Telepartner International PC-to-Host Products

In this report:

Product Summary

Editor's Note
Telepartner International is the result of a merger between Packet/PC and Telepartner A/S. The company now offers a Macintosh version of its PACKET/3270, as well as PACKET/FLASH, CRYPTO/3270, a protected mode for PACKET/3270, and PACKET/400. The company expanded its product line outside of the Async market with Synchrony, a management system for the distribution and retrieval of PC software and data.

Description
Telepartner International offers various PC-to-host software products for asynchronous communications between PCs and mainframes or midrange computers.

Strengths
These products offer potential cost savings to customers, because no add-in board is required. Savings is also found in PACKET/3270 through the program's bit compression algorithm.

Limitations
The market is saturated with 3270 communications products. The company does not have a high profile.

Competition
Simware, Network Software Associates (NSA).

Vendor
Telepartner International
135 South Road
Farmington, CT 06032-2551
(203) 678-1961; (800) 722-3270

Price
Products cost from $145 to $15,000.

GSA Schedule
No.

Analysis

Product Strategy

In February 1991, Packet/PC announced a merger with one of its European distributors, Telepartner A/S of Oslo, Norway. The resulting company, Teleparner International, represents a unified international organization with corporate headquarters in Farmington, CT, and European headquarters in Oslo. The company feels that this merger will allow for a more effective response to customer and market needs, since over 50 percent of its customers use the products for international communications.

Since 1985, the company has provided low-cost, asynchronous communications alternatives for accessing applications in an IBM SNA environment. Its first product, PACKET/3270, remains as the company's flagship product.

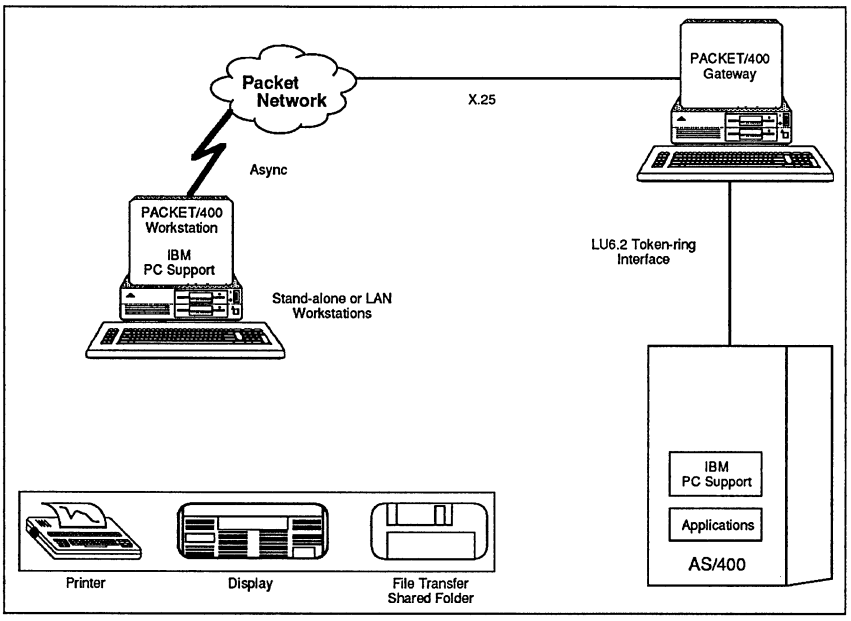
As a result of PACKET/3270's success, Telepartner International has introduced LAN and Macintosh versions of PACKET/3270. The LAN version works with all IBM NETBIOS-compatible LANs, while the Macintosh version provides Macintosh computers with worldwide access to IBM 3270 SNA applications. PACKET/5250 provides a link between PCs and IBM midrange computers. These products are software-based packages (though the 3270 LAN version includes an X.25 network adapter board) that use a proprietary SNA/Async protocol that allows the use of asynchronous modems and X.25 packet-switching networks in accessing SNA mainframe/midrange applications.

Telepartner International's CRYPTO/3270 works in conjunction with PACKET/3270 communications packages. It provides secure worldwide access to 3270 SNA/Async communications applications. The package does not require mainframe hardware or a protocol converter.

SNA/Async is a link-level protocol that provides SNA/SDLC functions, such as end-to-end error detection and correction (using a CRC algorithm), 8-bit data, and full-duplex blocked transmission, in an asynchronous communications environment. All of Telepartner International's communications products use this proprietary protocol (rather than the synchronous SDLC) to allow inexpensive, asynchronous access to SNA applications. Enveloping data in this type of SNA protocol also allows the use of data compression algorithms at the mainframe, which increases the effective throughput of transmitted data and decreases potential traffic charges.

Figure 1.
PACKET/400

PACKET/400 enables the IBM AS/400 PC Support program on a PC to communicate with an AS/400 midrange computer via asynchronous modems and X.25 packet-switching networks.



Company Profile
Telepartner International

Corporate Headquarters
135 South Road
Farmington, CT
06032-2551
(203) 678-1961;
(800) 722-3270

Officers
North American Headquarters
Chairman: Mark Orenstein
President: David Kimball
VP of Sales: Glen Parchmann
VP of Operations: Ken Dixon
European Headquarters
President: Per Horgen
VP of Marketing: Tommy Fernandes

Company Background
Telepartner International, formed in 1991, is a partnership between Packet/PC and Telepartner A/S. Packet/PC got its start in 1985, when two of its principals developed a low-cost alternative for micro-to-mainframe asynchronous communications for The Travelers Insurance Co. They took their ideas and formed Packet/PC, with its first product being PACKET/3270, the flagship product of the company.

Telepartner A/S started in 1986 with the goal of identifying, enhancing, and marketing data communications solutions to the Nordic market. Through its marketing and support efforts, the Packet/PC line became the premier async connectivity solution in the Nordic market. Now, through the partnership, the company hopes to respond to customer and market needs even more effectively.

The Packet/PC product line complements and extends IBM's SNA for remote computer users through public packet networks. The software provides communications links without the need for expensive PC hardware or application changes for mainframe, midrange, and Macintosh systems.

The Synchrony product line manages the distribution and retrieval of software and information on distributed workstations, as well as local area networks.

As companies continue to network and distribute their computers and communications systems, Telepartner International sees a market for its products. The company is looking to work with other vendors to offer complete, integrated solutions. The company also looks forward to regional expansion in Europe and continued growth of distributorships in the Middle East, South America, and the Pacific Rim.

Telepartner International will continue to supply *Fortune* 1000 companies with the software it needs to support its communications systems. Sales have grown, on average, more than 50 percent per year over the last five years. International sales make up about 25 percent of total sales.

Management Statement
In the inaugural issue of its monthly newsletter, *Telepartner News*, David Kimball spoke about the new partnership and the company's direction. "This new partnership allows us to respond more effectively to your needs for products and service. Over 50 percent of our customers use the products for international communications. As many mid- to large-size companies expand operations overseas and develop worldwide networks, they look to us for global solutions. The company merger represents our commitment to serve a worldwide market."

Several data compression products are offered by Telepartner International to enhance the performance of SNA 3270 data communications. PACKET/FLASH uses a data compression technique that improves response time for interactive SNA/Async communications by as much as 80 percent. It compresses both variable use information and fixed formatted data. This package offers an alternative to high speed modems, since, on average, for large screens, a 2400 bps modem provides performance equivalent to 7500 bps.

The second package, COMMpress, provides file compression/decompression for IBM-compatible, micro-to-mainframe file transfer systems. The program generally reduces text file size by 50 percent. According to Telepartner International, compression results in cost savings of at least 50 percent, with some customers reporting savings of as much as 80 percent. Though compatible with PACKET/3270, which already contains a bit compression algorithm, COMMpress is sold separately and can be used with other file transfer packages.

Telepartner International also offers a package specifically tailored for the public packet data network, PACKET/400. This package extends remote PC support functionality over packet networks. It allows a PC to communicate with an AS/400 midrange computer through asynchronous

modems and X.25 packet networks. While providing connections to AS/400 SNA/Async communications, it also offers full access to all PC support functions such as file, print and communications serving, and workstation emulation.

Telepartner International departed from its asynchronous line of communications software products with the introduction of Synchrony management software. Synchrony automates and manages the distribution, installation, and retrieval of programs and data for personal computers. It also allows for mainframe access or for data collection from and delivery to PCs. This package eliminates manual updating of programs and provides access to vendor enhancements, customer information, and product prices. Synchrony supports LU6.2 communications, supports SAA, and can have its network activities monitored by the Network Control Center.

Since 1985, Telepartner International has earned its place in the communications market. Its product line is primarily targeted toward large, corporate users. Customers include AT&T, Texaco, Nissan Motors, Chase Manhattan Bank, and more than 300 other companies. The company has also moved into the international market, selling its products in more than a dozen countries including Finland, Norway, France, Germany, Italy, Australia, the United Kingdom, the Middle East, and the Pacific Rim. The company has also extended its market into South America and sells its products in Argentina, Chile, and Columbia. It has regional offices in Texas, England, Holland, and Sweden.

Competitive Position

Teiepartner International began marketing its products in late 1986. Since that time, the company has seen its list of customers grow from 20 to over 300 (both national and international). More than 175,000 of its products are currently in use. PACKET/3270 accounts for most of these installations; and with its releases of the 3270 LAN and Macintosh versions, as well as adding on new distributors, such as G.E. Information Services and Infonet, the company's standing in this market segment is likely to improve and grow stronger.

Unlike DCA, which offers software used in conjunction with an emulation board, Telepartner offers software-only links through its products. The links contain both microcomputer and host software components, so that there is no need for emulation boards for each connected PC. This concept is gaining in popularity.

The asynchronous PC-to-host market has become saturated with hundreds of products. DCA and Novell are the leaders in the emulation market and offer numerous products. Smaller companies, incapable of competing with the extensive product lines offered by these two companies, became specialized in certain areas, such as micro-to-minicomputer links or Macintosh-to-host connectivity products.

Telepartner International established itself as a software-only vendor, eliminating the need for emulation boards. The company's products offer help screens, menus, and user interfaces. Its packages include a Macintosh link, a LAN link, and support for PS/2 and AS/400 computers.

Despite its success in the 3270 market, Telepartner International remains largely unknown among communications users. Since its inception, the company invested little in advertising, using direct mail and word of mouth for its sales. With well over 175,000 products sold, the company has no immediate plans to change this approach in the 5250 market. The company feels that with its strong base of distributors and data vendors handling its products, the company's supposed lack of recognition will not be a major drawback.

As mentioned above, the 3270 communications market is saturated with products, and Telepartner International needs to focus on the PACKET/5250 to improve its overall market position. "The 5250 market is not as competitive [as the 3270 market] and, if the AS/400 continues to take off, this could be a hot area for us," a company spokesperson said. IBM's AS/400 has been successful, and with its continued success, the demand for micro-to-midrange connectivity products should also increase. If this happens, PACKET/5250, with its use of the same low-cost, asynchronous communications method as its 3270 predecessor, should establish Telepartner International in a key position in the 5250 marketplace.

Decision Points

As companies continue to want access to data and applications residing on mainframes or minicomputers, the need for PC-to-host communications

products will remain, and Telepartner International continues to develop software to meet changing needs. An example of this is seen in its introduction of Synchrony.

The company's main focus, however, remains on providing asynchronous access to host-resident SNA applications. This has enabled Telepartner International to develop a line of products that, while somewhat narrow in focus, represent a strong, quality entry in the communications market. In addition to text and binary file transfers, the products offer multiple sessions, ASCII/EBCDIC protocol conversion, a script language generator, a hotkey to DOS, online help facilities, and multilevel passwords.

The real strength of Telepartner International's communications products is in the potential cost savings they offer. Though one of its PC-to-host links can be expensive to implement, the use of low-cost asynchronous modems and packet-switching networks, as well as the elimination of adapter boards for each PC, quickly proves advantageous. Certainly, users attaching only a few PCs to a host might be well advised to avoid the potential $10,000 to $16,000 price tag associated with establishing a Telepartner International link. The company, however, does not have customers with as few as five PCs. Companies needing to provide host access to hundreds (or even thousands) of computers, on the other hand, are likely to find these products more cost-effective than methods requiring an often expensive add-in board for each PC.

PACKET/3270 users also realize additional cost savings through the program's bit compression algorithm, as well as the possible addition of COMMpress or PACKET/FLASH. The reduction in communications costs, resulting from the use of PACKET/3270's available compression/decompression facilities, combined with the low cost of asynchronous communications, is a very attractive package for high-volume users. Travelers Insurance, a Telepartner International customer, claims that its data transfer costs (for approximately 2,000 independent agents) have dropped nearly $60,000 a month since it began using PACKET/3270.

Characteristics

Models: PACKET/3270, PACKET/3270 LAN, PACKET/3270 MAC, PACKET/3270 Protected Mode, CRYPTO/3270, PACKET/FLASH, PACKET/74, PACKET/MAIN, PACKET/5250, PACKET/94, PACKET/400, COMMpress, and Synchrony.

Date Announced: PACKET/3270—1985; PACKET/74 and COMMpress—1986; PACKET/3270 LAN, PACKET/3270 MAC, Packet/3270 Protected Mode, PACKET/5250, and PACKET/94—1989; PACKET/400, PACKET/FLASH, CRYPTO/3270, PACKET/MAIN, and Synchrony—1990.

Date First Installed: PACKET/3270—1985; PACKET/74—1986; COMMpress—1987; PACKET/3270 LAN, PACKET/3270 MAC, Packet/3270 Protected Mode, PACKET/5250, and PACKET/94—1989; CRYPTO/3270, PACKET/400, PACKET/FLASH, PACKET/MAIN, and Synchrony—1990.

Number Installed to Date: 175,000+ for all models.

Distribution: Products are sold directly to end users, as well as marketed through authorized distributors such as CompuServe, G.E. Information Services, U.S. Sprint, and Infonet.

Models

PC-to-Host Products

These Telepartner International products provide SNA/Async connectivity in micro to midrange to mainframe computer systems. The major products in this line are listed below.

PACKET/3270: This product provides remote terminal emulation and acts as a network gateway to 3270 SNA mainframe applications.

PACKET/3270 LAN: This product provides a way for a LAN-based PC to access SNA mainframes through a single X.25 gateway connection.

PACKET/3270 MAC: This product provides access to IBM 3270 SNA mainframe application systems from Apple Macintosh computers.

PACKET/3270 Protected Mode: This version of PACKET/3270 is a protected mode/extended memory version. It works with an IBM PC AT or IBM PS/2 Model 50 that has extended memory.

CRYPTO/3270: CRYPTO/3270 provides secure, worldwide access to 3270 SNA/Async communications. It works in conjunction with other 3270 software products.

PACKET/FLASH: This product works with other 3270 products in the line to provide data compression for reduced response time.

PACKET/74: PACKET/74 is an SNA Controller/Host PAD that is used in connections between SNA networks and X.25 packet networks.

PACKET/MAIN: This is the mainframe software component in the PACKET/3270 SNA micro-to-mainframe link.

PACKET/5250: This product provides remote terminal emulation; it is the PC component of Telepartner International's micro-to-midrange communications software.

PACKET/94: This is an SNA Controller/Host PAD for communicating between IBM PCs and midrange systems using packet networks. It provides an X.25/SDLC gateway for the midrange systems that allows PCs to access 5250 applications.

PACKET/400: This product provides remote PC-to-AS/400 PC support connectivity.

COMMpress: This is a file compression/decompression system that is used with IBM-compatible, micro-to-mainframe file transfer systems.

Synchrony Product Line

Synchrony V.2.0 is management software for the automated distribution, installation, and retrieval of PC software programs and information for local and remote PCs. It updates files so that users always have the latest update. (Although Synchrony is mentioned in this report, it is not part of Telepartner International's PC-to-host product line and will not be fully discussed in this report.)

Environment

Emulation

PACKET/3270, PACKET/3270 MAC, and PACKET/3270 LAN: All PACKET/3270 versions provide IBM 327X/317X DFT terminal emulation. The PACKET/3270 also supports TTY.

PACKET/5250: This product provides IBM 5250-11, 5291, and 5292 terminal emulation.

PACKET/400: PACKET/400 provides 5250 emulation.

PACKET/FLASH: PACKET/FLASH is compatible with PACKET/3270 emulation software.

Host Environments

PACKET/3270 and its various versions support connections to IBM SNA mainframes such as IBM 43XX/30XX, System/36/38, and AS/400. These connections are supported in a number of environments that include CICS, VM/CMS, TSO, IBM DOS, MVS, IMS, CICS, SSP, and OS/400. PACKET/3270 MAC supports CICS, TSO, and VM/CMS environments.

PACKET/5250 connects with IBM System/36/38 and AS/400 in an SSP or OS/400 environment. PACKET/400 connects with IBM AS/400 in an OS/400 environment.

COMMpress supports IBM 43XX/30XX systems in TSO, CMS, or CICS environments.

Protocols

Telepartner International's communications products use SNA/Async, which is a proprietary asynchronous data link control protocol developed by the company. PACKET/400 also supports token-ring protocols.

Local Area Network Support

The PACKET/3270 LAN version and COMMpress support any NETBIOS-compatible LAN, Arcnet, IBM Token-Ring, or 3Com networks.

Computers Supported

All of Telepartner International's communications products are compatible with IBM PC/XT/AT, PS/2, and compatible computers. PACKET/3270 MAC also supports Apple Macintosh computers.

Communications Characteristics

The physical connection, transmission mode, transmission speed, and specific communications features are shown in Table 1.

Hardware

Communications Interface

All of Telepartner International's communications products use an RS-232-C interface to establish a mainframe/midrange link.

Adapter Cards

PACKET/3270 LAN includes an X.25 network adapter card for the gateway PC. This add-in board provides an SNA host connection over a switched or dedicated X.25 line, allowing up to 254 LAN users to share a single gateway and X.25 line.

PACKET/74 and PACKET/94 include two adapter cards. In each case, one board is dedicated to X.25 operations and one to SDLC operations. On an IBM PC

Table 1. Communications Characteristics

Product	Transmission Mode	Transmission Speed (bps)	Minimum Configuration	Operating Systems
PACKET/3270	Async	300, 600, 1200, 2400, 4800, 9600	360K (640K recommended)	DOS V2.0 or later, MS-DOS 3.0 for PM, OS/2
PACKET/3270 LAN	Async	Up to 64K	256K RAM/workstation	DOS V3.0 or later
PACKET/3270 MAC	Async	300, 600, 1200, 4800, 9600	384K	Macintosh Finder
PACKET/5250	Async	300, 600, 1200, 2400, 4800, 9600	512K of RAM	DOS V3.1 or later
PACKET/400	Async	300, 600, 1200, 2400, 4800, 9600	512K	OS/2, MS-/PC-DOS
COMMpress	Async/Sync	From 300 to 2.4M	256K	MS-/PC-DOS

AT, PS/2, or compatible computer (together with the accompanying software), the boards act as an SNA Controller/Host Packet Assembler/Disassembler (PAD). Once installed, the packages will appear to the SNA host as an SNA controller and to the X.25 network as an X.3 or X.29 PAD.

PACKET/400 includes an IBM Token-Ring adapter card for connection to the network. The gateway acts as a single controller that relays messages between remote workstations and the AS/400.

Software

All of Telepartner International's communications products are software based. The individual products and their functions are discussed in this section.

PACKET/3270: This software is Telepartner International's PC component in its micro-to-mainframe connectivity products. It offers access to 3270 SNA mainframe applications by putting SNA communications for the PC into the lower-priced asynchronous world. This software offers end-to-end error detection and retransmission, local keyboard and screen control, security options, a menu-driven user interface, an online help facility, concurrent display and printer sessions, a hot-key to DOS, a customizable keyboard, an ASCII-to-EBCDIC conversion, foreign-language keyboard and display support, a script language, macros support, and multilevel passwords. It uses IBM's IND$FILE for text and binary file transfer capabilities with mainframes in a CICS, VM/CMS, or TSO operating environment. It supports from one to eight communications ports.

The package also offers the IBM API; HLLAPI; and its own proprietary PACKET/3270 API, which allows programmers to write custom applications for mainframe communications. PACKET/3270 can also be used with COMMpress (another Telepartner International program) to provide file compression/decompression for file transfers. The program is capable of overriding link-level protocol parameters on a session-by-session basis and also offers simultaneous display (LU2) and printer (LU1) sessions with customizable selection of SNA Logical Unit names.

The protected mode/extended memory version of PACKET/3270 contains all the features of the real mode version. It works on computers with an 80286, 80386, or an 80486 processor. The PM version puts as much of itself above the 640K line as possible and then allocates its remaining extended memory. The PM version that remains below the 640K line coexists and communicates with DOS. PACKET/3270 PM runs with a virtual disk or other RAM disks that use the same extended memory allocation method. It also runs with QEMM and other extended memory managers. It operates in either single-session mode or multisession mode.

PACKET/3270 LAN version allows LAN-based PCs to access SNA mainframes through a single X.25 gateway connection. A PC user, attached to a NETBIOS-compatible LAN, has the same functions as on a standard PACKET/3270. An X.25 network adapter board is installed in the gateway PC. At the host site, either PACKET/MAIN or PACKET/74 must be run.

PACKET/MAC is the Macintosh version of Telepartner International's micro-to-mainframe software. It is the SNA/Async 3270 emulator for Macintosh computers and provides access to IBM 3270 SNA mainframe application systems through dial-up and public packet networks. This package incorporates the PACKET/3270's features with the Macintosh interface that includes pull-down menus, universal Macintosh key combinations, mouse-driven menus, and resizable windows. A proprietary link-level protocol is used to extend SNA communications for the Macintosh into the async world. This protocol offers all the functions of SNA/SDLC.

CRYPTO/3270 operates as an integrated, micro-to-mainframe software security system. It works with PACKET/3270 software products providing secure access to 3270 SNA/Async communications applications.

This package offers electronic, verifiable user and workstation ID, centralized key management, total transparency to PC and mainframe applications, session timeout for unattended PCs, and a single DES key for data encryption/decryption. It supports an unlimited number of users, offers session-by-session DES key exchange, limits user access on an individual-by-individual and/or application-by-application basis, and offers a DES cryptographic function at 300K bps.

The system consists of a PC component and a mainframe component, which work in conjunction with the communications software. The PC component encrypts data, in both LAN and standalone environments, using the user DES key for transmission to the mainframe. The mainframe component builds and keeps the users' directory.

PACKET/FLASH is a data compression technique for interactive data communications. It works in conjunction with PACKET/3270 micro-to-mainframe emulation software. The package offers customizable memory requirements defined by user needs, outbound compression of interactive user and fixed format data beyond standard 3270 optimization techniques, optional customized tables, and data-sensitive compression of fixed format information and user data for optimum table space. Table selection uses a logon word or primary Logical Unit name.

PACKET/FLASH reduces data transmission time by as much as 80 percent. PACKET/FLASH is also a viable alternative to high speed modems. On average, for large screens, a 2400 bps modem offers performance equivalent to 7500 bps. A proprietary, phrase encoding technique is used that optimizes both fixed screen format data and interactive user data.

PACKET/74 is a hardware/software host-end component for the PACKET/3270 communications link, and is basically an SNA Controller/Host PAD. The PACKET/74 software (together with two accompanying communication boards) must be loaded on an IBM PC AT, PS/2, or compatible computer, and is connected to the front end by either a crossover cable, a modem eliminator, or a pair of modems. The package provides support for the SNA/Async protocol, bit compression of outbound messages, and online diagnostic tests.

This package eliminates the need for NCP Packet Switch Interface (NPSI) while providing access from IBM and Macintosh PCs to IBM SNA 3270 applications, and it needs no special front-end or mainframe software. To the mainframe network, PACKET/74 appears as a standard SNA/SDLC link-attached 3274 controller supporting 32 or 64 simultaneous users. To the packet network, it appears as an X.25 DTE.

PACKET/MAIN software is the host-end component of the PACKET/3270 communications link. It is a VTAM program that is loaded on the mainframe and relays information between a mainframe application and the PC component of the link. PACKET/MAIN interfaces with a packet-switching network via IBM's NCP Packet Switch Interface (NPSI), and with a direct dial network through an IBM 3708 or 3710. It appears to host applications as standard SNA 3270 LU Type 2 and LU Type 1 sessions. It works under either MVS or VM operating systems. When used with an IBM 3708 or 3710, the 3708 or 3710 must be configured for protocol enveloping mode.

The program provides support for Telepartner International's proprietary SNA/Async protocol, supports all standard 3270 SNA host applications, provides authorization checking for security purposes, and supports 15 mainframe user exits. It offers extended diagnostic tests, full-duplex transmission, error detection, selective retransmission, multiple session support, and can be customized for ACF or RACF security control.

PACKET/5250: This software is the PC component of Telepartner International's micro-to-midrange link for connecting to IBM System/36, System/38, and AS/400 computers. It offers most of the same features found in PACKET/3270. The program provides support for the IBM System/3X PC Support Program and FTX for file transfers. PACKET/5250 also offers windowing capabilities not available with PACKET/3270, and up to seven simultaneous sessions, in contrast to the two sessions (one printer and one display) available with PACKET/3270.

Additional features are no network echo delay, flexible SNA session assignment options, screen print to PC disk file or printer, end-to-end error detection and retransmission, security options, online help, status line support, local keyboard and screen control, and choice of window size. It also offers one or two communications ports and numerous keyboard and display capabilities. Functions include data compression/decompression for interactive and file transfer session, hotkey between sessions and hotkey to DOS, and a script language generator. The program can override the async link-level protocol parameters on a user-by-user basis.

The package does not currently offer macros or LAN support, and it is compatible only with the IBM API. Since the program provides communications with midrange computers, it cannot make use of COMMpress, which is a mainframe utility.

PACKET/94 is the hardware/software host-end component of the PACKET/5250 link for communicating with IBM System/3X and AS/400 computers. The package provides the same type of features and operates in basically the same manner as PACKET/74, acting as a Controller/Host PAD to simplify communications between an X.25 network and an SNA midrange computer. It allows PCs to access 5250 applications without an IBM 5208 or additional application changes. PACKET/94 appears to a midrange computer network as one to five standard SNA/SDLC link-attached 5294 controllers, each supporting up to eight LUs. It appears to the packet network as a DTE. It attaches through an SDLC line or lines to the midrange computer using a modem eliminator or pair of modems, and connects to the packet network through an X.25 line.

The package offers bidirectional bit-compression of all messages, file transfer using FTX/ETU software programs, a proprietary SNA/Async link-level protocol support, and can map a virtual circuit into one or more SNA display and printer sessions for each active user. It also offers optional integrated access control security.

PACKET/400: This program provides a simple, error-free connection for PC-to-AS/400 SNA/Async communications, as well as permitting full access to all PC support functions. These support functions are file, print, and communications serving; router functions; and workstation emulation. PACKET/400 extends all the functionality of PC support to Async dial-in users over X.25 packet networks without having to use emulation hardware at the PC.

PACKET/400 features 8-bit data compression, menu-driven scripting facility, status line report, no network echo delay, one or two communications ports, end-to-end error detection and retransmission, and gateway support for up to 32 concurrent users.

PACKET/400 uses two components: a software-only workstation component that emulates a Token-Ring adapter, and a gateway component that operates on a dedicated PC physically connected to a Token-Ring network. The gateway component acts as a single communications controller sending messages between remote workstations and the AS/400.

COMMpress: This file compression/decompression system is for use with IBM-compatible, micro-to-mainframe file transfer systems. Using its compression algorithms, COMMpress can typically reduce text file size by half. It is executed automatically within a TSO CLIST or a CMS EXEC, CICX program, DOS BAT file, or by operator command. It reduces the size of the file to be sent to the micro or the mainframe. Once the file is received, COMMpress expands the file to its original size. It processes both binary and text files, as well as doing ASCII/EBCDIC translation. COMMpress works with PACKET/3270, as well as with other file transfer packages.

Support

Phone Support: Technical support is available at (800) 722-3270 from 8:30 a.m. to 5:00 p.m. Eastern time. The company also offers initial on-site support and implementation assistance for $1,000 per day plus expenses.

Warranty: A one-year warranty, which provides free maintenance and upgrade support, covers Telepartner International's communications products.

Maintenance: Telepartner International offers a maintenance/upgrade support contract for products no longer under warranty.

Pricing

Most of the following prices are based on number of copies ordered; price decreases as the number of copies ordered increases. Software fees include licensing of software and communications cards.

Software Prices

	Purchase Price ($)
PACKET/3270*	145-295
PACKET/3270 Protected Mode*	145-295
PACKET/3270 MAC*	145-295
PACKET/3270 LAN*	2,350-6,000
PACKET/400 (workstation)	75-195
PACKET/400 (gateway)	7,200-8,000
PACKET/FLASH (PC)	75
PACKET/FLASH (gateway)	4,000
PACKET/FLASH (host)	6,000
PACKET/5250*	195-295
PACKET/MAIN*	8,500-15,000
PACKET/74*	7,900-9,500
PACKET/94*	7,900-9,500
COMMpress	5,000

**Prices depend on accumulated quantity. Contact vendor for details.* ■

Thomas-Conrad Local Area Network Products

In this report:

Product Summary

Editor's Note
This is our first report on Thomas-Conrad, a company that has become a leader in ARCnet hardware. The company is moving into the token-ring market and has also released a very high speed proprietary network running on fiber media.

Description
Network interface boards and hubs for ARCnet, token-ring, and the proprietary TCNS 100M bps fiber optic network.

Strengths
A comprehensive line of ARCnet cards and hubs, including ARCnet for Macintosh; 16 port token-ring MAU.

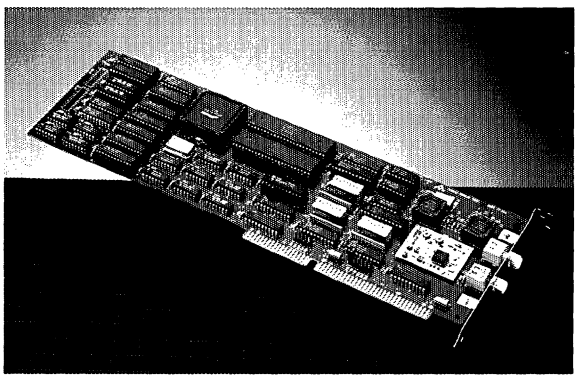
Limitations
No significant limitations.

Competition
Standard Microsystems and Datapoint ARCnet products; IBM and Proteon token-ring products.

Vendor
Thomas-Conrad Corp.
1908-R Kramer Lane
Austin, TX 78758
(512) 836-1935, (800) 332-8683

Price
Network interface board prices start at $249.

GSA Schedule
Yes.



The Thomas-Conrad Network System (TCNS) operates at 100M bps over fiber optic media, and is compatible with popular network operating systems such as Novell NetWare and Banyan Vines. The initial TCNS offering, pictured above, is an interface card that operates in IBM PC/ATs, PS/2 Models 25 and 30, and compatibles.

Analysis

Product Strategy

Thomas-Conrad Corporation (TCC) is an Austin, TX manufacturer of ARCnet and token-ring interface cards and hubs. The company has a complete line of products in these categories, and has recently taken the bold step of introducing a 100M bps fiber optic network. Called TCNS, for Thomas-Conrad Networking System, the token passing network is a proprietary scheme, not compatible with the Fiber Distributed Data Interface (FDDI). Unlike FDDI, however, TCNS is here today and operates with existing ARCnet drivers and popular network operating systems such as Novell NetWare and Banyan Vines. Indeed TCNS is like a very high speed ARCnet, employing a modified token passing scheme similar to that used by ARCnet. TCNS' high speed suits applications that generate high volumes of network traffic, such as CAD/CAM, graphics, and automated process control. Used as a backbone, TCNS can connect networks based on ARCnet, Ethernet, or token-ring. TCC's initial TCNS offerings will be a 16-bit PC/AT card and a TCNS hub.

An ARCnet Leader

ARCnet does not have the high profile of Ethernet or token-ring, but it has gained a reputation as a "working person's" networking scheme. Cheap to install and maintain, it delivers deterministic performance, is available from many vendors, and always adheres to a strictly enforced standard. Datapoint, which invented ARCnet in 1977, has licensed the system to many vendors with the stipulation that any product billed as ARCnet must conform to the ARCnet specifications. While an official standard has never been established by a group such as the IEEE, Datapoint's insistence on compatibility has worked very well, ensuring that products from all vendors work together.

Thomas-Conrad is one of the leading manufacturers of ARCnet products. The company has boards for all varieties of the IBM PC, PC/AT, and compatible machines, and for the PS/2 Micro Channel architecture. In addition, Thomas-Conrad is one of the few manufacturers to offer ARCnet cards for the Macintosh II and SE models.

ARCnet is usually wired in a star configuration with central hubs through which all transmissions must pass. Hubs can be passive devices that merely connect the individual stations, or they can be active hubs that amplify and condition the signal. Thomas-Conrad manufactures active and passive hubs and also offers two models of its Smart Hub, which provides status information about individual ports on an LED display. The top-of-the line TC6151 Smart Hub can be remotely monitored and controlled from a personal computer using TCC's HubTalk software. Thomas-Conrad manufactures rack mount versions of its Smart Hub and its active hub, which are expandable up to 64 ports.

The TC6171 HubTalk software runs on an IBM PC/XT, AT, or compatible and transforms it into a network management console that can monitor and control up to 32 Smart Hubs daisychained together. A network administrator can enable or disable any individual port or all ports on a TC6151 Smart Hub connected via HubTalk. The Smart Hubs communicate over twisted-pair wire, which is separate from the ARCnet connections, allowing the hubs to continue delivering information even if the network itself is down. HubTalk is also compatible with TCNS hubs.

A Token-Ring Competitor

In 1989 Thomas-Conrad entered the token-ring marketplace with a 4M bps interface card for the IBM AT and compatibles and a 16 port multistation access unit (MAU). A MAU on a token-ring network performs a function similar to a hub on an ARCnet network. Most token-ring MAUs, including those from IBM, feature only eight ports. The TCC 16 port MAU takes up the same space as two IBM 8 port MAUs, while it costs about 25 percent less.

Thomas-Conrad says it expects to bring out a complete line of 4M/16M bps token-ring cards in 1990, including models for the PC/AT bus, the Extended Industry Standard Architecture (EISA) bus, the IBM Micro Channel Architecture (MCA) bus, and the Macintosh II and SE.

Competitive Position

Thomas-Conrad is one of the leaders in the Arcnet market, along with Standard Microsystems and Datapoint. TCC's line of ARCnet products is especially complete and offers innovative enhancements to the basic ARCnet architecture.

There is every reason to expect that the company will bring new ideas and enhancements to the burgeoning token-ring market as well. One area of that market that is generating a lot of interest is the 16M bps network on unshielded twisted pair (UTP) wiring. IBM has declined to offer such cards, citing problems with noise and transmission distances, but Proteon and Ungermann-Bass have each announced 16M bps UTP cards. It will be interesting to see if TCC enters the 16M bps UTP arena.

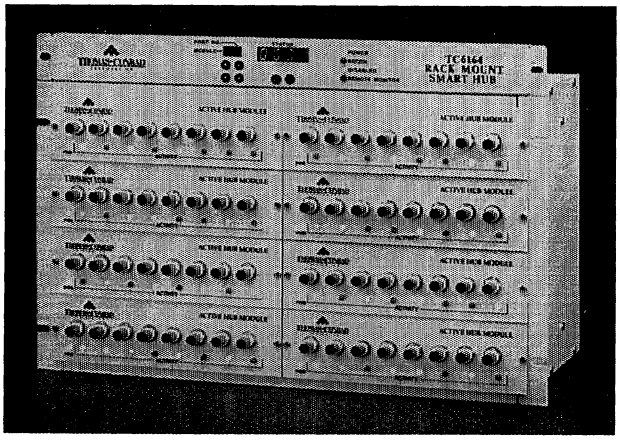
A recent statement of direction outlines the company's plans for 1990, which include widening the scope of its token-ring offerings to include 4M/16M bps cards for all popular PC bus architectures including the Extended Industry Standard Architecture (EISA), and the Macintosh buses. Thomas-Conrad also is evaluating FDDI and may offer FDDI products in the future, in addition to its own TCNS fiber optic system. More additions to the TCNS 100M bps line, including Micro Channel Architecture cards, are also promised.

Decision Points

Thomas-Conrad offers one of the most complete lines of ARCnet cards and accessories available. Its line of hubs, in particular, is well designed and innovative. TCC is unique in its support of the Macintosh and its product line for these computers is also quite comprehensive.

TCC's venture into token-ring products promises to deliver similar benefits to users in the near future. TCC could offer token-ring users substantially lower prices than IBM or Proteon quite soon, and there's every reason to expect that the company will, in the future, add enhancements to its token-ring products that will increase their attractiveness.

How the 100M bps TCNS network will fare is an open question. Many vendors have announced FDDI support, and TCNS will have to prove itself a substantially better, or substantially cheaper, network to stem the FDDI tide. If Thomas-Conrad can keep the price of TCNS well under that of FDDI it could help to bring high speed and fiber media to many users who would otherwise never have it. Its ability to easily connect to ARCnet may be its biggest advantage, allowing its use as an ARCnet backbone.



TCC's Rack Mount Smart Hub links up to 64 ARCnet nodes and includes network management features that simplify troubleshooting.

Company Profile

Thomas-Conrad Corporation is a privately held company based in Austin, TX. Thomas-Conrad was founded in 1982 as an engineering consulting firm specializing in process control applications and communications technology. An early contract led to the development of the company's first ARCnet board. An entire family of ARCnet products followed this initial offering. The company has been noted for many significant improvements to ARCnet technology, including compact driver software and the industry's first "smart" hub. Thomas-Conrad employs approximately 128 people.

Characteristics

Models: Several models of ARCnet cards and hubs; token-ring card and MAU; TCNS card.

Date of Announcement: ARC-CARD/CE, 1985; ARC-CARD/AT, December 1987; ARC-CARD/SE and SE30, November 1989; 4M bps Token-Ring Adapter/AT, November 1989; TCNS Adapter/AT, May 1989.

Date First Installed: ARC-CARD/CE, 1985; ARC-CARD/AT, December 1987; ARC-CARD/SE and SE30, April 1990; 4M bps Token-Ring Adapter/AT, February 1990; TCNS Adapter/AT, yet to be delivered.

Number Installed: Information unavailable.

Distribution: Through authorized distibutors.

Architecture

Thomas-Conrad manufactures products for two popular network architectures, ARCnet and token-ring, as well as its new TCNS 100M bps network.

ARCnet is a 2.5M bps network which employs a token-passing access method. It can be arranged in either a star or bus topology, and can use any type of media: coaxial cable, unshielded twisted-pair wire, or fiber optic cable. The star is the most commonly used topology and requires hubs at the center of the star to which stations are linked. A special bit pattern called a token must be held by a station that wants to transmit, and this token is passed from one station to the next in order. The effect is such that, while the network has a physical star shape, its logical shape is that of a ring. ARCnet was developed in 1977 by Datapoint, and has become widely used, though it lacks the visibility of Ethernet or token-ring. While no IEEE standards have been established for ARCnet, Datapoint requires that manufacturers who build ARCnet products conform to their proprietary specifications, so compatibility is maintained among all ARCnet equipment.

Token-ring also uses a token-passing access method, but operates at higher speeds than ARCnet, either 4M or 16M bps. IBM has been the driving force behind token-ring, and the IBM standard has been adopted by the IEEE as its 802.5 standard. Token-ring workstations are attached to a media access unit (MAU), and the ring is formed by the circuitry within the MAU. Token-ring can operate on any type of media: coaxial cable, shielded or unshielded twisted-pair wire, or fiber optic cable. Since IBM announced its Token-Ring Network in 1985, several manufacturers have begun producing token-ring boards.

Hardware

Network Interface Boards

ARCnet Cards for PC and PS/2: Thomas-Conrad offers ARCnet cards for all IBM PC bus architectures: the TC6142 ARC-CARD/CE for the PC/XT, the TC6045 ARC-CARD/AT for the PC/AT, and the TC6046 ARC-CARD/MC for the PS/2 Micro Channel bus. Each card is offered in a variety of media configurations, so that twisted pair telephone wire, coaxial cable, or fiber optic cable can be used. The fiber optic boards are available with either SMA or ST type connectors.

All the ARCnet cards operate at the standard Arcnet speed of 2.5M bps. Up to 255 workstations can be connected into a single ARCnet network spanning a distance of 20,000 feet. On coaxial cable, stations can be up to 2,000 feet apart, on twisted pair up to 800 feet apart, and on fiber optic cable up to 8,000 feet apart.

For ARCnet bus configurations on coaxial cable, TCC offers a high impedance version of each card. Up to eight stations can be connected to an ARCnet bus without using hubs, up to a maximum length of 1,000 feet. This provides an inexpensive path for users who require only a small network, allowing them to avoid buying a hub.

All the cards feature two modes of operation. The compatible mode allows the cards to work with almost any ARCnet driver, such as those shipped with Novell NetWare or Banyan Vines. The enhanced mode, using Thomas-Conrad's enhanced ARCnet drivers, requires only 16K of base memory, 75 percent less than most network interface cards. Base memory addresses and interrupt request lines can be selected by the user to avoid conflicts with other option cards which may be installed.

Using a TC9010 or TC9021 boot ROM allows the cards to be used in diskless workstations.

ARCnet Cards for Macintosh: Thomas-Conrad offers ARCnet cards for each of the three models of the Macintosh that include expansion slots for add-on boards: the Macintosh SE, the SE30, and all versions of the Macintosh II. The TC6843 ARC-CARD/SE uses the 16-bit data bus of the SE, while the TC6844 ARC-CARD/SE30 and the TC6842 ARC-CARD/NB both use the 32-bit data path of the SE30 and Macintosh II computers. All three cards are available in versions for twisted pair wire, coaxial cable, or fiber optic cable, and for high impedance ARCnet bus configurations. Transmission speed and distance specifications for these cards are similar to the corresponding specifications for the IBM PC cards listed above.

Token-Ring Cards: At this time, Thomas-Conrad offers only one token-ring network adapter, the TC4035. Designed for the 16-bit IBM PC/AT bus, the card features 4M bps speed and bus mastering. Bus mastering allows high speed data transfers between system memory and the card's 128K of on-board RAM, leaving the CPU free for other chores. When used with the TCXL/TR driver supplied with the board on Novell NetWare 2.12 or higher, performance is improved by up to 200 percent over the standard adapter handler interface (AHI). The TC4035 is fully compatible with the IEEE 802.2 Logical Link Control (LLC) and 802.5 token-ring standards.

Additional Hardware Products

ARCnet Hubs: Thomas-Conrad's ARCnet hubs come in three different varieties: passive, active, and smart.

A passive hub requires no power of its own and simply acts as a connection point for the star topology of the physical wiring of ARCnet. Thomas-Conrad offers the TC6040 passive hub.

An active hub digitally conditions, amplifies, and relays signals received from ARCnet workstations before passing them on to their destination. To achieve the maximum overall distances for ARCnet networks, active hubs must be used. The TC6050 active hub is available in several configurations, supporting 8 or 16 coaxial or twisted pair ports, a combination of 8 coaxial and 8 twisted pair ports or 12 coaxial and 2 fiber optic ports. Since fiber optic LANs require separate cables for the transmit and receive sides of the line, the total number of ports on the fiber optic models is two less than on the coaxial or twisted pair versions. Users can upgrade 8-port coax or twisted pair active hubs with the addition of 8 port expansion modules for coaxial or twisted pair, or a 4 coaxial and 2 fiber optic port module.

The TC6064 is a rack mount version of the TC6050 active hub available in 16 port base units for twisted pair or coaxial cable, and expandable up to 64 ports with the addition of 8 port expansion modules.

The top of the line Thomas-Conrad hubs are the TC6150 and TC6151 Smart Hubs. These hubs can detect reconfiguration attempts by network nodes, which can indicate transmission problems. Two LED displays report the port number and the number of times the node connected to that port has attempted to reconfigure itself. A four position keypad allows an operator to select a port for display, disable the port or reset its reconfiguration counter. An activity LED and a two color status LED is provided for each of the 16 ports. The status LED glows red to indicate a disabled node and green when reconfiguration is attempted. A status LED turned off indicates an enabled node.

The TC6151 Smart Hub features an out-of-band communications channel for connection via a twisted pair line to a PC running TCC's HubTalk software. This separate channel can report status information even if the network is down. An upgrade kit is available to add this separate channel to a TC6150, to turn it into a TC6151.

Both the TC6150 and the TC6151 are offered in base units of 8 ports and are expandable up to 16 ports with the addition of expansion modules. As with the other Thomas-Conrad hubs, mixed media types are supported so that one Smart Hub can connect LAN segments of different cable types. A rack mount version of the TC6151, called the TC6164, is also available, with features similar to the TC6064 rack mount hub, plus an LED display, four position keypad, and the out-of-band communications channel.

Token-Ring Multistation Access Unit: Thomas-Conrad's TC4050 Multistation Access Unit (MAU) connects up to 16 stations in a token-ring network running at 4M or 16M bps. Similar devices from IBM, Proteon, and other manufacturers connect only eight stations to a single MAU. The TCC MAU uses the IBM Cabling System/IEEE 802.5 "hermaphroditic" connectors, and each port has an activity LED, a bicolored status LED, and enable-disable switch. The activity LED lights when the node is transmitting, the status LED shows the connection status of the node: inserted or not inserted in the ring, or electrically disconnected from the ring. The switch allows network administrators to remove a malfunctioning station from the network without physically detaching the cable.

100M bps Thomas-Conrad Networking System (TCNS): TCNS is a 100M bps network that operates over fiber optic media and uses a modified token-passing access method. Up to 255 stations can be connected to a network spanning up to 20,000 feet in length. Stations can be wired in either distributed star or star topologies, with active hubs connecting the nodes.

TCNS is compatible with the ARCnet drivers shipped with major network operating systems, such as Novell NetWare or Banyan Vines, or Thomas-Conrad's enhanced ARCnet drivers, called Global Accelerated drivers (GXL/ARC).

TCNS is not compatible with the emerging FDDI standard, which uses a token passing ring topology. TCNS uses SMA and ST style connectors and can be connected using one of four different sizes of fiber optic cable: 50/125 μm, 62.5/125 μm, 85/125 μm, and 100/140 μm. The smaller the diameter of the cable the longer the distances that can be achieved—50 micron cable can extend up to 1.8 miles between nodes.

The initial TCNS offering from Thomas-Conrad is an interface card for the IBM AT and compatibles, and PS/2 Models 25 and 30.

Software

HubTalk ARCnet Monitor: HubTalk transforms an IBM PC/XT, AT, or compatible into a remote operator's console for TC6151 Smart Hubs. Up to 32 Smart Hubs can be linked over the TC6151's twisted-pair communications channel so that an entire ARCnet network can be monitored from a single location. The TC6151 communication channel operates independently of ARCnet, so that troubleshooting can be performed using HubTalk even if the network itself is down. HubTalk's full-screen display delivers information about the status of each node, telling whether it is enabled or disabled, and detecting and logging reconfiguration attempts. Any port can be selected for display, enabled or disabled, and reconfiguration counters can be reset from the HubTalk PC. Smart Hubs can be located up to 10,000 feet from the computer.

TXD Diagnostic Software for Novell Networks: TXD is a menu-driven network diagnostic package for use with networks running Novell Netware Version 2.1 or higher.

TXD queries all nodes to determine the configuration of the network, and can analyze data from all nodes or from a subset selected by the network administrator. Administrators can set threshold levels for unusual activity by a node, beyond which TXD will issue reports, accompanied by explanations of the cause for the high activity level, and suggest possible solutions. Point-to-point communication testing is automatically performed between any selected node and all other nodes. TXD can monitor a variety of performance data including packets sent by Internetwork Packet Exchange (IPX) and Sequenced Packet Exchange (SPX); packets transmitted and received by the shell; packets serviced by a bridge; and others. Analysis of such data can help to pinpoint problems with application software, network hardware, or noise.

Equipment Prices

		Purchase Price ($)
ARCnet Token-Ring Products		
TC4035	4M bps Token Ring Adapter	595
TC4050	16 port Token Ring Media Access Unit (MAU), type 1 connectors	985
ARCnet Interface Cards		
TC6142	ARC-CARD/CE (8 bit Coax-Star Topology)	249
TC-6142-HZ	ARC-CARD/CE-HZ (High Impedance version for ARCnet bus topology)	295
TC6042-TP+	ARC-CARD/CE (Twisted Pair Plus version for star or bus topology)	289
TC6042-FO	ARC-CARD/CE (Fiber Optic version with SMA connector)	395
TC6042-ST	ARC-CARD/CE (Fiber Optic version with ST connector)	395
TC6045	ARC-CARD/AT (16 bit Coax-Star Topology)	379
TC-6045-HZ	ARC-CARD/AT-HZ (High Impedance version for ARCnet bus topology)	395
TC6045-TP+	ARC-CARD/AT (Twisted Pair Plus version for star or bus topology)	379
TC6045-FO	ARC-CARD/AT (Fiber Optic version with SMA connector)	550
TC6045-ST	ARC-CARD/AT (Fiber Optic version with ST connector)	550
TC6046	ARC-CARD/MC (PS/2 Micro Channel Coax-Star Topology)	249
TC-6046-HZ	ARC-CARD/MC-HZ (High Impedance version for ARCnet bus topology)	425
TC6046-TP+	ARC-CARD/MC (Twisted Pair Plus version for star or bus topology)	395
TC6046-FO	ARC-CARD/MC (Fiber Optic version with SMA connector)	595
TC6046-ST	ARC-CARD/MC (Fiber Optic version with ST connector)	595
ARCnet Interface Cards for Macintosh		
TC6842	ARC-CARD/NB (32 bit Macintosh II Coax-Star Topology)	395
TC-6842-HZ	ARC-CARD/NB-HZ (High Impedance version for ARCnet bus topology)	545
TC6842-TP+	ARC-CARD/NB (Twisted Pair Plus version for star or bus topology)	495
TC6842-FO	ARC-CARD/NB (Fiber Optic version with SMA connector)	895
TC6842-ST	ARC-CARD/NB (Fiber Optic version with ST connector)	895
TC6843	ARC-CARD/SE (16 bit Macintosh SE Coax-Star Topology)	445
TC-6843-HZ	ARC-CARD/SE-HZ (High Impedance version for ARCnet bus topology)	495
TC6843-TP+	ARC-CARD/SE (Twisted Pair Plus version for star or bus topology)	445
TC6843-FO	ARC-CARD/SE (Fiber Optic version with SMA connector)	845
TC6843-ST	ARC-CARD/SE (Fiber Optic version with ST connector)	845
TC6844	ARC-CARD/SE30 (32 bit Macintosh SE30 Coax-Star Topology)	495
TC-6844-HZ	ARC-CARD/SE30-HZ (High Impedance version for ARCnet bus topology)	545
TC6844-TP+	ARC-CARD/SE30 (Twisted Pair Plus version for star or bus topology)	495
TC6844-FO	ARC-CARD/SE30 (Fiber Optic version with SMA connector)	895
TC6844-ST	ARC-CARD/SE30 (Fiber Optic version with ST connector)	895
ARCnet Hubs		
TC6040-0	Passive Hub (No terminators)	65
TC6040-1	Passive Hub (with 1 terminator)	75
TC6040-2	Passive Hub (with 2 terminators)	85
TC6050-10	Active Hub with 8 Coaxial Ports	695
TC6050-11	Active Hub with 16 Coaxial Ports	995
TC6050-12	Active Hub with 12 Coaxial and 2 Fiber Optic Ports	1295
TC6050-15	Active Hub with 8 Twisted-Pair Ports	695
TC6050-16	Active Hub with 16 Twisted-Pair Ports	995
TC6050-80	Active Hub with 8 Coaxial and 8 Twisted-Pair Ports	995

		Purchase Price ($)
TC6050-51	Active Hub Expansion Module with 8 Coaxial Ports	495
TC6050-52	Active Hub Expansion Module with 4 Coaxial and 2 Fiber Optic Ports	750
TC6050-55	Active Hub Expansion Module with 8 Twisted Pair Ports	495
TC6150-10	Smart Hub with 8 Coaxial Ports	895
TC6150-11	Smart Hub with 16 Coaxial Ports	1195
TC6150-61	Smart Hub Expansion Module with 8 Coaxial Ports	595
TC6064-10	Rack Mount Hub Base Unit with 16 Twisted-Pair Ports	1495
TC6064-16	Rack Mount Hub Base Unit with 16 Coaxial Ports	1495
TC6064-50	Rack Mount Hub Expansion Module with 8 Coaxial Ports	495
TC6064-55	Rack Mount Hub Expansion Module with 8 Twisted-Pair Ports	495
TC6151-10	HubTalk Smart Hub with 8 Coaxial Ports	895
TC6151-11	HubTalk Smart Hub with 16 Coaxial Ports	1195
TC6151-15	HubTalk Smart Hub with 8 Twisted-Pair Ports	895
TC6151-16	HubTalk Smart Hub with 16 Twisted-Pair Ports	1195
TC6151-30	HubTalk Smart Hub with 8 Fiber Optic Ports, SMA Connectors	1995
TC6151-30ST	HubTalk Smart Hub with 8 Fiber Optic Ports, ST Connectors	1995
TC6151-31	HubTalk Smart Hub with 15 Fiber Optic Ports, SMA Connectors	2795
TC6151-31ST	HubTalk Smart Hub with 15 Fiber Optic Ports, ST Connectors	2795
TC6151-51	HubTalk Smart Hub Expansion Module with 8 Coaxial Ports	595
TC6151-55	HubTalk Smart Hub Expansion Module with 8 Twisted-Pair Ports	595
TC6151-57	HubTalk Smart Hub Expansion Module with 7 Fiber Optic Ports, SMA Connectors	1195
TC6151-57ST	HubTalk Smart Hub Expansion Module with 7 Fiber Optic Ports, ST Connectors	1195
Network Software		
TC6010	GXL/ARC ARCnet Driver Kit for Novell NetWare	95
TC6171	HubTalk Remote Communications Software	279
TC8310	TXD Network Diagnostic Software for Novell NetWare version 2.1x	195

■

Thomas-Conrad Local Area Network Products

Product Enhancement

Analysis

Thomas-Conrad Corp., best known for its extensive line of Arcnet networking hardware and TCNS, its proprietary 100M bps fiber optic network, has recently released its first Ethernet networking products—three adapter cards and an eight-port concentrator. The company also announced two new Arcnet hubs and two new Arcnet adapter cards which are each available in five different configurations for various cabling requirements.

A Broader Product Line

Thomas-Conrad is one of the two largest vendors of Arcnet hardware, matched only by Standard Microsystems. Both of these companies have been broadening their product base in recent months, in an effort to move away from total dependence on Arcnet sales. Arcnet, long a popular low-end networking solution, is expected to lose ground to 10BASE-T Ethernet in the future. Thomas-Conrad introduced token-ring equipment last year, while Standard Microsystems brought out 10BASE-T hardware. Standard Microsystems has also announced a forthcoming token-ring line.

Ethernet Products

All of the Ethernet adapter cards fit the IBM PC AT 16-bit bus and comply with the IEEE 802.3 standard. Each card has LEDs that display transmit and receive activity; collisions; and, on the 10BASE-T cards, link integrity. The TC5045-TIO is relatively unique among Ethernet adapter cards in that it is equipped with all three types of connectors commonly used. An RJ45 connector for 10BASE-T unshielded twisted-pair connections, a BNC connector for thin coaxial cable, and a 15-pin Attachment Unit Interface (AUI) connector are all provided, giving the card its name—"Three-In-One."

The TC5045-T is designed for 10BASE-T applications and comes with RJ45 and AUI connectors. The TC5045-2 for thin coaxial Ethernet networks (10BASE-2) has BNC and AUI connectors.

The TC5055 10BASE-T concentrator is an eight-port device for linking unshielded twisted-pair segments. In addition to the eight RJ45 modular connectors, an AUI connector is also provided for linking to any type of Ethernet media using a transceiver.

Several diagnostic LEDs are also provided, indicating collisions, link integrity, polarity reversal, partitioning status, and enable/disable status of each port. Any network segment that malfunctions is automatically partitioned from the rest of the network until problems are corrected, without affecting the operation of the rest of the network. Each port is equipped with an enable/disable switch so that any port can be manually removed from the network.

The TC5045-T and the TC5045-2 adapter cards cost $395. The Three-In-One TC5045-TIO costs $449. The TC5055 concentrator sells for $649.

New Arcnet Hubs

There are two models of TC6250 Series Hubs—the TC6250 Active Hub and the TC6251 Smart Hub. Both are eight-port devices for coaxial cable. They have an extremely small footprint, measuring only 11.0 by 4.5 inches, and their connectors are located on the front panel for easy access. Both hubs feature activity and status LEDs for each port. Both have a ninth BNC connector for daisy-chaining one hub to another.

The TC6251 Smart Hub can be used with Thomas-Conrad's HubTalk Network Hub Manager software. HubTalk information is reported to the network management console over a separate, out-of-band channel, and RJ11 connectors for this twisted-pair circuit are included on the back panel of the TC6251. The hub also features two digital displays that indicate port numbers and reconfiguration counts. A four-function keypad allows the user to enable or disable a port, select it for display, or reset its reconfiguration counter.

The TC6251 Smart Hub costs $729; the TC6250 Active Hub, $495.

New Arcnet Adapters

Thomas-Conrad's newest Arcnet adapter cards, the TC6242 family for the 8-bit IBM PC bus, and the TC6245 family for the 16-bit PC AT bus, are each available in five different configurations to cover the full range of Arcnet cabling possibilities. Among these different configurations, one is a new addition in the Thomas-Conrad line.

Thomas-Conrad's Arcnet adapter cards have in the past conformed to the RS485 ANSI standard for twisted-pair signaling that allows cabling distances of up to 800 feet between active devices. Most other vendors, including Standard Microsystems and PureData, use a signaling method that only allows distances of up to 400 feet.

Thomas-Conrad's "Twisted-Pair Plus" (TP+) line, as it called its ANSI-signaling cards, was not compatible with cards from other vendors. Thomas-Conrad has now released cards that operate with cards from other vendors and is calling them "Ordinary Twisted-Pair" (OTP) to differentiate them from its other TP+ cards.

Other available cable configurations are the All-In-One (AIO) that comes with both BNC and RJ45 connectors for use in coaxial star, coaxial bus, Twisted-Pair Plus, and industry-standard twisted-pair environments; the high impedance (HZ) coaxial version for use in Arcnet bus networks; and a coaxial star topology version (which has no suffix added to the model number).

The eight-bit TC6242 cards cost $199 for the coax star version; $249 for the HZ, TP+, and OTP versions; and $279 for the All-In-One version. The 16-bit TC6245 cards sell for $379 for the coax star, TP+, and OTP versions; $395 for the HZ version; and $449 for the All-In-One version. ■

3Com LAN Products

In this report:

In February 1991, 3Com withdrew from the network operating system business and turned its NOS customers over to Microsoft for support and upgrades. 3Com has redirected its energies toward global data networking, focusing on end systems connectivity through adapters and terminal servers and on intermediate systems support through hubs and bridges/routers. To tie these products together, the company relies on *binding agents*, its term for common protocols, network management, and service and support.

Strengths

- Comprehensive adapter line
- Entry into third-generation hub market
- Expertise in 10BASE-T

Limitations

- Lack of extensive fiber support until recently
- Identification in the marketplace primarily as a network operating system vendor

Competition

Digital Equipment Corp., Racal InterLan, Ungermann-Bass, and several others.

Vendor

3Com Corp.
5400 Bayfront Plaza
Santa Clara, CA 95052-8145
(408) 764-5000; fax (408) 764-5738
In Canada:
3Com Canada Inc.
225 E. Beaver Creek Road
Richmond Hill, ON L4B 3P4
(416) 882-9964

Price

EtherLink adapters—$295 to $899 (EtherLink/MC 32); LinkBuilder Ethernet Management Module—$3,995; MultiConnect Multiport Repeater—$1,295. GSA Schedule: Yes.

—By Barbara Callahan
Associate Editor

Product Analysis

After divesting itself of the 3+ and 3+Open network operating systems in February 1991, 3Com refocused its energies on Ethernet adapters, the core product upon which the company built its business and its reputation. Within the EtherLink family of adapters, 3Com has positioned products for every network contingency. 3Com produces adapters for IBM PC/AT/XTs, PS/2 Models 25 and 30, and compatibles; IBM Micro Channel Architecture PS/2s and compatibles; and Apple Macintoshes.

Twisted-pair EtherLink adapters and 16-bit EtherLink adapters support IEEE 10BASE-T standards and are backward compatible with prestandard twisted-pair hubs from SynOptics, David Systems, Hewlett-Packard, and AT&T. Sixteen-bit EtherLink adapters accommodate high-performance workstations and servers. These devices ship with drivers for 3+, 3+Open, LAN Manager, NetWare, and many other network operating systems. EtherLink/MC adapters for IBM Micro Channel computers, operating over coaxial cable, are also backward compatible with prestandard twisted-pair hubs from the aforementioned vendors. EtherLink/NB serves as an Ethernet network interface for the Apple Macintosh II family.

Recently, 3Com introduced the NW1000 NetWare-ready adapter family for IBM PC/XT/ATs, PS/2 Models 25 and 30, and compatibles. NW1000 is compatible with NetWare 286/386 (client and server sides). Rounding out 3Com's lineup of adapters, TokenLink is compatible with IEEE 802.5, IEEE 802.2, 4M bps baseband and token-passing LANs. TokenLink supports 3+ and 3+Open; IBM PC LAN, NETBIOS, APPC, and 3270 Emulation 3.0; Novell NetWare (client side); and Banyan VINES (client and server sides).

Over the years, 3Com has replenished its CS terminal server line, which now includes CS/2000, CS/2100, CS/1, and CS/50. The CS/2000 and CS/2100 are compact, high-performance terminal servers that concurrently support 10 asynchronous and synchronous devices operating at data rates up to 19K bps. The CS/1 is a modular terminal server that supports up to 64 devices at speeds up to 38.4K bps. The CS/50 is a compact, two-port communications server that links asynchronous terminals, PCs, printers, host ports, or modems to a LAN. When operating as a data switch, the CS/50 supplies virtual circuit connections to networked resources that support TCP/IP.

LinkBuilder is a modular, intelligent hub for Ethernet coaxial, twisted-pair, and fiber installations. The Model 500 Premises Concentrator supports up to 12 system modules and a maximum of 132 twisted-pair 10BASE-T ports, 88 thin Ethernet coaxial ports, or 66 fiber optic ports. The Model 100 Department Concentrator holds up to four system modules and 10BASE-T ports (36), coaxial ports (24), or fiber optic ports (18). NETBuilder is an Ethernet platform that facilitates internetworking network systems.

3Com developed the MultiConnect product line to address the needs of structured wiring systems that concentrate network control in a single location for all data communications. A MultiConnect network configuration includes wiring closet, wiring closet/building interconnections, and users' desktops. MultiConnect enables Ethernet networks to be configured with twisted pair (10BASE-T), coax, or fiber. In July 1991, 3Com announced the MultiConnect TP Starter Kit, a cost-effective 10BASE-T modular hub that enables users to expand their networks incrementally.

On the software side of the business, 3Com's most recent release is TN3270, IBM 3270 emulation software that features 3Com's Demand Protocol Architecture (DPA). By enabling a personal computer to emulate an IBM 3270 terminal, the software facilitates access to IBM host systems over TCP. Before the introduction of TN3270, personal computers running 3Com TCP required a protocol translator card and applications or IBM SNA gateways to connect network PCs to IBM host systems.

Target Applications

3Com targets customers with connectivity and interoperability needs within their workgroups and enterprise-wide networks. The company has defined its mission as focusing on global data networking and "simplifying the complexity of global data networks." The goal of global data networks is to enable organizations to construct computer networking infrastructures that send data as rapidly and efficiently as telephone networks transmit voice. 3Com wants to deliver more bandwidth to the desk through its LinkBuilder 3GH third-generation hub.

Strengths

Comprehensive Adapter Line: The proof of the strength of 3Com's adapter line is in the numbers—3 million sold. Since developing the first Ethernet adapter for PCs in 1982, the company has dominated the field. To maintain

Overview

Families	EtherLink	CS Family	LinkBuilder	MultiConnect
Product Types	Adapters	Terminal servers	Intelligent hub	Structured wiring system
Base Price ($)	345 (EtherLink II TP); 445 (EtherLink 16)	2,300	1,995 (base unit)	445 (single-module MultiConnect TP)
Date Announced	1982 (EtherLink); March 1991 (EtherLink 16 TP); April 1991 (EtherLink/MC 32)	1987	1989	1987
Date Delivered	1982	1987	1989	1987
No. Installed	3 million worldwide	52,000+	1,000,000 nodes installed	—

Decision Points

Model	Requirements	Comments
EtherLink Adapters	Serve as the interface between a PC and Ethernet	EtherLink adapters link IBM PC/XT/ATs, PS/2 Models 25 or 20, Micro Channel IBM PS/2s, and compatibles, as well as Apple Macintoshes to IEEE 802.3 Ethernet networks.
TokenLink Adapter	Serve as the interface between a PC and token-ring	TokenLink connects IBM PC/XT/ATs, PS/2 Models 25 or 30, or compatibles to an IBM or IEEE 802.5, 4M bps token-ring LAN.
CS/2000, CS/2100, CS/1 Terminal Servers	Connect terminals, PCs, printers, and other RS-232 async devices to the network and also carry out the proper protocols	These devices connect up to 10 (CS/2000 and CS/2100) or 64 (CS/1) terminals, printers, modems, and other RS-232-based devices; they also support TCP/IP, concurrent TCP/IP, LAT, XNS, OSI.
LinkBuilder Intelligent Hubs	Monitor and control the physical components of LANs	To support various phases of network activity, regardless of media, LinkBuilder includes Retiming Modules, 10BASE-T Host Module, ThinNet Host Module, Fiber Optic Host Module, and Management Modules.
MultiConnect Ethernet System	Serve as structured wiring system conforming to IEEE 802.3 standard	MultiConnect's configuration consists of wiring closet, wiring closet/building interconnection, and user's desktop; supports IEEE 802.3 Ethernet standard.
ViewBuilder	Manage network	ViewBuilder is network management software with a graphical interface. It integrates and centralizes the management of 3Com hubs, adapters, bridges, and terminal services. It is based on SNMP. A PC running OS/2 serves as a network management station

its position as market leader, 3Com continues to refine its adapters, offering a broad product line that includes adapters for 8-bit AT, 16-bit AT, 16-bit MCA, 32-bit MCA, and Macintosh machines. The devices run on coaxial cable and on 10BASE-T unshielded twisted pair (UTP).

Although 3Com adapts its adapters to the most current technologies, the company keeps them within cost-effective limits and reduces prices frequently. In August, 3Com lowered the price of EtherLink II TP, a 10BASE-T adapter card, by more than 20%. In a supreme vote of confidence for its products, the company offers a lifetime warranty on its adapters.

After recommitting to the adapter line, 3Com has disclosed a new adapter strategy, based on trends observed over the past 18 months. Having noted the increasing need for reliability, better management capabilities, and easier installation, the company concluded that standard high-integration silicon does not satisfy all these needs. 3Com's adapter strategy calls for the integration of hardware and selected software functions into the company's customized silicon.

Entry into Third-Generation Hub Market: As part of its plan to break the complexity barrier in networking, 3Com has intensified efforts in producing intelligent hubs that support token-ring, Ethernet, and FDDI. LinkBuilder 3GH represents a third-generation hub that delivers scalable bandwidth to the desktop and gives dedicated 10 megabit-per-second service. The product is based on multiprocessor RISC architecture and features hot-swappable modules. 3Com's decision to strengthen its hub line adds impetus to its goal of simplifying complex networks. As the hub becomes more powerful and assumes more capabilities, networks can shed excessive devices.

Expertise in 10BASE-T: The emergence of 10BASE-T for data communications served as the proverbial shot in the arm for Ethernet. The standard fits quite well into 3Com's quest for network simplification since communications occur over ordinary twisted-pair telephone wire. 10BASE-T also saves users money, simplifies moves and changes, reduces downtime, and centralizes network administration. According to the Gartner Group, the addition, move, or change of a 10BASE-T node costs $800 less than performing those changes in a coaxial environment.

3Com has incorporated 10BASE-T support into its EtherLink adapters, MultiConnect chassis and modules, and LinkBuilder chassis and modules. The adapters operate with all hubs conforming to 10BASE-T, as well as with many non-10BASE-T UTP Ethernet hubs. Since there are many pre-10BASE-T-standard hubs in existence—notably from SynOptics, Hewlett-Packard, AT&T, and David Systems—users of 3Com 10BASE-T adapters can be assured that their products will operate with these popular hubs.

Limitations

Lack of Extensive Fiber Support until Recently: Except for some fiber orientation in its adapter line, 3Com is a late entrant into the fiber market. As the costs of fiber decreased over the years, more and more vendors have incorporated fiber support, particularly FDDI support, into

3Com User Groups (U.S.)

Location	Representative	Phone Number
San Diego, CA	Matt Scholz	(619) 297-3218
Atlanta, GA	Bo Reahard	(404) 237-5400
Des Moines, IA	Sherry Smiley	(515) 245-7530
Cambridge, MA	Joe Grande	(617) 494-8200
Reading, PA	Barry Pierce	(215) 775-2600
Austin, TX	Bud Hesch	(512) 891-3091

their products. Perhaps because of its operating system orientation and the reexamination of the company's core products, 3Com delayed getting into the fiber side of the business. Although fiber has not caught on as quickly as many vendors would like and resistance to it still exists, other vendors have lead time over 3Com in hopping on the fiber bandwagon when it really takes off. Fiber could be like fax—around for years, but suddenly appearing as an overnight sensation.

Identification in the Marketplace Primarily as a Network Operating System Vendor: Perceptions are difficult to change. For years, the name 3Com was synonymous with the 3+ and 3+Open operating system. Now that 3Com is specializing in hardware, with software a necessary ingredient within the equipment, the company is working very hard to tell its new story. Fortunately, its adapter line remained in the spotlight during the 3+ years.

Vendor Analysis

Product Strategy

By stating its purpose as "simplifying the complexity of global data networks," 3Com has made a refreshing declaration—an honest admission that networking is a difficult task for communications professionals, one that increases in difficulty as networks grow. This approach is certain to appeal to network administrators who have grown weary of hearing about promised but undelivered "open" systems that will supposedly make interoperability child's play.

Since January 1991, 3Com has radically changed its direction. After almost seven years as a network operating system vendor with its 3+ products, 3Com removed itself from the NOS lineup by returning 3+ and 3+Open to Microsoft, the company with which it had originally developed the product. The decision to let IBM, Novell, and Microsoft compete for leadership in the NOS market was not so much a tactical withdrawal as a method for clearing the deck for a better view of where the LAN market is heading.

After observing the trend toward the divergence of client/server requirements, 3Com mapped out a course that distanced itself from client/server networking and headed toward global data networking. By taking the global data networking approach, 3Com focuses on products that enable users to build large data networks based on an infrastructure that "transmits data as quickly and efficiently as today's telephone networks make voice connections." To accomplish this goal, 3Com has restructured its product line into two divisions: End Systems Connectivity (adapters and terminal servers) and Intermediate Systems (hubs and bridges/routers).

In carrying out these changes, 3Com has acted decisively, but not rashly. The company's adapter line still generates a solid revenue stream and serves as a source of growth. 3Com continues to enhance the EtherLink series of adapters, which accounts for 63% of its revenues. During 1991, 3Com introduced the EtherLink 16 TP, a 10BASE-T adapter for 16-bit Ethernet over UTP, and EtherLink/MC 32, a 32-bit bus master Ethernet adapter for Micro Channel-based personal computers. In 1991, 3Com also celebrated an adapter milestone—3 million shipped.

In September 1991, 3Com announced the development of a series of adapters, based on custom silicon, for client and server applications. Products under development include 16- and 32-bit Ethernet adapters for ISA, EISA, and Micro Channel buses in coaxial and twisted-pair media. The company also announced that it is in the process of developing FDDI adapters in fiber and twisted pair. The products are expected to be available in the first half of 1992.

Recognizing the ongoing need for terminal servers, 3Com maintains a strong presence in that market through the CS family. Estimates by International Data Corp. (IDC) attribute revenues of over $400 million to terminal servers, which, though commodity items, are unlikely to go away in the near future. Since its acquisition of Bridge Communications in 1987, a company that specialized in terminal servers, 3Com has ranked as a leader in that field. The Bridge/3Com merger did not occur without difficulties, however, which stemmed from a struggle to determine which company would attain corporate dominance. At this time, the schism appears to be resolved, and the company is putting up a united front in promoting the terminal server line.

Not content to depend solely upon proven product lines, 3Com has stepped up its activity in the hub segment of the LAN market. After surveying customers about their hub requirements, 3Com noted that the results indicated that users want scalable bandwidth to the desktop, unshielded twisted-pair wiring, protection for their investments, standards-based products, and hubs that can be managed. To that end, 3Com designed LinkBuilder 3GH, a third-generation hub oriented toward bridging more bandwidth to the desktop.

3Com User Groups (International)

Location	Representative	Phone Number
Brisbane, Australia	Cliff Wignell	61-07 352 5011
Ottawa, ON, Canada	Mark Pytlik	(613) 951-2420
Milan, Italy	Primo Bonacina	39 2 254-9741
Tokyo, Japan	Hayao Washizaki	81 03 356-6351
Kista, Sweden	Annika Kvarnstrom	46-08-7034870
Remscheidt, Germany	Eckhard Klockhaus	49 02191/51741

Supporting Ethernet and FDDI, LinkBuilder 3GH makes use of shared and single-user Ethernets and private FDDI lines. The hub features 3x3 real backplanes, in-box bridging and routing, fault-tolerant operation, multiprocessor RISC architecture, hot-swappable modules, and integration with NETBuilder and earlier LinkBuilder families. Its standards-based management capabilities are based on SMT 6.2 for FDDI and SNMP for general-purpose applications.

3Com has been active in the software side of the LAN business. The recently released ViewBuilder network management software manages not only 3Com's internetworking devices and adapters, but also equipment based on SNMP from other vendors. The company is also moving into UNIX-based network management for its high-end products like LinkBuilder.

In addition, 3Com supports its own 3+ software and LAN software from leading vendors, such as Allsa Systems, Apple, Artisoft, AT&T, Banyan, Brightworks, Clarkson, Digital Equipment, DSC, Essex Systems, Farallon, FTP Software, Hayes, IBM, Lanport, Lanworks, Microsoft, Novell, Olivetti, Pacer, Polygon, The Santa Cruz Operation (SCO), Sun Microsystems, Tech Concepts, WEBcorp, Wollongong, and XIOS Systems.

Target Markets

3Com designs its products to link computer systems into a network that enables organizations to access and share information in a workgroup, across a corporate campus, or around the world. The systems produced by 3Com supply the physical connections between users and the larger networks. The intermediate systems connect multiple users and groups within the network. The company targets large, complex networks with the goal of simplifying them to the point that the intricacies of the data network become as transparent to the users as the workings of a worldwide telephone network.

The company is moving away from its workgroup-centered orientation, as evidenced by its sale in 1991 of its Communications Solutions, Inc. business, which focused on IBM SNA workgroup connectivity products, to Attachmate Corp. In April 1991, 3Com announced that it would continue to sustain operations in its workgroup systems division although the company had actively pursued selling it. No more development is planned in the workgroup business.

At present, 3Com's customer base includes worldwide businesses that have developed or are in the process of creating distributed computer networks. 3Com customers have connected over 2.5 million computer systems to the compnay's networks.

Internationally, 3Com maintains a strong presence, deriving about 40% of its revenues from that market. Recently, the company has significantly expanded its international operations by entering into a joint venture with Seiji Uehara, a Japanese networking entrepreneur. The new business, 3Com Kabushiki Kaisha (K.K.), develops and markets global data networking solutions adapted to Japanese requirements and local standards. The new company functions as a partnership of 3Com with 51% ownership and Seiji Uehara with 49%.

Uehara commented, "3Com is already a well-recognized participant in the Japanese marketplace. Their product leadership in the global data networking market, leading technologies, and worldwide market presence will enable 3Com K.K. to capture a significant share of Japan's growing networking market." 3Com had already entered the Japanese market through a relationship with Soliton Systems K.K. of Tokyo, which resulted in the acceptance of 3Com networking products by Nippon Telegraph and Telephone (NTT), Nippon Electric Company (NEC), and Hokkaido and Chiba Universities.

Its early entry into the Japanese networking market places 3Com in a strategically desirable position. Networking in Japan is in its infancy and clamoring for attention. NEC computers, which constitute the largest installed base in the country, are incompatible with U.S. and European Intel-standard personal computers. The lack of networking of Japanese computers opens up a vast market for adapters. Eric Benhamou, 3Com's president, has stated that 3Com intends to be in on "the first wave" of Japanese networking.

Competitive Analysis

Market Position

In two areas of local area networking, 3Com holds a substantial share. In the terminal server segment of the market, International Data Corp. (IDC) ranks 3Com second to Digital Equipment in the number of ports shipped. According to IDC, 3Com is the leader in worldwide Ethernet adapter shipments, having captured 29% of the market, followed by Western Digital with 23%.

At present, 3Com's emphasis on intelligent hubs has not made a significant impact on that market. Although the Yankee Group's list of the 10 leading hub vendors did not include 3Com, it would be unwise to consider the company a noncontender. Estimates of the 1991 hub market hover around the $380 million mark, and industry analysts predict a doubling of that figure by 1994. IDC estimated

3Wizard Programs

Name	Description
3Wizard Conferences	Occur twice a year in U.S. and Europe; open to all 3Wizard professionals; two to three days of 3Com product presentations, meeting with 3Com engineers and architects, and peer-to-peer discussions
Ask3Com	Technical support electronic bulletin board available in most areas on CompuServe; allows users to exchange messages with 3Com's own 3Wizards and other 3Wizards; use of 3Wizard utility library 24 hours a day, 7 days per week
3Wizard Mailings	Quarterly publication with current networking developments, technical tips, product information, and 3Wizard news
3Wizard Council	Consists of a dozen 3Wizards representing the broader 3Wizard community; meets four times a year to present program and product feedback to 3Com's product architects and strategists

3Com's share of the Ethernet hub market at 2.5%. The aggressive marketing stance taken by 3Com in recent months should alert hub vendors to the company's goal of snaring a portion of the hub pie.

Major Competitors

In the worldwide Ethernet adapter market, 3Com holds the lead. Observations on the adapter market from International Data Corp. (IDC) show that 3Com's share increased from 27% in 1989 to 29% in 1990. IDC has assigned 8% of the worldwide Ethernet adapter market to Racal InterLan, a figure that remained unchanged in 1989 and 1990.

3Com's purchase of Bridge Communications in 1987 placed the company squarely in the terminal server market. Although Digital Equipment dominates this market, 3Com realizes sufficient revenue from the line not to abandon it. 3Com sees the movement toward open, modular networking as creating an ongoing need for terminal servers to link terminals to LANs. The company sells these products to end users via distributors and resellers. 3Com also supplies terminal servers through OEM agreements to Bull and Data General.

Intensifying its venture into the hub market, 3Com confronts three strong opponents—SynOptics, Ungermann-Bass, and Cabletron—as well as a growing number of smaller vendors that have entered the arena. At present, SynOptics eclipses the other vendors, having zeroed in on hubs and attained high market recognition since its origin in 1985. IDC estimates SynOptics' Ethernet hub market share at 35.6%, with Cabletron second at 15.4%, and Ungermann-Bass third with 10.7%.

Relationships to Other Markets

3Com also markets a strong line of internetworking products: the CS/1-SNA gateway, IB/1 and IB/3 bridges, NETBuilder family of bridges and routers, BR/3 brouter, and GS/X.25 gateway server and router for X.25 services.

Sales and Distribution Strategy

Sales

In fiscal 1990, 40% of 3Com's sales were international. In the first nine months of fiscal 1991, more than 40% of sales occurred outside the United States.

Distribution

Throughout the world, 3Com supports a variety of sales channels, including storefront dealers, business-to-business direct marketing, value-added resellers (VARs), distributors, and original equipment manufacturers (OEMs). All are supported by 3Com's salespeople, sales engineers, and service organization.

For U.S. customers, dealers stock a broad range of products and offer a variety of support services. Among 3Com's dealers are Businessland, ComputerLand, Intelligent Electronics, and Valcom.

The additional value furnished by 3Com's certified VARs includes technical support, customized applications development, and vertical market solutions. Some VARs assist in designing and integrating network systems. 3Com maintains relationships with more than 100 authorized VARs worldwide, including Groupe Bull, Evernet Systems, Government Technology Service (GTS), GTE, and JWP Information Systems.

Worldwide distributors include Bricom, Central Systems Design, Esselte, Fouad & Sons, Goldstar Information and Communications, Hauman, Imagineering, Logitec, McKenzie Brown, Metrologie, Modus, Protokol Sistemas, Roctec, and Trigem.

In the United States, 3Com sells to more than 2,000 indirect VARs through its distributors, which include Graybar, Hall-Mark Electronics, Ingram Micro, Merisel, Micro Connect, and Tech Data.

OEM customers include Data General, IBM, Nokia Data, Norsk Data, Olivetti, Siemens, Sun Microsystems, Unisys, and Xerox.

Support

Policies and Programs

3Com offers a wide variety of service, support, and educational programs.

Warranty

3Com offers a one-year factory warranty on hardware, except for the following:

- EtherLink adapters (lifetime limited warranty)
- TokenLink adapters (three-year warranty)
- Instrumentation (90-day warranty or the remainder of the initial warranty period, whichever is longer)
- Repairs (90-day warranty)

The warranty period is calculated from the date of sale to the end user or 120 days from the date of shipment to the authorized reseller, whichever comes first.

Support Services

The 3Com Technical Service Regions in the United States are located in the West in San Jose, CA; in the Central section of the country in Rosemont, IL; in the Northeast in Teaneck, NJ; and in the Southeast in Vienna, VA.

The company maintains the Customer and Reseller Resource Center for Presales Support. By calling 800-NET-3Com, Dept. A1769, Monday through Friday from 6 a.m. to 5 p.m. Pacific time, resellers and customers have access to trained personnel who can assist in the following areas:

- Providing system configuration information
- Describing product features and benefits
- Responding to compatibility questions
- Supplying list prices for all 3Com products
- Providing local sales office information

Reseller Service Partner Programs

In July 1991, 3Com announced three reseller service partner programs that expand the technical expertise and the geographical coverage of customer support for 3Com global data networking products. The programs are Professional Services Partner (PSP), Network Development Center (NDC), and Authorized Repair Center (ARC).

The PSP program supports 3Com resellers that specialize in network implementation, project management, design, consultation, and training in internetworked and wide area network (WAN) environments. The company recommends PSPs for designing and implementing turnkey, multisite network installations that connect to public or private telecommunications lines.

The NDC program supports resellers that focus on post-sales support and maintenance contracts for LANs. NDCs install, service, and support local bridges, LAN hubs, and LAN network management products. The NDC program includes an Advanced Product Authorization Option that authorizes NDCs to service 3Com terminal servers, routers, remote bridges, bridge/routers, and network management software.

The ARC supports resellers that provide warranty and out-of-warranty repairs on 3Com adapter boards and receive warranty reimbursement from 3Com.

Service Hours

No-Charge Technical Support Programs for direct resellers include telephone technical support and the Ask3Com electronic database. The Telephone Technical Support Service (800/876-3266) operates Monday through Friday, from 6 a.m. to 5 p.m., Pacific time. The Ask3Com database operates 7 days per week, 24 hours per day. Users access Ask3Com by calling their local CompuServe number that appears on the CompuServe Phone Access Sheet.

Chargeable Technical Support to Resellers includes Factory Hardware Repair, Time & Materials Telephone Technical Support, and Time & Materials On-Site Technical Support. Resellers can access all three by calling (800) 876-3266. The Factory Hardware Repair Service for warranty and nonwarranty repair operates Monday through Friday from 6 a.m. to 5 p.m., Pacific time. Time & Materials Telephone Technical Support keeps the same hours. Time & Materials On-Site Technical Support operates Monday through Friday from 8 a.m. to 5 p.m., local time.

Technical Support Alliance

In May 1991, 3Com announced a strategic service alliance with Novell. Customers of 3Com using Novell's NetWare with 3Com adapters and the NETBuilder family receive comprehensive and coordinated support, regardless of which vendor is contacted about the problem. As part of the alliance, Novell's support engineers receive training on 3Com adapters and internetworking products, and 3Com support engineers receive training on NetWare. Novell and 3Com exchange product and information databases to replicate customer problems and to facilitate self-training.

3Com also participates in Digital Equipment's Desktop Services and Hewlett-Packard's Authorized Customer Support Program, under which HP provides support for 3Com products.

Network Systems Integrator Program

The Network Systems Integrator (NSI) program assists 3Com resellers in developing internetworking business and works to attract new resellers experienced in selling internetworks. The five new elements introduced to the existing 3Com reseller program are:

- New contracts for resellers that buy directly from 3Com
- Broader selection of internetworking and terminal server products for distributors selling to indirect VARs
- Introduction of SALES*builder*, a sales development kit to assist Network Systems Integrators with a marketing plan focused on direct mail and seminars
- New set of service partner programs
- New set of internetworking training programs

Training/Education

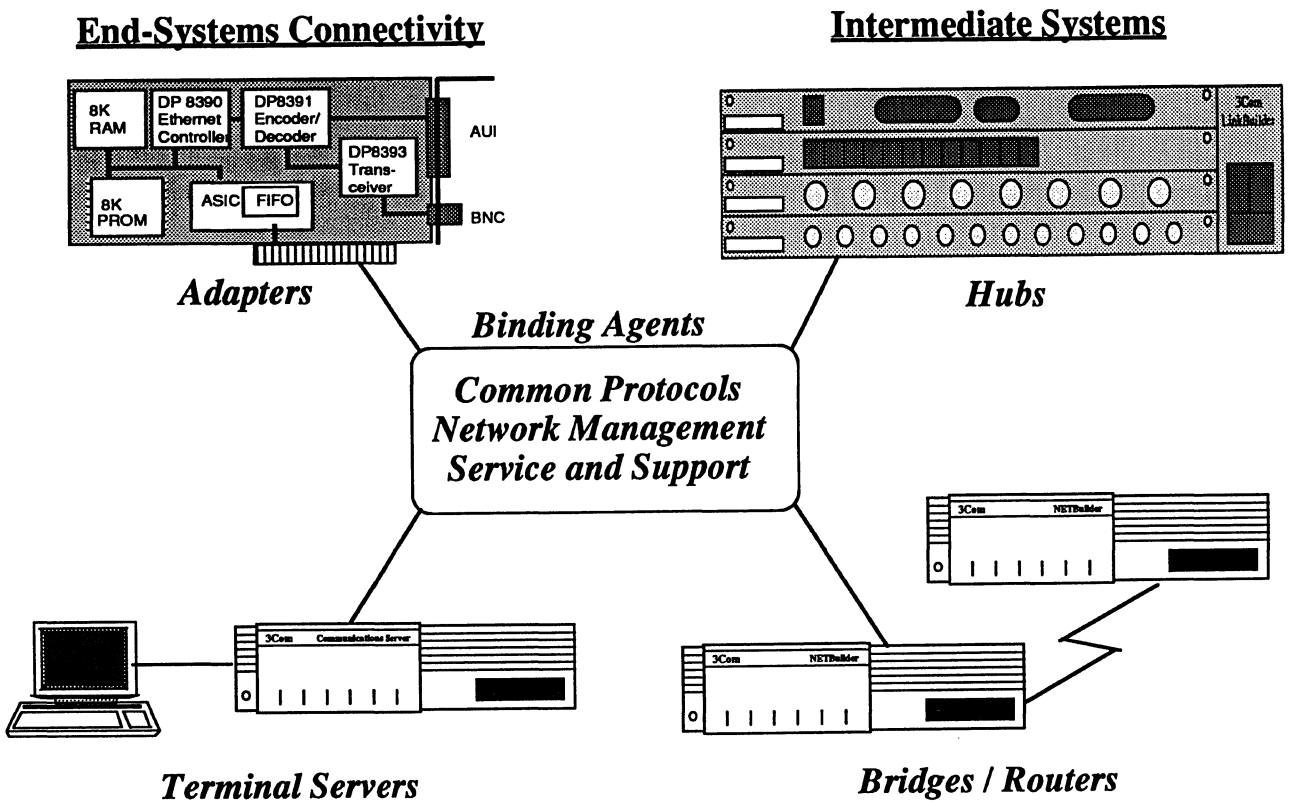
3Com offers a training program called 3Wizard, an in-depth training program that produces 3Wizards, more than 2,000 networking professionals who have mastered one or more sequences of courses and become certified technical users of 3Com products. After completing 3Wizard training, 3Wizards become members in a worldwide community of technical experts who share information with their peers in other organizations and learn the latest developments in network technology, troubleshooting, and maintenance.

In addition to the 3Wizard program, 3Com offers a variety of training courses and programs for resellers and end users. Twice a year, the company publishes *Education Services Course Catalog*. The company maintains training classrooms in Santa Clara and San Jose, CA; Rosemont, IL; Dallas, TX; Vienna, VA; and Atlanta, GA.

Documentation

In May 1991, 3Com announced the availability of product information on compact disk read-only memory (CD-ROM). Based on optical storage technology, the 3Com Laser Library features full-color data sheets, engineering technical notes, and software patches and fixes on a single

Figure 1.
3Com's Global Data Networking Approach



Source: 3Com.

compact disk. The current disk can access more than 60 product manuals and 1,400 technical articles. Users do not undergo training to access the 3Com Laser Library. They obtain information by entering simple keywords related to their topics of interest.

Shortly after the request has been entered, the 3Com Laser Library provides text and images related to the keywords, drawn from all sources in the library. The 3Com Laser Library is currently DOS based and contains approximately 200 megabytes of data. It is designed to accommodate up to 640 megabytes of data. The library is available from 3Com and its worldwide network of resellers and distributors for US$600 for a one-year subcription. Users receive quarterly updates via CD-ROM.

Competitors' Programs

Digital Equipment Corp.

Digital is currently offering services that focus on the development and integration of customers' open network environments.

DECnet/OSI Transition Planning Service: This service assists customers in making the transition to open network environments. Pricing is set on a per-contract basis.

Open Network Customer Training: This service offers network managers, application developers, and network planners access to Digital Services courses on a variety of open networking subjects.

NETsupport Operations Management Services: These services provide customers with ongoing management of their DECnet/OSI and/or TCP/IP network resources. Pricing is set on a per-contract basis.

NETsupport Shared TCP/IP Service: This service provides customers with operations support for TCP/IP networks, including network management hardware and software, on-site consulting, and telephone advisory support.

Racal InterLan

Racal InterLan offers a lifetime warranty on its Ethernet adapter cards. The warranty covers any defect in materials or workmanship for all Ethernet adapter cards purchased after July 30, 1990. Under the warranty, the company guarantees repair or replacement of any defective card at no cost to the customer.

Specifications

Ethernet Adapter Features/Functions

For IBM PC/XT/AT and PS/2 Models 25 and 30 and Compatibles

Model	EtherLink II	EtherLink II TP	EtherLink Plus
Description	Easy two-jumper installation; broad software support	Twisted-pair adapter compliant with IEEE 10BASE-T standard; backward compatible with prestandard twisted-pair hubs from SynOptics, David Systems, Hewlett-Packard, and AT&T; software compatible with EtherLink II	Intelligent Ethernet network interface; Intel 80186 microprocessor and 256KB RAM (expandable to 512KB) enable downloading of software to run on the adapter; LinkPlus Optimizer included

For IBM PC/XT/AT and PS/2 Models 25 and 30 and Compatibles

Model	EtherLink 16	EtherLink 16 TP
Description	16-bit Ethernet adapter for high-performance workstations and servers; ships with drivers for 3+, 3+Open, LAN Manager, and NetWare; entirely software configurable (no jumpers)	High-performance 16-bit Ethernet adapter for 10BASE-T applications; backward compatible with prestandard twisted-pair hubs from SynOptics, David Systems, Hewlett-Packard, and AT&T; software compatible with EtherLink 16

For Micro Channel Architecture IBM PS/2s and Compatibles

Model	EtherLink/MC	EtherLink/MC TP	EtherLink/MC 32
Description	High-performance 16-bit Ethernet adapter for coax; optimized shared-memory architecture with socketed 16KB packet buffer and 16-bit data bus interface; support for IBM's Programmable Option Select (POS) utility for jumperless installation	Has all the features of the EtherLink/MC adapter for twisted-pair cabling; compliant with IEEE 10BASE-T standard; backward compatible with prestandard twisted-pair hubs from SynOptics, David Systems, Hewlett-Packard, and AT&T; software compatible with EtherLink/MC	Highest-performance 32-bit Ethernet adapter for coaxial cabling for high-performance workstations and servers; optimized 32-bit bus master data transfers

For Apple Macintosh Computers

Model	EtherLink/NB
Description	High-performance Ethernet network interface for the Apple Macintosh II family; 64KB RAM; fully compliant with Apple's EtherTalk standard and hardware compatible with Apple's EtherTalk NB network adapter

NW1000 NetWare-Ready Adapter

Model	NW1000
Compatibility	Novell NetWare 286/386 (client and server)
Hardware	IBM PC XT/AT, PS/2 Models 25 and 30, and compatibles
Network Interface	Ethernet IEEE 802.3 10M bps baseband CSMA/CD LANs
Random Access Memory	8KB RAM for multipacket buffering
Data Path	8 bit
DMA Channels	1, 2, 3

Token-Ring Adapter Features/Functions

Model	TokenLink
Hardware	IBM PC/XT/AT or PS/2, Model 25 or 30, and compatibles
Software	3Com 3+ and 3+Open; IBM PC LAN program, PC LAN support program, NETBIOS, APPC, and 3270 Emulation 3.0; Novell NetWare (client side); Banyan VINES (client and server sides)
Network Interface	IEEE 802.5, IEEE 802.2, 4M bps baseband, token-passing LANs
RAM	16KB for multiframe buffering
ROM	16KB ROM for on-board execution of IEEE 802.2 link-level control protocols licensed by 3Com from Texas Instruments
DMA Channels	0, 1, 3, 5, 6, 7

LinkBuilder Intelligent Hub Features/Functions

Model	LinkBuilder Model 500	LinkBuilder Model 100
Type	Premises Concentrator	Department Concentrator
Number of System Modules	12	4
Number of Ports Supported	132 10BASE-T twisted-pair ports, 88 thin Ethernet coax ports, or 66 fiber optic ports	36 10BASE-T ports, 24 coax ports, or 18 fiber optic ports
Installation	Standard 19-in. equipment rack	Tabletop or equipment rack; wall mounted through brackets

Transceiver Features/Functions

EtherLink TP Transceiver for 10BASE-T

Model	EtherLink TP Transceiver
Connection	Device equipped with an Ethernet AUI port to UTP
Compatibility	Full compatibility with IEEE 802.3 10BASE-T standard
Connectors	15-pin AUI; RJ-45 twisted pair
Tests	Signal quality error (SQE) and Link Integrity
LEDs	Power, Polarity, Transmit, Receive, SQE Test, Link

Terminal Server Features/Functions

Model	CS/2000/CS/2100	CS/1
Hardware Platform	12MHz 68000 CPU; 1MB private memory; compact size; diskless (CS/2000); internal disk drive (CS/2100)	Multibus-based modular product; 68020 32-bit CPU; 1MB private and 512KB shared memory
Performance Specifications	Data throughput—19.2K bps; maximum distance to attached devices—200 feet at 19.2K bps; maximum port operating speed—38.4K bps	600K bps
Maximum Number of Sessions	8 per port; 20 to 40 (varies by Connection Service protocol)	8 per port; 64 to 96 per server (varies by Connection Service protocol)
Serial Communications	Interface—10 EIA RS-232 async, bisync, or bit sync (XNS only for bit sync); line speeds—300 bps to 38.4K bps	—
Network Interface	IEEE 802.3 10BASE5 15-pin AUI connector; DB-25 connector	Baseband the same as CS/2000 and CS/2100; broadband 5M bps CSMA/CD interface through 3Com RFM/5 modem
RS-232 Control Lines	RTS, CTS, DTR, DSR, DCD, TXC, RXC; EXC for sync modem, 2 ports maximum	Option—IEEE 802.3 10BASE5 15-pin AUI connector, 3Com 5M bps broadband connector
Connection Service Protocols	XNS, TCP/IP, TCP/IP-LAT (concurrent), OSI (CS/2100 only)	XNS, TCP/IP, TCP/IP-LAT (concurrent), OSI (CS/1 with disk only)
Boot Source	NCS only (CS/2000); Internal 3½-in. diskette drive or NCS	Option—internal diskette drive or NCS

Network Control Server (NCS) Features/Functions

Model	NCS/AT	NCS/2
Network Size	Up to 512 communications servers or equivalent load	Over 512 communications servers or equivalent load
Processor	80286	Sun-3 workstation
Operating System	Xenix System V	Sun's version of UNIX
Availability	Can be purchased as a system or as an upgrade kit for a compatible PC	Can be purchased as a system or as an upgrade kit for a customer's compatible Sun-3
Configuration, if purchased as system	Based on Wyse 2108 computer equipped with 80286 processor, 2MB RAM, 40MB disk, 1.2MB 5¼-in. diskette drive, two serial ports, two parallel ports, monochrome adapter and monitor	Based on 25MHz, 32-bit 68020 Sun-3/140, 4MB RAM, 141MB, ¼-in. cartridge tape drive, 2 serial ports, high-resolution 19-in. monochrome monitor

MultiConnect Ethernet Repeater Features/Functions

Module	Function
MultiConnect Ethernet Repeater IEEE 802.3/ Ethernet Repeater Chassis	Includes power supply, repeater, retiming, preamble extension, and regeneration logic; provides 15 empty slots, which can be populated with any of the modules listed in this table
Transceiver Interface (AUI) Module	Provides AUI interface for connecting the repeater to thick or thin coax via external transceivers
Thin Ethernet Module	Provides connection to thin coax
10BASE-T Module	Provides twisted-pair connectivity conforming to IEEE 802.3 specifications for dual twisted-pair telephone wire; contains three RJ45 ports, each with three LEDs; supports connection to dual twisted-pair telephone wire segments of up to 150 meters
PairTamer Unit (operates with PairTamer Module)	Provides direct twisted-pair wire connectivity to the desktop
PairTamer Kit	Provides twisted-pair connectivity using a single twisted pair (two wires); supports daisychaining with coaxial of up to 30 additional stations to the twisted-pair run
LanScanner	Provides test instrument for characterizing twisted-pair and coaxial cabling; measures impedance, distance, open, short, noise resistance
CableTamer/75	Adapts Wangnet, CATV, and RG59 to carry Ethernet signaling
CableTamer/93	Adapts IBM 3270, Arcnet, and RG62 to carry Ethernet signaling

Network Management Software Features/Functions

Program	ViewBuilder
Description	Integrates and centralizes the management of 3Com intelligent hubs, network adapters, bridges, and terminal servers in a local wiring environment
Protocol Supported	SNMP
Computer System	IBM PS/2, Models 55SX, 70/386; Compaq Models 386/20, 386/20e, 386/25e, 386/33L, or 486/25; or compatibles
Network Management Station	PC functioning as a central console
Graphics	Graphical interface, network maps, icons, windows
Remote Management	Can manage 3Com NETBuilder bridges and bridge/routers and CS/2000 terminal servers using SNMP and the ViewBuilder Telnet terminal emulation capability
Network Monitor	Provides realtime data; displays traffic statistics and error counters; strip charts display MIB variables

Software Development

Program	NetProbe
Users	Software developers, certified 3Wizard engineers, and network troubleshooters
Media Supported	Ethernet, token-ring
Problems Addressed	Nonresponding workstations, internet route malfunctions, network failures, and overloaded network servers
Main Menu	Displays information about two-way communications between network servers and stations on the network
Packets Interpreted	Packets following XNS, TCP/IP, AppleTalk, or SMB protocols and 3Com extensions to SMB; monitoring of 802.3 and 802.5 packets in pure hex format

Software Development (Continued)

Program	NetProbe
Packet Filtering	Via source or destination address, socket number, or unique bit patterns
Installation	Detailed instruction manual and online help
Off-Line Analysis	Screen displays of up to 200 packets can be stored in a DOS file for analysis with user's programs
Operation	Runs on any 640KB IBM PC or compatible; requires a 3Com EtherLink Plus or TokenLink adapter board

Physical Environment

Physical Specifications—EtherLink TP Transceiver

Length (in./cm.)	3.0/7.6
Width (in./cm.)	1.5/3.8
Height (in./cm.)	0.75/2.0
Weight (oz./g.)	3.5/105

Electrical Requirements

Power Consumption	1.2 W typical; 3.6 W max.
Required Input Voltage	9.5 to 16 V

Physical Specifications—EtherLink/NB

Length (in.)	13.0 (board), 15.25 (package)
Width (in.)	4.0 (board), 3.7 (package)
Height (in.)	6.7
Weight (oz.)	24

Electrical Requirements

Power	+5 V @ <2.0A; +12 V @ 0.5A with on-board transceiver; +12 V @ 0.5A max. with external transceiver
Isolation Voltage	500 V RMS with on-board transceiver

Physical Specifications—EtherLink/MC, EtherLink/MC TP, EtherLink/MC32

Length (in./cm.)	11.5/29.2
Width (in./cm.)	3.475/8.8

Electrical Requirements

Power	+5 V at 2.00A; +12 V at 0.5A

Physical Specifications—EtherLink II, EtherLink II TP, EtherLink Plus

Models	EtherLink II	EtherLink II TP	EtherLink Plus
Dimensions (in.)	IBM PC half-size card, 4.2 x 6.6	IBM PC card, 9.4 x 4.2	IBM PC full-size card, 4.2 x 13.2
Electrical Requirements			
Isolation Voltage	500 V RMS with on-board transceiver	1500 V RMS with on-board transceiver	500 V RMS using on-board transceiver

Physical Specifications—EtherLink 16, EtherLink 16 TP

Models	EtherLink 16	EtherLink 16 TP
Length (in.)	9	9.4
Width (in.)	4.2	4.2

Physical Environment (Continued)

Electrical Requirements

Power	+5 V @ 1.6A, +12 V @ 200 mA with on-board transceiver, +12 V @ 500 mA max. with external transceiver	+5 V @ 1.6A, +12 V @ 200 mA with on-board transceiver, +12 V @ 500 mA max. with external transceiver

Physical Specifications—TokenLink

Model	**TokenLink**
Length (in.)	32.2
Width (in.)	4.2

Electrical Requirements

Power	+5 V @1.0A

Physical Specifications—NW1000

Model	**NW1000**
Physical Dimensions	IBM half-size card
Length (in.)	6.6
Width (in.)	4.2

Electrical Requirements

Power	+5 V @ 0.30A, +12 V @ 0.25A with on-board transceiver

Physical Specifications—LinkBuilder

Models	**LinkBuilder Model 100**	**LinkBuilder Model 500**
Length (in.)	17.3	19
Width (in.)	15	12
Height (in.)	5.2	19.2
Weight (lb.)	Chassis—17.7, fully loaded (approx.)—28, shipping weight (approx.)—30	Chassis—33.3, fully loaded (approx.)—75, shipping weight (approx.)—60

Electrical Requirements

AC Line Frequency	47-63 Hz	47-63 Hz
V AC Input Requirement	90-250 V AC	90-132 V AC (110 V AC operations; 180-265 V AC (220 operations)
AC Volt Ampere Rating	300 VA max.	1,200 V A max.
Current Rating	3.0 Amp nominal at 110 volts; 1.5 Amp nominal at 220 volts	8 Amp (110 V AC operations); 4.2 Amp (220 V AC operations)

Physical Specifications—CS Family

Models	**CS/2000 and CS/2100**	**CS/1**
Length (in.)	12.6	21.3
Width (in.)	16.2	17
Height (in.)	3.8	9.6
Weight (lb.)	12	32

Electrical Requirements

Power	115 V AC ± 15%, 47 to 63 Hz, 1.0A; 230 V AC ± 15%, 47 to 63 Hz, 0.7A	115 V AC ± 15%, 47 to 63 Hz, 2.6A; 230 V AC ± 15%, 47 to 63 Hz, 1.7A

Physical Specifications—MultiConnect

Models	Modular Multiport Repeater	TP Module
Length (in./cm.)	19.5/49.5	4.5/11.4
Width (in./cm.)	17/43	2.74/7
Height (in.)	5.5/14	1.25/3.2
Weight	20-25/9-11.25 kg. (depending on loading)	5 oz./0.14 kg.
Mounting	Rack mount: shelf mountable in standard 19-in. rack; wall mount: mounting keyholes on base for wiring closet wall	Same as Multiport Repeater
Electrical Requirements		
Voltage	90-270 V, 50-60 Hz, self-adjusting	90-270 V, 50-60 Hz, self-adjusting
Watts	200 W max.	200 W max.
Minimum Power Factor	0.6	0.6
Power Protection	Back-panel circuit breaker/switch	Back-panel circuit breaker/switch

Physical Specifications—MultiConnect (Continued)

Models	MultiConnect PairTamer	MultiConnect LanScanner
Length (in./cm.)	4.5/11.4	9/22.8
Width (in./cm.)	2.75/7	5.5/13.9
Height (in./cm.)	1.25/3.2	2/5
Weight	5 oz./0.14 kg.	2 lb./0.9 kg.

Pricing

		Purch. Price ($)
Network Adapters		
	EtherLink	495
	EtherLink II	295
	EtherLink II (five pack)	1,225
	EtherLink II TP	245
	EtherLink II TP (five pack)	1,375
	EtherLink Plus	895
	EtherLink Plus (five pack)	4,225
	EtherLink 16	445
	EtherLink 16 (five pack)	1,975
	EtherLink 16 TP	479
	EtherLink 16 TP (five pack)	2,195
	NW1000	289
	NW1000 (five pack)	1,195
	EtherLink/MC	425
	EtherLink/MC (five pack)	1,875
	EtherLink/MC TP	495
	EtherLink/MC TP (five pack)	2,225
	EtherLink/MC 32	899
	EtherLink/NB (for Macintosh II)	595
	TokenLink	595
Hubs		
	LinkBuilder Ethernet Management Module	3,995
	LinkBuilder Ethernet Management Module FOIRL	4,395
	LinkBuilder Ethernet Retiming Module	1,495
	LinkBuilder Ethernet Retiming Module FOIRL	1,895
	LinkBuilder 10BASE2 Host Module (8 ports)	1,795
	LinkBuilder Fiber Optic Host Module (6 FOIRL ports)	2,895
	Ethernet Modular Multiport Repeater	1,295
	Transceiver Interface Module	250
	Thin Ethernet Module	295

		Purch. Price ($)
ViewBuilder		
	Basic Network Management, 5¼-inch software media	3,995
	Basic Network Management, 3½-inch software media	3,995
	Graphical LinkBuilder Application (both 5¼-inch and 3½-inch software media are supplied)	2,495
	Desktop Management (both 5¼-inch and 3½-inch software media are supplied)	2,495
Terminal Servers (CS Product Line)		
	CS/2000	2,300
	CS/200B-10	2,800
	CS/2100	2,700
	CS/1 (base unit only—empty; with disk drive)	4,500
	CS/1 Complete Upgrade	4,000
	CS/1 Processor Unit Upgrade (without EC/2 board)	2,500
NCS/AT		
	For Ethernet, 5¼-inch software media upgrade	3,500
	For Ethernet, 3½-inch software media	3,500
	For Broadband, 5¼-inch software media	3,500

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3Com Internetworking Products

In this report:

Following its strategy to become a major supplier of global data networking products, 3Com has increased its emphasis on internetworking. The company's internetworking product line is based on its NETBuilder family of bridges, bridge/routers, and multiprotocol routers. The NETBuilder line offers support for a wide range of networking and routing protocols; is software-upgradable; and is available in Ethernet, token-ring, and broadband versions.

Strengths

- Flexibility and ease of upgrade
- Support for most current routing protocols
- Support for a wide range of networking protocols

Limitations

- Recognition as primarily a network adapter and operating system vendor

Competition

Advanced Computer Communications (ACC), Cisco Systems, Digital Equipment, IBM, Proteon, Retix, Vitalink/Network Systems, Wellfleet Communications, and several others.

Vendor

3Com Corp.
5400 Bayfront Plaza
Santa Clara, CA 95052
(408) 764-5000, (800) NET-3COM
Fax: (408) 764-5001
In Canada:
3Com Canada Inc.
225 E. Beaver Creek Road
Richmond Hill, ON L4B 3P4
(416) 882-9964

Price

Prices for the NETBuilder II bridge/router range from $10,495 to $32,695. **GSA Schedule:** Yes.

—By Joseph F. Kelly
Managing Editor

Product Analysis

3Com's decision to withdraw from the network operating system market signaled a corporate shift away from its earlier focus on local workgroup computing. The company's new focus on global data networking renews its emphasis on LAN and LAN/WAN interconnections. 3Com withdrew from the network operating system (NOS) market in February 1991, discontinuing sales of its 3+ and 3+Open NOSs. The company also withdrew from the file server, diskless workstation, and SNA gateway markets.

Network interface cards have traditionally been 3Com's strength, and the company has refocused its efforts toward its highly successful line of Ethernet adapters. 3Com has also beefed up development for its hub and network management product lines. LinkBuilder 3GH, unveiled in September 1991, is 3Com's entry in the fast-growing high-end intelligent hub market.

Perhaps the most significant strategic shift, however, is 3Com's renewed emphasis on internetworking. With the acquisition of Bridge Communications in 1987, 3Com became a major player in the early stages of the internetworking market via Bridge's extensive bridge and gateway product line. As the market for bridges and routers grew, however, 3Com's focus was split between its NOS and adapter products on one hand, and its internetworking line on the other. This split focus allowed upstarts like Cisco Systems, Vitalink Communications, and Wellfleet Communications to enter the market and grab sizable shares. Established vendors such as Digital Equipment, Proteon, and IBM also captured significant market shares. Although 3Com's shares of the bridge and router markets are certainly significant, its early entry into the market did not translate into a leadership role once the market took off.

3Com's internetworking product line is spearheaded by its NETBuilder line of bridges and bridge/routers. The NETBuilder family consists of NETBuilder Bridges, NETBuilder Bridge/Routers, NETBuilder Token-Ring, and NETBuilder for Broadband. NETBuilder is available in two basic models: a local NETBuilder that supports two LAN connections, and a wide area NETBuilder that supports two LAN and two WAN connections. Upgrade kits are available to convert local models into wide area versions. All NETBuilders feature a choice of menu-driven or command-line user interface.

The NETBuilder platform is based on a Motorola 68020 microprocessor. An important advantage to 3Com's NETBuilder bridge/router product family is its upgradability. Users wanting to upgrade a NETBuilder from a bridge to a bridge/router need not change the box; they simply load new software. NETBuilder bridges and bridge/routers also support a wide range of networking (TCP/IP, IPX, DECnet, AppleTalk, XNS, OSI) and routing (OSPF, RIP, EGP, IS-IS, ES-IS) protocols. In addition to Ethernet, NetBuilder is available in token-ring and broadband versions.

Internetworking is a key element of 3Com's global networking strategy, and the company has been quick to expand the scope of its internetworking offerings. Perhaps the most significant addition came in September 1991, when 3Com introduced NETBuilder II, its next-generation modular bridge/router. As the newest member of 3Com's NETBuilder bridge and bridge/router family, NETBuilder II is designed to accommodate the high-bandwidth networking applications of the future. The product's architecture combines a RISC processor, custom Application-Specific Integrated Circuits (ASICs), and an 800M bps backplane. The high-speed backplane is significant—it guarantees a high level of throughput when supporting bandwidth-consuming network interfaces such as T3 and FDDI.

NETBuilder II supports FDDI, Ethernet, and wide area connections; token-ring support will be available in 1993. NETBuilder II is customer installable, upgradable, and serviceable. Users can add and remove modules; modules are hot-swappable.

Internetworking products are a key element in 3Com's global networking strategy. The company will undoubtedly continue to enhance and upgrade its NETBuilder line in order to increase market share.

Target Applications

Internetworking vendors target their products to users who need to interconnect their networks—whether those networks are LANs or WANs. Bridges and routers allow users to interconnect multiple LANs within an enterprise, or connect a LAN to a WAN using a "cloud" technology such as X.25, SMDS (switched multimegabit data service), or frame relay. 3Com explains its strategy as "simplifying the complexity of global data networks." As such, its NETBuilder product line is targeted to large users with multiple LANs and complex enterprise-wide networks.

Strengths

Flexibility and ease of upgrade. All NETBuilder Ethernet models share the same chassis, motherboard, power supply, and disk drive. This common hardware platform allows NETBuilders to be upgraded or reconfigured by rebooting with new software. In addition, NETBuilders can

Overview

Families	NETBuilder	NETBuilder II	NETBuilder Token-Ring	NETBuilder for Broadband	LinkBuilder 3GH
Product Types	Ethernet bridges and bridge/routers	Ethernet bridge/routers	Token-ring bridge	Broadband bridges and bridge/routers	Intelligent hub
Base Price ($)	4,995	10,495	6,950	6,245	27,500
Date Announced	1989	1991	1991	1991	1991
Date Delivered	1989	1991	1991	1991	1991
No. Installed	Approx. 25,000	New	New	New	New

Decision Points

Model	Requirements	Comments
NETBuilder Family	Local and remote bridging capabilities	NETBuilder bridges are available in local (IB/2000) and remote (IB/3000) versions. NETBuilder bridge/routers are also available in local (BR/2000) and remote (BR/3000) versions.
	Extensive protocol support	NETBuilder bridges and bridge/routers support a wide range of networking (TCP/IP, IPX, DECnet, AppleTalk, XNS, OSI) and routing (OSPF, RIP, EGP, IS-IS, ES-IS, PPP) protocols.
	LAN support	In addition to its family of Ethernet bridges and bridge/routers, 3Com offers token-ring and broadband versions of NETBuilder.
	FDDI support	NETBuilder II includes an 800M bps backplane to support 100M bps FDDI bandwidth.
LinkBuilder 3GH	Multifunctionality	LinkBuilder 3GH integrates both intelligent hub and internetworking capabilities in a single device.
	Multiple LAN connections	LinkBuilder 3GH provides 9 data buses for Ethernet, token-ring, and FDDI connections.

be reconfigured or upgraded across the network using 3Com's Network Control Server (NCS). This flexibility protects the user's initial investment in the product.

Support for most current routing protocols. NETBuilder internetworking products support the most popular routing protocols. In a TCP/IP environment, NETBuilder supports OSPF (Open Shortest Path First), RIP (Routing Information Protocol), and EGP (Exterior Gateway Protocol). For OSI environments, IS-IS (Intermediate System to Intermediate System) and ES-IS (End System to Intermediate System) protocols are supported. For wide area networking, NETBuilder supports the PPP (Point to Point Protocol) serial line protocol. Multiprotocol routing support makes the NETBuilder products appropriate for most networks.

Support for a wide range of networking protocols. NETBuilder supports TCP/IP, Novell NetWare IPX, Digital Equipment DECnet Phase IV, Apple AppleTalk Phase II, and XNS. Once again, support for multiple networking protocols expand the user's routing options.

Limitations

Recognition as primarily a network adapter and operating system vendor. Although it obtained a broad internetworking product line via its merger with Bridge Communications in 1987, 3Com concentrated most of its resources on its workgroup computing products in the late 1980s. 3Com's joint development of OS/2 LAN Manager with Microsoft generated plenty of industry publicity; its 3+Open NOS was the most popular of the several OEM versions of LAN Manager. 3Com has been the leader in Ethernet adapter shipments for several years, and was also strong in file servers (3Server) and diskless workstations (3Station).

However, 3Com's financial performance faltered during that same time period. In early 1991, the company announced a major change in direction. Out went the 3+Open and older 3+ operating systems, as did the file server and diskless workstation lines. Its SNA gateway product line was also scuttled. 3Com announced its new global computing strategy. Since then, the company has spent a lot of time and money trying to gets its story out to the industry. Even though its NETBuilder product family is a strong one, 3Com must overcome stiff challenges from vendors such as Cisco Systems and Wellfleet Communications. Its success in this market is key to the success of its new strategy, and 3Com must build the same name recognition among internetworking customers as Cisco and Wellfleet have done.

Competitive Analysis

NETBuilder II is 3Com's response to the new generation of internetworking products being introduced by vendors such as Cisco Systems and Wellfleet Communications. Its incorporation of support for wide area networking technologies such as frame relay and SMDS is absolutely essential for effective competition in this market. Likewise, its support for a wide variety of both networking and routing protocols, as well as SNMP and SMT network management, puts NETBuilder II on the cutting-edge of bridge/router technology.

In the same vein, LinkBuilder 3GH is well-positioned to compete with the latest selection of high-end intelligent hubs being brought to market by SynOptics, Cabletron, and a host of others. Its RISC architecture and high-speed backplane provide support for future high-bandwidth applications and technologies such as FDDI. Support for both network management and bridging places LinkBuilder 3GH squarely in the market for multifunctional

intelligent hubs, which will be one of the most lucrative and hotly contested LAN market segments in the early 1990s.

Vendor Analysis

Marketing Strategy

3Com's global networking strategy focuses on developing and marketing products that enable users to build large data networks based on an infrastructure that "transmits data as quickly and efficiently as today's telephone networks make voice connections." 3Com has created two divisions to address this goal: End Systems Connectivity (adapters and terminal servers) and Intermediate Systems (hubs and bridge/routers).

The company's NETBuilder line is an offshoot of the original IB (Internetwork Bridge) product line obtained from Bridge Communications. The key selling point of the older NETBuilder models is their software-upgradability; this is an attractive feature for users that do not want to be forced to buy new hardware when they decide to upgrade from bridging to routing.

The Intermediate Systems division made its most significant announcements to date on September 23, 1991. On that day 3Com introduced its next-generation bridge/router and hub, NETBuilder II and LinkBuilder 3GH respectively. Both products provide 3Com customers with support for high-bandwidth (100M bps) FDDI connections. This support is key to preparing for future bandwidth-hungry applications, a preparation that many users are very interested in making today. "These standards-based products protect users' investments in existing network infrastructure, while providing for future bandwidth growth," states 3Com president and CEO Eric Benhamou.

NETBuilder II features a state-of-the-art design encompassing RISC technology, custom ASICs, and an 800M bps backplane to provide filtering rates of 900,000 packets per second (pps) and 100M bps FDDI throughput. Available in 4- and 8-port versions, NETBuilder II supports multiple LAN and WAN interfaces. It represents 3Com's first internetworking offering with FDDI support.

LinkBuilder 3GH (third-generation hub) integrates both hub and internetworking functions in a single device. It features RISC multiprocessing and allows users to allocate Ethernet bandwidth (10M bps) to many users or to a single user, or FDDI bandwidth (100M bps) to the backbone or directly to the desktop. It provides nine data buses for Ethernet, FDDI, and token-ring connections; accommodates up to 12 plug-in modules for network expansion; and provides forwarding rates up to 400,000 pps.

Target Markets

3Com designs its products to link computer systems into a network that enables organizations to access and share information in a workgroup, across a corporate campus, or around the world. The systems produced by 3Com supply the physical connections between users and the larger networks. The intermediate systems connect multiple users and groups within the network. The company targets large, complex networks with the goal of simplifying them to the point that the intricacies of the data network become as transparent to the users as the workings of a worldwide telephone network.

The company is moving away from its workgroup-centered orientation, as evidenced in 1991 by the sale of its Communications Solutions, Inc., business, which focused on IBM SNA workgroup connectivity products, to Attachmate Corp. In April 1991, 3Com announced that it would continue to sustain operations in its workgroup systems division although the company had actively pursued selling it. No more development is planned in the workgroup business.

At present, 3Com's customer base includes worldwide businesses that have developed or are in the process of creating distributed computer networks. 3Com customers have connected over 2.5 million computer systems to the company's networks.

Internationally, 3Com maintains a strong presence, deriving about 40% of its revenues from that market. The company has significantly expanded its international operations by entering into a joint venture with Seiji Uehara, a Japanese networking entrepreneur. The new business, 3Com Kabushiki Kaisha (K.K.), develops and markets global data networking solutions adapted to Japanese requirements and local standards. The new company functions as a partnership; 3Com maintains 51% ownership while Seiji Uehara controls 49%.

Uehara commented, "3Com is already a well-recognized participant in the Japanese marketplace. Their product leadership in the global data networking market, leading technologies, and worldwide market presence will enable 3Com K.K. to capture a significant share of Japan's growing networking market." 3Com had already entered the Japanese market through a relationship with Soliton Systems K.K. of Tokyo, which resulted in the acceptance of 3Com networking products by Nippon Telegraph and

3Com User Groups (U.S.)

Location	Representative	Phone Number
San Diego, CA	Matt Scholz	(619) 297-3218
Atlanta, GA	Bo Reahard	(404) 237-5400
Des Moines, IA	Sherry Smiley	(515) 245-7530
Cambridge, MA	Joe Grande	(617) 494-8200
Reading, PA	Barry Pierce	(215) 775-2600
Austin, TX	Bud Hesch	(512) 891-3091

Telephone (NTT), Nippon Electric Company (NEC), and Hokkaido and Chiba Universities.

Its early entry into the Japanese networking market places 3Com in a strategically desirable position. Networking in Japan is in its infancy and clamoring for attention. NEC personal computers, which constitute the largest installed base in the country, are incompatible with U.S. and European Intel-standard personal computers. The lack of networking products for Japanese computers opens up a vast market for adapters. 3Com president, Eric Benhamou, has stated that 3Com intends to be in on "the first wave" of Japanese networking.

Market Position

Its reputation as primarily a network adapter and operating system vendor notwithstanding, 3Com maintains a solid share of both the bridge and router markets. International Data Corp. (IDC) estimates that 3Com gained a 10.5% share of worldwide local bridge shipments in 1990. This ranked the company behind Digital Equipment (24%), Retix (16%), Ungermann-Bass (13%), IBM (12%), and Cabletron (11%). In the router market, IDC showed 3Com with a 13% share of total 1990 shipments, behind Cisco Systems (35%) and Digital Equipment (20%), but ahead of Wellfleet (9%), Proteon (8%), and ACC (7%).

Major Competitors

Just seven years after its founding, Cisco Systems stands as the undisputed leader in the router market. Cisco has been an innovator in the router and bridge/router market; it is credited with several industry firsts, including the first multiprotocol router and the first bridge/router to concurrently support all major networking protocols. Cisco also spawned its own routing protocol, IGRP (Interior Gateway Routing Protocol), an interim solution for the corresponding ISO IS-IS protocol.

Wellfleet Communications, Proteon, Digital Equipment, and ACC also bring strong router and bridge/router product lines to the market. Digital's position, however, is deceptive; it is a reseller of Vitalink Communications' line of routers. Vitalink was recently acquired by Network Systems, which is also plunging into the router market.

The market for local and remote bridges is even more crowded. Digital's DECbridge and LANbridge are strong entrants in the Ethernet bridge arena. Retix is also strong in Ethernet bridges, as is Cabletron and Ungermann-Bass. In the token-ring bridge market, IBM naturally holds a strong position, but is being challenged by vendors such as Netronix, Madge Networks, Andrew, and CrossComm.

Relationships to Other Markets

More and more, intelligent hubs are gaining consideration as internetworking devices via integrated bridging and routing capabilities. Competition in the hub marketplace is fierce. SynOptics, Ungermann-Bass, and Cabletron are the major players in this market, and are being challenged by vendors such as David Systems, Chipcom, Optical Data Systems (ODS), and BICC. IDC shows 3Com with a small (2.5%) share of the Ethernet hub market; 3Com's share of the market should grow with the addition of LinkBuilder 3GH to its product line.

As mentioned earlier, 3Com is the acknowledged leader in Ethernet adapter shipments, and is ranked second (to Digital) by IDC in the terminal server market. 3Com also markets repeaters, transceivers, token-ring (TokenLink) network adapters, the Network Control Server (NCS), and network management software (ViewBuilder).

Sales and Distribution Strategy

Sales

In fiscal 1990, 40% of 3Com's sales were international. In the first nine months of fiscal 1991, more than 40% of sales occurred outside the United States.

Distribution

Throughout the world, 3Com supports a variety of sales channels, including storefront dealers, business-to-business direct marketing, value-added resellers (VARs), distributors, and original equipment manufacturers (OEMs). All are supported by 3Com's salespeople, sales engineers, and service organization.

For U.S. customers, dealers stock a broad range of products and offer a variety of support services. Among 3Com's dealers are Businessland, ComputerLand, Intelligent Electronics, and Valcom.

The additional value furnished by 3Com's certified VARs includes technical support, customized applications development, and vertical market solutions. Some VARs assist in designing and integrating network systems. 3Com maintains relationships with more than 100 authorized VARs worldwide, including Groupe Bull, Evernet Systems, Government Technology Service (GTSI), GTE, and JWP Information Systems.

Worldwide distributors include Bricom, Central Systems Design, Esselte, Fouad & Sons, Goldstar Information and Communications, Hauman, Imagineering, Logitec, McKenzie Brown, Metrologie, Modus, Protokol Sistemas, Roctec, and Trigem.

3Com User Groups (International)

Location	Representative	Phone Number
Brisbane, Australia	Cliff Wignell	61-07 352 5011
Ottawa, Ontario, Canada	Mark Pytlik	(613) 951-2420
Milano, Italy	Primo Bonacina	39 2 254-9741
Tokyo, Japan	Hayao Washizaki	81 03 356-6351
Kista, Sweden	Annika Kvarnstrom	46-08-7034870
Remscheidt, Germany	Eckhard Klockhaus	49 02191/51741

3Wizard Programs

Name	Description
3Wizard Conferences	Twice a year in the U.S. and Europe; open to all 3Wizard professionals; two to three days of 3Com product presentations, meetings with 3Com engineers and architects, and peer-to-peer discussions
Ask3Com	Technical support for electronic bulletin board available in most areas on CompuServe; allows users to exchange messages with 3Com's own 3Wizards and other 3Wizards; use of 3Wizard utility library 24 hours a day, 7 days per week
3Wizard Mailings	Quarterly publication with current networking developments, technical tips, product information, and 3Wizard news
3Wizard Council	Consists of a dozen 3Wizards representing the broader 3Wizard community; meets four times a year to present program and product feedback to 3Com's product architects and strategists

In the United States, 3Com sells to more than 2000 indirect VARs through its distributors, which include Graybar, Hall-Mark Electronics, Ingram Micro, Merisel, Micro Connect, and Tech Data.

OEM customers include Data General, IBM, Nokia Data, Norsk Data, Olivetti, Siemens, Sun Microsystems, Unisys, and Xerox.

Support

3Com offers a wide variety of service, support, and educational programs.

Policies and Programs

Warranty

3Com offers a one-year factory warranty on hardware, except for the following:

- Instrumentation (90-day warranty or the remainder of the initial warranty period, whichever is longer)
- Repairs (90-day warranty)

The warranty period is calculated from the date of sale to the end user, or 120 days from the date of shipment to the authorized reseller, whichever comes first.

Support Services

The 3Com Technical Service Regions in the United States are located in the western United States in San Jose, CA; in the Central section of the country in Rosemont, IL; in the Northeast in Teaneck, NJ; and in the Southeast in Vienna, VA.

The company maintains the Customer and Reseller Resource Center for Presales Support. By calling (800) NET-3Com, Dept A1769 Monday through Friday from 6 a.m. to 5 p.m. Pacific time, resellers and customers have access to trained personnel who can assist in the following areas:

- providing system configuration information
- describing product features and benefits
- responding to compatibility questions
- supplying list prices for all 3Com products
- providing local sales office information

Reseller Service Partner Programs

In July 1991, 3Com announced three reseller service partner programs that expand the technical expertise and the geographical coverage of customer support for 3Com global data networking products. The programs are Professional Services Partner (PSP), Network Development Center (NDC), and Authorized Repair Center (ARC).

The PSP program supports 3Com resllers who specialize in network implementation, project management, design, consultation, and training in internetworked and wide area network (WAN) environments. The company recommends PSPs for designing and implementing turnkey, multisite network installations that connect to public or private telecommunications lines.

The NDC program supports resellers who focus on post-sales support and maintenance contracts for LANs. NDCs install, service, and support local bridges, LAN hubs, and LAN network management products. The NDC program includes an Advanced Product Authorization Option that authorizes NDCs to service 3Com terminal servers, routers, remote bridges, bridge/routers, and network management software.

The ARC supports resellers who provide warranty and out-of-warranty repairs on 3Com adapter boards and receive warranty reimbursement from 3Com.

Service Hours

No-Charge Technical Support Programs for direct resellers include telephone technical support and the Ask3Com electronic database. The Telephone Technical Support Service (800/876-3266) operates Monday through Friday, from 6 a.m. to 5 p.m., Pacific time. The Ask3Com database operates 7 days per week, 24 hours per day. Users access Ask3Com by calling their local CompuServe number that appears on the CompuServe Phone Access Sheet.

Chargeable Technical Support to Resellers includes Factory Hardware Repair, Time & Materials Telephone Technical Support, and Time & Materials On-Site Technical Support. Resellers can access all three by calling (800) 876-3266. The Factory Hardware Repair Service for warranty and nonwarranty repair operates Monday through

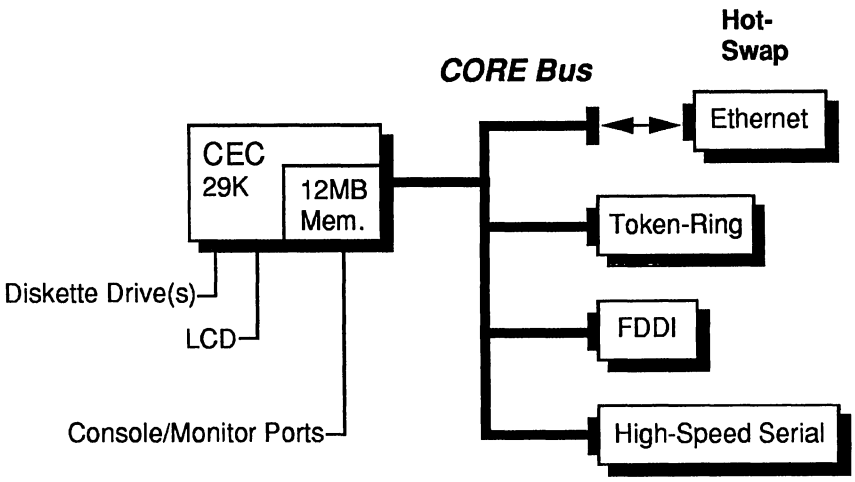


Figure 1.
NETBuilder II Architecture

The NETBuilder II architecture combines a RISC processor, custom ASICs, and an 800M bps backplane. Available in 4- and 8-slot chassis versions, NETBuilder II supports the following modules: Communications Engine Card (CEC), Ethernet, FDDI, High-Speed Serial (T1/E1 WANs), and Token-Ring (not yet available).

Friday from 6 a.m. to 5 p.m., Pacific time. Time & Materials Telephone Technical Support keeps the same hours. Time & Materials On-Site Technical Support operates Monday through Friday from 8 a.m. to 5 p.m., local time.

Technical Support Alliance

In May 1991, 3Com announced a strategic service alliance with Novell. Customers of 3Com using Novell's NetWare with 3Com adapters and the NETBuilder family receive comprehensive and coordinated support, regardless of which vendor is contacted about the problem. As part of the alliance, Novell's support engineers receive training on 3Com adapters and internetworking products, and 3Com support engineers receive training on NetWare. Novell and 3Com exchange product and information databases to replicate customer problems and to facilitate self-training.

3Com also participates in Digital Equipment Corp.'s Desktop Services and Hewlett-Packard's Authorized Customer Support Program, under which HP provides support for 3Com products.

Training/Education

3Com offers a training program called 3Wizard. This in-depth training program produces 3Wizards, more than 2000 networking professionals who have mastered one or more sequences of courses and become certified technical users of 3Com products. After completing 3Wizard training, 3Wizards become members in a worldwide community of technical experts who share information with their peers in other organizations and learn the latest developments in network technology, troubleshooting, and maintenance.

In addition to the 3Wizard program, 3Com offers a variety of training courses and programs for resellers and end users. Twice a year, the company publishes *Education Services Course Catalog.* The company maintains training classrooms in Santa Clara and San Jose, CA; Rosemont, IL; Dallas, TX; Vienna, VA; and Atlanta, GA.

Documentation

In May 1991, 3Com announced the availability of product information on compact disk-read only memory (CD-ROM). Based on optical storage technology, the 3Com Laser Library features full-color data sheets, engineering technical notes, and software patches and fixes on a single compact disk. The current disk can access more than 60 product manuals and 1400 technical articles. Users do not undergo training to access the 3Com Laser Library. They obtain information by entering simple key words related to their topics of interest.

Shortly after the request has been entered, the 3Com Laser Library provides text and images related to the key words, drawn from all sources in the library. The 3Com Laser Library is currently DOS-based and contains approximately 200 megabytes of data. It is designed to accommodate up to 640MB of data. The library is available from 3Com and its worldwide networks of resellers and distributors at $600 for a one-year subscription. Users receive quarterly updates via CD-ROM.

Competitors' Programs

Cisco Systems

Cisco offers several maintenance plans that include replacement of parts, online technical support, and for customers that require it, field service subcontracted from Motorola providing four-hour or overnight response times.

Cisco maintains a 25-person staff at its centralized technical support facility in Menlo Park, CA. Hours are 6 a.m. to 6 p.m. PST, and an emergency "net down" number is provided for off-hour assistance. Technical support calls are free during the warranty period, and they are included under any of the maintenance plans offered.

Cisco warrants all hardware and software for 90 days. Cisco will advance ship parts for hardware under warranty overnight, meaning that the customer only needs to call and report the failed part and Cisco will ship it. According to Cisco, most vendors require the customer to return the failed part first.

Digital Equipment Corp.

Digital is currently offering services that focus on the development and integration of customers' open network environments.

DECnet/OSI Transition Planning Service: This service assists customers in making the transition to open network environments. Pricing is set on a per-contract basis.

Open Network Customer Training: This service offers network managers, application developers, and network planners access to Digital Services courses on a variety of open networking subjects.

NETsupport Operations Management Services: These services provide customers with ongoing management of their DECnet/OSI and/or TCP/IP network resources. Pricing is set on a per-contract basis.

NETsupport Shared TCP/IP Service: This service provides customers with operations support for TCP/IP networks, including network management hardware and software, on-site consulting, and telephone advisory support.

Specifications

Bridge Features/Functions

Model	NETBuilder	NETBuilder Token-Ring	NETBuilder for Broadband
Local area network interfaces	Thin/thick Ethernet	4M/16M bps token-ring	Broadband, thick Ethernet
Wide area network interfaces	Thin/thick Ethernet	4M/16M bps token-ring	Broadband, thick Ethernet
Communications interface options	RS-232, RS-449, V.35	RS-232, RS-449, V.35	None
Spanning Tree Algorithm support	Yes	No	No
Max. packet forwarding rate (pps)	10,000	30,000	10,000
Max. aggregate packet filtering rate (pps)	19,500	900,000	19,500
Single segment max. packet filtering rate (pps)	14,000	410,000	14,000
Latency time (microseconds)	150	150	150

Bridge/Router Features/Functions

Model	NETBuilder	NETBuilder II	NETBuilder for Broadband
Local area network interfaces	Thin/thick Ethernet	Thin/thick Ethernet	Broadband, thick Ethernet
Wide area network interfaces	Thin/thick Ethernet, X.25, frame relay	Thin/thick Ethernet, X.25, frame relay, SMDS	None
Communications interface options	RS-232, RS-449, V.35	RS-232, RS-449, V.35	None
Network management support	SNMP	SNMP, SMT	SNMP
Bridging			
Spanning Tree Algorithm support	Yes	Yes	No
Max. packet forwarding rate (pps)	10,000	30,000	10,000
Max. aggregate packet filtering rate (pps)	19,500	900,000	19,500
Single segment max. packet filtering rate (pps)	14,000	410,000	14,000
Latency time (microseconds)	150	150	200
Routing			
Network protocols supported	TCP/IP, DECnet, IPX, XNS, OSI	TCP/IP, DECnet, IPX, XNS, OSI, AppleTalk	TCP/IP, DECnet, IPX, XNS, OSI
Routing protocols supported	OSPF, RIP-IP, EGP, IS-IS	OSPF, RIP, EGP, ES-IS, IS-IS	OSPF, RIP-IP, EGP, IS-IS
Maximum packet forwarding rate (pps)	6,400	20,000	6,400
Latency time (microseconds)	200	200	200

Intelligent Hub Features/Functions

Model	LinkBuilder 3GH
Type	Third-generation intelligent enterprise hub
Number of system modules	12
Number of ports supported	8 Ethernet ports per module; 4 FDDI ports per module
Backplane architecture	RISC; FDDI, Ethernet, token-ring
Network management	SNMP, SMT
Internetworking capabilities	Bridging at 400,000 pps (aggregate); Ethernet-to-Ethernet and Ethernet-to-FDDI

Physical Environment

Physical Specifications

Model	NetBuilder*	NetBuilder II	LinkBuilder 3GH
Length (in./cm.)	12.6/32.3	15.9/40.4 (4-port chassis); 16.7/42.4 (8-port chassis)	16.5/41.9
Width (in./cm.)	16.2/41.1	17.4/44.2 (4-/8-port chassis)	19/48.2
Height (in./cm.)	3.8/9.6	5.3/13.5 (4-port chassis); 7.3/18.5 (8-port chassis)	17.5/44.5
Weight (lb./kg.)	12/5.5	30/13.6 (4-port chassis); 50/22.7 (8-port chassis)	Configuration dependent

Electrical Requirements

Model	NetBuilder*	NetBuilder II	LinkBuilder 3GH
Power Requirements	90-132 V AC, 1.5 Amp/180-264 V AC, 0.75 Amp	90-132 V AC, 2.3 Amp/180-264 V AC, 0.9 Amp	90-132 V AC/180-264 V AC
Environmental Operating Range	41°-104° F, 5°-40° C	41°-104° F, 5°-40° C	32°-104° F, 0°-40° C

**Includes NetBuilder Token-Ring and NetBuilder for Broadband.*

Pricing

		Purchase Price ($)
NETBuilder Hardware		
3C5802B	NETBuilder Local (Thick Ethernet)	4,745
3C5803B	NETBuilder Local (Thick/Thin Ethernet)	5,145
3C5804	NETBuilder Broadband Local (Thick Ethernet)	5,995
3C5822B	NETBuilder Wide Area (Thick Ethernet, V.35/RS-232)	7,245
3C5823B	NETBuilder Wide Area (Thick/Thin Ethernet, V.35/RS-232)	7,445
3C5832B	NETBuilder Wide Area (Thick Ethernet, RS-449/RS-232)	7,245
3C5833B	NETBuilder Wide Area (Thick/Thin Ethernet, RS-449/RS-232)	7,445
3C750	NETBuilder Token-Ring Local	6,700
3C751-V35	NETBuilder Token-Ring Wide Area (V.35/RS-232)	11,250
3C752-RS4	NETBuilder Token-Ring Wide Area (RS-449/RS-232)	11,250
3C6000	NETBuilder II 4-Slot Chassis	2,995
3C6001	NETBuilder II 8-Slot Chassis	5,495
3C6010	NETBuilder II Communications Engine Card	5,000
3C6020	NETBuilder II FDDI Module	7,500
3C6021	NETBuilder II Ethernet Module	1,125
3C6022	NETBuilder II High-Speed Serial Module	1,425
NETBuilder Software (Required)		
3C6705F	NETBuilder Bridge Software 4.1	250
3C6705C	NETBuilder Bridge Software 3.2	250
3C6720E	NETBuilder Bridge/Router Software 3.1	750
3C6720B	NETBuilder Bridge/Router Software 2.0	750
3C6730A	NETBuilder Bridge/Router with Frame Relay/X.25 Software 1.1	1,500
3C755	NETBuilder Token-Ring Bridge Software	250
3C6756	NETBuilder Token-Ring Bridge with Frame Relay Software	750
NETBuilder Software (Optional)		
3C6706B	NETBuilder Bridge Software 3.2, NCS/2	250
3C6707B	NETBuilder Bridge Software 3.2, NCS/AT	250
3C6721B	NETBuilder Bridge/Router Software 2.0, NCS/2	750
3C6722B	NETBuilder Bridge/Router Software 2.0, NCS/AT	750
3C6706E	NETBuilder Bridge Software 4.1, NCS/2	250
3C6707E	NETBuilder Bridge Software 4.1, NCS/AT	250

		Purchase Price ($)
NETBuilder Software (Optional) (Continued)		
3C6721E	NETBuilder Bridge/Router Software 3.1, NCS/2	750
3C6722E	NETBuilder Bridge/Router Software 3.1, NCS/AT	750
3C6731A	NETBuilder Bridge/Router with Frame Relay/X.25 Software 1.1, NCS/2	1,500
3C6732A	NETBuilder Bridge/Router with Frame Relay/X.25 Software 1.1, NCS/AT	1,500
3C6030	NETBuilder II Bridge Software 5.0	250
3C6031	NETBuilder II Bridge/Router Software 5.0	750
3C6032	NETBuilder II Bridge/Router Software 5.0 (Enhanced WAN)	1,500
LinkBuilder 3GH Hardware		
3C9000	LinkBuilder 3GH Chassis (Single Power Supply)	12,900
3C9001	LinkBuilder 3GH Chassis (Dual Power Supply)	15,700
3C9010	LinkBuilder 3GH System Management Module	6,125
3C9011	LinkBuilder 3GH FDDI Backbone Module (Single MAC)	9,000
3C9012	LinkBuilder 3GH FDDI Backbone Module (Dual MAC)	11,200
3C9013	LinkBuilder 3GH FDDI Concentrator Module	8,500
3C9014	LinkBuilder 3GH Ethernet LAN Module	12,500
Sample Configurations		
	NETBuilder II (4 Ethernet Modules, Bridge Software)	13,245
	NETBuilder II (1 Ethernet Module, 3 High-Speed Serial Modules, Bridge Software)	14,145
	NETBuilder II (1 Ethernet Module, 1 FDDI Module, Bridge Software)	16,870
	NETBuilder II (2 Ethernet Modules, 1 FDDI Module, Bridge Software)	17,995
	NETBuilder II (8 Ethernet Modules, Bridge Software)	20,245
	NETBuilder II (6 Ethernet Modules, 1 FDDI Module, Bridge Software)	24,995
	LinkBuilder 3GH (System Management Module, Ethernet LAN Module)	31,525
	LinkBuilder 3GH (System Management Module, Ethernet LAN Module, FDDI Backbone Module [Single MAC])	40,525
	LinkBuilder 3GH (System Management Module, Ethernet LAN Module, FDDI Backbone Module [Single MAC], FDDI Concentrator Module)	49,025
	LinkBuilder 3GH (System Management Module, 11 Ethernet Modules, Dual Power Supply Chassis)	159,325

■

Ungermann-Bass Net/One and Access/One

In this report:

Product Summary

Editor's Note

Since our last report, Ungermann-Bass announced Net/One LAN Manager Release 2.0, which features capabilities similar to those of Microsoft's LAN Manager. The company also announced ODI Drivers for NetWare '386 and OS/2 workstations, NIUpc/Ethernet on twisted pair, NIUps/EOTP adapters, NetDirector, and Access/One ASM 8320. Recently, U-B enhanced MaxTalk with new software.

Description

Ungermann-Bass offers hardware and software solutions. U-B's systems implement data communications in terminal-to-host, PC-to-host, and PC-to-PC enivronments in large enterprises. Access/One is an intelligent wiring hub.

Strengths

Ungermann-Bass literally covers all bases in enterprise-wide networking by producing adapters, gateways, bridges, routers, software, intelligent wiring concentrators, and network management tools. Net/One supports Ethernet, token-ring, coaxial cable, optical fiber, and twisted-pair LANs.

Limitations

Although U-B is currently targeting middle-tier customers, it is perceived mainly as a high-end vendor.

Competition

Cabletron, Digital Equipment, Hughes LAN Systems, IBM, Proteon, 3Com, SynOptics, Vitalink.

Vendor

Ungermann-Bass, Inc.
3900 Freedom Circle
Santa Clara, CA 95052
(408) 496-0111, (800) 873-6381

Price

NIU-130—$1,525; NIU-74—$5,425.

GSA Schedule

Yes.

—By Barbara Callahan
Associate Editor

Analysis

Product Evaluation

Ungermann-Bass markets a comprehensive line of networking and internetworking products. The company offers adapters, gateways, bridges, software, intelligent wiring concentrators, and network management tools. U-B products support both Ethernet and token-ring network access methods as well as coaxial cable, optical fiber, and twisted-pair telephone wiring. The products connect to a variety of backbone and wide area networks (WANs), including FDDI and T1.

Ungermann-Bass product families include:

Access/One Family—a network management and structured wiring network delivery system that integrates LAN and WAN applications into a single platform.

Universal Workstation Family—a combination of hardware and software that provides DOS, OS/2, and Macintosh users with access to the resources of mainframes, host systems, peripherals, and other workstations.

NetDirector—a network management platform and a group of network management tools that deliver comprehensive management capabilities, including management of configuration, fault, performance, security, and accounting of complex networks.

Internetworking Products—a family of standards-based bridging and routing products that interconnects local and remote sites over many types of media using multiple networking protocols.

Market Position

For many years, Ungermann-Bass enjoyed a high level of recognition throughout the LAN industry, and justifiably so. The company pioneered many of the techniques and technologies that are commonplace today. In addition, U-B demonstrated uncanny insight into the direction the market was heading, notably in requiring total solutions for enterprise-wide networking. As U-B concentrated on the forest, many other companies focused on the trees and established niche markets for themselves.

Although U-B markets over 800 products, including an internetworking line, the company had no intention of being labeled a router vendor or a gateway vendor or an adapter card vendor. U-B set its sights on supplying total solutions before the word solution became fashionable. Unfortunately, somewhere during this pursuit of totality, U-B lost its high-profile identification in the marketplace but fortunately retained favor with users, ▶

Table 1. Network Interface Unit Specifications

Model	NIUpc/EOTP	NIUps, NIUps/EOTP	Personal NIU/ex
Data Rate	10M bps baseband	10M bps baseband; 5M bps broadband (NIUps only)	10M bps baseband; 5M bps broadband
Data Link Interface	IEEE10BASE-T revision D10 compatible	IEEE10BASE-T revision D10, 802.3, Ethernet V2.0, and 10BASE5 compatible	IEEE 802.3, 10BASE5, Ethernet V2.0 compatible
On-Board RAM (bytes)	512K; upgradable to 1M	512K, upgradable to 1M	512K
Host Interface	16-bit AT bus; 8-bit XT bus	16-bit MicroChannel Architecture bus	8-bit XT bus
Host System	IBM PC/XT/AT, PS/2 Model 25 or 30, or PC-compatible system	IBM PS/2 Models 50/50Z/60/70/80	IBM PC/XT/AT, PS/2 Model 25 or 30, or PC-compatible system
Software Recommend.	DOS 3.1 or above; BNS/PC Ethernet (XNS or TCP/IP); OS/2 1.1, LAN Manager 1.1, NDIS, NetWare 386 (ODI NetWare 2.15)	DOS 3.2 or above, BNS/PC Ethernet (XNS or TCP/IP), OS/2 1.1, LAN Manager 1.1, NDIS, NetWare 386 (ODI NetWare 2.15)	DOS 3.1 or above, BNS/PC Ethernet (XNS or TCP/IP), OS/2 1.1, LAN Manager 1.1
Remote Boot Capability	Standard; when enabled, requires an 8KB shared-memory window; user configurable	Standard; when enabled, requires an 8KB shared-memory window; user configurable	Not available

Company Profile
Ungermann-Bass

Corporate Headquarters
3900 Freedom Circle
Santa Clara, CA 95052-8030
(408) 496-0111, (800) 873-6381

In Canada
Ungermann-Bass Ltd.
2255 Sheppard Avenue E., Suite W308
Willowdale, ON M2J 2Y1
(416) 494-4426

Officers
President and CEO: Ralph K. Ungermann
Chief Operating Officer: K. William Sickler
Vice President of Finance and Customer Satisfaction, CFO: Jack L. Acosta
Vice President of Sales and Marketing: Michael S. Gardner
Vice President of Marketing: Roger Bertman

Company Background
Ralph Ungermann and Charlie Bass founded Ungermann-Bass in 1979. Sharing a common vision of a future that would bring automation in offices and factories, requiring the interconnection of equipment from disparate vendors, the two coined the term "general-purpose local area networking." After having established leadership in that field, U-B moved past the limitations of LANs, which were increasingly perceived as small groups of micros in offices, and pioneered enterprise networking, which U-B defines as "the sharing of data resources among dissimilar computer systems throughout an organization."

Primary product development is conducted in Santa Clara, CA; Andover, MA; Boca Raton, FL; and Tokyo, Japan. The primary manufacturing facility is located in Milpitas, CA. Ungermann-Bass maintains 17 U.S. sales offices and 11 international sales offices. With more than 1,500 employees worldwide, the company has a strong sales presence throughout North America, South America, Europe, Japan, Asia, and Australia. Sales outside the United States account for approximately 55 percent of revenues. A leader in the smart hub market, U-B claims revenues of $139 million from the total market estimated at $385 million.

Merger with Tandem
In March 1988, Tandem Computers successfully completed a tender offer for U-B stock. U-B now operates as an independent subsidiary of Tandem, which has revenues of $1.87 billion. The relationship does not preclude or end joint development relationships between U-B and other computer vendors, including IBM and Hewlett-Packard. Tandem is a billion dollar company specializing in computer systems and networks for online transaction processing applications.

Milestones
Ungermann-Bass was the first company to dedicate all of its research, development, and marketing efforts to the creation of multivendor enterprise networks. The company developed the first token-ring-to-Ethernet bridge to achieve transparent interconnectivity. U-B also installed the first Fiber Distributed Data Interface (FDDI) production network. At present, the company's Net/One hardware and software support networks with up to 10,000 nodes in North America, South America, Canada, Europe, Asia, and Australia. U-B is a leading supplier of structured wiring platforms in enterprise networks throughout Europe and Japan.

Agreements
U-B's most recent agreements:

April 1990—British Telecom, which establishes a partnership between the two companies for the joint development of OSI LAN products.

May 1990—LANSystems, which enables LANSystems to offer U-B's full Access/One product line as part of its own network integration solutions.

June 1990—GTE Telephone Operations, which allows GTE to sell U-B's Access/One line.

June 1990—Norton-Lambert, which allows U-B to resell Norton-Lambert's Close-Up software and integrate it into customer support programs.

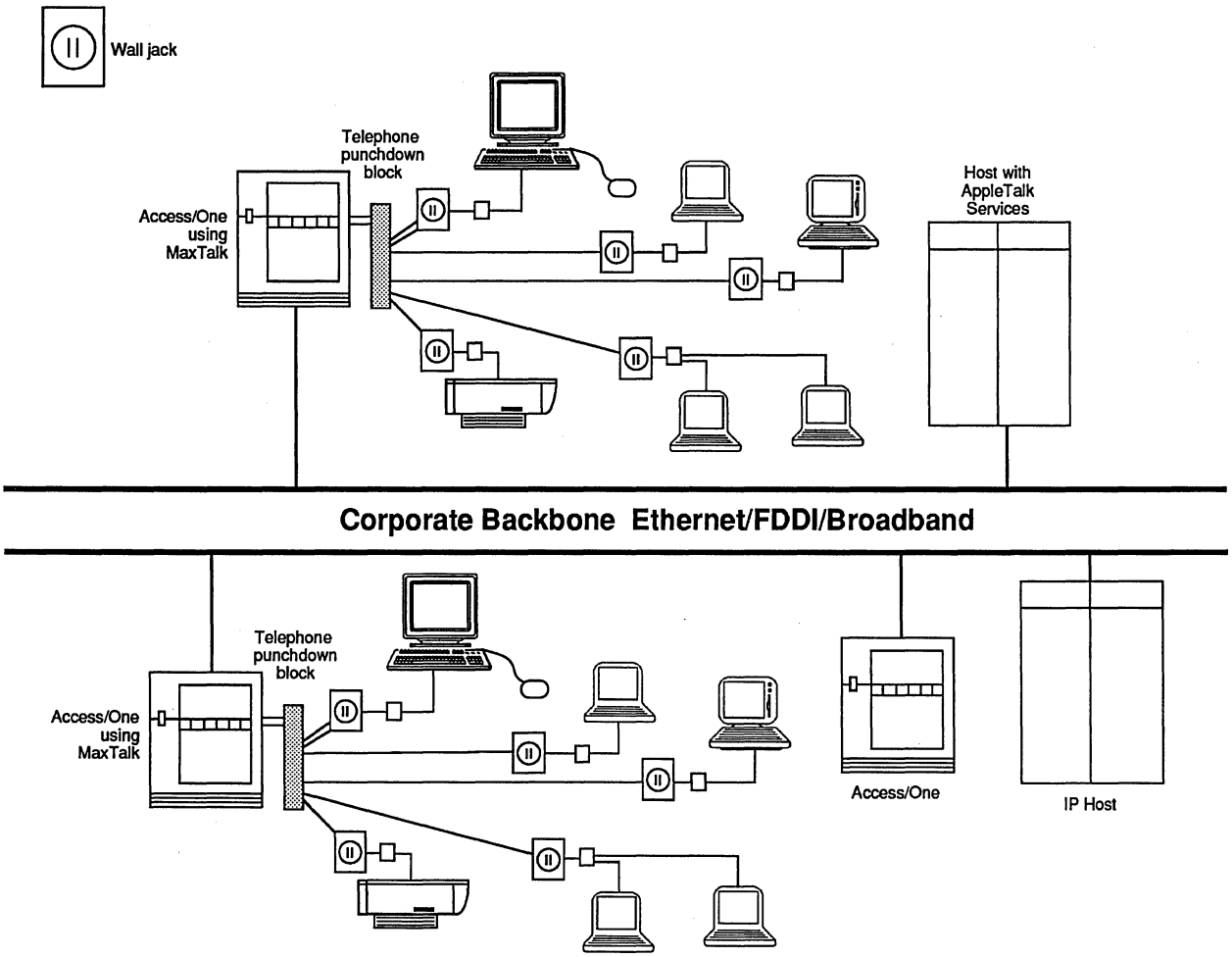
October 1990—Tiara Computer Systems, which authorizes U-B to sell 10BASE-T adapter cards that were jointly developed by the two companies.

October 1990—Tandem Computers, which initiated a joint technology effort to significantly improve the network connection between Tandem's systems and U-B's Access/One, focusing on enhanced networking of end-user devices over TCP/IP.

November 1990—Advanced Computer Communications (ACC), which enables U-B to integrate ACC's bridge/router technology into its Access/One hub.

January 1991—Falcon Microsystems, in a one-year, multimillion dollar VAR agreement, which authorizes Falcon to be the exclusive GSA schedule holder covering U-B's Access/One and Net/One products.

Figure 1.
MaxTalk



Using the MaxTalk Interface Module.

▶ *(Analysis continued)*

achieving something of the status of the professional's professional. The company is doing fine and has been profitable during its 12 years in business.

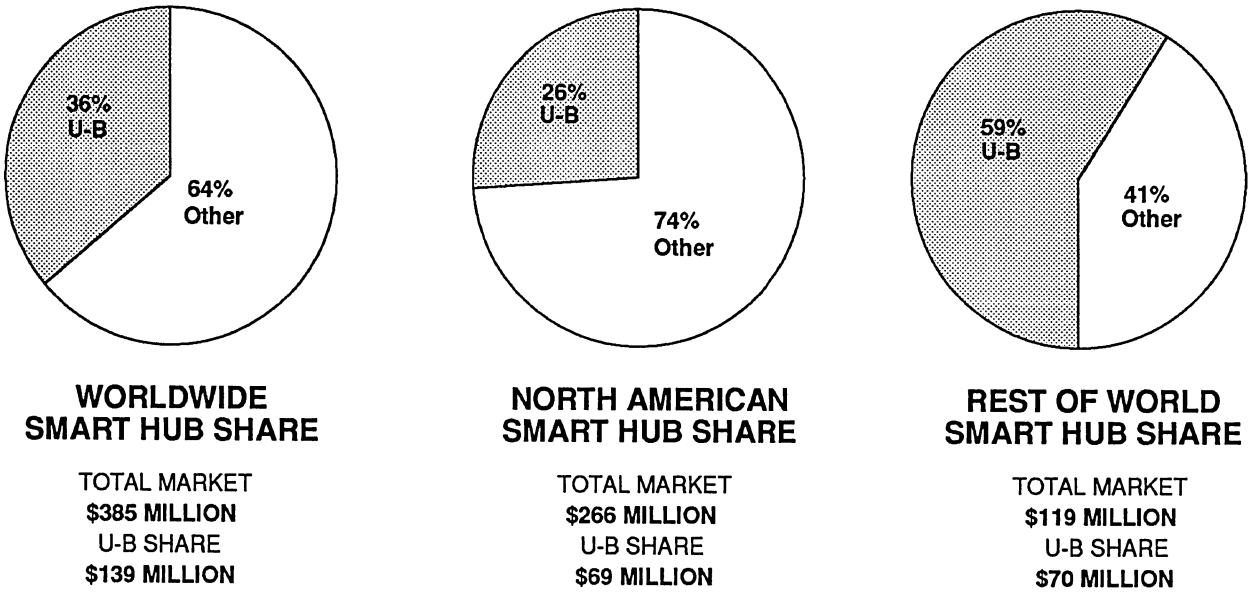
At the present time, U-B wants to heighten its visibility. The driving force behind this move to center stage is the evolution of Access/One into the total solution that U-B had been grooming in the wings. U-B wants to tell the world about this intelligent hub and about its leadership in the intelligent hub business. Since its debut in 1988 as the first truly integrated smart hub, Access/One has become the company's fastest-growing product line.

In 1990, Access/One revenues increased 122 percent over calendar 1989. Currently, over 10,000 enclosures and over 500,000 ports have been shipped. The company has also sold about 3,000 bridges within Access/One. To celebrate this pleasant state of affairs, U-B is energetically setting out to make the Ungermann-Bass name synonymous with the smart hub market.

Competitive Position

In its quest to provide enterprise-wide solutions with an intelligent hub as the platform, U-B has run up against some strong opponents, notably SynOptics and Cabletron and, to a lesser degree, Chipcom. Globally, U-B has taken the lead with 50 percent of its revenues generated from international sales. SynOptics draws 89 percent of its sales from the United States; Cabletron, 78 percent. Roger Bertman, vice president of marketing for U-B, suggests that SynOptics and Cabletron are

Figure2.
Smart Hub Shares



shipping in the high 90 percentile of Ethernet, whereas U-B's sales cover a broader scope. In 1990, Access/One took a large chunk out of the $385 million smart hub market with worldwide sales amounting to $139 million.

To illustrate that point, Bertman defines an intelligent hub "not just as a wiring hub, not just Ethernet, but a hub that includes terminal services, including internetworking, token-ring as well as Ethernet, and management capabilities." That definition suits Access/One. Bertman wants to set U-B apart from its competitors as being known as "the people who conceived the idea of a smart hub first, delivered it first, and continue to deliver that solution in the context of an enterprise."

IBM also ranks as a competitor to U-B, but Bertman believes that IBM's recent announcements signal that the company is strengthening its position in token- ring. Since it is rare to find a user that is strictly an IBM customer, U-B can move in with products that are compatible with those of IBM and also complement them. According to Bertman, "We don't get upset every time IBM comes up with another tweak to token-ring."

In addition, Bertman noted that IBM has not established itself as an expert in the wiring arena. "Many users," he claims, "have written off IBM as a solver of wiring problems. IBM lags in the use of unshielded twisted-pair wiring." U-B's products run over unshielded twisted pair.

Decision Points

Through its extensive line of products and its flexible use of media, Ungermann-Bass offers the administrator of large networks a one-stop shopping tour. Net/One system architecture delivers resiliency and adaptability by means of its software and three basic hardware elements: Network Interface Units (NIUs), Network Management Console (NMC), and Network Control Console (NCC).

U-B states that "the company's goal is to continually provide complete, flexible communications systems to its customers. It is committed to integrating the personal computer into the information processing environment. The key elements in Ungermann-Bass' product strategy are communication services independent of LAN technologies, such as media, topology, access control technique, data rate, and protocol suite, as well as compatibility with de facto and established standards."

A key element in U-B's success is the company's ability to take proactive measures through its accurate readings of the market and where that market is heading. Since 1986, U-B has made the

Table 2. Support Programs

Comp.	Partnership	Elite	Basic
On-site software problem resolution	On-site software problem resolution	Twelve days/year on-site assistance	Remote (telephone software problem resolution)
On-site hardware problem resolution	Overnight hardware replacement	Monthly activity reports	Software updates
Spares stocking by U-B journal	—	—	DARTBoard, Technical
Annual performance analysis	—	—	—
All Basic support features	All Basic support features	All Basic support features	—

PC a focal point of its networking strategy, a decision quite in tune with a PC-oriented marketplace. The Net/One Universal Workstation Series, released in November 1986, enabled a single, networked IBM PC to replace most standard terminal devices. The company further advanced networking with PCs in 1987 by introducing an Ethernet LAN adapter card (NICps/2) for IBM's Personal System/2 Models 50, 60, and 80.

Concurrent with the delivery of these systems, U-B recognized the need for a smart structured wiring hub to tie all the elements together and readied the solution, Access/One, by 1988. Access/One connects asynchronous and 3270 terminals, PCs, and other distributed devices via Ethernet and token-ring over common twisted-pair wiring.

Recently, U-B has correctly read the welcome extended to the Macintosh in corporate environments, an observation that led to the development of the MaxTalk Ethernet-to-LocalTalk (Apple's built-in networking media) router for Access/One in October 1989. The arrival of MaxTalk eliminated the limitations and cumbersome wiring arrangements required by LocalTalk. When MaxTalk operates with Access/One, Macintosh systems are seamlessly integrated into Ethernet broadband and FDDI backbones over telephone wires, which is good news for the vast installed base of Macintosh users in corporate and university environments.

Network managers can also rejoice because as a standard wiring platform, Access/One simplifies the tasks of moving systems, adding systems, and changing systems. All these moves occur through changes made at the smart hub and/or in the wiring closet punch-down block by unplugging a PC from the phone jack and plugging in a Macintosh without any alterations to the wiring scheme.

Access/One integrates Macintosh connectivity solutions into U-B's centralized management system, NetDirector, which handles network management down to the port level. NetDirector identifies the devices linked to each port of the MaxTalk modules, displays operational statistics, and disables designated ports for troubleshooting. Security features prevent unauthorized access to the network.

As the Macintosh advances in connectivity capabilities, so do U-B's efforts to keep up with it. MaxTalk now supports AppleTalk Phase 2, a protocol enhancement to the original AppleTalk network system. U-B's support for Phase 2 enhances the capabilities of large networks by featuring interoperability between AppleTalk Phase 1 and Phase 2, thereby equipping users with smooth migration capabilities to the new protocol without delaying their access to enterprise-wide network resources.

Users on TCP/IP networks can take advantage of MacUWS, a U-B software solution, which promotes the seamless integration of Macintoshes into TCP/IP networks. The software allows Macintosh users to directly access host applications through the process of automating the connection between the Macintosh and TCP/IP resources.

U-B endorses and supports the Network Driver Interface Specification (NDIS), which is emerging as the preferred specification for the Data Link layer of the OSI model by 70 major networking vendors, including 3Com, Western Digital, Sun, Digital Equipment, IBM, AT&T, and Banyan. The company offers an NDIS protocol stack and an adapter driver, which handles the transmission and reception of packets between NDIS-compliant protocols and its line of Ethernet and token-ring adapters. To promote the use of NDIS, U-B offers complete documentation with its NDIS products and presents technology briefs on configuring NDIS into existing networks. NDIS application configurations are available through U-B's Net/One Vendor Association (N/OVA) third-party certification program.

For installations looking into fiber or extending their use of it, U-B offers the fiber optic Net/One Baseband network, an Ethernet-compatible

LAN that transmits at a maximum rate of 10M bps and uses the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method. The most cost-effective approach to integrating fiber optics into a 10M bps LAN is to have multiple Ethernet baseband segments interconnected with a fiber optic backbone.

U-B also markets the Net/One Local and Remote XNS Routers (formerly known as Local and Remote Bridges), which enable a Net/One fiber optic network to connect to a Net/One broadband and baseband network. Star couplers can also connect directly to Network Interface Units (NIUs) via optical transceivers instead of baseband network transceivers. Multisegment systems offer virtually unlimited geographical coverage with thousands of device connections.

To extend the capabilities of a PC, U-B offers the Universal Workstation Series, a family of hardware and four software products that converts a personal computer into a "universal workstation." The Universal Workstation Series provides the Net/One system user with terminal emulation, file transfer, and micro-to-mainframe applications. The series operates over all Net/One-supported media and supports XNS and TCP/IP protocols.

Characteristics

Date Announced: Net/One—1986; Access/One—1988.

Number Installed to Date: Access/One: ETOP—234,000 nodes; Ethernet over Fiber—9,500 nodes; Local Talk—27,500; Async and 3270—194,000; Access/One Bridges—2,650.

Hardware

Architecture

All Net/One systems use the same five-layer architecture. The Physical and Data Link architecture layers differ according to transmission medium, but after the transmission hardware has been installed and the Network Interface Units (NIUs) have been connected, any differences are transparent to the user. The principal advantage of a layered architecture is its capability to accommodate a variety of media. Net/One supports Ethernet baseband coaxial cable, thin coaxial (RG 58 A/U) baseband, CATV-compatible broadband coaxial cable, shielded or unshielded twisted-pair wire, and Ethernet-compatible optical fiber, implemented through a replacement at the physical layer. Net/One also supports connection to Fiber Distributed Data Interface (FDDI) backbone networks via its Access/One Smart Bridges.

Most Net/One hardware is modular; users can implement various Net/One applications by selecting from a wide range of options for a few basic devices. These devices include the Network Interface Unit (NIU), Personal Network Interface Unit (Personal NIU), Personal Network Interface Controller (Personal NIC), Network Repeater Unit (NRU), Buffered Repeater, Local and Remote XNS Routers, Network Management Console (NMC) and Network Control Console (NCC), and X.25 Gateway. Most Net/One hardware products operate transparently of the transmission media used. Ungermann-Bass also supplies special fiber optic components for Net/One.

Bridges

Net/One Token-Ring Bridge: The Net/One Token-Ring Bridge is a fully compatible implementation of IBM's token-ring source-routing algorithm. Since it conforms to the source-routing specification, the bridge can support multiple protocols from independent vendors. Incorporating the U-B token-ring chipset, the bridge can function in standard IBM Token-Ring Networks. Fully compatible with IBM or U-B token-ring devices, the Net/One Token-Ring Bridge conforms to IEEE 802.2 Logical Link Control and IEEE 802.5 token-ring standards as well as to Transmission Control Protocol/Internet Protocols (TCP/IPs).

Its maximum throughput of 3.9M bps (dependent on frame size) accommodates the development of larger token-ring configurations. For the construction of the physical ring, the bridge supports the IBM Cabling System and the AT&T PDS wiring system. In addition, the bridge attaches directly to unshielded twisted-pair wiring without a media filter. Users can place the bridge in a wiring closet or on a desktop.

Net/One Token-Ring Ethernet Data Link Bridge: This integrated product enables network managers to develop complex network topologies. The data link bridge enables large networks to be configured and managed from a central site. Via an Ethernet backbone, the bridge can connect isolated token-ring LANs to furnish high-speed connections to a variety of heterogeneous networks consisting of IBM mainframes, other host systems, and isolated token-ring workgroups. Fully compatible with IEEE 802.2, 802.3, and 802.5 standards, the

bridge also supports all Net/One, International Organization for Standardization (ISO), and IBM token-ring protocols.

Net/One Remote Data Link Bridge: This product supports high-bandwidth data transmission between geographically dispersed Net/One networks that are connected via high-speed telecommunications links. Based on 68000 microprocessor architecture, the Remote Data Link Bridge sends data between Ethernet networks over telecommunications links at speeds up to 2.048M bps. Since it supports protocol-independent transmission of data packets, the bridge accommodates the transparent interconnection of multiple types of Net/One networks. Compatibility with the Net/One Local Data Link Bridge allows any combination of local and remote bridges to be interconnected.

An internetwork created by Remote Data Link Bridges supports all Net/One services. U-B offers three serial interface options that are software configurable: V.35, RS-232-C, and RS-449. The company also markets versions of the Remote Data Link Bridge to connect Net/One Ethernet/IEEE 802.3 baseband, broadband, and optical fiber media. The bridge features a 9,000-packet-per-second filtering rate and a 2,600-packet-per-second forwarding rate over T1 lines.

Gateway

Net/One X.25 Gateway: A hardware and software product, the Net/One X.25 Gateway supports a standards-based connection between Net/One networks and X.25 networks and hosts. Media independent, the product supports baseband, broadband, and fiber optic Net/One networks. The X.25 Gateway's capability to supply high-speed access to a packet-mode X.25 host from a Net/One network eliminates the need for multiple, asynchronous RS-232-C connections to the host.

The gateway and the host communicate over a synchronous X.25 link, over which user traffic is also multiplexed. The X.25 link can be RS-232-C or V.35 and can support 32 circuits. The V.35 operates at data rates up to 64K bps. When interfacing to a public data network, the X.25 gateway can function as data terminal equipment (DTE); when interfacing to an X.25 host, the X.25 Gateway can act as data circuit terminating equipment (DCE). The user selects the DTE or DCE option when the gateway is configured.

Each X.25 Gateway can support a connection for up to 32 simultaneous users. The product allows each of the multiple X.25 resources to use up to 32 circuits. Users can assign a set number of circuits to support specific services, a feature that enables the 32 available circuits to provide virtual support for a large number of services.

The X.25 Gateway software makes use of the balanced link access procedure (LAPB) DTE/DCE interface at the link level and interfaces to the access line via the high-level data link control (HDLC) framing format.

Through its support of X.3 PAD, the X.25 Gateway allows synchronous devices to connect to an X.25 network and supports PAD parameters 1 through 14. Configuration of the PAD occurs through the use of the X.28 protocol or by a host that uses X.29 protocols. The gateway supports the full X.28 command set and all X.29 commands except Reselect.

The gateway offers incoming and outgoing call support. Outgoing call support enables a connection to be established from the gateway over the X.25 link, such as a connection from a Net/One asynchronous terminal to an X.25 resource. Incoming calls, such as a call from a terminal connection to a public data network through the X.25 Gateway to a Net/One resource, support connections over the X.25 to the gateway.

Adapters

Personal NIU Ethernet Adapter: The Personal Network Interface Unit (Personal NIU) is a second-generation Ethernet adapter for demanding connectivity applications. The device furnishes IBM PC/XT/ATs and PS/2 models with a high-performance connection to Ethernet LANs. The Personal NIU is a co-processor that executes network protocol software independently of the PC. Running under either DOS or OS/2, the Personal NIU supports up to 48 concurrent network connections to provide PC users with simultaneous access to multiple network resources such as file servers, shared printers, and host terminal sessions.

The product supports the Ethernet 2.0 and IEEE 802.3 standard data transmission rate of 10 megabits per second. Its 8-bit bus interface functions in 8-bit and 16-bit slots to accelerate data transfers between the workstation and the network. The Personal NIU includes 128K bytes of RAM memory, which is factory upgradable to 512K bytes. The Personal NIU/ex incorporates 512K bytes of on-board RAM for protocol processing and data buffering.

U-B equips the Personal NIU with either TCP/IP or XNS software protocol stacks. It is compatible with network application software that uses the NETBIOS interface and with application software such as dBASE III Plus and Microsoft Word. The Personal NIU supports Ungermann-Bass Net/One PC, Novell NetWare, IBM PC LANProgram, Microsoft MS-Net, and Net/One MS LAN Manager.

The Personal NIU includes a 15-pin D connector for attachment to a standard Ethernet cabling system. It also attaches to thin Ethernet coaxial cable or to the U-B Access/One twisted-pair wiring system via external transceivers. An internal broadband modem provides broadband network media support.

NIUps Network Adapter: A second-generation co-processor, the NIUps supplies IBM PS/2s with a high-performance connection to Ethernet local area networks. The NIUps also executes the network protocol, thereby relieving the PS/2 of that task. The product

supports up to 96 concurrent network connections, providing PS/2 users with simultaneous access to multiple network resources. The NIUps supports the Ethernet 2.0 and the IEEE 802.3 standard data transmission rate of 10 megabits per second.

The device includes 512K bytes of RAM memory, upgradable to 1M byte of RAM, for protocol processing and data buffering. The workstation can access this memory through a shared memory window. The NIUps fully exploits the advanced features of the IBM Micro Channel Architecture. It emulates either the DCA IRMA card or the IBM Coaxial Adapter.

3270 NIUpc Ethernet Adapter: In addition to providing IBM PC/XT/ATs and PS/2 Models 25 and 30 with a high-performance connection to Ethernet LANs, the 3270 NIUpc features 3270 emulation capabilities. As a co-processor, it executes network protocol software independently of the PC. When running under either DOS or OS/2, the 3270 NIUpc supports up to 96 concurrent network connections to provide PC users with simultaneous access to multiple network resources. The product supports the Ethernet 2.0 and the IEEE 802.3 standard data transmission rate of 10 megabits per second.

The 3270 NIUpc includes 256K bytes of on-board RAM memory for protocol processing and data buffering. The workstation accesses this memory through a shared memory window. U-B offers the 3270 NIUpc with the option of emulating either the DCA IRMA card or the IBM 3278 Coaxial Adapter in Control Unit Terminal (CUT) mode.

For specifications on NIUpc/EOTP, NIUps, NIUps/EOTP, and Personal NIU/ex, see Table 1.

Personal NIU Token Ring Adapter: The Personal NIU/TR provides IBM PC/XT/ATs and PS/2 Models 25 and 30 with a high-performance connection to token-ring local area networks. Its co-processor architecture allows it to execute network protocol software independently of the PC. The device supports up to 48 concurrent network connections and conforms to the IEEE 802.5's standard data transmission rate of four megabits per second. It includes 256K bytes of on-board RAM memory for network software processing and data buffering.

NIC Ethernet Adapter: The Network Interface Card (NIC) Ethernet Adapter provides IBM PC/XT/ATs and IBM PS/2 Models 25 and 30 with a low-cost connection to Ethernet LANs. Via the NIC, a PC user can access a wide range of resources, such as file servers and shared printers. The NIC supports the Ethernet 2.0 and the IEEE 802.3 standard data transmission rate of 10 megabits per second. Its 16K bytes of RAM are separated into a 4K-byte area for buffering transmitted data and a 12K-byte area for buffering received data. This full-duplex buffer prevents the loss of data packets and maximizes NIC performance.

ODI Drivers: U-B's Open Data-Link Interface (ODI) Drivers support Novell's NetWare '386 servers and OS/2 workstations. The drivers enable users of the Net/One NIUpc and NIUps adapter series to access NetWare servers and Novell's OS/2 Requestor.

NICps/2 Ethernet Adapter: The Network Interface Card (NIC) ps/2 gives IBM PS/2s high-performance connections to Ethernet local area networks. NICps/2 supports the Ethernet 2.0 and the IEEE 802.3 standard data transmission rate of 10 megabits per second. Its 32K bytes of RAM memory optimize the performance of the product and prevent the loss of data packets.

Users need not perform preinstallation activities for the NICps/2. Once installed in an IBM PS/2 and connected to an Ethernet or token-ring network, the NICps/2 card is configured through the Programmable Option Select (POS) architecture of the PS/2. After configuration occurs, the user accesses the network via Net/One system software.

TCP for NDIS: TCP for NDIS is U-B's Transmission Control Protocol/Internet Protocol (TCP/IP) stack, based on Microsoft's Network Driver Interface Specification (NDIS). TCP for NDIS can run on third-party NDIS drivers and adapters from 3Com or IBM. In addition to the NDIS protocol stack, U-B offers an adapter driver that handles the transmission and reception of packets between NDIS-compliant protocols and U-B's line of Ethernet and token-ring adapters. TCP for NDIS is fully compatible with U-B's Net/One LAN Manager. The company also offers an XNS for NDIS stack.

Net/One Net/Scope Network Analyzer: Consisting of software and a special Network Interface Unit (NIU), this product enables the network manager to monitor and analyze the network. Net/Scope operates on any Ethernet or IEEE 802.3 baseband network and on Net/One broadband and optical fiber networks. Capable of analyzing networks of any size, it functions with XNS and TCP/IP protocols. NetScope turns an IBM PC/XT/AT into a troubleshooting tool.

NET/Scope displays portions of the packets, indicating the source and destination addresses, as well as the network and transport protocols in use.

Its main menu guides users to the analyzer's functions with which they can:

- display packets and record them to disk,
- set start and stop triggers for recording packets automatically in response to a predefined event,
- define filters that restrict the traffic being displayed, or record and view traffic levels over a period of time,
- create custom counters to monitor traffic levels of packets that meet a certain criterion,
- use predefined counters for commonly required information, and
- view a histogram of packet sizes as well as all predefined or user-specified custom counters.

Network Management Console
The Network Management Console (NMC) provides the execution environment for Net/One network management software and PC-DOS utilities. The NMC also stores operating software that specifies NIU characteristics and their attached devices. These characteristics are downloaded to Net/One network components. The network administrator can run network management software from the NMC or may access many of the programs from a remote terminal connected to the Net/One System (provided the NMC has been redirected from local to remote access). The NMC is an IBM PC/XT/AT with a keyboard and display, requiring a minimum of 512K bytes of memory. The 10M-byte Winchester disk drive on the PC/XT/AT provides on-line storage for network management software and the Net/One operating software. The PC/XT/AT, which must be licensed to run PC-DOS Release 2.0 or later, is connected to the Net/One via a Personal NIU. The 80186 microprocessor-based NIU connects to Net/One media.

Network Control Console
The Network Control Console (NCC) provides Net/One control and monitoring functions. It also stores operating firmware that specifies NIU characteristics and devices attached to NIUs and downloads the characteristics to Net/One network components. Network management software provides full network control capabilities to ensure efficient network operation, as well as to provide for access and resource security. The NCC is also responsible for reporting on network resources usage and assists in diagnosing and correcting hardware, software, and operational problems within the network. The NCC is a workstation based on AT&T's UNIX operating system, with a 71M-byte Winchester disk, a 0.25-inch cartridge tape drive, and 2M bytes of main memory. The workstation is connected to Net/One via an integral NIU. The 80186 microprocessor-based NIU connects to all Net/One baseband, broadband, and optical fiber networks. In a broadband Net/One network, the NCC is connected to single- or dual-cable systems via an internal modem.

Net/One Fiber Optic Components

Optical Transceiver is an Ethernet-compatible device that serves as the transmission interface to the optical fiber. The device converts an electrical signal into an optical signal before coupling it to an optical fiber. Each star segment accommodates up to 64 Optical Transceivers. The maximum transceiver cable length is 50 meters.

Fiber Optic Star Coupler supplies the multiple access capability in a fiber optic cable system. A pair of fibers runs from every network node to the star coupler, and light entering any one of the fibers on the coupler's input side is distributed across all output fibers. The couplers come with 8, 16, 32, and 64 ports.

Star Wiring Center (SWC) simplifies the fiber optic cable connection by acting as a cross-connect panel, a test point, and a splicing center. It serves as the location for a Fiber Optic Star Coupler, allowing the multiple-fiber cable access to emulate bus systems.

Fiber Wiring Center (FWC) operates in a manner similar to the Star Wiring Center, but the FWC is centralized rather than widely dispersed. The FWC functions as a cross-connect panel, a test point, and a splicing center. It also serves as the location for a transmissive star coupler that allows multiple-fiber cable access to emulate bus systems.

Access/One Network Delivery System

Access/One, a network delivery system that moves information from the corporate backbone to the end user, is a modular network system that supports both Ethernet and token-ring media access methods on twisted-pair wiring. A smart wiring hub, Access/One clusters network hardware in a system enclosure that can be wall or rack mounted in the wiring closet. Its modular architecture is protocol independent.

Access/One is a structured wiring concentrator that allows users to connect terminals and workstations to high-capacity backbones. It supports multiple protocols transparently and uses modular components to provide a choice of fiber optic, broadband coaxial, or baseband coaxial cable in the backbone network. Among the newest members of the Access/One line are the FDDI SuperLAN bridges, protocol-independent modules for linking and managing enterprise networks. They provide Ethernet and token-ring interoperability and access across the 100M bps fiber optic backbone.

System modules, up to 11 of which are inserted into the enclosure, provide Access/One's connectivity. The system modules supply network access to a wide range of devices, such as asynchronous terminals and hosts, PCs or workstations on Ethernet or token-ring, 3270 devices, modems, and printers.

ASE-3000: U-B's Access/One small enclosure, the ASE-3000 incorporates concentrators that support IBM PCs, Apple Macintoshes, asynchronous and 3270 terminals, and host computer systems. The ASE-3000 is functionally equivalent to the larger Access/One system.

Access/One Asynchronous Interface Module: The Asynchronous Interface Module performs the terminal switching service for Access/One. It supports up to eight asynchronous devices with RS-232-C interfaces. Users can add up to 10 modules to the enclosure to support 80 asynchronous devices.

Access/One 3270 Interface Module: The 3270 Interface Module supplies 3270 connectivity capabilities to the Access/One system. It supports up to eight 3270 displays, including graphic displays and printers. Users can add up to 10 modules to the enclosure to support eighty 3270 devices.

Access/One Ethernet Concentrator Module: The Ethernet Concentrator Module supports up to 12 Ethernet

connections over shielded or unshielded twisted-pair wiring at a data rate of 10M bps. Users can add up to 10 modules to the enclosure to support 120 Ethernet devices.

Access/One Token-Ring Concentrator Module: The Token-Ring Concentrator Module supports up to 20 token-ring stations over twisted-pair wiring. If daisy-chained, it can form larger rings to support up to 220 stations in a single Access/One system.

Access/One 10BASE-T Concentrator Module: The concentrator, a managed active repeater, provides signaling for up to twelve 10BASE-T ports at 10 megabits per second over twisted-pair (telephone) wiring. In an optional mode, the concentrator supports device distances exceeding 150 meters on unshielded twisted-pair wiring. For users with IBM Type 1 and 2 cabling, even longer distances are supported. The 10BASE-T concentrator operates with U-B's intelligent and non-intelligent 10BASE-T personal computer network adapter cards. It conforms to the IEEE 802.3 10BASE-T standard.

Access/One Network Interface Module: The Network Interface Module serves as the key connection to the network backbone. U-B offers modules for baseband, broadband, and fiber optic network backbones. All Ethernet system units use this module to access the backbone. To maximize network availability, the Network Interface Module can be implemented redundantly through the use of the Supervisor Module.

Access/One Supervisor Module: The Supervisor Module performs local or remote monitoring, control, and diagnostic functions in realtime. Serving as the local network management agent for all system modules, the Supervisor Module constantly monitors the network interface, system temperature, power supply, and individual modules for their operating status. The Supervisor Module also provides the Access/One Ethernet system with access to the network backbone. Access/One Supervisor Modules exist for baseband, buffered baseband, buffered broadband, and token-ring applications.

Access/One Manager: Access/One Manager supplies network management capabilities for Access/One System Enclosures over the enterprise network by showing realtime, color-coded status displays and controlling all modules within any Access/One Enclosure. The system supports Ethernet and token-ring; asynchronous and 3270 terminal servers; MaxTalk, a LocalTalk concentrator; and bridge modules.

Access/One Local High-Performance Bridge Modules: The Local High-Performance Bridge Modules perform protocol-independent traffic filtering in the network backbone to prevent heavily trafficked local networks from clogging the backbone with unnecessary data. The modules select the best media for the local networks, independent of the media in the network backbone.

Access/One Smart Bridges

FDDI SuperLAN: These bridges are protocol-independent modules for linking and managing enterprise networks. They provide Ethernet and token-ring interoperability and access across the 100M bps fiber optic backbone.

Ethernet-to-FDDI SuperLAN: Compatible with all Ethernet and IEEE 802.3 protocols, this bridge transparently interconnects multiple types of networks, such as XNS, TCP/IP, and DECnet, and filters messages addressed to local stations.

Token Ring-to-FDDI SuperLAN: This product performs IBM-compatible source-routing functions to enable source-routed frames to cross the FDDI ring. It handles the conversion and routing of frames across FDDI-based, Ethernet, and token-ring networks.

Local Token Ring-to-Ethernet Data Link Bridge: The first bridge that transparently links both LAN technologies, the product conforms to IEEE 802 and IBM standards. Users can control and monitor the bridge through a remote Network Management Console from either token-ring or Ethernet networks.

Ethernet Data Link Bridges: Two local devices address baseband and broadband interfaces and supply redundancy with the spanning tree algorithm. They filter and partition local traffic from the corporate backbone to increase its overall efficiency.

Remote Ethernet Bridge: This device operates in full-duplex, synchronous modes at speeds up to 2.048M bps. HDLC/LAPB protocol acknowledges received frames and retransmits frames that have not arrived at their destinations. The bridge interfaces to standard customer equipment, such as modems and channel service units/data service units (CSU/DSUs).

Remote Token-Ring Bridge: Functionally similar to the remote Ethernet bridge, this product supports IBM's source-routing packet protocol.

Local Token-Ring Bridge: This bridge supports IBM's source-routing protocol and connects multiple Ungermann-Bass and IBM Token-Rings.

Twisted-Pair Access Unit (TPAU): An external transceiver, this product provides 10BASE-T signaling for an Ethernet device. It complies with the IEEE 802.3 10BASE-T standard.

Access/One Multiprotocol Bridge/Router

Access/One ASM 8320: Announced in January 1991, ASM 8320 is the first in a family of multiprotocol bridge/router modules for the Access/One smart wiring hub. ASM 8320 is a multiple, serial port bridge/router that connects devices on remote Ethernet networks. ASM

8320 is the first product that evolved from the technology agreement, announced in November 1990, between U-B and Advanced Computer Communications (ACC). The device facilitates the interconnection of isolated LANs over wide area networks (WANs) and provides token-ring and Ethernet connectivity. As part of the Access/One hub, the 8320 connects to FDDI-based and Macintosh networks. The device serves as a local or remote router. Routing information can be downloaded through the local LAN interface or through the remote point-to-point interface across the internetwork.

All protocols are routed concurrently; multiprotocol routing and bridging occurs over the same port. Routing takes place through point-to-point serial lines or through private and public X.25 data networks. Both serial ports in the two-port models can serve as point-to-point or X.25 links, or users can configure one of each. When a combination of links is in use, the X.25 network can act as a fault-tolerant backup to the point-to-point line.

The module concurrently routes Internet Protocol (IP) networks, including Open Shortest Path First (OSPF), Routing Information Protocol (RIP), External Gateway Protocol (EGP), Xerox Network Systems (XNS), Ungermann-Bass' XNS, and Novell's Internet Protocol Exchange (IPX). The module also supports DECnet Phase IV. Future bridge/routers will include AppleTalk Phase II routing.

The 8320 bridge/router includes transparent Ethernet bridge features. Both serial ports can link to the same remote site or to different sites. When attached to the same site, both links perform congestion management or provide fault tolerance with the IEEE 802.1D Spanning Tree algorithm. Other key features of ASM 8320 include customized filters and user-configurable packet precedence, which allows administrators to determine the protocols that receive resource priority.

MaxTalk

A high-performance AppleTalk multiport router residing in Access/One, MaxTalk provides each Apple Macintosh with its own dedicated 230.4K bps transmission channel by filtering traffic on each port and forwarding data packets only to their addressed destinations. The MaxTalk module implements the full set of Apple routing protocols and forwards AppleTalk and IP traffic between attached LocalTalk devices and an Ethernet network. This process enables LocalTalk devices attached to MaxTalk to exchange traffic over the Ethernet network, both with Ethernet devices and LocalTalk devices attached via other MaxTalk modules or other AppleTalk routers.

Each MaxTalk module supports 16 LocalTalk devices or 16 daisychained LocalTalk networks via unshielded twisted-pair wiring. LocalTalk connectors from Apple or other vendors can be used with no additional hardware or software at the attached device.

In March 1991, U-B introduced enhanced software for MaxTalk that supports AppleTalk Phase 2 protocol and supports a smooth migration between AppleTalk Phase 1 and Phase 2. MaxTalk also provides support for TCP/IP connectivity of Macintoshes in heterogeneous computing environments. When the MaxTalk module is combined with U-B's NetDirector management platform, users gain a Macintosh connectivity solution for their enterprises. The enhanced MaxTalk software facilitates management and troubleshooting of the Macintosh network. Port-level statistics indicate utilization and error rates on a per-port basis.

Software

Operating System Software

Net/One LAN Manager

Net/One LAN Manager is U-B's network operating system for IBM PC and PS/2 workstations connected to Ethernet XNS and TCP/IP, as well as those connected to token-ring networks. Based on Microsoft's OS/2 LAN Manager, this software provides a platform for workgroup computing in large data processing centers. On IBM or IBM-compatible PC AT or PS/2 computers, Net/One LAN Manager server software runs as an extension of the OS/2 multitasking operating system. The product also supports DOS workstations. U-B supports both LAN Manager and NetWare.

Net/One LAN Manager workstations and servers can interoperate and share resources with Net/One PC System and with LAN Manager implementations from other vendors, such as 3Com's 3+Open under TCP/IP. Workstations operating under Net/One LAN Manager can access Novell's NetWare servers. These capabilities enable users to mix and match Net/One PC System, LAN Manager, DOS, and OS/2 workstations and servers on a single network and share applications, files, and other resources. U-B also provides a migration strategy to companies going to LAN Manager.

U-B's LAN Manager supports industry-standard application program interfaces (APIs) and protocols. It supports current and future NETBIOS applications on DOS and OS/2 workstations. For workstation connectivity beyond PC LAN Manager servers, Net/One LAN Manager uses the standard Server Message Block (SMB) protocol, which is also supported by IBM, Digital Equipment, and Tandem. The system's Named Pipes APIs serve as a standard platform for powerful distributed application development.

For connection to asynchronous devices on the network, DOS and OS/2 Net/One LAN Manager workstations include a terminal emulator. U-B's Net/One bridge and gateway products enable users to access workstations and server resources within a building, throughout a campus, or across the country. Net/One LAN Manager supplies a variety of printer management utilities for the network administrator and workstation users. A range of administration utilities assists users in the management of server-based resources.

U-B also supports Microsoft's LAN Manager Release 2.0, which includes additional administrative tools, security enhancements, and fault tolerance. In June 1990, U-B brought out its Net/One LAN Manager 2.0, a version designed to simplify the management of multiple servers across large enterprise networks. Release 2.0 supports multiprocessor servers, offers disk duplexing and mirroring, performs file replication, and enhances security features.

Net/One LAN Manager 2.0 enables users to take advantage of OS/2 at the server and DOS or Windows at the workstation. The operating system also allows users to communicate with Hewlett-Packard's LMX UNIX LAN Manager, Novell's NetWare 286/386 servers, and IBM's LAN Server.

An enhanced statistics reporter assists network administrators in managing and fine-tuning multiple servers by providing log files of statistical values, averages, and trends. Users can display statistics by time intervals and servers through a LAN Manager-compatible user interface.

Universal Workstation Software

Net/One PC System Version 2.0

Net/One PC System Version 2.0 is U-B's network operating system for personal computers. It enables disk and printer resources located on server computers to be shared with PC workstation users over a Net/One LAN. Based on Microsoft Networks operating system, Version 2.0 acts as an extension of PC/MS-DOS. A member of U-B's Universal Workstation family, Net/One PC System Version 2.0 can incorporate printers, plotters, and other peripheral devices attached to Net/One Network Interface Units (NIUs), making them available to workstation users.

Net/One TCP

Net/One TCP delivers the multivendor interconnectivity required by large enterprises. Based on Transmission Control Protocol/Internet Protocol (TCP/IP), Net/One TCP consists of a family of products that provide universal host connectivity, terminal emulation, and high-speed file transfers to facilitate information access within an organization. Net/One TCP software runs at and above layer three of the ISO seven-layer Open Systems Interconnection (OSI) reference model and is independent of network access media and methods.

TCP-PC software allows PC and PS/2 workstations running MS-DOS to access hosts and wide area networks. TCP-PC is compatible with most network operating systems, including U-B's Net/One PC System, IBM's PC Network and PC LAN, Microsoft's MS-Net and LAN Manager, and Novell's Advanced NetWare. When TCP-PC runs in conjunction with U-B's Net/One 3270 PC Graphics software, PC or PS/2 users can concurrently access text and graphics information from servers and hosts.

TCP-Mac allows Apple Macintosh PCs to access a range of hosts and other resources and to communicate with a wide range of dissimilar computers from various vendors. TCP-Mac users can access either TCP/IP or AppleTalk applications on an EtherTalk or LocalTalk network.

A full-featured terminal service capability, which runs on all of the company's asynchronous network interface units, implements connectivity to asynchronous hosts. This capability uses the Telnet virtual terminal protocol, a standard for TCP/IP, allowing access to TCP/IP-based hosts via Telnet. Users can access non-TCP/IP hosts through Net/One TCP and a terminal service.

For network program-to-program communications, U-B provides four programmable interfaces, including the Socket Library and NETBIOS, an industry-standard interface for peer-to-peer communications. A "C" language interface is available through the TCP-PC Socket Library, which is compatible with UNIX 4.3 BSD system calls. Host-to-host or host-to-workstation file transfers occur through File Transfer Protocol (FTP), another TCP/IP standard. Users on separate networks can communicate over Net/One TCP via local and remote internetworking products.

Net/One 3270 PC

Net/One 3270 PC software allows PC users on a Net/One Ethernet or token-ring LAN to access host information residing on IBM or IBM-compatible mainframes, as well as information on Hewlett-Packard HP 3000s and Digital Equipment's VAX machines.

Users can concurrently access up to seven window environments: four host sessions, one PC session, and two notepads. Any host session can serve as a 3287 host-addressable printer, 3270 terminal, or asynchronous Digital VT100 or IBM 3101 terminal.

Users can select up to three connection paths for each host session:

- IBM Distributed Function Terminal (DFT) mode for concurrent connection to multiple 3270 host or printer sessions.
- Control Unit Terminal (CUT) mode for 3278 or 3279 terminal emulation, which supports concurrent connections to multiple 3270 hosts, and 3287 printer emulation, which enables mainframe printing tasks to be routed to a personal computer or LAN-attached printer.
- Asynchronous mode for connection to asynchronous resources.

The Net/One 3270 application program interface (API) is compatible with the IBM 3270 PC Control Program, Release 2.1. U-B offers a low-level application program interface (LLAPI) that allows applications to be written directly to the Net/One hardware. The LLAPI is also compatible with IBM's 3270 PC high-level language application program interface (HLLAPI), which enables micro-to-mainframe application programs conforming to

these interfaces to run with Net/One 3270 PC software. In addition, this program is fully compatible with software using the IBM 3270 PC file transfer facility (IND-$FILE).

Net/One 3270 PC Graphics

Net/One 3270 PC Graphics software, an extension of the Net/One 3270 PC emulation program, enables PC users on a Net/One Ethernet or token-ring LAN to access host graphics residing on an IBM or IBM-compatible mainframe. It must be used in conjunction with Net/One 3270 PC. The software is compatible with mainframe graphics programs, such as SAS Institute's SAS/GRAPH. When using Net/One 3270 PC Graphics and Net/One 3270 PC, users can concurrently access up to four host mainframe graphics sessions. Each host session can function as a 3279 S3G terminal, featuring color and programmed symbols. Graphics data can be saved to a disk file, printed from a PC-attached or network printer, or edited with other PC graphics programs.

The software requires no special hardware and is compatible with a standard personal computer equipped with an IBM Color Graphics Adapter (CGA), Enhanced Graphics Adapter (EGA), or compatible displays.

Net/One CONTACT

Net/One CONTACT enables PC users to access and process information located on asynchronous host mainframes and on minicomputers such as Digital Equipment VAX machines and IBM systems. Designed specifically for use with U-B Net/One PC adapters or asynchronous communications ports, the program enables IBM PC/AT/XTs and compatibles, as well as IBM PS/2s, to act as IBM 3101 and Digital VT220, VT100, and VT52 terminals.

When used with Net/One Universal File Manager, Net/One CONTACT accommodates automated host connections, file transfers, data manipulations, and integration with a variety of application programs. CONTACT supports file transfers over all Net/One baseband, broadband, fiber optic, and token-ring twisted-pair media access methods, as well as asynchronously via the communications port of a PC.

The program supports industry-standard communications protocols, such as Kermit, xmodem, and Net/One Universal File Manager. Its multitasking kernel enables CONTACT to run in background mode behind other applications.

MacUWS

MacUWS integrates Macintosh computers into the TCP/IP environment by supporting FTP, Telnet, and VT100 terminal emulation over TCP/IP protocols. The package operates across EtherTalk or LocalTalk. When combined with U-B's MaxTalk, the product provides direct access to host computers.

Network Management

NetDirector

NetDirector is an open, standards-based network management platform supporting XNS and TCP over Ethernet, token-ring, or FDDI-based networks. NetDirector can manage multiple management protocols concurrently. Featuring an SQL database and a client/server architecture, NetDirector manages all Access/One connectivity modules and integrates the management of new modules, such as ASM 8320, via Simple Network Management Protocol (SNMP).

In January 1991, U-B participated in a demonstration with British Telecom to publicize multivendor interoperability, achieved by following Network Management Forum Release 1 specifications. The presentation featured the CONCERT Integrated Management System (IMS) from British Telecom and NetDirector from U-B. Linked to the Access/One wiring enclosure via NetDirector, CONCERT IMS received information from NetDirector. Subsequently, live alarms from an Access/One wiring enclosure were relayed to NetDirector, which passed a Network Management Forum-defined message over an X.25 link to CONCERT IMS.

Net/One Media Manager

This software enables the network administrator to manage the operation, configuration, and performance of up to 60 bridges and 15 token-ring networks. The program informs the administrator of the Ring Bridge operational mode (limited broadcast support/shadow mode operation) and bridge hop limits, as well as its location and operational statistics. The system gathers performance statistics for all frames that transit the bridge.

Universal File Manager

The Universal File Manager supports universal file access and management among any combination of IBM PCs and Apple Macintoshes and IBM, Digital Equipment, and Hewlett-Packard mainframes and minicomputers. It enables files to be transferred between different computer types and transformed into different formats. It also provides security by allowing data access only to authorized users. Linkware Corp., a wholly owned subsidiary of U-B, developed Universal File Manager, which consists of a core product called Universal File Transfer, and two options: Universal File Transformer and Universal File Administrator.

Universal File Transfer software resides on both hosts and PCs, providing file transfer services for most file types to and from mainframes, minicomputers, and PCs. The host-resident Universal File Transformer option reformats and translates data into host and PC formats. The host-resident Universal File Administrator option furnishes the control necessary in environments requiring high security. Multiple users can share hot

data, but the Universal File Administrator allows users to see the names of only those files for which they have access.

Pricing and Support

In May 1990, U-B announced two customer support programs for Net/One enterprise networking users. Table 2 outlines the features of the various programs. During 1990, U-B also enhanced its Customer Support Organization by setting up a Customer Response Center, which provides technical assistance through an 800 number, and the Data Access and Recording Tool Bulletin Board (DARTBoard), a PC bulletin board that allows support customers 24-hour access to an expert support database for troubleshooting and interactive communications with other DARTBoard users.

Equipment Prices

		Purchase Price U.S. ($)
Net/One Hardware Components		
	NIU-130	1,525
	NIU-140	2,595
	NIU-190	2,995
	NIU-74	5,425
	NIU-78	3,950
	Personal NIU	695
	NIC	395
	NIUpc and EOTP	1,095
	3270 NIUpc	995
	NICps/2	495
	NIU-DMF-32	5,395
	Baseband-to-Baseband Buffered Repeater	3,000
	Baseband-to-Broadband Buffered Repeater	3,800
	Baseband-to-Baseband Local XNS Router	9,450
	Baseband-to-Broadband Local XNS Router	9,450
	Local Ethernet/Token-Ring Data Link Bridge	9,450
	Local Ethernet/Ethernet Data Link Bridge	9,450
	Remote Ethernet Data Link Bridge	9,850
	MaxTalk Interface Module	4,695
	MaxTalk software enhancement for non-support customers	250
	X.25 Gateway	9,200
Access/One Hardware Components		
	Five-slot enclosure, 115 or 230 V AC	2,095
	Eleven-slot enclosure, 115 or 230 V AC	2,495
	Five-slot power supply	995
	Eleven-slot power supply	1,650
ASM100	Access/One Interface Module, Asynchronous XNS	1,395
ASM200	Access/One Interface Module, 3270	2,775
ASM300	Access/One EOTP Concentrator Module	2,245
Access/One Hardware Components (Continued)		
ASM310	Access/One 10BASE-T EOTP Concentrator Module	2,485
ASM400	Access/One Concentrator Module, Token Ring	1,800
ASM500	Access/One Network Interface Module, Baseband Ethernet	1,395
ASM510	Access/One Network Interface Module—Baseband Ethernet, Buffered	8,595
ASM700	Access/One Supervisor Module—Baseband Ethernet	3,350
ASM710	Access/One Supervisor Module—Baseband Ethernet, Buffered	4,550
ASM700	Access/One Supervisor Module, Token Ring	3,350
ASM 800	Access/One Fiber Optic Ethernet Concentrator Module/FlexMount Adapter	2,850
ASM900	Access/One Concentrator Module	2,800
ASM8320	Access/One Multiple Serial Port Bridge/Router for connecting devices on remote Ethernet	7,495
	Access/One SuperLAN Ethernet-to-FDDI Bridge	25,000
	Access/One SuperLAN Token Ring-to-FDDI Bridge	25,000
	Access/One Local Baseband Ethernet Bridge	3,950
	Access/One Local Broadband Ethernet Bridge	4,600
	Access/One Remote Ethernet Bridge	4,995
	Access/One Local Token Ring Bridge	5,250
	Access/One Remote Token Ring Bridge	5,250
	Access/One Local Token Ring-to-Ethernet Bridge	5,250
	Access/One MaxTalk Interface Module	4,695
	Network Management Console	5,000

Software Prices

		Onetime Charge ($)
	Net/One LAN Manager 2.0	5,995
	Net/One PC Operating Software (OPS)	1,595
	Synchronous Communications Service I (SCS-I)	2,000
	Synchronous Communications Service II (SCS-II)	2,000
	Synchronous Communications Service III (SCS-III)	2,000
	Remote XNS Router Software	2,000
	Data Link Bridge Software	2,000
	X.25 Gateway Software	2,500
	Net/One 3270 PC	295
	Net/One 3270 Personal Connection Model I	95
	Net/One 3270 PC Graphics (workstation)	225
	Net/One Async PC; PC-Term (server)	1,600
	Net/One Async PC; PC-Term (workstation)	1,600
	Net/One PC (server)	1,895
	TCP-PC (per workstation)	325
	MacUWS	495

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Ungermann-Bass Access/One Enhancements

Product Enhancement

Analysis

In May 1989, Ungermann-Bass (U-B) announced a technological breakthrough that enabled 16M bps token-ring products to operate on unshielded twisted-pair (UTP) wire. With this announcement, U-B put to rest the argument—mainly promulgated by IBM—that 16M bps token-ring networks could not function on ordinary telephone wire. At the same time, Proteon announced its version of 16M bps token-ring over UTP.

Originally, U-B scheduled availability for products based on its new technology for the third quarter of 1990. Unable to meet that date, U-B delivered on its promise in June 1991 by introducing a two-part concentrator for Access/One—ASM 410T and AMO 410T/2—as well as two 16M bps token-ring adapter cards for IBM-compatible PCs and workstations—Access/ISA TR and Access/MC TR.

ASM 410T and AMO 410T/2

U-B has incorporated jitter elimination technology into its 16/4M bps token-ring concentrator. The ASM 410T and daughtercard, AMO 410T/2, reduce jitter on a 12-station concentrator to the level of a single station. This technique avoids the failures that occur from jitter accumulation. U-B has applied for a patent for its jitter elimination technology and has also presented it to the IEEE 802.5 committee.

The ASM 410T is an active concentrator that supports 12 token-ring stations. The AMO 410T/2 daughtercard provides additional support for unshielded twisted pair (UTP), accommodating up to 255 stations on a ring at lengths up to 100 meters. Typical 16M bps UTP token-ring networks support up to 72 stations.

About the products, Roger Bertman, vice president of marketing, commented, "The concentrator and daughtercard provide the highest reliability for the 16M bps token-ring environment in the market today. The concentrator is a single part of an end-to-end token-ring solution Ungermann-Bass will roll out in the upcoming year, including adapter cards and internetworking products."

—By Barbara Callahan
Associate Editor

The ASM 410T base card offers basic network management functions and support for unshielded and shielded twisted pair. When users couple the optional AMO 410T/2 with the base card, they gain increased unshielded twisted-pair functionality through the jitter elimination technology.

The concentrator can be customer installed in a single slot in the Access/One smart hub, which requires no upgrading. The concentrator, with daughter card, provides advanced network management functions and can be managed by U-B's NetDirector network management system. Additional network management features include port-level statistics and automatic recovery from hard errors.

ASM 410T costs $1,150, and ASM 410T with the AMO 410T/2 daughterboard costs $1,900.

Access/ISA TR and Access/MC TR

These two 16M bps token-ring adapter cards are designed for IBM-compatible PCs and workstations. They enable users to link a 16M bps or 4M bps token-ring to Access/One. Access/ISA TR and Access/MC TR, which feature extended-range 16M bps support over UTP, also support shielded twisted-pair and coaxial wiring. Access/ISA TR costs $925, and Access/MC TR costs $895. ■

Vitalink Communications Internetworking Products

In this report:

Product Summary

Editor's Note

Since our last report on Vitalink's products, the company introduced a bridge and bridge/router platform, the VX335. In addition, Vitalink incorporated SNMP into WANmanager, added multiprotocol support to the TransPATH family of bridges/routers, implemented an Access Module for Digital Equipment Corp.'s DECmcc, added Digital's DECnet Phase IV support to the TransPATH family, produced Tempest versions of its Ethernet and token-ring bridges and bridge/routers, added network capacity planning to its network management system, and enhanced TransLAN III with a new software release.

Description

TransLAN bridges are protocol-transparent remote bridges that extend multiple Ethernet or IEEE 802.3 LANs into backbone wide area networks (WANs). TransRING products are transparent remote bridges that connect IBM Token-Ring or IEEE 802.5 LANs to create wide area networks. Via the TransRING bridges, the user views every resource as appearing on the same LAN. TransPATH products are LAN interconnect processors based on Ethernet and token-ring. Each TransPATH system can bridge, route, or perform concurrent bridging and routing between LANs.

—By Barbara Callahan
Associate Editor

Strengths

Vitalink pioneered remote bridging. Its product line, which covers bridging, routing, and bridging/routing, operates over Ethernet and token-ring.

Limitations

By adding routers to its product line, Vitalink has overcome its previous limitation of producing only bridges.

Competition

cisco Systems, Proteon, 3Com, Ungermann-Bass.

Vendor

Vitalink Communications Corp.
6607 Kaiser Drive
Fremont, CA 94555
(415) 794-1100

Price

Prices range from $12,750 to $17,250.

GSA Schedule

Yes.

Analysis

In August 1990, Vitalink announced the VX335, a bridge and bridge/router platform that can serve as an entry-level TransPATH remote Ethernet bridge/router with TransPATH 11.1.4 software or as a midrange TransLAN remote Ethernet bridge with TransLAN 10.3.4 software. At present, Vitalink has no plans to release a token-ring version of VX335.

Product Strategy

According to Vitalink, over 1 million LANs are currently isolated. The company's vision for the 90s is to play a key role in interconnecting those LANs over wide areas through products such as TransLAN, TransRING, TransPATH, WANmanager, and VX335. Vitalink's products interoperate with equipment from over 400 vendors. The company has constructed its products to function in networks of almost unlimited sizes and complexity. To manage these intricate networks, Vitalink offers WANmanager. When users blend Vitalink products with T1 and T3 multiplexers, they achieve voice/data integration to form an enterprise-wide network.

Originating as a satellite data transmissions vendor in 1980, Vitalink changed course in 1984 and introduced TransLAN, the industry's first remote bridge, which interconnects LANs via the Ethernet standard. As the token-ring LAN standard evolved, Vitalink expanded its bridging platform to encompass TransRING, a line of bridges for token-ring applications. In July 1989, Vitalink introduced the TransPATH family of high-performance TCP/IP routers, which incorporates and extends the capabilities of the company's remote bridges. By adding routers to its product line, Vitalink firmly established itself as a LAN internetworking company.

In July 1990, Vitalink enhanced WANmanager with Version 1.1. Key features added to this network management system include Simple Network Management Protocol (SNMP) client, expansion of the node performance monitoring facility, the ability to print all system graphics to a laser printer, and an enhanced user interface, which is fully compatible with DECwindows. WANmanager currently supports Digital's LAN Bridge local bridges, Chipcom's Ethermodem III broadband-to-baseband bridges, and StrataCom's IPX T1 multiplexers.

Competitive Position

Vitalink has quickly achieved high visibility within the internetworking industry because of the quality of its products, its technical innovations, and its ongoing relationship with Digital Equipment Corp. The company has penetrated significant industry segments, and its installed base is represented in the following areas:

- Computer Communications Equipment—25 percent
- Electronics—8 percent
- Aerospace—9 percent
- Utilities—6 percent
- Service Industries—9 percent
- Education—3 percent
- Manufacturing—8 percent
- Government—11 percent
- Finance—10 percent
- Other—11 percent

Through its creation of remote bridging technology, Vitalink enjoys a substantial lead over competitors in that segment. By broadening its efforts to include routing, the company continues to make its mark in the LAN internetworking market, which is where the action is and will continue to be. By 1993, industry analysts predict that the LAN internetworking market will top $1 billion. Vitalink's progress reflects that dynamic growth: the company doubled its installed base of bridge users in a year.

A California neighbor and internetworking company, cisco Systems, poses strong competition, not from its pricing structure, but from its emphasis on the number of protocols supported by its products. At present, cisco supports 14 protocols. Network protocols supported by cisco include IP, DECnet Phase IV, Novell IPX, Xerox XNS,

Ungermann-Bass XNS, OSI (& GOSIP), Apollo Domain, AppleTalk, and Chaosnet. Gateway protocols include RIP, EGP, IGRP (proprietary), and VCP (proprietary). The WAN protocol supported by cisco is X.25, and the network management protocol is SNMP.

In the war of the protocols, Vitalink considers the demand for routing Apollo Domain and Chaosnet to be very meager, and is not, therefore, planning any support to compete against cisco in those two areas. Support for DECnet Phase IV, however, is slated by Vitalink for the second quarter of 1991. Vitalink is currently working on support for OSI & GOSIP, DECnet/OSI Phase V, AppleTalk, EGP,

Table 1. TransLAN Specifications

	TransLAN 320	TransLAN III	TransLAN 335	TransLAN 350
Serial Line Interface	2 ports Each Universal interface supports V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28	1 to 8 ports Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card or DS-1 card	2 ports CCITT V.35	1 to 8 ports Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card or DS-1 card
Link Speed Support	9.6K bps-64K bps	9.6K bps-2.048M bps	9.6K bps-2.048M bps	9.6K bps-2.048M bps
Performance				
Filtering Rate	14,880 frames/second	14,880 frames/second	14,800 frames/second	14,800 frames/second
Forwarding Rate	2,000 to 2,400 frames/second*	5,000 to 7,000 frames/second*	5,000 to 7,000 frames/second*	5,000 to 7,000 frames/second*
Aggregate Bandwidth	2 ports: 2 x 64K bps	1 port: T1/E1 2 ports:1 T1/E1*, 1 56K bps/64K bps 3-8 ports: Aggregate 1.024M bps	2 ports: 2 x T1/E1	1 port: T1/E1 2 ports: 2 x T1/E1 3 ports: 3 x T1* 4-8 ports: Aggregate 4.096M bps
Physical Dimensions				
Inches	3.5H x 17.2W x 22.75D	5.2H x 17.5W x 23.5D	3.5H x 17.2W x 22.75D	5.2H x 17.5W x 23.5D
Centimeters	8.9H x 43.7W x 57.8D	13.2H x 44.5W x 59.7D	8.9H x 43.7W x 57.8D	13.2H x 44.5W x 59.7D
Weight	15.5 lbs., 7.05Kg	32 lbs., 14.5Kg	16.5 lbs., 7.5Kg	32 lbs., 14.5Kg
LAN Interfaces (1 port)	Ethernet Version 2.0 or IEEE 802.3	Ethernet Version 2.0 or IEEE 802.3	Ethernet Version 2.0 or IEEE 802.3	Ethernet Version 2.0 or IEEE 802.3
Mounting Options	Rack, cabinet or tabletop	Rack, cabinet or tabletop	Rack, cabinet or tabletop	Rack, cabinet or tabletop
Operating Environment	Temperature: 5° to 40°C. Humidity: 10 to 90% without condensation	Temperature: 5° to 40°C. Humidity: 10 to 90% without condensation	Temperature: 5° to 40°C. Humidity: 10 to 90% without condensation	Temperature: 5° to 40°C. Humidity: 10 to 90% without condensation
Network Management	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)
Hardware	Vitalink Network Processor with one internal floppy drive Operator Terminal (Optional) Diagnostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)
Power Requirements	100-130 V AC or 200-260 V AC 47-63 Hz 150 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 150 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum
Address Table Size	Supports more than 8,000 nodes	Supports more than 8,000 nodes	Supports more than 8,000 nodes	Supports more than 8,000 nodes

**Requires UIC or CCITT V.35 card plus v6.10 (TransLAN III) or v10.4 (TransLAN 350) software.*

Company Profile
Vitalink Communications Corporation

Corporate Headquarters
6607 Kaiser Drive
Fremont, CA 94555
(415) 794-1100

Officers
Chairman and CEO: Donald J. Herman
Vice President, Operations: Michael Yost
Vice President, Strategic Relations: Terry Lawrence

Company Background
Founded in 1980, Vitalink Communications produces LAN internetworking equipment that includes bridges, routers, and bridges/routers which conform to Ethernet and token-ring LAN standards. The company pioneered the development of the remote bridge, creating a product that interconnected geographically dispersed LANs to form a wide area network (WAN). Through Vitalink's innovative technology, devices on bridged LANs appear to users as local devices, regardless of the distance between them. To penetrate more deeply into the LAN internetworking market, Vitalink added high-performance routers to its product line.

Vitalink has a solid relationship with Digital Equipment Corp. Together, the two companies developed Spanning Tree Protocol (STP) to optimize network topology. Since 1984, the two companies have been fulfilling an agreement to develop and provide marketing and service support for remote bridging technology, STP, Digital's EMA, and DECnet protocol. In November 1988, Digital became a reseller of Vitalink's TransLAN Ethernet remote bridges. In July 1990, Vitalink and Digital signed a Technology Exchange Agreement in which Digital gave Phase IV routing code and documentation to Vitalink and also agreed to supply network management code and technical support to assist Vitalink in developing and implementing a Phase IV router.

Recent Agreements
February 1990: Vitalink and StrataCom of Campbell, CA, manufacturer of IPX FastPacket, announced the joint development of internetworking systems based on Frame Relay technology. The agreement calls for Vitalink to build support for StrataCom's standards-based Frame Relay Interface into its family of bridges and bridges/routers. The Vitalink/StrataCom relationship will enable users to take advantage of fast packet switching over wide area networks. Vitalink and StrataCom previously worked together to develop the WANmanager network management platform.

March 1990: Vitalink and Touch Communications of Campbell, CA, announced a multiyear technology agreement in which Touch provides Vitalink with its implementation of the OSI protocol stack. Vitalink offers customers Touch's OSI routing protocol set on TransPATH bridge/router systems. OSI will be available on Vitalink's TransPATH family in 1991. Touch Communications develops enterprise-wide connectivity solutions based on OSI standards such as MAP/ TOP and GOSIP. Touch's product line enables systems integrators and large end users to build OSI networks that merge their workgroup solutions into large corporate networks.

June 1990: Vitalink and Xyplex of Boxborough, MA, completed a strategic marketing and technology transfer agreement that includes provisions for a reseller relationship. Xyplex, a communications server provider, is sharing technologies with Vitalink to create fully interoperable multivendor remote bridges. Xyplex is designing a new line of remote bridges that will interoperate with Vitalink's bridges and bridge/routers. Vitalink is assisting to ensure complete compatibility. In addition, Xyplexresells Vitalink's family of TransLAN bridges and TransPATH bridge/routers. The products retain the Vitalink label, but Xyplex provides installation and support.

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and X.25. Both Vitalink and cisco are planning CMIP support. Vitalink continues to do battle with cisco by stressing its bridge and router features and refusing to get drawn into a protocol numbers game. The company's refusal to support Apollo Domain and Chaosnet underscores this point. The key words for Vitalink are "widely used" protocols.

Although Vitalink reduced prices on its TransRING products and TransLAN 320 in 1989, and lowered prices on TransLAN III and TransLAN 350 in May 1990, the company claims that the price reductions did not occur as a counterattack to 3Com's announcement of a remote bridge/router supporting two T1s at only $8,000. Vitalink does not disclaim the importance price plays in the competitive environment but maintains that reliability and service are more important considerations than price. Vitalink keeps a careful eye on

July 1990: Vitalink announced agreements with Samsung Electronics and I3P International Limited for distribution of all Vitalink's products in Korea and Hong Kong, respectively. As part of the agreement, Vitalink provides Samsung and I3P with sales and technical support services, including customer education. Samsung Electronics develops and builds computer networks in Korea. A wholly owned subsidiary of U.S.-based General Logistics International, I3P International designs and builds global, value-added networks, primarily in Hong Kong's transportation and financial industries. I3P integrates its specialized software systems with Digital Equipment Corp. and Sun Microsystems platforms.

Financials

For the third quarter, which ended June 30, 1990, net sales amounted to $15.8 million, compared to $15.7 million for the same quarter a year ago. Net income and income from continuous operations for the third quarter of fiscal 1990 were $2.4 million, or $0.17 per share, compared to $3.3 million, or $0.28 per share, from continuing operations for the same period in fiscal 1989.

For the nine months ended June 30, 1990, the company increased its sales 31 percent over the same period in 1989, from $40.1 million to $52.7 million. Net income from continuing operations increased 34 percent over the same period, from $8.3 million to $11.2 million.

In 1989, Vitalink enjoyed a very good year. Net sales increased to $57.2 million, which represented an increase of 53 percent over net sales of $37.4 percent recorded in 1988. The company earned $12.6 million or $1.01 per share from continuing operations, compared with income from continuing operations of $6.7 million or 66 cents per share in fiscal 1988, and maintained gross margins for the year of 67 percent.

International Operations

Vitalink's international operations are based in Gouda, The Netherlands, and Windsor, England. In the North Pacific, the company maintains a site in Hong Kong and in the South Pacific, in Sydney, Australia. Vitalink's products are in more than 28 countries.

Company Milestones

1984

Entered into agreement with Digital Equipment Corp., leading to the development of the first remote bridge

Introduced the first self-learning remote bridge supporting Ethernet LAN standard

1985

Expanded the relationship with Digital to include joint marketing argreement

1986

Made the decision to focus exclusively on data communications

Introduced first T1 LAN interconnection product, TransLAN III

Digital and Vitalink introduced and proposed Spanning Tree Protocol as IEEE 802.1 standard

1988

Introduced first high-end remote bridge for T1 links

Introduced first self-learning remote bridge for token-ring LAN

Made initial public offering

Introduced WANmanager network management system

Entered into a cooperative marketing agreement that allowed Digital to directly market Ethernet LAN bridges

1989

Entered midrange Ethernet remote bridge market with TransLAN 320

Entered the midrange token-ring remote bridge market with TransRING 530

Received U.S. patent on Distributed Load Sharing

Opened European office in the Netherlands

Made secondary public offering

Introduced TransPATH router family

Sold 10,000 bridge and welcomed 1,000th customer

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price/performance and listens to its customers, however, and will adjust prices when necessary to gain market share.

In addition to price monitoring, Vitalink intends to increase its market share in the internetworking arena by aggressive marketing, ongoing development of its relationship with Digital Equipment Corp., and additional worldwide sales. Although Vitalink only recently established a base in Europe in the Netherlands, the company has gotten in under the wire to take advantage of the major economic changes that will occur on the continent in 1992.

Recent TransPATH enhancements position Vitalink strongly in the internetworking market. The enhancements empower TransPATH with both bridge and mutliprotocol router capabilities. Since users who build large multivendor networks require bridge and router internetworking technologies, they can do one-stop shopping by configuring TransPATH as a bridge *and* a router.

Decision Points

Size is no object for potential users of Vitalink products. The company's bridges, routers, and bridges/routers support networks in two locations, as well as networks in hundreds of locations. The principal features common to the product line include self-learning configuration, automatic path optimization, and automatic recovery from network link failures.

In the decision-making process for buying equipment, customers are far more interested in what the products can do for them than in a razzle-dazzle list of product features promoted by vendors. Vitalink stresses product benefits to users. TransLAN and TransRING, for example, advance network efficiency by ensuring that no bandwidth is wasted. The products also keep superfluous traffic from crossing WAN links and enhance security. Vitalink can also customize the products to support additional WAN bandwidth during peak traffic conditions.

Table 2. TransRING Specifications

	TransRING 530	TransRING 550
Serial Line Interface	1 to 4 ports Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card	1 to 8 ports Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card or DS-1 card
Link Speed Support	9.6K bps-64K bps	9.6K bps-2.048M bps
Performance		
Forwarding Rate	Limited only by available bandwidth (WAN to WAN and LAN to LAN)	1,200 frames/second (LAN to LAN) 5,000 frames/second (WAN to WAN)
Filtering Rate	20,000 frames/second	20,000 frames/second
Aggregate Bandwidth	4 ports: 4 x 64K bps	1 port: T1/E1 2 ports: T1/E1 3 ports: 3 x T1* 4-8 ports: Aggregate 4.096M bps
Physical Dimensions		
Inches	5.2H x 17.5W x 23.5D	5.2H x 17.5W x 23.5D
Centimeters	13.2H x 44.5W x 59.7D	13.2H x 44.5W x 59.7D
Weight	32 lbs., 14.5Kg	32 lbs., 14.5Kg
LAN Interfaces (1 port)	IBM Token-Ring or IEEE 802.5 (4M bps Token-Ring)	IBM Token-Ring or IEEE 802.5 (4M bps Token-Ring)
Mounting Options	Rack, cabinet or tabletop	Rack, cabinet or tabletop
Operating Environment	Temperature: 5° to 40°C. Humidity: 10 to 90% with condensation	Temperature: 5° to 40°C. Humidity: 10 to 90% with condensation
Network Management	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)
Hardware	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diganostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diganostic Modem (Optional)
Power Requirements	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum

**Requires Turbo UIC or V.35 card plus v10.4 software.*

To address the most difficult problem of all—managing the network—Vitalink incorporates network management capabilities into its products by enabling diagnostics and configuration to occur locally at an attached terminal or remotely through a modem. Vitalink's WANmanager also performs network management through the integrated Vitalink Management Program (VMP), which delivers realtime statistics on stations and nodes.

TransPATH's unique duality—functioning as a standalone bridge or a standalone router or bridging and routing simultaneously—presents an attractive package to users. The product selects the best paths between bridges and routers and automatically chooses an alternative data path when a link failure occurs. TransPATH also supports peer-to-peer communications over an array of network architectures.

With VX335, users receive a low-priced LAN interconnect system that can perform as an entry-level TransPATH remote Ethernet bridge/router or as a midrange TransLAN remote Ethernet bridge. Customers can upgrade TransPATH software to Vitalink's new multiprotocol 11.2 software release to route IPX and XNS, as well as TCP/IP.

Characteristics

Number Installed: Over 13,000 internetworking systems worldwide.

Architecture

Vitalink developed a network architecture based on IEEE 802 standards to allow computers and devices from different vendors to communicate over long distances via a common backbone. Vitalink's 802 wide area network (WAN) architecture provides a common pathway through which data can travel at high speeds across multivendor equipment platforms. Designed to satisfy the demands of peer-to-peer computing, the 802 WAN architecture can concurrently move high-speed and low-speed data transfers and dynamically forward frames to a variety of locations quickly. Vitalink designed the WAN 802 as an open architecture to ensure compatibility with future equipment.

The 802 WAN operates with data framed in compliance with networking standards developed by the IEEE. The 802 standards are based on "global addressing," an approach that ensures that every device manufactured carries a unique identifying address. In each 802 frame, a source address and a destination address identify the origin of the packet and its destination. Since every device on an 802-based network has a

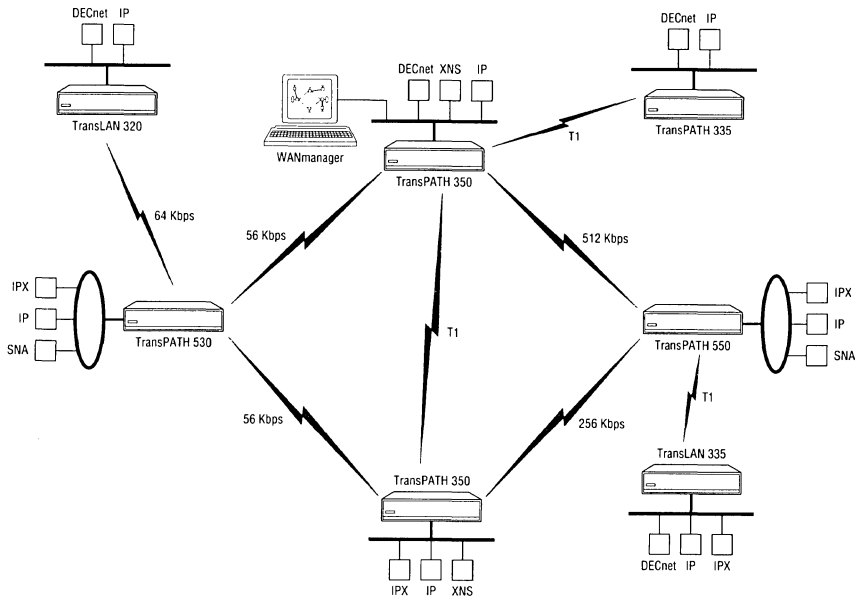


Figure 1.
TransPATH Overview

unique address, a network forwarding function guarantees that each data packet reaches its destination. All 802 standards, including token bus, token-ring, and Ethernet, follow this method of packaging data and addressing it. Although the addressing scheme for all 802 standards remains constant, the media access and transmission media can differ.

The 802 WAN transmits data packets over distances via various physical media, line speeds, and paths. Vitalink constructed the 802 WAN with equipment that performs several functions, such as the transparent extension of a local area network to a distant local area network, connecting data to a format that can be carried

Table 3. TransPATH Specifications

	TransPATH 335	TransPATH 350	TransPATH 530	TransPATH 550
Serial Line Interface	2 ports CCITT V.35	1 to 8 ports Universal Interface Card: Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card or DS-1 card	1 to 4 ports Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card	1 to 8 ports Universal Interface Card: V.35, V.36/V.10, V.36/V.11, RS449/RS422, RS449/RS423, X.21, RS232, V.24/V.28 or CCITT V.35 card or DS-1 card
Link Speed Support	9.6K bps-2.048M bps	9.6K bps-2.048M bps	9.6K bps-64K bps	9.6K bps-2.048M bps
Performance				
Filtering Rate	14,880 frames/second	14,880 frames/second	20,000 frames/second	20,000 frames/second
Forwarding Rate	2,900 frames/second	2,900 frames/second	Limited only by available bandwidth	At least 3,000 frames/second
Forwarding Rate/Bridging	5,000 to 7,000 frames/second*	5,000 to 7,000 frames/second*		1,200 frames/sec (LAN to LAN) 5,000 frames/sec (WAN to WAN)
Aggregate Bandwidth	2 ports: 2 x T1/E1	1 port: T1/E1 2 ports: 2 x T1/E1 3 ports: 3 x T1* 4-8 ports: Aggregate 4.096M bps	4 ports: 4 x 64K bps	1 port: T1/E1 2 ports: 2 x T1/E1 3 ports: 3 x T1* 4-8 ports: Aggregate 4.096M bps
Physical Dimensions				
Inches	3.5H x 17.2W x 22.75D	5.2H x 17.5W x 23.5D	5.2H x 17.5W x 23.5D	5.2H x 17.5W x 23.5D
Centimeters	8.9H x 43.7W x 57.8D	13.4H x 44.5W x 59.7D	13.4H x 44.5W x 59.7D	13.4H x 44.5W x 59.7D
Weight	16.5 lbs., 7.5Kg	32 lbs., 14.5Kg	32 lbs., 14.5Kg	32 lbs., 14.5Kg
LAN Interfaces (1 port)	Ethernet Version 2.0 or IEEE 802.3	Ethernet Version 2.0 or IEEE 802.3	Token-Ring or IEEE 802.5	Token-Ring or IEEE 802.5
Mounting Options	Rack, cabinet or tabletop	Rack, cabinet or tabletop	Rack, cabinet or tabletop	Rack, cabinet or tabletop
Operating Environment	Temperature: 5° to 40°C Humidity: 10 to 90% without condensation	Temperature: 5° to 40°C Humidity: 10 to 90% without condensation	Temperature: 5° to 40°C Humidity: 10 to 90% without condensation	Temperature: 5° to 40°C Humidity: 10 to 90% without condensation
Network Management	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)	Vitalink Management Program (included) WANmanager (Optional)
Hardware	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)	Vitalink Network Processor with dual internal floppy drives Operator Terminal (Optional) Diagnostic Modem (Optional)
Power Requirements	100-130 V AC or 200-260 V AC 47-63 Hz 150 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum	100-130 V AC or 200-260 V AC 47-63 Hz 200 Watts maximum

**Requires Turbo UIC or V.35 card.*

by the wide area network links, and managing and analyzing the operation of both the local and wide area networks.

For users, the principal benefits of the WAN 802 architecture are transparency, protocol independence, high throughput, automatic configuration features, alternate transmission path management, maintenance of data integrity, traffic filtering and priority, dial-up capability, and automated network management.

Multicast Storm Isolation

Vitalink has incorporated a multicast storm isolation feature into its bridges and routers. This software release prevents multicast storms on one LAN from degrading the performance of an enterprise-wide, bridged network. A multicast storm occurs when malfunctioning computers create an abnormally high level of multicast messages on a LAN. This software release allows Vitalink products to be configured with a multicast traffic ceiling that stills the storm and promotes WAN reliability. When multicast traffic attains a preestablished ceiling, the device stops forwarding the multicast traffic to the network. This software release also features the capability to segment the network into separate, bridged domains; concurrent support for IEEE 802.1 Spanning Tree Protocol and Digital Equipment Corp.'s version of Spanning Tree Protocol; additional filtering capabilities; improved user interface; and generation of detailed traffic statistics.

Products

TransLAN bridges are protocol-transparent remote bridges that extend multiple Ethernets or IEEE 802.3 LANs into integrated, wide area networks based on the 802.3 standard. TransLAN III and TransLAN 350 make multiple Ethernets function as one. Since the token-ring LAN has emerged as an alternative to Ethernet in the IBM environment, Vitalink announced the TransRING products. In July 1989, Vitalink released TransPATH, a family of LAN interconnect products that incorporates a TCP/IP router and the capabilities of Vitalink's bridges.

The features shared by the TransLAN and TransRING products are Spanning Tree Protocol, T1 service, Distributed Load Sharing, advanced network management capability, link speeds ranging from 9.6K bps to 2.048M bps, automatic adaptive learning of network configuration, protocol transparency, and end-to-end data integrity.

Distributed Load Sharing. Vitalink's patented Distributed Load Sharing (DLS) feature enables a bridge to offer the path control functions of a router with the protocol transparency of a data link-layer bridge. Vitalink products that provide DLS capability with protocol transparency are referred to as "routing bridges" because they combine the functionality and transparency of ordinary bridges with the benefits and path control of routers. With routing bridges, DLS surpasses the automation provided by Vitalink's earlier products. The network not only learns the location of all resources but also automatically determines the network topology and optimizes the path between resources, as well as automatically recovers from network failures. DLS works with Spanning Tree Protocol (STP), jointly developed by Digital Equipment Corp. and Vitalink.

Advanced Network Management. Through this feature, users can assign class-of-service priorities to types of traffic and assign routes for load distribution. The class-of-service forwarding option allows different transmission priorities to be assigned to frames on the same physical link or multiple links. For example, users can assign interactive traffic priority over batch traffic or confer priority on a set of devices over another set. A "next available link" assignment automatically balances traffic between two nodes with multiple links. The products also provide comprehensive node, LAN, link, and network statistics for traffic measurement, network planning, and fault isolation.

Automatic Adaptive Learning of Network Configuration. This feature facilitates installation and supports automatic reconfiguration to accommodate the addition or removal of devices.

Protocol Transparency. TransLAN 320, TransLAN 350, and TransLAN III are transparent to higher level protocols, such as TCP/IP, DECnet, LAT, and XNS.

End-to-End Data Integrity. To accomplish end-to-end data integrity, Vitalink bridges retain the packet checksum capability (information used on the LAN for transmission error detection) across the network.

TransLAN Family

For additional specifications on TransLAN, see Table 1.

TransLAN 320. Vitalink designed TransLAN 320 for the small office. It supports two links operating at speeds up to 64K bps and can form a simple two-bridge network or a daisychained network with multiple bridges. It can support single-link, parallel-link, or dual-homed link configurations. TransLAN 320 can also serve as a feeder to TransLAN III or TransLAN 350 bridges in a large network. It has a filtering rate of 14,880 frames per second.

TransLAN 320 can function with all Vitalink and other 802 WAN products and with all Digital LAN bridges.

TransLAN III. TransLAN III is Vitalink's midrange bridge that functions as part of a star configuration or as part of a major data backbone. It supports up to eight 64K bps data links or one T1 link. TransLAN III also connects directly to a T1 CSU and does not require a separate DSU. It has a forwarding rate of 2,000 to 2,400 frames per second and a filtering rate of 14,880 frames per second. TransLAN III works with all Digital LAN bridges and with all Vitalink and other 802 WAN products.

TransLAN 350. TransLAN 350 is the most powerful member of Vitalink's routing bridges. It supports three T1 links and operates over telephone lines, broadband cable, fiber optics, microwave, and satellite. TransLAN 350 has a forwarding rate of 5,000 to 7,000 frames per second and a filtering rate of 14,880 frames per second. It works with all Vitalink and other 802 WAN

products and with all Digital LAN bridges. Vitalink offers a Tempest version of TransLAN 350.

TransRING Family

For additional specifications on TransRING products, see Table 2.

TransRING 530. Vitalink designed TransRING 530 for the small office. The product supports one to four links of up to 64K bps and can form a simple, two-bridge network or a complex network with multiple bridges. It can also serve as a feeder to TransRING 550 bridges in a larger network. It supports up to four links, operating at speeds up to 64K bps and single-link, parallel-link, or mesh configurations. TransRING bridges filter 20,000 token-ring frames per second. The product works with all Vitalink and other 802 WAN products.

TransRING 550. This bridge supports three T1 links or up to eight lower speed links. The 550 can operate over telephone lines, broadband cable, fiber optics, microwave, and satellite. It connects directly to the T1 channel service unit (CSU) and requires no separate data service units (DSUs). Vitalink offers a Tempest version of TransRING 550.

TransPATH Family

For additional specifications of TransPATH products, see Table 3.

The TransPATH product line consists of a family of LAN interconnect products that perform TCP/IP, XNS, and IPX routing and incorporate the capabilities of Vitalink's bridges. TransPATH enables users to build networks capable of linking an almost unlimited number of remote sites into a single computer network. The TransPATH products for interconnecting token-ring and Ethernet LANs are TransPATH 335, TransPATH 350, TransPATH 530, and TransPATH 550. TransPATH can interoperate with the many Vitalink and Digital Equipment bridges in use throughout the world. TransPATH 350 can support three T1 lines. Vitalink offers Tempest versions of TransPATH 350 and TransPATH 550.

The 11.2 software release enables TransPATH users to add routing capabilities for Xerox and Ungermann-Bass versions of XNS, as well as Novell IPX protocol suites. New bridge and router forwarders incorporated into the 11.2 release enable TransPATH to function as a standalone router for TCP/IP, XNS, or IPX. Users can also configure TransPATH to operate as a MAC layer bridge to transparently bridge TCP/IP, XNS, or IPX. Through the addition of Exterior Gateway Protocol (EGP) to the TCP/IP protocol suite, Vitalink enables TransPATH users to communicate between autonomous systems. TransPATH also supports IBM source routing, socket-level traffic control, an X.25 interface, Management Information Base II (MIB II), and SNMP. Vitalink plans to add DECnet, GOSIP, and OSI routing capabilities in 1991.

In July 1990, Vitalink added Digital Equipment Corp.'s DECnet Phase IV support to the TransPATH family. As a result of a Vitalink/Digital Technology Exchange Agreement, Digital gave Vitalink Phase IV routing code and dcoumentation. Digital also supplies network management code and technical support to assist Vitalink in the development and implementation of a Phase IV router. In exchange, Vitalink's TransPATH Phase IV bridge/router will enhance Digital's current routing capabilities. Vitalink will offer a migration path that starts with a full implementation of DECnet Phase IV and ends with a full implementation of DECnet Phase V/OSI.

VX335 Bridge and Bridge/Router Platform

Vitalink offers the VX335, introduced in August 1990, as an entry-level TransPATH remote Ethernet bridge/router or a midrange TransLAN remote Ethernet bridge. The VX335 can operate as a bridge/router with the TransPATH 11.1.4 software release or as a bridge with the TransLAN 10.3.4 software release. This new platform features one Ethernet port and two CCITT V.35 serial ports and supports a bandwidth of two T1/E1 lines. Customers using VX335 can upgrade their TransPATH software to Vitalink's new multiprotocol 11.2 software release. This upgrade enables users to route IPX and XNS, as well as TCP/IP.

Vitalink's Internetwork Access Module (VIAM)

In July 1990, Vitalink demonstrated its first implementation of an access module for Digital Equipment Corp.'s DECmcc at DECworld. VIAM complies with Digital's Enterprise Management Architecture (EMA) and manages Vitalink's LAN internetworking products. An original member of the DECmcc Strategic Vendor Program, Vitalink has been actively involved in the development of DECmcc network management tools in the area of effective management of third-party non-Digital devices.

Phase 1 of VIAM provides status and statistical information about Vitalink's LAN internetworking products, including Ethernet and token-ring bridges and routers. Vitalink will release Phase 1 concurrently with the release of DECmcc v1.1 in 1991. Phase 2, also scheduled for 1991, will support the SET command, which allows a DECmcc operator to configure and directly control Vitalink LAN internetworking products from graphical and terminal-based DECmcc interfaces.

WANmanager

WANmanager manages the IEEE 802 wide area network. By exploiting the network visibility in TransLAN bridges, the WANmanager presents a complete picture of the network configuration and status. A problem on the network immediately appears by LAN and by link. The system identifies the following: bridges that are busy, congested, or disabled; primary and DLS links; and broken data links. Vitalink offers WANmanager as a turnkey system consisting of WANmanager Application ULTRIX operating system, Version 2.2, and a Digital VAXstation equipped with a minimum of 6M bytes of memory, 154M-byte disk drive, 19-inch color display, 95M-byte tape drive, and mouse.

The graphical interface automatically learns and displays network topology in a simple color diagram, which can be reconfigured to reflect users' needs. Multiple windows enable users to view network status and manage operations. In addition, users have simultaneous access to multiple Vitalink Management Services (VMS) sessions through individual windows. They can view different ports on the same or different bridges to conduct comparative traffic analyses.

By viewing realtime network parameters in graphic format, users can observe what is occurring at a specific bridge or link and detect problems without going through a time-consuming analysis of strings of characters. In addition to acquiring statistics from TransLAN bridges, WANmanager can gather data from Digital LAN Bridge 100s and Chipcom EtherModem III bridges. The point-and-shoot connection feature allows users to connect to any bridge on the map via the mouse and pull-down menus to access Vitalink Management Services information from any port.

In February 1990, Vitalink introduced a software release for WANmanager, which includes a historical database that assists users in determining usage trends on their networks. Through the use of an SQL relational database engine, WANmanager captures network performance parameters, such as traffic and the frequency of network errors occurring on LAN segments or WAN facilities. Graphic and tabular reports represent current and previous network activity.

Additional features incorporated into WANmanager from this software release include an SNMP client; expansion of node performance monitoring; capability to print system graphics to a laser printer; and an enhanced user interface. The SNMP client allows a user to monitor the MIB in TransPATH routers. The graphical user interface is DECwindows compatible.

Pricing and Support

Vitalink provides 24-hour customer support through its Network Operations Center, which is staffed with technicians who can respond to questions about Vitalink's products and carrier services. Technicians can connect to a customer's network from the Network Operations Center to search for and diagnose problems and suggest corrective measures. Vitalink also offers on-site service, which includes a high-priority option of guaranteed six-hour door-to-door response.

Equipment Prices

	Purchase Price ($)
TransLAN 350 with 64KB serial links	17,250
TransLAN III with software	14,250
WANmanager software	10,000
VX335 as a TransPATH 335 bridge/ router	13,500
VX335 as a TransLAN 335 bridge	12,750

■

Walker Richer & Quinn Reflection Series

In this report:

Product Summary

Editor's Note

Since our last report, Walker Richer & Quinn's Reflection Series has advanced communications between desktop and host computers beyond terminal emulation with new peripheral products that provide network links and electronic mail access. This report examines the features, functionality, and pricing of the Reflection Series and the company's competitive position in the marketplace.

Description

Reflection Series products integrate PCs and Macintosh computers into the Digital Equipment, Hewlett-Packard (HP), and UNIX data processing environments through terminal emulation software, network links, and electronic mail and messaging software.

Strengths

Reflection offers the broadest integration of the PC and Macintosh in Digital Equipment, HP, and UNIX data processing environments. Reflection Series has the widest selection of HP terminal software that is recognized for its functionality—lucid applications, common user interface, LAN support, and multiple-session access—and its user popularity.

Limitations

No significant limitations found.

Competition

Futuresoft Engineering, Pacer Software, Persoft, Polygon, Tymlabs, White Pine Software.

Vendor

Walker Richer & Quinn, Inc.
2815 Eastlake Avenue E.
Seattle, WA 98102
(206) 324-0350
In Canada:
Birket Foster
M.B. Foster
50 Water Street
Chesterville, ON K0C 1H0
(613) 448-2333

Price

Reflection Series products range from $199 for Reflection 2 to $399 for Reflection 7 Plus.

GSA Schedule

No. Some Walker Richer & Quinn distributors, however, are on the GSA schedule.

—By Donna Horsley
Staff Writer

Analysis

Product Strategy

Six years ago, Walker Richer & Quinn (WRQ) saw the need for HP terminal emulation in the marketplace and pioneered Reflection 1 software. Today, WRQ dominates the HP terminal emulation market with Reflection 1 and has a firm foundation in the Digital platform with Reflection Series. Reflection products can also be configured to look like a Tektronics terminal

Terminal emulation, however, is no longer WRQ's sole business. The company has expanded the Reflection Series to include support for Microsoft Windows; multivendor network connectivity for an HP 3000, VAX, or UNIX host over Ethernet; and electronic mail and messaging software for HP and Digital.

WRQ's new peripheral products in Digital, HP, and UNIX markets are part of the company's strategy to deliver a single-vendor solution for desktop-to-host communications.

"While we recognize the value of LANs, we also know that the powerful applications that companies need to conduct their business are host based. We're offering a way for PC users to get at those host-based applications and still be able to take advantage of the services that a LAN provides," stated George Hubman, WRQ vice president of sales and marketing, in *The Sun Observer* (November 1990).

Since Reflection Series' inception in 1985, 430,000 copies of Reflection products have been delivered. WRQ earned $26.3 million last year and expects 1991 revenue to increase more than 25 percent with its new network software and data communications products.

Reflection Product Line

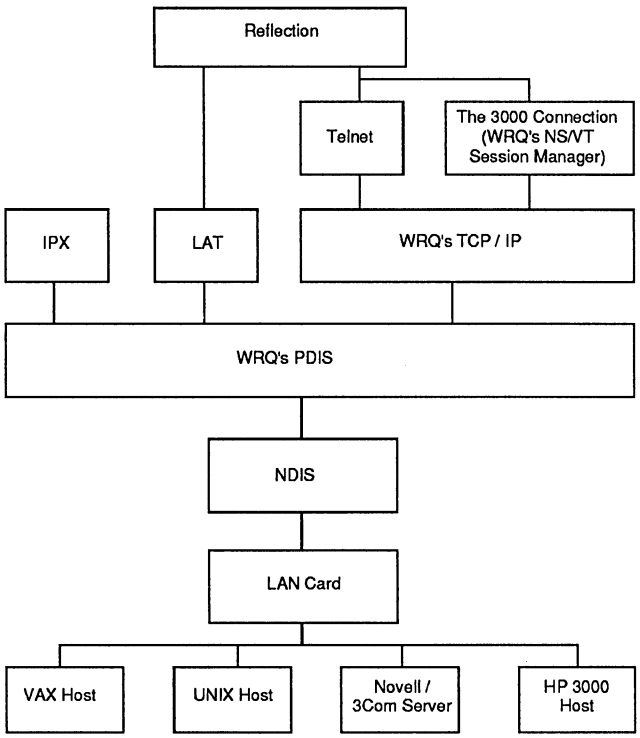
The Reflection Series offers various routes in desktop-to-host integration—terminal emulation, network links, and electronic mail.

Reflection Series Software

Installed on a PC or Macintosh, Reflection Series software products access information on Digital, HP, and UNIX minicomputers. The software, which is the foundation for the Reflection product line, supports communications capabilities, file transfer, and a script language. It is menu or command driven and has automatic installation programs, a common user interface, and on-line help facilities. It is also available in Plus versions that provide backup and restore features and terminal emulation and file transfer over LANs and WANs such as Novell, 3Com, and Ungermann-Bass.

Reflection Series software comprises eight Hewlett-Packard and Digital terminal emulation products: ***Reflection 1 for Windows***, ***Reflection 1 for MS-DOS*** (with available Plus version), ***Reflection 2***

Figure 1.
The 3000 Connection



The 3000 Connection gives a PC with a single network interface the capability to communicate with a wide range of hosts—HP, VAX, UNIX—and a Novell or 3Com server. A user can maintain an NS/VT terminal session with simultaneous access to PC networks and other hosts that use the TCP/IP and LAT protocols. The 3000 Connection is the solution for users who need access to HP's Network Services in addition to TC/IP, LAT, and/or PC servers.

Table 1. Reflection Network Series

	LAT Connection	Telnet Connection	TCP Connection	3000 Connection
Supported Hosts:	Any Digital VAX running VMS with an Ethernet card installed; any terminal server supporting the LAT protocol	Sun or Apollo UNIX; HP 9000s running HPUX; HP 3000s running Wollongong's Telnet; VAX hosts running ULTRIX; Unisys, Prime, and Cray hosts running Telnet; IBM mainframe hosts with special gateways	All of the hosts supported by the LAT and Telnet Connections	Any HP 3000 or 9000 with a network card and running HP Network Services; all of the hosts supported by the LAT and Telnet Connections
PC Requirements: Hardware—	IBM PC, XT, AT, PS/2, or compatible with a supported Ethernet card	IBM PC, XT, AT, PS/2, or compatible with a supported Ethernet card	IBM PC, XT, AT, PS/2, or compatible with a supported Ethernet card	IBM PC, XT, AT, PS/2, or compatible with a supported Ethernet card
Software—	Reflection 1 Plus, 2, 2 Plus, 4, 4 Plus, or 7 Plus for MS-DOS Version 3.1 or higher or any Reflection for MS-DOS product Version 4.1 or higher	Any Reflection Plus for MS-DOS product Version 4.0 or any Reflection for MS-DOS product Version 4.1 or higher, Reflection 1 for Windows	Any Reflection Plus for MS-DOS product Version 4.0 or any Reflection for MS-DOS product Version 4.1 or higher	Reflection 1 or Reflection 7 for MS-DOS Version 4.1 or higher, Reflection 1 for Windows
Supported Third-Party Vendors: Network Cards—	Racal-InterLan: NI5210, NI9210	Driver support is not included	Racal-InterLan: NI5210, NI9210	Racal-InterLan: NI5210, NI9210
	3Com: 3C501, 3C503, 3C505, 3C523		3Com: 3C501, 3C503, 3C505, 3C523	3Com: 3C501, 3C503, 3C505, 3C523
	Western Digital: 8003,8013		Western Digital: 8003,8013	Western Digital: 8003,8013
	Xircom Pocket Adapter Card		Xircom Pocket Adapter Card	Xircom Pocket Adapter Card
	Any card for which there is an NDIS driver		Any card for which there is an NDIS driver	Any card for which there is an NDIS driver
TCP/IP Stacks—	—	PC-NFS; LAN Workplace for DOS; WIN/TCP PathWay; Fusion; PC/TCP; TCP with Demand Protocol Architecture; ARPA Services for MS-DOS; TCP Gateway for Novell NetWare; BWNFS	TCP Connection supplies its own TCP/IP stack	3000 Connection supplies its own TCP/IP stack
Memory Requirement without Card Driver (bytes):	27K	Memory requirement varies depending on third-party TCP/IP installed; minimum is 55K	LAT-27K Telnet-55K TCP/IP-30K	LAT-27K Telnet-55K TCP/IP-30K NS/VT-20K (for two sessions)
Minimum Memory Requirement for Card Driver (bytes):	6K	—	6K	6K
Commands:	The command interpreters in all of the Reflection Network Series products allow the user to show sessions, connect, disconnect, switch to a different terminal session, reactivate a specified session, or display help on any given command.			

for MS-DOS (with available Plus version), ***Reflection 4 for MS-DOS*** (with available Plus version), ***Reflection 7 for MS-DOS*** (with available Plus version), ***Reflection 1 Plus for Macintosh***, ***Reflection 2 Plus for Macintosh***, and ***Reflection 3 Plus for Macintosh***.

Reflection Network Series

Reflection Network Series, which began shipping in February, connects PCs to HP 3000, VAX, and UNIX-based host computers while providing concurrent access to Novell and NDIS-compliant

LANs. Without rebooting, users can switch sessions on various hosts; gateways or additional hardware is not required.

Installed with Reflection, Reflection Network Series comprises four products: ***LAT Connection***, ***Telnet Connection***, ***TCP Connection***, and ***3000 Connection***.

Reflection Office Connection Series

Reflection Office Connection Series contains electronic mail and messaging software for HP and Digital products. It offers communication and document transfer over local or worldwide electronic mail systems. It comprises five software products: ***PostHaste***, ***DeskDirect***, ***DIRECT-TO-1***, ***MailMessenger***, and ***Reflection's Spooled Virtual Printer (RSVP)***.

Other Walker Richer & Quinn Products

WRQ client/server software provides tools for developers designing client/server applications. Such software allows PC-based programs to do remote procedure calls and to off-load data manipulation to the PC that would otherwise be performed on the HP 3000 or Digital, thus freeing host computer resources. WRQ client/server software comprises two products: ***Process-to-Process Link (PPL)*** and ***PPL Toolkit***.

Competitive Position

WRQ dominates the market for HP terminal emulation and has a strong foundation in Digital and Tektronix platforms. Its new networking software and data communications products make WRQ the first among its competitors to provide broad-range integration of the PC and Macintosh in Digital, HP, and UNIX data processing environments.

In HP terminal emulation, WRQ competes with a small number of vendors. Other than Hewlett-Packard, which has HP terminal emulation offerings, Tymlabs, of Austin, TX, offers some competition.

"There really just isn't a major account that uses anything but Reflection for HP emulation," according to WRQ's Hubman.

In Digital terminal emulation, WRQ is a strong competitor in a market with an increasing number of vendors. WRQ 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. (WRQ is currently developing VT terminal emulation for Windows 3.0.)

In HP and Digital terminal emulation, WRQ, Persoft, and Polygon products all support menu-driven interfaces, on-line help, and pop-up windows.

Some WRQ competitors have entered the Data General terminal emulation market. WRQ has opted instead to provide more extensive PC and Macintosh integration of the Digital, HP, and UNIX data processing environments with its new networking software and data communications product line. The company also continues to fine-tune and expand the capabilities of its existing Reflection Series products.

Decision Points

Ease of Use

Reflection Series' success lies in its functionality—lucid applications, common user interface, LAN support, and multiple-session access.

Reflection products provide on-line help features and menus that are easy to access and understand. They support a same user interface that allows PC and Macintosh users within the same company to easily move from one system to another for host access. Users can upgrade the IBM PC-based products from a Reflection Series package to include Plus functionality—backup files to the host and LAN support. It also provides users with as many as eight multiple sessions and the ability to suspend, resume, or switch between those sessions.

Reflection Network Series allows efficient access to host-based applications and to the service of a LAN. With one network interface card for the PC, Reflection Series software users can run a variety of networking protocols concurrently while maintaining simultaneous access to Novell, 3Com, and any other NDIS-compilant LAN. In addition, users need not reboot when moving from a terminal session to a network application.

Comprehensive Product Line

WRQ has emerged as a top player in desktop-to-host integration with Reflection Series. The product line covers both major minicomputer platforms—the VAX and HP 3000—and both major PC platforms—the IBM PC and Apple Macintosh. Supplementing the Reflection Series are recently introduced peripheral products providing network links and electronic mail access in HP and UNIX markets.

WRQ is the only vendor providing terminal emulation for MS DOS, Macintosh, and Windows 3.0 with design programming and support done at a single location.

Digital Review, which recognizes excellence in Digital-compatible products, presented WRQ in January with the 1990 Target Award for Best PC-to-VAX Connectivity for Reflection 4. Reflection 2 Plus for the Macintosh was also nominated for a Target Award in the Mac-to-VAX category but was edged out by Digital Equipment Corp.'s Pathworks.

Company Profile

WRQ was established in 1981 as a consulting firm customizing applications for Hewlett-Packard HP 3000 minicomputers. Early in the partnership, however, WRQ's four founders, Doug Walker, Marty Quinn, Mike Richer, and George Hubman, decided to refocus the company's mission when Quinn designed a software package allowing a client's PC to perform the function of an HP terminal. The popularity of that first software package—PC 2622—convinced WRQ of the need for HP terminal emulation in the computer industry.

PC 2622 was later enhanced and reintroduced in 1985 as Reflection 1. Today, Reflection 1 remains WRQ's best-selling product.

Within the last year, WRQ has introduced complementary products to Reflection Series software. With network links and electronic mail and messaging software, WRQ hopes to expand Reflection Series beyond terminal emulation.

Targeting *Fortune* 1000 companies, Reflection Series is the cornerstone of WRQ's business, with annual sales increasing from $5 million in 1986 to $26.3 million in 1990. WRQ has been named in *Inc.* magazine's list of the fastest-growing, privately held companies each year since 1986. The company has received many honors, including the ICP Million Dollar Award from 1987 to 1989 and the *Digital Review* Target Award for excellence in Digital-compatible products in 1989 and 1990.

Reflection Series products sell well in the manufacturing and computer businesses. The company has sold its products to approximately 20,000 end-user companies, including Boeing, McDonnell Douglas, Dupont, Corning Glass, and Proctor & Gamble.

In the international arena, WRQ provides its products and services worldwide to approximately 50 countries. In 1989, WRQ opened a European office in Den Haag, Netherlands in anticipation of increased international profits, particularly in Europe, where WRQ does most of its international business. Twenty-five percent of WRQ sales are in the international market.

Characteristics

Models: Reflection 1, Reflection 7, Reflection 1 for Windows 3.0, Reflection 1 Plus, Reflection 3 Plus, Reflection 2, Reflection 4, Reflection 2 Plus, LAT Connection, Telnet Connection, TCP Connection, 3000 Connection, PostHaste, Mail Messenger, DeskDirect, DIRECT-TO-1, RSVP.

Date Announced: Information not available.

Date Installed: Information not available.

Number Installed: WRQ has installed approximately 300,000 packages in the Hewlett-Packard terminal emulation market and approximately 200,000 packages in the Digital terminal emulation market.

Distribution: WRQ sells its products directly or through preferred dealers, value-added remarketers (VARs), and via OEM agreements with hardware vendors. The company sells its products domestically and internationally.

Models

Individual products in the Reflection Series and their general specifications are as follows.

Reflection 1: A software product allowing a PC to emulate HP 2392 and VT 102 text terminals to connect to HP 1000, 3000, and 9000 minicomputers; Digital VAXes; IBM mainframes; public data networks; mail systems; information services; and UNIX systems. Emulated terminals include HP 700/94, 2394A, 2642B, 700/92, 2622A, and 2626A and Digital VT220, VT220x, VT100, VT100ac, and VT100p.

Reflection 1 supports network connections and direct and modem communications. ASCII and binary files can be transferred using the Kermit, xmodem, and CRC-CCITT error-checking protocols. It supports 100 to 115.2K bps transfer rates and eight serial ports. Features include horizontal scrolling to column 9999 and a keyboard or typeahead buffer that allows the user to type commands while waiting for a host response.

Reflection 1 can be installed on any IBM PC/XT/AT, PS/2, or compatibles. A minimum of 256K bytes of memory and DOS Version 2.0 or later are required. It supports 132-column display adapters and addresses up to 64K bytes of memory to Lotus/Intel/Microsoft (LIM) expanded memory. A variety of popular networks is supported, including HP AdvanceNet; Ungermann-Bass Net/One; AT&T's Starlan Network; Novell networks with NACS; 3Com networks supported by EtherTerm, TokenTerm, PCS/SNS, and PCS1; and Walker Richer & Quinn 3000 Connection.

Reflection 7: A software product allowing an IBM PC with an enhanced graphics display and an EGA or VGA card to communicate with HP 1000, 3000, and 9000 computers; Digital hosts; IBM mainframes; public data networks; and UNIX systems via the HP 2627 color graphics terminal and HP 2623A, HP 2392A, and VT102 terminal emulation. HP terminal emulation includes HP 2397A, 2627A, 2393A, 700/94, 2394A, 2642B, 700/92, 2622A, and 150A; Digital terminal emulation includes VT220, VT220x, VT102, VT100av, and VT100p.

Reflection 7 supports network connections and direct and modem communications. ASCII and binary files can be transferred using the Kermit, xmodem, and FTP protocols. It supports transfer rates of 110 to 115.2K bps, eight serial ports, 64K bytes of LIM, dual graphics, and an alphanumeric display.

Reflection 7 is installed on any IBM PC/AT/XT, PS/2, or compatibles. It uses a minimum of 384K bytes of memory and runs on systems that have DOS Version 2.0 or later installed. The product supports a mouse and 132-column display adapters. A variety of popular networks is supported, including HP AdvanceNet; Ungermann-Bass Net/One; AT&T Network; Novell networks with NACS; 3 Com networks supported by EtherTerm, TokenTerm, PCS/SNS, and PCS; and Walker Richer & Quinn 3000 Connection.

Reflection 2: A software product allows a PC to communicate with Digital VAX/VMS and UNIX systems via Digital VT320, VT220, VT102, and VT52 terminal emulation. It supports network connections and direct and modem communications. ASCII and binary files can be transferred using the Kermit, xmodem, and FTP protocols. It supports up to eight serial ports and 110 to 115.2K bps transfer rates. Features supported include scrolling to 132 columns; double-high, double-wide characters; soft keys; and a line modify mode. A record of any session scrolls into the product's display memory and can be edited at a later time.

Reflection 2 is installed in any IBM PC/XT/AT, PS/2, or compatibles, using a minimum of 145K bytes of RAM for text emulation. It requires at least 256K bytes of RAM for graphics emulation. It can use up to 64K bytes of expanded memory and runs on systems that have DOS Version 2.0 or later installed. The product supports a variety of 132-column adapters.

Network support includes HP AdvanceNet; Ungermann-Bass Net/One; AT&T Starlan Network; Novell networks with NACS; 3Com networks supported by EtherTerm, TokenTerm, PCS/XNS, and PCS1; and Walker Richer & Quinn Telnet Connection and TCP Connection.

Reflection 4: A software product allowing a PC to communicate with Digital VAX/VMS and UNIX systems via Digital VT340 and VT330 graphics terminal emulation or VT241, VT240, VT220, VT102, VT52, and Tektronix 4010/4014 terminal emulation. It supports network connections and direct and modem communications. ASCII, binary, and Image files can be transferred using the Kermit, xmodem, and FTP protocols. It also supports up to eight serial ports, depending on the hardware used. Files are transferred at rates from 110 to 115.2K bps. Features supported include scrolling to 132 columns; double-high, double-wide characters; soft keys; and a line modify mode.

Reflection 4 is installed in IBM PC/XT/AT, PS/2, or compatibles, using a minimum of 145K bytes of RAM for text emulation. It requires 256K bytes of RAM for graphics emulation. It uses a maximum of 64K bytes of expanded memory and a minimum of 384K bytes of memory. It supports a variety of 132-column adapters running on systems that have DOS Version 2.0 or later installed.

A variety of popular networks is supported, including HP AdvanceNet; Ungermann-Bass Net/One; AT&T Starlan Network; Novell networks with NACS; 3Com networks supported by EtherTerm, TokenTerm, PCS/XNS, and PCS1; and Walker Richer & Quinn Telnet Connection and TCP Connection.

Reflection 1 PLUS: A software product allowing a Macintosh to communicate with an HP 3000 host computer via HP 2392A alphanumeric terminal emulation while maintaining the functionality of the Mac. It supports X.25, direct, and modem connections. Reflection 1 Plus, using the Kermit and xmodem protocols, transfers ASCII, binary, and MacBinary files at rates of 300 to

57.6K bps. Supporting both serial ports, Reflection 1 features include a typeahead buffer, unlimited configurations, and multitasking through MultiFinder.

Reflection 1 Plus can be installed on Macintosh 512, 512E, Plus, SE, SE/30, II, IIx, IIcx, and IIci computers.

Reflection 3 Plus: A software product allowing Macintosh 512, 512E, Plus, SE, SE/30, II Series, or Portable communication with HP 1000, 3000, and 9000 host computers; Digital VAX minicomputers; other Macs; and IBM PCs via HP 2393A monochrome graphics and VT102 text terminal emulation. Using Kermit and xmodem protocols, it transfers ASCII, binary, and MacBinary files at rates from 300 to 57.6K bps. Product features include dual graphics, an alphanumeric display, a typeahead buffer, and multitasking through MultiFinder.

Reflection 2 Plus: A software product allowing VT320, VT220, VT102, and VT52 terminal emulation for the Macintosh 512E, Plus, SE, SE/30, II Series, or Portable. Using Kermit and xmodem protocols, it supports rates from 300 to 57.6K bps. Product features include multitasking through MultiFinder, dual graphics, and an alphanumeric display.

Reflection 1 For Windows: A software product allowing a PC to emulate HP 2392A to connect to HP 1000, 3000, and 9000 minicomputers. It supports network connections and direct and modem communications. Using Kermit and xmodem protocols, it transfers ASCII, binary, or label files.

Reflection 1 For Windows is installed on any IBM PC/XT/AT, PS/2, or compatibles. It requires a minimum of 256K bytes of memory and Microsoft Windows 3.0 and DOS 3.1. It supports up to 80-column display adapters and popular networks, including HP LAN Manager and OfficeShare, Ungermann-Bass Net/One, 3Com LAN Manager, Novell networks with NACS, and WRQ's Telnet Connection and 3000 Connection.

LAT Connection: A software product supporting any Digital VAX running VMS with an Ethernet card installed and any terminal server supporting the LAT protocol. It requires IBM PC/XT/AT, PS/2, or compatibles with a supported Ethernet card, as well as Reflection 1 Plus, 2, 2 Plus, 4, 4 Plus, or 7 Plus for MS-DOS Version 3.1 or higher. Supported third-party vendors include Racal-InterLan NI5210, NI9210; 3Com 3C501, 3C503, 3C505, 3C523; Western Digital 8003, 8013; Xircom Pocket Adapter Card; and any card for which there is an NDIS driver. LAT Connection requires 27K memory without card driver; 6K minimum memory for card driver.

Telnet Connection: A software product supporting Sun or Apollo UNIX; HP 9000s running HP-UX; HP 3000s running Wollongong's Telnet; VAX hosts running ULTRIX; Unisys, Prime, and Cray hosts running Telnet; and IBM mainframe hosts with special gateways. It requires an IBM PC, XT, AT, PS/2, or compatible with a supported Ethernet card, as well as any Reflection Plus for MS-DOS product Version 4.0 (or any Reflection for MS-DOS product Version 4.1 or higher) and Reflection 1 for Windows. Supported TCP/IP Stacks include PC-NFS; LAN Workplace for DOS; WIN/TCP Pathway; Fusion; PC/TCP; TCP with Demand Protocol Architecture; ARPA Services for MS/DPS; TCP Gateway for Novell NetWare; and BWNFS. The memory requirement varies depending on the third-party TCP/IP installed; the minimum requirement is 55K bytes.

TCP Connection: A software product supporting all the hosts supported by the LAT and Telnet Connections. It requires IBM PC/XT/AT, PS/2, or compatibles with a supported Ethernet card, as well as any Reflection Plus for MS-DOS product Version 4.0 or any Reflection for MS-DOS product Version 4.1 or higher. Third-party vendors supported include Racal-InterLan NI5210, NI9210; 3Com 3C501, 3C503, 3C505, 3C523; Western Digital 8003, 8013; Xircom Pocket Adapter Card; and any card for which there is an NDIS driver. TCP Connection supplies its own TCP/IP stack and requires LAT-27K, Telnet-55K, and TCP/IP-30K memory without a card driver and 6K-byte minimum memory for a card driver.

3000 Connection: A software product supporting any HP 3000 or 9000 with a network card and running HP Network Services and all of the hosts supported by the LAT and Telnet Connections. It requires IBM PC/XT/AT, PS/2, or compatibles with a supported Ethernet card; Reflection 1 or Reflection 7 for MS-DOS Version 4.1 or higher; and Reflection 1 for Windows. Supported third-party vendors include Racal-InterLan NI5210, NI9210; 3Com 3C501, 3C503, 3C505, and 3C523; Western Digital 8003 and 8013; Xircom Pocket Adapter Card; and any card for which there is an NDIS driver. 3000 Connection uses its own TCP/IP stack and requires LAT-27K, Telnet-55K, TCP/IP-30K, and NS/VT-20K (for two sessions) and 6K-byte minimum memory for a card driver.

PostHaste: An electronic mail product for the HP 3000 requiring HP 3000 MPE V; Series 39-58, 925, 925LX; Series 6x-70, 935; or Series 950 or 955. It supports terminals, PCs, and Macintosh computers with direct, modem, or network connection to the HP 3000.

DeskDirect: A file transfer utility supporting HP LaserJet, ANSI printers, or any HP PCL printer. Host requirement include HP 3000, MPE or MPE XL, HP DeskManager IV, 30 sectors of disk space, and PCLINK (included with Reflection). PC requirements include IBM PC/XT/AT, PS/2, Vectra, or compatible and Reflection 1 or Reflection 7 for MS-DOS Version 2.0 or higher. Macintosh requirements include 512E, Plus, SE, SE/30, II Series, or Portable and Reflection 1 Plus or Reflection 3 Plus for the Macintosh Version 3.2 or higher. Host requirements include HP 3000, MPE or MPE XL, HP DeskManager IV, 30 sectors of disk space, and PCLINK (included with Reflection).

DIRECT-TO-1: A PC and Macintosh file transfer to ALL-IN-1 over ASCII, binary, Image, MacBinary, WordPerfect, DECdx, and WPS-PLUS. Host requirements include Digital VAX, ALL-IN-1, Version 2.3 or higher, and VAXLINK.EXE or VAXLINK2.EXE upload to the VAX (included with Reflection). PC requirements include an IBM PC/XT/AT, PS/2, or compatible and Reflection Version 3.4 or higher. Macintosh requirements include Macintosh 512E, Plus, SE, SE/30, II Series, or Portable Reflection 2 Plus for the Macintosh Version 3.4 or higher.

Mail Messenger: A message router to HP mail systems using a star network with HP 3000 and attached PC server at the hub. It requires an HP 3000 hub and nodes with MPE V or higher and either PostHaste Version 2.0 or higher or HP DeskManager Version B.00.00 or higher. It also requires IBM PC/XT/AT, PS/2, or compatibles; MS-DOS Version 3.0 or higher; 512K bytes of RAM; a hard drive; two serial ports; a modem; and RS-232 or LAN connection to the hub.

RSVP (Reflection's Spooled Virtual Printer): A printer sharing utility requiring an HP 3000 with MPE or MPE XL and Reflections PCLINK2 or Digital VAX with VMS and Reflection VAXLINK2 host. The PC requirement includes IBM PC/XT/AT, PS/2, or compatibles; DOS 2.1 or higher; a hard disk; and Reflection PC product Version 4.0 or higher. RSVP's buffer size includes 4K, 8K, 16K, 32K, and 64K bytes.

Support

Telephone Support: WRQ telephone support is available to registered users without charge 7 a.m. to 5 p.m. Pacific Standard Time at (206) 325-4357. WRQ bulletin board service at (206) 322-8047 is an alternative to the technical support department.

User Magazine: *WRQuartely* is a quarterly magazine for WRQ registered users. It contains product update information, new product announcements, and technical advice.

Warranty: All products come with a 60-day money-back warranty and a 90-day warranty allowing customers to receive upgrades without charge.

Maintenance: There is a $100 charge to upgrade to a new version (beyond 90 days). The cost to upgrade to the next (different) product is the difference in price between the two , plus a $100 upgrade charge.

Equipment Prices

	Purchase Price ($)
Reflection 1 for MS-DOS	299
Reflection 1 for MS-DOS with Plus	369
Reflection 7 for MS-DOS	399
Reflection 7 for MS-DOS with Plus	469
Reflection 1 for Windows 3.0	399
Reflection 1 Plus for the Macintosh	299
Reflection 3 Plus for the Macintosh	399
Reflection 2 for MS-DOS	199
Reflection 2 for MS-DOS with Plus	269
Reflection 4 for MS-DOS	299
Reflection 4 for MS-DOS with Plus	369
Reflection 2 Plus for the Macintosh	249
PostHaste	5,000-17,500
Mail Messenger	5,000
DeskDirect	99
DIRECT-TO-1	2,500
RSVP	99
LAT Connection	99
Telnet Connection	99
TCP Connection	199
3000 Connection	299

■

Wellfleet Communications Internetworking Products

In this report:

Product Summary

Editor's Note
This report contains new information on Wellfleet's routing support for Novell's Integrated Packet Exchange Protocol (IPX), Xerox Network Systems' Internet Transport Protocol (XNS), and Apple Computer's AppleTalk Phase 2. The report also covers Wellfleet's support of token-ring, FDDI, and source routing.

Description
Wellfleet produces a modular family of standards-based internetworking products, offering a high-performance platform that delivers up to 180,000 packets per second. The Wellfleet Feeder Node (FN), Link Node (LN), and Concentrator Node (CN) address the needs of small-, medium-, and large-sized networks. Multiprotocol router and bridge services, combined within a single Wellfleet node or on a single LAN interface, produce heterogeneous LAN connectivity. Wellfleet's products provide multivendor connectivity for LAN-to-LAN and LAN-to-WAN applications. Protocols supported include TCP/IP, DECnet, XNS, IPX, AppleTalk, Spanning Tree Bridge, and Source Routing.

Strengths
The multiprocessor architecture that forms the basis of the products supports networks of various sizes and configurations. The products handle LAN and WAN applications and support a variety of protocols. The multiprocessor design offers consistent high performance, no matter how many protocols or links are supported.

Limitations
Since Wellfleet supports FDDI, which is still an emerging standard, the company might have to make adjustments when FDDI is approved.

Competition
cisco Systems

Vendor
Wellfleet Communications
15 Crosby Drive
Bedford, MA 01730
(617) 275-2400

Price
$1,000 to $14,000.

GSA Schedule
No.

Analysis

Product Strategy

The Wellfleet product line accommodates LAN-to-LAN and LAN-to-WAN connections with multiprotocol internetwork routing and bridging. Wellfleet markets multiprotocol routing and bridging products that interconnect LANs within a facility, campus, or wide area over token-ring, Ethernet, or FDDI. The basic family consists of Feeder Node (FN), Concentrator Node (CN), and Link Node (LN) servers; LAN Services Software Modules; and Intelligent Link Interfaces. The products support multiple local and wide area network interfaces. Management features include integrated voice and data transmission, Simple Network Management Protocol (SNMP) network management support, in-band and dial local and remote diagnostics, a single point of control for managing the network, automatic reconfiguration with alternate routing and load balancing, and power supply redundancy with the CN server.

The FN, LN, and CN servers interconnect LANs via direct connections across WAN facilities or within a facility across high-speed local area backbone networks. The CN supports large networks with direct attachment of up to 26 LAN links, 52 WAN links, or a mixture of both. The LN, for small- to medium-sized networks, can function as a remote node interconnected with other Wellfleet nodes. LN supports direct attachment of up to 8 LAN links, 16 WAN links, or a mix. FN supports up to two Ethernet and two WAN interfaces. The Intelligent Link Interface modules fit into slots in the CN and/or LN. These interfaces serve as the points for physical and electrical interconnection with the local and wide area networks.

Wellfleet's software architecture supports router and learning bridge services on all interfaces. The software options include Spanning Tree Learning Bridge, Source Route Bridging, and routers for TCP/IP, DECnet Phase IV, XNS, AppleTalk Phase 2, and IPX.

Wellfleet also provides WAN interfaces that permit direct attachment to advanced T1 digital services, such as fractional T1. The FN, LN, and CN attach directly to T1 circuits. The products also support connections to public or private X.25 packet-switching networks. Interfacing to wide area circuits and to wide area multiplexing, switching, and transmission devices occurs through D4 frame and format-compatible T1 interfaces, or through RS-232-C, V.35, or RS-449/422 synchronous interfaces.

Wellfleet supports the Simple Network Management Protocol (SNMP). The SNMP Network Management Software (SNMP-NMS) features diagnostic, fault management, and performance management capabilities. It offers a view into internetworks comprised of Wellfleet nodes running router and/or bridging services.

Competitive Position

Many industry analysts believe that the market for LAN interconnectivity devices will reach almost $1.5 billion by 1995. Taking note of this potential bonanza, LAN vendors have been hastily entering the internetworking side of the business. Wellfleet holds a lead over the new entrants, some of which are highly experienced companies, by having carved out an internetworking niche since 1986. In this young market, Wellfleet quickly made its mark by releasing products that pioneered concurrent bridging and routing.

Holding on to a slippery market is challenging, but Wellfleet looks set for the long haul. Last year, the company's original investors displayed a vote of confidence by signing on again, this time for $6 million, to help the company maintain and enhance its position as sales grow and push it forward—not an unhappy situation to be in.

To strengthen its position in the internetworking market, Wellfleet set its sights on LAN/WAN integration. Its principal competitor, cisco, however, has done the same. Wellfleet seems to enjoy a seesaw competitive relationship with cisco. In the area of protocols, cisco supports a few more than Wellfleet, but not enough to cause buyers to tip their decisions to cisco. Wellfleet's products have operated over a variety of transmission media, and in the past, cisco's have not. This year, ▶

Company Profile
Wellfleet Communications

Corporate Headquarters
15 Crosby Drive
Bedford, MA 01730
(617) 275-2400

Officers
President: Paul Severino
Senior Vice President, Operations: Lou Piazza
Vice President, Marketing and Sales: Gary Bowen
Vice President, Manufacturing: Phillip Rackley
Vice President and Controller: Gregg Savage
Vice President Advanced Engineering: William M. Seifert

Company Background
Year Founded: 1986

Started in 1986, Wellfleet took its name from the site where Marconi made the first transatlantic radio transmission in 1903. Wellfleet's original investors included ABS Ventures of Baltimore, MD; Ampersand Ventures, Boston, MA; Continental Illinois Venture Corp., Chicago, IL; J.H. Whitney & Co., New York, NY; Security Pacific Capital, Los Angeles, CA; and Sigma Partners, San Jose, CA. In November 1989, these original investors, along with Oak Partners of Westport, CT, and Institutional Venture Partners, Menlo Park, CA, participated in a new financing round of $6 million to fund growth and provide working capital to support the large increase in company sales.

The company has entered into OEM agreements with Network Systems Corp., Newbridge Networks, BBN, and Hewlett-Packard. The Newbridge agreement, announced in May 1989, involved technology exchange in which Newbridge Networks marketed under its name Wellfleet's LAN internetwork router/bridges. The companies also agreed to exchange technology.

Wellfleet announced a strategic partnership in February 1989 with Network Systems Corp. of Minneapolis, MN, under which Network Systems markets under its name Wellfleet's line of high performance routers. The Wellfleet routers complement Network Systems' HYPERchannel systems.

Announced in April 1990, the Hewlett-Packard pact called for a nonexclusive OEM and technology agreement for high-performance, multiprotocol routers. Under the agreement, HP can OEM some of Wellfleet's current line of multiprotocol routers and have access to key Wellfleet software technology for future product development. The Wellfleet routers complement HP's EtherTwist PC LANs and other networking products that interconnect LANs to LANs and LANs to WANs.

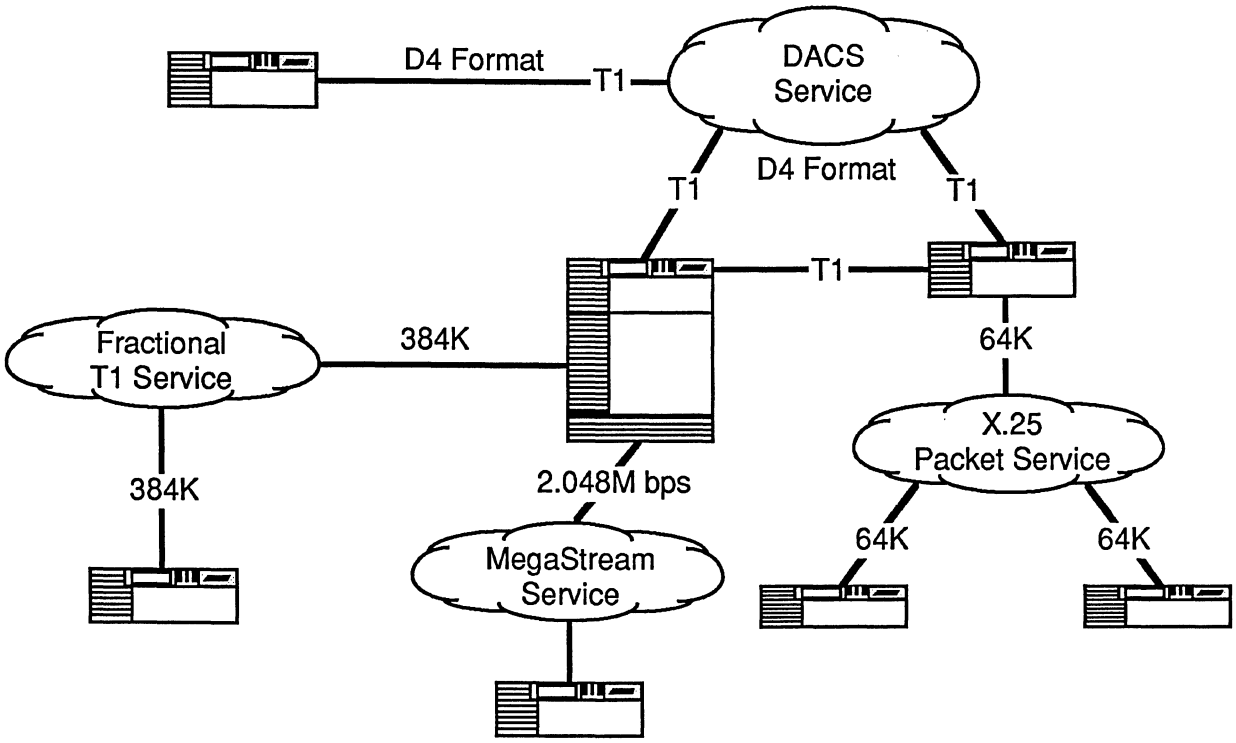
In February 1990, Wellfleet signed an OEM agreement with BBN Communications Corp. of Cambridge, MA, a company that produces private wide-area network solutions based on X.25 switching technology. Under the agreement, BBN Communications resells Wellfleet's Feeder Node, Link Node, and Concentrator Node multiprotocol router/bridges under the name T/200 Integrated Packet Routers (IPRs). The agreement also calls for BBN Communications to resell Wellfleet's SNMP-based Network Management Software (SNMP-NMS).

In July 1990, Wellfleet announced a distribution agreement with Datarange Communications, a U.K. data networking and structured cabling specialist. The agreement calls for Datarange to act as the Wellfleet Master Distributor in the U.K., entitled to sell Wellfleet's Feeder Node, Link Node, and Concentrator Node router/bridges, as well as its SNMP-based network management system.

At DECWORLD '90 in July, Wellfleet announced that it had jointly defined the basis for an SNMP-based Access Module with Digital Equipment Corp. that allows the DECmcc Management Station to manage a network of Wellfleet Feeder Node, Link Node, and Concentrator Node multiprotocol router/bridges. At the same time, Wellfleet announced that it had joined Digital's DECmcc Strategic Vendor Program. Under this program, Wellfleet has provided Digital with the specifications for its SNMP Management Information Base (MIB), which Digital plans to incorporate into the DECmcc Management Station. In addition to supporting the standard SNMP-defined MIB, the DECmcc Wellfleet Access Module supports a set of Wellfleet-defined private enterprise MIB extensions.

Wellfleet has distributors in Australia, Belgium, Canada, France, Germany, Israel, Italy, Japan, Norway, Spain, Switzerland, Taiwan, and the U.K.

Figure 1.
Wellfleet High-Performance Internetworking



Advanced wide area interconnect options.

Courtesy of Wellfleet.

▶ *(Analysis continued)*

however, cisco has corrected that lack and incorporated Ethernet, token-ring, FDDI, and T1 capabilities into its high-end internetwork router.

The real difference between cisco's products and Wellfleet's lies in the product architecture. The multiprocessor design of Wellfleet's products serves as a platform for a variety of internetworking tasks that are performed without loss of quality. Each processor supports routing and bridging software. Each processor has two microprocessors, one a 68030 and the other a 68020. This type of structure delivers consistently high performance, no matter how many devices users add to their networks. The design also supports growth, migration, and emerging OSI standards.

Decision Points

For users who want a vendor on top of the latest developments in internetworking, Wellfleet fills the bill. The company is incorporating Phase V into its DECnet protocol and Phase 2 into AppleTalk. Wellfleet's interface options support the most current technologies: Ethernet, token-ring, FDDI, Framed T1, and Framed E1. Its products travel across all transmission media, and its software implements complex tasks. Wellfleet is definitely a company that delivers solutions and anticipates new ones.

Network management may be a buzzword in some quarters, but it ranks high on users' lists of requirements. Wellfleet puts network management capabilities in the hands of users by equipping each node with the capabilities for local configuration management, statistical measurement, event reporting, and diagnostic control. Users can access these management services in each node via a local console, remote dial, or an IP-host-initiated Telnet session.

Wellfleet designed a peer multiprocessor architecture for its products, which in essence involves interconnecting multiple high-performance processors through a 320M bps VMEbus midplane. The industry-standard VMEbus not only supports

communication among multiple processors, but also clears the way for the addition of FDDI interfaces when the need arises. The multiprocessor design enables each processor to support high-performance bridging, as well as routing to each attached port.

Many vendors are claiming "distributed" capabilities for their products, but in Wellfleet's case, the assertion is valid. Wellfleet has implemented distributed architecture by empowering each processor with the ability to run all the software in the company's protocol repertoire. This distributed architecture does away with the need for a central supervisory processor, thereby eliminating bottlenecks that degrade system performance.

Wellfleet's WAN interfaces enhance the price/performance ratio of adding new sites to networks. The Wellfleet Framed T1/E1 interface enables nodes to be interconnected across economical common carrier services such as fractional T1 and DACS. The Wellfleet CCITT X.25 interface allows traffic to be bridged or routed simultaneously over a single X.25 interface. This simultaneous bridging/routing capability significantly reduces costs because separate X.25 lines are not required to support either bridging or routing.

Characteristics

MODELS: Feeder Node (FN), Link Node (LN), Concentrator Node (CN); LAN Services Software Modules; Intelligent Link Interfaces.

DATE ANNOUNCED: FN—1989; LN and CN—1987; Intelligent Link Interfaces—1987; SNMP software—1989.

Architecture

The Wellfleet product line consists of base units, intelligent link interfaces, and software modules. The systems are based on a 32-bit VME bus architecture that makes use of multiple 68020- or 68030-based microprocessors. The Advanced Communications Engine (ACE) processors are connected through the VMEbus, which provides a high-capacity 320M bps backbone for connecting multiple LANs within a single node. Each processor supports bridging and multiprotocol routing in a symmetric multiprocessor.

The microprocessors perform link control, routing, bridging, and network management functions. The system architecture supports concurrent operation of multiple protocol routing and bridging services for LANs using TCP/IP, DECnet, and other protocols; integrated interfaces for direct connection to multiple LAN/WAN links; voice and data traffic integration over T1 links; and automatic reconfiguration of physical and logical network topologies. The architecture supports the implementation of multisite, high-speed data communications networks; the hardware supports routing functions, while the software removes I/O functions from processing functions.

The base units contain an enclosure, power supply, system controller with serial I/O and disk interface, VME backplane, diskette drive, and front panel. Users access processor modules and the system controller from the front of the enclosure; they access system I/O, network connections, and link interfaces from the rear.

The *system controller* offers the basic functions for VME bus and system operation, such as multimaster bus arbitration, power fail notification, backplane clock generation, and status inquiries on bus cycle error conditions. Global resources activated by the system controller include a clock calendar, global nonvolatile RAM, and a semaphore register.

The *system I/O and disk controller* acts as the controller for the internal 5.25-inch diskette drive and provides four asynchronous ports for communications with external equipment. The disk drive loads system software and stores resource management files.

Wellfleet's board-to-board performance is 14,500 bridged frames per second and 14,500 IP packets per second. Port-to-port performance is 14,500 bridged frames per second and 12,200 IP packets per second. The LN has 4 times this performance, and the CN, 13 times this performance.

Hardware

The Wellfleet product family includes the Feeder Node (FN), Link Node (FN), and Concentrator Node (CN). Each network node includes a Base Unit with one or more Intelligent Link Interface (ILI) Modules. The ILI consists of an ACE (Advanced Communication Engine) processor, functioning as the application processing engine, and a Link Module, providing the physical interfaces to connected local area and wide area networks.

Feeder Node (FN)

The Feeder Node (FN) delivers an interconnection solution for small networks or sites in larger networks that forecast limited growth. The FN card cage supports a single processor slot, allowing a maximum of two LAN

and two WAN interfaces. Wellfleet offers multiple fixed-configuration FN models, each with a different mixture of network interfaces.

Product	Expansion Slots	Number of LAN Links	Number of WAN Links
Feeder Node	1	1-2	1-2
Link Node	4	1-8	1-16
Concentrator Node	13	1-26	1-52

The FN Base Unit includes either 2 megabytes of memory, supporting a fixed software configuration, or 5 megabytes of memory, supporting the full complement of Wellfleet protocols. Each FN Base Unit includes a system controller with a floppy controller/disk drive. Wellfleet offers tabletop or rackmounted units. The single processor Feeder Node supports sustained bridge forwarding rates of 11,700 frames per second.

Link Node

The Link Node (LN) supports small to medium networks and acts as a remote node interconnected to other Wellfleet nodes. The LN comes in tabletop or rackmount configurations with five horizontal front and rear slots. The LN Base Unit includes a system controller with floppy controller/disk drive. The VME bus system controller and the system controller I/O and disk controller module are located in the first slot, front and back, respectively.

The Model 2000 LN Base Unit features an expandable configuration for networks anticipating growth. A maximum of four processor slots support any combination of Intelligent Link Interface modules, accommodating expansion to a maximum of eight LAN and eight WAN interfaces. The Link Node, with up to four processors, supports bridge forwarding rates of over 46,000 frames per second.

Concentrator Node

The Model 3000 CN Base Unit, offered only in a rackmount configuration, accommodates maximum expansion requirements for rapidly growing networks or large central hub sites. Equipped with 13 processor slots for adding ILIs, the CN supports a maximum of 26 LAN and 26 WAN interfaces. The CN's aggregate packet forwarding performance exceeds 180,000 packets per second. Wellfleet offers optional dual redundant power supplies for the CN.

Intelligent Link Interface (ILI) Modules

The ILIs are the expansion modules that supply increased performance and connectivity to the nodes in the Wellfleet product line. An Intelligent Link Interface contains an ACE processor module that works with a Link module. Interface modules are as follows:

- Dual Port Ethernet/802.3—provides two independent 10M bps interfaces that conform to IEEE 802.3 and Ethernet specifications.
- Dual Port T1 Framer/Multiplexer—offers two AT&T-compatible, 1.544M bps DS-1 channels that support the DSX-1 standard.
- Dual Port T1 Framer/Multiplexer with Channel Service Unit—electrical and physical interface to T1 provided by the CSU; provides the electrical and physical interface to the T1 circuit; performs line conditioning and signal regeneration.
- Quad Port Synchronous V.35/RS-449/422/423—offers four full-duplex synchronous bit streams through 15-pin connectors configured as V.35 or RS-449/422 interfaces. Each port sends and receives full-duplex data and operates at 2.048M bps.
- Ethernet/Dual Port Synchronous V.35/RS-449/422/423—offers a single Ethernet/802.3 port and two full-duplex high-speed synchronous ports; both synchronous ports operate at over 2.048M bps.
- Dual Ethernet and Dual Synchronous V.35/RS-449/422/RS-232-C—offers two independent Ethernet/IEEE 802.3 10M bps interfaces and two full-duplex synchronous bit streams through 15-pin connectors configured as RS-232, V.35, or RS-449/422 interfaces.
- IEEE 802.5 Token Ring—supports 802.2 Logical Link Control layer with the IEEE 802.2 Type 1 protocol and 802.5 Media Access Control (MAC) Token Passing Protocol.
- FDDI ILI—provides a Class A Dual Attachment to a dual, counter-rotating 100M bps FDDI ring; supports ANSI X.3T9.5-specified Physical Medium Dependent (PMD), Physical Protocol (PHY), and Media Access Control (MAC) standards.

The processor module, Advanced Communications Engine (ACE), operates with a link interface module and serves as the central processing element of the Wellfleet architecture. The ACE supports the operating environment, which includes DECnet routing, XNS routing, IPX, AppleTalk, and TCP/IP router learning bridge, as well as X.25 support. The engine contains two Motorola 68020 microprocessors, a full internal 32-bit data path, 1 megabyte of local memory for Wellfleet applications, and 1 megabyte of global memory. Users can expand the two memories up to 4 megabytes each for an 8-megabyte capacity per processor module. Wellfleet offers ACE processors in two models: 5110 (68020-based) and 5120 (68030-based). Users can upgrade from the 5110 to the 5120. Software image compatibility enables both models to operate in the same Wellfleet node.

Wellfleet 802.5 Token Ring Product

Users can integrate token-ring into their Wellfleet nodes by adding *Token Ring Intelligent Link Interface* (ILI) modules, which support 4M bps and 16M bps operation. The token-ring product features multiprotocol routing

for connectivity across mixed token-ring, Ethernet, and FDDI networks. Wellfleet markets the following token-ring products:

- 4705 Token Ring ILI
- 4710 Dual Port Token Ring ILI
- 4720 Token Ring/Single Sync ILI
- 4740 Token Ring/Dual Sync ILI
- 1205 Feeder Node—Dual Token Ring
- 1215 Feeder Node—Token Ring/Single Sync
- 1216 Feeder Node—Token Ring/Dual Sync

Based on the Texas Instruments 380C16 chip set, the Token Ring ILI supports a maximum frame size of 4,500 bytes for 4M bps and 16M bps operation. The ILI supports fragmentation and reassembly for routing TCP/IP traffic between token-ring and Ethernet networks that accommodate different frame sizes.

Wellfleet FDDI Intelligent Link Interface (ILI)
Wellfleet's FDDI interface operates over ANSI-specified 62.5 micron multimode fiber, which restricts the distance between two stations to 2 kilometers. The interface also supports the defined maximum frame size of 4,500 octets. Its single MAC layer enables the two physical connections to the dual FDDI ring to share a single MAC address, thereby allowing the secondary ring automatically to back up the primary ring.

Network Interface Options

Interface	Support
Ethernet	10M bps interface for IEEE 802.3 and Version 1.0/2.0 Ethernet frame format
Token Ring	IEEE 802.5 interface, with 802.2 Type 1 LLC support
FDDI	FDDI interface, supporting Class A Dual Attachment to an FDDI ring at 100M bps; supports a single MAC layer
Synchronous	Interface supporting V.35, RS-449/RS-422 Balanced, RS-232, X.21 interfaces
Framed T1	1.544M bps DSX-1 interface supporting D4 Framing for access to Fractional T1 and DACS
Framed E1	Interface providing a 2.048M bps G.703 physical interface with G.704 Framing and G.732 signaling

Bridge Service

IEEE 802.1 Spanning Tree Learning Bridge
This standards-based bridge service sustains forwarding rates of over 14,500 frames per second for achieving LAN-to-LAN and LAN-to-WAN connectivity. Based on the IEEE 802.1 Transparent Spanning Tree algorithm, the bridge handles advanced traffic management and ensures security with packet filters that forward or drop packets based on source address, destination address, multicast or broadcast address, and protocol type. The Circuit Group feature accommodates load sharing across multiple physical links between two Wellfleet nodes.

Multiprotocol Routing Services

The Feeder Node, Link Node, and Concentrator Node support the full range of protocols offered by Wellfleet.

TCP/IP Router
Wellfleet's implementation of TCP/IP features packet forwarding rates that exceed 12,600 packets per second. The company supports the industry-standard Routing Information Protocol (RIP) and Exterior Gateway Protocol (EGP). The TCP/IP router also supports Extended RIP (ERIP), designed by Wellfleet to address the industry-recognized limits of RIP for very large networks. Wellfleet's extensions assign circuit costs and increase network diameter to improve communication line usage in large mixed-speed, multimedia environments. Wellfleet implements these extensions in conformance with the RIP norm.

Wellfleet supports next-generation routing protocols, particularly Open Shortest Path First (OSPF), which supplements RIP protocols on the host. Devised for very large networks, OSPF supports routing on backbones and reduces network overhead. OSPF is a standards-based, multivendor protocol that features the Link State Shortest Path First technique.

The TCP/IP router features configurable support for Ethernet Type Fields, IEEE 802.2-defined Link Service Access Points (LSAPs), and IEEE 802.2-defined Sub Network Access Point (SNAP) protocol for transmission over Ethernet and token-ring.

DECnet Router
DECnet routing technology is a component of Digital Equipment Corp.'s Digital Network Architecture (DNA). DECnet establishes a hierarchical network architecture based on the concept of administratively defined "areas." Each network can support a maximum of 63 areas, with each area supporting up to 1,023 end nodes or hosts.

Wellfleet's DECnet Router conforms with the DECnet Phase IV specification and supports Level 1 Intra-Area and Level 2 Inter-Area Routers. It supports configurable circuit costs for improved performance in mixed-speed, mixed-media environments. DECnet Router also features a configurable "Hello" timer to reduce protocol overhead in large networks. Users can access Wellfleet node-resident DECnet routing tables through a local console or via a TCP/IP host-initiated Telnet session to any node in the network.

In May 1990, Wellfleet announced support for Digital's DECnet Phase V routing service. By implementing

DECnet Phase V, Wellfleet offers users a single high-performance internetworking platform that assists users in migrating to an emerging universal networking standard. Wellfleet is offering its user base a migration path from DECnet Phase IV to Phase V.

XNS Router

Xerox Network Systems originally designed XNS for integrated office applications. Compatible with the Xerox Grey Book standard, the Wellfleet XNS Router supports XNS Level 1 Internet Datagram Protocol (IDP) and XNS Level 2 Echo, Error, and Routing Information Protocol (RIP). In addition to the dynamic routing provided by RIP, the Wellfleet XNS Router supports operator-defined static routes. It also supports configurable costs for RIP, which enables weighting of network routes to be based on circuit delay or capacity characteristics. Users can access node-resident XNS routing tables through local consoles or via TCP/IP host-initiated Telnet sessions to any node in the network.

IPX Router

Wellfleet's IPX Router supports the Novell-defined Internet Packet Exchange (IPX) Protocol, Echo Protocol, Error Protocol, and Routing Information Protocol (RIP). It supports dynamic routing through RIP while also supporting static route definition under operator control. IPX Router also supports configurable circuit costs for RIP, with routing table access accomplished through local consoles or an IP host-initiated Telnet session to any node in the network. For operation over Ethernet and token-ring networks, the router supports Ethernet framing and Novell proprietary frame-level encapsulation. IPX Router supports Service Advertising Protocol (SAP).

AppleTalk Phase 2 Router

The AppleTalk Phase 2 Router supports Datagram Delivery Protocol (DDP), Routing Table Maintenance Protocol (RTMP), Name Binding Protocol (NBP), AppleTalk Echo Protocol (AEP), Zone Information Protocol (ZIP), and AppleTalk Address Resolution Protocol (AARP). For EtherTalk and TokenTalk networks, AppleTalk Router supports 802.2 Logical Link Control protocol, Sub Network Access Point (SNAP).

X.25 Interface

Wellfleet's Framed T1/E1 interface enables nodes to be interconnected across common carrier services such as fractional T1 and DACS. The X.25 interface option allows interconnection across public or private X.25 backbone networks, providing simultaneous support for router and bridge traffic across a single X.25 interface. Synchronous serial lines, operating at up to 6M bps, provide dedicated connections between Wellfleet nodes.

The X.25 interface operates as a logical DTE, supporting Switched Virtual Circuit (SVC) and Permanent Virtual Circuit (PVC)-like service. The SVC service enables TCP/IP hosts on a Wellfleet node to access TCP/IP hosts directly connected to an X.25 network, using standard X.121 addressing. SVC also supports DDN IP hosts and the DDN addressing algorithm. To ensure maximum connectivity in large networks, up to 256 simultaneous virtual circuits are supported on a single X.25 interface.

Frame Relay, the new WAN interface from the ISDN world, interconnects LAN traffic across backbones in T1 and packet-switching applications. To provide an interface optimized for LAN interconnect applications, Wellfleet is committed to Frame Relay support.

Software Architecture

Wellfleet software provides the means for concurrent operation of router and learning bridge services on one or many interconnected LANs. It supports learning bridge and multiple protocol routing functions, as well as resource and system management functions. Each ACE contains a copy of all software. The software architecture accommodates various system configurations, ranging from low-end, two-link systems to high-end multiple-link, multiple concurrent routers. Each LAN supports bridge and router services.

Software

SNMP-NMS Software

SNMP-NMS monitors the systems and provides a window into domestic or international internetworks of Wellfleet nodes running routing and/or bridging services, LANs, and WANs. SNMP-NMS supports bridge-only networks, single router networks, or networks with a combination of bridges and routers. The software runs on Sun-3/50 and Sun-3/60 workstations with Sun OS 3.5 or 4.0 and the X Window System (V11, Release 2 or 3). SNMP-NMS manages and controls networks based on any or all of the following protocols: DECnet, XNS, MAC-Layer Learning Bridge, IPX, AppleTalk, and X.25. SNMP-NMS also manages wide area network circuits and true T1 circuits.

Features of SNMP-NMS include graphical interface; icon-based user interface; information-retrieval commands; audible and visible alarms; tools to isolate network faults; archival storage; and realtime monitoring of network routers/bridges, end-stations, and LAN/WAN connections. The system also provides graphical representations of network topology and performance data and allows remote access to routers/bridges and end-stations. SNMP-NMS complies with the Simple Network Management Protocol (SNMP) standard defined in Internet RFCs 1065, 1066, and 1067.

The SNMP-NMS' Network (Master) Log file and individual Node (Local) Log file windows open to show the network status of a particular node. Graphical meter

displays show realtime node performance. TCP/Telnet service establishes remote access and control of any network node. The software performs continuous polling, allowing users at a central location to view a WAN composed of Wellfleet equipment connecting dispersed LANs. In January 1990, Wellfleet announced that SNMP-NMS operates on the Sun Microsystems SPARCstation platform.

Wellfleet provides SNMP support through a private enterprise Management Information Base (MIB), which the company has extended to cover all bridging, routing, and circuit types, including Ethernet, token-ring, FDDI, and wide area circuits. The company has started integrating multivendor management information bases, including SynOptics' Wiring Hub and Kinetics FastPath.

Pricing and Support

Customer support includes:

- 24-hour technical assistance for problem reporting and technical support
- Help Desk for configuration support and applications assistance, with on-site technical assistance as needed
- Remote dial-in Diagnostics Center for network problem evaluation and diagnosis
- Software Subscription Service for latest software releases and technical documentation
- Comprehensive Product Training Program
- Next-business day shipment of spares

Equipment and Software Prices

		Purchase Price ($)
FN Systems		
1000	FN LAN/LAN	8,995
1005	FN 5M-byte LAN/LAN	9,995
1010	FN LAN/WAN 1 x 1	8,995
1015	FN 5M-byte LAN/WAN 1 x 1	9,995
1020	FN LAN/WAN 2 x 2	9,995
1025	FN 5M-byte LAN/WAN 2 x 2	10,995
LN Base Unit		
2000	Consists of enclosure, system controller, quad port system controller I/O module, diskette and disk controller, and 3 software options. LN base unit contains 4 expansion slots.	6,330
CN Base Unit		
3000	CN Base Unit—consists of enclosure, backplane, system controller, quad port system controller I/O module, 5.25″ diskette and disk controller, power supply, operating system software, front panel, and fans; contains 13 expansion slots and 3 additional power supply slots. Rack mountable.	14,000
Intelligent Link Interfaces (ILI)		
4100	Dual Port Ethernet/802.3 ILI	4,000
4200	Dual Port T1 Framer/Multiplexer ILI	7,000
4220	Single Port T1 Framer ILI	4,000
4300	Quad Port Synchronous ILI	7,000
4410	Ethernet/802.3 and Single Port Synchronous ILI	4,500
4420	Ethernet/802.3 and Dual Port Synchronous ILI	7,000
4430	Dual Ethernet/802.3 and Dual Port Synchronous ILI	7,500
4705	Single token ring	5,500
4720	Single token ring/single synchronous	7,000
4740	Single token ring/double synchronous	8,000
Software		
6100	Learning Bridge software	NC
6200	TCP/IP Router software	NC
6300	DECnet Router software	1,000
6400	XNS Router software	1,000
—	AppleTalk software	1,000
—	X.25 software	1,000
Network Management Software (options)		
6800	SNMP Client Software—¼-inch cartridge tape	15,000
6801	SNMP Client Software—½-inch reel-to-reel tape	15,000
6860	SNMP Agent Software	NC

NC—No charge. ■

Wellfleet Communications Internetworking Products

Product Enhancement

Analysis

In April 1991, Wellfleet and Digital Link Corp., a supplier in the T1 and T3 connectivity markets, announced products that enable Wellfleet routers to interface to Switched Multimegabit Data Service (SMDS) networks through Digital Link's data service units/channel service units (DSUs/CSUs). Through the use of Wellfleet's high-performance, multiprotocol routers equipped with Wellfleet's SMDS software and Digital Link's SMDS-compliant DSUs/CSUs, users can link LANs supported by router/bridges over high-speed, switched SMDS lines.

David Yates, senior product manager for wide area networking at Wellfleet, commented, "User demand for SMDS products is beginning to ramp up so Wellfleet and Digital Link have been working together combining their expertise, to bring a product to market as quickly as possible. This will allow Wellfleet and Digital Link users to realize all the benefits of SMDS by running LAN data over high-speed switched services. These include cost savings associated with high-speed switched services relative to leased lines and the ability to communicate with other companies over the public switched network."

—By Barbara Callahan
Associate Editor

Product Descriptions

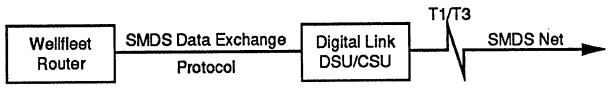
The combined solution offered by Wellfleet and Digital Link involves the division of the SMDS work load. Wellfleet's routers perform high-level protocol processing and transfer the information to Digital Link's intelligent DSUs/CSUs for additional processing and subsequent transmission to the SMDS network.

Critical to the transference of information is *SMDS Data Exchange Interface*, the protocol operating between the Wellfleet routers and Digital Link DSUs/CSUs. Jointly defined by the two companies, the protocol is being promoted as a standard within the SMDS Interest Group, a consortium that includes AT&T, Hewlett-Packard, NCR, and Northern Telecom. In March 1991,

the SMDS Interest Group formed a working committee to review the Wellfleet/Digital Link protocol specification.

SMDS Data Exchange Interface uses High-Level Data Link Control (HDLC) for communications between the Wellfleet router and the Digital Link DSU/CSU. Wellfleet's *SMDS Software* encapsulates LAN packets into SMDS Level 3 Protocol Data Units (L3PDUs), as required by the SMDS specification. By means of the protocol defined with Digital Link, L3PDU data is encapsulated into the HDLC format. Linked to the Wellfleet router over a V.35 interface, the DSU/CSU receives the data; removes the HDLC envelope; and segments the L3PDU packets into L2PDU, the format required for inserting the data onto a T1 or T3 diagram. Figure 1 illustrates this process.

Figure 1.
Wellfleet/Digital Link SMDS Solution



- Wellfleet accepts data from LAN and forms SMDS L3 PDUs.
- Wellfleet transmits to Digital Link using SMDS Data Exchange Protocol.
- Digital Link performs SMDS L2 segmentation and insertion onto SMDS access line.

In its initial implementation, *SMDS Data Exchange Interface* supports T1, but the two companies plan to enhance the interface to support T3 as well. Wellfleet's *SMDS Software* is available on new installations and will be an upgrade to existing Wellfleet routers. ■