users to receive the most current version of their NetWare product at a discount, or upgrade to a higher level product. The program includes a six-month subscription to the NetWare UpDate program previously described.

### Training

**Novell Authorized Education Centers:** Novell authorizes qualified organizations to establish Novell Authorized Education Centers (NAECs). At present, there are over 750 NAECs around the world.

**Certified NetWare Engineer (CNE):** The CNE program trains user technical staff, independent service organizations, and reseller personnel to maintain NetWare networks. CNE certification is highly regarded in the industry, and the testing process required to obtain it is rigorous.

**Certified NetWare Instructor (CNI):** Certified NetWare Instructors provide training at NetWare Authorized Education Centers. An intensive train-the-trainer program, coupled with periodic update training, is conducted at Novell's own Novell Education Centers.

**Other Training Courses:** Novell offers over 30 courses aimed at specific groups with varied professional interests in NetWare. Courses for users, resellers, system managers, technical and engineering support personnel, and developers are offered covering nearly all aspects of NetWare use, maintenance, and development. In addition, Novell offers several Computer-Based Training (CBT) courses that can be purchased by individuals or organizations.

## Software Prices

	Purchase Price (\$)
<b>NetWare v3.11</b>	
NetWare v3.11 250-user	12,495
NetWare v3.11 100-user	6,995
NetWare v3.11 20-user	3,495
<b>NetWare v2.2</b>	
NetWare v2.2 100-user	5,495
NetWare v2.2 50-user	3,495
NetWare v2.2 10-user	1,995
NetWare v2.2 5-user	895
<b>NetWare Services</b>	
NetWare for Macintosh 100-user	895
NetWare for Macintosh 20-user	200
NetWare Requester for OS/2 v1.1	200
NetWare FTAM	4,995
NetWare NFS	4,995
<b>NetWare for VMS Version 2.1</b>	
NetWare for VMS Class I	5,500
NetWare for VMS Class II	8,500
NetWare for VMS Class III	13,500
NetWare for VMS Class IV	19,500
NetWare for VMS Class V	26,500
<b>NetWare IBM Host Connectivity Products</b>	
NetWare 3270 Multiworkstation	475
NetWare 3270 CUT Workstation	350
NetWare 3270 LAN Workstation	995
NetWare 5250 LAN Workstation	200
Token-Ring Server Option	3,995
NetWare 3270 SNA Gateway ELS	595
NetWare 3270 SNA Gateway	2,995
NetWare 5250 SNA Gateway	550
NetWare 3270 Tools	100
NetWare LU6.2 Tools	600
<b>NetWare TCP/IP Connectivity Products</b>	
LAN Workplace for DOS 10-user	1,995
LAN Workplace for DOS single-user	450
LAN Workplace for OS/2	495
LAN Workplace for Macintosh single-user	250
<b>NetWare X.25/Wide Area Network Products</b>	
NetWare X.25 Gateway	550
NetWare Link/X.25	1,750
NetWare Link/64	1,495
NetWare Link/T1	3,995
NetWare Asynchronous Remote Bridge	395
NetWare Asynchronous Multipoint Bridge	1,750
<b>NetWare Remote PC Access Products</b>	
Upgrade for ACS	195
NetWare Access Server	1,995
<b>NetWare Asynchronous Gateway Products</b>	
NetWare Asynchronous Communications Server (NACS)	1,495
Upgrade to NACS from ACS 1.xx	900

**Purchase  
Price  
(\$)**
**NetWare Database Products**

Btrieve for DOS	245
Btrieve for Windows	595
Btrieve for OS/2	595
NetWare SQL (per-user license)	595
NetWare SQL/386	1,495
Xtrieve Plus for DOS	595
Xtrieve Plus for OS/2	595
Report Executive for DOS	145
Report Executive for OS/2	145
XQL for DOS	795
XQL for OS/2	795

**NetWare Network Management Products**

NetWare Name Service	1,995
LANalyzer kit for Ethernet	9,980
LANalyzer kit for token-ring	9,980
LANalyzer kit for 4/16M bps token-ring	11,980
LANalyzer Starlan Adapter kit	495
LANtern Network Monitor for Ethernet	4,495
LANtern Services Manager	4,995

**NetWare Programming Languages**

NetWare C Interface	295
NetWare System Calls for DOS	195
NetWare RPC for DOS	950
NetWare RPC/386	1,750
Network C for DOS	1,195
C Network Compiler/386	995

# Novell LANalyzer Series



**In this report:**

Analysis ..... -202  
 Characteristics..... -208  
 Pricing..... -210

**Product Summary**

**Editor's Note**

Because Novell acquired Excelan in 1989, the former Excelan LANalyzer EX5000 Series is now Novell's LANalyzer product line.

**Description**

The LANalyzer is a high-performance, interactive, portable LAN testing device. It can be configured for any combination of Ethernet, token-ring, or Starlan capability.

**Strengths**

The LANalyzer's specialized hardware can simultaneously transmit and receive packets, allowing the network manager to simulate traffic and monitor its impact at the same time. Protocol decodes have been expanded significantly.

**Limitations**

Novell does not yet offer 16M bps token-ring capability, although it expects to do so in the fourth quarter of 1990.

**Competition**

AR Division of Telenex, Navtel, Digilog, Dynatech Data Systems, Tekelec, Spider Systems, Hewlett-Packard, and others.

**Vendor**

Novell, Inc.  
 LANalyzer Products Division  
 2180 Fortune Drive  
 San Jose, CA 95131  
 (408) 434-2300

**Price**

Kit price is \$9,980; system price varies, depending on platform.

**GSA Schedule**

Yes.

# Analysis

## Product Strategy

This report examines the following Novell LANalyzer products:

- LANalyzer Network Analyzer
- LANalyzer Network Analyzer Ethernet Kit
- LANalyzer Network Analyzer Token-Ring Kit

## Recent Enhancements

Novell has recently added the following enhancements to the LANalyzer:

- Application test suite
- On-line troubleshooting guide
- Multichannel monitoring

These features are explained in the following text.

## Application Test Suite

The Application Test Suite (ATS) lets novice and experienced users exercise the LANalyzer's analysis and diagnostic capabilities. Testing routines are predefined, so the network manager need only input the criteria. The LANalyzer then completes the test. More than 40 preprogrammed applications for troubleshooting and performance management are included. These include NetWare, TCP/IP, AppleTalk, and DECnet. More experienced users can develop customized tests, which can speed up later analysis. See Figures 1 and 2.

## On-Line Troubleshooting Guide

The on-line troubleshooting guide uses menus to direct users step-by-step through the testing process. It suggests probable causes for disruptions on the network and recommends the next test procedure to confirm the diagnosis. With help available at each stage, analysis and diagnosis are greatly accelerated and simplified.

## Multichannel Monitoring

Multichannel monitoring provides a realtime graphics display of network activity. It gives users a view of the complete network. The LANalyzer can gather information on up to nine different channels simultaneously. (A channel is a set of conditions for categorizing network traffic in realtime.) Each channel can filter up to 16 criteria, capturing specific information, separating pertinent data from unrelated network traffic. Data is displayed in realtime and can be captured for later analysis and report generation. See Figure 3.

## Additional Features

Novell emphasizes the following special features that it believes make the LANalyzer unique among LAN testers:

- True utilization
- Collision detection and tracking
- Token rotation time
- Network characterization
- Simultaneous transmit and receive
- User-definable triggers
- Multiple, user-definable alarms
- Full protocol decodes
- Specialized hardware

## True Utilization

The LANalyzer can determine true network utilization, including that caused by what Novell calls "dirt" on the network: collisions, jam patterns, small packets, and packets with damaged preambles. By quantifying the "dirt," the LANalyzer lets the user detect problems such as a misconfigured network or a network with malfunctioning repeaters, transceivers, or fan-out units. Novell points out that network analyzers that use standard hardware can only infer usage from the traffic they can see—namely, good packets and certain error packets.

## Collision Detection and Tracking

The user can employ the LANalyzer to detect collisions on an Ethernet network and track down their source. (A collision occurs when two stations attempt to gain access to the network simultaneously.) The LANalyzer can detect collisions and

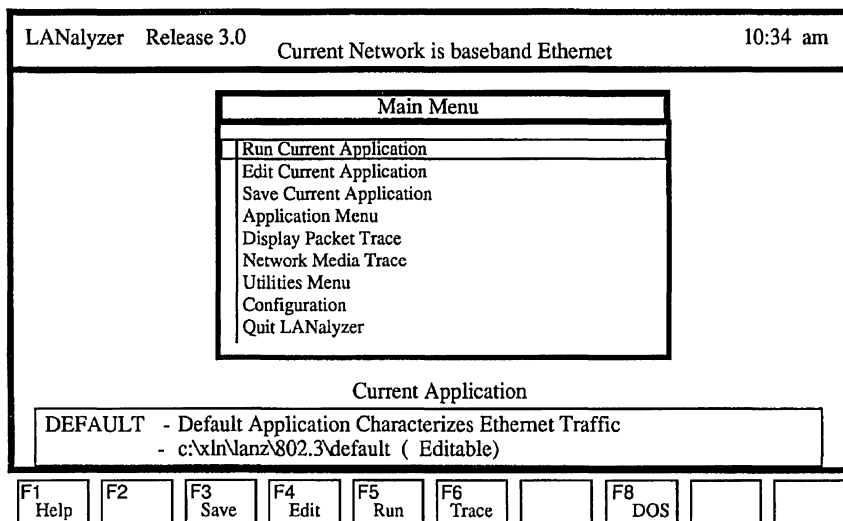


Figure 1.  
*Initial Screen for Ethernet*

*This initial screen lets the user select and run an application to help pinpoint a network malfunction.*

provides a collision tracking utility and application notes for detecting the problem and finding its cause.

### Token Rotation Time

The LANalyzer lets the user monitor the average token rotation time on a token ring. (This indicates the average delay that an individual station encounters when trying to transmit a packet.) This feature can also indicate if the ring is too large, if it is improperly configured, or if it contains malfunctioning components.

### Network Characterization

The LANalyzer allows the user to monitor as many as eight user-defined categories (or channels) of network traffic. The LANalyzer, for example, can monitor traffic to and from each network server, or it can zoom in on a particular server to examine how intensively it is being used by each station on the network. Users can thus determine the optimum distribution of users across servers as well as how the network should be segmented. The eight input channels are configured by the user; it is the user, therefore, who generates whatever tests are important to that particular network. LANalyzer software contains a library of more than 40 of the most commonly used predefined setups.

### Simultaneous Transmit and Receive

The LANalyzer simultaneously transmits and receives packets. Users can therefore communicate with workstations and servers on a Novell NetWare network as well as with TCP/IP stations or

other machines that support echo function. The LANalyzer can also generate a load to simulate additional users on the network, and the user can then monitor the network to see how the additional load affects it.

### User-Definable Triggers

Users can program the LANalyzer to start and stop programming according to customer-specific criteria. These criteria may include the time of day and network traffic levels. The LANalyzer's multichannel capability makes it more flexible than test equipment constrained by predefined options.

### Multiple, User-Definable Alarms

Multiple channels give the LANalyzer multiple-alarm capability. Alarms can be linked to a given situation, such as an acceptable threshold of activity that, when exceeded, alerts monitoring personnel. Alarms can also alert managers to the presence of an intruder on the network.

### Full Protocol Decodes

LANalyzer captures and displays all protocol layers of the OSI model for NetWare, Novell NETBIOS, TCP/IP, SNMP, AppleTalk Phases I and II, DECnet, and XNS protocols. See Figure 4.

### Specialized Hardware

The newest version of the Novell LANalyzer's special circuitry offers such advantages as the capability to transmit and receive packets simultaneously and to gain a global view of the network.

## Company Profile Novell, Inc.

### Corporate Headquarters

122 East 1700 South  
Provo, UT 84606  
(801) 429-7900

### In Canada

Novell Canada, Ltd.  
3100 Steekes Avenue  
East  
Markham, ON L3R 8T3  
(416) 940-2670

### Officers

*Chairman and CEO:* Raymond J. Noorda  
*Executive VP of Sales:* James C. Bills  
*Executive VP Software Group:* Darrell Miller

### Company Background

Novell is another of the computer industry's remarkable success stories. The company began its corporate existence as Novell Data Systems in late 1979. A pair of entrepreneurs, George Canova and Jack Davis, founded the firm with \$500,000 in

seed money from Safeguard Scientific Inc. They planned to develop a line of intelligent terminals to compete against similar products from Sperry Corp.

Not long after Novell Data Systems was formed, however, the Apple computer was introduced and with it the advent of the microcomputer industry. As a viable product, the intelligent terminal was clearly doomed. Novell Data Systems scrapped its plans for terminals and began development of an 8-bit, CP/M-based microcomputer, the Nexus I. By the time the Nexus I was shipped in 1981, however, the microcomputer industry had been changed forever by the introduction of the IBM Personal Computer.

By 1982, Novell Data Systems was in serious trouble. Both founders had

	Fiscal 1989	Fiscal 1988
Net revenue	\$421.9 million	\$347.0 million
Net income	\$48.5 million	\$35.9 million
Operating expenses	\$203.3 million	\$146.0 million
Net income per share	\$1.46	\$1.09

left the company, and Safeguard Scientific, the original investor, had assumed control. Only about 20 employees remained, from a high of well over 100. The company's product line consisted of CP/M-based microcomputers and printers, which had been made virtually obsolete by the DOS-based IBM PC and its growing legion of imitators.

There was one interesting product, though. Novell Data Systems' management had given a short-term programming assignment to a development firm called the Superset Group to improve the CP/M operating system for Novell Data Systems' microcomputers. The Superset Group, consisting of four Brigham Young University graduates, developed ShareNet, a LAN operating

system that linked IBM PCs running DOS and Z80-based microcomputers running CP/M for resource sharing. ShareNet became the basis for NetWare.

Unwilling to liquidate the firm, the Safeguard Scientific management team recruited Raymond Noorda, an industry veteran with a reputation as a corporate turnaround specialist. Noorda concentrated on the network software, now called NetWare, discarding most of the unsuccessful hardware products. In January 1983, the company was incorporated as Novell, Inc. Noorda's decision to concentrate on LAN software as the cornerstone of the company's business would turn a floundering microcomputer maker into a LAN industry giant.

## LANalyzer Products

### LANalyzer Network Analyzer

The LANalyzer Network Analyzer is built on a PC-compatible NEC PowerMate Portable SX platform, which contains an EXOS network analyzer board. The LANalyzer product family includes network analyzers for Ethernet/IEEE 802.3 LANs and for token-ring/IEEE 802.5 LANs. A system providing both Ethernet and token-ring support in the

same unit is available for mixed network environments. Optional Starlan support is available with the Ethernet version.

The LANalyzer can monitor network activity, troubleshoot problems, debug protocol and application software, and fine-tune performance for a variety of local area networking hardware, software, and protocols. Novell emphasizes that the LANalyzer's Ethernet board detects early collisions

From 1983 to 1987, Novell's annual sales virtually doubled each year. Novell became a publicly owned company in February 1985 and now employs over 1,500 people. The company attributes much of its success to its "PC-centric" vision of computing: that the personal computer will increasingly become the center of the computing environment and the window to other computing resources. It is certainly ironic that the PC revolution, which nearly caused Novell's demise in 1982, is primarily responsible for Novell's success today.

In June 1989 Novell completed a merger with Excelan, Inc., whereby Excelan became a wholly owned subsidiary of Novell. About 5,230,912 shares of Novell common stock were exchanged for all the outstanding Excelan common stock.

Novell reported record revenues for the fiscal year ended October 28, 1989, of \$422 million, up from \$347 million in fiscal 1988. Net income for the year was \$48.5 million, up

35 percent from the \$35.9 million reported in 1988. Earnings for 1989 came in at \$1.46 per share; fiscal 1988 earnings were \$1.09 per share.

#### **Management Statement**

In its annual report, Novell states that its business strategy is to be a leading supplier of connectivity software products for the network computing industry. "We have already more than offset our strategic reduction in hardware revenue with higher margin software revenue," said Raymond Noorda, chairman, president, and chief executive officer of Novell, in a press release. "Fiscal 1989 marked the year of Novell becoming a connectivity software company. Two years ago less than 50 percent of Novell's sales were attributed to software. For the quarter we are reporting today [fourth quarter 1989], over 70 percent of revenues represent software sales."

Novell regards itself as a systems software company that is able to meet

customers' present needs and future challenges. The company is committed to moving out of the hardware business. During the fourth quarter of fiscal 1989, software revenue reached 72 percent of net sales, and for the year reached 67 percent. By comparison, in fiscal 1988 only 54 percent of net sales were software related.

Novell has opted to assume a role of responsible leadership in the networking computing industry. The company believes that, through its efforts, mainframe, mini, and PC vendors share in the industry growth Novell is promoting. Novell wants to grow network computing for the success of all its industry partners.

The Excelan merger immediately added to Novell's expertise in network communications protocol technology addressing Apple Macintosh, UNIX, and Digital Equipment VAX computers, as well as OS/2 and DOS computers.

Novell's strategic move away from hardware is based on the belief that software determines what computer networks can do for its customers. This move has allowed the company to increase product development spending to a high of 11 percent of sales during the third and fourth quarters of 1989. Previously, Novell had spent about 7 or 8 percent of net sales on product development.

Novell's role has always been to accelerate the growth of the network computing industry and to provide responsible leadership in this sector of the market. Over the last seven years Novell has set a new standard for sharing information among distributed desktop computers, network servers, and mainframes and minicomputers. That standard is Novell's NetWare server operating system software.

not recognized by standard LAN controllers, and the token-ring analyzer board senses token rotation time.

The LANalyzer monitors and captures selected Ethernet or token-ring packets based on criteria and triggers that the user specifies. Thus, users can see the overall network picture as well as focus on a particular station. Network statistics can be viewed in realtime or saved in a DOS file. The LANalyzer can search for up to eight different conditions at the same time; these conditions can include network addresses, errors, packet sizes, and

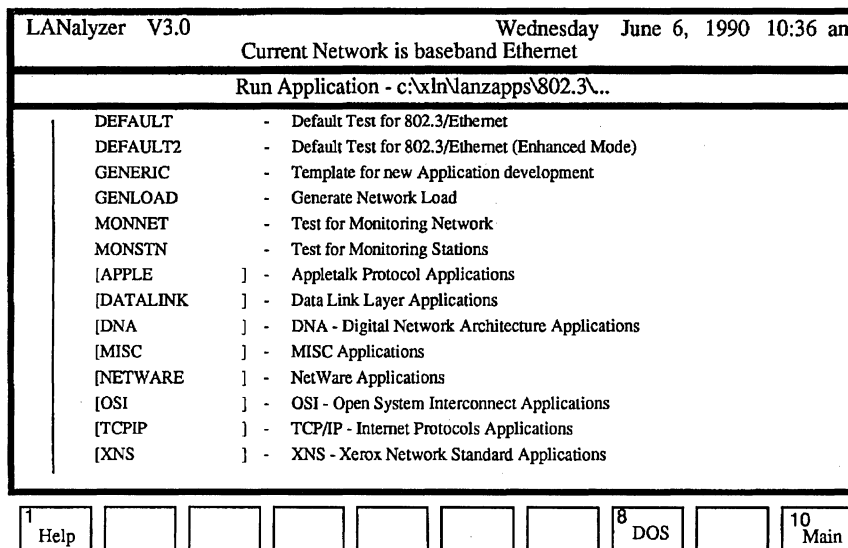
data patterns. Novell emphasizes that the LANalyzer user interface is designed to require little training, so users can start running standard tests quickly.

#### **LANalyzer Network Analyzer Ethernet Kit**

Novell's LANalyzer Network Analyzer Ethernet Kit comprises an EXOS 325 network analyzer board designed to be installed in an IBM PC/AT or compatible; LANalyzer system software; and the LANalyzer application library.

**Figure 2.**  
**Application Test Suite Menu**

*The Applications Test Suite contains more than 40 pre-programmed applications for troubleshooting and network management. These applications are automated for easy use, prompting users for specific diagnostic criteria and then running the test.*



Installing the LANalyzer Ethernet Kit lets the user monitor network activity, troubleshoot problems, debug protocol and application software, and fine-tune the performance of an Ethernet/IEEE 802.3 network. Users may also install the Starlan adapter board (discussed in the Characteristics section), thus having both Ethernet and Starlan interfaces in the same unit.

The LANalyzer Ethernet Kit monitors and captures Ethernet packets based on user-defined criteria and triggers, monitors network activity by station, displays statistics in realtime and stores them in a DOS file, checks cable, and generates controlled amounts of traffic and decode protocols.

Statistics displayed include collision counts, cyclic redundancy check (CRC) errors, short packets, instantaneous and average usage, and a count of packets that match various filtering criteria. The system searches for up to eight user-defined criteria at once, including network addresses, errors, packet size, and data patterns. The user can accurately pinpoint very specific problems on the network. In fact, the LANalyzer can filter data before it is captured, thus reducing the rate of data acquisition and enabling the user to save data to the disk.

Novell points out that the user interface is simple and easy to learn; a predefined test can be run with only a few keystrokes. A mouse interface is also supported. The application library has an extensive choice of test templates that can be edited, run, or used to make other tests. The library is discussed more fully in the Characteristics section of this report.

### LANalyzer Network Analyzer Token-Ring Kit

The LANalyzer Network Analyzer Token-Ring Kit comprises an EXOS 325TR network analyzer board; LANalyzer system software; and the LANalyzer application library. The board is designed to be installed in an IBM PC/AT or compatible.

Installing the LANalyzer Token-Ring Kit lets the user monitor and capture token-ring packets based on user-defined criteria; monitor token-ring network activity by station; troubleshoot problems; debug protocol and application software; display statistics in realtime and save them to a DOS file; generate controlled amounts of network traffic and decode protocols; and fine-tune the performance of any IEEE 802.

Statistics displayed include MAC frames, ring recoveries, token rotation time, average and instantaneous usage, and the count of packets matching various filtering criteria. The system searches for up to eight user-defined criteria at once, including network addresses, errors, packet size, and data patterns.

Novell points out that the user interface is simple and easy to learn; predefined tests can be run with only a few keystrokes. A mouse interface is also supported. The application library has an extensive choice of test templates that can be edited, run, or used to make other tests. The library is discussed more fully in the Characteristics section of this report.

### Competitive Position

The LAN market itself has seen a more or less amicable resolution between the adherents of Ethernet



networks and those of token-ring systems. The LAN tester market, however, is quite competitive. It has attracted the interest of many U.S.-based vendors as well as foreign ones.

Like other vendors in this market, Novell offers a LANalyzer version housed in another manufacturer's terminal—in this case an IBM PC-compatible NEC PowerMate Portable SX. Also like other vendors, Novell offers kit versions, the main element of which is a printed circuit board (PCB) that fits into an IBM PC/AT or compatible.

As far as price is concerned, Novell's \$9,980 for its kit version makes it competitive with other LAN testers. Comparable products in Datapro's 1990 survey of test, monitor, and control equipment were priced at about \$10,000.

### Decision Points

The LANalyzer network analyzer is aimed at network planners, installers, and network managers. Its specialized hardware is designed to solve problems typical of a heterogeneous computing environment. The LANalyzer is particularly valuable because of its integrated packet analysis (protocol decodes), including NetWare, TCP/IP, and DECnet. Kanwal Rekhi, a Novell executive vice president, has pointed out that the LANalyzer has over 3,000 units in use worldwide, which according to Rekhi makes it the largest installed base of network analysis tools.

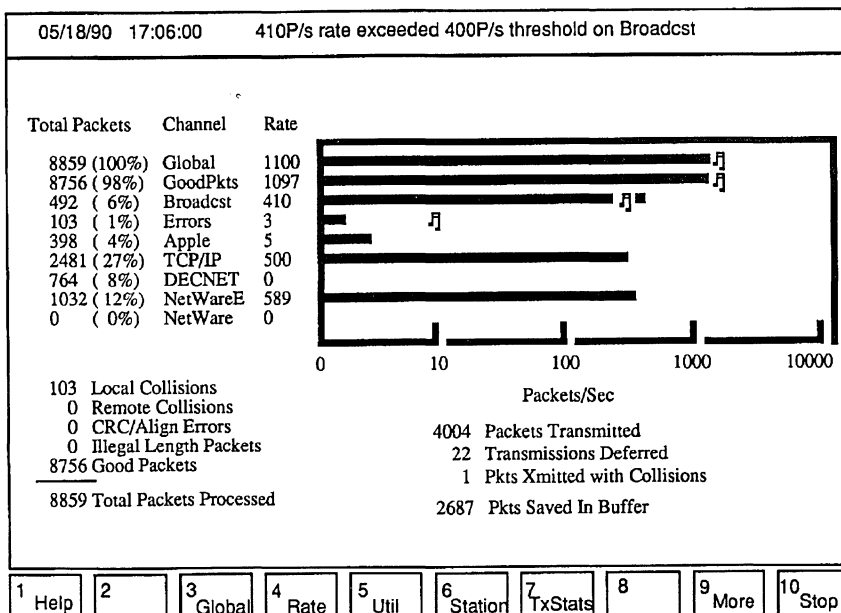
Two of Novell's chief competitors are Spider Systems and Network General. Both Novell and Network General employ baseband and broadband transmission techniques, while Spider uses baseband only. Spider offers a memory capacity of 640K bytes; Network General offers 6M bytes; Novell offers 2M bytes, but this is expandable to 16M bytes. The following protocols are supported by these three vendors:

*Spider Systems:* TCP/IP, XNS, ISO, LAT, IPX, AppleTalk, Novell NetWare

*Network General:* TCP/IP, XNS, ISO, DECnet, SNA, AppleTalk, VINES, Sun, Novell NetWare (X-Windows)

*Novell:* TCP/IP, XNS, DECnet, NetWare, Novell NETBIOS, SNMP, AppleTalk Phases I and II

Novell enjoys a distinct advantage over many competitors in that its LANalyzer captures and decodes data packets from all seven protocol layers. This is a real advantage for software developers because this feature facilitates protocol development and helps the user locate software bugs as they occur on the network.



**Figure 3.**  
**Multichannel Monitoring for Ethernet**

The LANalyzer can simultaneously gather information on up to nine separate channels. This screen shows that the LANalyzer is monitoring global network usage. It has also been configured to capture specific types of data, such as good packets, bad packets, or Ethernet packets, while monitoring AppleTalk, TCP/IP, DECnet, and NetWare traffic. The musical notes represent alarms that have been set to alert managers when traffic reaches unacceptable levels.

# Characteristics

**Product:** Novell LANalyzer Series: LANalyzer Network Analyzer, LANalyzer Network Analyzer Ethernet Kit, LANalyzer Network Analyzer Token-Ring Kit.

**Number Installed to Date:** Over 3,000

**Serviced by:** Novell

## System Description

### LANalyzer Network Analyzer

The Novell LANalyzer is built on an IBM PC-compatible NEC PowerMate Portable SX platform. The LANalyzer comprises the following components:

- One NEC PowerMate Portable SX computer with EXOS 325 and/or EXOS 325TR network analyzer board(s)
- LANalyzer software on 3.5-inch diskettes
- LANalyzer documentation: installation guide, reference manual, and application library

The LANalyzer offers 386SX performance, 2M bytes of DRAM (optionally expandable to 16M bytes), a 42M-byte hard disk, and a high-resolution plasma display screen.

The unit comes with one 1.44M-byte, 3.5-inch diskette drive, one parallel port, one serial port, an external fiber-distributed data (FDDI) connector, and an RGB connector for an external VGA monitor.

The LANalyzer's large buffer capacity stores up to twenty-nine hundred 512-byte packets when operating with Ethernet LANs, and up to sixty-six hundred 256-byte packets when testing token-ring LANs. The following table shows the realtime statistics that the LANalyzer provides:

LAN Type	Statistics
Ethernet	Collision counts, CRC/align errors, size errors
Token-Ring	MAC frames, ring recoveries, token rotation time
Both	Instant and average usage, counters for filtering criteria

The LANalyzer can monitor up to 600 stations in real-time.

An EXOS 325TR board is available for token-ring operation. It offers full IEEE 802.5 compliance at 4M bps and full IBM token-ring compliance at the same rate.

A Starlan adapter board is also available. It operates at a data rate of 1M bps and offers full IEEE 802.3 1BASE5 compliance.

### LANalyzer Network Analyzer Ethernet Kit

The LANalyzer Ethernet kit comprises the following components:

- One EXOS 325 Ethernet network analyzer board
- LANalyzer software on either a 5.25-inch or 3.50-inch diskette
- LANalyzer installation guide, reference manual, and application library

The following predefined network tests are built into the Novell LANalyzer Ethernet kit:

- Traffic generator
- Test to monitor stations
- Test to filter common packet types

The LANalyzer Ethernet kit has flexible start and stop triggers; start and stop events can include keyboard input, packet activity on a selected receive channel, and relative or absolute times. The LANalyzer Ethernet kit can receive a filter matrix of 16 filters of up to 128 bytes. Bytes for filtering criteria can occur anywhere within the packet. Templates provide an easy way to set up filters. The unit's buffer stores up to twenty-nine hundred 512-byte packets, and it offers a timestamp resolution of 1 ms.

The following realtime statistics are provided:

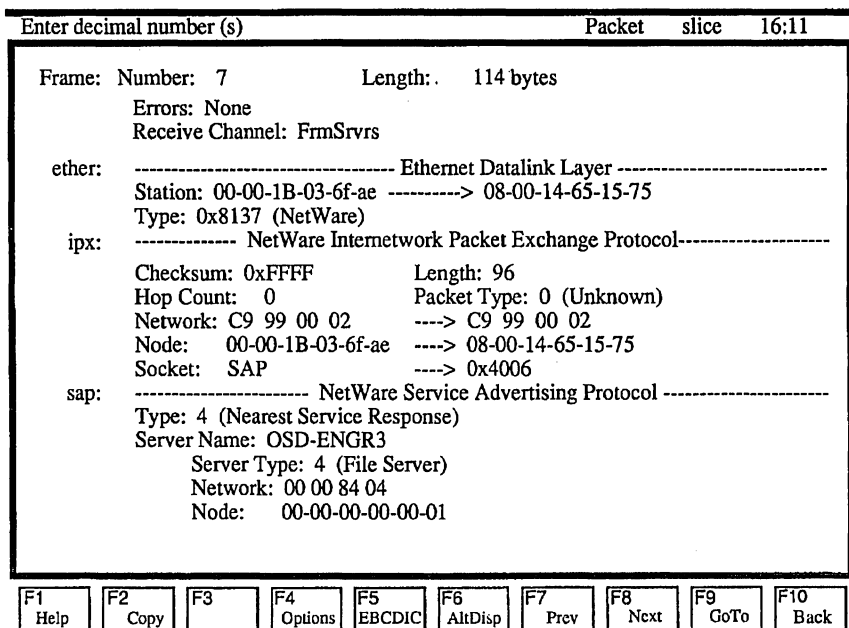
- Collision counts
- CRC/align errors
- Size errors
- Instant and average usage
- Counters for various filtering criteria

The LANalyzer application library for the Ethernet kit comprises the following tests and decodes:

- AppleTalk
- SMB functions
- NBP
- Yellow Pages
- 1002 Compliant NETBIOS
- TCP/IP
- XNS packets
- NFS
- RFC 1001
- Sun RPC packets

Third-part decodes are available.

The Ethernet kit can search for any arbitrary string or data through captured packets, and it can search for



*Figure 4.*  
**Full Seven-Layer NetWare Decode**

*The LANalyzer addresses the needs of software developers by capturing and displaying all protocol layers (corresponding to the OSI model) for NetWare, Novell NETBIOS, TCP/IP, SNMP, AppleTalk I and II, DECnet, and XNS protocols.*

many predefined filters or packet types. The unit provides mnemonic names for Ethernet, IEEE 802.3, and Internet addresses, with up to 2,000 names per name file. It also converts host or Ethernet tables into LANalyzer format.

When installed in an IBM PC/AT or compatible system, the Ethernet kit provides the following powerful transmission features:

- Generates up to 97 percent network load
- Sets up to six transmit channels using predefined templates
- Copies from a previously received frame into the transmit channel
- Defines 2 to 2,044 bytes to be transmitted for each transmit channel
- Generates packets with CRC errors and/or abnormal preamble
- Generates collisions and late collisions
- Transmission and receive can occur simultaneously

The user can choose to print realtime statistics at intervals of up to 4.25 hours. Built-in diagnostics are also provided.

**LANalyzer Network Analyzer Token-Ring Kit**

The LANalyzer Token-Ring Kit contains the following:

- One EXOS 325TR network analyzer board
- LANalyzer software on 5.25-inch or 3.5-inch diskettes
- LANalyzer installation guide, reference manual, and application library

The following predefined network tests are built into the Novell LANalyzer Token-Ring Kit:

- Traffic generator
- Test to monitor stations
- Test to filter common packet types

The LANalyzer Token-Ring Kit has flexible start and stop triggers; start and stop events can include keyboard input, packet activity on a selected receive channel, and relative or absolute times. The LANalyzer Token-Ring Kit can receive a filter matrix of 16 filters of up to 128 bytes. Bytes for filtering criteria can occur anywhere within the packet. Templates provide an easy way to set up filters. The unit's buffer stores up to 6,600 256-byte packets, and it offers a timestamp resolution of 1 ms.

The following realtime statistics are provided:

- MAC frames
- Ring recoveries
- Token rotation time
- Instantaneous and average usage
- Counters for various filtering criteria

The LANalyzer application library for the token-ring kit comprises the following tests and decodes:

- AppleTalk
- TCP/IP
- NGP
- NFS
- RFC 1001 and 1002 compliant NETBIOS

- Sun RPC packets
- SMB functions
- XNS packets
- Yellow Pages

Third-party decodes are available.

The kit can search for any arbitrary string or data through captured packets, and it can search for many predefined filters or packet types. Data can be displayed in either ASCII or EBCDIC form. The unit provides mnemonic names for MAC and Internet addresses, with up to 2,000 names per name file. It also converts host or MAC address tables into LANalyzer format. Transmit and receive can occur simultaneously. The user can choose to print realtime statistics at intervals of up to 4.25 hours. Built-in diagnostics are also provided.

---

## Physical Specifications

The following table gives the physical dimensions of the equipment described in this report:

Product	H×W×D (in.)	Weight (lb.)
LANalyzer Network Analyzer	11.2×15.5×7.6	22 with EXOS board
EXOS 325 Ethernet Board	13×4.5	Not Applicable
Starlan Adapter Board	13×3.p	Not Applicable
EXOS 325TR Board	13×4.5	Not Applicable

---

## Pricing

The LANalyzer kit versions (Ethernet and token-ring) cost \$9,980. The system price varies depending on the platform. ■

---

# Novell LAN-to-Host Connectivity Products

---

## In this report:

Product Analysis .....	-302
Vendor Analysis .....	-303
Support .....	-305
Specifications.....	-306
Pricing .....	-307

**Note:** NetWare for SAA is available in three packages supporting 16, 64, and 254 concurrent host sessions, and can also accommodate campus-wide LANs, supporting up to 508 concurrent host sessions from a single NetWare v3.11 server dedicated to communications.

Novell's NetWare for SAA v1.1 offers support for all *five* desktop environments, pushing itself to the number one spot in the industry. This software provides NetWare workstations with IBM mainframe and AS/400 host connectivity while integrating with NetWare v3.11's high-performance, security, and administration features.

### Strengths

- Includes SNA connections from DOS, Windows, and Macintosh workstations
- Provides LAN-to-IBM host connectivity
- Integrates with the NetWare v3.11 operating system
- Provides centralized and distributed network management functions
- Includes Novell's open application development environment

### Limitations

- NetWare 3270 LAN Workstation for Macintosh product does not include support for host printing (LU1 or LU3 emulation) or an interface to IBM's APPC networking protocol.

### Competition

IBM OS/2 EE SNA Gateway, Banyan SNA Services, DCA/Microsoft OS/2 Communications Server.

### Vendor

Novell, Inc.  
122 East 1700 South  
Provo, UT 84606  
(801) 429-7000

### In Canada:

Contact U.S. office.

### Price

NetWare for SAA v1.1 16 sessions—\$1,995; for 64 sessions—\$5,995; for 254 sessions—\$14,995. Prices vary depending upon the configuration. **GSA Schedule:** No.

---

—By *Melissa S. Morales*  
Staff Writer

## Product Analysis

As new products are developed, so are the strategies that enable the product to succeed in the marketplace. "Novell's NetWare for SAA is a culmination of over two years of development as a direct response to customer needs," claims a Novell representative. The products featured in this report are a direct result of that statement. With interoperability and connectivity being the driving forces in almost every enterprise network, you will read how Novell has targeted its LAN-to-IBM host connectivity solutions with a family of communication products that are integrated with NetWare v3.11, and also perform sophisticated network management tasks.

### LAN-to-Host IBM Connectivity Products

Novell's LAN-to-Host IBM connectivity products consist of the following products.

- NetWare for SAA
- NetWare SNA Gateway
- NetWare SNA Gateway ELS
- NetWare 3270 LAN Workstations for DOS, Macintosh, and Windows

#### NetWare for SAA

Built on the Communication Executive, NetWare for SAA provides LAN-to-host connectivity over SNA networks integrated with NetWare v3.11. The Communication Executive adds communication-specific extensions to NetWare v3.11 and provides functions available to both individual communication services located on the server and to client applications located on workstations.

#### NetWare SNA Gateway

The NetWare SNA Gateway is a software product that turns any IBM PC, PS/2, or recommended compatible into an SNA gateway server. Novell calls it, its high-end SNA gateway solution for DOS machines. It allows up to 96 PCs, PS/2s, and recommended compatibles on a LAN to communicate with an IBM or compatible SNA mainframe or midrange computer. The software runs on NetWare

SPX or IBM NETBIOS networks and supports four different host connection options: coaxial, CoaxMux, remote, and Token-Ring.

#### NetWare SNA Gateway ELS

The NetWare SNA Gateway ELS is an entry-level gateway solution that turns any IBM PC, PS/2, or recommended compatible into an SNA gateway server. Up to 16 PCs, PS/2s, and compatibles on a LAN can communicate with an IBM SNA mainframe or compatible. The software supporting the NetWare SNA Gateway ELS runs on NetWare SPX or IBM NETBIOS networks.

#### NetWare 3270 LAN Workstation for DOS

NetWare 3270 LAN Workstation for DOS is an IBM terminal and printer emulation software package used with the NetWare SNA Gateway, NetWare SNA Gateway ELS, or NetWare for SAA. NetWare for SAA requires NetWare 3270 LAN Workstation for DOS V.2.0. The LAN workstation provides PC, PS/2, and recommended compatible workstations with cost-effective access to SNA mainframe and midrange host computers via the NetWare SNA Gateways or NetWare for SAA.

#### NetWare 3270 Vector Graphics Option v2.0

Novell's NetWare 3270 Vector Graphics Option v2.0, when used with the NetWare 3270 LAN Workstation for DOS, NetWare for SAA, or the NetWare SNA Gateway, allows DOS workstation users on a LAN to access IBM mainframe graphics applications such as GDDM, SAS/GRAF, DISSPLA, and TELLAGRAF. It supports full-screen Models 2, 3, and 4 on EGA or VGA color displays. The NetWare 3270 Vector Graphics Option is server based, which is cost-effective to the user because only one copy needs to be installed on the server for use by all workstations on the LAN.

#### NetWare 3270 LAN Workstation for Macintosh

NetWare 3270 LAN Workstation for Macintosh is an application that provides Macintosh-to-IBM host connectivity via NetWare for SAA. Twenty-six host sessions can be concurrently active providing simultaneous access to multiple hosts. Each host session occupies a separate window that can be independently sized and moved around the screen.

#### NetWare 3270 LAN Workstation for Windows

NetWare 3270 LAN Workstation for Windows provides IBM host connectivity for workstations running Microsoft

## Overview

	Date Released	Operating Systems Supported
NetWare for SAA v1.1	1991	NetWare v3.11
NetWare SNA Gateway v1.2	October 1990	DOS
NetWare SNA Gateway ELS	October 1990	DOS
NetWare 3270 LAN Workstation for DOS	June 1991	DOS
NetWare 3270 Vector Graphics Option	August 1991	NetWare v3.11
NetWare 3270 LAN Workstation for Macintosh	October 1991	Macintosh System 7
NetWare 3270 LAN Workstation for Windows	December 1991	Windows 3.0

---

## Decision Points

Model	Requirements	Comments
NetWare for SAA	Provides NetWare workstations with flexible IBM mainframe and AS/400 host connectivity while integrating with NetWare v3.11's security and administration features. Available in three packages that support 16, 64, or 254 simultaneous display, printer, or APPC sessions.	Application Program Interfaces (APIs) designed for NetWare for SAA provide a third-party development environment.

Windows 3.0 via NetWare for SAA. Multiple host sessions can be concurrently active providing simultaneous access to multiple hosts. Each host session occupies a separate window that can be independently sized and moved around the screen. Host sessions can be any combination of display, printer, or APPC sessions.

### PC-to-Host Products

Formerly, Novell's PC-to-Host products consisted of NetWare 3270 Communications Utility Transmission (CUT) Workstation and NetWare 3270 Multi Workstation. Effective November 1, 1991, Novell transferred the sales and support for Novell's single-user IBM emulation products and supporting hardware to Microdyne Corp., formerly Federal Technology Corp.

---

### Target Applications

- Multiple geographically dispersed branch offices or agencies
- Large central-site LAN installations
- *Fortune* 1000 accounts and government organizations with large, established SNA networks
- Existing NetWare SNA Gateway customers

---

### Strengths

Novell's NetWare for SAA will now support DOS, Windows, Macintosh, OS/2, and UNIX desktops, allowing users to operate their existing workstations to access IBM mainframe and minicomputer resources. Novell is currently the only vendor offering support for all five desktop platforms. NetWare v3.11 and NetWare for SAA customers can also take advantage of new server hardware innovations and multiple LAN topologies.

---

### Limitations

The only limitation we find is that the 3270 LAN Workstation for Macintosh does not include support for host printing (LU1 or LU3 emulation) or an interface to IBM's APPC networking protocol.

---

### Competitive Analysis

There are a few big factors that differentiate Novell from its competitors. Novell is the only one that offers support for all *five* desktop environments, and it does not look like Banyan, IBM, or DCA have that option in their future strategies. Novell NetWare v3.11 is the only one available in three packages supporting 16, 64, and 254 concurrent host sessions, and can also accommodate campus-wide LANs, supporting up to 508 concurrent host sessions from

a single NetWare v3.11 server dedicated to communications. Novell also provides the most comprehensive support and documentation, while its competitors supply just enough to get a user by.

---

## Vendor Analysis

---

### Marketing Strategy

Novell NetWare has long been accepted as the standard in network operating systems. "With NetWare v3.X, the latest version of NetWare designed according to Novell's Integrated Computing Architecture (NICA), the Novell solution became even stronger," a Novell representative commented. The NICA architecture ensures that all Novell products work together to connect all computer hardware and software. This has no bearing on which vendor supplied them or the standards that have been chosen.

Novell developed NetWare Communication Services to complement NetWare v3.X. NetWare Communication Services is a new generation of software technology that allows any combination of LAN-to-host, LAN-to-LAN, or remote LAN communication services to operate simultaneously with file, print, and database services.

NetWare for SAA was the first product introduced out of the family of communications services developed by Novell. NetWare for SAA is a LAN-to-host product that connects NetWare-based workstations into the powerful IBM mainframe environment. With NetWare for SAA, Novell focused its attention on the following six points in order to continue its winning ways in the industry.

- Develop products providing IBM connectivity built on NetWare.
- Offer flexible, cost-effective solutions.
- Offer support for popular desktop systems.
- Provide complete network management capabilities.
- Offer an open development environment.
- Leveraging off its proven SNA track record.

---

### Target Markets

Novell NetWare for SAA provides products to a broad base of corporations and organizations with requirements to connect NetWare LANs into business-wide networks.

The following is a description of the market segments to which Novell NetWare products are geared.

*Multiple Geographically Dispersed Branch Offices or Agencies:* Retail, banking, and finance companies are typical branch office or agency accounts, but any corporation with a nationwide sales and support capability fits this classification as well. The NetWare for SAA products offer these customers integration of multiple services on a single NetWare platform, centralized management and control of a distributed network of servers, and highly reliable communication services.

*Large Central-Site LAN Installations:* These sites can be corporate headquarters facilities, manufacturing or R&D plants, or campus installations, and can have mixed networks running several different transport protocols. These customers can be considering the purchase of dedicated gateways for specific network transports and client platforms, or the purchase of multiple gateways to support a large user community. The NetWare Communications Services products offer these customers a powerful, high-performance platform for providing host connectivity to all their users regardless of workstation platform.

*Fortune 1000 Accounts and Government Organizations with Large, Established SNA Networks:* These accounts require network management services, NetView support, and high-performance host connections. The NetWare Communications Services products offer customers a high-performance migration path from terminal-based centralized computing to distributed network computing.

*Existing NetWare SNA Gateway Customers:* The NetWare Communications Services products offer existing NetWare SNA Gateway customers greater capacity, increased management control, heterogeneous client support, and integration of multiple NetWare v3.11 services in a single platform.

---

## Market Position

Novell, as the PC LAN market leader, enjoys a larger distribution channel than DCA can offer in its micro-to-mainframe market. DCA's strength lies in the single-user market, which is smaller than that for NetWare products. As a result, Novell and its NetWare connectivity products are in a position to challenge DCA's current hold on the micro-to-mainframe market.

## Major Competitors

### IBM OS/2 EE SNA Gateway

The OS/2 EE SNA Gateway offers three connectivity options including SDLC, X.25/QLLC, and Token-Ring. It also offers a complete set of APIs including APPC, EHL-LAPI, SRPI, and an LU0 interface. Compared to NetWare for SAA, IBM's OS/2 EE SNA Gateway shows these weaknesses.

- Limited capacity—supporting only 64 active workstations at any one time.
- Workstation-based architecture—providing downstream physical unit support for the workstation clients, but does not perform any SNA protocol processing.
- Does not support multiple desktops.
- Offers no third-party support.

### Banyan SNA Services

Multiple communications services such as X.25 routing and SNA communications can be combined with file services on a single server, reducing the customer's hardware costs and simplifying maintenance. Compared to NetWare for SAA, Banyan's SNA Services show these weaknesses.

- Limited capacity—supports only 96 active workstations at any one time.
- No support for APPC—Banyan SNA products cannot be integrated into an organization's SAA-compliant development plans without APPC support.
- No support for network management.
- Does not support multiple desktop platforms—only supports DOS.
- Offers no third-party support.

### DCA/Microsoft OS/2 Communications Server

This product contains two components. First a server application that runs on OS/2 servers, and second, a workstation application that runs on users' PCs. The server does not need to be dedicated to communications because the same server can be used to run LAN Manager file and printer services, Microsoft SQL Server, or other OS/2 server applications. The product also offers support for a range of connectivity options. Compared to NetWare for SAA, the following limitations filter through from DCA/Microsoft.

- Limited capacity—supports only 64 active workstations at any one time.
- Does not support multiple desktop platforms.
- Offers *limited* third-party support.
- Provides no commitment to integrating LAN-to-LAN or remote-to-LAN communications into the OS/2 LAN manager platform.

---

## Sales and Distribution Strategy

Novell LAN-to-Host products are sold by Novell Gold and Platinum resellers directly to Novell's larger customers. According to Novell, NetWare v.1.1 (64 and 254 sessions) is exclusively sold by Novell Platinum resellers, while all other products are sold by both Novell Platinum and Gold resellers.



---

## Company Activity

Date	Activity
September 1987	Novell introduced Open Protocol Technology
September 1988	Novell shipped NetWare for VMS, NetWare Requester for OS/2
November 1988	Novell Requester for OS/2 supports Extended Edition
December 1988	Novell shipped AFP-compliant Macintosh support
February 1989	Novell introduced Portable NetWare
May 1989	Novell introduced NetWare Open Systems
September 1989	Novell shipped first 32-bit, 80386-based LAN operating system
January 1990	Novell shipped SNMP-based network monitor
April 1990	First strategic partner, NCR, shipped Portable NetWare
July 1990	Novell shipped first multiprotocol, multimedia server architecture
July 1991	Novell announced that it has agreed to purchase privately held Digital Research Inc.
September 1991	Novell Inc. and Network Communications Corp. signed a licensing agreement and technology partnership
October 1991	Novell Inc. and UNIX System Laboratories (USL) have signed a memorandum of understanding calling for a joint venture to be formed to develop and market products and services to enhance NetWare and UNIX System V Release 4 interoperability
November 1991	Novell announced that is reorganizing into three business units: NetWare Systems, Interoperability Systems, and Digital Research Systems
December 1991	Novell selected Maynard Electronics Inc. to help develop Novell's Storage Management Services (SMS) software for the NetWare network operating software
December 1991	Novell introduced NetWare Requester for OS/2 v2.0 (@ \$200 per license), simplifying access to NetWare services providing icon-defined desktop utilities and an enhanced installation program, both utilizing IBM's Presentation Manager environment

## Support

As the capabilities of any network computing environment increase, so does the demand for superior support and education. This demand extends from users to distribution channels to third-party developers and manufacturers. Novell's support programs and services are extensive and well approached.

### Policies and Programs

#### Warranty

Contact a Novell representative regarding this information. Warranties will differ depending upon the configuration.

#### Support Services

Novell offers a range of support services including on-site technical support and telephone support. Novell is widely recognized for its training and education programs.

#### Service Provider

Support is available through Novell Support Organizations (NSOs). Some NSOs, like Hewlett-Packard and Xerox, are hardware vendors with service divisions. Others, like Federal Technologies and Banctec, are independent companies that specialize in technical support services on a regional and national basis.

#### Service Locations

Service is provided on-site through Novell Support Organizations.

#### Training/Education

According to Novell, it has established education programs to help move service closer to the user. The Certified NetWare Engineer (CNE) program helps improve the technical support offered by resellers and service providers. Certified NetWare Engineers undergo extensive product education and training on the installation and maintenance of NetWare systems.

The Novell Authorized Education Center (NAEC) program provides educational resources for training NetWare users and CNEs. Many companies choose to support themselves whenever possible. To meet this need, Novell offers technical courses on NetWare products and system support taught by certified NetWare instructors (CNIs) at more than 200 Novell Authorized Education Centers worldwide. In addition, users may also enroll technicians in the CNE program so they can have a high level of expertise in-house.

Courses are taught at Novell facilities, at Novell Authorized Education Centers worldwide, or at the customer's location. Courses include hands-on experience on the network, interactive discussions, individual or group exercises, and question-and-answer sessions. Classroom instruction includes videos, slide presentations, and product manuals.

#### Documentation

Documentation is available; contact your local Novell representative.

## Upgrade Policies

### NetWare UpDate

NetWare UpDate, along with NetWare Upgrade, replaces the former NetWare Assurance program. NetWare UpDate is a subscription service for users of the most current versions of NetWare that provides all updates, patches, fixes, and enhancements for a period of one year. Users not at the current version of their NetWare product must purchase NetWare UpGrade described in the following paragraph.

### NetWare UpGrade

NetWare UpGrade allows users to receive the most current version of their NetWare product at a discount, or

upgrade to a higher level product. The program includes a six-month subscription of the NetWare UpDate program previously described.

## Competitors' Programs

Against the competition, Novell provides the most comprehensive educational course training. Novell offers six categories of training courses: Network User, Reseller, System Manager, Technical Support, Programming, and Computer-Based Training. All three competitors—Novell, Banyan, and DCA—offer the same 90-day warranty on their products. Telephone support varies from vendor to vendor, but they all offer the traditional 12 hours' worth of support.

# Specifications

## Features/Functions

	NetWare for SAA	NetWare SNA Gateway	NetWare SNA Gateway ELS
Minimum Memory Required	6M bytes	202K to 502K (depending upon host connection)	232K (coax), 238K (remote)
Number of Users Supported	254	Multiuser; 96 workstations (1)	Multiuser; 16 (1)
Network Interface Supported	IPX/SPX	SPX NETBIOS	IPX/SPX, NETBIOS
Network Media Supported	Token-Ring, SDLC	Coax, Token-Ring, SDLC	Coax, SDLC
Terminal Emulation	3270 (1)	IBM, 327X/317X DFT	IBM 327X/317X DFT
User Interface	Command line, MicroSoft mouse, lightpen (1)	Install program, online help, diagnostics, windows	Install program, online help, diagnostics, windows
API Compatibility	IBM EEHLLAPI, low-level API, NetWare, LU6.2	IBM API, DCA IRMA API, LU6.2	IBM API, DCA IRMA API, IBM LU6.2, proprietary
Number of Concurrent Host Sessions	Remote SDLC—64; token-ring—64	Coaxial—5; CoaxMux—40; Remote—128; token-ring—128	Coaxial—5; Remote—16
DOS Access During Sessions	Yes	Yes	Yes
File Transfer/Conversion	Yes; Yes	Yes; Yes	Yes; Yes
Host Systems Supported	IBM 43XX/30XX, AS/400	IBM 43XX/30XX, AS/400	IBM 43XX/30XX, AS/400
Host Software Environment	MVS, VM	IBM DOS, MVS, VM, TSO, CMS, IMS, CICS	IBM DOS, OS/VS, MVS, VM, TSO, CMS, IMS, CICS
Host Protocols	SAA, SNA	SNA	SNA
Host Connection	Token-Ring, SDLC	Coax, Token-Ring, SDLC	Coax, SDLC
Transmission Speed (bps)	64K bps (SDLC); 16M bps (token-ring)	2.4M (coax), 1200 to 64K remote (SDLC); 16M bps (token-ring)	19.2K to 2.4M (coax), 1200 to 19.2K (remote)

	NetWare 3270 LAN Workstation for DOS	NetWare 3270 LAN Workstation for Macintosh	NetWare 3270 LAN Workstation for Windows
Minimum Memory Required	121K bytes	2M bytes	2M bytes
Number of Users Supported	Multiuser, depends on gateway product used	Up to 253	Up to 253
Network Interface Supported	IPX/SPX, NETBIOS	IPX/SPX	IPX/SBX
Network Media Supported	Ethernet, Arcnet, Token-Ring	Ethernet, Token-Ring, Arcnet, LocalTalk	Ethernet, Token-Ring, Arcnet
Terminal Emulation	IBM 3270/3287	IBM 3270/3287	IBM 3270/3287
User Interface	Command line, Microsoft mouse, lightpen	Microsoft mouse, lightpen	Windows, mouse

## Features/Functions (Continued)

<b>API Compatibility</b>	IBM EEHLLAPI, low-level API, Novell's NetWare, LU6.2, 3270 API	IBM EEHLLAPI	LU6.2, IBM API
<b>Number of Concurrent Host Sessions</b>	5	26 per workstation	Multiple, depending on environment and configuration
<b>DOS Access During Sessions</b>	Yes	Yes	Yes
<b>File Transfer/Conversion</b>	Yes; Yes	Yes; Yes	Yes; Yes
<b>Host Systems Supported</b>	IBM 43XX/30XX, AS/400	IBM 43XX, AS/400	IBM 43XX
<b>Host Software Environment</b>	TSO, CMS, CICS, DOS	NetView, DB2, TSO, CMS, CICS, PROFS, OfficeVision	NetView, DB2, TSO, CMS, CICS, PROFS, OfficeVision
<b>Host Protocols</b>	Does not apply	Does not apply	Does not apply
<b>Host Connection</b>	Does not apply	Does not apply	Does not apply
<b>Transmission Speed (bps)</b>	Does not apply	Does not apply	Does not apply

(1) When used with NetWare 3270 LAN Workstation for DOS.

## Pricing

### Novell NetWare

Models	Base Price (\$)
NetWare for SAA (16 sessions)	1,995
NetWare for SAA (64 sessions)	5,995
NetWare for SAA (254 sessions)	14,995
NetWare SNA Gateway	2,995
NetWare SNA Gateway ELS	595
NetWare 3270 LAN Workstation for DOS	1,495
NetWare 3270 LAN Workstation for Macintosh	4,995
NetWare 3270 LAN Workstation for Windows	Vendor did not disclose
NetWare 5250 Gateway Version 2	995
NetWare 5250 LAN Workstation	1,495



# O'Neill Communications Local Area Wireless Network (LAWN)

**In this report:**

Analysis ..... -102  
 Characteristics..... -104  
 Pricing..... -105

**Product Summary**

**Editor's Note**

In May 1990, O'Neill Communications, Inc. (OCI) introduced its second-generation LAWN. The enhanced version of its wireless PC network includes new software capabilities and a lower unit price.

**Description**

OCI's Local Area Wireless Network (LAWN) is a wireless LAN designed for use in small workgroups. The LAWN interconnects IBM and IBM-compatible PCs for file transfer, electronic mail, and peripheral sharing.

**Strengths**

- LAWN costs \$298 per unit.
- LAWN signals transmit through walls, floors, and other office obstructions.
- LAWN requires no wiring or interface cards.

**Limitations**

- LAWN's transmission speed of 19,200 bps, while double that of the first-generation product, remains relatively slow.

**Competition**

Photonics offers a wireless LAN; other RS-232 (zero-slot) LANs are available from vendors such as Digital Products, SimpleNET Systems, and The Software Link. Other vendors of entry-level LANs include Artisoft, D-Link Systems, and DNA Networks.

**Vendor**

O'Neill Communications, Inc. (OCI)  
 100 Thanet Circle  
 Princeton, NJ 08540  
 (609) 497-6800

**Price**

\$298 (suggested retail).

**GSA Schedule**

Yes, via resellers.

—By Joseph F. Kelly  
 Associate Managing Editor

# Analysis

## Product Strategy

After a slow start in the late 1970s and early 1980s, LAN technology has gained the full acceptance of the corporate world. In fact, most major corporations in the U.S. now have one or more LANs installed. This has promoted an explosion of the LAN interconnection market, as vendors introduce bridges, routers, brouters, and gateways to allow LANs to communicate with each other and with other resources.

One niche of the LAN market often overlooked, however, is the market for inexpensive, entry-level LANs targeted at small businesses or small workgroups (typically from 2 to 20 PCs). RS-232 LANs (also known as zero-slot LANs, or sub-LANs) were the first entry-level LAN solutions targeted specifically at this market. These simple, inexpensive products allow small workgroups to interconnect a limited number of PCs for file transfer, electronic mail, and printer sharing. They consist primarily of communications software and cable to interconnect PCs via their RS-232-C ports; interface boards, transceivers, repeaters, and other devices found on larger networks are eliminated. Likewise, these networks do not require complex network operating system software.

RS-232 LANs are inappropriate for the heavy networking requirements of large companies. Many small companies, however, do not need the sophistication (or expense) of a full-scale LAN—thus the market for RS-232 LANs.

In June 1989, O'Neill Communications (OCI) advanced the state of the art in entry-level LANs by introducing the Local Area Wireless Network (LAWN). The LAWN interconnects small workgroups of PCs (OCI recommends 2 to 20) for file transfer, electronic mail, and peripheral sharing. The product uses no cable to interconnect the PCs; instead, the LAWN uses ultrahigh-frequency spread spectrum radio to transfer data. The LAWN is actually a modem-sized device that incorporates

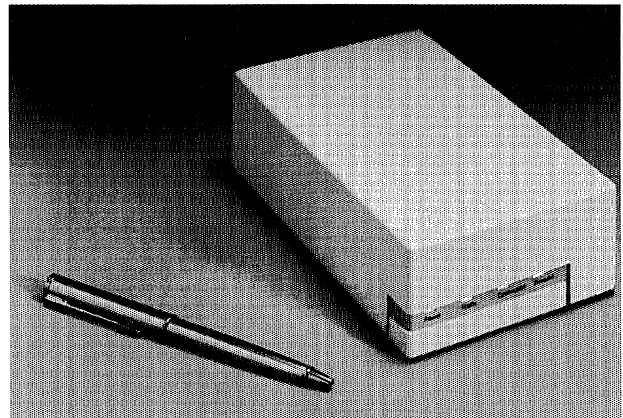
a radio transceiver, a microprocessor, memory for storing electronic mail, a 45-day battery backup for memory retention, and four radio channels into a single box. The LAWN unit attaches to the RS-232 port of an IBM-compatible PC or peripheral.

## LAWN—The Next Generation

In May 1990, OCI introduced its second-generation LAWN product. The new LAWN is 100 percent compatible with the first-generation product and includes significant enhancements.

- increased network speeds of up to 19,200 bps (from 9600 bps)
- direct connect mode to run third-party software
- decrease to 25K (from 40K) of memory-resident software
- COM3 and COM4 port support (instead of COM1 and COM2)
- command line program
- additional electronic mail features
- improved user interface
- reduced price of \$298 per LAWN unit (from \$495)

OCI expects to take advantage of PC vendors' anticipated announcements of new, low-cost PCs that have fewer add-on or attachment capabilities for direct linkage to PCs and peripherals. According to



*OCI's Local Area Wireless Network (LAWN) is based on the LAWN unit, a compact device that attaches to the serial port of a PC, modem, or printer. The LAWN unit incorporates a transceiver, a microprocessor, memory for E-Mail, a 45-day battery backup, and four radio channels.*

OCI's vice president of marketing, Dwight Custer, "If this occurs as expected, the LAWN represents perhaps the best and only way of adding networking capabilities for any user in virtually any business environment."

---

### Competitive Position

As the local area network has gained prominence in the past three years, the more powerful LAN technologies and the well-known vendors that support them have overshadowed entry-level solutions such as the RS-232 LAN. Although products such as Digital Products' NetCommander have been successful, the RS-232 LAN category has not received the publicity (and thus the legitimacy) of the full-featured, faster, standardized LAN technologies, such as Ethernet and token-ring (or the non-standardized ARCnet).

While many large users may be unfamiliar with entry-level LANs, they are an attractive alternative for small companies. A typical RS-232 LAN, for example, offers file transfer, electronic mail, and printer sharing for a small cluster of PCs, which is all many companies need from their networks. In fact, the capability of many PCs to share a single, expensive laser printer is what prompts many companies to adopt LANs.

Most RS-232 LANs consist of software to run the network and cable to interconnect the PCs. OCI has further simplified entry-level networking by eliminating the need for cabling between PCs. Using spread spectrum radio technology, the LAWN product is among the first wireless LANs to enter the market.

Another company, Photonics, offers a wireless LAN called Photolink. It uses infrared technology and achieves data transmission rates comparable to full-scale LANs. Some RS-232 or zero-slot LANs now marketed include NetCommander from Digital Products, SimpleNET Systems' OnePlus, and LANLink by The Software Link.

Another group of vendors offers entry-level LAN solutions that include network operating system software and interface cards. These include Artisoft (LANtastic), D-Link Systems (LANsmart), and DNA Networks (MicroNet). Artisoft also markets a zero-slot version of LANtastic, called LANtastic Z.

---

### Decision Points

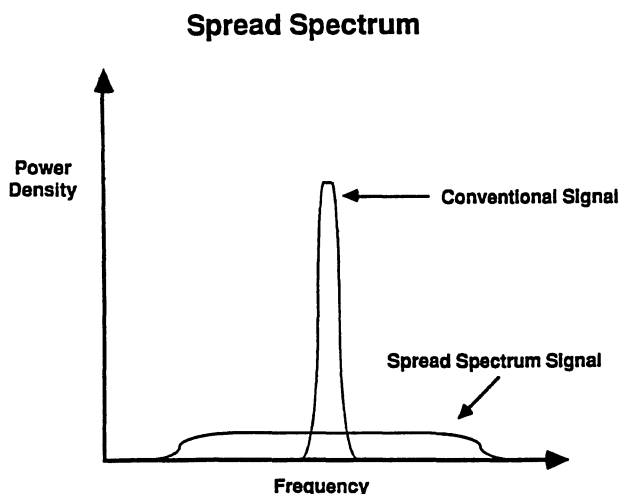
According to O'Neill's CEO and President James J. Healy, "We designed the LAWN to be easy to install, easy to use, and easy to move. Our product is targeted at the small office or workgroup that needs communications but not the problems associated with cabling or complex systems."

The LAWN package, priced at \$298, consists of the LAWN unit; RS-232 cable to connect the LAWN unit to the serial port of an IBM-compatible PC, printer, or modem; a power cord; and menu-driven communications software. Although technically a LAWN network will support over 100 connections, OCI recommends that the number not exceed 20.

Key to the LAWN's uniqueness is its use of spread spectrum radio technology, which was developed during World War II for secure military communications. Instead of using conventional, high-power density radio waves over a narrow bandwidth, the LAWN "spreads" the signal out over a larger bandwidth and at a lower power density. This makes the signal difficult to detect and less likely to interfere with other office equipment. The LAWN operates in the 902MHz to 928MHz band.

---

Figure 1.  
Spread Spectrum Technology



*The LAWN uses high-frequency spread spectrum radio technology to provide secure communications over the network.*

As with most entry-level LANs, the LAWN does not achieve the high transmission rates associated with full-scale LANs. The transmission rate between LAWN units is 38,400 bps, while transmission through the RS-232 port is 19,200 bps. The LAWN *does* implement data spooling, however, so data transmission occurs in the background, freeing the computer for use immediately after data transmission. LAWN units can be placed up to 100 feet apart and will communicate successfully through obstructing walls. A LAWN unit can also serve as a repeater to extend coverage.

Because it is wireless, OCI feels that the LAWN product provides some important features to the user: It is easy to install, can be operational minutes after installation, and is easy to expand and nodes can be relocated easily and quickly. (LAWN units "beacon" to one another, providing automatic updates of user lists.) Users who often travel with laptop computers can quickly plug them into the network and disconnect them just as quickly. In addition, like zero-slot LANs, the LAWN requires no interface card in the computer (hence the term zero-slot), saving the user the time and trouble of opening the computer.

---

## Company Profile

O'Neill Communications (OCI) was founded in 1986 by Gerard K. O'Neill, professor emeritus of physics at Princeton University and founder of Geostar, a satellite location company. OCI is a privately held company based in Princeton, NJ. Officers include CEO and President James J. Healy, Vice President of Marketing J. Dwight Custer, Vice President of Engineering Raymond W. Simpson, and Vice President of Finance Loretta L. Metcalfe.

OCI introduced the LAWN at a New York press conference on June 7, 1989 and first exhibited it at PC Expo in New York on June 20. At the time of its introduction, the Federal Communications Commission (FCC) had not yet approved the product; FCC approval was granted in July 1989.



# Characteristics

**Models:** Local Area Wireless Network (LAWN).

**Date Announced:** June 1989.

**Date First Installed:** October 1989.

**Number Installed:** Over 1,000.

**Distribution** The LAWN is available through value-added resellers and dealers.

---

## Architecture

The LAWN uses high-frequency spread spectrum radio technology for communications among LAWN devices. The LAWN unit spreads the radio signal over a large bandwidth and at a low power density. This makes the signal difficult to detect, which helps prevent unwanted interception. The spread signal is also unlikely to interfere with other office equipment. The LAWN unit operates in the 902MHz to 928MHz band.

In spreading the signal, the LAWN codes the data transmitted into a sequence of "chips" that must be decoded at the receiving end. Security is further enhanced by the use of user-selectable security codes. To decode incoming data, the receiving LAWN unit has the decoding algorithm and the correct security code.

The use of an error detection scheme with acknowledgment ensures the integrity of transmitted data. The LAWN uses a data packetizing scheme called AX.25, a version of X.25. AX.25 was specifically designed for transmitting data over radio waves. If a reception acknowledgment is not received for a packet of data, that packet is resent.

Users may place LAWN units up to 100 feet apart within buildings and communicate through obstructing walls. Typical coverage area for the LAWN network is approximately 10,000 square feet. Coverage may be extended by using up to two LAWN units as repeaters. The range of the LAWN units increases to 500 feet when used in line-of-sight windows to communicate with nearby buildings.

The LAWN unit connects to the RS-232 serial port of a PC, a modem, a printer, or a plotter. It supports data transmission rates up to 38,400 bps. OCI recommends that LAWN networks be used in workgroups of no more than 20 users, though technically a LAWN network can support over 100 connections.



---

## Hardware

The LAWN product is based on the LAWN unit, a modem-sized box. The LAWN unit incorporates the following:

- radio transceiver;
- microprocessor;
- memory for storing electronic mail when the computer is turned off;
- 45-day battery backup for memory retention; and
- four radio channels for multiple networks.

The LAWN unit measures 7.06 inches long by 4.19 inches wide by 2.06 inches high. It connects to the RS-232 port of a PC, a modem, or a printer via an RS-232 cable, which comes with the unit. A power cord is also supplied.

---

## Software

Menu-driven communications software is supplied with the LAWN unit. The software supports file transfer, electronic mail, and peripheral sharing. The RAM-resident portion of the LAWN communications software requires approximately 25K bytes of memory.

The second-generation LAWN product includes several software enhancements. Additional electronic mail features include a receipt option, the ability to create mail groups, and the ability to reply directly to messages. Electronic mail and files can be sent from the DOS command line without entering the LAWN program. File transfers that occur on a regular basis can be

run from a batch file. The LAWN's user interface has been enhanced with the addition of improved function key operations, dynamic screen updates, and improved file handling.

A direct connect mode has been added to allow users to establish a direct serial link with another user through the LAWN software, and then enter a third-party communications program (such as DCA's Remote<sup>2</sup> or Microcom's Carbon Copy Plus). This provides LAWN users with additional capabilities such as terminal emulation, file retrieval, and screen sharing.

---

## Support

**Installation:** The LAWN is designed for user installation.

**Training:** OCI states that no training is necessary for operation of a LAWN network.

**Warranty:** OCI provides a 1-year warranty on each LAWN and offers a 30-day money-back guarantee.

**Maintenance:** Technical support to end users is provided through a toll-free support line; the telephone number is (800) OCI-LAWN (800/624-5296).

---

## Pricing

The LAWN package costs \$298; it includes the LAWN unit, RS-232 cable, a power cord, and communications software. ■



# Persoft PC and Network Connectivity Products

## In this report:

Analysis.....	-102
Characteristics.....	-104
Pricing.....	-107

## Product Summary

### Editor's Note

Since our last report, Persoft—a microcomputer software company—has created cross-platform capabilities with its new Intersect product line. This report examines the functionality, competitive position, and pricing of Persoft SmarTerm and Intersect products.

### Description

Persoft products integrate IBM PCs and compatibles into the Digital Equipment and Data General processing environments through terminal emulation software and network bridge products.

### Strengths

Persoft's SmarTerm products are full-featured, high-performance terminal emulation products that are continually fine-tuned and strengthened with enhancements and network support capabilities—all at no extra cost to the buyer.

### Limitations

Despite the mainstreaming of the Apple Macintosh in corporate America, Persoft does not offer Digital

terminal emulation for the Macintosh. Secondly, Persoft products offer a similar but uncommon interface. For example, a user who has purchased a Digital emulation product and wants to migrate to a higher level product must learn the nuances of the new product's interface.

### Competition

Walker Richer & Quinn, Coefficient, Polygon.

### Vendor

Persoft, Inc.  
UW Research Park  
465 Science Drive  
Madison, WI 53711  
(608) 273-6000

In Canada:

Keating Technologies  
505 Hood Road, Unit 22  
Markham, ON L3R 5V6  
(416) 479-0230

### Price

Prices range from \$225 for the individual version of SmarTerm 320 Digital text terminal emulation to \$1,495 for the five-concurrency SmarTerm 340 for File Servers.

### GSA Schedule

Yes.

—By *Donna Horsley*  
*Staff Writer*

# Analysis

## Product Strategy

Long reputed for its SmarTerm terminal emulation product line, nine-year-old Persoft has expanded its interests to the network connectivity market. Since 1990, the company has divided its marketing efforts between SmarTerm and its new Intersect network bridge products.

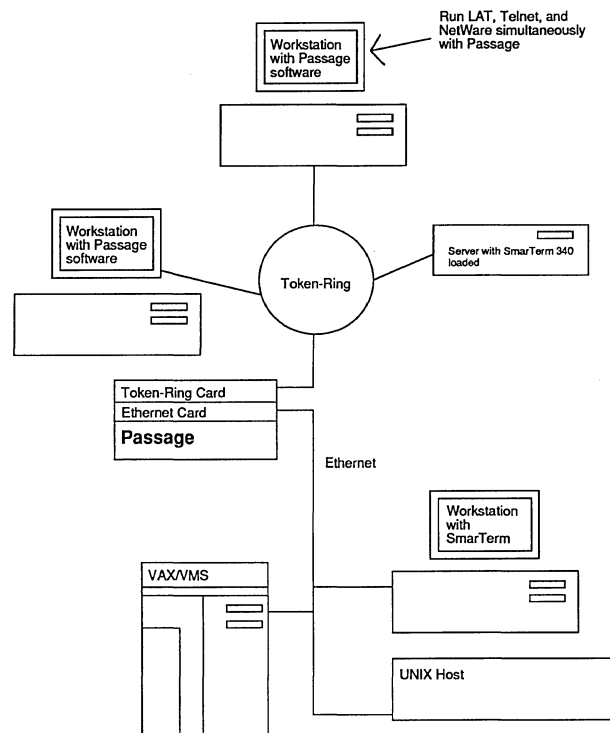
Responding to a maturing terminal emulation market, Persoft created the Intersect product line to offer low-cost, full-featured ways to connect Ethernet LAN segments. Intersect Remote Bridge, which began shipping in April, has generated much industry interest; it is the only bridge using wireless spread spectrum radio technology to connect Ethernet network segments that are physically separated.

With its SmarTerm product line that has sold over 235,000 packages, Persoft sales topped \$6.8 million in 1990. The company has expanded its Digital terminal emulation software line with SmarTerm 340 (now Persoft's premiere product) and has enhanced the network features of the SmarTerm line by introducing three new enhancements: its own implementation of Telnet, full NDIS protocol support, and a network reporting utility called SmarTrack. Persoft has discontinued its Hewlett-Packard terminal emulation offering.

## Terminal Emulation Products

Persoft's strength lies with its SmarTerm terminal emulation software. Available in both single and multiuser versions, SmarTerm software precisely emulates text and graphics terminals on IBM PCs or compatibles, and provides access to host systems from Digital Equipment, Data General, and Tektronix. The multiuser versions of SmarTerm products, called SmarTerm for File Servers, reside on a network file server and are accessed by workstations connected to the network.

Figure 1.  
*Token-Ring to Ethernet Host Connectivity*



*Introduced in February, Passage is one of Persoft's Intersect network bridge products. Passage enables workstations on token-ring networks to access host systems from Digital Equipment and UNIX on Ethernet networks.*

SmarTerm 340 allows PCs to emulate all Digital text and graphics terminals up through the high-end VT340 terminal. SmarTerm 320 emulates all Digital text terminals through VT320. SmarTerm 470 emulates a wide range of Data General text and graphics terminals, up to the D470 graphics terminal.

## Bridge Products

Persoft's Intersect network bridge products provide a low-cost, full-featured means to connect Ethernet LAN segments. Intersect consists of software and appropriate network cards placed in a PC. Intersect Local Bridge connects two contiguous Ethernet networks. Intersect Remote Bridge uses wireless spread spectrum radio technology to connect Ethernet network segments that are physically separated. Persoft's Passage, announced in February, is a connectivity product that enables workstations on token-ring networks to access host systems on Ethernet networks.

### **Other Persoft Products**

Persoft offers SmartMOVE, an inexpensive Digital VT100, VT102 terminal emulator.

---

### **Competitive Position**

In the crowded market for general-purpose asynchronous communications packages that include basic VT100 and VT52 emulation, Persoft has a strong foundation in the Digital platform and holds 30 percent of the market share. The company's new network connectivity products provide pioneering bridge capabilities that are unmatched by the competition, which includes Walker Richer & Quinn, Polygon, and Coefficient.

Persoft provides first-rate Digital Equipment, Data General, and Tektronix terminal emulation. Like its competitors, Persoft continues to fine-tune and strengthen its terminal emulation products with enhancements. For example, in April 1990, Persoft became the first terminal emulation software company to license Digital Equipment Corp.'s LAT protocol. Persoft's enhancements come at no extra cost, whereas other competing vendors sell their product enhancements separately.

Persoft has phased out its Hewlett-Packard (HP) terminal emulation product support. Walker Richer & Quinn and Minisoft are the only terminal emulation software companies supporting HP. Persoft and Polygon continue to provide Data General terminal emulation, whereas Walker Richer & Quinn does not. Persoft is the only vendor that offers a file server version for Data General emulation.

Despite the mainstreaming of the Apple Macintosh in corporate America, Persoft has no plans to offer Digital terminal emulation for the Macintosh; the company, like Polygon, supports only IBM PCs and compatibles. Walker Richer & Quinn is the only vendor to offer Digital terminal emulation for the Macintosh, as well as Microsoft Windows 3.0 emulation for MS-DOS and Macintosh users. Both Persoft and Walker Richer & Quinn are now developing VT terminal emulation for Windows.

In recent years, network connectivity has become an integral part of company strategy for Persoft and its competitors. Persoft's Intersect bridge products are pioneering and cost-effective. Walker Richer & Quinn's networking products, while not

as cost-effective or innovative, provide broader integration of the PC and Macintosh in Digital, HP, and UNIX data processing environments.

---

### **Decision Points**

#### **Cost-Effectiveness**

Persoft's Intersect software bridge, which began shipping in December 1990, provides cost-effective Ethernet LAN-to-LAN connectivity.

According to George Fluck, vice president of technology at *Standard & Poor's* in New York, "Intersect is a low-risk alternative that provides great flexibility and straightforward maintenance. Given Intersect's software approach to bridging, users can immediately set up low-profile PC systems to act as an intelligent bridge. This enables high bridge performance at a greatly reduced cost."

The company's Intersect Remote Bridge—the first wireless remote bridge available using spread spectrum radio technology—replaces costly leased telephone line connections.

#### **Digital and Data General Connectivity**

Persoft's SmarTerm products are easy to use, provide precise terminal emulation, and are well documented. Recent enhancements to its products have strengthened the network support of SmarTerm.

In April 1990, Persoft began shipping its SmarTerm products with full LAT support built directly into them. Designed from Digital's specifications, Persoft's implementation includes enhancements not found in Digital's LAT or in any reverse-engineered LAT. Such enhancements include complete compatibility with Novell NetWare, reduced memory, increased speed, and the ability to completely unload from memory. In September, Persoft further enhanced its licensed implementation of Digital's LAT to support Ethernet boards compliant with the NDIS protocol. SmarTerm's NDIS support, which is fully compatible with any NDIS-compliant LAN including 3Com 3+Open, permits simultaneous use of both LAT and 3Com using the same Ethernet card. Users may run SmarTerm from any network that supports multiple NDIS stacks, use LAT to connect to a VAX, and transfer a file back to the network file server or local disk without having to reconfigure or reboot the PC. Users can maintain transparent

simultaneous PC-to-host and PC-to-PC connectivity/communications.

In September 1990, Persoft introduced a full-featured implementation of Telnet, the TCP/IP terminal interface protocol, to enhance SmarTerm's Transmission Control Protocol/Internet Protocol capabilities. SmarTerm's Telnet supports network products from Sun Microsystems, Wollongong, Novell, and FTP Software. Previously, SmarTerm handled TCP/IP implementations for the PC by interacting with the specific network vendor's Telnet interface. Features of Persoft's Telnet include support for multiple sessions to multiple hosts; the capability to maintain a network session even after exiting SmarTerm; limited memory requirements; support for BSD 4.2, Domain Name Service, and Sun Yellow Pages; as well as the capability to completely unload itself from PC memory after use.

In September 1990, Persoft also introduced SmarTrack, a menu-driven utility that reports important information to network administrators about the use of SmarTerm for File Servers. SmarTrack intelligently tracks the number of concurrent sessions in use, adding and subtracting as users start or exit SmarTerm from the file server. Information reported includes the number of concurrencies in use at any given time, enabling network administrators to see peak periods of usage; how often each user logs into SmarTerm and how long each session is; and the number of times access is denied because the maximum number of concurrencies allowed has been reached.

---

### Company Profile

Targeting MIS environments in *Fortune* 500 companies, Persoft's SmarTerm products are the cornerstone of its business, followed by its Intersect bridge products.

Established in 1982, Persoft is a privately held company with 63 employees. Initially, Persoft functioned as a two-person operation manufacturing a Digital terminal emulation software package. By 1989, however, the company had grown to approximately 85 employees and offered three Digital terminal emulation packages, a Hewlett-Packard (HP) terminal emulation product, a Data General terminal emulation package, a Tektronix terminal emulation product, and a general asynchronous communications package.

In 1990 the company refocused its terminal emulation products, revamping its Digital and Data General offerings, and dropping its Hewlett-Packard and Tektronix packages. At this time, Persoft perceived a maturing terminal emulation market and entered the network connectivity market with a product line of pioneering network bridge packages.

Today, Persoft divides its marketing efforts between its prosperous SmarTerm product line and its new Intersect network bridge products. Last year, the company's SmarTerm line sales topped \$46.8 million. Persoft is optimistic about its Intersect offerings, reporting that its bridge products are generating a favorable reaction in the computer industry.

Persoft has long been among *SOFT\*LETTER's* top 100 independent microcomputer software companies. More than 250,000 copies of its products have been sold to users in more than 50 countries and in 75 percent of *Fortune* 100 U.S. companies. Thirty percent of the company's sales come from its international market. Persoft sells to 53 countries, with a European headquarters in the Netherlands and a distribution center in Germany.



## Characteristics

**Models:** SmarTerm 340, SmarTerm 320, SmarTerm 240, SmarTerm 340 for File Servers, SmarTerm 320 for File Servers, SmarTerm 240 for File Servers, SmartMOVE, Intersect Local Bridge, Intersect Remote Bridge, Passage, SmarTerm 470, SmarTerm 470 for File Servers.

**Date Announced:** SmarTerm 340—1990; SmarTerm 320—1989; SmarTerm 240—1986; SmarTerm 470—1989; SmarTerm 340 for File Servers—1990; SmarTerm 320 for File Servers—1990; SmarTerm 240 for File Servers—1989; SmarTerm 470 for File Servers—1990; SmartMOVE—1987; Intersect Local Bridge—1990; Intersect Remote Bridge, Passage—1991.

**Table 1. Persoft SmarTerm Product Line**

	<b>Terminals Emulated</b>	<b>Graphics Emulated</b>	<b>Network Support Drivers</b>	<b>Xmodem Support</b>	<b>Kermit Support</b>	<b>Memory Needed</b>
<b>SmarTerm 340</b>	Digital VT340, VT241, VT240, VT320, VT220, VT102, VT100, VT52, TTY	16-color ReGIS and Tektronix 4014 on VGA and CGA adapters	Included	xmodem, CRC, xmodem LK	Server mode, wild card, batch choice, large packets	310K-490K bytes depending on configuration
<b>SmarTerm 240</b>	VT340 (ReGIS), Digital 240/241, 220, 102, 100, 52, TTY	16-color ReGIS and Tektronix 4014 on VGA, EGA, CGA, and Hercules adapters	Included	xmodem, CRC, xmodem LK	Server mode, large packets, wild card	512K
<b>SmarTerm 320</b>	Digital VT320, VT220, VT102, VT100, VT52	No	Included	xmodem, CRC, xmodem LK	Server mode, wild card, batch choice, large packets	320K
<b>SmarTerm 470</b>	Data General D470, 461, 460, 450, 410, 411, 400, 220, 215, 214, 211, 210, 200, 400	D470C, 461, 460, 450 color and mono on EGA and VGA adapters	Included	xmodem CRC, xmodem check-sum, ymodem	No	448K
<b>SmarTerm 400 (1)</b>	Data General D410, 400, 215, 214, 211, 210, 200, 100	No	Optional	xmodem CRC, xmodem check-sum, ymodem	No	320K
<b>SmartMOVE</b>	Digital VT100, VT102, VT52	No	Optional	Yes	Server Kermit	320K

(1) *SmarTerm 470 is an upgrade version of SmarTerm 400.*

**Date First Installed:** SmarTerm 340—1990; SmarTerm 320—1989; SmarTerm 240—1986; SmarTerm 470—1989; SmarTerm 340 for File Servers—1990; SmarTerm 320 for File Servers—1990; SmarTerm 240 for File Servers—1989; SmarTerm 470—1989; SmartMOVE—1987; Intersect Local Bridge—1990; Intersect Remote Bridge, Passage—1991.

**Number Installed:** Over 250,000 packages from the SmarTerm family.

**Distribution:** Persoft products are available directly from Persoft and through Merisel, Ingram Micro D, Avnet Computer, value-added resellers, and retail software outlets. The company currently has no OEM arrangements.

## Models

### Terminal Emulation Products

**SmarTerm 340:** This product allows an IBM PC or compatible to emulate Digital VT340, VT240, and Tektronix 4010/4014 graphics terminals. It supports page memory, report sequences, and Digital character sets, as well as providing an easy-to-use interface, international

support, and full network functionality. The package provides its own implementation of Telnet, which supports network products from Sun Microsystems, Wollongong, Novell, and FTP Software. A multiuser version, SmarTerm 340 for File Servers, enables users to share software residing on a network file server and access information simultaneously. SmarTerm 340 for File Servers provides its own implementation of Telnet, full NDIS protocol support, and SmarTrack—a menu-driven utility reporting information to network administrators about the use of SmarTerm for File Servers.

SmarTerm 340's page memory feature enables users to keep up to 144 lines of the most recently displayed text, at either 80 or 132 columns, in memory for review. Report sequences exchange information about the PC's terminal state with the host. It supports Digital Technical, National Replacement, Multi-National, and ISO LATIN-1 character sets. Both versions of SmarTerm 340 include Persoft's implementation of LAT, which uses 33K bytes of memory on the PC, is unloadable from memory, and is completely compatible with Novell NetWare.

The package can run on many popular networks such as IBM LANACS, 3Com, and Novell. SmarTerm requires an IBM PC or compatible running DOS Version 2.1 or higher. It uses as little as 335K bytes of memory—depending on configuration—and requires a

VGA or an EGA graphics card. It also offers Lotus 1-2-3 for VAX/VMS and WordPerfect keyboard support.

**SmarTerm 320:** This product is an upgrade version of SmarTerm 220 (now discontinued). It allows an IBM PC to emulate Digital VT320, VT220, VT102, VT100, VT52, and TTY text terminals. Using the package, a PC can communicate with a Digital mainframe or minicomputer or an on-line information service, such as CompuServe or The Source. Users can preset eight setup configurations. The package provides its own implementation of Telnet, which supports network products from Sun Microsystems, Wollongong, Novell, and FTP Software. A multiuser version, SmarTerm 320 for File Servers, enables users to share software residing on a network file server and access information simultaneously. SmarTerm 320 for File Servers provides its own implementation of Telnet, full NDIS protocol support, and SmarTrack—a menu-driven utility reporting information to network administrators about the use of SmarTerm for File Servers.

When using SmarTerm 320, file transfers are performed using Kermit, xmodem, and PDIP (Persoft proprietary) protocols. Users can specify full pathnames for the transfers. Capture files can be overwritten with new data, or the data can be appended to the file. Wild card file transfers can be initiated when using Kermit. Other file transfer features include adjustable timing delays between characters, a built-in test pattern, and two pop-up windows that display the text as it is being sent by the PC and received by the host. Both versions of SmarTerm 320 include Persoft's implementation of LAT.

The product supports 132-column text display and double-high, double-wide character display in different ways, depending on the user's system configuration. If a PC has a graphics adapter, 132-column text is compressed and double-high/-wide characters are displayed as on a VT220 terminal. If the PC uses a standard monochrome display board, a horizontal scroll feature is used to show 132-column text, and extra spaces are inserted between characters or lines to represent double-high/-wide characters. Other features of SmarTerm 320 include user-defined colors for emulation mode; a built-in, character trace mode for diagnostics; and control of the local PC from a remote PC or host system.

**SmarTerm 240:** This product allows an IBM PC to emulate Digital VT240 and TTY 4010/4014 graphics terminals, as well as Digital VT220, VT102, VT100, VT52, and TTY text terminals. It allows a PC to communicate with a Digital mainframe or minicomputer, as well as on-line information services.

Text emulation features supported include double-high, double-wide characters, 132-column text display, and horizontal scrolling. When using SmarTerm 240 with an EGA, CGA, or VGA board, the PC can access ReGIS color graphics programs designed for the VT241 color graphics terminal. ReGIS images are also displayed on monochrome monitors using CGA or Hercules boards. When SmarTerm 240 is in graphics mode,

users can view an entire image or a portion of an image. Graphics images can be downloaded from the host and redrawn on the PC. SmarTerm 240 for File Servers provides its own implementation of Telnet, full NDIS protocol support, and SmarTrack—a menu-driven utility reporting information to network administrators about the use of SmarTerm for File Servers.

File transfers are performed using Kermit, xmodem, and PDIP protocols. Users can specify full pathnames for the transfers. Capture files can be overwritten with new data, or the data can be appended to the file. Wild card file transfers can be initiated when using Kermit. Other file transfer features include adjustable timing delays between characters (to slow transmission), a built-in test pattern, and two pop-up windows that display the text as it is being sent by the PC and received by the host.

**SmarTerm 470:** This product is an upgrade version of SmarTerm 400. It allows an IBM PC to emulate Data General D410, D400, D215, D214, D211, D210, D200, and D100 terminals for communications with Data General mainframes. The product supports TTY emulation for access to on-line information services. Additional software can be purchased to allow the product to communicate through Ungermann-Bass Net/One networks.

SmarTerm 470 allows files to be transferred using xmodem, ymodem, or PDIP protocols. The product supports all the file transfer features noted for SmarTerm 320. The package provides its own implementation of Telnet, which supports network products from Sun Microsystems, Wollongong, Novell, and FTP Software. A multiuser version, SmarTerm 470 for File Servers, enables users to share software residing on a network file server and access information simultaneously. SmarTerm 470 for File Servers provides its own implementation of Telnet, full NDIS protocol support, and SmarTrack—a menu-driven utility reporting information to network administrators about the use of SmarTerm for File Servers.

Dasher terminal emulation features supported include multiple window display, window erase, vertical scrolling within windows, work processing, and line drawing. Compressed characters are also displayed if a 132-column video card is installed in the PC.

**SmartMOVE:** This product is a general asynchronous communications package that allows a PC to emulate Digital VT102, VT100, and VT52 text terminals. It supports all VT100 keys (including the Gold Key), double-high and double-wide character display, fast and slow scrolling, and 132-column text display.

Files can be transferred in background using xmodem and Kermit protocols. A screen with two windows pops up to show data being transmitted and received. Unlike the other programs, SmartMOVE supports a dialing directory that displays 16 configurations; additional dialing directories can also be created. The package will automatically redial any number until a connection is established.



SmartMOVE supports an advanced softkey language that uses "if then" statements. The language includes a speed connect feature that allows a user to establish communications from a DOS prompt. Other features supported include a trace mode and changeable screen colors.

## Bridge Products

**Intersect Local Bridge:** This software bridge runs on an IBM PC/XT/AT or compatible CPU to create an intelligent bridge that connects two Ethernet LANs, regardless of the LAN operating systems. Operating at the MAC layer, this product supports any combination of Novell, Ungermann-Bass, 3Com, Banyan, TCP/IP, XNS, DECnet, LAT, TOP, or ISO traffic. Fully IEEE 802 compliant, Intersect functions independently of vendor-specific products. It runs over thick Ethernet, thin Ethernet, and twisted-pair media connections.

Intersect features the ability to learn the locations of nodes in each network as nodes in either network are moved or eliminated, thus forwarding information accordingly. The software bridge automatically detects loops (multiple bridge paths between LANs) and designates one bridge to forward packets. It minimizes network traffic by filtering packets—forwarding only those packets destined for the LAN on the other side of the bridge. Intersect also performs a self-diagnostic procedure at start-up.

**Intersect Remote Bridge:** This companion product to the Intersect Local Bridge uses wireless technology to connect Ethernet LANs that are physically separated. It is a MAC-layer bridge that is fully IEEE 802.1d draft compliant and includes Spanning Tree Protocol to eliminate looping. It is a learning bridge that automatically learns and adjusts for new or changed addresses on the network.

Intersect Remote Bridge runs in a dedicated IBM AT or compatible supplied by the user. Operating at the Media Access Control layer enables Intersect Remote Bridge to run over virtually any Ethernet operating system, including NetWare, DECnet, and Banyan VINES, and over protocols including TCP/IP, LAT, and ISO. It uses the spread spectrum of radio frequency to transmit information.

**Passage:** This product, designed to be used with SmarTerm terminal emulation products, connects token-ring workstations to VAX/VMS or UNIX hosts. It gives token-ring workstations simultaneous access to Digital LAT and other UNIX TCP/IP hosts. It serves as a NetWare IPX bridge/router that provides token-ring workstations with access to all services on NetWare servers on both the Ethernet and token-ring networks.

Passage is comprised of software, a token-ring network card, and an Ethernet network card. It runs on a dedicated IBM PC AT or compatible to connect the two networks. In environments with multiple token-ring networks bridged together, only one Passage unit is needed to connect the entire token-ring environment to the Ethernet network. Passage works in conjunction with Persoft's terminal emulation software, SmarTerm 340 or SmarTerm 320; it can be used with either the file server or standalone version of SmarTerm.

## Support

**Phone Support:** Unlimited, free technical assistance is available to registered Persoft users Monday through Friday, 8:30 a.m. to 5:00 p.m. Central time at (608) 273-6000.

**Warranty:** All Persoft products can be purchased under a 30-day, money-back guarantee.

**Upgrades:** Customers who purchase a software package within 60 days prior to a software upgrade will receive the upgrade free of charge.

## Software Prices

	<b>Purch. Price (\$)</b>
SmarTerm 340	375
SmarTerm 320	225
SmarTerm 240	375
SmarTerm 340 for File Servers	1,495
SmarTerm 320 for File Servers	895
SmarTerm 240 for File Servers	1,495
SmartMOVE	149
Intersect Local Bridge	1,495
Intersect Remote Bridge	4,995
Passage (for 20-workstation license)	5,995
Passage (for 50-workstation license)	9,995
SmarTerm 470	375
SmarTerm 470 for File Servers	1,495



# Proteon Local Area Network Products

## In this report:

Analysis .....	-102
Characteristics.....	-106
Pricing.....	-109

## Product Summary

### Editor's Note

Since our last report, Proteon announced the p4100+ Bridging Router, incorporated fiber optic connectivity and 16M bps support into the Series 70 Intelligent Wire Center, added 16M bps support for TokenVIEW and TokenVIEW Manager network management software, introduced the p1890 ProNET-4/16 Micro Channel Adapter, and announced the ProNET CNX 500 RISC-based bridging router. In June, Proteon announced a worldwide reseller agreement with Digital Equipment Corp. In July, Proteon added frame-relay support to CNX 500 and p4100+.

### Description

Proteon produces the ProNET LAN family, which includes the 4M bps ProNET-4, the 10M bps ProNET-10, the 16M bps ProNET-4/16, and the 80M bps ProNET-80. The company's network interface cards provide token-ring connectivity for IBM PC ATs and compatibles, EISA-based workstations, and IBM Micro Channel systems.

—By Barbara Callahan  
Associate Editor

Among its internetworking products, the company numbers the p4200 FDDI router, the p4100+ bridging router, and the CNX 500 RISC-based bridging router.

### Strengths

Proteon offers innovative LAN products, which feature IBM Token-Ring compatibility and 16M bps speeds on UTP. The company has entered the RISC arena and is providing frame-relay and SNA support.

### Limitations

Proteon does not specialize in Ethernet LAN products, but supports Ethernet on its routers.

### Competition

Cisco Systems, Gateway Communications, IBM, 3Com, Ungermann-Bass, and Wellfleet.

### Vendor

Proteon, Inc.  
Two Technology Drive  
Westborough, MA 01581  
(508) 898-2800

### Price

CNX 500—\$10,995 to \$19,995;  
p4100+—\$5,195 (base platform).

### GSA Schedule

Yes.

# Analysis

## Product Strategy

Proteon defines its mission as "providing the network infrastructure for the '90s." Having targeted IBM SNA/mixed-vendor installations as the environments in which it can excel, Proteon plans to fortify those sites with its own infrastructure, which consists of adapters, smart hub and wiring strategies, bridge/router access points, and integrated network management solutions. As the finishing touches to an excellent product line that promotes enterprise-wide connectivity, Proteon adds FDDI, frame relay, and SNA, driven by RISC-based engines.

Proteon is no newcomer to LAN innovation. The company pioneered token-ring networking and produced the first commercially available token-ring network in 1981. It also participated in the development of the IEEE 802.5/Token-Ring standard. During the past decade, Proteon has refined its ProNET token-ring products, and in the process, accomplished the extraordinary feat of releasing ProNET-4/16, the industry's first 4/16M-bps solution for unshielded twisted-pair (UTP) cabling. Creating technological breakthroughs has always moved the company forward.

For its latest venture into uncharted territory, Proteon selected reduced instruction-set computing (RISC) technology and applied it to the CNX 500 bridging router. Although RISC originated in the workstation environment, interest in the technology has been running high in the LAN industry. Proteon has earned the distinction of becoming the first vendor to bring a product to market that incorporates the technology. Proteon believes that basing internetworking routers on RISC processors creates an ideal method for cost effectively achieving higher speeds and optimizing operations. The company is also banking on the arrival of faster RISC processors in the near future to accelerate the development of RISC-based routers capable of performance that exceeds 100,000 packets per second.

Leveraging its expertise in token-ring applications, Proteon announced a reseller agreement with Digital Equipment in June 1991. Digital's selection of Proteon as a strategic partner offsets Digital's lack of token-ring products. With a rallying cry of "Token-Ring to Everything," Proteon's president, Patrick Courtin, affirmed Digital's decision at the announcement. The worldwide Basic Order Agreement (BOA) calls for Digital to purchase and resell Proteon's 802.5/Token-Ring and internetworking products, which include PC adapters, intelligent wiring hubs, bridges and routers, and network management software.

Digital's move into token-ring-to-Ethernet connectivity stems from the proliferation of mixed-media networks in the business world. A Gartner Group report cited by Digital spokespersons states that 70 percent of *Fortune* 500 companies have installed both 802.3/Ethernet and 802.5/Token-Ring networks. In addition to reselling Proteon's products, the multiyear agreement with Digital includes marketing, sales, and support programs through which Digital and Proteon work together on training, sales activities, and comprehensive customer service and support.

About the agreement, Digital's Gail Daniels, director of networks marketing, commented, "Proteon's decade of token-ring innovation, its comprehensive product family for integrating token-ring with other LANs/WANs, and its outstanding price/performance, make it an obvious choice for Digital. Our relationship with Proteon and planned token-ring support in PATHWORKS, coupled with Digital's established Ethernet and award-winning FDDI products, will deliver customers the widest choice for multivendor networking."

By making use of Proteon's 802.5/Token-Ring and internetworking technologies, Digital can connect 802.5/Token-Ring users with any Digital or non-Digital LAN or WAN, as well as with distributed applications, such as X.400-based electronic messaging, videotex, and electronic conferencing. In addition, Digital can manage both 802.3/Ethernet and 802.5/Token-Ring networks through its DECmcc management system.

Proteon has entered into similar agreements with OEMs and systems integrators such as AT&T, Compaq, Memorex-Telex, and Unisys, as well as with VARs and distributors such as Ingram Micro D. ▶

## Company Profile Proteon, Inc.

### **Corporate Headquarters**

Two Technology Drive  
Westborough, MA 01581  
(508) 898-2800

### **In Canada**

3100 Steeles Avenue W.,  
Suite 526  
Concord, ON L4K 3R1

International Offices in  
Europe and the Pacific  
Rim.

### **Officers**

Chairman and Chief Technical Officer: Howard C. Salwen

*President and CEO:*

Patrick Courtin

*Vice President, Engineering:* Nick Grewal

*Vice President, Marketing:*

Nathan Kalowski

*Vice President of Manufacturing Operations:* Daniel J. Capone, Jr.

*Vice President of Sales:*

Daniel E. Smith

### **Company Background**

*Year Founded:* 1972

*No. Employees:* Over 400

Proteon originated in 1972 as an engineering design and development firm, providing design consultation to corporations, government agencies, and the scientific community. The design of communications systems for a wide range of applications, including satellite tracking and telemetry, and the introduction of telecommunications products into the commercial marketplace, led Proteon

to the first commercial development of a token-ring LAN, the ProNet-10.

In a joint effort with MIT's Laboratory for Computer Science, Proteon developed and marketed the original ProNET system, the ProNET-10 star-shaped token-ring network. On April 19, 1991, Proteon announced that it had filed with the SEC for an initial public offering of 3.1 million shares of common stock. Of the shares offered, 2.5 are being offered by Proteon, and 600,000 are being offered by selling shares of stockholders.

In 1990, the company grew more than 40 percent over 1989 with revenues of \$74 million. A \$25 million contract with AT&T involving the sale of Proteon token-ring equipment to American Airlines contributed toward the banner year. Financial analysts expect Proteon's revenue to pass \$100 million in fiscal 1991.

Since the first release of the ProNET-10 network in 1981, Proteon claims a number of industry firsts—almost one every year and many in 1990.

- 1981—First independent token-ring network.
- 1982—First fiber optic token-ring.
- 1984—First infrared token-ring.

- 1985—First (and only) 80M bps token-ring.
- 1985—First multiprotocol internetworking router.
- 1986—First IEEE 802.5 token-ring network with intelligent network management.
- 1986—First microwave token-ring.
- 1988—First internetwork manager based on SNMP standard.
- 1989—First support of 16M bps networks over unshielded twisted pair (UTP).
- 1989—First implementation of OSPF dynamic routing protocol.
- 1989—First EISA token-ring interface.
- 1990—First multiprotocol FDDI router to pass AMD FDDI chip set interoperability tests; first multiprotocol bridging router with source routing and 16M bps backbone support; first jitter reduction technology for multi-vendor 4M/16M bps token-ring environments; first lifetime warranty for 4M/16M bps adapters; first demonstration of RISC-based routing technology.
- 1991—First RISC-based multiprotocol bridging router.

### **Recent Agreements**

*July 1990*—signed a \$3 million OEM contract with Acer Inc., under which Acer incorporates Proteon's IBM-compatible ProNet-4/16 network interface cards and Series 70 Intelligent Wire Center

into the Acer Token Ring Network 5290 Series.

*August 1990*—signed marketing agreements with Hewlett-Packard and Performance Systems International (PSI), which authorizes HP to market Proteon's p4100plus to its Apollo Token-Ring customers and PSI to act as a VAR for p4100plus.

*August 1990*—announced a value-added reseller agreement with Codex Corp., under which the System Division of Codex can sell Proteon's token-ring networking and internetworking products as part of its complete networking solutions.

*October 1990*—entered into a joint marketing agreement with Epoch Systems under which users of FDDI networks can use Proteon's p4200 router to access Epoch's Epoch-1 InfiniteStorage Servers.

*February 1991*—announced a U.S. distribution agreement with Ingram Micro Inc., under which Ingram Micro distributes Proteon's ProNET-4/16 token-ring product family.

*June 1991*—announced a reseller agreement with Digital Equipment Corp.

---

► (Analysis continued)

---

## Competitive Position

Because of the nature of its business and the breadth of its product line, Proteon competes against almost everybody in the LAN and internet-working arenas, and almost everybody is a major leaguer. Situated at the top of the roster of opponents, IBM instantly conveys an aura of unequalled token-ring market share that is hard to dispel. Industry watchers and a rising number of users, however, can attest to Proteon's past and current token-ring know-how. The company preempted IBM's release of token-ring LANs by four years and confounded IBM's assertion that 16M bps speeds could not operate over ordinary telephone wire by releasing ProNET-4/16, which does exactly that.

Another major competitor, Ungermann-Bass, broke the 16M bps/UTP barrier about the same time as Proteon, but Proteon began shipping its ProNET-4/16 in September 1989. U-B started shipping its 16M bps products on token-ring in the summer of 1991. Proteon also solved the jitter problem inherent in 16M bps UTP token-ring networks consisting of more than 50 nodes by introducing the "jitter buster" filter in 1990, which is currently under consideration by the IEEE 802.5 workgroup for incorporation into the standard.

Ungermann-Bass has lately shifted its focus to hubs, attempting to raise users' awareness of its competence in this market. This new approach by U-B gives Proteon a little more breathing room in other areas of internetworking. Although Proteon produces wiring centers, the company is not attempting to be perceived primarily as a hub vendor.

Lining up as opponents in the router field are Wellfleet and Cisco Systems, both young, aggressive companies with high-quality products. Cisco is marketing an FDDI router, the AGS+, which supports most of the protocols that are supported by Proteon's router line, spearheaded by the CNX 500, with the exception of Apollo DOMAIN and the IEEE 802.6 Metropolitan Area Networking standard. At \$12,300, the AGS+ costs more than the CNX 500's base price of \$10,995.

Like Cisco, Proteon expects to be doing quite a bit of business in IBM-dominated environments. To that end, the company has devised a three-stage

strategy. Stage I, currently in process, involves the existing and ongoing implementation of token-ring within multiprotocol routers and IBM's source route bridging environments. Network management occurs through SNMP/NetView. Stage 2, targeted for the first quarter of 1992, adds Source Routing (SRB) Encapsulation. Network management occurs through LAN Network Manager and NetView. Stage 3, targeted for the second quarter of 1992, includes Source Routing Transparent (SRT), transparent Ethernet/token-ring bridging, and APPN support. Network management is handled through CMIP and Native NetView.

Wellfleet has incorporated FDDI support into all of its routers: Concentrator Node, Feeder Node, and Link Node. Like Cisco, its routers support the same protocols as Proteon's, except Apollo Domain. Wellfleet's top-of-the-line Concentrator Node costs \$14,000, very close to the \$14,950 maximum configuration price set by Proteon for its p4200.

In March 1991, Cisco pulled off a first of its own by announcing the industry's first Switched Multi-megabit Data Service (SMDS) router interface for LAN-to-LAN connectivity. Not to be outdone, Wellfleet made its SMDS announcement in April 1991. Wellfleet, however, collaborated with Digital Link Corp. to produce routers that interface to SMDS through Digital Link's DSU/CSUs and Wellfleet's software. At present, Proteon has not revealed plans for SMDS router interfaces. In August 1990, however, the company released the industry's first router-based support of IEEE 802.6 and SMDS-based technology for metropolitan area networking.

---

## Decision Points

It is always reassuring to choose a vendor whose products have been tested and well received by independent third parties. In Proteon's case, the accolades came from Scott Bradner of Harvard University whose tests of multiprotocol routers were reported in the February 1991 issue of *Data Communications* magazine. In an article by Steven S. King, executive editor, technology, the author commented, "For single streams of traffic with mixed packet sizes, the tests indicated less than significant difference in maximum throughput for Cisco, Proteon, and Wellfleet routers . . . and he

[Bradner] thinks that Proteon's new RISC-based product is one to watch in future releases."

Later in the article, King selected Cisco, BBN, Proteon, and Wellfleet for its Tester's Choices awards. Regarding the choice of Proteon, he wrote, "As the only router vendor with a RISC-based multiprotocol router, Proteon deserves a great deal of credit—along with a top performance award—for pioneering advanced router architectures. We believe that these new RISC products ideally position Proteon to supply superior price/performance and the much-needed integration of the routing function into wire center and management technologies."

The object of this acclaim, the CNX 500, is the first in a family of multiprotocol bridging/routers planned by Proteon. The company incorporated RISC technology, well known for its use in UNIX workstations, into the CNX 500 because of its potential capability of supporting speeds up to 100,000 per second. Since the networking mandate for the nineties, issued by large users, is support for higher speeds, Proteon appears ready to meet their demands. Support by the CNX 500 for 16M bps and FDDI protects users' investments when their needs grow.

Somewhat eclipsed by the arrival of the CNX 500, but also an innovative product, the p4100+ delivers 16M bps backbone connectivity, IBM-compatible source routing bridging (SRB), and

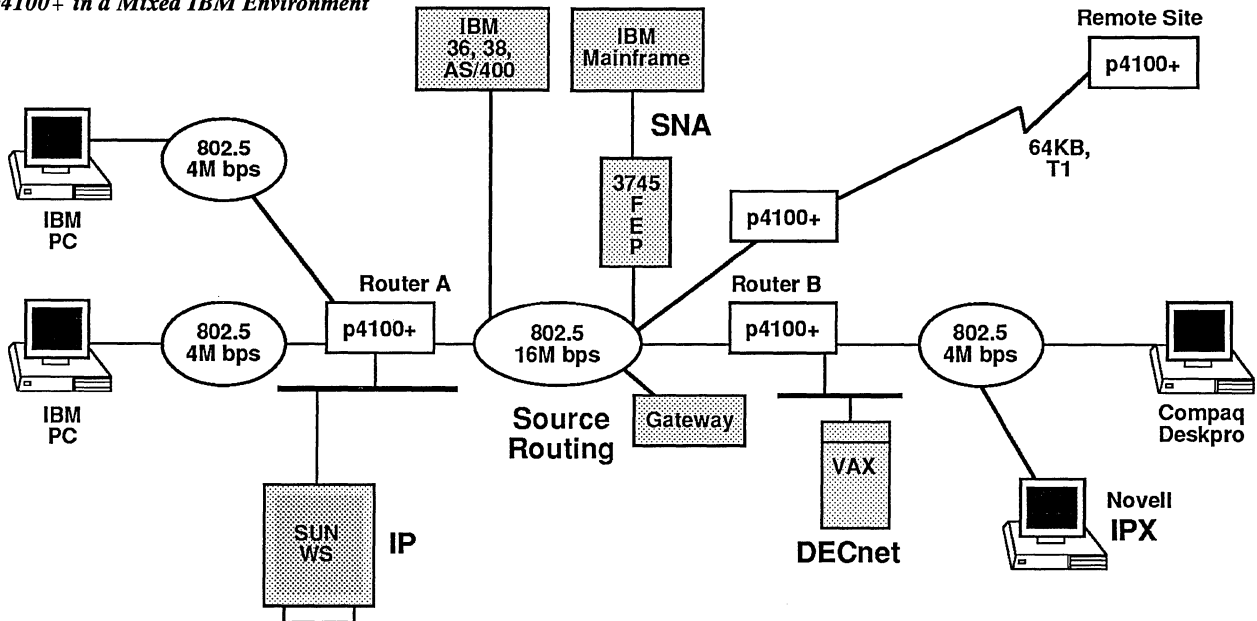
LAN/WAN integration. Attractively priced at under \$10,000, the p4100+ reduces the previously high price tag attached to integrating IBM systems into a multivendor LAN/WAN environment. Users can operate the product over fiber, unshielded twisted-pair, or shielded twisted-pair cabling. Proteon positions the p4100+ as a low-cost solution for remote routing applications.

Along with higher speeds, network users of all sizes are calling for better customer service. To deal with the complex issues involved in servicing multivendor networks, such as whose card caused the problem, Proteon instituted a Product and Program Management office in 1990. The office is charged with the responsibility of transferring engineering knowledge to support resources, which include VARs and distributors.

As for telephone support, Proteon's Tom Nephew, director of customer service, commented, "When our customers call us for telephone support, more of them are talking to an engineer before they hang up the phone. In fact, 53 percent of our calls go to an engineer." Proteon anticipated that by the second quarter of 1991, 80 percent of users' calls would go to engineers.

In September 1990, Proteon issued a paper entitled "Proteon's Network Management Strategy: A Guide for MIS Managers and PC LAN Administrators." In it, Proteon noted that it will build an IBM NetView interface to its TokenVIEW

Figure 1.  
*p4100+ in a Mixed IBM Environment*



Manager, its network management software, to allow NetView to monitor and control token-rings. Proteon also plans to integrate OverVIEW, its internetworking management software, with NetView for internetworking management.

Integration with AT&T's Unified Network Management Architecture (UNMA) is also in the works. The paper also noted that Proteon has become a partner in Digital Equipment's EMA Strategic Vendor program. The extent of that partnership became known in June 1991, when Digital announced its worldwide Basic Order Agreement with Proteon to purchase and resell Proteon's 802.5/Token-Ring and internetworking products.

These current and future collaborative efforts with major LAN and internetworking vendors will make life much easier for network managers and administrators. In addition, Proteon's support for current and future standards significantly advances the cause of interoperability.

## Characteristics

**Models:** ProNET-4/16; ProNET-4; ProNET-10; ProNET-80.

**Date of Announcement:** July 1989 (ProNET-4/16); October 1985 (ProNET-4); 1981 (ProNET-10); March 1985 (ProNET-80); 1986 (TokenVIEW); 1989 (TokenVIEW Plus); 1990 (p4100+).

**Number Installed:** Over 200,000 local area network nodes; over 16,000 ProNET-4/16 adapters.

**Distribution:** Distributors, value-added resellers, systems integrators, and OEMs.

### Architecture

All of Proteon's ProNET LANs—the 4M bps ProNET-4, the 10M bps ProNET-10, the 16M bps ProNET-4/16, and the 80M bps ProNET-80—are architecturally similar and follow the token-passing media access scheme,

although the ProNET-4 and ProNET-4/16 are IEEE 802.5-compatible networks while the ProNET-10 and ProNET-80 are proprietary networks. In October 1990, Proteon announced that its ProNET-4/16 token-ring UTP products support Wang's OPEN/server line.

Unlike the carrier sense multiple access with collision detection (CSMA/CD) LAN communications protocol—a contention-based media access method used primarily on Ethernet networks—token passing is a deterministic access scheme designed to circumvent the possibility of signal collisions; it, therefore, guarantees a higher system throughput.

## Hardware

### Interface Cards

**p1390 ProNET-4/16 AT Network Interface Card:** This card connects IBM PC ATs and compatibles to 4M or 16M bps token-ring networks. The p1390 features bus master direct memory access and 128K bytes of on-board memory for packet buffering.

**p1990 ProNet-4/16 EISA Network Interface Card:** This card is the first adapter designed for the new 32-bit Extended Industry Standard Architecture (EISA) bus. The p1990 connects EISA-based computers to 4M or 16M bps token-ring networks and has a 128K-byte packet buffer and bus master DMA.

**p1342 and p1346 ProNET-4 Network Interface Cards:** These cards connect IBM PC and PC AT computers to the ProNET-4 LAN. The p1347 is an AT-compatible board optimized for use in servers.

**Table 1. Packet Forwarders**

Model	Support
p5640 IP	IP, OSPF, EGP, SNMP, SGMP
p5641 XNS	XNS; RIP; XNS Error/Echo/Time Protocols
p5642 DNA	Full DNA Phase IV, Level 2; DNA Routing Layer Version 2.0.0; Ethernet Data Link Functional Specification Version 1.0.0
p5643 IPX	IPX/Sequenced Packet Exchange in Novell Advanced NetWare environments; Novell RIP; Novell Service Advertising Protocol; NETBIOS emulation protocol
p5648 AppleTalk	AppleTalk Phase 1; ZIP; RTMP
p5649 Domain	Apollo Domain; Asknode



**Table 2. p4100+ Features**

LAN Support	IEEE 802.3 Ethernet; IEEE 802.5 4/16 Token-Ring; ProNET-10; Apollo Token-Ring
Backbone	4/16M bps backbone operating over fiber optic cable, shielded twisted pair, and unshielded twisted pair
Network Management	SNMP (TCP/IP); compatible with Proteon's OverVIEW Manager
WAN Connectivity	64K bps; T1 (2.048M bps); PDN X.25; DDN X.25
Multiprotocol Routing	TCP/IP; NetWare/IPX, DEC-Net; XNS; OSI; Apollo Domain; AppleTalk
Bridging	Source Routing (spanning tree planned)

**p1347:** This card features 18K bytes of onboard memory and an IEEE 802.2 Logical Link Control (LLC) interface for compatibility with IBM networking software. All these ProNET-4 interface cards include an onboard media filter for unshielded twisted pair (UTP). The p1347 and p1346 use Proteon's bus master DMA access scheme. The p1346 can be enhanced to provide the same capabilities as the p1347 with the addition of an upgrade kit.

**p1840 PS/2 Micro Channel Interface Card:** Designed for 4M bps token-ring networks, this card supports the IBM Programmable Option Select (POS) feature, in which software controls the card's configuration. It uses the bus master DMA technique.

**p1308 ProNET-10 AT Network Interface Card:** This card allows IBM PCs, PC ATs, and compatibles to connect to the ProNET-10 10M bps token-ring network. The card operates in either 8- or 16-bit modes and features an onboard media filter for use of unshielded twisted-pair cabling.

**p1800 MCA Network Interface Card:** This card attaches computers based on the IBM Micro Channel Architecture to Proteon ProNET-10 networks. The p1800 supports IBM's POS configuration control. Each card has a unique Device Identification Number, registered with IBM, to avoid conflicts with other Micro Channel cards.

**p1307 Fiber Network Interface Card:** This card uses an onboard fiber optic interface for direct connection to optical fiber networks. The p1307 operates in 8-bit mode only. In addition to cards for PCs and compatibles, Proteon offers interface adapters for many widely used buses, including UNIBUS, Q-bus, Multibus, and VMEbus.

**p1890 ProNET-4/16 Micro Channel Adapter:** This adapter is designed for file server and high-performance applications.

#### Interface Card Drivers

Proteon's ProNET-4/16 and ProNET-4 NDIS drivers support LAN Manager 2.0 from Microsoft. The drivers use a directory structure compatible with the automatic driver installation procedures used by LAN Manager Version 2.0. ProNET-4/16 drivers are compatible with NetWare 386 Version 3.0 and Version 3.1.

Banyan's VINES Release 4.00 (2) includes client and server drivers for Proteon's p1390 and SMP server drivers for the p1990 ProNET-4/16 Network Interface cards. Banyan and Proteon are jointly developing VINES 4.00 (2) drivers for the p1890 ProNET-4/16.

#### Internetworking Products

Intelligence designed into Proteon's multiprotocol internetworking routers enhances network management.

#### Routers

Proteon's *p4200 Internetworking Router* can support the integration of diverse types of local area networks and connectivity options to several wide area networking schemes. Equipped with FDDI capabilities, the p4200 supports the most common wide area networking techniques, including X.25 for connection to Public Data Networks (PDNs) and the Defense Data Network (DDN). The p4200 can connect up to 500 nodes, located up to 2 kilometers apart, on the FDDI backbone over 100 kilometers. High- and medium-speed serial interfaces support connections to T1, Digital Data Service (DDS), and other point-to-point serial links. Proteon offers forwarders for protocols such as TCP/IP, Digital's DNA, Xerox Network Systems (XNS), Novell Advanced NetWare/IPX, AppleTalk, and emerging OSI protocols such as End System-Intermediate System (ES-IS). For details on packet forwarders, see Table 1.

**Table 3. CNX 500 Router**

LAN/Backbone Support	IEEE 802.3 Ethernet; IEEE 802.5 4/16M bps Token-Ring; FDDI
WAN Support	T1/E1; 64K bps; X.25; Frame Relay; Point-to-Point Protocol (PPP)
SNA Support	Source Routing Tunnel; SDLC/HDLC Relay
Multiprotocol Support	NetWare/IPX; TCP/IP (OSPF); OSI (ES-IS, IS-IS); DECnet Phase IV, IV+, and V; XNS; AppleTalk; Apollo Domain
Bridging Support	Source routing; spanning tree; source routing transparent (SRT)
Network Management	SNMP; MIB II

Based on a Motorola 68020 32-bit microprocessor running at 16.6MHz, the p4200 comes in two configurations, with 1M or 2M bytes of memory. The 1M-byte model is field upgradable to 2M bytes. An optional Integrated Boot Device (IBD) enables the router to self-load its operating programs if the station from which it normally loads is down.

A software update for the p4200, Version 9.1, enables the router to boot over FDDI, support AppleTalk over FDDI, and implement OSPF Version 2.

The *p4100 Router* is an entry-level counterpart of the p4200, capable of integrating up to four networks into a larger internetwork.

### **Bridging Routers**

In June 1990, Proteon introduced the *p4100+ Bridging Router*, which provides 16M bps backbone connectivity, IBM-source routing bridging, and diverse LAN/WAN integration. In July 1991, Proteon added frame-relay support for its CNX 500 and p4100+ routers. Proteon's frame-relay implementation includes congestion control, committed rate, network management, security, and simultaneous T1/E1 support on the same card. For information on the p4100+, see Table 2.

Proteon's most recent multiprotocol bridging router, the *CNX 500*, is the first member of the CNX family. Based on the AMD 29000 RISC processor, CNX 500 serves as a platform for Proteon's Transportable Software Architecture (TSA). CNX 500 consolidates IBM SNA/multiple protocol environments into an enterprise-wide network. The product forwards 25,000 packets per second, based on a two-step packet-handling system that brings packets from the LAN into its Multi-Port Packet Buffer Memory and sends them to the destination LAN.

For additional information on CNX 500 see Table 3.

### **Wire Centers**

The *Series 70 Intelligent Wire Center (IWC)* supports shielded or unshielded twisted-pair cabling, as well as fiber. The Series 70 works with Proteon's 4M, 10M, and 16M bps networks. A microprocessor built into the wire center communicates via its own communications channel with Proteon's TokenVIEW Plus network management software.

The *p7302 Workgroup Wiring Center* offers an inexpensive method for expanding unshielded twisted-pair networks that use the Series 70. The p7302 enables four unshielded twisted-pair lines to connect to a port on the Series 70, expanding the capacity of the Series 70 from 8 stations to 32.

---

## **Software**

### **Network Management Software**

Proteon introduced its first token-ring management product, TokenVIEW, in 1986. TokenVIEW managed individual token-rings through an in-band monitoring

channel and an out-band communications channel. The Intelligent Wire Center (IWC) forms the core of Proteon's token-ring strategy. Equipped with out-band capabilities, IWCs isolate defective components and restore the ring's operations. When the entire ring fails, TokenVIEW's out-band communications channel enabled network managers to communicate with the wire center to troubleshoot the network. TokenVIEW has been succeeded by TokenVIEW Plus.

### **TokenVIEW Plus**

Introduced in 1989, TokenVIEW Plus allows monitoring and control of a single token-ring network. When used with a Series 70 Intelligent Wire Center, an out-of-band communications channel provides information about the status of the network, even if the network is down. The program's database contains information about wire concentrators, workstations, and user connections as well as a log of network events, such as joins, leaves, and errors. TokenVIEW Plus is installed on a dedicated workstation and is connected to the local ring by a ProNET network interface card. TokenVIEW Plus-4/16 features token-ring physical layer management for 16M bps LANs.

### **TokenVIEW Manager**

TokenVIEW Manager works in conjunction with TokenVIEW Plus workstations to allow network management of distributed token-ring networks. TokenVIEW Manager gathers status information about all connected token-ring networks by continuously polling each local network's TokenVIEW Plus workstation. Users can ensure continuous communication between TokenVIEW Plus workstations and TokenVIEW Manager by installing a second ProNET interface card, attached to a different ring, in TokenVIEW Plus workstations. This secondary connection allows the TokenVIEW Plus workstation to report to TokenVIEW Manager, even when its local network has failed.

### **OverVIEW**

OverVIEW is an internetwork management tool that follows the rules of the Simple Network Management Protocol (SNMP). A graphics-based user interface centers around an interactive network map featuring icon and menu-driven operation. An on-screen icon can represent individual devices or the entire network. A color-coding scheme delivers information about the status of network components.

---

## **Support**

Proteon's ProNET products are supported by authorized dealers, VARs, systems integrators, and OEMs. All distributors are trained to assist in network installation and are equipped to provide continuing support. Proteon offers telephone support for all of its distributors and end users; phone support is available from 8 a.m. to 8 p.m. Eastern time, Monday through Friday.

Proteon offers a lifetime warranty for 4/16M bps token-ring cards. The program authorizes the repair or replacement with a comparable card for the original user throughout the life cycle of the adapter.

In 1990, the company established the Product and Program Management office, which manages the transfer of knowledge from the engineering department to VARs and distributors. In 1991, Proteon set up a new Certification Program for resellers, which qualifies them to support and add value to the end user's networking applications.

## Equipment and Software Prices

		<b>Purchase Price (\$)</b>
<b>CNX 500</b>		
p4501-006	CNX 500 with 6 T1/E1 ports	16,495
p4501-014	CNX 500 with 1 Ethernet port, 4 T1/E1 ports	13,495
p4501-022	CNX 500 with 2 Ethernet ports, 2 T1/E1 ports	10,995
p4501-030	CNX 500 with 3 Ethernet ports	11,750
p4501-104	CNX 500 with 1 token-ring port, 4 T1/E1 ports	13,995
p4501-112	CNX 500 with 1 token-ring, 1 Ethernet, 2 T1/E1 ports	12,750
p4501-120	CNX 500 with 1 token-ring port, 2 Ethernet	12,495
p4501-202	CNX 500 with 2 token-ring ports, 2 T1/E1 ports	14,995
p4501-210	CNX 500 with 2 token-ring ports, 1 Ethernet port	12,995
p4501-300	CNX 500 with 3 token-ring ports	12,995
p4500	CNX 500 router base unit with universal power supply	7,995
<b>Interfaces</b>		
p4210	ProNET-4 (802.5) Interface and Driver for p4200 router	3,200
p4211	ProNET-10 Interface and Driver for p4200 router	3,850
p4212	ProNET-80 Interface and Driver for p4200 router	1,600
p4222	FDDI for 100M bps	14,950
p4110	ProNET-4 (802.5) Interface and Driver for p4100+ router	695
p4111	ProNET-10 Interface and Driver for p4100+ router	545
p4111	ProNET-4/16/IEEE 802.5 Interface and Driver for p4100+ router	1,045

