Sytek LocalNet 20
Broadband Local Area Network

■ PROFILE

Architecture • LocalNet 20 local area networks.

Type • broadband packet-switched network using 75-ohm coaxial cable or standard CATV 300- to 400-MHz cable, connections, and fittings • LocalNet requires 16 percent of 300-MHz bandwidth; 84 percent remains for other applications, such as voice and video.

Transmission Speed • aggregate data rate is 15.4M bps divided into 120 channels each with 128K-bps aggregate data rate.

Cable Length • up to 50 kilometers (31 miles).

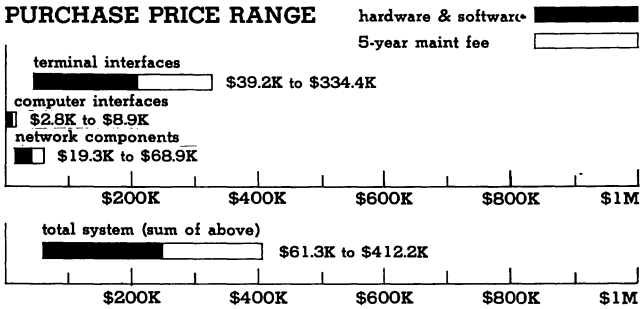
Applications • local area networks for office automation, distributed processing, and industrial control and monitoring with gateways to global networks • low-speed lines primarily used to interconnect terminal devices with computers.

Configuration • up to 255 devices can reside on each channel; bridges provide gateways between channels • maximum S-MUX configuration supports 20,000 concurrent users.

Interface • through Packet Communication Unit (PCU) or S-MUX; PCU available in 2 models for LocalNet 20 to connect either 2 or 8 units to a low-speed channel; S-MUX can connect from 2 to 32 units to a LocalNet 20 channel • PCU includes RF transceiver with frequency agile modem assigned to designated frequency for Frequency Division Multiplexing (FDM) of channels on the cable (see Figure 1).

Gateways • BSC option on LocalNet 20 allows connection to any device supporting BSC • Sytek is developing gateway to X.25 networks to be available in 1985 time frame.

PURCHASE PRICE RANGE



SYTEK LOCAL AREA NETWORKS PURCHASE PRICE bar graph covers price range of small to large LocalNet 20 LAN • **SMALL SYSTEM** uses 2 LocalNet 20 channels to interconnect 100 terminals and 2 host computers; each channel interconnects 50 terminals with 1 host; a bridge is used to interconnect the 2 channels • small system includes two 20/220 S-MUX (32 ports) with 32 20/222 asynchronous Packet Communications Processors (PCPs), 2 dual-ported 20/100 Packet Communication Unit (PCU), 2 dual-ported 20/105 PCUs (synchronous), and four 8-ported PCUs • small system network components include 50/50 Central Retransmission Unit with TO1 Filter Group, 50/201 Brink/Link Chassis, and 50/210 Bridge Interface Kit (BIK) for 2 channels with AO1 Filter Group • terminals are assumed to use an RS-232C interface and asynchronous protocol; host computers use RS-232C interface and synchronous protocol • **LARGE SYSTEM** uses 4 channels to interconnect 500 terminals with 4 hosts; each channel interconnects 125 terminals with one host; a bridge is used to interconnect channels • large system includes 16 20/220 S-MUXs (32 ports each), 252 20/222 asynchronous PCPs, and four 20/105 dual-ported PCUs (synchronous) • network components include 50/50 Central Retransmission Unit with TO1 Filter Group A, 50/201 Bridge/Link chassis, two 50/210 BIKs (2 channels each), 50/120 Statistical Monitor, 50/100 Network Control Center (Base Unit), and VO2 Digital Monitor • bar graph **DOES NOT** include prices for cable wiring, host processors, and terminals.

Support of Foreign Devices • vendor independent • BSC device support on LocalNet 20/100 PCU for terminals such as IBM 2770, 2780, and 3780 workstations, IBM 3270 terminals and controllers, and HASP workstations.

Communications Management • distributed among all nodes attached to LocalNet; Network Control Center (NCC) automates network management services on LocalNet 20.

Protocols • CSMA/CD for access control of each channel; FDM for access to each channel • each node implements lower 6 layers of protocols defined by Open Systems Interconnect (OSI) model of the International Standards Organization (ISO) • IBM has licensed Sytek's LocalNet/PC protocols for the IBM PC Network • will also be available to other vendors by mid-1985.

Distributed Functions • communication and network management and services • communication services include file transfers for data buffers up to 32K bytes long, datagram service for data buffers up to 32K bytes long, and message datagram services • applications programmed by user.

Support Software • Version 2 software in PCU, UNIX Version 7 on NCC.

First Delivery • LocalNet 20; 1980.

Systems Delivered • over 650 LocalNet 20 networks and over 100,000 ports.

Comparable Systems • no other LAN is quite comparable because LocalNet is vendor independent and broadband; Ethernet is comparable in terms of applications but uses baseband technology; Wangnet uses broadband technology but is vendor dependent; Ungermann Bass with its Ethernet-compatible baseband and broadband Net/One is most comparable • Network Systems Corporation with its HYPERchannel to interconnect high-speed devices and computers, and HYPERbus to interconnect slow-speed office equipment is similar in philosophy, but WSC's networks are baseband.

Vendor • Sytek, Inc; 1225 Charleston Road, Mountain View, CA 94043 • 415-966-7300.

Canadian Headquarters • Sytek, Inc; 235 Yorkland Boulevard, Suite 300, Willowdale, ON M2V 4Y8 • 416-494-8200.

Distribution • through 18 sales offices in the United States and through distributor networks in Europe, United Kingdom, Israel, and Asia • associated with General Instruments Data System Group, which provides service for all LAN products.

GSA Schedule • listed.

■ ANALYSIS

Sytek was founded in 1979 by a group from Ford Aerospace whoi were involved with systems software and network development and secure systems research. Initially, the company provided consulting services for network design and development. In 1980, Sytek acquired the Network Resources Corporation (NRC), which produced products for network implementation. With NRC, Sytek developed its LocalNet product line, and NRC has become the production arm of Sytek.

In 1981, General Instruments invested $6M in Sytek with arrangements to continue investing in the company as it grows and develops. The Jerrold Divisions Data Systems Group of General Instruments, primarily involved in CATV operations, now services all of Sytek's LANs. General Instruments is also building a Metropolitan Area Network (MAN) called MetroNet based on the Sytek broadband architecture.

Sytek was profitable from the start. Its revenues have doubled or

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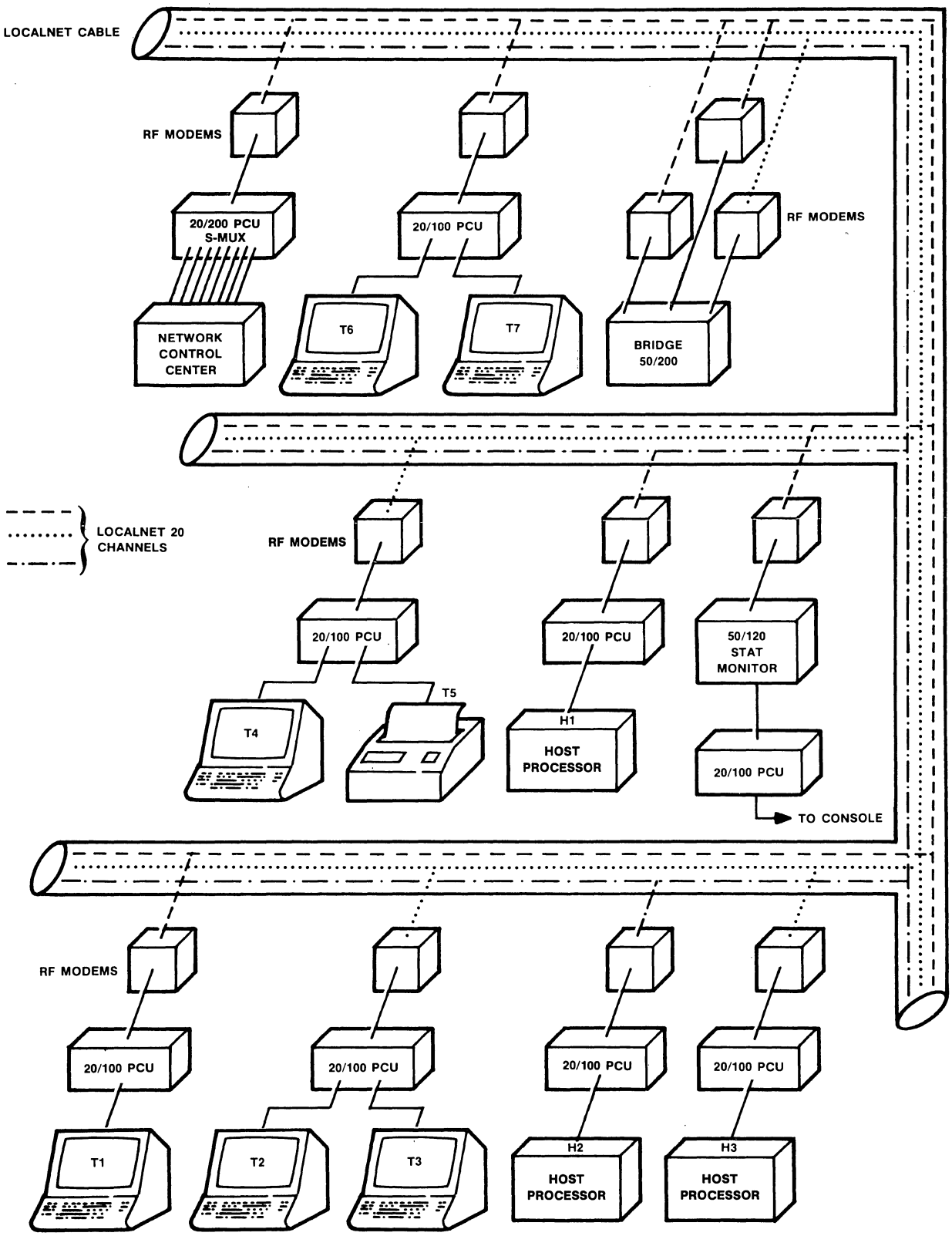

Figure 1 • LocalNet configuration.

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more than doubled each year since it was founded. Revenues were $1.28M in first year; $2.5M in 1981; $6.6M in 1982; $16.4M in 1984. This year's revenues for its fifth year of operation ending May 31, 1984 were $30.6M. Such revenue growth indicates the great need for LANs as well as Sytek's ability to fulfill that need.

LocalNet is a broadband local area network with a total throughput capacity of 15.4M bps available in 120 channels (128K bps). Each channel is actually an individual LAN that can be used by itself or bridge can interconnect up to 8 channels. The interchannel bridge passes traffic to the other channel only when the message frame is addressed to a device interfaced to the other channel.

Sytek also plans to offer a gateway to X.25 global networks, which should be announced before the end of 1985. Sytek not only offers hardware products but comprehensive software to control its networks. The software implements functions comparable to the lower 6 layers of the OSI model for distributed processing. Sytek's LocalNet/PC protocols have been licensed by IBM for use in the IBM PC Network; they will also be available for general licensing to other companies by mid-1985.

The basic physical network components are standard CATV components: cable, connectors, and fittings. The chips used to implement the digital channel protocol are standard HDLC chips. The company's relationship to General Instruments allows it to take advantage of a large service organization for maintaining LocalNets.

The largest LocalNet currently installed has more than 3,500 network ports. Most large networks utilize no more than 2 or 3 channels. Thus, LocalNet customers need not worry about outgrowing its capacity. A large network with cascaded bridges can interconnect up to 65,000 devices. This still leaves room for video and voice on the same cable.

Sytek offers an inexpensive solution to interconnect computers and terminals with its LocalNet 20. LocalNet not only handles the protocols for a Datagram service but also the higher-level protocols for guaranteed message delivery and for other services, such as name service/access control and key distribution control for secure networks.

In August, 1984, IBM announced its IBM PC Network, a broadband LAN, to interconnect PCs. Under OEM agreements with IBM, IBM helped design and develop the PC Network. Currently, Sytek manufactures the Adapter Card, a board that plugs into the back of the PC, and the Network Translator Unit.

☐ Strengths

Sytek offers a complete line of broadband products for the distributed processing, real-time control, and monitoring environments. It can interconnect a broad range of terminals and computers using standard CATV cables, fittings, and connectors.

Especially impressive is the Sytek software residing in the PCU located at each network node. It implements the lower 6 levels of the OSI model. Most LANs offer software support for only the 2 lowest levels. Exceptions are Xerox with its office systems connected by Ethernet and Network Systems with its NETEX software for HYPERchannel and HYPERbus. Also, Digital implements all higher-level protocols with DECnet IV. These 3 vendors, however, offer baseband, not broadband, LANs.

LocalNet is based on a comprehensive architecture, first in LocalNet 20, now in LocalNet/PC. The main features of that architecture include partitioning of service by application, full set of protocols, internetworking, and security.

Also, Sytek's broadband LocalNet will fit into nondata applications developing for broadband LANs. Voice and video (for teleconferencing) can fit on the same physical network as the one used by LocalNet. Buildings can be "wired" once for LocalNet with fittings and connectors in each room so that devices can be moved or added with no stringing of new wires.

So far, most customers implement no more than 3 or 4 LocalNet channels, thus LocalNet has plenty of capacity for additional services.

☐ Limitations

Sytek is still a small company, although its affiliate, General Instruments, is a $1 billion company. Sytek's product plans as announced are impressive, but it remains to be seen if the company can remain steadily on course and deliver new products as scheduled. Especially crucial are the gateways to X.25 and other global networks. Currently, Sytek offers only a BSC interface to IBM hosts.

Network Summary

LocalNet is a broadband Local Area Network (LAN) that uses Frequency Division Multiplexing (FDM) for data distribution. The network uses standard 70-ohm CATV coaxial cable and has a bandwidth of 300 MHz to 400 MHz. Transmission over the cable is unidirectional, therefore, various topological configurations are used to obtain bidirectional transmission. The use of 2 cables to achieve bidirectional transmission is the simplest solution. Bidirectional transmission can be achieved using a single cable through midsplit and subsplit techniques. These techniques split the bandwidth into a set of frequencies; some are assigned to transmission in one direction while the others transmit in the opposite direction. Highsplit or midsplit topology assigns half the frequencies to one direction and the other half to the opposite direction. Subsplit assigns specific frequencies for each direction. A head-end frequency translator converts transmit frequencies to receive frequencies.

A user device is connected to the cable via a Radio Frequency (RF) "frequency agile" modem, a split-frequency modem that can be adjusted to discrete transmit and receive frequencies within a band. The modem is tuned to transmit at one frequency and receives at another. Sytek's modems are designed for a 6-MHz transmit or receive bandwidth. Separation between the 2 frequencies is 156 MHz for midsplit operation and 216 MHz for subsplit operation. The frequency agile modems are switched to a new frequency by a command given manually from a keyboard. Sytek does not use the modem's agility to switch traffic from one channel to another. This is done through an interchannel bridge.

LocalNet 20 provides 120 channels with a channel-to-channel separation of 300 KHz. Transmit and receive frequency bandwidths are each 36 MHz for midsplit operation and 18 MHz for subsplit. Midsplit frequencies range from 70- to 106-MHz transmit, and from 226 to 262 MHz receive. Subsplit frequencies range from 10- to 28-MHz transmit, and from 226- to 244-MHz receive.

Transmission speed is 128K bps on each LocalNet 20 channel. Sytek offers a LocalNet 50/200 bridge to allow devices connected to 1 channel on LocalNet 20 to communicate with devices connected to other LocalNet 20 channels. The bridge can interconnect to up to 8 channels and act as a store-and-forward packet gateway.

Devices connect to a LocalNet channel through a Packet Communications Unit (PCU) which is a sophisticated RF transceiver, implemented using a microprocessor to interface an RF modem to the user device. The PCUs provide the modem to interface to the LocalNet cable. The frequency of the modem is software controlled.

The PCUs provide the distributed intelligence in the network. They handle the CSMA/CD access protocol, control communications, provide error and flow control, support local or centralized network control, and implement the network architecture in accordance with the lower 6 levels of OSI reference model for distributed processing. The LocalNet 20/100 and 20/200 PCUs can be set to operate at any of 20 different frequencies.

The LocalNet 20/100 PCU has dual ports for user devices. It operates in full-duplex mode and provides an RS-232C interface to the user device. The LocalNet 20/200 PCU has 8 ports for interfacing user devices. Each handles either bisynchronous or asynchronous protocols.

Sytek provides for redundancy of the LocalNet 50/50 Head-End Frequency Translator with the LocalNet 50/55 Redundant Translator Auto Switch Unit, which switches to the backup translator if the primary translator fails. The transfer is automatic,

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and users are unaffected by the switchover. Manual switching is also provided.

The LocalNet 20/220 S-MUX is a modular Packet Communication Unit (PCU) with up to 32 ports per unit for high performance, low-cost host applications. Ports are added in increments of 2-port cards. The S-MUX allows multiple hosts to share a single unit, thereby minimizing costs and rack space requirements. The 20/220 connects to the standard LocalNet 20 broadband cable.

The LocalNet 50/100 Network Control Center (NCC) automates LocalNet 20 network management services such as network administration, access control, and secure communication. Multiple NCCs can be connected for redundancy or to divide services. The NCC is supported by the LocalNet PCUs and Interchannel Bridge.

NCC also supports a Key Distribution Center Option that operates with secure PCUs to implement secure LocalNet 20 transmissions. The service operates as an end-to-end encryption service.

The 50/120 Statistical Monitor is a passive device that can listen to up to 8 LocalNet 20 channels to monitor channel activity. It is used in conjunction with the Digital Monitor option on NCC for automatic system collection of statistical data for network management.

The LocalNet 50/70 Cable Test Unit is a portable, self-contained device that provides quantitative test data to determine the radio frequency continuity of midsplit cable systems (single and dual cable) and to indicate how well the system is functioning. If the Cable Test Unit indicates the system is not operating within design specifications, it can initiate corrective measures (such as translator gain adjustment) or it can locate a specific failure point (such as a faulty amplifier, malfunctioning cable tap, or cable break).

■ SOFTWARE

☐ Terms & Support

Terms • the only real software available for LocalNet 20 is in the Network Control Center (NCC); the PCU is firmware-controlled and the firmware is bundled with the hardware.

Support • software is supported with the hardware under contract with General Instruments.

☐ Operating Systems

UNIX

The Network Control Center (NCC) operates under control of a subset of the UNIX V.7 operating system, providing a multitasking environment and a structured file system. The software system is NCC database driven. The database consists of a set of data-dictionary data files. Access to the files is through a Database Interface (DBI) program.

Name service and access control services are provided by multiple copies of the User Interface (UI); each UI services a separate UI port on NCC.

The network manager can access DBI and the configuration (config) process through a user service port (after special validation) and through the UNIX system's console port. DBI is an interactive program. Other programs run as background tasks. The network manager can use UI and config to view, print, archive, and clear files as needed.

PCU Software (Firmware)

The PCU software is constructed as a set of cooperating sequential processes that are scheduled by a central event processor in response to communication events. Two processes are provided for each level of LocalNet's protocol architecture: one process is on the receiving side and the other on the transmitting side of the PCU ports. PCU implements the port, session, transport, network, and link architecture levels. The PCU contains a command language interpreter through which it is controlled for initialization, configuration, and troubleshooting.

Flow control to user devices is selectable: none, EIA signal level flow control, or XON/XOFF flow control.

With the encryption option, the PCU stores a master key for access to the NCC Key Distribution Center (KDC) to establish secure sessions over LocalNet 20. The PCU uses a session key distributed by KDC to encrypt/decrypt messages.

■ HARDWARE

☐ Terms & Support

Terms • LocalNet components are available for purchase only • the 50-Hz 220VAC units are not available for U.S. customers but are available for international customers only • dollar-volume discounts are available up to 30 percent.

Support • various contracts available through Business System Services group within General Instruments • standard monthly maintenance is for on-call support with 4-hour guaranteed response time, 5 days per week, 8 hours per day; includes regularly scheduled preventive maintenance; monthly maintenance fee is up to 1 percent of purchase price for specialty items; fixed monthly maintenance fees for the most common LocalNet 20 components are $10.50 for LocalNet 20/100 PCU, $22.60 for LocalNet 20/200 PCU, and $15.40 for LocalNet 50/50 PCU Central Retransmission Unit.

LocalNet 20 Packet Communication Unit • microprocessor-based, packet-mode network interface unit for each device; provides distributed intelligence and connection between user device and CATV-based local area network; compatible with midsplit-, subsplit- and dual-cable installations; uses branching-tree cable topology so failure of node or branch does not affect rest of network; provides virtual connection support and value added services such as protocol and code conversion, directory services, and end-to-end encryption • can select from among 120 channels spaced 300 KHz apart; data rate is 128K bps • select frequency agile RF modem that can operate on preselected frequencies (up to 20) with fixed spacing between receive and transmit frequencies • implements CSMA/CD access method so up to 200 devices can use cable concurrently • receiver frequency range is 226.25 to 262.25 MHz (midsplit topology) or 226.25 to 244.25 MHz (subsplit topology); transmitter frequency range is 70 to 106 MHz (midsplit topology) and 10 to 28 MHz (subsplit topology) • EIA RS-232C asynchronous digital interface with full modem control; byte synchronous protocols are optional; flow control is EIA (RTS/CTS), XON/XOFF, or none; data rate range is 300 bps to 19.2K bps; provides 2 or 8 interfaces • supports 4 or 16 concurrent virtual connections per unit • parameters and functions for DTE interface similar to CCITT X.3; LocalNet interface similar to CCITT X.28; line protocol is HDLC-derivative designed for LAN use • programmed with extensive set of user commands for its operation and status display.

LocalNet 20/100 PCU • includes 2 user-interface ports and supports 4 concurrent virtual connections:
$1,090 prch

LocalNet 20/105 PCU • includes 2 user-interface ports, synchronous only:
1,390

LocalNet 20/200 PCU • includes 8 user-interface ports and supports 16 concurrent virtual connections:
3,750

P01 User Device Protocol • asynchronous, not available on 20/105 PCU:
NC

P02 User Device Protocol • bisynchronous; supports 2780/3780 RJE and HASP Multileaving workstations, 327X cluster

PRCH: purchase price. NC: no charge. NA: not available/ not applicable. RFQ: request for quotation. Standard maintenance prices available for most prevalent items as shown under Hardware Support section. Prices current as of May 1985.

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controllers, and 270X/370X communication controllers; includes RS-232C control port for asynchronous ASCII terminal; available on 20/105 only:

110

U00 User Device Physical Interface • RS-232C:

NC

W00 60-Hz Power • 115 VAC:

NC

Z01 Asynchronous Secure PCU • required to convert 20/100 to secure PCU to implement secure LocalNet option; available on 20/100 PCU only • conforms to National Bureau of Standards Encryption Standard (DES) • used with master key stored on secure PCU to initiate and establish secure sessions; session key generated and distributed by KDC under master key control used to encrypt and decrypt data messages • encryption occurs at the session layer of LocalNet's protocols; see Figure 2 • requires 50/100 V03 at NCC:

500

X01 Asynchronous Extended Performance PCU • available on 20/100 PCU only; offers 19.2K-bps data rate and provides Hewlett-Packard block-mode terminal support; provides flow control protocol conversion from ENQ/ACK to XON/XOFF:

160

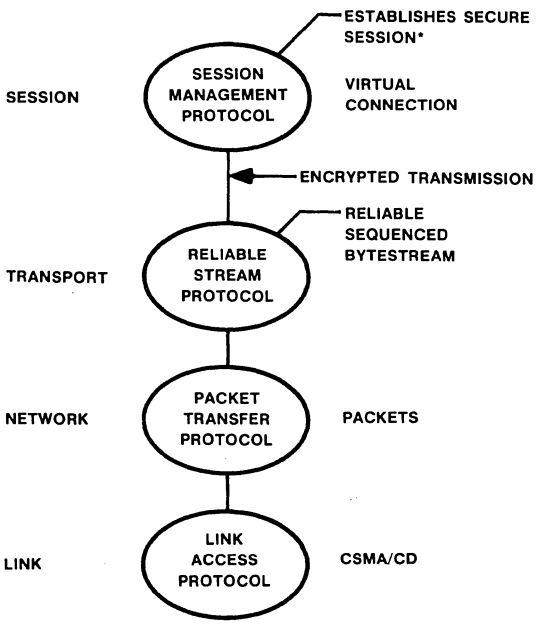

Figure 2 • LocalNet protocol hierarchy.

LocalNet 20/220 S-MUX • 32-port packet communication unit concentrator with overall throughput of 40K bps; data rates per port up to 19.2K bps • modular system that can be configured with from 2 to 32 ports • Base Unit with A01 standard modem:

2,200

20/222 Asynchronous PCP (Packet Communication Processor) • up to 16 per S-MUX; each provides 2 ports to LocalNet 20:

550

A01 Single-Cable Midsplit Channel Group • Group A for 20 channels, 300 KHz apart • transmits at 70 to 76 MHz and receives at 226 to 232 MHz:

NC

E01 Single-Cable Midsplit Channel Group • Group E for 20 channels, 300 KHz apart; transmits at 94 to 100 MHz and receives at 250 to 256 MHz:

60

LocalNet 50/50 Central Retransmission Unit • head-end frequency converter; supports up to 60 LocalNet 20 FDM channels • requires selection of a filter group to specify operating range:

3,500

LocalNet 50/55 Redundant Head-End Switch • provides automatic switchover to backup unit if frequency drifts outside limits:

4,000

T01 Filter Group A • transmits in 70-MHz to 76-MHz frequency range and receives 226-MHz to 232-MHz frequency range:

400

T04 Filter Groups J, K, A • transmits in 58 MHz to 64 MHz (J), 64-MHz to 70-MHz (K), or 70-MHz to 76-MHz (A) frequency range and receives in 214-MHz to 220-MHz (J), 220-MHz to 226-MHz (K), or 226-MHz to 232-MHz (A):

NC

T15 Filter Group L • transmits in 10-MHz to 16-MHz frequency range and receives in the 226-MHz to 232-MHz frequency range:

400

T18 Filter Groups C, D, E • transmits in 82-MHz to 88-MHz (C), 88-MHz to 94-MHz (D), or 94-MHz to 100-MHz (E) frequency range and receives in 238-MHz to 244-MHz (C), 244-MHz to 250-MHz (D), or 250-MHz to 256-MHz (E) frequency range:

480

T31 Pilot Tone Option for 50/55 • for use with T01 and T04 50/50; one per 50/55:

NC

T34 Pilot Tone Option for 50/55 • for use with T18 50/50; one per 50/55:

400

LocalNet 20 Bridge • provides interconnection of different frequency channels on 1 cable and of different frequency channels on different cables, allowing devices on different channels to communicate as if they were attached to the same channel; acts as a store-and-forward gateway; maintains a routing memory, mapping the network configuration to locate point-to-point paths for sessions across channels • designed to operate in parallel with other bridges to allow for backup or load sharing; can be organized into cascaded configurations so that up to 65,000 ports can be connected to LocalNet; implements link and network layer protocols • Motorola 68000 controls functions and multiple Z80 provides intelligence in Bridge Interface Kits (BIKs); each BIK supports 2 channels using Link Interface Kits (LIKs), provides access to other networks.

LocalNet 50/201 LocalNet 20 Bridge/Link Chassis • supports up to 4 Bridge/Link Interface Kits (BIKs):

9,000

LocalNet 50/210 Bridge Interface Kit (BIK) • 128K-bps interface; supports 2 LocalNet 20 channels; requires selection of Channel Group Options and Link Interface Kits; all other channel groups require special approval and quote from factory:

4,500

50/231 RS-422 Link Interface Kit (LIK) • provides access to another network through RS-422 link:

4,500

50/232 RS-232C/V.24 Link Interface Kit (LIK) • provides access to another network RS-232C/V.24:

4,500

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A01 Single-Cable Midsplit Channel Group • Group A: NC

E01 Single-Cable Midsplit Channel Group • Group E: 120

A02 Dual-Cable Midsplit Channel Group • Group A: 400

E02 Dual-Cable Midsplit Channel Group • Group E: 600

L11 Single-Cable Subsplit Channel Group • Group L: 400

LocalNet 50/100 Network Control Center (NCC) • provides high-level network administration and control including access control and secure communications; multiple NCCs can be connected to LocalNet for backup or division of services; remotely accessible from any terminal in the network • supports Network Resource Management Package, Digital Monitor Option, and Key Distribution Center option • Resource Management Package includes configuration manager, access server, name server, and access controller; Digital Monitor Option provides continuous displays of network operation and status, such as throughput error rates and packet size, with network alarms • Key Distribution Center Option provides control for secure LocalNet communication • implemented using MC68000L 8-MHz microprocessor with 512K-byte dynamic, parity RAM, 16K/32K/64K-byte EPROM, up to 2 10M-byte Winchester disks, 8 or 16 RS-232C serial I/O ports, and 20M-byte streaming tape drive; runs under subset of UNIX/V7 operating system • database capacity with 10M-byte disk provides for 3,000 users, 1,200 PCUs, and 300 symbolic destinations; increases to 6,000 users, 2,400 PCUs, and 600 symbolic names with two 10M-byte disks • report file capacity is for 5,000 names, server, and configuration control interactive reports • provides 8 or 16 RS-232C ports with recommended data rate of 4800 bps: port 0 is dedicated to hard-copy printer, port 1 provides direct access to NCC for the Network Manager Terminal, port 2 supports configuration control for remote Packet Communication Units (PCUs), port 3 supports communication with remote 50/120 Statistical Monitors, and ports 4 to 7/15 provide User Interfaces (UIs) for name service/access control/remote network manager access to NCC and/or Key Distribution Center (KDC) interfaces for secure session management; the number dedicated for UIs or KDC interfaces depends on the network requirements, but all the UIs and all KDC interfaces operate as a rotary and appear to the user as a single UI or KDC service • NCC ports connect to LocalNet 20 through ports on 20/100 or 20/200 PCUs, see Figure 3 • KDC requires a secure PCU; other PCUs connected to NCC may also need to be secure, depending on network security requirements; all PCUs involved in secure communication must be secure • NCC performance for name service and access control is measured as a function of number of new session requests, busy-period interval, user-to-NCC session interval (hold time), and number of name service ports; hold time is the major factor, thus the user service program enforces a limit of 90 seconds; NCC with 13 user-service ports can handle up to 500 new session requests per hour if average hold time does not exceed 30 seconds • configuration control can initialize up to 60 PCU ports,

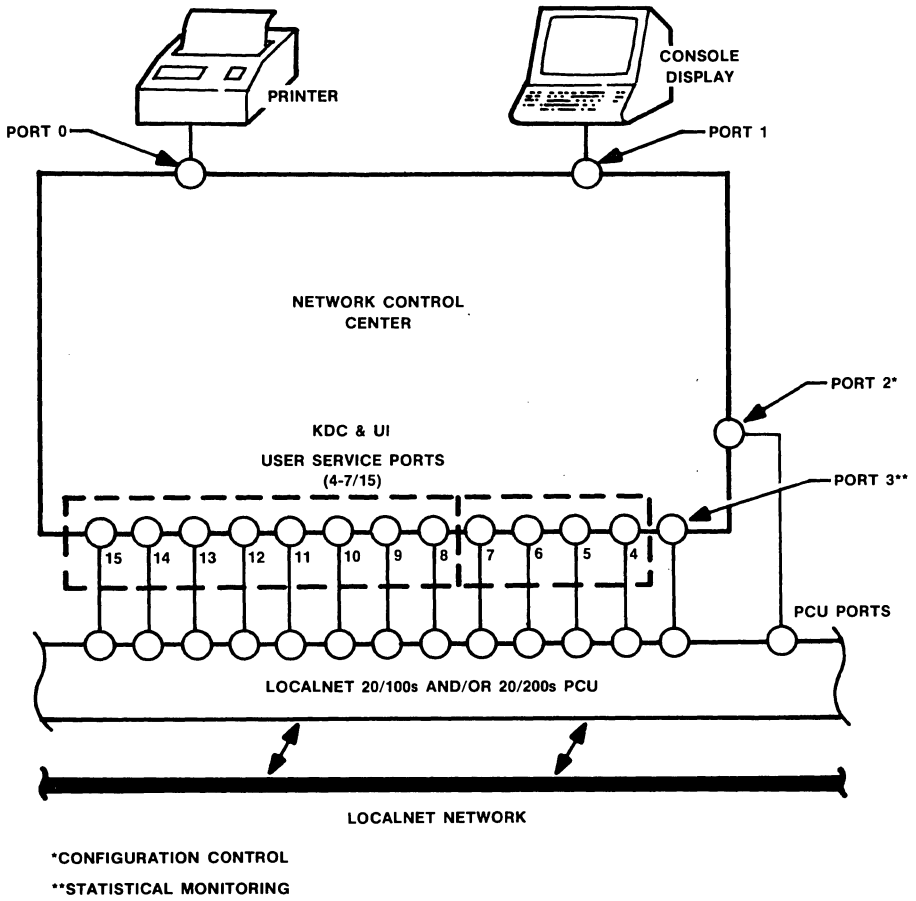

Figure 3 • NCC port allocation.

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update up to 140 PCU ports, or poll up to 240 PCU ports per hour.

50/100 Base Unit NCC • includes 8 ports and 10M-byte disk:
18,000

V01 Network Resource Manager Option • required to control and optimize network; basic package provides configuration tool, database creation tool, and name server access controller • data dictionary-driven database records administrative and operational data on each network component; database interface is screen oriented to allow network manager to define component configurations, symbolic destination names, user IDs and passwords, and access rights of user, destination, and components • configuration tool allows network manager to initialize, monitor, and enforce component configurations • network manager can configure user PCUs to call the name server/access controller ports of the NCC to translate destination names to physical LocalNet addresses, to validate user PCU access rights, and to create a session between user and destination • status information includes channel throughput, error rates, and alarms:
3,000

V02 Digital Monitor Option • automates centralized monitoring, collection, and display of network performance data and alarms for up to five 50/120 Statistical Monitors on LocalNet channels; traffic alarms are displayed when channels are congested or number of channel errors reaches significant level • uses port 3 on NCC for statistics collection; requires 1 or more 50/120 Statistical Monitor(s):
2,000

V03 Key Distribution (KDC) Center Option • control center of the secure LocalNet 20; 1 installed per network • operates as a set of servers with each server attached to a port; as many ports as needed can be dedicated to KDC, but all ports belong to same rotary and appear to user as a single service • maintains list of master keys on the network, generates and distributes session keys; each secure PCU has a different master key; master keys are never transmitted over the network; only 2 master keys are available for each secure PCU, one is stored in the KDC database, and the other is in the secure PCU memory • shares many of same files as other NCC processes but also adds its own KDC file to the NCC database • Secure PCUs and nonsecure PCUs can reside on the same network, and secure and nonsecure traffic can flow over the same network • when KDC option is implemented, all PCUs used to connect NCC to the network must be secure PCUs • secure sessions can be established between secure PCUs only:
3,000

V04 Development Package • provides additional UNIX software modules in NCC; requires V11, additional 10M-byte disk; allows user to customize user interface on NCC; allows use of NCC as a personal computer:
3,500

V11 Mini-Winchester Disk • additional 10M-byte disk drive:
3,000

V12 8 I/O Ports • additional ports for basic NCC:
2,500

V50 Rackmount Kit • for 50/100:
175

LocalNet 50/120 Statistical Monitor • gathers performance statistics for 1 LocalNet channel during a specific user-specified time interval; operates as a passive device that monitors the line • includes RF modem interface for connection to LocalNet 20 and RS-232C serial interface for connection to an ASCII terminal console for standalone use or to a PCU for operation in conjunction with a Network Control Center for centralized network management • all statistical data supplied on a single-screen display • responds to 10 individual commands to manipulate monitoring functions; commands include such functions as channel spacing, specific channel, generate a report, reset, type of report, begin and end reporting • Base Unit:
1,890

A01 Channel Group • also supports A02, L11, and L12:
NC

E01 Channel Group • also supports E02 channel group:
60

50/10 Test Bed Cable Kit • allows user to simulate broadband LAN:
100

50/70 Cable Test Unit • self-contained portable RF generator and field strength meter to isolate faults, verify gain attenuation for single or dual cable:
2,360

☐ Specification

LocalNet implements a network architecture comparable to the lower 6 layers of the OSI architecture model for distributed processing: physical, data link, network, transport, session, and presentation layers, see Figure 2. Only the application layer must be user programmed.

The **physical layer** is broadband coaxial cable that distributes data among the devices connected to it.

The **data link control layer** uses an HDLC-derived packet-mode protocol for data transmission. Another link level protocol used to control access to the channels is CSMA/CD. Other protocols are used in the bridge and gateway products.

The **network layer** implements a datagram service with addressing and routing of packets. Datagram packets are unacknowledged.

The **transport layer** provides error-controlled connections and flow control between the PCUs on LocalNet. This level provides in-sequence delivery, end-to-end acknowledgement, and packet retransmission. Up to 4 (LocalNet 20/100 PCU) concurrent virtual connections are supported.

The **session layer** handles access control, service accounting, name directory, and extended addressing services. It is responsible for resource protection, data security, network authentication, and symbolic-to-physical name translation.

The **presentation layer** provides virtual terminal, stream transfer, and datagram services for communication. The virtual terminal service, oriented toward character-at-a-time transmission, is a single transport layer virtual connection constructed from network layer datagram packets. Facilities allow formatting and converting data to conform to requirements of the communicating devices. The stream transfer service (STS) provides reliable file transfers of up to 32K bytes; larger files are segmented into multiple 32K-byte packets. The datagram service is message oriented and provides simple unacknowledged delivery; includes broadcast facility to send messages to all nodes on the network.

Packet Format

The packet format is HDLC based. Sytek uses a standard HDLC chip but does not use all fields of format; thus it implements an HDLC subset. Each packet contains a variable-length message field that uses a flag character to signal the end of message.

Transmission Characteristics

Transmission is by standard-frequency modulation techniques using Radio Frequency (RF) carriers on the LocalNet portion of the RF spectrum. Using Frequency Division Multiplexing (FDM), LocalNet establishes 120 LocalNet 20 digital channels. These channels can operate concurrently with other services that use other portions of the RF spectrum on the cable.

Each LocalNet channel is shared by up to 200 devices using Time Division multiplexing (TDM) to utilize the channel's capacity. LocalNet uses CSMA/CD access method to allocate the channel to devices requesting its use.

Channel Encoding • uses own clock interval, not Manchester encoding.

Data Rate • 128K bps on LocalNet 20 channels.

Carrier • Radio Frequency (RF) carrier.

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Sytek LocalNet 20
Broadband Local Area Network

Control Procedure

LocalNet uses CSMA/CD access method to control access to each digital channel. Detects collisions by transmitting device listening on receive channel and comparing received data with transmitted data. Cross-channel communications are controlled by the bridge device connecting the channels.

Transmission Medium

LocalNet uses standard 75-ohm CATV coaxial cable, fittings, and connectors. Buildings can be "wired" with fittings so that devices can be plugged in anywhere (like electrical outlets) and moved from one place to another with no change in the device's operation.

Use

LocalNet has been designed to integrate the local communication facilities of computers and terminals. Applications include the automated office, real-time monitoring and control, and distributed processing.

• END

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