Gateway Communications Network Products

In this report:

Product Summary

Editor's Note
Since our last version of this report was published, Gateway Communications has introduced a number of new products, including a line of 10BASE-T-compatible interface cards and hubs under the G/EtherTwist name. The company has discontinued OEM sales of Novell's NetWare network operating system.

Description
Gateway Communications manufactures and markets local area network (LAN) and wide area network (WAN) products, including Ethernet and token-ring network interface cards, hubs, repeaters, and transceivers, as well as gateway and bridge/router devices. Gateway's products are designed for use with IBM and compatible personal computers.

Strengths
Gateway offers a comprehensive line of networking and internetworking solutions. The company's new G/EtherTwist line provides products for the active and growing 10BASE-T market. Gateway provides support for all major network

—By Joseph F. Kelly
Managing Editor

operating systems, including Novell NetWare, Banyan VINES, and Microsoft LAN Manager.

Limitations
Gateway's line of Ethernet products is much more complete than its token-ring line; there is no support for 16M bps token-ring transmission. Its G/Net network, while successful, does not conform to IEEE 802.X specifications.

Competition
Cabletron, David Systems, Proteon, Racal InterLan, Standard Microsystems, 3Com, and several other companies.

Vendor
Gateway Communications, Inc.
2941 Alton Avenue
Irvine, CA 92714
(714) 553-1555
In Canada:
Contact Gateway Communications.

Price
Network interface cards are priced from $250 to $695; gateways and bridge/routers cost from $895 to $4,580.

GSA Schedule
No. (Proposal submitted and under review.)

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Analysis

Product Strategy

Like many companies in the LAN hardware business, Gateway Communications has concentrated recently on expanding its presence in the IEEE 802.3 10BASE-T market. With the user community's widespread acceptance of 10M bps Ethernet transmission over unshielded twisted-pair wire (UTP), virtually every vendor that offers Ethernet products has expanded its line to include 10BASE-T hardware. Gateway's line, called G/EtherTwist, includes network interface cards (NICs), hubs, and transceivers.

Included in Gateway's G/EtherTwist family are two unique members: G/EtherTwist AT Hub Adapter and G/EtherTwist AT Hub Expander. Introduced in April 1991, the G/EtherTwist AT Hub Adapter is an NIC and hub combined on a single card. G/EtherTwist AT Hub Expander increases the number of nodes supported by G/EtherTwist AT Hub Adapter from 5 to 9; up to 13 nodes are supported with a second expander card. According to Gateway's vice president of sales and marketing, Bert R. Ott, "These products are ideal for small networks where the investment in a more expensive, full-size hub is not practical."

Gateway's other LAN hardware product offerings fall under three families: G/Ethernet, G/Token-Ring, and G/Net. G/Ethernet and G/Token-Ring comply with the IEEE 802.3 and 802.5 specifications, respectively. G/Net, Gateway's original product, is a nonstandard LAN that employs a baseband linear bus topology and uses the carrier sense multiple access with collision detection and collision avoidance (CSMA/CD/CA) access method, supporting error detection and correction (EDC).

The company's comprehensive product line also includes LAN-to-LAN bridge/routers and gateways, LAN-to-WAN gateways, LAN-to-host gateways, and PC-to-LAN gateways. Gateway has offered X.25, SNA, and async gateways and

bridges since 1985. G/Remote Bridge was the first NetWare-based product that allowed any type of Advanced NetWare LAN to be connected to any other kind of Advanced NetWare LAN, regardless of the topology or hardware.

In late 1990, Gateway announced that it would discontinue OEM sales of Novell's NetWare network operating system software and would sharpen its focus on providing connectivity products. Previously, Gateway had packaged versions of NetWare with its own hardware and sold these packages as starter kits. At the announcement, Ott explained, "We will continue to support NetWare and participate in Novell's Independent Manufacturer's Support Program, so that we can remain compatible with NetWare and address the market in the future. In addition, we have been aggressively developing LAN software for non-NetWare operating systems such as Banyan VINES, OS/2 LAN Manager, and NETBIOS environments." Gateway's decision is part of a strategy to decrease its dependency on NetWare and broaden the scope of network operating systems supported by its product line.

David S. McMaster, Gateway's president and CEO, expanded on the company's strategy in its 1990 annual report. "The core of Gateway's LAN strategy will continue to be the development and marketing of a full range of leading edge Ethernet products and accessories," said McMaster. Focusing on the WAN and internetworking market, McMaster said, "Gateway's WAN communications expertise will be used to create remote access products for local area networks. Our strategy for these products will be primarily focused on opportunities in the asynchronous communications market niche."

Competitive Position

Gateway Communications competes in a crowded market; its LAN and WAN products are sold against a wide variety of competitors, including 3Com, IBM, Proteon, SynOptics, Cabletron, and many others.

Gateway's strength is in the Ethernet market; its new G/EtherTwist line accounted for 25 percent of the company's NIC shipments by the end of 1990. The company also maintains a strong position in the internetworking market; International Data Corp. (IDC), a market research firm based in

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Company Profile
Gateway Communications, Inc.

	1990	1989	1988	1987
Net Sales ($)	25.0	25.3	16.7	12.8
Net Income ($)	0.4	1.0	0.5	0.5
Net Income per Common Share ($)	0.10	0.22	0.12	0.11

Figures in millions, except for share data; fiscal years ending December 31.

Corporate Headquarters
2941 Alton Avenue
Irvine, CA 92714
(714) 553-1555

Officers
President and CEO: David S. McMaster
Vice President Finance and CFO: Kirk E. Andrews
Vice President Research and Development: Edward C. Fudurich
Vice President Sales and Marketing: Bert R. Ott

Company Background
Year Founded: 1981
No. Employees: 119

Gateway Communications designs, develops, manufactures, and markets local and wide area network products. The publicly held company was incorporated in 1981. Gateway conducts all manufacturing, research and development, and marketing activities in a 22,000-square-foot building in

Irvine, CA. Sales operations are conducted through seven domestic sales offices located in the Atlanta, Boston, Dallas, Detroit, Los Angeles, New York, and San Francisco metropolitan areas. Gateway also operates a European sales office in Abingdon, England. The company's products are resold through 74 domestic and 37 international distributors located in over 60 countries.

Financial Profile
Gateway Communications overcame a poor first quarter to finish 1990 with a net income of $470,000, or $0.10 per share (see table). First-quarter 1990 results showed a loss of $0.07 per share, which Gateway attributed to the disposal of an unprofitable Australian subsidiary. Earnings for the subsequent three quarters of 1990 totaled $0.17

per share. In May 1991, Gateway reported first-quarter 1991 results that included a net income of $331,000, or $0.07 per share, on revenues of $6.3 million.

Gateway reports total assets of $10.5 million as of the end of 1990, including $2.7 million in cash and certificates of deposit. In the last half of 1990, Gateway cash reserves increased by $900,000 "while maintaining our virtually debt-free history," according to McMaster. Gateway also claims a revenue-to-employee ratio of $216,000, better than the high-technology industry average of $164,000. Product shipments have increased for the past three years, from over 50,000 units shipped in 1988 to approximately

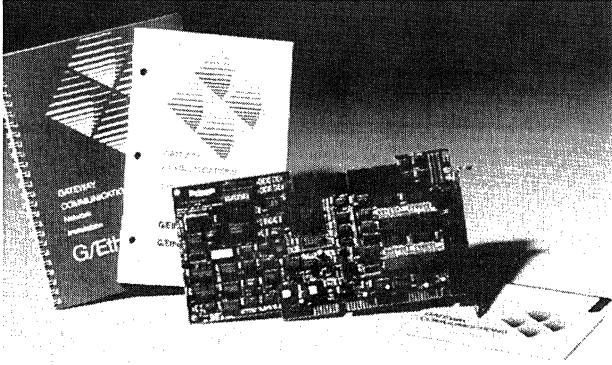100,000 units shipped in 1990.

Management Statement
In his letter to shareholders in Gateway Communications' 1990 annual report, McMaster stated, "We are very enthusiastic about the opportunities we see for Gateway in 1991, and look forward to the challenges that lie ahead. We believe that the necessary management controls and procedures are in place to take advantage of upcoming market opportunities. Gateway's 1990 product development, sales, and shipping achievements reflect the dedicated efforts of our employees. Their hard work and loyalty allowed the company to remain profitable despite tight profit margins and tough competition."

Framingham, MA, ranked the company number one in worldwide gateway shipments and number two in worldwide router shipments as recently as 1989.

The traditional leader in the Ethernet NIC market is 3Com. Another strong competitor, Western Digital, recently sold its NIC business to Standard Microsystems, a leader in Arcnet NIC shipments. Other strong competitors in the Ethernet and 10BASE-T card and hub market are

Cabletron, David Systems, Racal InterLan, SynOptics, and Ungermann-Bass.

IBM holds the lion's share of the token-ring adapter market. Other prominent token-ring vendors include Proteon and Madge Networks. It should be noted that while most token-ring LAN vendors offer products that support both 4M and 16M bps transmission speeds, Gateway's products support only 4M bps transmission.

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*Gateway Communications' new G/EtherTwist
AT Hub Adapter is an IEEE 802.3 Ethernet
AT adapter and a four-port 10BASE-T hub
combined on a single card.*

Decision Points

Gateway's strength lies in its ability to provide a variety of networking and connectivity technologies and solutions. The company has been in business for 10 years and offers LAN products that comply with two industry networking standards (IEEE 802.3 and 802.5), in addition to its original local area network product, G/Net. Also, Gateway's X.25, async, remote bridge, and SNA products offer local and wide area connectivity solutions that will meet the needs of most network installations.

Gateway products have traditionally done well in benchmark tests conducted by industry press. Ethernet NIC tests conducted by National Software Testing Laboratories (NSTL), a Datapro company, showed the G/Ethernet adapter scoring 8.1 out of a possible 10 in Overall Evaluation, ranking it fourth out of 11 cards tested. In a similar test for token-ring cards, the G/Token-Ring AT card scored a 6.4, tying for fifth (with the IBM Token-Ring Adapter II) out of 10 cards tested. Gateway's G/EtherTwist AT, G/Ethernet/16, and G/Ethernet AT NICs all garnered awards from various industry magazines in 1990, as did the G/X25 Gateway 64.

Perhaps most important, Gateway has consistently been on the leading edge of industry trends, providing products for important emerging technologies. Gateway was among the first LAN companies to compete seriously in the internetworking market with its gateway and bridge/router products. It introduced token-ring products when that market first heated up. Now, with the 10BASE-T

market exploding, it is well positioned with its G/EtherTwist line of NICs and hubs.

Characteristics

Models: G/Net, G/Ethernet, G/EtherTwist, and G/Token-Ring product lines.

Date Announced: G/Net—1983; G/Ethernet—1987; G/EtherTwist—1990; G/Token-Ring—1989.

Date First Installed: Same as announcement dates.

Number Installed: 600,000 adapters (worldwide).

Distribution: Through Gateway Communications sales offices and authorized domestic and international resellers.

Architecture

G/Ethernet and G/EtherTwist: G/Ethernet is a family of Ethernet-compatible (IEEE 802.3 10BASE5 and 10BASE2) local area network products. The G/Ethernet network uses a linear bus architecture supporting 10M bps transmission speeds. G/Ethernet offers software drivers for Novell NetWare, Microsoft OS/2 LAN Manager, 3Com 3+Open and 3+Share, TCP/IP, Microsoft Network Driver Interface Specification (NDIS), and compatible network operating systems. The network supports transmission over standard (thick) or thin Ethernet coaxial cabling, at distances up to 9,800 feet with repeaters or 1,640 feet without repeaters. The CSMA/CD access method is used. G/Ethernet adapters are available in 8-bit, 16-bit, and Micro Channel versions to support the IBM PC/XT/AT family and compatibles, IBM PS/2 and compatible systems, and Intel 80X86-based machines.

G/EtherTwist is a family of Ethernet IEEE 802.3 10BASE-T LAN products. A G/EtherTwist network supports transmission speeds of 10M bps over unshielded twisted-pair wire (UTP). G/EtherTwist uses a star configuration with nodes wired into a centrally located G/EtherTwist hub. The network supports the same software drivers as G/Ethernet and provides 8-bit, 16-bit, and Micro Channel adapters as well.

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Table 1. Ethernet NIC Specifications

	G/Ethernet PC	G/Ethernet AT	G/Ethernet MC	G/EtherTwist PC	G/EtherTwist AT	G/EtherTwist MC
IEEE LAN Standard	802.3 10BASE2/5	802.3 10BASE2/5	802.3 10BASE2/5	802.3 10BASE-T	802.3 10BASE-T	802.3 10BASE-T
Transmission Medium	Coaxial	Coaxial	Coaxial	UTP	UTP	UTP
Data Path	8-bit bus	16-bit bus	16-bit MCA	8-bit bus	16-bit bus	16-bit MCA
Card Size	Half slot	3/5 slot	Full slot	Half slot	3/5 slot	Full slot
On-Board RAM (bytes)	40K	64K	64K	40K	64K	64K
On-Board Transceiver	Standard	Standard	Standard	Standard	Standard	Standard
I/O Address	8 hardware selectable	8 hardware selectable	9 software selectable	8 hardware selectable	8 hardware selectable	9 software selectable

G/Token-Ring: G/Token-Ring LAN products conform to IEEE 802.5 specifications. G/Token-Ring is plug compatible with the IBM Token-Ring Network and supports software and hardware products developed for the IBM Token-Ring Network. G/Token-Ring is available with four-port and eight-port Multistation Access Units (MAUs). G/Token-Ring adapters support Novell NetWare and all NETBIOS-based operating systems, including the IBM PC LAN Program and IBM OS/2 LAN Server. G/Token-Ring supports transmission speeds up to 4M bps over twisted-pair wire (shielded or unshielded) in a star topology. G/Token-Ring adapters do not support 16M bps transmission speeds. The token-passing access method is used. Network nodes can be up to 150 feet from access units; the main ring path (backbone cable) can be 400 feet total.

G/Net: G/Net is a local area network featuring a baseband linear bus topology, supporting up to 255 PCs (IBM PC/XT/AT, PS/2 Model 30, compatibles, and 80386 based) on one network. The network uses a proprietary carrier sense multiple access with collision detection/collision avoidance (CSMA/CD/CA) access method, supporting error detection and correction (EDC). Media supported is standard (thick) and thin coaxial cable. The network supports a physical transmission range of up to 4,000 feet. Maximum transmission speed is 1.43M bps with the standard G/Net adapter board or 7.16M bps between machines with the G/Net VS adapter board installed.

G/Net's network interface cards support on-board co-processing that off-loads network functions from the PC workstation and provides 64K bytes of on-board, dual-ported RAM on the standard G/Net board or 512K bytes on the G/Net VS board. G/Net LAN supports all versions of Novell NetWare, MS-DOS, and all NETBIOS-based software. The network allows any IBM PC/XT/AT or compatible to be used as a file server and supports multiple file servers in a network.

Hardware

Network Interface Cards
Gateway manufactures and markets Ethernet, token-ring, and proprietary G/Net network interface card families.

Ethernet Cards
Table 1 presents the functional specifications of the G/Ethernet and G/EtherTwist network adapters. (Please note that the G/Ethernet PC and G/Ethernet AT products shown in Table 1 are available in G/Ethernet 8 and G/Ethernet 16 versions, respectively. These products are identical except that G/Ethernet 8 and G/Ethernet 16 do not include cabling and include NetWare drivers only.)

Token-Ring Cards
Gateway offers two token-ring NICs.

G/Token-Ring PC: This product is an 8-bit bus adapter for IBM PC/XT/ATs, PS/2 Model 30, and compatibles. It occupies a full slot and supports IBM Cabling System Types 1, 2, 6, 8, and 9 (shielded twisted pair), and Type 3 (UTP). It offers no on-board memory and two hardware-selectable I/O addresses. The G/Token-Ring PC card supports the IEEE 802.5 and 802.2 (LLC) standards.

G/Token-Ring AT: This product includes a 16-bit bus for the IBM PC AT and compatible systems. It contains all of the features of the G/Token-Ring PC and adds 128K bytes of on-board memory and bus mastering.

G/Net Cards
Gateway offers two NICs for its proprietary G/Net LAN.

G/Net Adapter: This NIC has a Z80-B co-processor with 64K bytes of dual-ported RAM to handle network requests, off-loading tasks from the PC workstation and allowing applications to run faster. The G/Net Adapter supports the IBM PC/XT/AT, IBM PS/2 Model 30, and

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compatible computers. It has an 8-bit bus, occupies a full slot, supports thin and thick Ethernet coaxial cable, and features 16 hardware-selectable I/O addresses.

G/Net VS Adapter: This NIC has an 8088 co-processor with 512K bytes of dual-ported RAM. It is designed for use in file servers and high-usage PC workstations. G/Net VS (variable speed) dynamically adjusts from 1.43M bps to 7.16M bps speeds. The G/Net VS Adapter supports the same computers as the G/Net Adapter and boasts identical features.

Hubs
Gateway provides two hubs for its G/EtherTwist 10BASE-T Ethernet networks.

G/EtherTwist Hub: This is the central component of a G/EtherTwist network. G/EtherTwist or other 10BASE-T-compatible nodes are wired in a star configuration to the centrally located G/EtherTwist Hub. The hub chassis supports up to two modules and can be configured to support 11 or 22 ports. Hubs can also be interconnected to support over 1,000 nodes within the 10BASE-T standard. Hub modules have 1 Attachment Unit Interface (AUI) port and 11 RJ-45 ports.

G/EtherTwist AT Hub Adapter: This product is an IEEE 802.3 Ethernet AT adapter and four-port 10BASE-T hub combined on a single card. It plugs into a 16-bit PC expansion slot and provides the LAN interface in the host PC plus a four-port hub that is accessible by any UTP-wired workstation on the LAN. It includes an on-board repeater and transceivers and features a basic monitoring utility (EtherStat).

G/EtherTwist AT Hub Expander: This is a four-port expansion card that increases the number of nodes supported by the G/EtherTwist AT Hub Adapter. Up to two G/EtherTwist AT Hub Expanders can be attached to a single hub adapter within the host PC.

Multistation Access Units
Multistation Access Units (MAUs) are available in both four-port and eight-port versions for the G/Token-Ring LAN. On a G/Token-Ring LAN, workstations are attached to MAUs, which are daisy-chained together throughout the system to form larger networks.

Transceivers and Repeaters
Gateway offers a variety of transceivers and repeaters for use with the G/Ethernet LAN.

G/Ethernet Transceiver: Transceivers provide the physical and electrical interface between the adapter and the transmission media on the network. The G/Ethernet Transceiver contains two ports—an interchangeable network interface (tap) for standard or thin coaxial cable and an AUI drop cable connection for the PC.

G/EtherTwist Transceiver: This is a coax-to-UTP media converter for Ethernet networks. G/EtherTwist Transceiver enables existing coaxial Ethernet adapters, fan outs, repeaters, and other devices to operate over UTP media. It complies with IEEE 802.3 10BASE-T specifications and attaches directly to an AUI port of a coaxial Ethernet adapter.

G/Ethernet Repeater: Repeaters extend the length and topology of the network beyond the limits imposed by the IEEE 802.3 specifications. Each repeater connects up to five standard cable segments in a series, extending the 1,500-foot-per-cable segment limit to a maximum distance of 9,800 feet. When used with a transceiver, the repeater can connect thick and/or thin Ethernet cable segments.

G/Ethernet Multiport Repeater: This repeater connects up to seven thin Ethernet cable segments to a thick Ethernet cable segment, or it functions as the central node in a star-configured thin Ethernet cable network. G/Ethernet Multiport Repeater supports up to 210 PCs and contains the same features as the G/Ethernet Repeater.

G/Ethernet Fan Out: This product expands a network into clusters of up to eight star-configured PCs. G/Ethernet Fan Out acts as a transceiver multiplexer, providing the network's full data rate to the eight PCs. Each G/Ethernet Fan Out supports up to eight additional fan out devices, for a total of 64 PCs per cable segment connection. It eliminates the need for an individual transceiver for each connected PC.

Software

Network Operating System
Gateway Communications does not offer network operating system software. G/Ethernet and G/EtherTwist interface cards offer driver software for Novell NetWare 2.0X or greater, Microsoft OS/2 LAN Manager, Banyan VINES, 3Com 3+Open and 3+Share, IBM LAN Server and IBM LAN Manager, TCP/IP, NETBIOS, and other Microsoft NDIS driver-compatible operating systems. G/Token-Ring interface cards offer driver software for Novell NetWare, the IBM PC LAN Program, and other NETBIOS-compatible operating systems. G/Net adapters support Novell NetWare.

However, Gateway has announced that it plans to introduce its own operating system this year. The new operating system will be peer to peer with client/server capabilities and will operate with the G/Ethernet and G/EtherTwist product families.

Communications Software
Gateway provides a variety of additional hardware/software products, including gateways, bridge/routers, and asynchronous communications software.

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SNA Communications

G/SNA Gateway: G/SNA Gateway is a multiuser LAN-to-SNA mainframe link for any NetWare or NETBIOS-based LAN, regardless of the LAN topology or manufacturer. G/SNA Gateway supports high-speed synchronous connections from the network to IBM SNA/SDLC mainframes and supports file transfers, data entry, and batch processing tasks. All LAN users have access to the IBM mainframe, without the need for additional hardware or software. The interface board features an Intel 8MHz 80186 CPU with 512K bytes of dual-ported RAM and includes an RS-232-C interface. RS-422 or V.35 interfaces are available as options at no extra charge.

G/SNA Gateway features both 3270 workstation emulation and 3770 Remote Job Entry (RJE) batch device emulation. The 3270 program can emulate an interactive IBM 3278 or 3279 terminal with file transfer capabilities. The 3770 program provides RJE tasks such as concurrent batch processing, keyboard to disk transfer, print jobs, print routing, and downloading information from the mainframe to the LAN. Three versions of G/SNA Gateway are available, supporting 8, 16, and 32 host sessions or logical units (LUs).

X.25 Communications

G/X25 Gateway: G/X25 Gateway is a family of products that provides multiuser access to remote information using the CCITT X.25 protocol. LAN users can select any of 27 bundled terminal emulators to access information or exchange batch files with dissimilar computers. The G/X25 family functions on NetWare-based networks utilizing Novell's IPX software and on NETBIOS-based LANs using NETBIOS software. All use the synchronous X.25 protocol and feature X.25 session control, packet assembler/diasassembler (PAD) functions, and built-in macros for single-keystroke implementation of commands. There are five products in the family.

G/X25 Gateway 64: This product uses Gateway Communications' Wide area Network Interface Module (WNIM) 186, featuring an on-board Intel 80186 processor and 512K bytes of dual-ported RAM. It operates at LAN-to-host speeds of up to 64K bps and supports up to 254 concurrent user sessions.

G/X25 Gateway: This product features Gateway's WNIM Z80 hardware adapter, providing up to 64 virtual circuits to the LAN and transmitting data at 19.2K bps through each of two ports.

G/X25pc: This is a single-user version of G/X25 Gateway.

G/X25 Gateway & Bridge: This is a gateway and bridge/router that combines the capabilities of G/X25 Gateway with those of G/Remote Bridge.

G/X25 Gateway & Bridge 64: This product offers the same functions as G/X25 Gateway & Bridge while using the WNIM 186 to operate at 64K bps.

Bridge/IPX Router Communications

G/Remote Bridge: G/Remote Bridge is an IPX router that connects two or more remote NetWare-based LANs, regardless of LAN topology or hardware. Connections to remote networks are completely transparent to the user, making remote access seem like a local connection. Users log on to remote file servers using familiar NetWare commands, eliminating the need to learn new commands. G/Remote Bridge operates at speeds up to 19.2K bps; supports up to 64 LAN connections through two RS-232 ports; and features data compression (4:1 to 10:1 ratios), a high-speed File Transfer Module (available as a separate product called Zip Zap), and a WNIM Z80 co-processor adapter.

G/Remote Bridge 64: G/Remote Bridge 64 is an enhanced version of G/Remote Bridge. It is designed for installations requiring speeds up to 64K bps, and it includes a WNIM 186 co-processor adapter to connect as many as 128 LANs simultaneously.

Zip Zap: Zip Zap is LAN-to-LAN file retrieval and transfer software. It operates in conjunction with the G/Remote Bridge family over telephone circuits, public data networks (PDNs), or direct hard-wired connections. Zip Zap uses a streaming block technique for data transfer.

Asynchronous Communications

G/Async Gateway: G/Async Gateway is an asynchronous multiuser communications gateway for Novell NetWare LANs. It provides LAN users with outbound communications links and inbound access to the LAN from remote PCs. It supports transmission speeds up to 19.2K bps and up to four concurrent sessions between the LAN and remote value-added networks, mainframes, midrange systems, and service bureaus. G/Async Gateway includes a WNIM Z80 hardware adapter and more than 10 terminal emulators. It also includes ASCOM IV and pcANYWHERE remote PC-to-PC software.

G/Async II Gateway: G/Async II Gateway contains all of the features of G/Async Gateway while adding Network Communications Services Interface (NCSI) software. This software provides a communications interface that is supported by most of the popular terminal emulation software packages on the market.

G/Async 100: This product is an outbound communications software package for LAN users that provides access to local or remote resources such as mainframes, midrange systems, bulletin boards, and on-line services. G/Async 100 allows network users to gain access to any modem physically connected to a PC on the LAN by

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using a software routing feature that dynamically allo-
cates available modems through a pooling method. It is
available in three versions with support for single mo-
dems, 2 to 5 modems, and 6 to 20 modems.

G/Async 200: This product is an inbound communica-
tions software package that permits a remote PC to
gain access to any NetWare or NETBIOS-based LAN,
take control of one of any number of designated
password-protected workstations, and manipulate and
download files as if it were a local workstation. G/Async
200 consists of Redirector, Processor, and network per-
sonality software modules.

TCP/IP Communications
Gateway Communications offers TCP/IP communica-
tions capabilities for its G/Ethernet and G/EtherTwist
networks by combining its own software drivers with
FTP Software's PC/TCP product.

PC/TCP: PC/TCP software is a collection of programs
that implement the standard TCP/IP protocol family for
IBM PCs and compatibles running DOS. Using PC/TCP,
G/Ethernet and G/EtherTwist users gain access to a
variety of other PCs, network technologies, and operat-
ing systems that are connected to a TCP/IP internet.
Features available with PC/TCP include file transfer,
remote login, electronic mail, printing, remote com-
mands, network testing, and access to remote backup
facilities and user information.

PC/TCP Plus: PC/TCP Plus includes all the features
and functions of PC/TCP, plus functional access to DOS
applications and files stored on Sun Microsystems' Net-
work File System (NFS) protocol-compliant servers.

Network Management

EtherStat: In June 1991, Gateway introduced EtherStat,
a network monitor software utility for Ethernet LANs.
EtherStat monitors, captures, and displays statistical
information for use by network managers in network
performance analysis and troubleshooting. It installs on
any non dedicated PC workstation with a minimum of
256K bytes of RAM and either a G/Ethernet AT,
G/EtherTwist AT, or G/EtherTwist AT Hub adapter.

ComSystem
This product is an integrated multifunction, multiproto-
col, multiuser communications system that provides
LAN users with concurrent, realtime access to remote
systems through a single, configurable communications
server. It includes multitiered software modules linked
by Gateway's Interactive Compatibility Software
(ICS)—a communications kernel with installation config-
uration software; selectable communications load mod-
ules; network/communications monitoring and
diagnostic software; and a choice of DOS, NetWare, or
NETBIOS interface shells.

In its base configuration, ComSystem functions as
a gateway, a router, or a gateway and router.

SNA 64 Gateway: This gateway provides multiuser
connectivity to IBM mainframes using a synchronous
line connection and SDLC. It provides 3270 and 3770
RJE emulation.

X.25 64 Gateway: This gateway uses the CCITT X.25
protocol for remote communications with any X.25 de-
vice. It performs all PAD functions, features full X.25
session control, and includes a platform for custom con-
figuration of single-keystroke command sets.

IPX Router 64: This router allows transparent connec-
tivity of remote NetWare LANs; it connects up to 128
LANs simultaneously.

X.25 Gateway and Router 64: This product combines
the features of an X.25 gateway with an IPX router
through one X.25 link.

Support
Gateway's products are supported by its authorized
distributors as well as by Gateway Communications. All
resellers are trained to assist in network installations
and are equipped to provide continuing support. Gate-
way offers free telephone support for all product users.
A toll-free number is available. In North America, sup-
port lines are open Monday through Friday from
6:00 a.m. to 5:30 p.m. Pacific time. Europe is supported
through Gateway's U.K. Support Center.

Installation: Gateway installations are handled through
its authorized distributors.

Training: Initial training is provided free of charge to
Gateway Communications' distributors. Gateway also
provides technical training seminars on networking and
communications.

Warranty: Gateway provides a one-year warranty on all
hardware sold through authorized resellers.

Maintenance: Gateway offers an advance replacement
program beyond the one-year warranty.

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Equipment Prices

	Purchase Price ($)
Ethernet Products	
G/Ethernet PC Adapter	370
G/Ethernet AT Adapter	445
G/Ethernet MC Adapter	495
G/Ethernet 8 Adapter	250
G/Ethernet 16 Adapter	300
G/EtherTwist PC Adapter	300
G/EtherTwist AT Adapter	348
G/EtherTwist MC Adapter	460
G/EtherTwist Hub (11-port version)	1,995
G/EtherTwist Hub (22-port version)	3,195
G/EtherTwist AT Hub Adapter	800
G/EtherTwist AT Hub Expander	400
G/Ethernet Transceiver	275
G/EtherTwist Transceiver	150
G/Ethernet Repeater	1,250
G/Ethernet Multiport Repeater	2,695
G/Ethernet Fan Out	995
Token-Ring Products	
G/Token-Ring PC Adapter	595
G/Token-Ring AT Adapter	695
G/Token-Ring Multistation Access Unit (MAU) (4-port version)	395
G/Token-Ring Multistation Access Unit (MAU) (8-port version)	660
G/Net Products	
G/Net Adapter	395
G/Net VS Adapter	595
Communications Products	
G/SNA Gateway (8 LUs)	2,580
G/SNA Gateway (16 LUs)	3,580
G/SNA Gateway (32 LUs)	4,580
G/X25 Gateway	1,895
G/X25 Gateway 64	2,995
G/X25 Gateway & Bridge	2,495
G/X25pc	895
G/Remote Bridge	1,595
G/Remote Bridge 64	2,495
Zip Zap	300
G/Async Gateway	1,595
G/Async II Gateway	1,895
G/Async 100 (1 modem support)	395
G/Async 100 (2-5 modem support)	695
G/Async 100 (6-20 modem support)	995
G/Async 200	395
PC/TCP (1 user)	400
PC/TCP (20-49 users)	175 per user
PC/TCP Plus (1 user)	490
PC/TCP Plus (20-49 users)	230 per user
EtherStat	250
ComSystem	6,995

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Halley Systems ConnectLAN and ConnectVIEW

Product Summary

Editor's Note
Since our last report, Halley Systems has been quite active. The company announced and shipped the Connect-LAN 200 Series of local and remote token-ring brouters; announced and shipped the ConnectVIEW Network Management System for token-ring environments; announced and shipped a data acceleration scheme for ConnectLAN 200 Series remote brouters; announced and shipped ConnectLAN 300 Series of local and remote token-ring brouters; and announced and shipped full X.25 WAN support for the ConnectLAN 100 Series Ethernet brouter product line.

Description
Halley's product line includes ConnectVIEW network management systems, ConnectLAN 100 Ethernet brouters (hybrid bridge/router), ConnectLAN 200 Token-Ring brouters, and ConnectLAN 300 Token-Ring bridges. Functioning as a unifying factor throughout the product line, ConnectVIEW manages and controls the Ethernet and token-ring internetworking devices.

—By Barbara Callahan
Associate Editor

Strengths
By expanding its token-ring product line, Halley has become a full-service vendor, offering products that support Ethernet and local and remote token- ring environments.

Limitations
Since Halley has only recently penetrated the token-ring market more fully with its ConnectLAN 200 and 300 Series, the company will have to change users' perceptions of it as primarily an Ethernet vendor.

Competition
cisco Systems, SynOptics, Wellfleet, Vitalink.

Vendor
Halley Systems, Inc.
2730 Orchard Parkway
San Jose, CA 95134
(408) 432-2600

Price
ConnectLAN 210 Token Ring Local Brouter with two token-ring connections to a LAN, with cables and software—$12,995; ConnectLAN 302 Local Token Ring Bridge for local connection of two 16/4M bps token-ring LANs—$6,995.

GSA Schedule
No.

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Analysis

Product Strategy

Halley's strategy consists of supplying the marketplace with integrated systems based on open architecture for multivendor networking environments. The Halley product line enables large organizations to consolidate current network resources into a single, cohesive system that can be controlled and expanded economically in a manner transparent to the user. Since many networks in large organizations have evolved sporadically without an overall design, Halley responds to the chaotic state created by the existence of multiple LANs and WANs that are not integrated by setting up transparent, high-performance links among them.

In November 1989, Halley sold its "Z" and "H" series of modems for data communications on broadband coaxial cable to TYTEC Enterprises of Diamond Springs, CA. The sale of the modem line represented Halley's firm commitment to the LAN side of its business. At the time of the sale, Halley's president, Robert Craven, offered an insight into the company's vision for the future when he commented, "The growth in the LAN business was developing a customer base that was placing different demands on Halley than the modem customer base. Halley chose to continue its focus on its growing internetworking and network management product lines for connecting Ethernet and token-ring local area networks and divest the modem product line to a company whose focus was broadband technology."

To accommodate the "growth in the LAN business," Halley enhanced its product line with the ConnectLAN 200 Series of local and remote token-ring brouters, the ConnectVIEW Network Management System for Token Ring, and the ConnectLAN 300 Series of local and remote Token Ring brouters. Not overlooking its existing ConnectLAN 100 Series Ethernet brouter family, Halley incorporated X.25 WAN support into it. Support for X.25 in the ConnectLAN 200 Series is imminent.

Although Halley does offer a bridge product, the ConnectLAN 111/B remote bridge, the company has opted to focus on the brouter approach to internetworking. A brouter is a hybrid bridge/router product. Halley has designed its products as brouters because conventional spanning tree bridges do not support active loops and cannot provide users with secondary routing or path costing, and routers support only single protocols. Brouters are protocol-transparent bridges that feature many routing capabilities. Since Halley specializes in outfitting medium to large internetworks that support a variety of traffic, the company produces brouters to offset the functionality gap which exists between bridges and routers.

Since its product strategy relies strongly on delivering total solutions with network management capabilities, Halley offers software throughout the product line, such as ConnectVIEW, Brouter Control Software (BCS), ConnectLAN 200 Token-Ring SRB software, and Brouter System Software (BSS/X for X.25 brouters).

Competitive Position

For a company not quite five years old, Halley Systems has established a firm niche in the internetworking market, currently supporting a customer base of more than 200 *Fortune* 1000 companies. Moving forward in the internetworking market, however, is going to require ingenuity and marketing know-how because many of Halley's competitors, like itself, are young, dynamic companies.

San Francisco-based cisco Systems offers Ethernet and token-ring devices that, unlike Halley's, support Simple Network Management Protocol (SNMP), which is very much in favor with internetworking companies. The AGS+ from cisco also supports Fiber Distributed Data Interface (FDDI). As yet, Halley has not announced FDDI support for its products, although they can operate on fiber optic cabling. Halley's products are, however, priced somewhat lower than cisco's.

SynOptics of Mountain View, CA, well known for its wiring hubs, also markets a brouter, the 3383, which supports only Ethernet. The 3383 does support SNMP and, according to the vendor, 14 other protocols.

Vitalink of Fremont, CA, prices its products, which also function on Ethernet and token-ring networks, a bit higher than Halley's. The Transpath 530 and 550 support token-ring networks, and

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the Transpath 350 supports Ethernet. Vitalink's
brouters range in price from $9,000 to $16,500.

A competitor whose products cost about the
same as Halley's is Wellfleet Communications of
Bedford, MA. Wellfleet's FeederNode and LinkN-
ode support Ethernet and token-ring. Both prod-
ucts also support FDDI.

Decision Points

Halley's decision to drop its modem line and focus
completely on internetworking products appears to
be a wise move. Several modem companies that
have entered the internetworking market as an ad-
junct to their original businesses are experiencing a
fragmentation of direction and emphasis. This am-
bivalent situation will not occur with Halley. Nor
will the company have to prepare for various con-
tingencies, as will companies retaining modem
product lines, when ISDN really hits its stride.

Users who must connect geographically dis-
persed LANs can do so with ConnectLAN 100, a
local, remote, composite brouter. The device offers
active loop support, a feature that optimizes re-
sources by ensuring the use of every link in the in-
ternetwork. Alternate route switching offsets the
problem of disconnections in upper level protocol
sessions, and an access control algorithm offers
security at the node level.

Since IBM and Novell have captured a large
share of the LAN market, users with products from
those two vendors can invest in ConnectLAN 200
and 300 with the assurance that the products are
compatible. ConnectLAN 200 token-ring brouters
can interconnect local or geographically dispersed
token-ring 802.5 LANs. According to Halley, the
ConnectLAN 200 is the only source routing-
compliant product on the market with multiple
links. The 200 filters data at rates up to 20,000
packets per second and forwards data at up to
3.2M bps. To lessen propagation delay between
brouters, users can drive fiber and other high-speed
links at speeds up to 7M bps.

For users of "source routing-only networks"
who require faster throughput over their WANs or
need multiple WAN links in each bridge, Halley's
ConnectLAN 300 can satisfy their needs. Com-
pletely IBM compatible, the ConnectLAN 300
token-ring bridge can be switched between 16M
bps and 4M bps token-ring networks. The new data

Company Profile
Halley Systems

Corporate Headquarters
2730 Orchard Parkway
San Jose, CA 95134
(408) 432-2600

Officers
*President and Chief Exec-
utive Officer:* Robert Cra-
ven
*Vice President of Market-
ing and Sales:* George
Donohoe

Company Background
Halley Systems originated
in 1987 as a spin-off from
Zeta Labs. Equipped with
the "Z" family of broad-
band modems and an in-
stalled base of *Fortune*
1000 customers, Halley
set out to provide inter-
networking solutions for
large and geographically
dispersed organizations.

The company designs,
manufactures, and mar-
kets high-performance
local area network (LAN)
and wide area network
(WAN) internetworking
systems. Halley's prod-
ucts include Connect-
VIEW network

management systems,
ConnectLAN 100 Ethernet
brouters, ConnectLAN
200 Token-Ring brouters,
and ConnectLAN 300
Token-Ring bridges. The
installed base for Halley's
products includes over
200 *Fortune* 1000 compa-
nies.

In 1990, Halley sold its
modem product line to
TYTEC Enterprises in or-
der to focus on its Ether-
net and token-ring
internetworking lines.
TYTEC is located in Dia-
mond Springs, CA. Re-
garding the sale, Halley's
president, Robert Craven,
commented, "Providing
continuous service and
support for our broad-
band customer base was
the determining factor in
selling the product line to
TYTEC."

Halley's headquarters are
in San Jose, CA. All sales
and engineering are done
out of the company's
headquarters.

acceleration feature incorporated into each mem-
ber of the ConnectLAN 300 family increases ring-
to-ring data throughout and reduces unnecessary
operator wait times. The ConnectLAN Token Ring
family of bridges is compatible with Novell Net-
Ware via Novell Source Drivers.

The operative term today is "network
management"—avidly sought after by, but fre-
quently undelivered to, many users. Halley
strongly supports network management through

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ConnectVIEW, which features realtime, color-coded displays and diagnostic capabilities. ConnectVIEW automatically displays error conditions and produces detailed error logs with statistics.

Characteristics

Overview

Halley Systems' products cover four categories: network management systems with ConnectVIEW, ConnectLAN 100 Ethernet brouters, ConnectLAN 200 token-ring brouters, and ConnectLAN 300 token-ring bridges.

Functioning as an integrated solution for managing and controlling Halley's internetworking products, *ConnectVIEW* handles network design and planning, configuration and problem management, and realtime network monitoring via an icon-based graphic interface. Halley offers ConnectVIEW in two versions: ConnectVIEW Ethernet Brouter Manager and ConnectVIEW Token-Ring Manager.

*ConnectLAN 100*s are Ethernet brouters (hybrid bridge/routers), managed by ConnectVIEW, that sustain the independence of LANs and WANs and create a path for transparent internetworking communications.

ConnectLAN 200 is a series of local and remote token-ring brouters that interconnect local or geographically dispersed token-ring, IEEE 802.5 LANs.

ConnectLAN 300 is a family of high-performance token-ring bridges.

ConnectVIEW

ConnectVIEW Ethernet Brouter Manager
The communication between ConnectVIEW and the ConnectLAN 100 brouter conforms to network management standards recommended by Draft IEEE 802.1 Part B. A windows-based system, ConnectVIEW runs on any IBM PC/AT or IBM PS/2 Model 30/286 computer. Centralized network control enables the network manager to view the entire network from a single management station. Color-coded icons are part of the graphic display of the internetwork. Planning tools and a database management system enable users to define and display internetwork and network elements. Traffic statistics and error log reports assist users in locating bottlenecks.

Network managers can add or modify brouter and link parameters. They can also assign different access levels to groups of nodes and individual nodes. ConnectVIEW polls the brouters at intervals established by users and updates changes in the status of the brouters and links on the graphical network display. When a malfunction occurs, the automatic scroll feature scrolls the network display to the screen. User ID/Password protection prevents unauthorized access to the ConnectVIEW Management Station.

In February 1990, Halley introduced Version 1.1 of ConnectVIEW Ethernet Brouter Manager. Version 1.1 supports enhanced database management, custom filtering, short-term and long-term statistics, and filtering for the activity log. The enhanced database management functions enable network managers to define and store information about LANs and links. Custom filtering allows users to define various protocol masks for routing and security.

In March 1990, Halley announced Version 1.12 of the ConnectVIEW Ethernet Brouter Manager. This version supports a second LAN channel on local and remote Ethernet brouters. A "Vendor.LST" file includes additional Ethernet adapter vendors, and the size restriction on this and other system text files has been removed. Halley has also added several Activity Log Warnings to enhance realtime status monitoring.

For additional specifications, see Table 1.

ConnectVIEW Token-Ring Manager
Token-Ring Manager enables users of ConnectLAN 200 brouters to manage their token-ring brouter networks from a single workstation. A Microsoft Windows/286-based package, Token-Ring Manager runs on any IBM PC/AT or compatible. A planning menu enables users to draw their network maps before or during installation of physical devices. An Activity Log displays messages generated by the ConnectVIEW station and every brouter on the network. Link and brouter icons turn color in realtime to indicate status.

Table 1. ConnectVIEW

NMS Standard	Draft IEEE 802.1 Part B
User Interface	Microsoft Windows based
Database Management	c-tree based
Network Interface	3Com Etherlink II adapter
Minimum System Requirements	IB PC/AT compatible or PS/2 Model 30/286

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Table 2. ConnectLAN 100

Model	Serial Ports	Ethernet
ConnectLAN 101	1, 2, or 4 optional	1 standard, 1 optional
ConnectLAN 102	1, 2, or 4 optional	2 standard
ConnectLAN 111	1 standard	1 standard, 1 optional
ConnectLAN 112	1 standard	2 standard
ConnectLAN 121	2 standard	1 standard, 1 optional
ConnectLAN 122	2 standard	2 standard
ConnectLAN 141	4 standard	1 standard, 1 optional
ConnectLAN 142	4 standard	2 standard
ConnectLAN 111/B	1 standard	1 standard

ConnectLAN 100

A series of high-performance brouter (bridge/router) products, ConnectLAN 100 interconnects geographically dispersed Ethernet IEEE 802.3 local area networks via brouter-to-brouter serial communications links at rates up to 2.048M bps. The 100 Series makes use of the IEEE 802.3 Media Access Control (MAC) sublayer to send data transparently between LANs. The 100 Series is transparent to protocols, such as TCP/IP, DECnet, XNS, LAT, and ISO, and can work simultaneously with Novell's NetWare, 3Com's 3+, Ungermann-Bass' Net One, and Banyan's VINES.

Features include:

- bridging and routing capabilities
- local and remote brouting capabilities
- active loop support
- load sharing and load balancing
- protocol transparency
- self-learning and auto configuration
- transparent alternate route switching
- programmable routing control
- dynamic access control

For additional features, see Table 2.

    Network management is implemented through the Brouter Control System (BCS) and ConnectVIEW. The Brouter Control System (BCS) is a network management system that monitors and controls a network of Halley's ConnectLAN Ethernet local and remote brouters. With BCS, the network manager can manage the network from a central point or distribute the management of the network over several locations.

    BCS continuously monitors the network for alarm messages generated by individual brouters and displays them for acknowledgment. It also collects statistical values that reflect the network's status and performance.

The network manager can change the configuration parameters of any brouter in a network. Through the Programmable Routing Control feature, the network manager can use masks to selectively forward or discard packets. Passwords assigned to BCS and each brouter prevent unauthorized access to management data and functions.

ConnectLAN 100/X Brouters

ConnectLAN 100/X Brouters connect geographically dispersed Etherent/IEEE 802.3 LANs via X.25-based packet switched data networks (PDNs). The X.25 link speed can range from 4.8K to 64K bps. The X.25 link can be used simultaneously with up to four dedicated links. In this type of configuration, the X.25 link can serve as an alternate link. The Brouter Control System (BCS) can manage and control the X.25 link. ConnectLAN 100 brouters use the PDN on an "as required" basis to transfer data between interconnected LANs. When triggered, the brouter sets up virtual connections with other brouters, transfers data, and subsequently disconnects the virtual circuits. The triggers are based on time periods and traffic demand.

Additional features include:

- transparent connection
- multiple circuits
- custom filtering
- protocol independence
- self-learning and auto configuration
- access control
- end-to-end data integrity

For configurations of the remote brouters in the ConnectLAN 100/X family, see Table 3.

ConnectLAN 111/B Remote Bridge

These bridges connect geographically dispersed Ethernet/IEEE 802.3 LANs via high-speed links at speeds ranging from 4800 bps to 2.048M bps. Users can perform upward migration to larger networks via direct link connections to the ConnectLAN 100 Ethernet brouters. The 111/B connects remote LANs via a variety of media, including wide area transmission facilities, fiber optics, T1, and CEPT. The devices are independent of higher layer protocols, thereby ensuring transparent data flow in multivendor environments. ConnectVIEW or Brouter Control System (BCS) performs network management for the bridges. Additional features include self learning, auto configuring, and access control.

ConnectLAN 200

As high-performance brouter (bridge/router) products, the ConnectLAN Series can interconnect geographically dispersed token-ring IEEE 802.5 LANs, creating a wide area network (WAN) and integrating it into a single internetwork. Brouter-to-brouter serial communication links,

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Table 3. ConnectLAN 100/X Configurations

ConnectLAN 101/X Remote Brouter	Provides one X.25 link for attachment to a PDN and one AUI connection for attachment to an Ethernet IEEE 802.3 LAN
ConnectLAN 111/X Remote Brouter	Provides one X.25 link for attachment to a PDN, one serial link up to 2.048M bps, and one AUI connection for attachment to an Ethernet IEEE 802.3 LAN
ConnectLAN 121/X Remote Brouter	Provides one X.25 link for attachment to a PDN, two serial links each up to 2.048M bps, and one AUI connection for attachment to an Ethernet IEEE 802.3 LAN
ConnectLAN 141/X Remote Brouter	Provides one X.25 link for attachment to a PDN, four serial links each up to 2.048M bps, and one AUI connection for attachment to an Ethernet IEEE 802.3 LAN

operating at rates up to 2.048M bps, implement network interconnections. ConnectLAN 200 is IBM host compatible, IBM OS/2 LAN Server compatible, and Novell Net-Ware compatible. ConnectLAN 200 bridges IBM's source-routed traffic the same as IBM bridges. It is compatible with token-ring bridges from other vendors.

Non-source-routed traffic can be passed over any source-routed bridge if the ConnectLAN brouter is first and last in the path. The device fully supports multiple active transmission paths between LANs, including active loops, and uses all transmission paths regardless of topology. Additional features include end-to-end error checking, self-learning, auto configuring, transparent alternate route switching, and concurrent network management.

In 1990, Halley incorporated the Data Acceleration feature into ConnectLAN 200 Series remote brouters. This feature implements variable-rate data compression across lower speed WAN links (up to 128K bps), allowing the user to achieve higher actual data throughput than that which normally occurs across these links.

For specifications of ConnectLAN 200, see Table 4.

ConnectLAN 202
A member of the ConnectLAN 200 family, the Connect-LAN 202 is a local token-ring brouter that interconnects IEEE 802.5-compatible IBM source-routed token-rings and other vendors' non-source-routed token-rings to form an extended ring for sharing information. Connec-tVIEW manages the device. ConnectLAN 202 transparently supports source routing and non-source-routing algorithms for the interconnection of token-rings. In the "source-routed only" traffic environment, ConnectLAN

202 coexists and interoperates with source and transparent bridges from others vendors when it is the first and last bridge in the chain.

ConnectLAN 202 uses IEEE 802.5 Media Access Control (MAC) layer procedures to pass data transparently between two token-ring networks. It is transparent to SNA (LU 6.2), TCP/IP, XNS, 3270 emulation, and APPC. The product also works simultaneously with Novell NetWare, PC LAN, 3Com 3+, Banyan VINES, Ungermann-Bass Net/One, and Microsoft LAN Manager. ConnectLAN 202 supports multiple active transmission paths between token-rings, including active loops and parallel bridges. For non-source-routed token-rings, ConnectLAN 202 uses all transmission paths, regardless of topology. Additional features include end-to-end error checking, self-learning, and transparent alternate route switching.

For additional specifications of ConnectLAN 202, see Table 5.

ConnectLAN 211 Token-Ring Local Brouter
ConnectLAN 211 interconnects IEEE 802.5-compatible networks and processes packets of IBM source-routed and other vendors' non-source-routed token-rings. The 211 links local token-ring LANs, thereby allowing users access as if to a single network. The device filters data at speeds up to 40,000 packets per second and forwards data at up to 8,000 packets per second. It is fully tranparent to SNA (including LU6.2), PC LAN, TCP/IP, 3270 emulation, XNS, and SMB. ConnectLAN 211 is compatible with source-routed bridges for source-routed traffic from other vendors.

The 211 integrates with ConnectVIEW, performs end-to-end error checking, continuously learns the location of ring stations, automatically reconfigures changes to the internetwork, automatically switches to alternate paths if a failure occurs on the primary path, and automatically shares traffic loads between parallel links.

ConnectLAN 221 and 231
In February 1990, Halley announced two- and three-port remote token-ring brouters: ConnectLAN 221 and ConnectLAN 231, respectively.

Table 4. ConnectLAN 200 Specifications

Filtering	20,000 frames per second
Forwarding	3.2M bps (constrained by WAN speeds)
Number of Ring Interfaces	1
Ring Interface Connectors	9-pin subminiature D/RJ11 phone jack
Number of Link Interfaces	1, 2, or 3
Type of Link Interfaces	RS-422 (449)/V.36, V.35, X.21
Link Interface Connector	DB15 female

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Table 5. ConnectLAN 202 Specifications

Filtering	40,000 frames per second
Forwarding	3.2M bps
Number of Ring Interfaces	2
Ring Interface Connectors	9-pin subminiature D/RJ11 phone jack

ConnectLAN 200 Token-Ring SRB Software

A DOS-based local or remote bridge product, the SRB software can interconnect locally or geographically dispersed token-ring/IEEE 802.5 LANs. Remote network interconnections occur via serial communication links at speeds up to 7M bps. Local connections can be 16M bps or 4M bps. SRB software filters data at speeds up to 20,000 packets per second and at forwarding rates up to 3.2M bps over local links or multiple wide area network (WAN) links. The product bridges IBM's sourced-routed frame traffic over as many as four WANs in a single platform. Compatible with IBM's local bridges and source-routed traffic, SRB uses the IBM Token-Ring Network 16/4 adapter and the IBM 4M bps Token-Ring Network adapter.

SRB software can run on PC/AT/ISA-compatible platforms or on any PS/2. Remote versions must run on PS/2 Model 30s or PC/AT or equivalents. Minimum system requirements include a dedicated PC/AT or PS/2 with 512K bytes of RAM, DOS 3.3 or higher, and a 5.25-inch or 3.25-inch diskette drive. ConnectLAN 200 SRB includes the Brouter Control System (BCS) and BR-View, which enables users to monitor the extended network from a single local or remote location.

ConnectLAN 300

The ConnectLAN 300 family consists of high-performance token-ring bridges that interconnect local or geographically dispersed 16/4M bps token-ring/IEEE 802.5 local area networks. Remote network interconnections occur via bridge-to-bridge serial communication links at rates up to 7M bps. Users can switch the bridges between 16M bps and 4M bps with Type 1 cabling. The devices are fully transparent to SNA (including LU6.2), PC LAN, and 3270 emulation. The ConnectLAN 300 family is compatible with source-routed bridges for source-routed traffic from other vendors. When integrated with ConnectVIEW Token-Ring Manager, users can graphically display the network, configure bridges, and display network statistics.

Table 6. ConnectLAN 300 Specifications

Filtering	90,000 frames per second
Forwarding	6.1M bps
Number of Ring Interfaces	1(CL 3x1 Remote), 2 (C1 302 Local)
Ring Interface Connectors	9-pin subminiature D
Number of Link Interfaces	1, 2, or 3
Link Interface Types	RS-422 (49)/V.36, V.35, X.21
Link Interface Connector	DB15 female

The ConnectLAN 300 family supports BRView, a network management system that enables a user to monitor an extended network from a single location. Additional features include end-to-end error checking, self-learning, auto configuration, parallel bridging, compatibility with ConnectLAN 200 Token Ring brouters, concurrent network management, and a single remote link interface for speeds from 9600 to 7M bps. Halley delivers ConnectLAN 300 preconfigured to customers' specifications as a turnkey system that can be reconfigured by the Halley configuration program supplied with the bridge software.

For ConnectLAN 300 specifications, see Table 6.

Pricing and Support

Halley offers toll-free telephone support to answer customers' questions to ensure that products are being properly used and to determine if maintenance is necessary. The company also offers depot repair service for products not covered by warranties or service plans, as well as next-day replacement service. Halley will ship a temporary service unit (TSU) to customers via express air as a loan until customers' units are repaired and returned.

The standard warranty coverage includes return-to-factory hardware maintenance with 30-day repair or replacement. Extensions to the initial one-year warranty are rolled into the Next Day Replacement Service (NDRS), which authorizes replacement of faulty hardware by the next working day. In addition to including the cost to repair the hardware, the software license renewal is also included in the NDRS. A customer can contract for NDRS of hardware any time during the initial one-year warranty coverage period. A problem that occurs after business hours is forwarded to Halley's after-hours Coverage Service.

The Equipment Prices section covers the purchase prices of the various systems.

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Equipment Prices

		Purchase Price ($)
—	ConnectLAN 210 Token Ring Local Brouter, with two token-ring connections to a LAN; cables and software	12,995
1203-02	ConnectLAN 302 Local Token Ring Bridge for local connection of two 16/4M bps token-ring LANs	6,995
1203-11	ConnectLAN 311 Remote Token Ring Bridge for remote connection of a 16/4M bps token-ring LAN and one remote link	8,295
1203-21	ConnectLAN 321 Remote Token Ring Bridge for remote connection of a 16/4M bps token-ring LAN and two remote links	9,995
1203-31	ConnectLAN 331 Remote Token Ring Bridge for remote connection of a 16/4M bps token-ring LAN and three remote links	11,500
2200-50	ConnectLAN 200 Token-Ring SRB software	1,250
5202-01	SRB Link Board	1,495
—	ConnectVIEW Token Ring Brouter Manager, Version 1.1	2,495

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Hayes Modems

In this report:

Product Summary

Editor's Note
This report includes information on the most recent Hayes release, V-series ULTRA Smartmodem 9600 (ULTRA 96). It also covers Personal Modem 2400plus and Smartcom for the Mac, Personal Modem 2400plus and Smartcom EZ, and V-series Smartmodem 2400. Software releases include Smartcom Exec and upgrades to Smartcom III and Smartcom II for the Macintosh.

Description
The Hayes products covered in this report are primarily V-series Smartmodems that operate at speeds of 2400 and 9600 bps and conform to V.42 or X.25 standards. These modems function with IBM PCs and compatibles, IBM PS/2s, and Macintoshes. The newest V-series model, ULTRA 9600, is a high-speed, full-duplex, 9600 bps, dial-up device that conforms to V.32, V.22bis, V.23, V.21, and V.42bis. Hayes designed ULTRA 96 for global distribution and worldwide connectivity.

Strengths
Hayes incorporates many features into its modems to ensure reliability and high-quality transmission.

Limitations
Hayes has only recently entered the V.32 market.

Competition
CXR Telecom/Anderson Jacobson, Fastcomm Communications, Gandalf, General DataComm, Memotec, Microcom, Multi-Tech Systems, Penril DataComm, Racal-Milgo, U.S. Robotics, Universal Data Systems.

Vendor
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Price
$199 to $1,249.

—By Barbara Callahan
Associate Editor

Analysis

Product Strategy

Hayes entered the high speed modem market in 1987 primarily through the introduction of the V-series Smartmodems. To broaden the applications for V-series products, in November 1988, Hayes announced the inclusion of CCITT V.42 or dial-up X.25 (CCITT X.32) features, which strengthened the company's leadership in dial-up communications products. Smartcom III communications software, which debuted with the hardware products, offers specific features that support V-series system capabilities, including V.42 and X.25.

The modems within the V-series are Smartmodem 2400 V.42, Smartmodem 2400B V.42, Smartmodem 2400 X.25, Smartmodem 2400B X.25, Smartmodem 2400M, Smartmodem 9600 V.42, Smartmodem 9600B V.42, Smartmodem 9600 X.25, Smartmodem 9600B X.25, and ULTRA Smartmodem 9600.

Hayes V-series products are not to be confused with their predecessors, the Smartmodems. The difference between them lies in the technology. V-series technology incorporates five features in V-series System products: error control, adaptive data compression, automatic feature negotiation, automatic speed buffering, and Adaptive Start-Up (9600 bps modems only).

The V-series Smartmodem 2400 offers CCITT V.42 error control and V.42bis data compression to accommodate data throughput up to 9600 bps, async/sync/Hayes AutoSync capabilities, X.25 for dial-up compatibility with packet switched networks, and compatibility with MNP 5 modems.

In October 1989, Hayes announced support of CCITT V.42bis for its V-series products. V.42bis specifies the data compression technique that increases the throughput of modems with the Link Access Procedure for Modems (LAPM) function, which produces data compression capabilities of three-to-one. The standard is based on the

Lempel-Ziv compression algorithm developed by AT&T Bell Laboratories and enhanced by IBM, British Telecom, and Hayes.

The top-of-the-line ULTRA Smartmodem 9600 (ULTRA 96) makes use of V.32 modulation. The modem supports the most frequently used technologies, such as MNP 5, V.22bis, V.23, V.22, and V.21. ULTRA 96 operates in a variety of PBX environments. Its modem control and operation depend on the Hayes Standard AT Command Set, Hayes escape sequence with guard time, automatic feature negotiation, auto mode, automatic speed buffering, and flow control.

For the home market, Hayes offers the Personal Modem 2400plus and Smartcom for the Mac, and Personal Modem 2400plus and Smartcom EZ communications software. Smartcom for the Mac enables users to store phone numbers, instructions, and frequently used commands. The software also allows users to automate the exchange of information with other Macs, PCs, or online services using Autotype. Users of Personal Modem 2400plus can bank and shop electronically, as well as review news and sports. Personal Modem 2400plus and Smartcom EZ communications software operate with IBM PC/XT/AT, PS/2, and compatible machines. With Smartcom EZ, users can also gather database information and perform electronic shopping and banking.

Decision Points

Although Hayes has only recently entered the V.32 market, the company has always had users' interests in mind. Originally, the company decided to bypass more expensive V.32 methods, which incorporated echo cancellation technology. According to Hayes, personal computer (PC) communications are usually one-way; therefore, expensive V.32, full-duplex capability is not really necessary for most PC applications.

The V-series modems, except ULTRA 96, simulate V.32 operation through a fast turnaround time that provides the benefit of rapid data transfer without the cost. The use of the word "simulate" here means the end user will not perceive any major delays in data transmission. It does not suggest that the Hayes V-series modems, except ULTRA 96, are in any way compatible with the CCITT V.32 recommendation.

The V-series modems are well-packaged, functional products that come with documentation that makes the units easy to install and operate. The modems carry Hayes' reputation for reliable products. In migrating toward ISDN, the company has chosen international standards for error control and has continued to make its new modems support the same U.S. modem standards and CCITT compatibility as the Smartmodems. The automatic negotiation feature has ensured that V-series Smartmodems are still compatible with Smartmodems. When Smartmodems are used with V-series units, automatic negotiation allows the "bypassing" of V-series features to establish a traditional asynchronous connection.

All the modems support asynchronous communication, the popular method of transmission for personal computers. In addition to synchronous communications using Hayes AutoSync, the modems can also communicate synchronously via adapter cards and synchronous software for the personal computer. Hayes AutoSync offers a cost-effective alternative to traditional personal computer synchronous communication.

Hayes AutoSync enables V-series modems to communicate synchronously through the personal computer asynchronous communications port, thereby eliminating the need for a synchronous adapter card. This function takes place via applications software implementing the Hayes Synchronous Interface (HSI) and Hayes Synchronous Driver (HSD), which were introduced in 1985. HSI is a set of conventions for use by software developers in designing synchronous communications applications. HSI defines the "rules" used to coordinate the exchange of information (status) and data between the software application and HSD, which assists in overcoming the hardware dependence prevalent in synchronous applications.

At present, users are stretching PCs to their limits by supporting exceptionally high communications port speeds of 19.2K bps or 38.4K bps. In addition, users are loading more sophisticated programs on to their PCs and taking advantage of multitasking systems. These strains on the PC can cause data loss when the PC cannot handle each interrupt from the COM card. To address these problems, Hayes developed Enhanced Serial Port (ESP) hardware and a public domain Enhanced Serial Interface (ESI) specification.

Smartcom III software, a functional and easy-to-use package, has a layered interface, based on five interface mechanisms: menus, tables, parameter entries, selection dialogs, and entry dialogs. According to the degree of their knowledge of the program, users can access different levels of detail. Novices can refer to a mini-help line that reminds them of the functions. Experienced users can bypass intermediate screens or automate repetitive tasks through the SCOPE program language.

X.25 technology assists in bringing multisession and multipoint communications to a personal computer workstation through a Public Data Network (PDN) and provides multiple-session connectivity to workstations on an Integrated Services Digital Network (ISDN). The X.25 V-series System products provide the user with error control from the local DTE, through the X.25 network, to the remote computer without incurring protocol conversion overhead.

Market Position

A major participant in the microcomputer modem market, Hayes established a *de facto* standard for PC data transmission with its Hayes Standard AT Command Set. (See Table 1.) The company has a solid reputation based on products and service and is a leader in research and development in the PC modem market.

Over the years, Hayes' growth and profitability depended heavily on the low-speed segment of the modem market. As profit margins in this market niche eroded from the presence of too many competitors and low-cost products, Hayes found itself with many buyers but declining profits.

Hayes faced this distressing situation by restructuring the company; discarding some research and development activities; and exploring new business avenues, notably the LAN marketplace. In addition, Hayes made a strong entry into the dial-up, V.32 arena, the scene of most industry growth activity, with its ULTRA 96. Although Hayes is a late arrival into V.32 territory, the ULTRA 96 is an appealing product, priced competitively at $1,199 while supporting sophisticated features, such as V.42bis.

In the dial-up, V.32 market, Hayes faces competition from a long line of opponents. Since many of the products from competitors run with either an IBM or an Apple PC, the edge Hayes holds over

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Company Background
A leader in the microcomputer modem market, Hayes develops, supplies, and supports computer communications equipment and software. The company distributes its products through an international network of authorized dealers, resellers, system integrators, and OEMs.

In January 1990, Hayes announced the commercial availability of the Hayes ISDN PC adapter, an internal device that provides the installed base of IBM PC and compatible computers with access to ISDN services. At the same time, the company announced a support program for ISDN applications software developers, for which Hayes provided the Hayes ISDN-BIOS Interface Programmer's Guide. The Hayes ISDNBIOS Interface is a high-speed, full-featured program interface used for the development of software applications for the Hayes ISDN PC adapter.

Hayes continued its diversification efforts by introducing in September 1990 the "Hayes for LANs" product line, which extends the company's presence in the networking market. "Hayes for LANs" is a global family of Ethernet LAN adapters for the IBM XT/AT, PS/2 (Models 25 and 30), IBM compatibles, and EISA computers. Products currently in the line include EtherMate 8, EtherMate 8UTP, and EtherMate Trio16.

Acquisitions
June 1989: Hayes purchased JT Fax from Intelligent Systems. The purchase included the ownership of rights to the JT Fax brand, including trademarks and tradenames, as well as products and associated technologies used in conjunction with the product line. Specific assets included the JT Fax trademark, copyright, and intellectual property in connection with the JT Fax brand and private-labeled contracts for facsimile products. Financial terms were confidential. The transaction called for the smooth transfer of the JT Fax brand through several procedures, including joint product manufacturing and distribution with Quadram and Inter-Quadram, subsidiaries of Intelligent Systems, under license from Hayes. Quadram continued to

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most of them is the ULTRA 96's functionality with both IBM and Apple PCs. The FDX 9624 and FDX 9696 from Fastcomm Communications operate in Apple and IBM environments and cost $899 and $999, respectively. General DataComm also offers V.32 modems for IBM and Apple in its DataComm 296B and DataComm 596 products, priced at $1,495 and $1,395, respectively. Western DataCom's modem, 432 Class 5, operates with IBM and Apple PCs and sells for $1,195. Additional V.32 modems for Apple and IBM PCs are offered by CXR/Telecom Anderson Jacobson, Multi-Tech Systems, Memotec, Racal-Vadic, and Telenetics.

Characteristics

Overview
This report covers Hayes Personal Modem 2400plus and Smartcom EZ, and Personal Modem 2400plus and Smartcom for the Mac, and the V-series Smartmodems for IBM PC and compatibles, IBM PS/2, and Macintosh.

V-Series Technology
The V-series includes all the functionality of its predecessors, the Smartmodems, but they also feature five

manufacture and distribute JT Fax products until December 1989. InterQuadram's joint distribution arrangement extended through 1990.

August 1989: Hayes purchased *Practical Peripherals, Inc.* of Westlake Village, CA, and made the company a wholly owned subsidiary. Practical Peripherals continued to operate under its own management as a separate corporation designated "A Hayes Company." Hayes did not disclose the financial terms of the acquisition. As part of the acquisition agreement, Hayes and Practical Peripherals settled litigation about the "Modem with Improved Escape Sequence" patent issued to Hayes in 1985. Hayes and Practical Peripherals have dismissed all claims relevant to this litigation. Dennis Hayes

commented, "This acquisition is a logical step in our corporate plan to expand our market position. Practical Peripherals has established a brand which is positioned as a supplier of low-cost modems for personal computers. This is a natural step in the maturing of the personal computer modem market."

Alliances
August 1989: Hayes and *Silicon Systems*, of Tustin, CA, announced the first complete V.42 error-control integrated circuit set for 2400 bps modem. The integrated circuit is the first device to incorporate V.42 and the Hayes Standard AT Command Set, as well as Hayes AutoSync, Hayes Adaptive Data Compression, and Hayes Automatic Feature Negotiation. Hayes and Silicon Systems initiated

the partnership in 1988, with an agreement to share technology for the development of new custom, semicustom, and standard integrated circuits for current and future Hayes products. Carmelo Santoro, president and CEO of Silicon Systems, stated, "The integrated circuit set provides system developers, OEMs, and modem producers with sophisticated architecture and optimal performance."

May 1990: Hayes and Phylon Communications of Fremont, CA, announced the formation of a strategic relationship for the joint development of a fully compliant CCITT V.32 modem module from Phylon, the PHY-96H, which will meet global requirements. In a related announcement, Hayes noted the immediate availability of the V-series

ULTRA Smartmodem 9600 (ULTRA 96), which contains the PHY-96H modem module. This module is an enhanced version of the PHY-96 for the exclusive use of Hayes. As a result of the joint development with Hayes, PHY-96 includes the implementation of the Hayes V-series Smartmodem 9600 Ping Pong protocol and enhancements of the basic V.32 modem engine to conform to global specifications. Regarding the relationship with Phylon, Dennis Hayes, president, commented, "Our relationship with Phylon benefits the entire industry by offering a competitive cost and performance alternative to modem engines supplied by Rockwell."

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additional features: error control, adaptive data compression, automatic feature negotiation, automatic speed buffering (ASB), and Adaptive Start-Up (ASU). In the case of the 9600 bps V-series modems, V-series technology also means that the modem operates in a simulated V.32 full-duplex mode.

 Error control: V-series V.42 products implement CCITT Recommendation V.42 for error control. The recommendation specifies Link Access Procedure Modem (LAPM) as the primary error-control protocol and includes an alternative protocol in Annex A for backward compatibility with MNP Class 2-4 modems.

 CCITT V.42 specifies the process by which data communications equipment handles error control during the exchange of data. When two Hayes V-series modems implement LAPM to exchange data, the receiving modem uses a Frame Check Sequence (FCS) to verify the accuracy of the data it has received in the data frame. Based on the FCS, the receiving modem acknowledges receiving accurate data or tells the sending modem to retransmit the data frame if FCS indicates an error has occurred.

 The protocol defines the link establishment parameters, error-control procedures, and negotiation parameters for establishing, maintaining, and conducting data transfer. To implement a reliable high-speed feature, some form of error control must instruct the modem to retransmit a block of data if the block contains errors.

 When Hayes V-series technology was introduced in 1987 in the United States, CCITT V.42 error control had not been finalized. Rather than use a proprietary error-control method, Hayes elected to base V-series error control on the LAPB link-level portion of X.25 for the following reasons: It allows point-to-point error control; it represents support for an existing, widely used international standard that is versatile; and it provides a logical migration path for future products with full implementation of X.25.

 The CCITT X.25 protocol uses bit-oriented synchronous communications to provide error control and bidirectional data exchange service to communicating

Table 1. Hayes Standard AT Command Set

Command	Description	Command	Description	Command	Description
AT	command prefix—precedes command line	VO	display result codes in numeric form	&QO	asynchronous mode
<CR>	carriage return character—terminates command line	V1	display result codes in verbose form (as words)	&Q1	synchronous mode 1
A	go into answer mode; attempt to go online state	WO	negotiation progress result codes not returned	&Q2	synchronous mode 2
AV	reexecute previous command line; not preceded with AT nor followed by <CR>	W1	negotiation progress result codes returned	&Q3	synchronous mode 3
				&Q4	synchronous mode 4
				&Q5	error-control mode
BO	select CCITT V.22 standard for 1200 bps communication	XO	enable features represented by result codes 0-4		Note: &Mn may be used in place of all &Qn options except &Q43 and &Q5.
B1	select Bell 212A standard for 1200 bps communication	X1	enable features represented by result codes 0-5, 10-12	&RO	track CTS according to RTS
D	go into originate mode; dial number that follows; attempt to go to online state	X2	enable features represented by result codes 0-6, 7, 10-12	&R1	ignore RTS; always assume presence of CTS
DS=n	dial stored number	X3	enable features represented by result codes 0-5, 7, 10-12	&SO	assume presence of DSR signal
EO	disable character echo in command state	X4	enable features represented by result codes 0-7, 10-12	&S1	track presence of DSR signal
				&TO	terminate test in progress
EI	enable character echo in command state	YO	disable long space disconnect	&T1	initiate local analog loopback
		Y1	enable long space disconnect	&T3	initiate local digital loopback
HO	go on hook (hang up)	ZO	reset modem and recall user profile O	&T4	grant request from remotemodem for RDL
H1	go off hook; operate auxiliary relay	Z1	reset modem and recall user profile 1	&T5	deny request from remote modem for RDL
IO	request product identification code			&T6	initiate remote digital loopback
I1	perform checksum on firmware ROM; return checksum	&CO	assume data carrier always present	&T7	initiate local analog loopback with self test
I2	perform checksum on firmware ROM; return OK or ERROR result codes	&C1	track presence of data carrier	&V	view active configuration, user profiles, and stored numbers
		&DO	ignore DTR signal	&WO	save storable parameters of active configuration as user profile 0
L0 or L1	low speaker volume	&D1	assume command site when an on-to-off transition of DTR occurs	&W1	save storable parameters of active configuration as user profile 1
L2	medium speaker volume				
L3	high speaker volume	&D2	hang up and assume command state when an on-to-off transition of DTR occurs	&XO	modem provides transit clock signal
MO	speaker off				
M1	speaker on until carrier detected	&D3	reset when an on-to-off transition of DTR occurs	&X1	data terminal provides transmit clock signal
M2	speaker always on				
M3	speaker on until carrier detected, except during dialing	&F	recall factory settings as active configuration	&X2	receive carrier provides transmit clock signal
NO	require modem to handshake at DCE speed selected with S37	&GO	no guard tone	&YO	recall user profile 0 on power-up
		&G1	550 Hz guard tone	&Y1	recall user profile 1 on power-up
N1	permit modem to handshake at any DCE speed	&G2	1800 Hz guard tone	&ZN=x	store phone number "x" in location "n" (n=0, 1, 2, or 3)
OO	go to online state	&JO	RJ-11/RJ-41S/RJ-45S telco jack		
O1	go to online state and initiate equalizer retrain at 2400 bps	&J1	RJ-12/RJ-13 telco jack	The AT commands and the associated conditions described below may also affect modem configuration and operation. These commands issued with parameters other than those specified will generate the **ERROR** result code
		&KO	local flow-control disabled	
QO	modem returns result codes	&K3	RTS/CTS	
Q1	modem does not return result codes	&K4	X-on/X-off	
		&K5	transparent X-on/X-off	
Q2	modem returns result codes in originate mode, does not return result codes in answer mode.	&LO	dial-up line operation	
		&L1	leased line operation	CI	enable transmit carrier switching (preset)
		&PO	pulse dial make/break ratio = 39%/61%		
Sr=n	set register "r" to value "n"				
Sr?	display value stored in register "r"	&P1	pulse dial make/break ratio = 33%/67%	F1	disable online state character echo (preset)

Note: Bold parameters indicate factory settings. If a parameter (0, 1, etc.) is not specified, the modem assumes the 0 parameter.

applications. The CCITT has adopted a policy for maintaining the dynamic nature of X.25 as evidenced by enhancements to the protocol over the past decade.

The V-series system products also come in asynchronous versions of LAPB and LAPM that make use of the Asynchronous Framing Technique (AFT), which is an asynchronous augmentation for any bit-synchronous protocol, such as LAPB, LAPD, or IBM's SDLC. It replaces part of the link level of the synchronous protocol and brings error-control operation to asynchronous transmission links.

Adaptive data compression: Hayes developed a data compression algorithm to allow V-series modems operating at 2400 bps to achieve effective data throughputs of up to 4800 bps. The 9600 bps V-series modems

Table 2. V-series Smartmodem 2400 Specifications

Models Specifications	V-series Smartmodem 2400 V.42	V-series Smartmodem 2400B V.42	V-series Smartmodem 2400 X.25	V-series Smartmodem 2400B X.25	V-series Smartmodem 2400M (internal)
Data rate in bps	2400, 1200, 300	2400, 1200, 300	2400, 1200, 300	2400, 1200, 300	2400, 1200, 300
Facility	Leased, dial-up lines	Leased, dial-up lines	Leased, dial-up lines	Leased, dial-up lines	Dial-up
Line type	Two-wire	Two-wire	Two-wire	Two-wire	Two-wire
Operating mode	Full-duplex	Full-duplex	Full-duplex	Full-duplex	Full-duplex
Synchronization	Async/sync	Async/sync	Async/sync	Async/sync	Async/sync
Compatibility	U.S. modem std. 103, 212A/ V.22, V.22 bis, AT command set	U.S. modem std. 103, 212A/V.22, V.22 bis, AT command set	U.S. modem std. 103, 212A/ V.22, V.22 bis, AT command set	U.S. modem std. 103, 212A/ V.22, V.22 bis, AT command set	AT&T 103/113, V.22, V.22bis, AT&T 212/212A
Interface	RS-232-C	—	RS-232-C	—	NuBus
Configuration	Point-to-point	Point-to-point	Point-to-point	Point-to-point	Point-to-point
Modulation	FSK, PSK, QAM	FSK, PSK, QAM	FSK, PSK, QAM	FSK, PSK, QAM	FSK, DPSK, QAM
Error control	V.42	V.42	X.25	X.25	V.42
Dimensions	1.75" x 5.5" x 9.6"	3.33" x 4.2" x 0.835"	1.75" x 5.5" x 9.6"	3.33" x 4.2" x 0.835"	—

can achieve effective throughputs as high as 19.2K bps. The rates each modem can achieve with proprietary data compression depend on the type of applications in which the modem is being used (the best compression rates are attained in data applications that contain many repetitive patterns, such as spreadsheets).

Hayes supports the CCITT V.42 bis standard, which received approval by the CCITT Study Group XVII in September 1989. V.42bis specifies the data compression technique to increase the throughput of modems that incorporate the LAPM error-control protocol, which averages three-to-one data compression and as much as four-to-one on some files to the V-series products. The standard is based on the Lempel-Ziv compression algorithm developed by AT&T Bell Laboratories and includes enhancements from IBM, British Telecom plc, and Hayes. V-series customers with V.42 capabilities can upgrade to V.42bis through Hayes Customer Service.

Automatic feature negotiation: This V-series feature improves the quality of communications and lessens the level of modem/end-user interaction. Automatic feature negotiation originates when a V-series product establishes a call. After the handshake, the V-series modem detects if the receiving modem belongs to the V-series. If the modem does not, the V-series modem automatically adjusts to the parameters that it and the

receiving modem share in common, such as speed, compression method, and error-control method. When the receiving modem is a V-series modem, the modem again selects a combination of common features that offer the most efficient data transmission.

Automatic Speed Buffering (ASB): ASB allows the Hayes V-series modem connected to the mainframe or PC to maintain a fixed speed between itself and the data terminal equipment (DTE) regardless of the speed of the incoming modem's data transmission. This feature provides a fixed-speed interface between modems and DTEs. In PC-to-host communications in which a lower speed modem may be contacting a higher speed modem attached to a mainframe, this feature is especially important. For example, in many instances, a mainframe maintains a constant 19.2K bps port speed with its modem, even though a range of lower speed modems may want to call in.

Adaptive Start-Up (ASU): This feature facilitates communications for a 9600 bps V-series modem operating in a synchronous, mainframe environment when the flow of data tends to be more bidirectional between the host and a connected PC. ASU lessens the equalization time required by a modem to adapt to the special needs of this type of communication, thereby enhancing the turnaround performance in these mainframe applications. ASU improves line turnaround time.

Table 3. V-series Smartmodem 9600 Specifications

Models Specifications	V-series Smartmodem 9600 V.42	V-series Smartmodem 9600B V.42	V-series Smartmodem 9600 X.25	V-series Smartmodem 9600B X.25	V-series ULTRA Smartmodem 9600
Data rate in bps	2400, 1200, 300, 9600, 4800	2400, 1200, 300,9600, 4800	9600, 4800, 2400, 1200, 0 to 300	9600, 4800, 2400, 1200, 0 to 300	9600, 4800, 2400, 1200, 7/1200, 1200/75, 300
Facility	Leased, dial-up lines	Leased, dial-up lines	Leased, dial-up lines	Leased, dial-up lines	Leased, dial-up lines
Line type	Two-wire	Two-wire	Two-wire	Two-wire	Two-wire
Operating mode	Half-duplex (2400 bps), simulated full-duplex (4800 and 9600 bps)	Half-duplex (2400 bps), simulated full-duplex (4800 and 9600 bps)	Half-duplex (2400 bps), simulated full-duplex (4800 and 9600 bps)	Half-duplex (2400 bps), simulated full-duplex (4800 and 9600 bps)	Full-duplex
Synchronization	Async, sync Hayes Auto Sync	Async, sync Hayes Auto Sync	Async, sync Hayes Auto Sync	Async, sync Hayes Auto Sync	Async/sync
Compatibility	U.S. modem std. 103, 212A/V.22, V.22 bis, AT command set	U.S. modem std. 103, 212A/V.22, V.22 bis, AT command set	U.S. modem std. 103, 212A/V.22, V.22 bis, AT command set	U.S. modem std. 103, 212A/V.22, V.22 bis, AT command set	V.32, V.42bis, X.25, V.21, V.22, V.22bis, AT command set
Interface	RS-232-C	—	RS-232-C	—	—
Configuration	Point-to-point	Point-to-point	Point-to-point	Point-to-point	Point-to-point
Modulation	FSK, PSK, QAM	FSK, PSK, QAM	FSK, PSK, QAM	FSK, PSK, QAM	Trellis encoding/Viterbi decoding
Error control	V.42	V.42	X.25	X.25	V.42
Dimensions	1.75" x 5.5" x 9.6"	13.33 x 4.2 x 0.937	1.75" x 5.5" x 9.6"	13.33" x 4.2" x 0.937"	1.75" x 5.5" x 9.6"

At 9600 and 4800 bps, the modems use a transmission protocol that accelerates turnaround time by automatically adjusting the activity on the line in proportion to the volume of data being transmitted, resulting in a "simulated" full-duplex operation. Users should note, however, that the modems only *simulate* V.32 operation.

Ping-Pong Protocol
At 9600 and 4800 bps, Hayes' ping-pong protocol goes into effect. The protocol incorporates unique synchronization techniques to deliver fast line turnaround to simulate full-duplex, V.32 operation in terminal or interactive modes. In situations involving fast downloads of large data files from mainframes to PCs, or full-screen data transfers in which the volume of data in the reverse direction is light, ping-pong protocol automatically allocates the direction of activity on the line in proportion to the volume of data being transmitted.

Hayes AutoSync
Hayes AutoSync is a cost-effective means for equipping a personal computer with synchronous communication capability. It enables a Hayes modem to execute an asynchronous-to-synchronous data conversion after the telephone connection has been made.

This communication capability originates from the Hayes Synchronous Interface (HSI) and the Hayes Synchronous Driver (HSD). HSI defines an applications interface for software developers to use in designing synchronous communications applications, setting "rules" that coordinate how the software applications and the driver exchange information (status) and data.

HSD "tells" the modem that it is about to receive data, which should be transmitted synchronously. The modem receives the data from the personal computer, strips some bits to convert the datastream to synchronous, and then transmits the data synchronously over phone lines. The driver's instructions are executed automatically and transparently.

Table 4. Personal Modem 2400plus/Smartcom; Smartmodem 2400

Features	Personal Modem 2400plus and Smartcom	Smartmodem 2400
V.22 bis—2400 bps	Yes	Yes
V.22—1200 bps	Yes	Yes
212A—1200 bps	Yes	Yes
103—300 bps	Yes	Yes
External	Yes	Yes
Internal	No	AT/EISA, Micro-Channel, NuBus
V.42 LAPM & MNP 2-4 Error Control	No	No
V-series LAPB Error Control	No	No
V.42bis data compression	No	No
Hayes Adaptive Data Compression	No	No
MNP 5 data compression	No	No
Maximum throughput	2400 bps	2400 bps
Dial line support	Yes	Yes
Hayes standard AT command set	Yes	Yes

Hayes Enhanced Serial Port (ESP)

Multitasking operating systems sharing system resources can impact a personal computer's capability to accommodate interrupts caused by high-speed data communications. This situation can generate data loss when the personal computer cannot process every interrupt from the COM card. To correct this problem, Hayes developed ESP technology for hardware and made use of a public domain Enhanced Serial Interface (ESI) specification, which makes logical extensions to the standard COM card interface. This solution enables software developers to support high data rates in DOS, Windows, OS/2, and UNIX environments. Hayes offers ESP products for the Micro Channel, XT/AT, and EISA bus computers.

Features of the normal operating mode of ESP are:

• Emulation of 16450 UART for transparent operating with existing DOS software applications with support of data rates to 115K bps

• Transparent operations with OS/2 communications software via standard OS/2 device drivers

• Selectable receive hardware flow control and 16-byte character buffer for 16550 UART emulation

Table 4. Personal Modem 2400plus/Smartcom; Smartmodem 2400 (Continued)

Features	Personal Modem 2400plus and Smartcom	Smartmodem 2400
Front panel status lights	Yes—2	Yes—8
X.32 (Dial X.25) & PAD	No	No
AutoStream/4 simultaneous sessions	No	No
Automatic feature negotiation	No	No
Automatic speed buffering	No	No
Flow control	No	No
Stored modem configurations—2	No	Yes
Stored phone numbers—4	Yes	Yes
V.54 diagnostics	No	Yes
Power-on self-test	Yes	No
Asynchronous	Yes	Yes
Synchronous	No	Yes
Hayes AutoSync	No	Yes
Bundled with software	Yes; Smartcom EZ (IBM); Smartcom for the Mac	No—externals; yes—internals; Smartcom III (IBM); Smartcom II (Macintosh)
EIA-232D/RS-232D interface control	8-pin DIN	25-pin

In enhanced operating mode, Hayes ESP, managed by a communications co-processor, has dual transmit-and-receive 1K buffers and flow control to ensure bidirectional data integrity to 38.4K bps. Direct Memory Access (DMA) data transfers between the PC and Hayes ESP maximize throughput to 38.4K bps by lowering the overhead of processor-received data interrupts.

Hayes AT Command Set

The Hayes AT Command Set has become an industry standard. Many vendors incorporate AT Command Set-compatibility within their modems. For a detailed description of the Command Set, see Table 1.

Technical subcommittee TR-29.2 of the Telecommunications Industry Association (TIA) has extended the Hayes AT Command Set for use with facsimile modems. The lack of general-purpose software conforming to a standard command set had previously hampered the growth of the facsimile modem market.

Table 5. Smartcom Software

Feature	Smartcom EZ	Smartcom Exec	Smartcom III
110/300/1200/ 2400 bps	Yes	Yes	Yes
4800/ 9600/19,200 bps	Yes	Yes	Yes
38,400,/ 57,600, 115,200 bps	Yes	Yes	Yes
XMODEM, CRC, & 1K	XMODEM only	Yes	Yes
YMODEM, G, & Batch	No	Yes	Yes
ZMODEM	No	Yes	No
Kermit & Kermit Server	No	Yes	Yes
Autotype— Send Lines & Pacing	Yes	Yes	Yes
File Scrambling	No	No	Yes
File Compression	No	No	Yes
TTY	Yes (VT subset	Yes	Yes
VT52/100/102	Yes	Yes	Yes
ANSI/Show Controls	No	Yes	Yes
Keyboard Mapping	No	Yes	Yes
Full-featured Text Editor	No	Yes	Yes
Delete/Move/ Copy	No	Yes	Yes
Reformat/ Autowrap	No	Yes	Yes
Find/Search/ Replace	No	Yes	Yes
Configurable Editor Keyboard	No	Yes	No
Capture to Editor or Printer	No	Yes	Yes

Table 5. Smartcom Software (Continued)

Feature	Smartcom EZ	Smartcom Exec	Smartcom III
Autqtype File from Editor	No	Yes	Yes
Peruse Buffer	No	Yes	Yes
Background Operation	No	Yes	Yes
Concurrent Printing	Yes	Yes	Yes
Single Session/Multi-Session	Yes/No	Yes/No	Yes/Yes
Hayes V-series/ULTRA 96 Support	No	Yes	Yes
Hayes ESP	No	Yes	Yes
Dial X.25 Support	No	No	Yes
AutoStream/4 Simultaneous Sessions	No	No	Yes
SCOPE Scripting Language	No	Yes	Yes
Keyboard Macros	Yes	Yes	Yes
Context Sensitive Help	Yes	Yes	Yes
Remote Access	No	Yes	Yes
Program Password— Security	No	Yes	Yes
RAM Requirement	256K	512K	512K
Mouse Support	No	Yes	No
COM1-COM2 Support	Yes	Yes	Yes
COM3-COM4 Support	No	Yes	No
COM5-COM8 Support	No	Yes	No

Software programs developed according to the AT command set function interchangeably with facsimile modems from various manufacturers. The interface between the facsimile modem and the computer is the RS-232-C serial asynchronous interface used by data modems. After TR-29.2 is accepted in the United States, the standard will be proposed to CCITT Study Group 8 for consideration as an international standard.

Personal Modems
Personal Modem 2400plus and Smartcom for the Mac includes a 2400/1200 bps modem, communications software, and telephone and computer cables. A modem speaker and two LEDs provide the status of the

modem and data transfer. Easily connected to the user's Mac and phone line with permanent cables, the device communicates over standard dial-up phone lines.

Smartcom software for the Mac enables users to store phone numbers, communications instructions, and frequently typed commands. The auto answer feature enables users to receive files at off-peak times when rates are lower. VT102 terminal emulation supports communications with Digital Equipment Corporation's VAX machines and other minis and mainframes. The software also enables users to access database information and to exchange information with other Macs, PCs, or online services via Autotype.

Personal Modem 2400plus and Smartcom EZ is an asynchronous dial-up communications system for home

office and personal business applications for users of IBM PC, XT, AT, PS/2, and compatibles. The system, which communicates at 2400 bps, includes computer and phone cables. Smartcom EZ communications software enables users to create phone books for storing phone numbers and communications instructions. The package also stores frequently typed commands and automates exchanges of information with other computers using Autotype. Users can also access databases.

V-Series Smartmodems
For specifications of V-series Smartmodems 2400 and 9600, see Tables 2 and 3.

Software
For details on Smartcom EZ, Smartcom Exec, and Smartcom III, see Table 5.

HayesConnect, announced in March 1990, is a software program that implements modem sharing for users on AppleTalk networks. The package makes use of the AppleTalk datastream protocol (ADSP) to link served devices and workstations over LocalTalk and EtherNet networks with the AppleTalk network protocols. This program enables internal or external modems attached to Macintosh computers to be shared. Users can buy HayesConnect as a single software product or bundled with the range of Hayes modems and communications software package.

Smartcom III Version 1.2 makes use of the V.42bis data compression capabilities in ULTRA 96 by selecting port speeds up to 38.4K bps. The software automatically adjusts the computer's communications port speed based on the computer's microprocessor speed. Through Enhanced Serial Interface (ESI), Version 1.2 supports the high-speed and data protection capabilities of Hayes Enhanced Serial Port (ESP). When Hayes ESP is operational, Version 1.2 uses a port speed of 38.4K bps, regardless of the type of computer. Internal buffering and automatic flow control ensure data integrity.

Smartcom II for the Macintosh Version 3.2 supports the ZMODEM file transfer protocol. Auto receive support for MacBinary and ZMODEM file transfer protocols enables users to send files to unattended remote systems. In print mode, users can control the filtering of form feed characters and specify lines per page and columns per line. Transparent printing features include formatting commands for character-per-inch spacing and superscript/subscript characters (VT102/52 printer command support). Version 3.2 also supports international keyboards.

Smartcom Exec is a global communications software program for users who need asynchronous communications capabilities in DOS environments to connect to corporate mainframes, bulletin boards, and online services. The announcement of Smartcom Exec in June 1990 marks the phasing-out over the next two years of Smartcom II for IBM PCs and compatibles.

Hayes will continue to offer Smartcom II until July 1991 and will support it through July 1992. Hayes will provide an upgrade to Smartcom Exec to existing Smartcom II users.

To support global communications, Smartcom Exec features International Business English as the primary communications interface. The program also supports ESI and ESP. Smartcom Exec runs in most DOS environments, including Windows as a full-screen application and Desqview. Additional features include mouse support, keyboard macros, peruse buffer, and text editor with word processing capabilities. The SCOPE scripting language automates repetitive tasks.

Device Control
Users set parameters on all *V-series Smartmodems* through software. Without the software, users can set parameters through Hayes' AT or "ATTENTION" commands. Each of the four standalone modem models has eight LED status indicators on the front panel: high speed, automatic answer, carrier detect, off hook, receive data, send data, terminal ready, and modem ready. The V-series Smartmodems 2400B and 9600B have rear-panel COM port selection switches, with two possible selections. Diagnostics check the modem's firmware ROM and the communication link.

Each V-series Smartmodem is compatible with the Hayes Standard AT Command Set, plus a subset of V-series commands. Each modem also stores three configuration profiles: one is a factory-prepared configuration; the other two are user-set profiles. Of the user-set profiles, one acts as the default setting, which is recalled whenever the modem is reset or powered on. Through modem commands, users can call up and display these profiles, as well as phone numbers that are stored in nonvolatile memory.

The call progress monitoring feature supported by all V-series Smartmodems recognizes a dialtone, a ringback signal, or a busy signal.

The *V-series Modem Enhancer* brings V-series features to the large installed base of Smartmodem 1200 and Smartmodem 2400 units. According to the company, the V-series Modem Enhancer enables Hayes to move technology forward while offering existing Smartmodem product users opportunities to implement new technology with existing products.

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Equipment Prices

	Price per Unit ($)
V-series Smartmodem 2400 and 9600	
V-series Smartmodem 2400 X.25	649
V-series Smartmodem 2400 V.42	649
V-series Smartmodem 2400B X.25	599
V-series Smartmodem 2400B V.42	599
V-series Smartmodem 2400B X.25/Smartcom III	649
V-series Smartmodem 2400B V.42/Smartcom III	649
V-series Smartmodem 9600 X.25	999
V-series Smartmodem 9600 V.42	999
V-series Smartmodem 9600B X.25	799
V-series Smartmodem 9600B V.42	799
V-series Smartmodem 9600B X.25/Smartcom III	849
V-series Smartmodem 9600B V.42/Smartcom III	849
V-series ULTRA Smartmodem 9600 (ULTRA 96)	1,199

■

Hayes LANstep Local Area Networks

Hayes compatibility has been a watchword to modem buyers since the early 1980s. Now Hayes has made a bold move to enter the LAN market with a product called LANstep.

Strengths

• A mature LAN operating system built around a graphical user interface.

• Electronic mail included with basic system.

• Ethernet adapter cards offered for all major wiring schemes.

Limitations

• LANstep workstations require hard disk reformatting to share files.

• DOS workstations have limited capabilities, cannot share files.

• Multiple DOS applications cannot run at the same time. Multitasking capability extends to only one DOS application and network services.

• No hub hardware for 10BASE-T.

Competition

Novell NetWare v2.2, WebCorp. Web, Artisoft LANtastic, Performance Technology PowerLAN.

Vendor

Hayes Microcomputer Products, Inc.
P.O. Box 105203
Atlanta, GA 30348
(404) 449-8791
In Canada:
Hayes Microcomputer Products
(Canada), Ltd.
295 Phillip Street
Waterloo, ON N2L 3W8

Price

LANstep network operating system costs $595 for five users. Five user expansion kits cost $395. Hayes EtherMate adapter cards start at $249.

—By John Krick
Associate Editor

Product Analysis

Product Description

Hayes LANstep is an entry-level network operating system built around an icon-based, mouse-driven graphical user interface (GUI) somewhat similar to the Macintosh and Microsoft Windows environments. LANstep is capable of connecting 255 workstations, but only 128 users can be logged on at one time. Unlike most other entry-level LAN operating systems, LANstep is not a true peer-to-peer network—it requires one PC to act as the Network Software Server (NSS). The NSS holds all the network operating system files, but does not have to be a dedicated machine. It can also perform as a user workstation.

Two types of user workstations can be implemented with LANstep—LANstep workstations and DOS workstations. LANstep workstations can perform a limited sort of multitasking—a DOS application can run at the same time as various network applications such as E-Mail. Two DOS applications cannot run at the same time, however.

DOS workstations have limited capabilities compared to LANstep workstations. While DOS workstations can access files, directories, and applications made public by LANstep workstation users, DOS workstation users cannot publish their files. DOS workstations also cannot perform the limited multitasking of a DOS application and network services that LANstep workstations can. DOS workstations can share printers with other stations on the network.

Hayes is also offering a line of Ethernet adapter cards that cover the major bus and wiring configurations for PCs on Ethernet. One card, the Trio16, is unique in that it includes connectors for all three major types of Ethernet cabling—thick coaxial cable, thin coax, and unshielded twisted pair. Hayes' spokespersons admit that these cards are not manufactured by Hayes, but decline to say exactly what company is the OEM.

Target Applications

File and printer sharing and electronic mail on small- to medium-sized local area networks.

Strengths

Hayes LANstep is a mature LAN operating system built around a graphical user interface (GUI). Formerly known as Waterloo PORT, LANstep has been marketed for some time and has a gained a loyal user following.

LANstep Mail, included with the basic LANstep system, is a full-featured electronic mail utility. It includes most of the features found in third-party E-Mail packages.

Hayes offers Ethernet adapter cards for all the popular wiring schemes. Hayes EtherMate cards are available in models for thick and thin coaxial cable, for unshielded twisted-pair wire and thick coaxial cable, and on the Trio16 card, in a unique configuration, for all three major wiring choices—thick and thin coaxial cable and unshielded twisted pair. In addition, these cards fit all of the major bus configurations of the IBM PC family, and cards are also offered for the Micro Channel Architecture used in the IBM PS/2 models.

Limitations

Since LANstep workstations require their own hard disk partition, a workstation's drive must be reformatted.

DOS workstations have limited capabilities and cannot share files. LANstep uses two types of workstations—LANstep workstations and DOS workstations. Only LANstep workstations can actually share files with other workstations. DOS workstations can only share printers.

Multiple DOS applications cannot run at the same time. The multitasking capability of LANstep is limited to LANstep workstations, which can run a single DOS application and several network services, such as E-Mail, concurrently. Multiple DOS applications cannot run at the same time. DOS workstations cannot do any sort of multitasking.

While Hayes has released network adapter cards for unshielded twisted-pair (10BASE-T) Ethernet, it has not brought out a 10BASE-T hub. A hub is a necessary component of an unshielded twisted-pair Ethernet network, and sales of Ethernet adapter cards could be adversely impacted if customers have to obtain a 10BASE-T hub elsewhere.

Overview

Models	Hayes LANstep Version 1.0
Product Type	Network operating system
Country of Manufacture	U.S.
Date Announced	2/91
Date Installed	3/91
No. Installed in 1990	Information not available
Target Market	Small- to medium-sized LANs

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Vendor Analysis

Product Strategy

In December 1990, Hayes purchased Waterloo Microsystems of Waterloo, ON, Canada. Long before GUI became an acronym familiar to most microcomputer users, Waterloo based its PORT network operating system around a GUI—a graphical user interface that, like the Macintosh GUI, uses a mouse, a pointer on-screen, and icons that respond to mouse clicks. In fact, Waterloo PORT's GUI predated commercial availability of the Macintosh. Hayes has now renamed PORT LANstep, but the GUI, based around a unique "room-and-door" metaphor, still delivers ease of use in the same intuitive manner. Applications and network utilities reside in "rooms." Access to a "room" is gained by clicking on its "door" icon.

One question that those familiar with the former Waterloo product line will probably ask is just why Hayes chose to whittle down that quite complete line to the barest minimum of products. Waterloo formerly offered two versions of its network operating system, as well as a rather complete line of connectivity options for a network operating system in this class. These options included a remote dial-in utility, a server that could support 32 simultaneous X.25 packet-switching sessions, an SDLC gateway to IBM's SNA networks, and a coaxial-attached terminal server for IBM 3278 emulation.

Target Markets

With LANstep, Hayes is clearly targeting the low-end user, but how Hayes can differentiate itself from any of the various DOS-based, low-end LAN operating systems seems problematic. LANstep actually occupies a middle ground between entry-level systems such as LANtastic and Web, and full-featured network operating systems such as Novell NetWare and Microsoft LAN Manager. Just how many

and what sort of network users fit into this middle is unclear. Hayes/Waterloo operating system, however, is probably not going to sell into places that already have a LAN installed—Hayes can only count on selling to users installing their first LAN.

Competitive Analysis

While there is a lot to be said for Hayes LANstep's GUI, the likelihood is that most PC users who are in the market for a mouse-driven user interface for their LAN are going to take a close look at Microsoft Windows running on Novell NetWare and not much else. The newest version of Novell NetWare, however, carries a list price of $895 in the five-user version and adding Windows for each workstation kicks the price up quite a bit. For $595, LANstep provides a graphical user interface. On the other hand, LANstep's GUI is primitive compared to Windows and while LANstep is Windows compatible, it seems strange to imagine the Windows GUI layered on top of the LANstep GUI.

Hayes' current method of offering expandability for LANstep users leaves a lot to be desired. The basic LANstep package supports five users and expansion packages must be purchased in five-user increments at $395 each. This means that if a user wants to attach the full 128 users that LANstep supports, he/she must purchase 25 expansion kits at a cost of nearly $10,000.

One thing LANstep has going for it is that it is a true multitasking operating system. The other systems listed here, with the exception of NetWare, run on top of DOS, and as such offer no multitasking capability at the workstation.

Market Position

There has been a recent upsurge in interest—among vendors, anyway—in entry-level LAN operating systems. Several new peer-to-peer network operating systems have appeared in the last year, and there are a few that have been around for awhile—most notably Artisoft's highly regarded LANtastic, that are still worthy competition for LANstep.

It appears as if Hayes has attempted to bring to market a LAN that is almost a turnkey solution, and that is admirable. At the low end, the market needs more serious single

Decision Points

Model	Requirements	Comments
Hayes LANstep Version 1.0		
	Network operating system software must be easily installable; menu-driven install programs are preferred.	LANstep features menu-driven install utility, but setup of LANstep workstations is complicated by necessity of reformatting and partitioning hard drive.
	Varying degrees of control over user IDs and passwords should be available to network administrators. In a peer-to-peer network, users should be able to make decisions about levels of permission (i.e., read-only, read-write, etc.) on files and directories they share with other users.	LANstep provides little control over user IDs and passwords beyond assigning them. User-defined permission levels are implemented, however.
	Open files must be uncorrupted in case of power failure. Incomplete disk write operations should be rolled back to status before write began. Disk mirroring and duplexing options should be provided.	Open files on LANstep networks are safeguarded against power failure, but no other specific fault-tolerance features are implemented.

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source suppliers, and a wider diversity of state-of-the-art, entry-level network operating systems. Hayes should, however, look to offering a solution that is more complete than its current line. While Hayes has wisely chosen to offer 10BASE-T compatible cards, it has not included a 10BASE-T hub. This is a serious omission from the current Hayes line that should be addressed. Such a device is necessary for implementing an Ethernet LAN, of any size, on unshielded twisted-pair wiring. While many hubs are available from other companies, the small user searching for a single source solution to his/her networking needs who has to obtain a hub from another vendor will probably purchase network adapter cards from that vendor, too.

That could leave Hayes selling its Ethernet cards to users who already have a LAN with an operating system and just need more LAN adapter cards. Here Hayes has entered a crowded market and is up against stiff competition.

Major Competitors

Novell NetWare Version 2.2: NetWare v2.2 offers all of the advantages of a full-featured network operating system including unlimited growth possibilities.

WebCorp. Web: Web is a simple, no frills network operating system that is easy to use and easy to install. It has no GUI but is hardware independent.

Artisoft LANtastic: LANtastic has been around for awhile but is still highly regarded among analysts and users.

Performance Technology PowerLAN: PowerLAN is powerful, fast, uses little memory, and offers broad interoperability options. It is also comparatively expensive.

Sales and Distribution Strategy

Sales
Hayes' international distribution network includes authorized distributors, dealers, and original equipment manufacturers (OEMs).

Distribution
The firms listed below distribute Hayes products in North America.
- Gates/F.A. Distributing
- Ingram Micro
- Merisel
- MicroUnited
- Tech Data

Support

Compared with most of its competitors—many of them small companies that offer only a few products—Hayes has a very strong support organization.

Competitors' Programs

- Novell NetWare Version 2.2 carries no specific guarantees about its interoperability; however, Novell spokespersons say that individual resellers will make any adjustments necessary in the event that NetWare does not perform as expected. Novell offers a broad range of support services including 24-hour technical support and a bulletin board on CompuServe called the NetWire Information Service.

- WebCorp. offers the "WEB Pledge" which states that if its product is found to be incompatible with the customer's major applications, WebCorp. will correct the incompatibility or refund the purchase price. Web maintains a technical support line for registered customers and dealers from 8 a.m. to 6 p.m. Pacific time. WebCorp. also offers a suite of bulletin board services from which customers can download software patches and obtain troubleshooting information. WebCorp. also offers, on a limited basis, on-line assistance in network setup, optimization, and troubleshooting.

- Artisoft provides a 30-day unconditional money-back guarantee. The guarantee extends to 90 days in the case of an incompatibility that Artisoft's technical support staff cannot resolve. Artisoft provides unlimited free technical support between 7 a.m. and 5 p.m. and also maintains two bulletin boards—one of its own and one on CompuServe. Software downloads, technical tips, and other items of interest are available. Artisoft also provides its unique FastFax service, through which users can receive tech bulletins and sales literature using their fax machine.

- Performance Technology offers a money-back guarantee on its software for the first 30 days after sale. The company offers technical support via a toll-free number from 8 a.m. until 5 p.m. Central time, weekdays only. The company also maintains its own bulletin board system. A $250 subscription fee is charged for the first hour of phone support, access to the bulletin board, a technical tips newsletter, and a marketing newsletter. Technical support is available through a 900 number at a charge of $2.50 a minute.

Policies and Programs

Warranty
Hayes LANstep carries a 90-day warranty with a money-back guarantee if LANstep does not perform as described in the documentation.

Hayes EtherMate products carry a four-year limited performance warranty, which means that Hayes warrants that its products will perform as advertised or the purchase price will be refunded. Hayes provides 24-hour turnaround of returned LAN products covered under warranty at no extra charge.

Support Services
Hayes Customer Service offers technical support for end users from 8 a.m. until 6 p.m. EST. Unlimited telephone support is provided for 90 days after the purchase, and additional technical support can be purchased for $120 per year. Hayes also maintains a 24-hour bulletin board system and Hayes Forums on the CompuServe and GEnie systems. The bulletin board and the Forums provide unlimited free technical assistance as well as access to software driver updates.

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Service Provider
Service is provided by Hayes resellers and distributors.

Service Location
Service locations vary depending on the provider. Many of Hayes' resellers and distributors have locations nationwide.

Service Hours
Service hours vary depending on reseller or distributor.

Training/Education
Hayes' spokespersons emphasize that the company's training representatives have given away over 2,000 free LANstep packages while giving training at dealer sites around the country. Beyond that, while users can arrange for individualized training through their Hayes sales representative, no formal training program is now in place for end users.

Documentation
LANstep documentation is extensive. An installation guide, a manager's guide, user manuals, and a reference card are included.

Specifications

Features/Functions

Product	LANstep with LANstep Mail Version 1.0
Characteristics	
LANs supported	Ethernet, Token-ring, Arcnet
Server Memory Req. Min. (bytes)	640K-byte DOS memory + 1.5M-byte extended memory
Server Operating System	LANstep
Workstation Memory Req. Min. (bytes)	640K bytes DOS memory + 512K extended memory
Workstation Operating System	LANstep or DOS
Network Interface Standards supported	NDIS
Protocols supported	NETBIOS
User Interface	GUI or command line
Mouse Support	Yes
MS Windows Support	Yes
Network Management Features	Super User logon has log of users on-line; memory usage reports for each station; disk space available reports for shared network disks; statistics on packets retries and failures; and a broadcast message facility.
File Sharing Features	Directories accessible to all network users are listed and broadcast. User directories can be "published" for access by all network users.
Printer Sharing Features	A workstation can share up to 3 printers with network; each printer has a separate queue and spooler. Users can monitor status of a job or cancel it. Super User can cancel, promote, and monitor any job in any queue.
Network Security Features	Users can designate access rights for individual shared files, selecting from Modify, Read Only, and None. DOS file and record locking is supported for databases and other applications. Network-level security is provided with user ID and password.

Features/Functions

Model	EtherMate 8	EtherMate 8UTP	EtherMate Trio16
Transmission Features			
LANs supported	Ethernet	Ethernet	Ethernet
Media supported	Thick, thin coaxial cable	Thick coaxial cable, unshielded twisted pair	Thick, thin coaxial cable, unshielded twisted pair
Connectors provided	AUI, BNC	AUI, RJ-45	AUI, BNC, RJ-45
Maximum data rate	10M bps	10M bps	10M bps
Operating systems supported	Hayes LANstep, Novell NetWare, Microsoft LAN Manager	Hayes LANstep, Novell NetWare, Microsoft LAN Manager	Hayes LANstep, Novell NetWare, Microsoft LAN Manager
Microcomputer bus supported	IBM PC XT, AT, EISA	IBM PC XT, AT, EISA	IBM PC AT, EISA
Bus size	8-bit	8-bit	16-bit
Card size	Half slot	Half slot	¾ slot

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Features/Functions (Continued)

Model	EtherMate P	EtherMate P/UTP
Transmission Features		
LANs supported	Ethernet	Ethernet
Media supported	Thick, thin coaxial cable	Thick, unshielded twisted pair
Connectors Provided	AUI, BNC	AUI, RJ-45
Maximum data rate	10M bps	10M bps
Operating systems supported	Hayes LANstep, Novell NetWare, Microsoft LAN Manager	Hayes LANstep, Novell NetWare, Microsoft LAN Manager
Microcomputer bus supported	Micro Channel	Micro Channel
Bus size	16-bit	16-bit
Card size	Full slot	Full slot

Options

Option: Configuration Dependent	Description
LANstep 5-step Expander Version 1.0	Allows additional users to be added in increments of 5. Up to 128 simultaneous active users and 255 workstations are supported.
LANstep Mail Gateway Version 1.0	Allows exchange of E-Mail messages between two LANstep networks. Installed on server.
LANstep Boot ROM Version 1.0	Allows diskless workstations to boot from server. Boot ROMs are available for the Hayes LANstep cards as well as for Western Digital and 3Com Ethernet cards and IBM Token-Ring cards.
LANstep Developer Kit Version 1.0	Includes 6 application program interfaces (APIs)—the Operating System API, the Name Services API, the File System API, the Printer API, the LAN Management API, the Menu API.

Compatibility

Support	Description
Standards Supported	IEEE 802.2, 802.3, 802.5, Ethernet Versions 1 and 2
Protocols Supported	NDIS, NETBIOS

Equipment Prices

	Purch. Price ($)
Hayes LANstep Software	
LANstep Network Operating System	595
LANstep 5-Step Expander	395
LANstep Mail Gateway	395
LANstep Developer Kit	595
Hayes EtherMate LAN Adapter Cards	
EtherMate 8	249
EtherMate 8UTP	329
EtherMate Trio16	349
EtherMate P	379
EtherMate P/UTP	399

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Hewlett-Packard Local Area Networks

In this report:

Product Summary

Editor's Note
Hewlett-Packard has made sweeping changes in the entire range of its local area networking products since our last report. New network operating systems based on OS/2 LAN Manager and new Starlan interface cards are some of the offerings reviewed here.

Description
Hewlett-Packard offers a comprehensive line of local area networking products comprising hardware and software.

Strengths
The networks provide innovative enhancements to industry-standard network operating system software. They offer a broad range of servers from PCs to minicomputers and multivendor connectivity and support.

Limitations
Hewlett-Packard's local networks have no major limitations.

Competition
IBM, Digital Equipment Corp., Novell.

Vendor
Hewlett-Packard Co.
Business Computing Systems
19091 Pruneridge Avenue
Cupertino, CA 95014
(800) 752-0900
In Canada:
Hewlett-Packard Ltd.
6877 Goreway Drive
Mississauga, ON L4V 1M8
(416) 678-9430

Price
Varies with configuration.

GSA Schedule
Yes.

Analysis

Product Strategy

Over the last few years the scope and direction of
Hewlett-Packard's PC networking efforts have
evolved from a largely proprietary scheme with
little flexibility to an integrated, multivendor sys-
tem incorporating many of the latest developments
in network operating systems and management.
Two major product announcements in the last
quarter of 1989 form the foundation of a compre-
hensive and well-structured network architecture
that includes products addressing every require-
ment of network implementation, from board-level
hardware to user interface.

In October 1989, Hewlett-Packard an-
nounced its new Vectra 486 PC. Based on the Intel
i486 chip and the Extended Industry Standard Ar-
chitecture (EISA) bus, and running under OS/2 or
UNIX, this high-performance microcomputer oc-
cupies a central position as a LAN server in HP's
networking plans. The floorstanding unit's six disk
drive shelves can hold two hard disks, with com-
bined storage capability of up to 1.3 gigabytes, and
four diskette drives.

The EISA bus was developed by Hewlett-
Packard and the eight other members of the "Gang
of Nine," as the EISA group has been dubbed. The
group has sought to extend the life of IBM's PC/AT
bus and the life of the thousands of products de-
signed for it by transforming it from a 16-bit bus
into a 32-bit bus. Using a two-tiered connector, the
bus will accommodate new 32-bit circuit cards
with a twin row of contacts, as well as the older
16-bit cards with only a single row.

In November 1989, HP announced the long-
awaited NewWave Office system. The release of
NewWave Office was held back pending the out-
come of the Apple vs. Microsoft and Hewlett-
Packard lawsuit. Apple charged that Microsoft
Windows and NewWave Office resembled the Mac-
intosh user interface closely enough to violate Ap-
ple's copyright. While the issue is still in litigation,
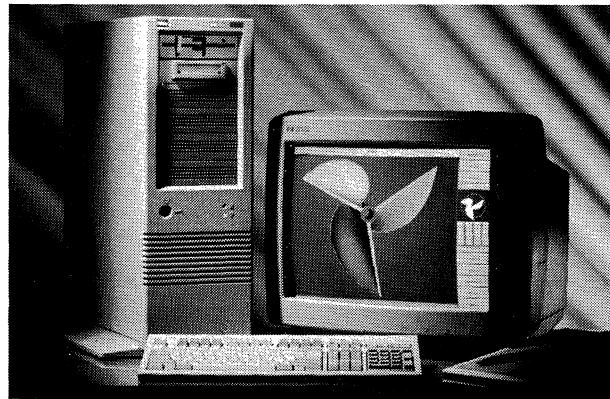
The HP Vectra 486 PC is expected to find
wide use as a file server in network applica-
tions. Based on the Intel i486 microprocessor,
the machine is Hewlett-Packard's first use of
the 32-bit EISA bus architecture.

one decision has been rendered allowing Microsoft
and HP to proceed with marketing products based
on Microsoft Windows.

NewWave adds significant features to the ba-
sic Windows icon and menu-driven graphical user
interface (GUI). Described as an object-oriented
environment, NewWave can tie together applica-
tions and data residing in various locations across
a network into one "object" represented by an
icon. A mouse click on an icon, for example, can
bring up a document containing statistical or ac-
counting information that has been updated by
another application, running on another network
node. This ability to integrate disparate processes
brings true distributed computing a step closer.
NewWave provides a consistent environment
across HP's broad line of computing products from
the HP 3000 and HP 9000 minicomputers to the
Vectra PC line.

In addition to these two newest offerings,
HP's continuing work, in cooperation with Mi-
crosoft and 3Com, to develop products based on
OS/2 LAN Manager has transformed Hewlett-
Packard into an important force in the connectiv-
ity market.

HP LAN Manager for OS/2 and MS-DOS

Central to Hewlett-Packard's vision of PC net-
working's future is Microsoft OS/2 LAN Manager,
which HP has licensed from 3Com. Developed
jointly by Microsoft and 3Com, OS/2 LAN Man-
ager is based on the emerging client-server model
of distributed computing, in which users share a

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powerful server that handles such chores as database search, rather than simply distributing files. In most networks today, when a database application running on a workstation needs a particular record, the entire database must be sent down the network for the workstation to do the search. In a client-server system, the server performs the search and sends the client only the requested information. The advantages of such a system are many: the amount of traffic that must be sent over the network is drastically reduced; tasks can be completed much more quickly, both because of reduced data transfer and because the server usually employs a much faster processor than the average workstation; and database integrity and security are maintained in a more consistent manner.

A PC configured as an OS/2 LAN Manager server requires 8 megabytes of memory and a minimum of 100 megabytes of hard disk space. HP also recommends that at least an 80386-based PC be employed as the server. In addition to HP Vectra PCs, a wide range of third-party PCs, including the IBM PS/2 product line, is supported as servers. OS/2 LAN Manager contains Microsoft's Network Driver Interface Standard (NDIS), which means that it will operate with a wide variety of interface cards, including HP's StarLAN 10 and IBM Token-Ring cards.

LAN Manager software is divided into three parts: the OS/2 server software, the OS/2 client software, and the MS-DOS client software. LAN Manager contains a standard set of application programming interfaces (APIs), which allow software developers to design common applications for all the supported systems: DOS, OS/2, or UNIX. The Named Pipes and Mailslots APIs for interprocess communications enable software developers to implement distributed applications across all the supported operating systems. NETBIOS also supports PC-to-PC communications for applications that require this standard. LAN Manager is compatible with the MS-Net network operating system and many of the products that were based on it, including HP's earlier OfficeShare network software and IBM's PC LAN Program.

HP LAN Manager/X
In addition to adopting OS/2 LAN Manager as its primary PC (server based) network operating system, HP has also developed LAN Manager/X in cooperation with Microsoft. LAN Manager/X runs

Company Profile
Hewlett-Packard

Corporate
Headquarters
3000 Hanover Street
Palo Alto, CA 94304
(415) 857-1501

In Canada:
Hewlett-Packard Ltd.
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Mississauga, ON
L4V 1M8
(416) 678-9430

European Operations
Headquarters are in
Geneva, Switzerland.

Officers
CEO: John A. Young
COO: Dean O. Morton
CFO: Robert P. Wayman

Company Background
Year Founded: 1939
No. Employees: 93,000

Bill Hewlett and Dave Packard founded their company in a garage with working capital of $538 and a single product. Hewlett-Packard celebrated its fiftieth anniversary in 1989. The company now manufactures over 10,000 products, including instrumentation for scientific, medical, and industrial applications, in

addition to computer systems and peripherals. HP today is a $10 billion company employing over 93,000 people worldwide.

Management
Statement
In fiscal 1989 HP had revenues of $11.9 billion, a 21 percent increase over 1988. Net earnings of $829 million were up 2 percent from $816 million in 1988. Orders totaled $12.2 billion, a 21 percent increase over 1988. "Within our computer business, we significantly strengthened our overall position this year with new workstations from Apollo and HP, new industry-leading PCs, and outstanding new peripheral products," said CEO John Young. "We also added some new high-end minicomputers to our growing family of HP Precision Architecture systems. We now feel we're in a better position to capitalize on business opportunities across a broader range of market segments than ever before."

under HP-UX, Hewlett-Packard's version of UNIX System V for its HP 9000 minicomputers, and will soon be adapted to run on the Vectra 486 and 386 PCs under SCO UNIX. LAN Manager/X allows workstations running OS/2 or MS-DOS to

take advantage of the powerful resources of the
UNIX operating system while retaining such ad-
vantages of the PC environment as ease of use and
availability of familiar applications. Workstations
can also communicate with servers running OS/2
LAN Manager.

HP and 3Com

In February 1989, Hewlett-Packard joined with
3Com in a marketing, product development, and
service support agreement. Centered around their
shared interest in Microsoft OS/2 LAN Manager,
the agreement also included cooperative develop-
ment of several projects to enhance the connectiv-
ity and interoperability of their respective LAN
Manager offerings. Development of a common
TCP/IP protocol will allow high-level interopera-
bility between 3Com's 3+Open, HP LAN Man-
ager, and the many other systems supporting this
industry standard. The two companies will also
ensure that future releases of their electronic mail
products will be compatible and conform to the
CCITT X.400 electronic mail standard. 3Com will
adopt HP's OpenView network management prod-
uct and cooperate on future development in this
area. 3Com has also endorsed the HP NewWave
Office environment and will incorporate its fea-
tures in future product releases.

In addition to product development, the
agreement provides a joint service and support re-
lationship, in which 3Com customers may choose
the option of Hewlett-Packard service for HP/
3Com products as well as for third-party devices
connected to the LAN. HP and 3Com will also
jointly develop network consulting and integration
and customer education programs and services.

OSI Support

Hewlett-Packard declared its support for the Open
Systems Interconnection (OSI) model as early as
1981. HP's support of OSI and the various IEEE
802 LAN standards committees has been substan-
tial, involving many of its employees and a consid-
erable share of its resources.

HP is committed to migrating its networking
products to complete OSI conformance by the mid
1990s, and that drive so far remains on schedule.
In the interim, HP has also committed itself to
supporting such de facto standards as the TCP/IP
protocol set.

HP OpenView Network Management

Based on the Microsoft Windows user interface,
OpenView provides network administrators with a
graphic picture of their networks and their opera-
tion. Color graphics and menu-driven operation
display network topology maps that enable online
management of systems and devices. The software
runs on HP Vectra PCs and most other IBM PC/
AT-compatible machines and supports manage-
ment of HP 3000 and 9000 servers, wide area
network links, and PCs.

HP StarLAN 10

At the top of Hewlett-Packard's hardware offer-
ings, StarLAN 10 is a 10M bps IEEE 802.3 net-
work. Using unshielded twisted-pair wire, this
network scheme employs a central hub with work-
stations connected in a star topology. The newest
StarLAN 10 interface card is offered in versions
for the 16-bit IBM AT bus and for the 32-bit IBM
PS/2 Micro Channel bus. These cards incorporate
an on-board medium attachment unit (MAU) that
connects a PC to the twisted-pair wire. Since most
twisted-pair cards require an external MAU, the
inclusion of this device on the card can mean sub-
stantial cost savings for network implementation.
A separate MAU connects HP 9000 and 3000
minicomputers to the Starlan network, either as
servers or to share host-system resources among
network users. Subnets can be linked by an HP
ThickLAN backbone to form a larger internetwork.

Support

Hewlett-Packard offers an organized, well-defined
program for HP AdvanceNet support. This pro-
gram comprises three "products": Network Plan-
ning and Design, Network Startup, and NetAssure.
(Each of these services requires at least one HP
CPU [HP 1000, HP 3000, or HP 9000] on the net-
work or at least one HP Personal Computer [Vec-
tra or HP 150] on a PC-only network.)

Network Planning and Design helps the customer
analyze data communications requirements and
create a detailed network design. An HP Network
Consultant interviews members of the customer's
organization to develop an in-depth requirements
analysis.

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Network Startup assists users in installing a new
HP network or in adding new connections to an
existing network. HP consultants help the user de-
velop a network start-up schedule; configure each
HP component in the network and coordinate ac-
tivities to configure other vendors' components;
test all connections installed under Network Start-
up; and document the installation process. This
documentation contains a network map, detailed
configuration information, and a list of support
contacts (including non-HP contacts, if available).

NetAssure is a contractual network maintenance
service that includes a multivendor problem man-
agement service. Multivendor problem manage-
ment services cover selected network vendors with
which HP has developed working relationships. If
an HP diagnosis of a network problem indicates
that equipment from one of these selected vendors
is involved, HP contacts the vendor directly for
remote or on-site assistance. HP continues to work
with the vendor until the problem is resolved,
keeping the network operator informed of the
problem status.

Competitive Position

Hewlett-Packard's position in the world of net-
working is, in some respects, tenuous. The com-
pany has emerged over the past few years from the
grip of a philosophy requiring computer manufac-
turers to produce as much of their products as pos-
sible. That philosophy, a holdover from the days
when computer meant mainframe, has prevented
many companies from facing the realities of the
multivendor, interconnectivity-oriented market-
place that exists today. For IBM or Digital Equip-
ment Corporation, the effects of such thinking
could be crippling. For Hewlett-Packard, never the
sales leader of either PCs or minicomputers, it
could be fatal.

HP has, however, made important strides in
the right direction. The company's leadership has
placed strong emphasis on connectivity, standards,
and alliances with other industry-leading firms for
mutual benefit. HP's work with 3Com and Mi-
crosoft is a case in point. Clearly, OS/2 will one
day be a leading PC operating system, perhaps the
dominant system. By extension, OS/2 LAN Man-
ager will carve out a niche as the preferred network

operating system under that environment. An alli-
ance with the creators of these two future heavy-
weights would make good sense for any PC
manufacturer.

Hewlett-Packard is not, however, just any
manufacturer of PCs out to win a slightly bigger
market for its products through "connectivity
solutions." HP is a giant corporation with a diverse
product line; therefore, it may have trouble offer-
ing the kind of price incentives that attract new
customers who are not HP minicomputer users by
tradition, or minicomputer users at all.

Decision Points

Hewlett-Packard hopes to offer potential custom-
ers several benefits. The quality of service pro-
vided by a major vendor such as HP could be
considered such a benefit and, as noted above, ser-
vice is a key aspect of the deal struck between HP
and 3Com. This agreement alone may help to get
HP's foot in many doors. Technical innovation—
always a hallmark of the company's products—is
evident in the specifications of such new products
as the NewWave Office user interface and the Vec-
tra 486 EISA-based microcomputer.

The market has a strongly held perception
that HP produces quality products. A recent HP
magazine advertising campaign reinforces this
opinion by showing a successful Wall Streeter who
chooses HP microcomputers because he fondly
remembers the HP calculator he depended on in
business school. Whether such considerations in-
fluence real buyers is not the issue. The point is
that Hewlett-Packard has in the past delivered in-
novative, high-quality solutions to real problems
and, judging by recent announcements, intends to
continue in this tradition. Whether such efforts
will be successful over the long term remains to be
seen.

User Profiles

The casual observer might expect that HP's biggest
market for networking solutions would be those
companies already using HP minicomputers. To
compete in a market where many vendors can pro-
vide LAN and WAN solutions, however, Hewlett-
Packard's networks must be judged on their own
strengths and not merely as appendages to previ-
ously installed minis. We spoke with users who

came to Hewlett-Packard from both directions. One of the HP customers has only a PC network with no HP minicomputer on-line. The other user acquired the whole solution: HP minis and LANs.

Los Angeles County Transportation Commission

We interviewed Walter Stephenson, MIS manager at the Los Angeles County Transportation Commission (LACTC). Operating under a mandate to provide public transportation within Los Angeles County, LACTC's jurisdiction encompasses 85 municipal entities including Long Beach, Torrance, and Santa Monica as well as the city of Los Angeles. The commission is undergoing rapid growth due to a program to construct rail transit systems throughout the county. "We're an organization that is closely involved with both local and state government," Stephenson said. "Working with elected officials, committees, and an informed public, our lifeblood is a mailing system." That system is on the network and available to all departments 24 hours a day. LACTC uses the system to deliver a continual flow of information about the commission's projects to city officials and various interest groups involved in public transportation. The commission must also send out construction notice flyers to residents, businesses, and schools and other public agencies in zip codes along the construction right-of-way. Other applications under development include project control for major construction projects, encompassing scheduling and costing, and building a consolidated transportation information database.

An interesting application currently in the "pilot project" stage involves proposals submitted by the various county municipalities. On a nightly, unattended basis, a single PC functioning as a communication server and using Microcom Carbon Copy remote software dials out to various municipal offices to pick up these proposals. This information is transferred to a database server for review by in-house analysts.

A StarLAN 10 network running under HP's OfficeShare network operating system, the LACTC network now comprises 28 machines, including four database servers for managing records and data lists for drawings. Servers are Hewlett-Packard Vectra RS-20 and RS-25 (386 based) machines. Workstations are Vectra 286 and 386 models and Compaq 286- and 386-based PCs.

Stephenson expects to bring the total number of machines up to nearly a hundred by the end of 1990.

A ThickLAN 802.3 backbone connects network segments on five floors of the 12-story building. Starlan hubs attached to the backbone connect via unshielded twisted-pair wires to the workstations. No problems were encountered during installation because all new wire was run at that time. "The phone system we have in place requires three conductors from each four-wire line, so there was no possibility of using existing telephone wire," Stephenson said.

LACTC will move to new quarters in mid-1990, and the network will remain in essentially the same form. The ThickLAN backbone will connect wiring closets on three floors, and each floor will have connections for as many as 120 machines. Stephenson said that an upgrade to OS/2 LAN Manager with UNIX-based servers was being considered.

Stephenson had high praise for the reliability of HP's products. "In two years we've only had one failure and that was only a plug-in jack," he said. "It's been a sweet relationship, if I can put it that way."

Hadson Corporation

We also spoke with Ray Thomas, manager of information services at Hadson Corporation. Headquartered in Oklahoma City, OK, Hadson is a holding company with diverse interests in oil and natural gas exploration and production, electric power plant construction, and defense. The company has achieved rapid growth through a corporate strategy of acquiring smaller firms. Its system of several LANs in widely separated locations linked into a wide area network is typical of networking challenges and possibilities in the 1990s.

Hadson has five Hewlett-Packard 3000 minicomputers—two in Dallas and one each in Oklahoma City; Hobbes, NM; and Irvine, CA. Each 3000 performs as a PC network server. The Dallas network supports 80 PCs; Oklahoma City and Irvine each have about 60, and Hobbes has 15. In addition, other LANs in Houston, TX; Denver, CO; and Washington, DC have as many as 15 PCs each. All the networks except Dallas use StarLAN 10. Dallas is on the earlier 1M bps Starlan. The 3000s also perform as host computers for many applications. The company has wound up with

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many types of IBM PCs and compatibles through its acquisitions, but newly purchased PCs are HP Vectras. All PCs are connected to the 3000s by unshielded twisted-pair wire.

The 3000s are linked to ITT/Metromedia leased lines by VitaLink TransLAN T1 connections to form a virtual LAN. A user anywhere on the system can address a logical drive or device transparently regardless of its geographic location. Printing is done by over 60 HP LaserJet IIs and 2000s. The LaserJet 2000s print 20 pages a minute and are connected to the HP 3000s.

For remote access to the 3000's resources, users can dial in over an X.25 Tymnet link; for example, from a construction site or from home. Tymnet also links Hadson's office in London, England with the United States. A planned Australian office will also use this public data network for access. No direct access to the PC network is possible from these remote links. The 3000's HP Desk Manager user interface features an electronic mail function allowing remote users to transfer files to and from the LANs in a two-step process. "We use this extensively," Thomas said. "We have a location in Weatherford, Oklahoma where drilling equipment inventory is kept, and all of their information is uploaded through E-Mail."

Asked why Hadson chose Hewlett-Packard, Thomas replied that the company's range of offerings was the major factor. "The software development facilities on the 3000 provided the rapid implementation we needed, it had the LAN which matched our strategy, and it had a very modular structure of systems and good communications options which allowed us to accommodate this dynamic corporate environment of buying and selling companies."

Characteristics

Model: LAN hardware and software products for micro- and minicomputers.

Date of Announcement: StarLAN 10—September 1987; LAN Manager/X—February 1988; OS/2 LAN Manager—January 1989.

Date First Installed: StarLAN 10—May 1988; LAN Manager/X—November 1989; OS/2 LAN Manager—November 1989.

Distribution: Direct sales and value-added resellers.

Architecture

Hewlett-Packard local area network products span the entire spectrum of network implementation, from small LANs composed only of PCs to global wide area networks including HP minicomputers, and employ industry-standard hardware and software. HP StarLAN hardware conforms to the IEEE 802.3 10BASET standard for a 10M bps network running on unshielded twisted-pair wire. HP's LAN Manager network operating system, available for both OS/2 and UNIX, is based on the Microsoft/3Com LAN Manager, which has been adopted by many LAN equipment manufacturers, including IBM.

Hardware

HP StarLAN 10 Link II and StarLAN 10 Micro Channel Link: StarLAN 10 Link II and Micro Channel Link PC face cards employ unshielded twisted-pair wire to link up to 1,024 HP Vectra, IBM PC/XT/AT or PS/2, and compatible machines. Conforming to IEEE 802.3 requirements, StarLAN 10 networks employ a star topology with central hubs connecting up to 12 devices. A workstation can be located up to 100 meters from a hub. An on-board Medium Attachment Unit (MAU) eliminates the need to purchase a separate MAU for each workstation.

HP StarLAN 10 Hub: StarLAN 10 Hub is a 10M bps multiport repeater for use with unshielded twisted-pair wire in IEEE 802.3 and Ethernet networks. The hub connects up to 12 workstations, which may be located as far as 100 meters away. Hubs can be connected directly to a coaxial backbone. A standard 50-pin telco connector allows the StarLAN hub to link 25-pair telephone cables from telco cross-connect blocks. A 12 Port Modular Adapter with twelve 8-pin jack connections is optional. An AUI port connects the hub to one of three Media Access Units (MAUs), for twisted pair, thin coaxial, or thick coaxial cable.

HP ThinLAN Link: ThinLAN Link uses thin coaxial cable arranged in a linear bus topology and can support as many as 30 nodes on a 185-meter segment.

HP 10M bps-to-10M bps LAN Bridge: LAN Bridge connects two or more LAN segments to extend the size and

capability of networks. 802.3 networks such as HP's StarLAN 10 can exchange information with Ethernet networks, since connections are made at the low-level MAC layer of the OSI model. Two LANs using different cabling, such as twisted pair and thin coaxial, can also connect through LAN Bridge. Up to eight bridge connections can exist between any two network points, with no redundant paths allowed.

HP 802.3 to Token-Ring Bridge: Token-Ring Bridge connects HP 802.3 Starlan or ThinLAN networks to networks employing IBM Token-Ring hardware.

Software

HP LAN Manager for OS/2 and MS-DOS: Based on 3Com's 3+Open and offered in five-user entry-level and unlimited-user versions, HP LAN Manager enables PCs running under MS-DOS or OS/2 to share applications, files, and peripherals. Users can create, delete, and modify files on OS/2 servers and can, via window interface, access resources and change the status of jobs in printer queues. Printer management and print spooling capabilities include flexible queuing and routing configurations, with one queue for multiple printers or many queues feeding a single printer; several levels of access rights and priorities; and user-friendly queue management.

Comprehensive security capabilities allow access rights to be set by the network administrator for directories, subdirectories and individual files.

Standard LAN Manager APIs are provided to ease administrative and interprocess communication program development. Administrative APIs enable programs to take advantage of server functions such as resource sharing, and they administer sessions, connections, and open files. Interprocess communications APIs include Named Pipes, Mailslots, and NETBIOS.

OS/2 LAN Manager software is offered in either 3.5-inch or 5.25-inch diskette formats, and upgrade options for HP OfficeShare and 3Com 3+ networks are available.

HP LAN Manager/X for the HP 9000: Available in versions for the HP 9000 Series 300, Series 600, and Series 800, HP LAN Manager/X enables these machines to operate as UNIX servers in networks of MS-DOS and OS/2 workstations. LM/X includes all the features of OS/2 LAN Manager described above, except for NETBIOS support. The MS-DOS and OS/2 client software is identical to that provided with OS/2 LAN Manager, so that servers running either OS/2 LAN Manager or LAN Manager/X can coexist on the same network and clients can address them both.

LAN Manager/X for the HP 9000 is available on magnetic tape in either reel or cartridge format. The Series 600 and Series 800 machines can support up to 512 users and the Series 300, up to 128.

HP LAN Manager Developer's Kit: The LAN Manager Developer's Kit is for both the OS/2 and UNIX versions and includes the OS/2 LAN Manager Programmer's Reference, the LAN Manager/X Programmer's Reference, and a diskette containing several programming examples.

HP PC Sockets Developer's Kit 1.0: The PC Sockets Developer's Kit contains the PC Sockets Programmer's Reference and a diskette containing library files.

HP Network Services 2.0/MS-DOS: Network Services provides MS-DOS PCs with Network File Transfer (NFT), Terminal Access, and Network Interprocess Communication (NetIPC).

NFT allows file transfer between networked PCs; HP 9000, 3000, and 1000 minicomputers; and Digital Equipment VAX minicomputers running Network Services for the VAX. A PC can also initiate transfers between any two of these minicomputers.

Terminal Access allows a networked PC to communicate as if it were a terminal directly connected to an HP 3000, using a terminal emulator such as HP AdvanceLink, HP Terminal Program, or a similar third-party product.

NetIPC allows interprocess communication for distributed applications between PCs and HP minicomputers.

Network Services also provides PC users of 3Com 3+Open 1.1 with connectivity to HP OfficeShare and HP Business System Plus (HP 3000) networks. The 3+Open client is also provided with NFT, Terminal Access, and NetIPC.

HP ARPA Services 2.0/MS-DOS: With the ARPA Services package, PCs running DOS can communicate using the protocols of the Advanced Research Projects Agency (ARPA) and the Berkeley Software Distribution (BSD) UNIX 4.3 system. De facto standards in the scientific and engineering communities, these protocols include FTP, TELNET, Berkeley Sockets, and Berkeley Remote Commands. FTP (File Transfer Protocol) provides commands for directory and file manipulation over networks. TELNET (Teletype Network Protocol) provides PCs with VT100 terminal capabilities for UNIX and other operating systems. Berkeley Sockets is an application program interface (API) that allows a program running on a PC to communicate with a similar program (its "peer") running on another machine on the network. Berkeley Remote Commands include remote UNIX file copy (rcp) that allows copying of files to or from a PC UNIX node; and remote shell (rsh) that allows UNIX commands to be executed on a host system from a remote PC UNIX node.

HP AdvanceLink: AdvanceLink provides terminal emulation capabilities for PCs. Emulating the HP 2392 or the Digital VT100 terminals, AdvanceLink allows speeds up to 19.2K bps and provides a proprietary error correcting file transfer protocol, as well as the popular xmodem protocol.

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HP AdvanceLink for the Macintosh: AdvanceLink for the Macintosh can provide Macintosh users with access to HP LANs. Requiring an Apple Ethertalk or Kinetics Etherport II interface card, AdvanceLink supports color graphics and the Apple Multifinder environment. Macintosh users can access HP DeskManager and OpenMail via terminal emulation.

HP NS LAN Gateway: NS LAN Gateway provides connectivity to HP 3000 minicomputers and Business System Plus functionality for customers with Novell NetWare LANs installed.

Equipment Prices

		Purchase Price ($)
Hardware		
D1808A opt.100	StarLAN 10 PC Link II	495.00
D1808A opt.200	StarLAN 10 Micro Channel Link	595.00
50927F	ThinLAN PC Link	695.00
28663A	StarLAN 10 Hub (includes ThickLAN MAU)	2,495.00
28663A opt. 241	StarLAN 10 Hub (without ThickLAN MAU)	1,995.00
28663A opt. 242	StarLAN 10 Hub (includes ThinMAU)	2,395.00
28648A	StarLAN 10 Bridge (10M bps to10Mbps)	7,250.00
28649A	802.3 to Token-Ring Bridge	8,250.00
28645A	ThinLAN Hub Multiport Repeater	3,168.00
92223A	Repeater Kit for ThickLAN	4,200.00
Software		
D1809A	LAN Manager for OS/2 and MS-DOS (5-user version)	995.00
D1810A	LAN Manager for OS/2 and MS-DOS (Unlimited user version)	3,495.00
B1003A	LAN Manager/X for the HP 9000 Series 300	*
B1011A	LAN Manager/X for the HP 9000 Series 800	*
D1814A	LAN Manager Developer's Kit for OS/2 and UNIX	150.00
D1813A	PC Sockets Developer's Kit 1.0	395.00
D1811A	Network Services 2.0/MS-DOS (software and manuals for 1 user)	395.00
D1812A	ARPA Services 2.0/MS-DOS (software and manuals for 1 user)	395.00
68333F	AdvanceLink	495.00
D2105A	AdvanceLink for the Macintosh (text version only)	299.00
D2106A	AdvanceLink for the Macintosh (with graphics support)	349.00
D2107A	AdvanceLink for the Macintosh (with color graphics support)	399.00
D1807A	NS LAN Gateway	4,995.00

Many options to LAN Manager/X are available depending on the HP 9000 model and number of users. Contact Hewlett-Packard for detailed pricing. ■

Hilgraeve Asynchronous Communications Products

In this report:

Note: Hilgraeve is presently previewing its first graphical user interface products: HyperACCESS for Windows and HyperACCESS for OS/2 Presentation Manager. Both are slated for introduction in early 1992.

HyperACCESS/5 is an asynchronous communications package for DOS and OS/2 platforms. It supports all popular file transfer protocols and modems and has remote control features, a built-in bulletin board, disk and file management, and antivirus protection while on-line.

Strengths

• Excellent ease-of-use features

• Powerful program features

• An abundance of options within one package

• Support for both DOS and OS/2 environments within one package

• Modest purchase and upgrading prices

Limitations

• Lacks support for Windows environment

• Lacks broad DOS local area network support

Competition

DCA's CROSSTALK Mk.4, Hayes' Smartcom III, Datastorm's Procomm Plus, Microcom's Carbon Copy, DMA's pcANYWHERE III, IBM's Communications Manager

Vendor

Hilgraeve Inc.
Genesis Center
111 Conant Avenue, Suite A
Monroe, MI 48161
(313) 243-0576, (800) 826-2760
In Canada:
Logiquest
3455 Isabelle, Local M
Brossard, PQ J4Y 2R2
1-514-444-3792

Price

$99.95 for DOS version; $199.00 for DOS and OS/2 version. GSA Schedule: Yes.

—*By Donna Horsley*
Staff Writer

Product Analysis

Introduced in 1985, Hilgraeve's HyperACCESS software continues to strengthen its position as a leading general-purpose communications program for DOS and OS/2 platforms.

The latest package, HyperACCESS/5 Version 2, is a powerful, easy-to-use communications program that supports all the latest file transfer protocols and modems. The same when used under DOS or under OS/2 operating systems, HyperACCESS/5 has features most communications programs lack: remote control of other PCs, a built-in bulletin board, disk and file management, a special high-speed file transfer protocol, and virus protection while on-line.

HyperACCESS/5 is well suited and intended for business professionals who are active PC users and who require communications software to provide a highly interactive environment and support of major platforms, connectivity, and customizing.

Target Applications

HyperACCESS software is targeted to the following applications:

- Business environments wanting to accept files from clients for subsequent processing, such as payroll, blueprint, plotting, printing, or publishing services.

- Business environments wanting to accept calls from clients, display custom prompts asking for order processing and billing information, then accept files transferred by the customer.

- Two or more individuals at different locations who are collaborating on projects such as developing a computer program, spreadsheet, or document.

- Users who call from home or on the road to access programs or data files on their office computers.

Strengths

Among communications packages, HyperACCESS/5's software consistently ranks superior for ease-of-use features. Its menus are easy to use and are the same throughout, and automation is simple with HyperPilot, Hilgraeve's own script language or learning feature. HyperACCESS/5's extensive protocol support provides speedy and accurate file transfer and terminal emulation.

HyperACCESS/5 provides powerful program features. Its programming language is strong, as is its support of file transfer protocols, including all the popular file-transfer schemes such as xmodem, zmodem, and Kermit, and its own, HyperProtocol, which is exceptionally fast. HyperACCESS/5 also features its own antivirus software called HyperGuard, which is patent pending.

In terms of options, many communications software packages have scripts, protocol support, and text editors, but few have them with all the options found in HyperACCESS/5. HyperACCESS/5 provides built-in BBS capabilities, is the first to pack full remote control capabilities, and is the first and only communications program to incorporate virus protection software.

Limitations

Although Hilgraeve's HyperACCESS/5 provides powerful program features, it could still benefit from a spell-checker feature and broader DOS local area network support. However, the company has made a step toward improving its LAN support for DOS; it has announced plans to incorporate shared modem support for DOS with a new version of HyperACCESS/5 that is equipped with the Novell NetWare Networks operating system.

Overview

Model	HyperACCESS/5 Version 2.0	HyperACCESS
System	8088, 80286, 80386, 80486	8088, 80286, 80386, 80486
Date Announced	March 1989	February 1985
Date Released	November 1989	October 1985
No. Installed	Information not available	Information not available
Base Price	$99.95 for DOS Version, $199.00 for both DOS and OS/2 Version	$159.00
Operating Environment	DOS, OS/2	DOS
Drives	Hard disk (750KB available)	5¼ in. or 3½ in., or hard disk
Memory	350KB; 450KB recommended	117K; 175K recommended

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Decision Points

HyperACCESS/5 Version 2.0

Requirements	Performance
Multiplatform support	Supports DOS and OS/2 operating systems. It lacks a Windows environment.
Network Support	IBM LAN Server, Microsoft LAN Manager, 3Com 3+Open, and other LAN Manager-based networks.
Speedy File Transfers	Supports the file transfer protocols reputed for speed in the DOS and OS/2 environments with minimum impact on the speed of other tasks: Xmodem Auto, Xmodem Checksum, Xmodem CRC, Ymodem, IK-Xmodem, Ymodem Batch, Zmodem, CompuServe QuickB, Kermit, HyperProtocol, Ymodem G.
Easy-to-Use Interface	HyperACCESS/5's main menu switches instantly from the familiar view of system names and settings, to new views showing how often and when the user called each system, or just the system name and phone number. The software's preference menu lets users determine how the program looks, sounds, and behaves without rerunning the install program.

Vendor Analysis

Product Strategy

When Hilgraeve was founded in 1978, its focus was on electronic products. The company slowly shifted its attention exclusively to software with the success of its ACCESS communications software for Heath/Zenith computers in the early 1980s. HyperACCESS, which was introduced in 1985, became a leading DOS communications program for IBM and compatible PCs by 1986. That first version, HyperACCESS, which is now sold only through the government's GSA schedule, has been updated to HyperACCESS/5 and HyperACCESS/5 2.0 (its latest version).

Today, Hilgraeve is aiming to expand HyperACCESS/5's 15% hold in the DOS market for advanced communications programs. It also wants to maintain its lead as the first OS/2 communications vendor and the first supporter of ISDN desksets. As part of this plan, Hilgraeve is presently previewing its first graphical user interface (GUI) products: HyperACCESS for Windows and HyperACCESS for OS/2 Presentation Manager.

According to Matt Gray, Hilgraeve president, the company's slow move to produce a Windows product was based on the belief that most communications software users were not demanding Windows operation because they were more interested in performance and ease of use, which present Windows programs lack. However, as user demands for GUI products increased, Hilgraeve began developing HyperACCESS for Windows, which Gray said outperforms CROSSTALK for Windows (the current Windows leader) in preliminary testing.

In terms of HyperACCESS for OS/2, this GUI product complies with IBM's CUA Workplace Model for Presentation Manager Interface, which features an object-oriented rather than application-oriented metaphor for communications. Both HyperACCESS for OS/2 and HyperACCESS for Windows are scheduled for release in early 1992.

Hilgraeve's product strategy also includes broader DOS local area network support. It has plans to incorporate shared modem support for DOS with a new version of HyperACCESS/5 equipped with the Novell NetWare Networks operating system.

The company has also enhanced its support of network architectures, remote communications, and customizing.

Hilgraeve, a privately held company, claimed its highest annual net sales in 1991. It reinvests most of the company's profits into research and development.

Target Markets

Hilgraeve targets business professionals in *Fortune* 500 companies who are active PC users and who require high-end communications software for an interactive environment, and it supports major platforms, connectivity, and customizing. Hilgraeve clients range from Citicorp and Charles Schwab, to NASA and the U.S. Departments of the Treasury and the Navy, to General Motors and Chrysler Corp.

Competitive Analysis

Market Position

According to Gray, HyperACCESS/5 ranks fourth in the DOS market behind Datastorm Technologies' Procomm Plus, DCA's CROSSTALK Mk.4, and Hayes' Smartcom III. Popular industry publications give HyperACCESS/5 above-average marks, citing the software's superior ease-of-use features and the capability—unlike most other communications programs—to bundle a wide array of functions in one package.

In the OS/2 market, HyperACCESS/5 is consistently named the top-rated asynchronous communications software package for OS/2 by leading industry publications. According to Hilgraeve, HyperACCESS/5 has captured 40% of the OS/2 market and is outsold only by IBM Communication Manager.

Hilgraeve forecasts that its position in both markets will improve when it releases its first graphical user interface products by early 1992: HyperACCESS for Windows and HyperACCESS for OS/2. Gray said its HyperACCESS for Windows outperformed CROSSTALK for Windows—the present Windows market leader—in recent preliminary testing.

Hilgraeve is not a major player in the international marketplace.

Major Competitors

In the crowded communications software market, HyperACCESS/5 fares better than most communications software programs for DOS and OS/2 platforms. It ranks among the top 10 communications software packages and competes specifically with Procomm Plus, CROSSTALK Mk.4, and Smartcom III.

In *The Software Digest Ratings Report*, published by National Software Testing Laboratories (NSTL)—a Datapro company that rates personal computer software— HyperACCESS/5 received the highest ease-of-use rating among 11 advanced asynchronous communications packages. It also scored high for its ease-of-learning features, outranked only by Smartcom III, which has an excellent programming language. Procomm, the top-selling communications software program, is difficult to access and use, according to NSTL, and does not support background operation.

Most of the communications packages in the industry have scripts, protocol support, and text editors, but few have them with all the options found in HyperACCESS/5. It provides built-in BBS capabilities, is the first asynchronous software program to pack full remote control capabilities, and is the first and only communications program that automatically screens downloaded files for a known computer virus. CROSSTALK Mk.4, which captures 25% of the asynchronous communications market and is considered the market's most powerful product, has a number of advanced features that rival those of HyperACCESS/5.

According to *The Software Digest Ratings Report*, HyperACCESS/5 provides good-quality Digital Equipment Corp. VT terminal emulation that is second only to CROSSTALK Mk.4. HyperACCESS/5 is also only one of three programs to support on-line compression.

DCA is presently the only communications vendor to have released a Windows package; however, Hilgraeve's HyperACCESS for Windows is scheduled for release in early 1992.

According to Gray, DCA's CROSSTALK for Windows has "no real edge" in the immature Windows market. He maintains that the still-unreleased HyperACCESS for Windows has outperformed CROSSTALK for Windows in preliminary testing. Hayes and Datastorm have not announced plans to release Windows products.

Sales and Distribution Strategy

Sales

Hilgraeve claims generous profits from selling its products through direct sales and resellers.

Distribution

Hilgraeve markets its products through leading resellers such as Kenfil Software Resource and GTSI, and direct to its customers. Hilgraeve is expanding its distribution network in the U.S. and in international markets.

Support

Hilgraeve provides HyperACCESS/5 users with traditional phone and maintenance support that is comparable to the competition.

Competitors' Programs

All the async programs that are competitive with Hyper-ACCESS provide, for the most part, related policies and programs. However, Microcom's Relay Gold provides easier upgrading or changes to its software packages with immediate access to any upgrades or changes in software packages by dialing Microcom's BBS and downloading the changes into their own software—all available free of charge. Microcom is also the only asynchronous communications vendor among HyperACCESS/5 competitors to offer free 30-day trials of its software packages.

Providing below-average product support among its peers is DMA's pcANYWHERE III. It does not offer a formal product warranty, and technical phone support is available only from 9:00 a.m. to 11:00 a.m. and 3:30 to 5:00 p.m EST Monday through Friday; most of the major competitive programs are available on average from 8:00 a.m. to 7:00 p.m. EST weekdays.

Policies and Programs

Warranty

HyperACCESS/5 comes with a 60-day guarantee, which allows users to return the program for refund or replacement within 60 days of purchase.

Support Services

HyperACCESS/5 users can access free technical phone support and bulletin board services.

Service Providers

Hilgraeve provides all services for HyperACCESS/5.

Service Location

Service for HyperACCESS/5 is provided via the Hilgraeve office.

Training/Education

Generally, Hilgraeve has not seen the need for standard training programs for HyperACCESS/5 users. However, specific arrangements in the form of customer-site and vendor-site training can be arranged to accommodate clients.

Service Hours

Phone support is available to HyperACCESS/5 users at (313) 243-0576 Monday through Friday from 8 a.m. to 6 p.m. EST. HyperACCESS/5 users can also access Hilgraeve's bulletin board service at no charge: (313) 243-5915.

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Documentation

HyperACCESS/5 software includes a Quick Install Guide plus a 360-page manual, which includes 200 pages on advanced use and script programming. Sample scripts and corresponding documentation are provided at no additional charge on the program disks and through Hilgraeve's bulletin board. A computer-assisted training disk is also available free from Hilgraeve.

Upgrade Policies

New versions of software programs are available to current users at reduced prices. A competitive upgrade offer enables users of other leading PC async communications programs, such as Datastorm's Procomm Plus, to purchase HyperACCESS/5 at considerably reduced rates.

Specifications

Enhancements

Feature	HyperACCESS/5
Improved Performance	Reduced memory requirement to 350K RAM; Added 16500A serial communications chip to boost speed and reliability when using high speed modems or in multitasking environments; Added modem sharing on networks such as IBM's LAN Server, 3Com 3+Open and other LAN Manager-based networks; Enhanced protocol support with zmodem file transfer protocol
New Features	Introduced remote control and antivirus software features
Improved Features	New support for 12 of the leading high-performance V.42 modems has been added; E-Mail added to host protection mode
New Options	Preferences option in the main menu allows users to reconfigure their system settings, including modem in use, without reinstalling the program
New Products	Previewing HyperACCESS for Windows and HyperACCESS for OS/2; both scheduled for release in early 1992

Features/Functions

Model	HyperACCESS/5
Network Interface Supported	IBM LAN Server, Microsoft LAN Manager, 3Com 3+Open
Media Supported	5¼-in. and 3½-in. program diskettes, containing both DOS and OS/2 versions of the program
Protocols Supported	Hilgraeve's HyperProtocol, ASCII, Kermit, Ymodem, Ymodem Batch, Ymodem G, IK-Xmodem, Xmodem Auto, Xmodem CRC, Xmodem Checksum, CompuServe Quick B protocols, Zmodem
Computers Supported	IBM PC/XT/AT, PS/2, and compatibles
Addressable Ports	COM1 through COM8
File Transfer	Text, binary
Terminal Emulation	Digital VT52/VT100/VT220/VT320, IBM 3101/3278, ANSI, and TTY

Pricing

	Purch. Price ($)
HyperACCESS/5 (for DOS and OS/2 Versions)	199.00
HyperACCESS/5 (for DOS Version only)	99.95

■

Hughes LAN Systems Products

In this report:

Hughes LAN Systems designs, manufactures, and markets LAN products that support multiple protocols and mixed-media networks consisting of 100 to over 20,000 connections. The company's products cover network management, internetworking, terminal-to-host links, and PC networking.

Strengths

• Effective hardware.

• Extensive software offerings.

• Version 4.0 of MONET, an SNMP-based network manager, capable of integrating third-party SNMP Management Information Base (MIB) extensions into an SQL relational database.

Limitations

• More Ethernet oriented than token-ring.

• Lack of products supporting 10BASE-T.

Competition
Cabletron, Racal InterLan, Ungermann-Bass.

Vendor
Hughes LAN Systems
1225 Charleston Road
Mountain View, CA 94043
(415) 966-7300
Fax: (415) 960-3738
In Canada:
1155 North Service Road West, Suite 11
Oakville, ON L6M 3E3
(416) 847-1098
Fax: (416) 360-3838

Price
LINC/Term servers—$175 per port.

—*By Barbara Callahan*
Associate Editor

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Product Analysis

The Hughes product line includes four categories: PC Networking, Terminal-to-Host Networking, Internetworking, and Network Management.

PC Networking: Within this product segment, Hughes offers ProLINC Multiple Protocol Connectivity Software, LINC/2000 LocalNet 2000 Workstation Software, 414X Ethernet Network Adapters, 6130 Broadband Network Adapter, and 6052/6053 Network Translator Units.

The ProLINC and LINC/2000 connectivity software addresses the multiprotocol and multimedia needs of PC-DOS and PS/2 users, equipping desktop devices with the capabilities of universal workstations. When used with ProLINC software, the 414X and 6130 network adapter cards activate simultaneous connectivity functions to workgroup networking environments.

Terminal-to-Host Networking: The LINC/Term Terminal-to-Host Product Family includes LINC/Term 4208/2208 8-port multiprotocol servers, LINC/Term 4296/2296 32- to 96-port multiprotocol terminal servers and asynchronous interface modules, LINC/Term 3208 Multi-Protocol Terminal Server Module for SynOptics LattisNet 3000, LINC/Term 5208 Multi-Protocol Terminal Server for Chipcom ONline System Concentrator, and LINC/Term TSRV-8 Multi-Protocol Server Module for Cabletron MMAC. Also included in the terminal-to-host sector is the LocalNet 2000 Terminal-to-Host product family.

Hughes equips these products with full-function user interfaces to SynOptics, Chipcom, and Cabletron hubs, making them suitable for servicing clusters of devices located in twisted-pair, structured wiring environments.

Internetworking: Hughes' ProBridge family includes the ProBridge 8033 Ethernet-to-Ethernet bridge, ProBridge

8133 Remote Ethernet bridge, ProBridge 8032 Broadband-to-Ethernet bridge, ProBridge 8233 Ethernet-to-Broadband Backbone bridge, and ProBridge 8235 Token-Ring-to-Broadband Backbone bridge.

These products perform high-performance internetworking services. They include a broadband backbone system and local and remote bridges.

Network Management: The software in this category includes MONET 4.0 Network Management Center and 9020 Network Monitor. MONET V4.0 is an SNMP-based network management software product that supports multivendor networks by integrating third-party MIBs directly into its relational database. MONET runs on a Sun-4 workstation.

Strengths

Effective Hardware: The ProBridge 8033 serves as an example of the effectiveness of Hughes' hardware. NSTL of Plymouth Meeting, PA, a division of Datapro, tested the Hughes ProBridge 8033 in a laboratory setting. For usability, NSTL rated ProBridge highly, assigning it an 8.4 out of a possible 10. NSTL also cited the product's "very good source address table, robust configuration/administration features, good performance under light-to-moderate loads, and excellent documentation."

LINC/Term multiprotocol terminal servers support packet switched connections for ASCII devices over Ethernet or broadband cabling systems. Asynchronous Interface Modules (AIMs) enable the servers to expand their base configurations of 32 devices to a maximum of 96 devices. Three LINC/Term server modules support packet switched connections to devices on the hubs of third-party vendors.

Extensive Software Offerings: Hughes offers a wide range of networking software. Network management software not only assists network managers with Hughes' products, but also with those from other vendors. The LocalNet

Overview

Product Families	MONET, ProLINC, ProBridge, LocalNet 2000, LINC/Term, Network Adapters
Models/Versions	MONET V4.0; ProLINC 2.0; ProBridge 8033/8133/8032/8233/8235; LocalNet 2508/2532/2522/25128/2528; LINC/Term 4208/2208; 4296/2296; 3208/5208 and TRSV 8; 414X and 6130 adapters
Product Types	Network management software; internetworking; terminal-to-host; PC networking
Base Price	ProLINC 2.0—$450; ProBridge 8033—$2,995; LINC/Term 3208/5208/TSRV-8—$1,395
Date Announced	MONET 4.0—7/91; ProLINC 2.0—2/91; ProBridge—8/90; LocalNet 6130—9/88; LINC/Term TSRV-8—7/90
Date Delivered	MONET 4.0—7/91; ProLINC 2.0—2/91; ProBridge—9/90; LocalNet 6130—11/88; LINC/Term 4296—12/88
No. Installed	Hughes has installed over 2,200 networks that connect over 700,000 devices; over 70 of these networks support over 1,000 connections.

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Decision Points

Models	Requirements	Comments
MONET	Network management for large users	This SNMP-based network management software supports large multivendor networks by integrating third-party MIBs into its relational database.
ProLINC software	Workstation software to provide multiprotocol, multimedia connectivity	ProLINC provides DOS-based PCs and PS/2s with seamless access to LAN and network resources.
ProBridge Family	Obtain packets from a LAN and pass them to another LAN; learn addresses of nodes on LANs	ProBridge bridges provide connectivity from Ethernet-to-Ethernet, from token-ring to broadband backbones, from Ethernet-to-broadband backbones, from broadband-to-Ethernet, and among remote Ethernet bridges; perform source or destination address filtering.
LocalNet 2000 Terminal-to-Host Family	Support the attachment of terminals or hosts to a large network	The models in this family attach from 8 to 128 user-devices to a Hughes network; family includes the hardware and software required to build networks consisting of several thousand devices.
LINC/Term Multiple Protocol Terminal Servers	Enable users to create simultaneous terminal connections across different media to hosts or hubs	LINC/Term products support packet switched connections for ASCII devices over Ethernet or broadband cabling systems to hosts or hubs from SynOptics, Chipcom, and Cabletron.
Network Adapters	Serve as interfaces between a PC and the network's transmission cable	Hughes' adapters support PCs and PC/2s with an 8-bit ISA bus; support broadband and baseband cabling.

2000 Configuration Manager shares the relational database of the MONET Network Management Center and supports the management of mixed networks from a single platform.

ProLINC Multiple Protocol Connectivity software combines access for IBM, Digital Equipment, UNIX, or Sun hosts. It also supports NetWare, VINES, and LAN Manager servers. When operating with ProLINC, LINC/2000 software enables users to log on to remote LN-2000-connected computers to transfer files and share access to remote devices.

MONET V4.0: MONET (Managing Open Networks) seamlessly integrates third-party Simple Network Management Protocol (SNMP) Management Information Base (MIB) extensions into an SQL relational database, a function eagerly anticipated by many users. Hughes solved the third-party SNMP MIB problem by incorporating the MIB

Master, an MIB parser, into MONET. The MIB Master enables users to install multivendor MIBs directly into the relational database at run time. In addition, Hughes' management applications can access the MIBs.

Since 1989, when the company introduced the first SNMP manager to use an SQL relational database management system, Hughes has actively promoted SNMP management. At present, MONET is the first SNMP manager that facilitates the integration of third-party MIBs into an SQL database. Although deeply committed to SNMP, Hughes has not neglected other protocols. MONET can support multiple management protocols concurrently.

Limitations

The Hughes product line tilts strongly toward Ethernet. Of the five bridges in the ProBridge line, only one supports

Company Activity

1979	Founded as Sytek
1981	Installed first commercial broadband LAN
1983	Installed first encrypted LAN
1984	First installed 500-connection network
1987	First 10,000-connection network
1987	Introduced Multiple Protocol Architecture
1988	Introduced token-bus backbone
1989	Sytek acquired by Hughes Aircraft Co.; renamed Hughes LAN Systems

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token-ring—the ProBridge 8235 Token-Ring-to-Broad-band Backbone bridge. The LINC/Term Terminal-to-Host family supports Ethernet or broadband cabling systems. Hughes' PC network adapters also support Ethernet or broadband.

In spite of its strong Ethernet leanings, Hughes does not support 10BASE-T, which received approval by the IEEE in September 1990. The possibility exists, however, that Hughes will be supporting 10BASE-T in the near future. The evolution of 10BASE-T, which supports the use of un-shielded twisted-pair wiring for Ethernet, has revitalized the Ethernet market, giving pause to industry analysts who predicted that token-ring would overtake Ethernet in the nineties. Widely accepted throughout the industry, 10BASE-T is the subject of many interoperability projects currently being conducted by leading vendors.

Vendor Analysis

Product Strategy

Hughes bases its product strategy on Multiple Protocol Architecture (MPA), which empowers PCs, workstations, terminal servers, and network management stations with the capability of "talking" in the appropriate protocol geared to a specific task. By taking the MPA approach, Hughes trims down its product line because the multiple protocol access implemented through the LINC series of software packages eliminates the need for gateways or for file servers acting as gateways. Dispensing with gateways saves users money and does away with delays and inconsistencies caused by protocol translation. For global internetworking, Hughes relies on a product line that includes network management software, workstation software, bridges, terminal-to-host products, and network adapters.

Recently, Hughes has been emphasizing software, particularly MONET V4.0, an SNMP-based network management package that runs on the Sun-4 workstation. Although Hughes does not as yet claim a sizable market share in internetworking, MONET is steering the company in the right direction. Innovation is prized anywhere, but particularly in the dynamic LAN market. Hughes scored a first in V4.0 of MONET by solving the intricacies of inte-grating third-party MIBs into its relational database.

Target Markets

As Sytek, the company attracted the attention of Hughes Aircraft because of a product line that supported the needs of large networks. Hughes Aircraft saw a synergy between Sytek and another subsidiary, Hughes Network Systems. After entering into the Hughes' fold and becoming Hughes LAN Systems in 1989, the company produced LAN equipment that neatly complemented the WAN offerings of Hughes Network Systems.

Located in Germantown, MD, Hughes Network Systems specializes in advanced digital telecommunications. The company markets the Personal Earth Station, Gemini Earth Station, Telephony Earth Station, InTELEconference, SkyRider, and Integrated Packet Network.

When teamed together, Hughes LAN Systems and Hughes Network Systems cover all bases by offering users products for LANs and products for WANs. Since net-working networks over vast geographical areas has become standard operating procedure for many large organizations in the nineties, the LAN/WAN combination of these two Hughes companies affords users the opportunity for smooth communications within their own buildings or around the world.

Competitive Analysis

Market Position

According to a 1990 report on the bridge market by IDC, Digital Equipment ranks as leader with a 24.07% market share, followed by Retix with a 16.04% share, and Ungermann-Bass with a 12.66% share. IDC does not attribute a specific market share for bridges to Hughes, but would most likely assign the vendor a place in its amorphous "Others" category, which accounts for 14.32% of the bridge market.

In an analysis of the terminal server market, also conducted by IDC in 1990, Digital Equipment Corporation again ranks first with a 50% share. The second place goes to "Other" with a 14% share. Hughes does not make the list of vendors singled-out for mention in a list that includes 3Com (9%), Emulex (7%), Ungermann-Bass (6%), Xyplex (5%), Datability (5%), and Cisco (4%).

Future reports in which Hughes LAN Systems is likely to figure prominently are those involving network servers and LAN links. A recent report from MIRC, a market analysis firm located in Mountain View, CA, forecasts growth in the network server market as reaching the $14.5 billion mark by 1997. MIRC also predicts that the market for LAN-to-LAN and LAN-to-WAN internetworking products will take off at a similar growth rate.

Major Competitors

Although many of its competitors offer similar internetworking products, Hughes wins the prize for solving a long-standing complaint of users of SNMP-based systems—that of supporting third-party Management Information Base (MIB) extensions. Hughes achieved this feat by equipping MONET V4.0 with the capability of integrating third-party SNMP MIB extensions into an SQL relational database. Through this feature, Hughes has considerably advanced the cause of managing multivendor networks.

Two of its competitors, Cabletron and Ungermann-Bass, have recently stressed hubs as the foundation of their product lines. Although Hughes does not produce hubs, the company does market bridges, which are also part of Cabletron's and U-B's product lines. Unlike Hughes, both Cabletron and U-B have incorporated support of fiber into their bridges. Cabletron's Ethernet-to-FDDI bridging module ranks as an industry-first for intelligent wiring hubs. Since the cost of fiber optic cable is rapidly decreasing, Hughes might lose potential buyers who have migrated to fiber.

The lack of 10BASE-T support can also affect Hughes' standing in the market. Approved as the IEEE 802.3i standard for Ethernet in September 1990, 10BASE-T supports the 10M bps operation of Ethernet LANs over unshielded twisted-pair (UTP) cabling, which is less expensive and easier to install than coax. Cabletron's Desktop Network

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Interface (DNI) cards support 10BASE-T, as do Racal InterLan's adapter cards. Ungermann-Bass supports 10BASE-T throughout its product line.

U-B intersperses a great deal of token-ring support throughout its line, particularly in its adapters. Hughes' adapters support only Ethernet. They also support SCO/Xenix, however, which can be an added incentive for purchase. Racal InterLan's cards support UNIX in the original version, and Cabletron addresses the growing UNIX market through the SPECTRUM network management system.

Along with MONET, the other major trump card Hughes holds is its relationship with Hughes Network Systems, an alliance that brings to the table twice the networking expertise. For the long and the short of it, the Hughes duo can deliver. Cabletron's LAN/WAN strategy focuses on its MMAC smart hub, which integrates LANs and WANs and Ethernet, token-ring, and FDDI over any type of media.

Hughes offers a fine support system, as do Cabletron and U-B. Internetworking competitor Racal InterLan, however, outdistanced all, at least in the adapter segment of the business, by offering lifetime warranties on all Ethernet adapter cards.

Sales and Distribution Strategy

Sales

For end-user sales, Hughes focuses on the large network user. In addition, Hughes markets its product line through indirect sales channels. The products sold through these channels are usually integrated into turnkey systems solutions sold by VARs and OEMs. Hughes maintains sales offices in 19 cities in the United States.

The bulk of Hughes' sales (58%) are in the business segment of the market. The other largest sales segment is government (27%). Universities and medical organizations make up the rest of Hughes' sales.

Hughes LAN Systems is also in the unique position to take advantage of the wide area networking (WAN) technology of Hughes Network Systems (HNS), also a unit of Hughes Aircraft Co. When the two companies combine their expertise, they produce LAN/WAN solutions.

Distribution

International sales, which account for 30% of Hughes' sales, take place through 30 distributors located in 16 countries. To complement its direct sales effort and broaden the distribution of its networking technology, Hughes has entered into agreements with corporations that sell Hughes' products or incorporate them into their own products.

These corporations include IBM, Nixdorf AG, Concord Communications, Texas Instruments, Medical Systems Support Inc., The Santa Cruz Operation (SCO), Network General, Novell, Sun Microsystems, SynOptics, Hewlett-Packard, and Apple Computer.

Support

Hughes LAN Systems maintains full-service support capabilities in the United States, Europe, and Canada.

Policies and Programs

Warranty

Hughes conducts "zero-defects" testing on its products and guarantees the quality of its products with a one-year warranty for parts, labor, and return shipment. Extended warranties are available.

Support Services

Presales support includes network planning and configuration. During installation, Hughes' field personnel provide technical assistance, network design and certification, product installation, and turnkey project management. Postinstallation support includes a wide range of ongoing maintenance options, such as on-site service and mail-in repair.

Hughes provides two days of installation and training support for MONET at no extra charge.

In July 1991, Hughes announced a new customer service program called *FAST*, which resolves customers' problems by providing hardware maintenance and diagnostic telephone support. This program builds on key elements of the company's existing customer support program, but includes additional enhancements for customers running mission-critical network applications.

The Advance Hardware Replacement service, a key feature of *FAST*, ensures the shipment of a replacement unit to a customer by the next business day without waiting for return of the malfunctioning equipment. The Advance Hardware Replacement Service can be used as an enhancement to Hughes' standard hardware product warranty (which remains at a full one year) or can be purchased as a postwarranty service option.

FAST also features hardware diagnostic telephone support through the Customer Service technical support group. *FAST* is available within the U.S. and is priced as an annual maintenance contract per product.

Service Locations

The company maintains a technical assistance center to provide immediate help for customers over the phone. For product information, call (800) 395-LANS.

Training/Education

Customer education programs include a full range of courses offered at Hughes' headquarters in Mountain View or at the customer's site. Among the topics covered in the course are operation, network management, and network architecture. The company's technical education department teaches customized classes.

Documentation

In the evaluation of Hughes' ProBridge 8033, NSTL rated the product's documentation as "excellent."

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Upgrade Policies

Hughes has incorporated a conversion utility in MONET V4.0, which automates the movement of existing database records from V3.0 to V4.0.

Competitors' Programs

Cabletron

A support hot line, staffed from 8 a.m. to 7 p.m. (EST), Monday through Friday, provides immediate response and assistance. Cabletron also offers maintenance contracts. In July 1990, Cabletron entered into an agreement with Intel to offer worldwide, on-site maintenance and support.

Racal InterLan

Racal InterLan offers a lifetime warranty for 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 repair cost to the customer.

Ungermann-Bass (U-B)

U-B offers two customer support programs for Net/One enterprise networking users. The programs range from on-site software and hardware problem resolution to remote telephone software problem resolution and software updates. In 1990, U-B 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 through which support customers receive 24-hour access to an expert support database for troubleshooting and interactive communications with other DARTBoard users.

Specifications

ProBridge Features/Functions

Features	ProBridge 8033	ProBridge 8133	ProBridge 8032
LANs Supported Functions	Ethernet-to-Ethernet Full bandwidth filtering and forwarding	Remote Ethernet Custom packet filtering	Broadband-to-Ethernet Provides a protocol-transparent communications path between Ethernet and a 2M bps broadband network; also functions as an interchannel bridge linking channels via Ethernet backbone segment
Protocols Supported	Spanning Tree, SNMP	SNMP, Spanning Tree, Linksaver	SNMP, Spanning Tree

ProBridge Features/Functions (Continued)

Features	ProBridge 8233	ProBridge 8235
LANs Supported Functions	Ethernet-to-Broadband Backbone Provides high-performance broadband backbone connectivity between multiple Ethernet or IEEE 802.3 networks, consolidating them into one virtual network; custom packet filtering	Token-ring-to-Broadband Backbone Provides broadband backbone connectivity between multiple 4M bps token-ring networks, consolidating them into one virtual network; operates as source routing bridge or transparent bridge
Distance	Spanning up to 24 miles	Spanning up to 24 miles

LocalNet 2000 Terminal-to-Host Features/Functions

Features	2508	25128	2528
Type	8-port packet communication unit	Modular packet communication unit	Multiple packet communication processor
Number of User Devices	Up to 8 (terminal or host)	32 to 128 (terminal or host)	8
Functions	Packet-mode interface unit, providing distributed intelligence; allows user device to communicate on a broadband LAN	Packet-mode interface unit	Modular card enabling 25128 to accommodate more than its base configuration

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LINC/Term Features/Functions

Features	LINC/Term 3208	LINC/Term 5208	LINC/Term TSRV-8
Type	Multiprotocol terminal server module for SynOptics LattisNet System 3000 Multiprotocol terminal server module for Chipcom ONline System Concentrator Multiprotocol terminal server module for Cabletron MMAC		
Number of Ports	8	8	8
Full-function User Interface	Yes	Yes	Yes
Functions	Servicing clusters of terminals or other devices in twisted-pair, structured wiring environments	Servicing clusters of terminals or other devices in twisted-pair structured wiring environments	Servicing clusters of terminals or other devices in twisted-pair structured wiring environments

LINC/Term Features/Functions (Continued)

Features	LINC/Term 4208/2208	LINC/Term 4296/2296
Type	Multiprotocol terminal servers	Multiprotocol terminal servers and asynchronous interface modules
Support	Packet switched connections for ASCII async devices over Ethernet or broadband	Packet switched connections for ASCII devices over Ethernet or broadband
Asynchronous Interface Modules (AIMs)	—	Modular cards expanding server attachments from base configuration of 32 device attachments to up to 96 device attachments

Adapter Features/Functions

Features	414X	6130
Type	Ethernet network adapter	Broadband Network Adapter
Models	414E for PCs with 8-bit ISA; 4141E/A for machines with IBM's MCA; 4141W for installations requiring twisted-pair and ISA BUS support; and 414W/A for twisted-pair support for IBM's MCA	4 models—one supporting 168.25MHz frequency offset and three supporting IEEE 802.7 frequency offset of 192.25MHz
Function	Allows connections to both file servers and host computers across a baseband Ethernet network	Provides network expansion of over 4,000 devices; supported by NETBIOS-based software, Novell NetWare, and SCO/Xenix-NET software

MONET Features/Functions

Features	Description
Platform	Runs on a Sun SPARCstation with OS Version 4.1.1
Upgraded Configuration Module	Features new "learning" capability; automatically learns the configuration parameters for registered devices and enters them into the relational database
Protocol	Supports SNMP
MIB Master	Designed as a MIB parser that allows users to install multivendor MIBs into the database at run time and to be accessed by all Hughes' management applications
Graphical Display	User-defined map interface with dynamic icons
Network Interfaces	Supports Ethernet 10BASE2/RS-232
Maximum Number of Nodes	Supports up to 28,000
Hughes' Devices Supported	Compatible with all ProBridge V1.0 and V1.1; all 8XXX Bridges V2.0; all LINC/Term VX3.2 & VX4.2; ProLINC V2.0
Network Topology Map	Capable of being viewed hierarchically, from a global network view to device-specific detail
Network Alarms	Reach to the highest hierarchical level for realtime picture of network
Problem Solving	Offers probable causes and recommended actions
Network Fault Logging	Sent to SQL relational database
Snapshot	Presents realtime graph of key network MIB object values
Integration of Third-Party MIBs	Integrates vendors' MIBs conforming to ASN.1 concise format
Prepackaged MIBs	Include Internet standard MIB II; MIBs for all Hughes products; MIBs from SynOptics, Cabletron, DAVID Systems, ODS, Cisco, Wellfleet, Proteon, ACC, and Novell's LANtern network monitor
Expanded Support Program	Includes access to a library of public domain MIBs and icons

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ProLINC 2.0 Features/Functions

Features	Description
Type	Connectivity software that allows multiple LAN and host protocols to operate simultaneously on a single workstation interface card
Platform	DOS-based PCs and PS/2s; Windows 3.0 PC workstations
Hosts Accessed	IBM, Digital Equipment, UNIX, Sun
Servers Accessed	NetWare, VINES, and LAN Manager
Protocols Supported	IPX, LAT, TCP/IP, DLC, NFS, SNMP

Physical Environment

Physical Specifications

Dimensions	ProBridge Family	LINC/Term 4208/2208	LINC/Term 4296/2296
Weight	2 lb.	4 lb.	45 lb.
Height	2.25 in.	2.75 in.	9.25 in.
Width	3.75 in. (115 V); 4.5 in. (230 V)	8.50 in.	19.0 in.
Depth	6.5 in. (115 V); 8.0 in. (230 V)	11.87 in.	18.0 in.

Electrical Requirements

	ProBridge Family	LINC/Term 4208/2208	LINC/Term 4296/2296
Power Supply	115-V or 230-V single-port power supply with DC cable	115 V or 230 V	115 V or 230 V

Physical Specifications	4141E Adapter	4141E/A Adapter	4141ETP Adapter
Segment Length	Ethernet—1,000 m.; Thin Ethernet—300 m.	Ethernet—1,000 m.; Thin Ethernet 300 m.	Cable length between concentrators up to 110 meters
Power	+5 V DC 0.75 Amp	+5 V DC 0.75 Amp	+5 V DC 0.75 Amp
Board Size	3.9 in. (H) x 5.25 in. (W)	3.5 in. (H) x 11.5 (W)	3.9 in. (H) x 13.3 (W)

Physical Specifications

Dimensions	LINC/Term TSRV-8	LINC/Term 5208	LINC/Term 3208
Weight	1.81 lb.	0.88 lb.	2.3 lb.
Height	1.99 in.	0.98 in.	1.185 in.
Width	11.50 in.	8.57 in.	14.95 in.
Depth	13.44 in.	10.27 in.	10.56 in.

Electrical Requirements

	LINC/Term TSRV-8	LINC/Term 5208	LINC/Term 3208
Power Consumption	+5 V DC, +12 V DC, –12 V DC	+5 V DC, +12 V DC, –12 V DC	+5 V DC, +12 V DC, –12 V DC

Physical Specifications

Dimensions	25128/2528
Weight	44.6 lb. with 16 AICs installed
Height	9.25 in.
Width	19.0 in.
Depth	18.0 in.

Electrical Requirements

	25128/2528
Voltage Requirements	90 to 132 V AC, 47 to 63 Hz; 207 to 253 V AC, 47 to 63 Hz

Equipment Prices

Prices	Purch. Price ($)
ProLINC Release 2.0 software—single user	450
ProLINC Release 2.0 software—per user for 25-user package	350
ProBridge 8033	2,995
ProBridge 8032	8,195
ProBridge 8133	3,995
ProBridge 8233	9,995
ProBridge 8235	9,995
LINC/Term 3208, 5208, and TSRV-8	1,395

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