

Ungermann-Bass Net/One

Baseband, Broadband & Fiber Optic LANs With IBM PC Support

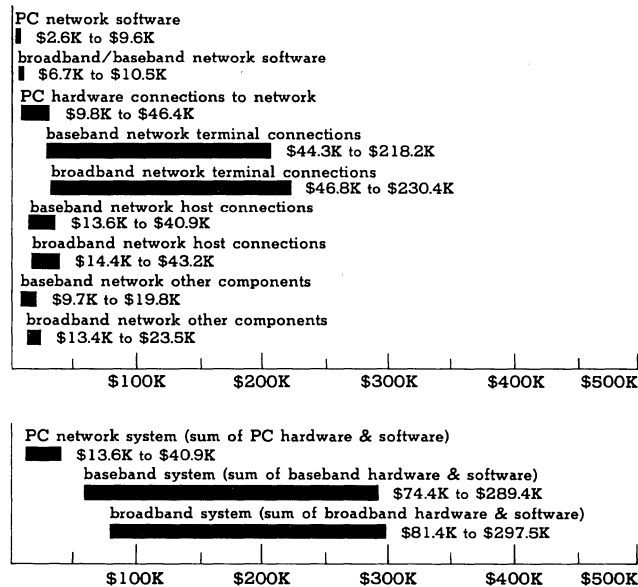
■ PROFILE

Architecture • Net/One Local Area Network (LAN).

Type • available in baseband and broadband versions • compatible with Ethernet specification • provides virtual circuit, datagram and name services.

PURCHASE PRICE RANGE

hardware & software



UNGERMANN-BASS NET/ONE PURCHASE PRICING • SMALL SYSTEM interconnects 100 terminals with 2 host computers; provides 16 ports per host computer and NMC for network management; the network management software is bundled with the NMC; shown for both baseband and broadband LANs • **small baseband Net/One** includes 17 NIU-180As, 18 NTR10 transceivers with 20-foot transceiver cables, NMC, OPS operating system and Virtual Circuit Service (VCS) software • **small broadband Net/One** includes 17 NIU-180Bs with RF modems, OPS operating system and VCS software, NMC with RF modem, CT-501 translator • **small PC Connection Net/One** connects 10 PCs to Net/One; includes 7 Personal NICs with transceivers, 3 Personal NIUs, 3 thin coax transceivers, and Printshare, Diskshare, and Mailshare software • **LARGE SYSTEM** interconnects 500 terminals with 4 hosts; provides 24 ports per host and NMC for network management; network management software is bundled with NMC • **large baseband Net/One** configuration includes 76 NIU-180As, 77 NTR10 transceivers with 20-foot cables, NMC, X.25 Gateway hardware and software, OPS operating system, and VCS software • **large broadband Net/One** configuration includes 76 NIU-180Bs with RF modems, CT-501 Translator, X.25 Gateway hardware and software, NMC with RF modem and network management software, OPS operating system and VCS software • **large PC connection Net/One** interconnects 50 PCs with 5 Print Servers and 5 Disk Servers; also runs Mailshare and CrossTalk Net/One Terminal Emulator • includes 38 Personal NICs with transceivers, 12 Personal NIUs, 12 thin coax transceivers, 5 Diskshare servers, 5 Printshare servers, Mailshare, and Crosstalk Net/One Terminal Emulator • networks do not include network cables and connectors • Ungermann-Bass provides maintenance contracts but the company has not released maintenance prices; thus these graphs do not include maintenance.

Transmission Speed • 10M bps for baseband; 5M bps per channel for 5 broadband channels.

Cable Length • 1,500 feet per segment for baseband; 2 extensions allow networks up to 4,500 feet; a remote repeater fiber optic link facility can extend cable length by 3,000 feet • 10 miles/50,000 feet for broadband • bridges can extend length even farther • for Fiber Optic Net/One, maximum end-to-end distance is 2.8 miles.

Applications • automated office, engineering shops, manufacturing plants, resource sharing through interconnection of personal computers.

Configurations • up to 100 taps for Network Interface Units (NIUs) can be placed on a baseband cable segment; NIUs can also serve as bridges to connect networks together • up to 300 NIUs can connect to each broadband channel; NIU models can support up to 24 user devices • see Figure 1 for typical baseband or broadband configuration • for Net/One Personal Connection PC network NIU is housed in PC • Personal NIU can connect to thin coaxial, fiber optic, Ethernet-compatible baseband or broadband cable • integrated networks can be configured as shown in Figure 2; Net/One Personal thin coax network connects to baseband Ethernet-compatible network through simple connector; baseband network connects to broadband network through a local bridge • Fiber Optic Net/One can implement complete standalone network or can function as a backbone network, interconnecting Ethernet-compatible cables located in separate buildings; standalone Fiber Optic Net/One can interconnect from 18 to 39 NIUs (432 to 936 user devices); when Fiber Optic Net/One is used as backbone network, it can interconnect up to 14 Ethernet-compatible Net/Ones or a total of 1,400 NIUs (up to 33,600 user devices) • Network Management Console (NMC) provides network manager with facilities to manage Net/One.

Interface • through Network Interface Units (NIUs).

Gateways • X.25 Gateway connects Net/One network to X.25 Public Data Network (PDN); can be used to connect 2 remote Net/Ones together or to connect Net/One to an X.25 interface on a host computer eliminating the need for multiple asynchronous RS-232C connections on host.

Support of Foreign Devices • RS-232C; IEEE-488; 8-, 16-, 32-bit parallel; RS-449; and V.35 physical interface support • IBM PCs.

Network Management • through Network Management Console Model 1 (NMC-1) based on an IBM PC/XT; provides NIU configuration, network download, and network debugging; planned facilities include network monitoring, access control, broadcast, collection of accounting data, dynamic port reconfiguration, port enable/disable, and network fault detection.

Protocols • software supports Async, BSC, HDLC/SDLC, DEC DDCMP, and DR-11B/W protocols.

Distributed Functions • some Network Interface Units (NIUs) are programmable and support data preprocessing, code conversion, protocol conversion, and attached resources management; multiple disk and print servers can reside on a single network • currently, program development can be done only on old NCF, not on NMC.

Support Software • software for loading NIUs; print and disk servers, and terminal emulator, runs under PC-DOS V.2.0 on IBM PC or IBM PC/XT (required by disk server) • some NIUs support multiple application processors.

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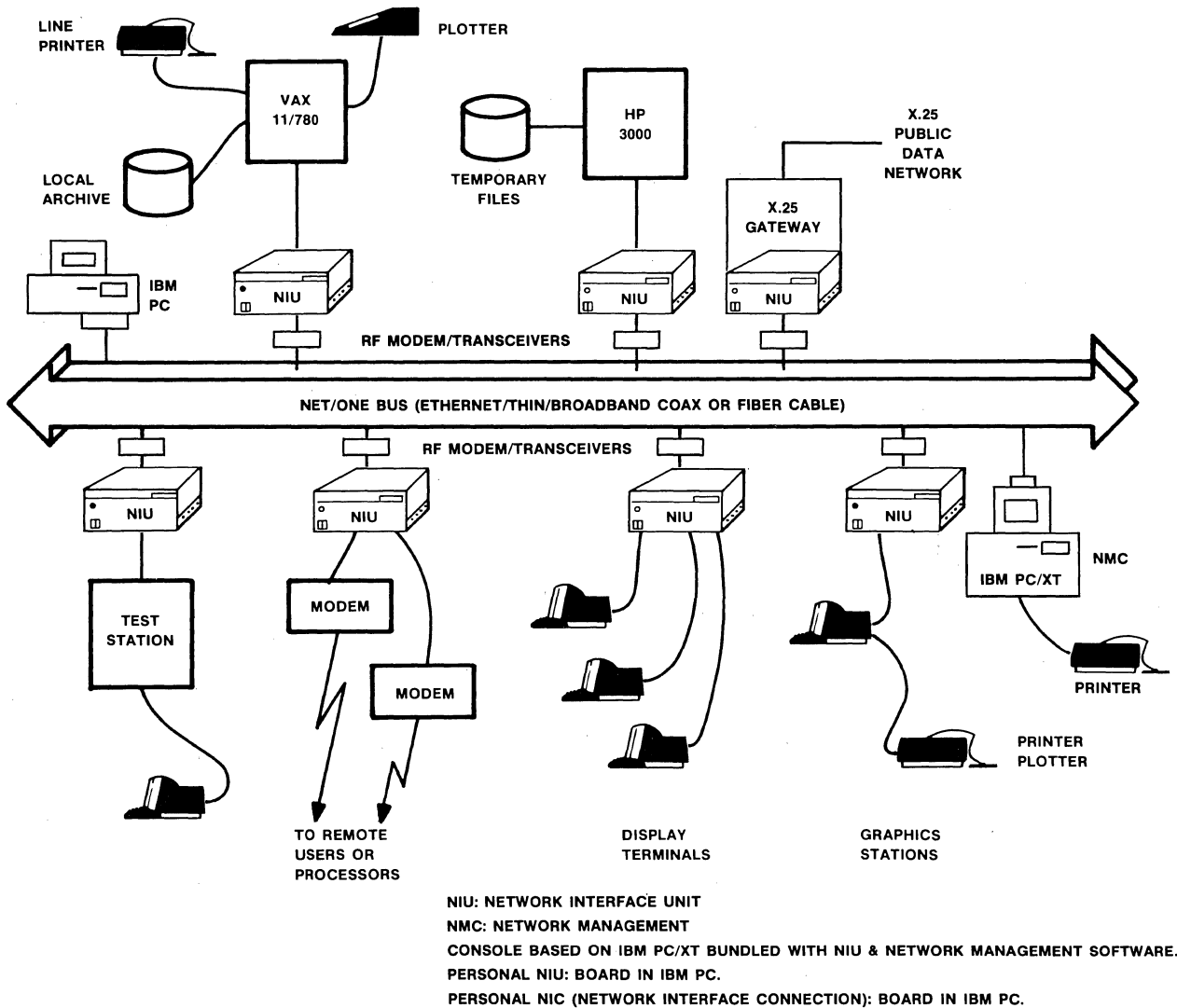


Figure 1 • typical Net/One configuration.

First Delivery • July 1980 for Net/One baseband; July 1981 for Ethernet-compatible Net/One baseband; July 1982 for Net/One broadband; 1983 for Fiber Optic LAN; January 1984 for Personal NIU.

Systems Delivered • over 700 Net/One networks.

Comparable Systems • Xerox Ethernet for Net/One baseband • Net/One is compatible with Ethernet specifications, and Xerox uses the Ungermann-Bass Network Interface Unit on its Xerox 8000 networks • Sytek's baseband LocalNet/20 is very different from the Net/One baseband network; transmission rate on each LocalNet/20 channel is 128K bps as compared to 10M bps on Net/One baseband • LocalNet/20 channels are slow for file transfers between host computers.

Vendor • Ungermann-Bass, Inc; 2560 Mission College Boulevard, Santa Clara, CA 95050 • 408-496-0111.

Distribution • through 12 Ungermann-Bass sales offices in the U.S., through distributors in Western Europe, Switzerland, Canada, United Kingdom, and Japan.

■ ANALYSIS

The Net/One baseband and broadband products are designed to complement one another. The Net/One baseband version is Ethernet-compatible and designed to interconnect word and data processing systems together within a building or location in a building. A bridge can interconnect Net/One broadband and baseband LANs as well as interconnect broadband channels. The Net/One Personal Connection interface units connect IBM PCs to either baseband or broadband Net/One or to the thin coaxial cable Net/One.

Ungermann-Bass has been supplying its Network Interface Units (NIUs) to Xerox for its Xerox 8000 Network System to interface devices to Ethernet since April 1981.

Net/One networks are supported by NIUs configured from Network Management Console (NMC) based on IBM PC/XT. The NMC can also function as a Workstation on Net/One.

Ungermann-Bass implements its Datagram and Virtual Circuit Services in software residing in the NIU. Users have complained

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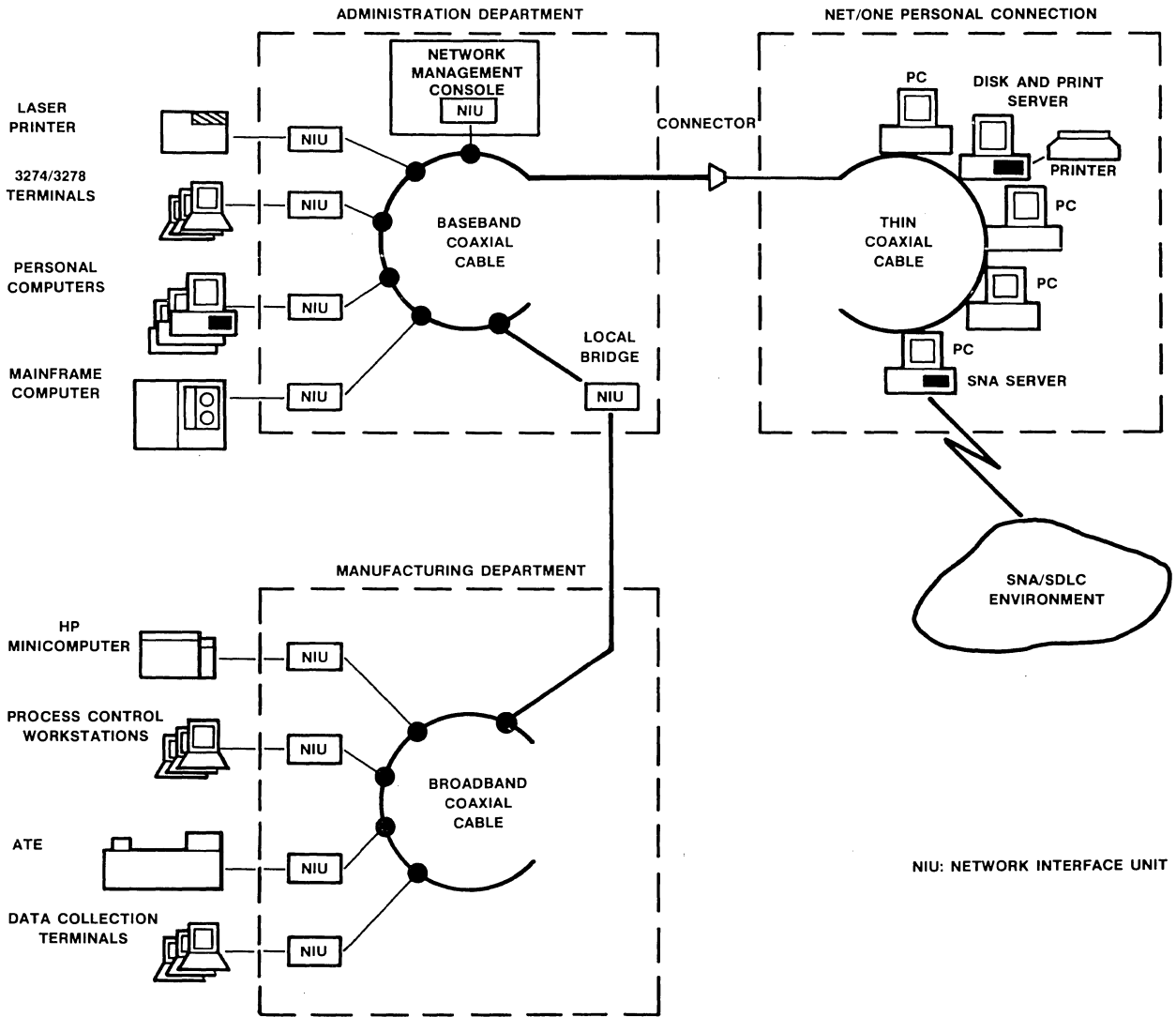


Figure 2 • integrated Net/One configuration using Ethernet-compatible coax, Personal Connection thin coax, and broadband coax cable networks.

that LANs lack virtual circuit connection to accommodate terminals or other systems that communicate with only one other system, for example, terminals that communicate with one host computer. The Net/One virtual circuits are established by software when the system is configured, so the user can operate as if the user device is connected by a direct, dedicated to the remote device.

The Net/One Personal Connection with Printshare, Diskshare, and Mailshare software running on the IBM PC or IBM PC/XT allows PCs on Net/One to share resources.

Ungermann-Bass was founded in 1979 to design, develop, and market communication systems to use in Local Area Networks (LANs). The company delivered its first version of Net/One with a 4M-bps data rate in July 1980. The company's first Ethernet-compatible network with a 10M-bps data rate was announced in April 1981 and shipped in July 1981. The broadband version of Net/One was announced in February 1982 and first shipped in July 1982. The Personal Connection network was announced in

September 1983; first delivery was January 1984. Fiber Optic Net/Ones were first delivered in 1983. Ungermann-Bass has grown rapidly since it was founded in 1979. Revenues of \$23M for first 6 months of 1984 were more than double that of 1983. The company has become the leading supplier of general purpose LANs.

Strengths

Net/One is compatible with Ethernet, the most prominent LAN on the market today. Intel makes an Ethernet controller chip set. Fujitsu is producing LSI chips for both Net/One broadband and baseband LANs.

Net/One provides both broadband and baseband versions, as well as the Personal Connection baseband version. All use CSMA/CD for access control.

The ability to interconnect broadband and baseband Net/One networks extends the area over which Net/One can be used.

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Multiple bridge products can extend Net/One to almost any required length. The bridge can be configured on each end of a communication link for interconnecting remote networks.

Although a custom product, a fiber optic backbone network can be used to implement very large networks. The fiber optic cables with star nodes are used to interconnect up to 14 standard cable networks.

Net/One is vendor independent, thus it can be used to interconnect multiple vendors' products. The interfaces to user devices are industry standard. Another strong feature of Net/One is its support of both Datagram and Virtual Circuit Services, not available for some other LANs.

With the popularity of the IBM PCs, Net/One's ability to support them is a big plus. Ungermann-Bass has not just settled for the connection capability but is offering services to the PCs with the Printshare, Diskshare, Mailshare, and terminal emulation software.

□ Limitations

Ungermann-Bass is still a small company although the products developed to date are impressive. So far, the Net/One product line includes no interfaces to IBM host systems except through ASCII terminal emulation. The company does have an X.25 Gateway. Ungermann-Bass announced an SNA gateway, which has not been delivered. The only special adapter available is the Digital Equipment DR11-W interface, a 32-bit DMA interface to the VAX-11.

■ NETWORK SUMMARY

Ungermann-Bass offers a complete line of products to construct baseband, broadband, personal computer, and fiber optic local area networks. The components of all networks are essentially the same except for the cable and the transceiver/RF modem interface. All networks use the same Network Interface Units (NIUs) with different boards to interface to the cable. The broadband system uses an RF modem tuned to the appropriate channel frequency. The Net/One Personal Connection can connect to either the baseband or broadband Net/One or to a special thin coaxial cable with a connection to a baseband Net/One for network management. The fiber optic network requires a fiber transceiver. In addition, it uses star node couplers to interconnect multiple fiber cables. Ungermann-Bass does not offer fiber optic Net/Ones as standard products. They must be ordered from the Network Design Group. Figure 3 shows single and multiple fiber optic cable configurations.

Net/One fiber optic, Ethernet-compatible, and thin coaxial cable baseband provide a single 10M-bps channel. Net/One broadband provides 5 5M-bps channels. All use CSMA/CD protocol for channel access. Net/One broadband uses standard CATV cable and fittings, and meets EIA guidelines for broadband LANs. RF modems are modulated using vestigial sideband amplitude modulation (VSB-AM) for compatibility with video transmissions over other channels.

The Net/One LAN design employs fiber optic cable to interconnect multiple baseband Net/Ones that serve individual buildings or locations within a building. A bridge interconnects Net/One baseband networks, Net/One broadband network channels, and broadband Net/One channels with Net/One baseband network. A simple "connector" to match different cable diameters connects the thin coaxial cable for PC networks to baseband Net/One.

Net/One uses a Network Interface Unit (NIU) to interface a user device to the LAN. The NIU is available in several versions: the NIU-150A/B uses the Fujitsu LSI chip set and is implemented on a single board. It is not expandable. The NIU-2A/B is a 3-board system based on the Z80A; it includes a transceiver interface and up to 4 optional application processors. The NIU-130A/B and NIU-180A/B use the Intel 80186 microprocessor to implement the CSMA/CD protocol. The Personal NIU is based on the 80186 microprocessor with 128K-byte memory. It is a single board that plugs directly into an IBM PC. A range of electrical interfaces can be connected to the Processor Boards on the NIU-2A/B. These

include the RS-232C, 8-bit TTL parallel, IEEE-488, 32-bit parallel with DMA, asynchronous, and high-speed serial interfaces. Interfaces to the other NIUs are RS-232C or V.35.

The NIU controls communication over the network. It performs CSMA/CD access control, provides self-diagnostics, and implements Datagram and Virtual Circuit Services for network users. The NIU is configurable through the Network Management Console (NMC), based on the IBM PC/XT running under MS-DOS. The NMC also includes an NIU to interface it to the network.

The NMC functions as a downline load server and network configuration device. The network management software is bundled with NMC.

Separate software packages implement Datagram or Virtual Circuit Services. The Datagram Service requires the user to specify the addressee of each packet that is transmitted. Packets can also be multicast to a list of devices or broadcast to all devices on the network. Net/One provides 3 types of Virtual Circuit Services: session-oriented, bound, and administrative.

Session-oriented circuits are established by direct commands from a user device to establish a circuit to any other specified device on the network. Command mode is available to both NIUs and the NMC. The virtual circuit is established only for the duration of the session.

Bound circuits are established in software at system initialization, and remain static or permanent in files stored in the NMC. The network administrator can change the bound circuits by reconfiguring the system.

Administrative circuits are established by the administrator with commands from the NMC.

Circuits can be established between 2 devices in the same NIU (internal circuits) or between devices connected to different NIUs (external circuits). Data is passed over external virtual circuits according to the packet-oriented Net/One Reliable Byte Stream Protocol (RBSP), which supports sequencing, retransmission, flow control, and error control.

RBSP allows many packets to be in transit on a connection at one time. It uses a sliding acknowledgement window to all packet acknowledgements to be grouped for maximum channel efficiency. RBSP uses standard flow control techniques, such as XON/XOFF character strategy and manipulation of RS-232C RTS/CTS or DSR/DTR signals.

Devices on Net/One can be designated command, data, or command/data devices. Command devices can establish virtual circuits. Terminals, computers, or any intelligent device can be designated as a command device if it has been programmed to generate the appropriate commands. Data devices cannot generate commands, thus they cannot establish virtual circuits. Data devices can operate as a target for a circuit request, and as an end point on a virtual circuit. Command/data devices can generate commands and operate as a target for circuit initiation. The administrator assigns device types at system initiation.

Net/One also offers an automatic local echo facility if a user desires characters echoed.

Devices on Net/One are addressed according to a hierarchical address format consisting of the NIU number to which the device is attached, the processor identification (for NIU 2A/B) within the NIU to which the device is attached, and the processor port number. Each processor has 6 I/O ports.

The administrator manages the network using a Network Management Console to examine or set parameters and to establish or break connections. Using commands, the administrator configures the network and loads each NIU with the appropriate software for the services available to each of its ports. Services provided by Ungermann-Bass include Virtual Circuits, Virtual Circuits with Administrative Command Parser, high-speed Datagram, multiport Datagram, SFT File Transfer, dual board system support board, dual board system user processor board, and nonstandard user-written module.

Virtual Circuit commands include CONNECT, LIST, SET, and

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QUIT. The Command Parser adds INTERCONNECT, EXAMINE, and DISCONNECT, commands used by a network administrator. High-speed Datagram service is designed for the 32-bit parallel I/O port and IEEE-488 I/O module. The multiport Datagram service is designed for the 6-channel serial and 4-channel serial/2-channel parallel I/O modules. The SFT file transfer service transfers user programs between computers.

The dual-board system support board supports user services residing on a user-programmable board. The dual-board system user processor board provides the appropriate interface to the supporting system board for the user services on the user processor board. The 6-channel initial diagnostics runs diagnostics each time the NIU is reset. The nonstandard load service is a user-written module in place of standard Net/One software modules.

The Net/One Personal Connection is a set of hardware/software products to connect IBM personal computers to Net/One. The Personal NIUs connect the IBM PCs to the network system and allow the PCs to access network services provided by network servers. So far, Ungermann-Bass supplies software to implement a printer network server, a disk network server, a mail network server, and a terminal emulation server.

The print network server can run on either the IBM PC or PC/XT; the disk network server runs only on the IBM PC/XT. Terminal emulation software provides for emulating a number of ASCII terminals. Mailshare provides for electronic mail.

The Personal NIU plugs into an expansion slot of the IBM PC or PC/XT. Two transceiver units are available for interfacing the Personal NIU to baseband networks, one for use with the standard Ethernet cable and the other for use with thin Ethernet cable. A Personal NIU modem is available to interface the Personal NIU to a broadband Net/One. A Personal Network Interface Connection (NIC) is also available to connect PCs to Ethernet. An NIC is cheaper than the NIU, but a PC acting as a server must be interfaced to the Net/One through an NIU. A Personal NIU is also available to connect PCs to broadband Net/One.

The IBM PCs can be loaded from a locally connected diskette or downline from a disk server. A network can implement multiple disk and print servers.

The IBM PCs can also use the same communication services as other devices connected to the Ethernet-compatible baseband and broadband networks. The Personal Connection network requires connection to an Ethernet-compatible baseband network to obtain the network management facilities provided by an NMC.

When a fiber optic network is operating as a backbone network to interconnect multiple Net/Ones located in separate buildings, Ungermann-Bass supplies Star Node-6 and Star Node-14 couplers. Star Node-6 can interconnect up to 6 networks and Star Node-14 up to 14 networks, see Figure 3.

■ SOFTWARE

□ Terms & Support

Terms • available for one-time charge license fee; multiple copy discounts for some packages.

Support • provided through home office.

□ Net/One Software Components

The Net/One System Software (NOSS) that runs on every NIU in the system has been repackaged to separate the Net/One Operating Software (OPS) from the Virtual Circuit Service (VCS). The Network Management Software, MS-DOS operating system, and a network interface unit (NIU) are bundled with the IBM PC/XT in the Network Management Console (NMC). NMC has replaced the Network Configuration Facility (NCF) for giving a network manager the tools to manage the network: adding, deleting, and configuring NIUs.

Part of the software running in an NIU is an "agent" that performs diagnostics and records NIU status. The manager can access the data collected by the "agent" from the centralized NMC.

Currently, NMC does not have an automatic network report generator.

Earlier program development for the network was done under CP/M on the NCF. So far, user program development facilities are not available from the NMC.

Other software provides for VCS, Datagram Service (DGS), System Control Software for BSC/SDLC/HDLC/DDCMP protocols, and support for the Local and Remote Bridges and the X.25 Gateway. See Figure 4.

Ungermann-Bass still supports the NCF with its software, but it is no longer actively marketed.

The Personal Connection Software to support IBM PCs on Net/One includes facilities to share resources and to emulate various terminals. Packages include Diskshare, Printshare, Mailshare, and Crosstalk Net/One Terminal Emulator.

7500A Net/One Operating Software • provides software to support the connection of an NIU to a Net/One network; provides facilities for diagnostics and network management; supports features and line drivers • price is per NMC:

\$1,000 lcons	\$100 yr
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7510A Virtual Circuit Service (VCS) • provides VCS among devices connected to Net/One.

For Network 1:

3,500	350
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For Networks 2 to 5 • per network:

2,500	250
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For Networks 6 and above • per network:

1,500	150
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7520A Datagram Service (DGS) • provides for DGS among devices connected to Net/One; per network:

2,000	200
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7540A SCS I-Net/One Bisync • option to support Bisync devices connected to Net/One, such as IBM 2770/2780/3270/3280 and HASP multileaving terminals; supports both EBCDIC and ASCII transmission codes, per network:

1,000	100
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7541A SCS II-Net/One SDLC/HDLC • option to support SDLC/HDLC devices connected to Net/One: 3770 Series and SDLC versions of 3270 Series Control Units:

1,000	100
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7542A SCS III-DDCMP • option to support DEC DDCMP devices; per network:

1,000	100
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7550A Remote Bridge Software • runs on an NIU configured as remote network bridge; makes bridge transparent to both networks; user on one network operates as if the device addressed were on the same network • required on both ends of remote link, see Figure 4; per bridge:

1,750	175
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7551A Local Bridge Software • runs in an NIU configured as a local bridge between 2 baseband networks, between baseband network and broadband channel, or between 2 broadband channels, see Figure 4; per bridge:

1,000	100
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X.25 Gateway Software • supports connection to X.25 network (see Figure 4); per network:

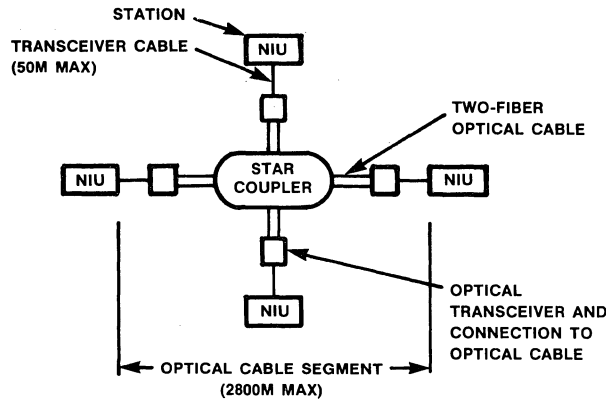
2,500	250
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LCNS: one-time license fee for each copy, sometimes per network and sometimes per unit. YR: yearly software update. NC: no charge. Prices are current as of January 1985.

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SINGLE CABLE SYSTEM CONFIGURATION



MULTIPLE CABLE SYSTEM CONFIGURATION

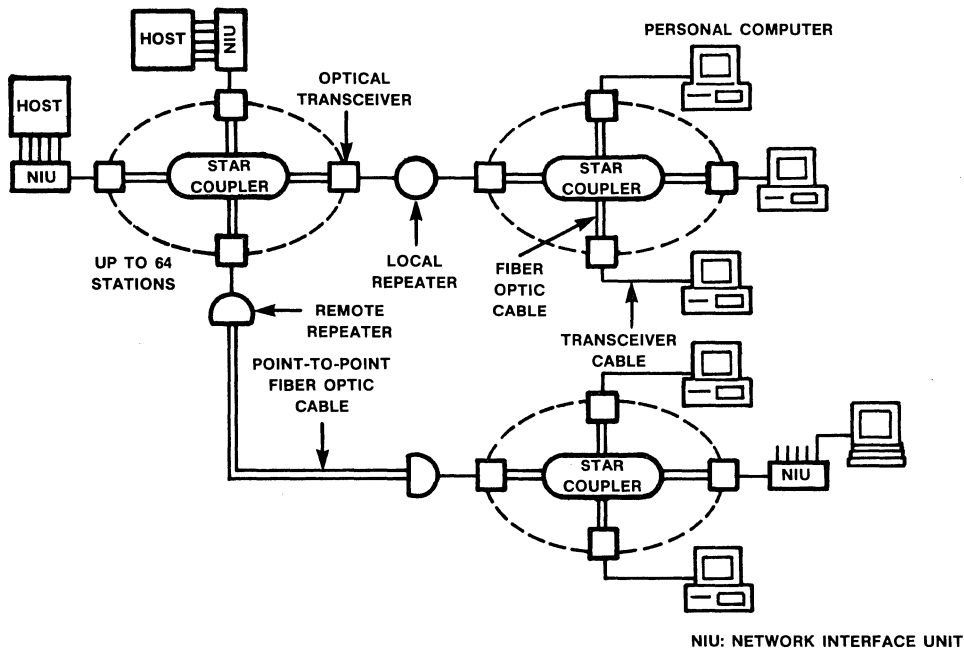


Figure 3 • Fiber Optic Cable Net/One configurations (available through special order from Network Design Group).

MS-DOS Operating System • bundled with Network Management Console (NMC):

NC NC

7411A Printshare Software • runs on an IBM PC network server to allow other IBM PCs on a network to share up to 2 printers connected to the network server; includes spooling to allow multiple users to access printer simultaneously; once the link is established, the data to be printed is sent to network server transparently • requires IBM PC with keyboard and display, 128K-byte memory, PC-DOS 2.0 licensed to run on the PC, one diskette drive, and Personal NIU; spooler requires at least one Diskshare network server • printer network server is free to run other applications • Printshare package includes software for the

network servers and for the PCs using the server:

500 50

7410A Diskshare Software • runs on an IBM PC/XT network server to provide shared access of other IBM PCs up to 3 hard disks connected to the server • disk volumes can be any size; public, private, or shared volume access supported; up to 10 workstations can share a network server; network server can download load network and PC-DOS software throughout network; network server is free to run other applications; a network can be configured with multiple disk network servers • network security is through password protection; both read and write passwords can be assigned to volumes for protection • network management utility programs provide for creation,

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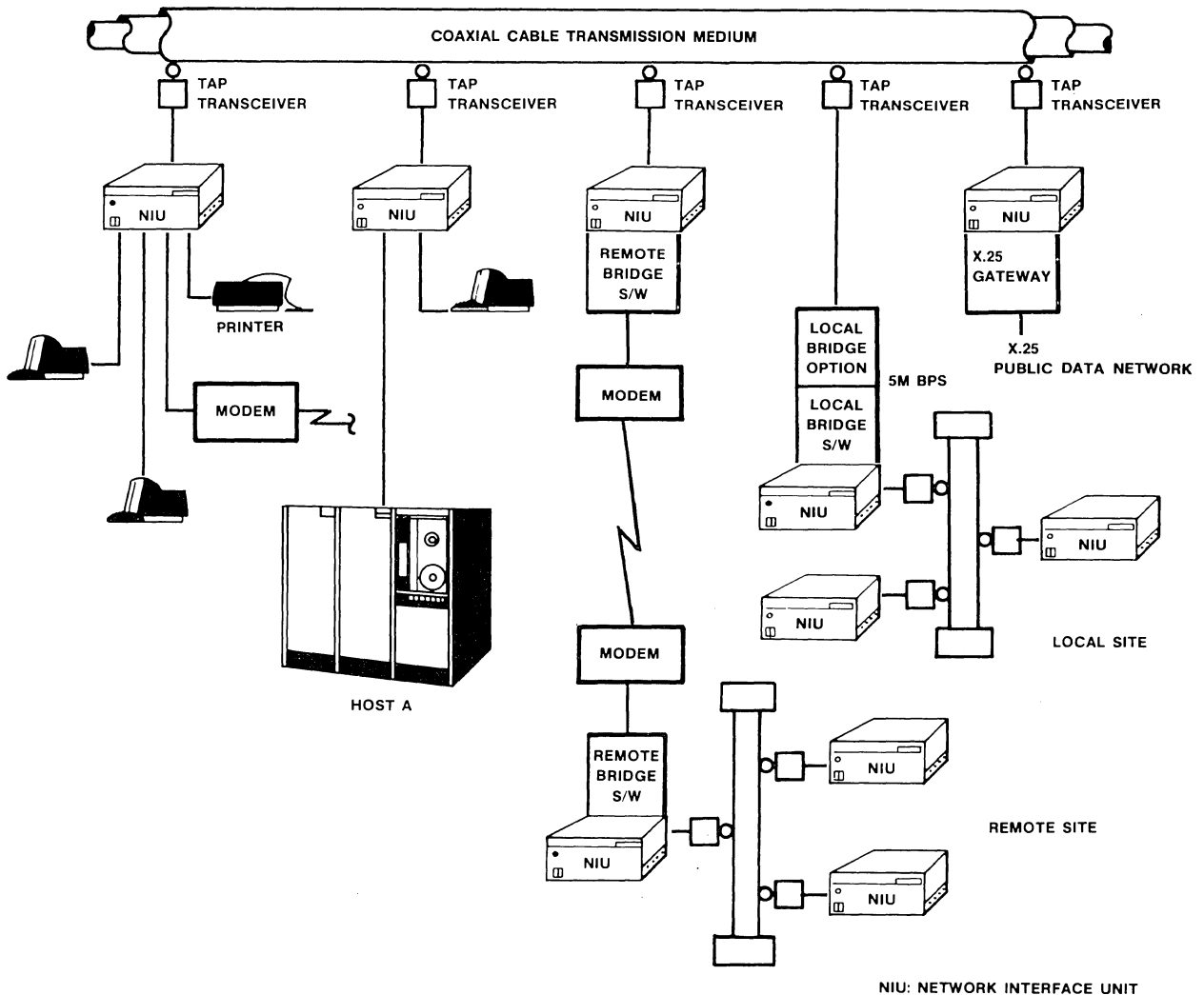


Figure 4 • Net/One configuration with local and remote bridges and X.25 Gateway.

configuration, and deletion of network disk volumes, adding new users, setting password protection and types of access; moving files between volumes, and volumes between disks and consolidating free space • IBM PCs that are downline loaded must include the Network IPL Facility • requires IBM PC/XT with keyboard and display, 256K-byte memory, PC-DOS 2.0 licensed to run on PC, and Personal NIU • includes network server software and user software needed to access the disk server; the user software contains the network software for the NIU and the Diskshare commands used to create links between volumes on the network servers and the logical drives specified by the IBM PC; once connection is established, the hard disk volumes appear local to PC-DOS and the application program; each PC workstation has 4 drive specifiers to link disk volumes:

500 50

7412A Mailshare • runs on PC/XT; allows network users to send memos, messages, letters, and associated data files to other users; mail can be sent to an individual, a list of individuals, or a predetermined distribution list; with proper ID and password, users can read their mail from a PC workstation on the network • requires that Diskshare software be resident on at least 1 PC on

the network • price is per network:

750 75

7420A Crosstalk Net/One Terminal Emulator • allow IBM PC and PC/XT Workstations on Net/One to emulate such popular ASCII terminals as DEC VT100 ADDS Viewpoint, IBM 3101, Televideo 910/920 Series, and Texas Instruments 940 • also provides PC users with the ability to download/upload ASCII files (text and binary) from/to mainframe host; with use of Diskshare, mainframe files can be stored on a network disk server and shared by all PC workstation users • can be loaded locally from diskette or across network from Diskshare server • price is per network:

650 65

■ **HARDWARE**

Terms & Support

Terms • available for purchase only; volume discounts available under 2 discount schedules: Schedule A for NIU-2 products and Schedule B for NIU-1 products • Schedule A discounts are \$0K to

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\$99K, no discount; \$100K to \$199K, 10 percent; \$200K to \$299K, 15 percent; \$300K to \$499K, 20 percent; \$500K to \$749K, 24 percent; \$750K to \$999K, 28 percent, \$1M to \$1.499M, 30 percent, and \$1.5M and above, negotiable • Schedule B discounts are approximately 5 percent less than the A discounts.

Support • in April 1984, Ungermann-Bass signed a third-party maintenance agreement with the RCA Service Company for service of Ungermann-Bass customers nationwide with a guarantee of a 4-hour response • Ungermann-Bass continues to service customers located within a 50-mile radius of Ungermann-Bass sales and technical support offices • Ungermann-Bass has not released its maintenance prices; the customer signs a separate agreement for RCA maintenance • a Systems Integration Group (formed August 1982) offers specialized networking solutions on an individual customer basis for site planning, system design, requirements analysis, and hardware/software support for both baseband and broadband Net/Ones • a group in Lausanne, Switzerland supports European distributors and OEMs • System Design Group offers custom fiber optic Net/Ones.

□ Net/One Hardware

The Net/One hardware for all baseband and broadband networks differs only on the cable side of the interface. The user interface is identical for all networks. The broadband Network Interface Unit (NIU) differs from the baseband NIU only in that it requires an RF modem in place of the transmit/receiver board in the cable interface. The baseband NIUs differ in the transceiver used to connect to the network cable.

Network Interface Unit (NIU) Hardware

2221A NIU-2A • operates at 10M bps as intelligent node on baseband Net/One; interfaces user devices to the network; provides passive, noncentralized network control; implements Datagram and Virtual Circuit Services; supports a range of electrical interfaces and device protocols; uses CSMA/CD protocol for access control; fully compatible with standard Ethernet 10M-bps networks; expandable; implemented on 3 boards and supports up to 3 application processor boards • provides up to 24 user ports:

\$4,325 prch

2321A NIU-2B • operates at 5M bps as intelligent node on broadband Net/One; interfaces user devices to network; provides passive, noncentralized network control; implements Datagram and Virtual Circuit Services; supports a range of electrical interfaces • device protocols; uses CSMA/CA protocol for access control expandable; supports up to 3 application processor boards for total of up to 24 user ports:

4,390

2241A NIU-130A • baseband, provides up to 2 RS-232C synchronous or asynchronous user ports with data rates ranging from 50 to 19.2K bps; uses Intel 80186 microprocessor to implement network protocols; can operate as DTE or DCE device:

1,400

2341A NIU-130B • broadband; provides up to 2 RS-232C synchronous or asynchronous user ports with data rates ranging from 50K to 19.2K bps; uses Intel 80186 microprocessor to implement network protocols; can operate as either a DTE or DCE device • includes RF modem for single-cable broadband network:

1,600

2341B NIU-130B • broadband, same as 234A except for dual-cable broadband network:

1,600

2231A NIU-150A • on-board implementation of baseband Net/One NIU including Z80A processor, 64K-byte RAM and Fujitsu VLSI chip sets for interfacing to Ethernet • nonexpandable; includes enclosure, power supply; transceiver controller, network processor, and 20-foot network transceiver cable • user must specify I/O module for network application processor board •

requires 5201B Network Transceiver Unit • provides up to 6 user ports:

2,235

2331A NIU-150B • nonexpandable 1-board model of broadband Net/One NIU based on VLSI Fujitsu Net/One chip set; includes enclosure, power supply, network modem controller, network processor, and 10-foot network modem cable • provides up to 6 user ports:

2,300

2281A NIU-180A • baseband, provides up to 8 RS-232C asynchronous user ports operating at data rates from 50K to 19.2K bps; based on Intel 80186 microprocessor:

2,950

2381A NIU-180B • broadband; provides up to 8 RS-232C asynchronous ports operating at 50K to 19.2K bps; based on Intel 80186 microprocessor • includes RF modem for single cable broadband network:

3,600

2381B NIU-180B • broadband; same as 2381A but with RF modem for dual cable broadband network:

3,600

Personal NIU • includes MS-DOS networking commands on diskette • provides connection for IBM PCs to Net/One local area network systems; implemented on a single circuit board that plugs into expansion slot on IBM PC or IBM PC/XT giving the IBM PC access to all the resource sharing services of Net/One • built around an 80186 microprocessor with 128K-byte memory; performs communication protocol processing • can be used to connect IBM PC to all the available Net/One cables; Ethernet-compatible baseband standard or thin coaxial cable, broadband cable, or fiber optic cable • all communication protocols used by Personal NIU follow the Xerox Network Systems (XNS) specifications • PCs connected to Net/One through Personal NIU must be either IBM PC or IBM PC/XT with keyboard and display, single expansion slot available for Personal NIU, 128K-byte memory, PC-DOS 2.0 operating system, and single double-sided diskette drive or Network IPL Facility.

2261A Personal NIU • baseband:

1,095

2361A Personal NIU • broadband:

1,095

Personal Network Interface Controller (NIC) • a plug-in controller board for the IBM PC, PC/XT, and compatibles; differs from Personal NIU in that NIU handles all protocol processing while NIC turns protocol processing over to the PC; includes 12K-byte receive and 4K-byte transmit buffers • requires external transceiver and transceiver cable for connection to Ethernet or fiber optic cable; requires an RF modem for connection to broadband cable.

2271A Personal NIC • baseband:

595

2272A Personal NIC • baseband with on-board transceiver:

750

2371A Personal NIC • broadband:

595

Network Storage Module (NSM)

Includes enclosure, power supply, diskette/disk storage, disk controller, IEEE-488 interface • connects to either NIU-2A (baseband) or NIU-2B (broadband) system with 6602B Application Processor Board, Network Operating Software, and CP/M • used to provide network management facility for networks without Network Management Console but with NCF.

PRCH: purchase price. No maintenance prices are available. Prices are current as of January 1985.

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3121A NSM-1 • includes 2 double-density, double-sided diskette units with 2M-byte storage capacity:

\$5,255 prch

Processor Boards for NIU-2

Each board requires a single NIU-2A or NIU-2B slot.

6600A Processor Board • PB without I/O:

\$1,100 prch

6601A Processor Board • PB with 4 serial asynchronous/2 parallel interfaces:

1,600

6601B Processor Board • PB with 4 serial synchronous interfaces for connection to DCEs:

1,600

6601C Processor Board • PB with 4 serial synchronous interfaces to DTEs:

1,600

6601G Processor Board • PB with 4 serial asynchronous ports; extended RS-232:

1,600

6601H Processor Board • PB with single asynchronous or parallel port for DTE:

1,600

6602A Processor Board • PB with IEEE-488 interface or 2 serial I/O ports:

1,695

6602B Processor Board • NCF processor with NSM interface:

1,695

6603A Processor Board • PB with 32-bit parallel interface:

2,400

6603B Processor Board • PB with 32-bit parallel interface; compatible with DEC DR11 port:

2,400

6605A Processor Board • PB high-speed serial synchronous port for Remote Bridge operation:

2,400

6606A Processor Board • PB with 6 serial asynchronous ports:

1,800

6607A Processor Board • PB with IEEE-488 interface:

1,695

6701A Processor Board • Motorola 68000, 8MHz processor with Memory Management Unit (MMU):

2,600

6702A Processor Board • Motorola 68000 12MHz processor without Memory Management Unit (MMU):

2,500

I/O Module Options for NIU-150

I/O modules provide the user device interface to Network Interface Unit.

6400A Null I/O Option • for NIU-150:

\$15 prch

6401A I/O Module • provides 4 serial/2 parallel ports:

500

6401B I/O Module • provides 4 serial synchronous interfaces to DCEs:

500

6401C I/O Module • provides 4 serial synchronous interfaces to DTEs:

500

6401G I/O Module • provides 4 serial asynchronous interfaces, extended RS-232:

500

6401H I/O Module • asynchronous/parallel port interface to DTE:

500

6403A I/O Module • provides general purpose 32-bit parallel interface:

1,300

6403B I/O Module • provides 32-bit parallel interface; compatible with DEC DR11-W/B:

1,300

6405A I/O Module • provides high-speed serial interface:

1,300

6406A I/O Module • for network processor board; provides 6 serial asynchronous ports:

700

6407A I/O Module • provides IEEE-488 interface:

595

Adapters

Adapter converts user interface to specific device requirements.

8403A Adapter • converts 6403 32-bit parallel I/O Module to DEC DR11-W/B interface DMA interface to VAX-11:

\$150 prch

8405A Adapter • for V.35 interface:

95

8407A DCE-to-DTE Null Modem • permits 6606A or 6406A 6-channel asynchronous ports to operate as DTEs:

65

8410A RS-232 DTE-to-DCE Sync Adapter • for RS-232C DTE interface:

65

8411A V.35 Adapter/DTE-to-DCE Sync Adapter • for V.35 DTE interface:

95

Gateways & Bridges

Ungermann-Bass supplies a Net/One X.25 Gateway for connection of a Net/One network to an X.25 interface. It can be used to connect Net/One to a Public Data Network or to an X.25 host, see Figure 5.

Local bridges are provided as options for the NIU-2 units. They can connect a baseband network to another baseband network or to a broadband channel or they can interconnect 2 broadband channels on a single network. Bridges extend the capability of Net/One, but are totally transparent to the user. The only traffic that passes over the bridge is that addressed to a unit on the other network. The NIU-2 must be configured with the Local Bridge Software.

Remote bridges can extend the length of Net/One to any distance by configuring NIUs at each end of a communication link with a communication high-speed serial interface and the Remote Bridge Software.

2701A Baseband-Baseband Local Bridge • for NIU-2, 10M bps:

\$9,850 prch

2711A Broadband-Broadband Local Bridge • for NIU-2, 5M bps:

9,850

2721A Baseband-Broadband Local Bridge • 10M bps to 5M bps:

9,850

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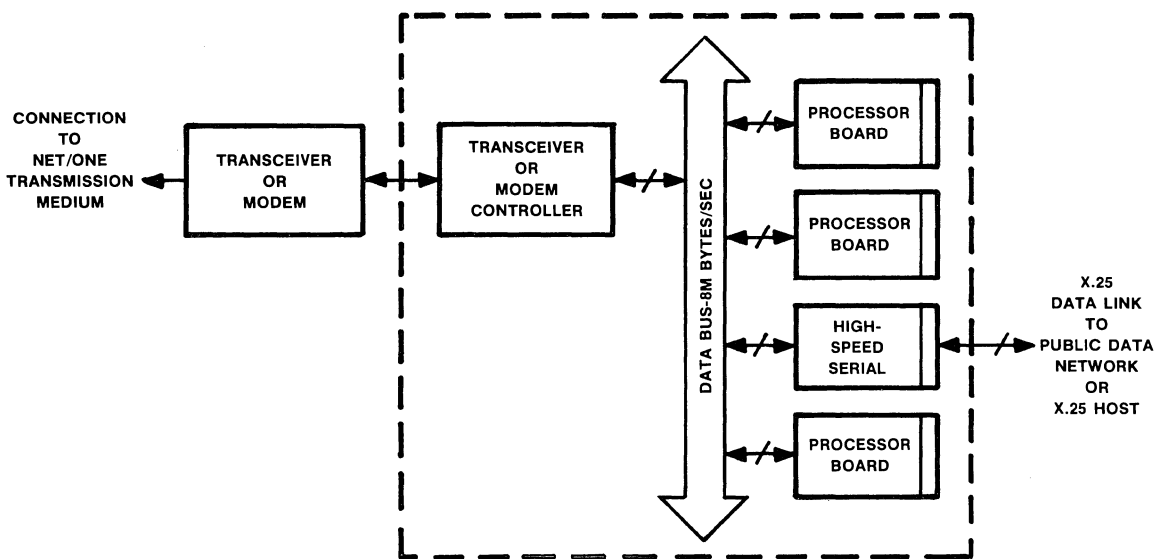


Figure 5 • X.25 Gateway.

2731A Broadband-Baseband Local Bridge • 5M bps to 10M bps:

9,850

Net/One X.25 Gateway • allows a Net/One network to connect to X.25 host link, see Figure 5 • X.25 network can be used to connect 2 remote Net/One networks via Public Data Network (PDN) or to connect a host with X.25 interface to Net/One network, thus eliminating need for multiple asynchronous RS-232C connections on the host • includes multiple microprocessors: 3 function as managers of Net/One Virtual Circuits; a fourth is on a high-speed communication board providing X.25 data link control • hardware is communication media independent, thus it can operate on standard baseband (Ethernet coaxial, thin-coaxial, or optical fiber) cable or broadband cable • operates as Data Terminal Equipment (DTE) when it interfaces to a PDN or as Data Circuit Terminating Equipment (DCE) when connected to X.25 host • provides up to 32 Virtual Circuits per gateway; link speed of 64K bps; internal or external clocking; RS-232C, V.35, or RS-449 interface; DTE or DCE option; PAD parameters recall and data forwarding character in the gateway; other PAD parameters distributed to the terminal NIUs; half-step outgoing call connection, incoming call support; media independent • requires X.25 Gateway Software • see Figure 5.

2401 X.25 Gateway • baseband:

10,025

2411A X.25 Gateway • broadband:

10,090

Network Transceivers, Cables, Connectors, Terminators & Clamps

5201C Network Transceiver (NTRIO) • 10M bps • for Net/One baseband; includes coaxial cable clamp:

\$395 prch

5211A Thin Coaxial Transceiver • for use with personal computer network using thin coaxial cable:

395

5216A Optical Transceiver • for use with optical fiber cable for extension of network or interconnection of networks:

1,500

8220A/8230A Network Transceiver Cable • 10-foot cable with lock ports/screws • 10M bps:

50

8221A/8231A Network Transceiver Cable • 20-foot cable with lock ports/screws • 10M bps:

65

8222A/8232A Network Transceiver Cable • 50-foot cable with lock ports/screws • 10M bps:

100

8223A/8233A Network Transceiver Cable • 80-foot cable with lock ports/screws • 10M bps:

140

8224A/8234A Network Transceiver Cable • 164-foot cable with lock ports/screws • 10M bps:

240

8270A Ethernet Cable • PVC, 10 meters:

150

8271 Ethernet Cable • PVC, 100 meters:

600

8272A Ethernet Cable • PVC, 250 meters:

1,350

8273A Ethernet Cable • PVC, 500 meters:

2,600

8280A Thin Coaxial Cable • 3 meters (10.8 feet):

25

8281A Thin Coaxial Cable • 10 meters (32.8 feet):

30

8282A Thin Coaxial Cable • 15 meters (49.2 feet):

45

8283A Thin Coaxial Cable • 30 meters (108.4 feet):

70

8284A Thin Coaxial Cable • 100 meters (328 feet):

170

8301A Coaxial Cable Connector • 2 required for each segment:

12

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8304A Coaxial Cable Terminator • terminates 1 end; 2 required per network:	18
8307A Coaxial Cable Adapter • allows connection of 2 cable segments; 1 required per connection:	9
8310A Coaxial Cable Clamp • permits attachment of transceiver to cable:	10
8311A Coaxial Cable Clamp Plug • prevents moisture penetration after removing transceiver:	7
8381A BNC Connector:	4
8382A BNC Barrel Connector:	3
8383A BNC Jack to N-Series Jack Adapter:	15
8384A BNC Terminator Pair:	10
8385A BNC T-Adapter:	10

Network Repeaters

5203A Local Network Repeater Unit (NRU-10) • conforms to Ethernet Specification 1.0 for repeaters which prevent distortion of information when cable is extended beyond a 500-meter (1,500-foot) segment; 2 can be added to end-to-end path to extend Net/One baseband to maximum end-to-end length of 1500 meters (4,500 feet); 100 repeaters can be configured around 1 500-meter segment; operates at standard 10M-bps data rate; see Figure 6:

\$1,475 prch

5211A Remote Network Repeater Unit (NRU-10) • complements local repeaters to extend cable length between any 2 baseband cable segments with 1,000 meters (3,000 feet) of fiber optic cable for a maximum end-to-end length of 2,500 meters (7,500 feet); 1 Remote NRU is required at each end of the fiber optic link; see Figure 6:

3,100

Broadband Modem & Translators

5311A NIU-150B Network Modem • single cable system; 5M bps; includes 50-foot drop cable for connection to coaxial cable tap; receives power from NIU; provides 2 separate channels for receive and transmit; channel pairs are 2 and O, 3 and P, 4 and Q, 4A and R, and 5 and S:

\$750 prch

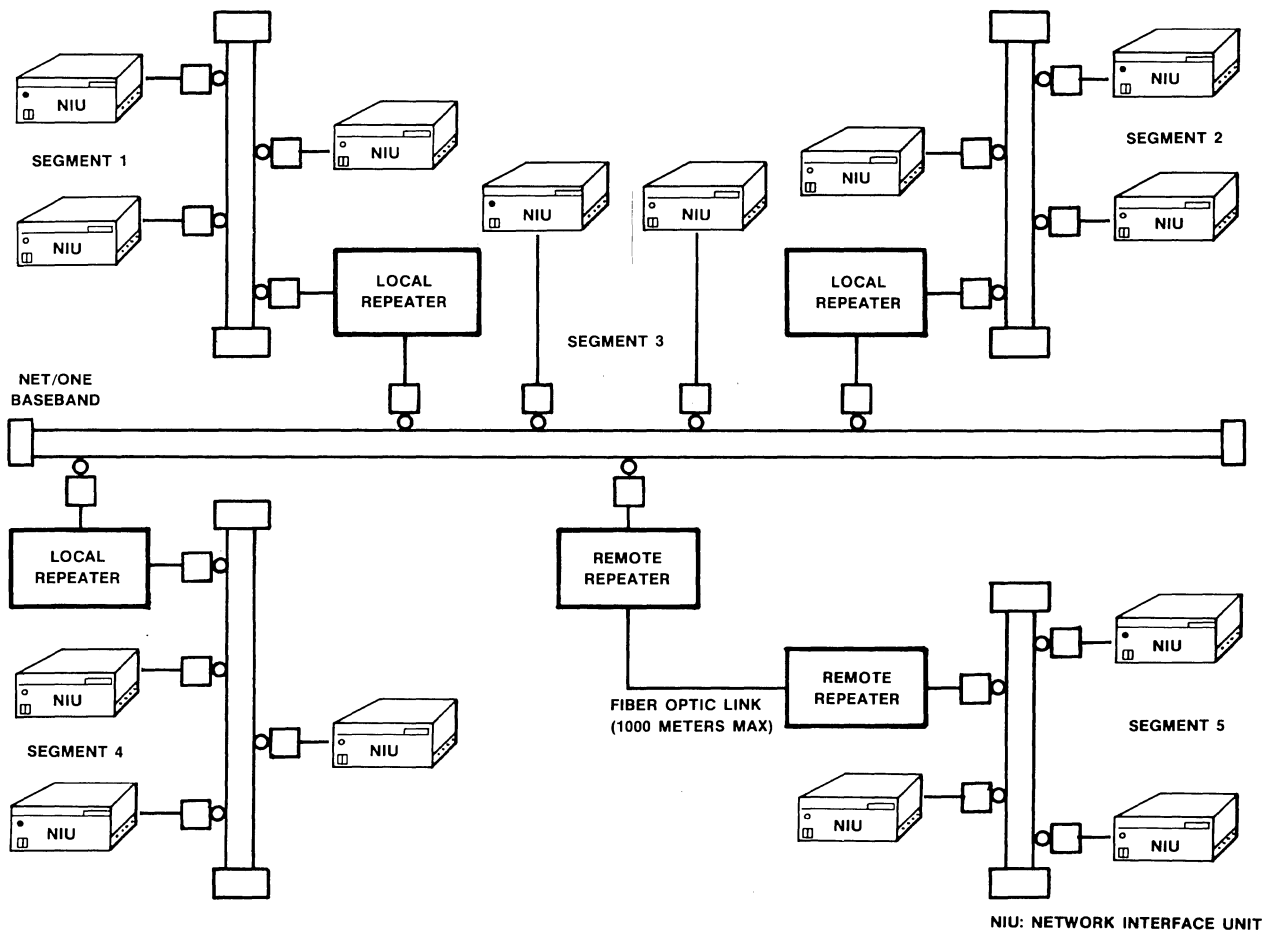


Figure 6 • typical large-scale Net/One configuration using local and remote repeaters.

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5312A NIU-150B Modem • same as 5311A except for dual cable system:

750

5321A NIU-2B Modem • same as 5311A except for NIU-2B:

950

5322A NIU-2B Modem • same as 5321A except for dual cable system:

950

5331A PC NIU Modem • same as 5311A except for PC NIU:

650

5332A PC NIU Modem • same as 5331A except for dual cable broadband network:

650

Network Modem Cable • single 50-foot length included with each NIU-1B or NIU-2B; additional cable available in other lengths.

8320A • 10-foot modem interface cable; 5M bps:

70

8330A Modem Drop Cable • 25-foot length:

20

8341A Broadband Cable • starter kit:

200

5513A/5515A/5517A/5519A/5521A CT-501 Single-Channel Frequency Translators • translate upstream frequency to downstream frequency for single channel pair: 3 to P, 4 to Q, 4A to R, 5 to S, 6 to T; offset is 192.25 MHz:

3,500

Fiber Optic Components

Ungermann-Bass supplies all the components for a fiber optic network through its Network Design Group. A fiber optic network is generally custom designed, and Ungermann-Bass does not stock fiber optic parts as standard components. The network is designed around star nodes. The company provides 6-port and 14-port Star Nodes for interconnecting fiber optic links from separate buildings or for building a multinode fiber optic Net/One. The star nodes can be used to construct very large networks with up to 1,400 NIUs (33,600 user devices). See Figure 3.

Spares

6210A Broadband/Baseband Transmitter Interface Board (TIB) • operates at 10M-bps or 5M-bps data rate; used for spare unit:

\$1,000 prch

6220A Baseband/Receiver Interface Board (RIB) • 10M bps; spare:

1,290

6225A Broadband/Receiver Interface Board • 5M bps; spare:

1,290

Series 600 CATV Products

4111A NM-640 Modem • tabletop version; single cable:

\$895 prch

4131A NM-640 Modem • rackmountable version; single cable:

945

4121A NM-640 Modem • tabletop version; dual cable:

895

4141A NM-640 Modem • rackmountable version; dual cable:

945

4211A CT-603 Frequency Translator • 3 channels:

4,000

4221A CT-609 Frequency Translator • 9 channels:

5,775

4311A TSU-615 Translator Switchover Unit • for back-up:

950

Rackmounts, Miscellaneous Items

8610A Upgrade Kit • 4M-bps to 10M-bps data rate on baseband Net/One:

\$2,000 prch

8650 Baseband Installation Kit:

400

8651A Coring Tool:

20

8652A Tool • foil shield remover tool:

25

8653A Insulation Piercing Tool:

30

8682A Wall Plate • 10M bps:

8

8690A Rack Mounting Kit • NIU-1:

175

8691A Rack Mounting Kit • NIU-2, NSM-2:

175

8692A Rack Mounting Kit • NSM-1:

175

8693A Rack Mounting Kit • NIU-150:

110

8694A Rackmounting Bay • for NM-640 or 670:

400

■ SPECIFICATION

Net/One is compatible with the Ethernet Specification as defined by Xerox, Intel, and Digital Equipment Corporation and available from Xerox.

Packet Format

Data packets range in size from 72 to 1526 bytes.

Format • 8-byte preamble, 6-byte destination address, 6-byte source address, 2-byte type field, N-byte data field with 46 greater than or equal to M less than or equal to 1500, and 4-byte CRC • preamble used for synchronization contains alternate 1s and 0s ending in 2 1s • destination and source addresses are long to provide unique addresses when a local Ethernet network functions as a subnetwork in a larger global distributed network; type field also included for use in a larger network, not used by Ethernet • minimum data field ensures that valid packets can be distinguished from collisions • CRC (cyclic redundancy check) is calculated on the destination and source address, type, and data fields • minimum spacing between packets is 9.6 microseconds • any sequence of bits shorter than minimum packet size is discarded as collision fragment.

Transmission Characteristics

Channel Encoding • uses Manchester encoding to ensure a transition for every bit position; transmits complement of the bit value in first half of bit time and true value in second half.

Data Rate • 10M bps equals 100 nanoseconds per bit on Net/One baseband, and 5M bps or 200 nanoseconds per bit on each Net/One broadband channel.

Carrier • signaled by presence of transitions on the cable; if no transition within 75 to 125 nanoseconds after last transition the carrier is lost, meaning the cable is free for another transmission.

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Control Procedures

Control procedures follow the CSMA/CD scheme to control accesses to the channel from the 1024 stations that can be connected to the cable. Only 1 station can transmit at a time, thus before transmission a station must determine if the channel is free. This is done by sensing the carrier on the line. During carrier absence, the station can transmit after waiting the minimum time between packets.

If a station starts to transmit, its data may collide with data from another station that also listened, determined no carrier was present, waited, then transmitted data. When this occurs, the collision is detected and each transmission is aborted. A jam of 4 to 6 bytes of arbitrary data is transmitted to make sure all stations detect the collision.

Each station then backs off and waits for a random retransmission time interval calculated using a backoff algorithm before trying to transmit again. A station will attempt to transmit its data 16 times. Further attempts are dependent on software control. The remote possibility of continued collisions that prevent delivery of a message makes Ethernet a datagram service.

Defer • a station defers transmission until 9.6 microseconds after carrier is dropped.

Transmit • when not deferring, a station can transmit until its message is complete or until it detects a collision.

Abort • when collision is detected, the transmission is aborted and a jam sequence transmitted.

Retransmit • after an abort, the station waits for a random length of time, then attempts to retransmit • random number lies in range from 0 to 1023.

Backoff • retransmission delay calculated using Truncated Binary Exponential Backoff Algorithm; calculates random number in range from 0 to 2 raised to the nth power minus 1 for n less than or equal to 10 where n is the retransmission attempt number; for attempts 11 to 15, 2 raised to the nth power is truncated to 1023 • time interval before retransmission is 51.2 microseconds times random number generated.

Transmission Medium

Net/One baseband uses Ethernet coaxial cable with terminators at each end of the transmission medium. Impedance is 50 ohms. Cable segments can be up to 500 meters (1,500 feet) long. Standard pressure taps provide for connection to cable. All stations interface to cable through transceivers. Up to 255 transceivers can connect to 1 cable segment. Transceivers must be at least 2.5 meters apart. Net/One broadband uses standard 300-MHz coaxial cable and radio frequency (RF) transmission. Frequency division multiplexing (FDM) techniques produce 5 broadband channels on a single channel pair. Transmit bandwidth is 30 MHz. Transmit frequencies range from 53.75M to 83.75 MHz; receive frequencies range from 246M to 270 MHz. Transmit/receive frequency separation is 192.25 MHz. Channel spacing is 6 MHz. The system is designed using dual cable or midsplit cable technology with either a single channel or 5-channel (block) translator at the head-end. All devices connect to the cable through an RF modem tuned to a single channel pair for transmit and receive frequencies. Each Net/One broadband channel can accommodate a maximum of 255 devices.

The Personal Connection network can use the standard Ethernet-compatible baseband cable, broadband cable, fiber optic cable, or thin coaxial cable.

The NIU provides an intelligent interface to the cable for broadband, baseband, and Personal Connection Net/One networks.

Use

Net/One has been designed to interconnect data processing and word processing personal computer systems in an automated office environment. It can also be used to interconnect equipment in a factory or industrial plant.

To date, the only specific interface Ungermann-Bass has developed is an adapter for Digital Equipment's DR11-W interface. Other general-purpose interfaces include IEEE-488, RS-232, and 32-bit parallel. An IBM SNA interface/gateway is scheduled for April 1984.

• END