Communications Processors: Overview

In this report:

Note: This report provides an overview of communications processors. It identifies the major equipment vendors, discusses market and technology trends, explains communications processor operation, and provides selection guidelines.

Datapro Summary

The communications processor, originally designed for the hierarchical mainframe network, performs device polling, line concentration, data packet routing, and other necessary functions. By off-loading these tasks from the host, the communications processor frees the host to perform the primary task for which it was designed: data processing.

Local area networking has largely displaced the mainframe, and the LAN router, offering a streamlined, cost-effective approach to concentration and switching, has become the workhorse of networking technology. To extend the life of the communications processor, IBM and other vendors have enhanced their products with multiprotocol host, LAN, and display terminal connectivity options, turning their processors into solutions for linking newer LAN environments with older host and terminal environments.

As a front-end processor, the communications processor remains an indispensable component in the communications strategies of IBM, Amdahl, NCR, and Unisys. It remains a major source of revenue, therefore, for these vendors in the years to come.

Market Analysis

Market Highlights

As a front end to a host computer, the communications processor monitors and manages multiple communications lines and the devices on them, concentrating the data into one or more host channels. As a remote processing node, the communications processor performs line concentration, intelligent switching (routing), flow control, error correction, protocol conversion, and LAN gateway functions. Freed from these routine tasks, the host can concentrate on its primary task—processing data for application programs.

As a front-end processor (FEP), the communications processor remains a strategic element in the networking architectures of major computer manufacturers including IBM, Amdahl, NCR, and Unisys. Vendors continue to enhance these products, primarily through intelligent communications modules, allowing the processor to interconnect hosts and multiple, incompatible LAN and WAN environments, thereby providing a migration path to open networking.

Originally designed, however, for the hierarchical (host-to-terminal) type of communications in which the host controls routing functions through static tables, communications processors are not the ideal solution for intelligent switching between LANs. Multiprotocol LAN routers, now marketed by a growing number of vendors, including IBM, lead in this area.

—By Martin Dintzis
Assistant Editor/Analyst

Market Leaders

IBM

IBM is the leading vendor in the communications processor market. All major vendors offer compatibility with IBM's Systems Network Architecture (SNA), its 3745 Communication Controller (a front-end processor), and its 3174 Establishment Controller (a terminal controller). Vendors of 3745-compatible equipment include NCR Corp., Amdahl Communications, and Unisys Corp. Vendors marketing terminal controllers compatible with the IBM 3174 include Memorex Telex, Apertus Technologies, IDEA, and McDATA.

IBM's *3745 Communications Controller* family includes the low-end Models 130, 150, and 170, and the larger processor Models 210, 310, 410, and 610. The most powerful model, the 3745-610, supports up to 16 IBM hosts concurrently, 896 low- and medium-speed lines, 16 T1 trunks, eight 16M bps token-ring LANs, and sixteen 10M bps Ethernet LANs. Models 410 and 610 offer two independent central control units (CCUs), which each run a separate Network Control Program (NCP). The IBM 3745 supports the ESCON adapter, which permits high-speed fiber optic channel access to a System/390 host, and frame-relay wide area networking connections.

In June 1993 IBM will introduce several enhancements to the high-end models (210 through 610). IBM will extend the power and capacity of these models through the 3746 Expansion Unit Model 900. This unit will house a new high-performance token-ring LAN adapter, the first of several new processing models to be released by IBM. By off-loading LAN gateway functions, the expansion unit will free 3745 option slots to handle other functions, such as holding 8MB of additional memory for a total of 16MB, managing ESCON channels, and supporting frame-relay WAN links. Upgraded with additional memory, an enhanced maintenance subsystem, and an interface to the 3746, these units are now renamed as Models 21A, 31A, 41A, and 61A, respectively.

IBM's *3172 Interconnect Controller*, available in three models, is a multivendor networking product capable of linking multiple, dissimilar LANs (TCP/IP Ethernet, token-ring, FDDI, and IBM PC Network), multiple remote IBM hosts over T1 trunks, or multiple IBM hosts over a LAN backbone. Like the 3745, it supports ESCON channels. Version 3.0 of IBM's 3172 Interconnect Controller Program (ICP) supports a *TCP/IP Offload* feature, which eliminates TCP/IP networking overhead from the host computer.

The IBM *3174 Establishment Controller*, available in more than 14 different models, performs concentration, protocol conversion, and gateway functions to link multiple terminals and PCs to both IBM and non-IBM hosts. Included in this family are floor-standing, rack-mounted, and tabletop units supporting local System/370 host channel attachment, ESCON host channel attachment, and remote host access via X.25, ISDN BRI, and fractional or full T1/E1 facilities. The 3174 features async bidirectional ASCII-to-IBM 3270 protocol conversion for terminal-to-host communications, access to multiple hosts and host sessions for attached devices, token-ring LAN-to-host gateways, and Advanced Peer to Peer Networking (APPN) support. The largest models can support up to sixty-four 3270-type or eighty-eight async devices.

IBM's *5394 Remote Control Unit* links up to 16 5250-compatible terminal devices to an AS/400 or System/3X midrange host. Both local and remote host links are supported.

Vendors of IBM 3745-Compatible Products

NCR Network Products Group

NCR's *Comten 5600* communications processor line comprises five models: 5630, 5645-B, 5655-B, 5665-B, and 5675-B. The Comten 5675-B, the largest unit, supports up to 1,024 low- or medium-speed lines, 24 T1/E1 links, 16 IBM hosts, sixty-four 16M bps token-ring LAN connections, and 48 Ethernet LAN connections.

Recent enhancements to NCR's Comten 5600 processors include support for TCP/IP Ethernet LANs on the Comten 5600's *Multiple Communications Adapter Module (MCAM)* and an ISDN basic rate network interface for European ISDN services.

For years, NCR based its strategy on providing a product that was easy to configure, upgrade, and install in an IBM network. NCR now places more emphasis on supporting multivendor communications and evolving standards. NCR's Comten 5600 processors run TCP/IP software for internetworking. They can be managed by Systems Center's Net/Master as well as IBM's NetView network management systems.

The Comten 5600 processor line is just one component of NCR's *Open Networking Environment (ONE)* strategy. ONE includes a suite of open networking hardware and software products based on TCP/IP, OSI, and SNA software that ensures coexistence between existing networks and OSI networks, and transition products that provide a smooth migration path to open networking. Having merged with AT&T in 1991, NCR has integrated AT&T's StarLAN family of network adapters and intelligent hubs, StarWAN line of bridges and routers, StarGROUP client/server software, and StarSENTRY network management software into ONE.

Amdahl Corp.

Amdahl's *4745 Communications Processor Models 110 and 210* run IBM software without any modification. Designed as an alternative to the IBM 3745-210, the 4745-210 supports up to eight IBM hosts through ESCON or System/370 channels, 256 low- or medium-speed communications lines, four T1/E1 links, and eight token-ring LANs.

Unlike NCR, Amdahl offers an IBM plug-compatible product, one that preserves the user's software investment. Although the 4745 does not offer the capacity and processing power of the larger IBM 3745 models, Amdahl's 4745 provides superior price/performance, flexibility, and ease of upgradability. Amdahl boasts that the 4745-210 can provide up to 13% greater internal throughput than the IBM 3745-210. The 4745 can run multiple releases of IBM ACF/NCP (Versions 3, 4, and 5); switching between software releases can occur through the execution of a single console command. All Amdahl processors are fully compatible, enabling a user to upgrade from an Amdahl 4725 (an older processor) to a 4745-110, which, in turn, can be upgraded to a 4745-210.

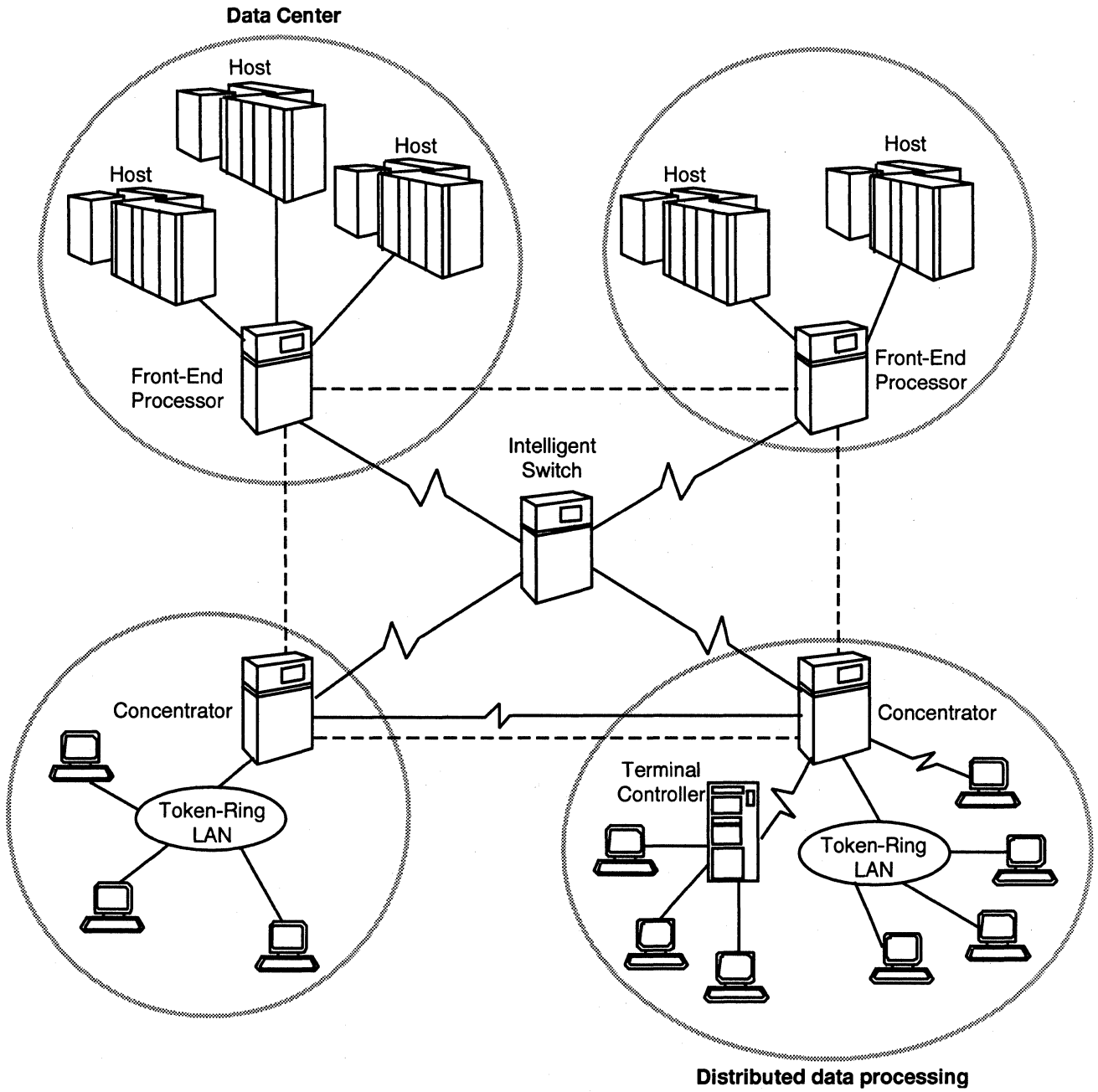
Unisys Corp.

Unisys's *Distributed Communications Processor (DCP) Series*, comprises six models: DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55. They range in size from the entry-level DCP/5, supporting up to 11 communications lines, to the top-of-the-line DCP/55, supporting over 1,500 communications lines.

DCP processors are designed for users of Unisys 1100/2200 Series mainframe computers who also need access to IBM SNA, OSI, TCP/IP, Ethernet LAN, and X.25 packet-switching environments. The processor models perform front-end processing, nodal processing, remote concentration, and network management functions.

A key feature of DCP processor software is IBM PU Type 2.1 node emulation, enabling DCP processors to dynamically route

Figure 1.
Applications



A communications processor can function as a front end for one or more host computers, an intelligent switching node, or a remote concentrator.

messages to and from other PU 2.1 devices, such as IBM FEPs, without IBM host assistance. The software also incorporates a menu-driven facility simplifying the process of logging on to multiple IBM hosts. A printer-sharing feature emulates the IBM printer sharing process for outbound open requests from Unisys systems. This feature provides automatic queuing of print requests.

In 1992 Unisys released the *Communications Access Processor (CAP)*, a product that integrates SNA networks and UNIX LAN environments. CAP implements a subset of the IBM mainframe's System Services Control Point (SSCP). Appearing as both a Physical Unit Types 4 and 5, CAP establishes and manages SNA sessions for both IBM- and UNIX-based devices independently of the IBM host computer. Special software running on a UNIX server provides mapping between SNA and UNIX applications, allowing any network device to access any application. CAP preserves the user's investment in SNA technology while allowing smooth migration to LAN-based processing. It accomplishes this without addition or modification to host software.

CAP is presently available in a version supporting 26 ports and two trunks: CAP/200. In June 1993 Unisys will release CAP/250, a larger model supporting 156 ports and six trunks.

Vendors of IBM 3174-Compatible Products

Memorex Telex Corp.

Memorex Telex is the world's largest supplier of IBM 3174 plug-compatible computer equipment and accessories. The company also markets intelligent workstations, local area network products, airline reservation systems, PBX equipment, and a variety of other products.

Memorex Telex's flagship hardware platform, the *1174 Network Controller*, is an IBM 3174-compatible controller. Available in two local and four remote attachment models, the 1174 provides access to as many as 16 IBM hosts for up to 128 IBM coax and 32 async ASCII or Digital LAT terminals. It supports both token-ring and TCP/IP Ethernet LAN connections, and its async terminal ports can be used to access async hosts. Attached terminals have access to up to ten concurrent host sessions and display up to five windowed sessions.

The *STP 6544 Multifunction Communications Controller* is an IBM 3174-compatible controller connecting as many as 48 synchronous and 32 asynchronous terminal devices to 4 IBM SNA or BSC hosts and 32 async hosts. The STP 6544 can access hosts through System/370 channels, X.25 and ISDN BRI WAN connections, and token-ring LANs.

IBM plug-compatible displays accessing the STP 6544 can support up to five simultaneous host sessions through hot-key switching. Memorex Telex displays can present up to four simultaneous sessions with windowing; users can cut and paste data from one session to another. Other STP 6544 features include bidirectional 3270-to-async ASCII protocol conversion, central site software distribution and diagnostics, and integration with NetView.

Apertus Technologies

Apertus markets IBM 3174-compatible terminal networking and gateway products. The *Datastar 3270 Access Hub* allows connection of synchronous and asynchronous terminals to TCP/IP Ethernet LANs, token-ring LANs, and SNA and UNIX hosts communicating with those LANs. Up to 16 downstream physical units (DSPUs) and more than 128 TELNET or 3270 CUT-mode terminal sessions can be supported concurrently.

The *Datastar 6800 TCP/IP LAN-to-Host Gateway*, functioning as both a protocol converter and a gateway, provides TCP/IP Ethernet LAN users with links to both IBM and async host environments directly, through wide area links, or through token-ring LANs. It off-loads all TCP/IP processing functions from host computers. Ethernet LAN users can execute file transfers without FTP Server software on the mainframe. The Datastar 6800 can also print 3270 data on LAN-attached printers. Each Datastar 6800 system can support up to 1,000 incoming TELNET and/or 3270 sessions.

IDEA

IDEA Concert is a family of IBM 3174/5394-compatible controllers providing interoperability between IBM mainframe and midrange hosts and terminals, Digital VAXs and VT Series terminals, and Ethernet and token-ring LANs. In addition to supporting IBM SNA, TCP/IP, and X.25 protocols over wide area links, IDEA Concert provides LAN routing for IP, Novell SPX/IPX, and Digital LAT environments and supports MAC-level spanning tree bridging (Ethernet) as well as source routing bridging (token-ring). The controller's SNA Datastream Management (SDM) feature efficiently routes SNA/SDLC traffic across LAN internetwork links. SDM's PU Concentrator feature simplifies host distribution of sessions and reduces mainframe VTAM/NCP resource requirements. IDEA Concert is available in five models supporting anywhere from 8 to 128 IBM terminals and 8 to 32 Digital VT-type terminals.

McDATA Corp.

McDATA's *LinkMaster* family of products comprises wide and local area channel extenders as well as IBM 3270-compatible controllers interconnecting terminals, token-ring and Ethernet LANs, and host computers. The *LinkMaster 7100 Network Controller*, an IBM 3174-compatible unit available in two local and three remote models, provides access up to four IBM hosts for as many as 128 coax devices and 34 async devices (or async hosts). The LinkMaster 7100 features multiple host protocol combinations (X.25, BSC, SDLC, SNA, and async ASCII), concurrent gateway and DSPU functionality for both token-ring and Ethernet LANs, 3270-to-Digital LAT conversion, ESCON channel support, GOSIP compliance, and 3270 access to UNIX hosts via the TELNET protocol.

The *LinkMaster 6200 Network Gateway*, an IBM 3172-compatible product based on UNIX technology, functions as both a channel server and a channel gateway simultaneously. As a channel server, it provides Ethernet, token-ring, and FDDI LAN access to host SNA applications, off-loading terminal emulation and file transfer processing functions from the host. As a channel gateway, it provides multiple logical paths between IBM-compatible mainframes for file transfer and automatic rerouting of traffic. In addition to SNA, the LinkMaster 6200 supports TCP/IP, Digital DECnet, and OSI/CS.

McDATA's *LinkMaster 7200 Network Concentrator* concentrates multiple remote SDLC lines into either a single SDLC line or token-ring LAN for host connection. With the LinkMaster 7200, users can consolidate multiple telecommunications lines or integrate older 3270 devices into a LAN environment.

Future Directions

As a front end to the host, the communications processor remains an indispensable component in the communications strategies of IBM, Amdahl, NCR, Unisys, and other computer manufacturers. These vendors have also maintained their products' usefulness through enhancements such as LAN gateways, T1 connectivity, and support for open networking using X.25, TCP/IP, and frame-relay protocols. The communications processor, therefore, has become a means to link the host to multiple dissimilar networking environments.

Support for multiple protocols in LAN routers, however, is offering a simpler, more efficient, and more economical method of transporting data between LANs, LAN-attached hosts, and even LAN-attached communications processors.

The communications processor is still needed for certain tasks that should not or cannot be handled by the LAN, including line concentration, device polling, performance monitoring, and certain network management functions. It remains a major source of revenue, therefore, for vendors in the years to come. It is doubtful, however, that any newcomers will arrive on the communications processor scene. Most of the market belongs to IBM, NCR, Unisys, and Amdahl. Taking on these giants is not likely to appeal to start-up companies, which would probably prefer a more dynamic field with more possibilities.

Technology Analysis

The term "communications processor" describes not only a specific category of equipment, but also systems that perform communications processing functions and other services. Datapro's

definition of communications processors covers multifunctional, intelligent systems dedicated to communications and serving as nodes in a network. These systems generally include three basic types of products: front-end processors, intelligent switches, and remote concentrators.

In the late 1970s, IBM's SNA and the ISO's OSI model advanced data communications as functions separate from applications processing. SNA and OSI defined a network as a physical entity, separate from its participating hosts and terminals. Implementing a physically separate communications function occurred through a system of small dedicated computers. Users placed these communications processors at the front end of a mainframe or allowed them to function independently as concentrators and switches within their architectures.

In most communications processors, the CPU directs some components to perform functions for the whole communications processor and others to perform functions for specific groups of communications lines. The former group includes host interfaces, input/output (I/O) processors, reference clocks, and operator interfaces, while the latter includes T1 and fractional T1 line interfaces and LAN gateway modules.

There are two kinds of network architectures: those for communications among computers and terminals from a specific vendor and those for open communications regardless of the vendor of the communicating devices.

This section of the report discusses communications processor design, evolution, and position in modern network architectures. It also provides Selection Guidelines for users.

Technology Basics

The definition of a communications processor varies greatly. Network designers hold one view of what a communications processor does, while equipment manufacturers hold another. The term "communications processor" has been applied to equipment ranging from an IBM 3745 to a four-port packet assembler/disassembler (PAD).

A network designer believes that a communications processor should set up connections to transmit and receive data, multiplex and demultiplex data, frame and unframe messages, perform error correction and protocol conversion, choose transmission routes, and collect performance and traffic statistics. Unfortunately, this definition has led many manufacturers to classify their protocol converters, PADs, and multiplexers as communications processors. Manufacturers consider communications processors as any devices that connect terminals to networks and maintain control through changing network conditions. This concept clouds the definition of the equipment—an IBM 3745 and a basic protocol converter do not belong in the same category.

Datapro defines a communications processor as a multifunctional, intelligent device dedicated to communications and serving as a control point, or node, in a data communications network. It functions as a front end to a mainframe, an intelligent switch, or a remote concentrator. As a *front-end processor*, the communications processor acts as a peripheral device locally attached to one or more large computers, relieving them of the overhead involved in message handling and network control. An *intelligent switch* routes messages among the network's various end points and participates in the network's control and management, either under the control of a master (usually front-end) processor or as a peer of other intelligent switches. A *concentrator* or *terminal controller* controls a community of terminals, clusters of terminals, or distributed applications processors; gathers, queues, and multiplexes their transmissions onto one or more high-speed network trunks; and participates in the network's control and management, either under the direction of a master processor or as a peer of other concentrators and switches.

Network Architectures

In general, there are two kinds of network architectures: those designed to provide communications among computers and terminals from a specific vendor, and those designed to provide open communications regardless of the vendor.

Proprietary mainframe vendor architectures include IBM's SNA, Bull HN's DSA, and Unisys's BNA and DCA. Open architectures include the CCITT X.25 packet-switching specification and several "transparent" network schemes marketed by communications vendors.

The communications processor plays an important part in vendor-specific and open architectures. The International Organization for Standardization (ISO) reference model for Open Systems Interconnection (OSI) provides a framework for examining the functions performed by communications processors in different network architectures.

Mainframe Architectures

In network architectures designed by mainframe vendors, the FEP controls communications in conjunction with one or more software systems in the host computer. In general, it handles the Data Link through Session layers of the ISO model, with host software implementing the Presentation and Application layers. The activity in the layers varies, depending on the architecture. In Unisys's DCA, the DCP-Series front-end controls many Presentation layer functions, while in IBM's SNA, the host's access method (along with software residing in the terminal controllers) handles communications down to the Session layer, with the 3745 front end acting almost as a channel-attached packet switch. The range of control assigned to front-end processors in other mainframe architectures varies between those extremes.

In all mainframe architectures, the same processor models serving as front ends can also function as intelligent switches and concentrators. Communications processors working in mainframe architectures also perform intelligent gateway functions, providing the interface between the mainframe network and communications facilities outside the architecture, particularly LANs and X.25 packet switched networks.

Open Architectures

In an open architecture, such as X.25, the communications processor serves as an intelligent packet switch, implementing the Data Link through Transport layers via a uniform set of complementary protocols. Designed specifically for public data networks, the X.25 protocol establishes virtual circuits, or logical paths, through the network for any vendor's devices. Communicating devices at either end of the virtual circuit must handle the Session, Presentation, and Application layers according to their own protocols.

In a public network, the network provider is responsible for network management. The packet-switching processors in the public network, therefore, bear the load of network access, routing, error-correction, and flow control functions, along with provisions for statistically recording traffic and usage data for individual users.

Communications processors operating in packet-switching configurations seldom perform gateway functions. The user must comply with the network's protocols, either through a combination of hardware and software residing on the front-end processor or through a standalone packet assembler/disassembler handling the Physical and Data Link layers of the architecture.

Evolution of the Communications Processor

Two developments in the late 1960s provided the technical base for the modern communications processor: the minicomputer and ARPANET. The minicomputer performed several functions more efficiently than a mainframe and supplied the bus architecture

that gave communications processors modularity and flexibility. ARPANET, the first large-scale packet switched data network, produced the fundamental design principles for current data communications architectures. From these principles originated the intelligent virtual circuit switch, the first functional communications processor.

A later development in minicomputer applications created the distributed processor, a small computer dedicated to part of a larger application that performed communications with its peers in a distributed network. Distributed processing contributed the idea of intelligent communications handling under software control.

The lower cost of dedicated processing in small computers made it feasible to dedicate a small computer for intelligent communications handling. The first intelligent front ends, such as IBM's 3704, predate modern network architectures and, to a large extent, made such architectures possible.

The microprocessor also contributed to the communications processor's development. The advent of inexpensive silicon intelligence enabled designers to implement the hierarchical scheme of the typical communications architecture in hardware, with dedicated microprocessors performing low-level functions and reporting to larger, more complex processors at higher levels. Indeed, some communications interface modules in present-day communications processors are programmable, receiving downloads from the units' CPUs that describe protocol and synchronization. Some systems consist of entirely redundant, microprocessor-controlled modules that perform the functions of other modules, using the proper software load.

Functions

Front-end processing is the most difficult task performed by a communications processor. In a large, complex network governed by one or more mainframe hosts, a front end must perform the following: physical transmission and reception of data; data buffering and queuing; multiplexing; message framing and unframing; transmission error control; message sequencing; message pacing and flow control; message or packet assembly and disassembly, route selection; session establishment and disconnection; and data formatting.

Intelligent switching is slightly less complex. When acting as a dedicated switch, the communications processor does not carry on a running dialog with a host computer and is not responsible for end-to-end establishment and disconnection of sessions. Still, an intelligent switch in normal operation must perform several basic functions.

Concentration is often combined with LAN gateway and protocol conversion functions in terminal controllers such as the IBM 3174 Establishment Controller. The terminal controller, therefore, should not be confused with less sophisticated, single-function devices like statistical multiplexers, basic terminal emulators, and PADs. Indeed, the widespread use of microprocessors and the declining cost of silicon intelligence, have enabled many devices at the high ends of these lines to approach true communications processor functions. In true communications processing, however, a dynamic process occurs that involves feedback from other intelligent devices in the network. Statistical multiplexing, simple terminal emulation, and packet assembly/disassembly are basically static processes that do not change as network conditions change.

An intelligent concentrator helps control the network, either under the direction of a master processor or as a peer of other concentrators and switches, receiving status information from the network and changing its behavior accordingly. These changes include accelerating or withholding transmissions, initiating diagnostic procedures for pathways and devices in its local domain, and controlling access to the network from its locally attached devices. Some sophisticated terminal controllers, notably IBM's 3174s, perform some or all of these functions.

Design

As shown in Figure 2, the basic design of almost all communications processors follows a three-tiered, hierarchical plan—a plan that they share in common with digital PBXs and other data communications components. This hierarchical arrangement includes the CPU, various common control components, and communications interface modules. All these components are linked via a common processor bus.

The CPU

The processor's central processing unit (CPU) with its main memory sits at the top of the hierarchy. The CPU controls the communications processor's operation according to the rules and parameters of its operating software and, in front-end configurations, in conjunction with instructions from the host computer. In general, the CPU performs addressing, route selection, protocol conversion, access control, session establishment, application-level formatting, and error logging. It also delegates rote operations to subsidiary components.

Common Control Components

Host Interfaces: Communications processors configured as front ends must have at least one host channel interface. The host channel interface converts serialized data from the front end's CPU into parallel bit streams transmitting the data up the channel to the host. The host channel interface performs an identical but reverse process on data from the host.

Input/Output Processors: Some communications processors contain one or more input/output processors that transfer data between the CPU and attached storage peripherals. In some cases, the I/O processors arbitrate among the various line bases for access to main memory and to the CPU, handling interrupts generated by the line bases or host interfaces to gain the attention of the CPU, or controlling the line bases' or host interfaces' access to main memory. In communications processors with more than one I/O processor, each I/O processor usually controls a set complement of storage units or communications lines.

Reference Clock: The reference clock generates a timing signal for other components of the communications processor. In many systems, the CPU performs reference timing. Some systems have separate reference clocks for timing signals at different data rates.

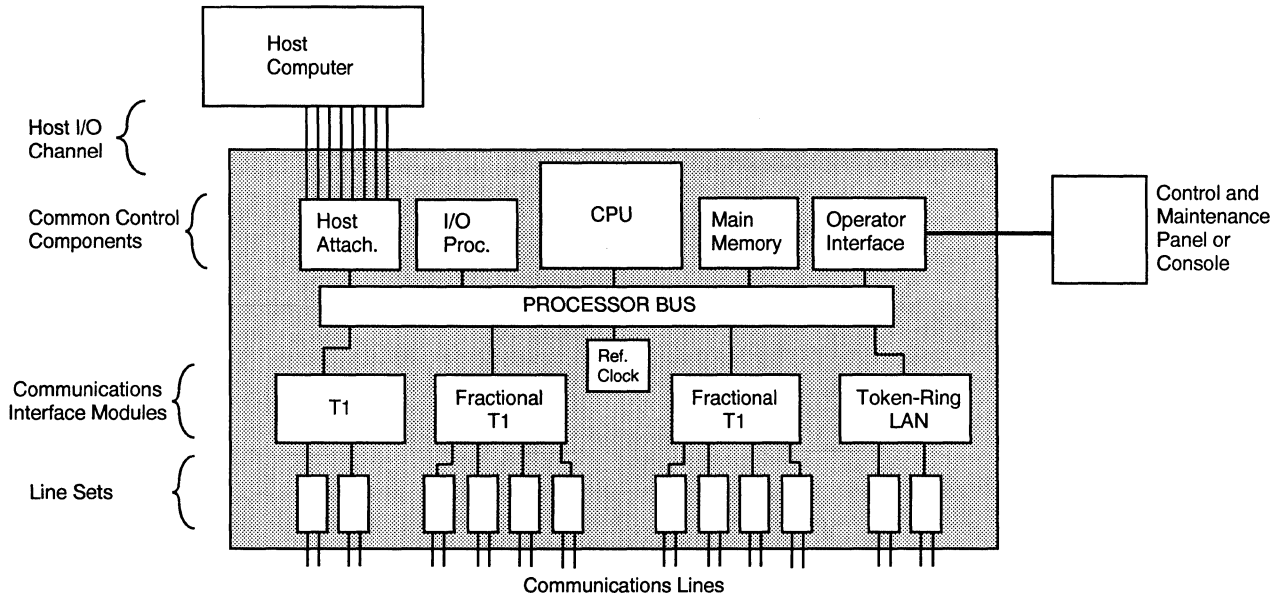
Operator Interface: The operator interface allows an operator to monitor and control the communications processor and to run diagnostic tests. In newer and more sophisticated systems, the operator interface works under software control from a dedicated workstation. In older communications processors, the operator interface works through a front panel equipped with manual switches and indicator lights.

Communications Interface Modules

All the aforementioned components perform functions that are shared among all communications lines; they sit just below the CPU in the communications processor's internal hierarchy. On the network side, the "business end" of a communications processor, the line bases and line sets complete the hierarchy.

Communications interface modules handle communications at the Data Link layer between the communications processor and one or more attached communications lines that share a common synchronization pattern, line speed, and protocol. Each module

Figure 2.
Communications Processor Architecture



The diagram shows the hierarchical, bus-based architecture of a typical communications processor. Such a processor can contain more than one host interface, several I/O processors, and different types of communications interface modules. Each communications interface module serves lines of a specific synchronization, speed, and protocol.

usually contains a dedicated microprocessor that performs framing and stripping, message buffering, message sequencing, synchronization, and error detection under the CPU's direction. Such modules are available for T1, fractional T1, and token-ring and Ethernet LAN connectivity.

Parallel Data Bus

All components of the communications processor communicate with one another over a parallel data bus, usually located along the backplane or a side plane of the processor's cabinet. The physical bus architecture, popularized by minicomputer design, supports easy installation and replacement of parts. In a hierarchical architecture, the bus also accommodates easy reconfiguration. To replace asynchronous communications over voice grade lines with HDLC communications over wideband or satellite circuits for a 16-line network segment, a user needs only to replace 1 line base and 8 line sets, rather than swapping out an entire front-end processor. The hierarchical design extends the communications processor's functionality over time and helps protect the user's investment.

Selection Guidelines

The principal advantage of using a communications processor as a networking tool is to physically and logically separate the networking functions from the host applications programs accessed by the network's end users. To achieve this goal, the communications processor must be capable of transparently providing networking services for any and all host applications. It must provide a modular hardware architecture allowing easy expansion and upgradability to accommodate additional users and networking environments. Additionally, a modular software architecture will allow introduction of support for new networking technologies, such as ISDN, OSI, and frame relay.

Redundancy for added reliability is another key feature to look for in a communications processor. Backup CPUs, communications modules, and network lines can maintain network integrity in the event of a processor component or line failure. Automatic switchover to backup host facilities, another important capability, allows users to continue working or to gracefully terminate their tasks before total system failure occurs.

A third issue to consider in selecting a product is its network management capabilities. Key features include the capability of interacting with major network management systems such as IBM's NetView and Systems Center's Net/Master; software distribution from a central site; on-line configuration through a user-friendly, menu-driven interface; and performance monitoring and statistics gathering to help plan for future expansion.

Emerging Technologies

Improvements in very large scale integration (VLSI) have enabled vendors to introduce intelligent and increasingly powerful add-on modules providing links to multiple environments without further loading down the processor CPU. Communications processors will continue to be marketed as platforms for integrating host processing systems with X.25 packet switched and frame-relay networks, T1 facilities, token-ring and Ethernet LANs, OSI networks, fiber optic communications facilities, and other environments.

Developments in VLSI technology have also enabled vendors to greatly reduce the total number of internal processor components and to improve their reliability. Greater reliability means less monitoring and maintenance costs for the user.

The communications processor still fulfills its original purpose: relieving the host of the overhead generated by keeping track of a network. Today's networks are larger and more complex than those of the mid-1970s when the first communications processors appeared. Thanks to the declining costs of memory and processing power, many of today's communications processors are faster and more powerful than early mainframes.

The complexity of communications processors, however, poses problems. In an era of user-friendly hardware and software, the communications processor remains a device hospitable only to trained engineers. Most require programs written in an arcane, Assembler-level language, sometimes (but not always) with the benefit of pregenerated macros in the host access method.

Vendors

The following list includes the names, addresses, and phone numbers of vendors that participate in the communications processor market.

Amdahl Corp.
1250 E. Arques Avenue
P.O. Box 3470
Sunnyvale, CA 94088-3470 (408) 746-6000

IBM
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

McDATA Corp.
310 Interlocken Parkway
Broomfield, CO 80021-3464 (303) 460-9200

NCR Corp.
Network Products Group
2700 Snelling Avenue North
St. Paul, MN 55113 (612) 638-7777

Memorex Telex Corp.
545 E. John Carpenter Freeway
Irving, TX 75062 (214) 444-3500

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424 (215) 986-4011 ■

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As a front-end processor (FEP), the communications processor remains a strategic element in the networking architectures of major computer manufacturers including IBM, Amdahl, NCR, and Unisys. Vendors continue to enhance these products—primarily through intelligent communications modules. These modules allow the processor to interconnect hosts and multiple, incompatible LAN and WAN environments, thereby providing a migration path to open networking.

Originally designed, however, for the hierarchical (host-to-terminal) type of communications in which the host controls routing functions through static tables, communications processors are not the ideal solution for intelligent switching between LANs. Multiprotocol LAN routers, now marketed by a growing number of vendors, including IBM, should take the lead in this area.

—By Martin Dintzis
Assistant Editor

Market Leaders

IBM is the leading vendor in the communications processor market. All major vendors offer compatibility with IBM's Systems Network Architecture (SNA) and its 3745 Communications Controller. IBM's foremost competitor is NCR Corp., followed by Amdahl Communications and Unisys Corp. Other competitors include Bull HN Information Systems, McData Corp., and Netlink Inc.

IBM

The 3745 Communications Controller family includes the low-end Models 130, 150, and 170, and the larger processor Models 210, 310, and 410. As the most powerful model, the 3745-410 supports up to 16 IBM hosts concurrently, 896 medium- and high-speed lines, and eight 16M bps token-ring LANs. Model 410 has two independent central control units (CCUs), which each run a separate Network Control Program (NCP).

The IBM 3745 supports the ESCON adapter, which permits high-speed fiber optic channel access to a System/390 host. In September 1992, IBM plans to release an Ethernet LAN adapter for the 3745 along with Version 6 of the Advanced Communications Function/Network Control Program (ACF/NCP). The new ACF/NCP software will support Ethernet LAN functionality and introduce frame-relay connectivity. With a single high-speed line to a public frame-relay network, users could access multiple remote 3745s. Reducing the number of lines will cut communications costs for IBM customers.

IBM also markets the 3172 Interconnect Controller, a multivendor networking product capable of linking multiple, dissimilar LANs (Ethernet, token-ring, MAP 3.0,

and IBM PC Network) or linking multiple remote IBM hosts over T1 lines.

In June 1992, IBM plans to release the 6611 Network Processor Model 140, a four-slot device, and the 6611 Network Processor Model 170, a seven-slot device.

These LAN routers are designed to provide peer-to-peer communications capability for local area networks, allowing LAN devices to establish remote communications links dynamically and without IBM host assistance. In the older hierarchical approach to SNA networking, for which the IBM 37XX communications processor was originally developed, data switching between processor nodes was controlled by static host-resident tables. The 6611, the first LAN product of its kind introduced by IBM, will provide a new, dynamic, intelligent switching method. This is becoming very necessary for interactive cooperative and distributed processing applications.

As a multiprotocol networking product, the 6611 can route SNA/SDLC, NETBIOS, TCP/IP, DECnet, IPX, AppleTalk, and XNS datastreams across wide area networks (WANs). It offers a means to consolidate multiple protocols on a single link, thereby decreasing networking expenses.

Features of the 6611 include:

- attachment of token-ring, Ethernet, downstream SDLC 3174, frame-relay, and X.25 devices
- local bridge connectivity, allowing up to seven IBM Token-Ring Network connections that converge at one location
- a Simple Network Management Protocol (SNMP) Agent in the IBM Multiprotocol Network Program, providing online configuration capability

IBM is entering this market in response to the multiprotocol routers introduced by several vendors, including Cisco Systems, CrossComm Corp., RAD Network Devices, and Wellfleet Communications, which also support SNA.

IBM's router is not intended to duplicate the functions of the 3745 and its NCP software—this would require that the 6611 emulate a physical unit type 4 (PU4) device. Instead, the router exploits IBM's Advanced Peer-to-Peer Networking Protocol (APPN) for intelligent communications between LAN devices without host assistance.

The router encapsulates SNA frames without modifying them, a strategy that reduces communications overhead and processing delays. The 6611 can also carry data from LAN-attached hosts and LAN-attached communications processors over the same wide area link that carries the LAN traffic. This arrangement provides higher throughput than conventional leased SDLC lines and can be used to reduce the total number of leased lines in a private network.

Although routers, such as the 6611, will take on some of the LAN-to-LAN communications handled by the 3745, the 3745 will still occupy an important place in IBM's networking strategy. It provides the only method to link a local or remote LAN environment to an IBM host computer. It also performs valuable functions such as device polling, error correction, performance monitoring, line concentration, and certain network management functions—which should not or cannot be off-loaded to another product. Both the 3745 and the 6611, therefore, will work together in the wide area network.

NCR

NCR's Comten 5600 communications processor line includes five models: 5630, 5645-B, 5655-B, 5665-B, and 5675-B. The Comten 5675-B, the largest unit, supports up to 1,024 low- or medium-speed lines, 24 T1/E1 links, 16 IBM hosts, sixty-four 16M bps token-ring LAN connections, and 48 Ethernet LAN connections.

Recent enhancements to NCR's Comten 5600 processors include the release of a new low-end processor, Model 5630, and the introduction of the *Multiple Communications Adapter Module (MCAM)*, which provides token-ring gateway functionality now and will eventually provide Ethernet LAN connections, frame relay, and SMDS connectivity.

For years, NCR based its strategy on providing a product that was easy to configure, upgrade, and install in an IBM network. NCR now looks beyond IBM, offering support for multivendor communications and evolving standards. NCR's Comten 5600 processors run TCP/IP software for internetworking. They can be managed by Systems Center's Net/Master as well as IBM's NetView network management systems.

The Comten 5600 processor line is just one component of NCR's *Open Networking Environment (ONE)* strategy. ONE includes a suite of open networking hardware and software products based on TCP/IP and OSI, SNA software that ensures coexistence between existing networks and OSI networks, and transition products that provide a smooth migration to open networking. Having merged with AT&T in 1991, NCR has integrated AT&T's Starlan family of network adapters and intelligent hubs, StarWAN line of bridges and routers, StarGROUP client/server software, and StarSENTRY network management software into ONE, which places the vendor in an even stronger position to offer multivendor wide area networking solutions.

Amdahl

Amdahl's 4745 Communications Processor Models 110 and 210 run IBM software without any modification. Designed as an alternative to the IBM 3745-210, the 4745-210 supports up to eight IBM hosts, 256 communications lines, and eight 4M bps token-ring LANs.

In the fourth quarter of 1991, Amdahl increased the throughput capacity of the 4745 by 90% through memory and channel adapter enhancements, increased the maximum number of channel-attached hosts to eight, and introduced T1/E1 communications adapters for leased SNA/SDLC lines. In January 1992, Amdahl introduced IBM ESCON adapter connectivity. Later this year, Amdahl intends to introduce support for 16M bps token-ring LANs. The 4745 presently accommodates only 4M bps LAN environments.

Unlike NCR, Amdahl offers an IBM plug-compatible product, one that preserves the user's software investment. Although the 4745 does not offer the capacity and processing power of the larger IBM 3745 models, Amdahl's 4745 provides superior price/performance, flexibility, and ease of upgradability. Amdahl boasts that the 4745-210 can provide up to 13% greater internal throughput than the IBM 3745-210. The 4745 can run multiple releases of IBM ACF/NCP (Versions 3, 4, and 5); switching from one software release to another can occur through the execution of a single console command. All Amdahl processors are fully compatible, enabling a user to upgrade from an Amdahl 4725 (an older processor) to a 4745-110, which, in turn, can be upgraded to a 4745-210.

Unisys

Unisys markets the Distributed Communications Processor (DCP) Series, which includes six models: DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55. They range in size from the entry-level DCP/5, supporting up to 11 communications lines, to the top-of-the-line DCP/55, supporting over 1,500 communications lines.

DCP processors are designed for users of Unisys 1100/2200 Series mainframe computers who also need access to some combination of IBM SNA, OSI, TCP/IP, Ethernet LAN, and X.25 packet-switching environments. The processor models can perform front-end processing, nodal processing, remote concentration, and network management functions.

Early in 1992, Unisys released a new version of its DCP SNA software, which now enables its communications processors to emulate IBM PU 2.1 nodes. With this new feature, DCP processors can route messages to and from other PU 2.1 devices, such as IBM FEPs, without IBM host assistance. The software also incorporates a new menu-driven facility that simplifies the process of logging on to multiple IBM hosts.

Future Directions

As a front end to the host, the communications processor remains an indispensable component in the communications strategies of IBM, Amdahl, NCR, Unisys, and other computer manufacturers. Vendors have also maintained their products' usefulness through enhancements such as LAN gateways, T1 connectivity, and support for open networking using X.25, TCP/IP, OSI, and frame-relay protocols. The remote communications processor, therefore, has become a means to link the host to multiple dissimilar environments.

Support for multiple protocols in LAN routers, however, has begun to offer a simpler, more efficient, and more economical method of transporting data between LANs, LAN-attached hosts, and even LAN-attached communications processors.

The communications processor will always be needed for certain tasks that should not or cannot be handled by the LAN, including line concentration, device polling, performance monitoring, and certain network management functions. It will remain a major source of revenue, therefore, for vendors in the years to come.

It is doubtful, however, that any newcomers will arrive on the communications processor scene. Most of the market belongs to IBM, NCR, Unisys, and Amdahl. Taking on these giants is not likely to appeal to start-up companies, which would probably prefer a more dynamic field with more possibilities.

Technology Analysis

Technology Highlights

The term "communications processor" describes not only a specific category of equipment, but also systems that perform communications processing functions and other services. Datapro's definition of communications processors covers multifunctional, intelligent systems dedicated to communications and serving as nodes in a network. These systems generally include three basic types of products: front-end processors, intelligent switches, and remote concentrators.

In the late 1970s, IBM's SNA and the ISO's OSI model advanced data communications as functions separate from applications processing. SNA and OSI defined a network as a physical entity, separate from its participating hosts and terminals. Implementing a physically separate communications function occurred through a system of small dedicated computers. Users placed these communications processors at the front end of a mainframe or allowed them to function independently as concentrators and switches within their architectures.

In most communications processors, the CPU directs some components to perform functions for the whole communications processor and others to perform functions for specific groups of communications lines. The former group includes host interfaces, input/output (I/O) processors, reference clocks, and operator interfaces, while the latter includes T1 and fractional T1 line interfaces and LAN gateway modules.

There are two kinds of network architectures: those for communications among computers and terminals from a specific vendor and those for open communications regardless of the vendor of the communicating devices.

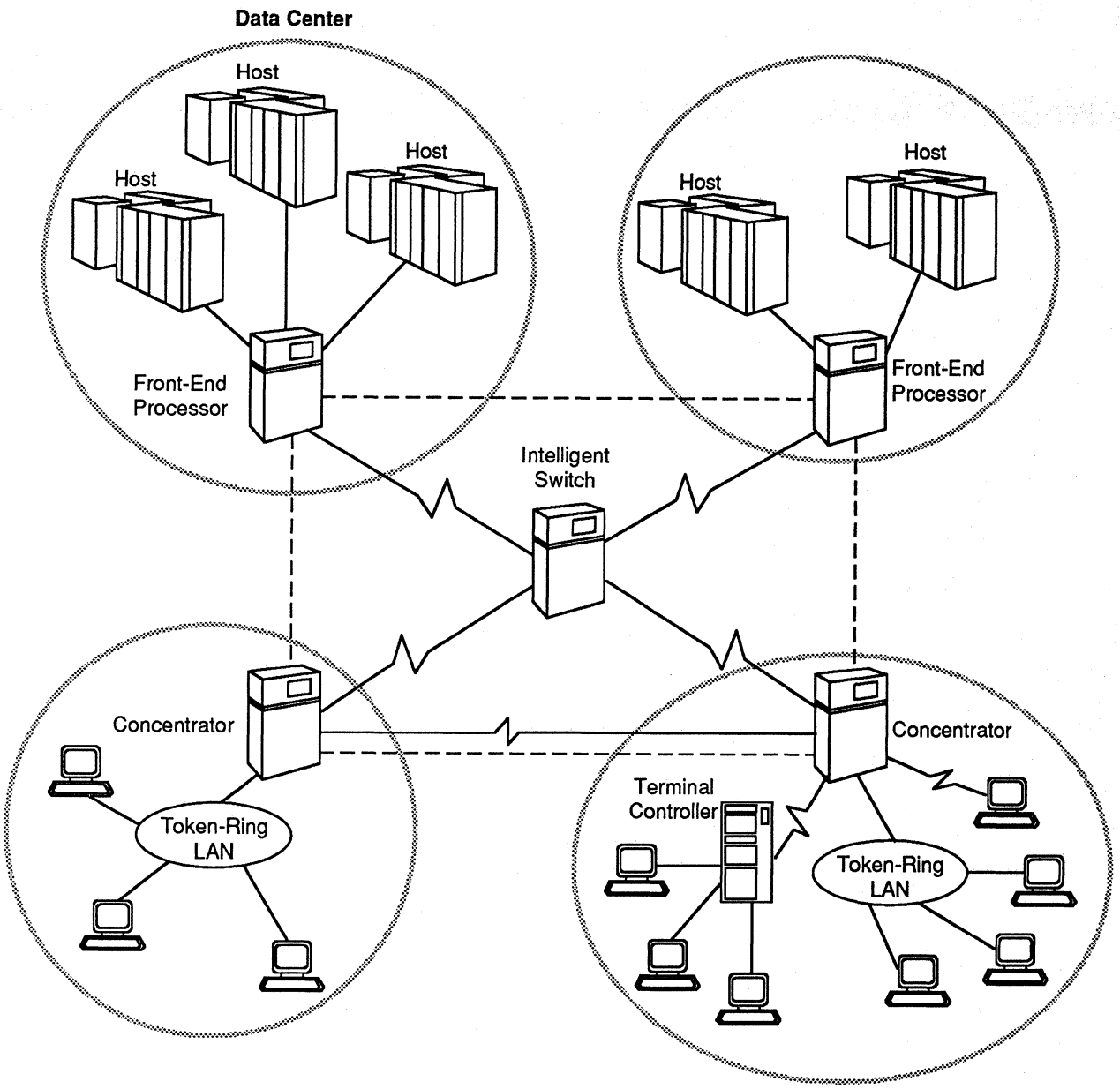
This section of the report discusses communications processor design, evolution, and position in modern network architectures. It also provides Selection Guidelines for users.

Technology Basics

The definition of a communications processor varies greatly. Network designers hold one view of what a communications processor does, while equipment manufacturers hold another. The term "communications processor" has been applied to equipment ranging from an IBM 3745 to a four-port packet assembler/disassembler (PAD).

A network designer believes that a communications processor should set up connections to transmit and receive data, multiplex and demultiplex data, frame and unframe messages, perform error correction and protocol conversion, choose transmission routes, and collect performance and traffic statistics. Unfortunately, this definition has led many manufacturers to classify their protocol converters, PADs, terminal controllers, and multiplexers as communications processors. Manufacturers consider communications processors as devices that connect terminals to networks and maintain control through changing network conditions. This concept clouds the definition of the

Figure 1.
Applications



A communications processor can function as a front end for one or more host computers, an intelligent switching node, or a remote concentrator.

equipment—an IBM 3745 and a protocol converter do not belong in the same category.

Datapro defines a communications processor as a multifunctional, intelligent device dedicated to communications and serving as a control point, or node, in a data communications network. It functions as a front end to a mainframe, an intelligent switch, or a remote concentrator. As a *front-end processor (FEP)*, the communications processor acts as a peripheral device locally attached to one or more large computers, relieving them of the overhead involved in message handling and network control.

An *intelligent switch* routes messages among the network's various end points and participates in the network's control and management, either under the control of a master (usually front-end) processor or as a peer of other intelligent switches. A *concentrator* controls a community of terminals, clusters of terminals, or distributed applications processors; gathers, queues, and multiplexes their transmissions onto one or more high-speed network trunks; and participates in the network's control and management, either under the direction of a master processor or as a peer of other concentrators and switches.

Network Architectures

In general, there are two kinds of network architectures: those designed to provide communications among computers and terminals from a specific vendor, and those designed to provide open communications regardless of the vendor.

Proprietary mainframe vendor architectures include IBM's SNA, Bull HN's DSA, and Unisys's BNA and DCA. Open architectures include the CCITT X.25 packet-switching specification and several "transparent" network schemes marketed by communications vendors.

The communications processor plays an important part in vendor-specific and open architectures. The International Organization for Standardization (ISO) reference model for Open Systems Interconnection (OSI) provides a framework for examining the functions performed by communications processors in different network architectures.

Mainframe Architectures

In network architectures designed by mainframe vendors, the communications processor usually functions as a front end and controls communications in conjunction with one or more software systems in the host computer. In general, the front-end processor handles the Data Link through Session layers of the ISO model, with host software implementing the Presentation and Application layers. The activity in the layers varies, depending on the architecture. In Unisys' DCA, the DCP-Series front end controls many Presentation layer functions, while in IBM's SNA, the host's access method (along with software residing in the terminal controllers) handles communications down to the Session layer, with the 3745 front end acting almost as a channel-attached packet switch. The range of control assigned to front-end processors in other mainframe architectures varies between those extremes.

In all mainframe architectures, the same communications processor models that serve as front ends also function as intelligent switches and remote concentrators. In these functions, the communications processors usually appear in smaller configurations than they do as front ends. Communications processors working in mainframe architectures also perform intelligent gateway functions, providing the interface between the mainframe network and communications facilities outside the architecture, particularly LANs and X.25 packet switched networks.

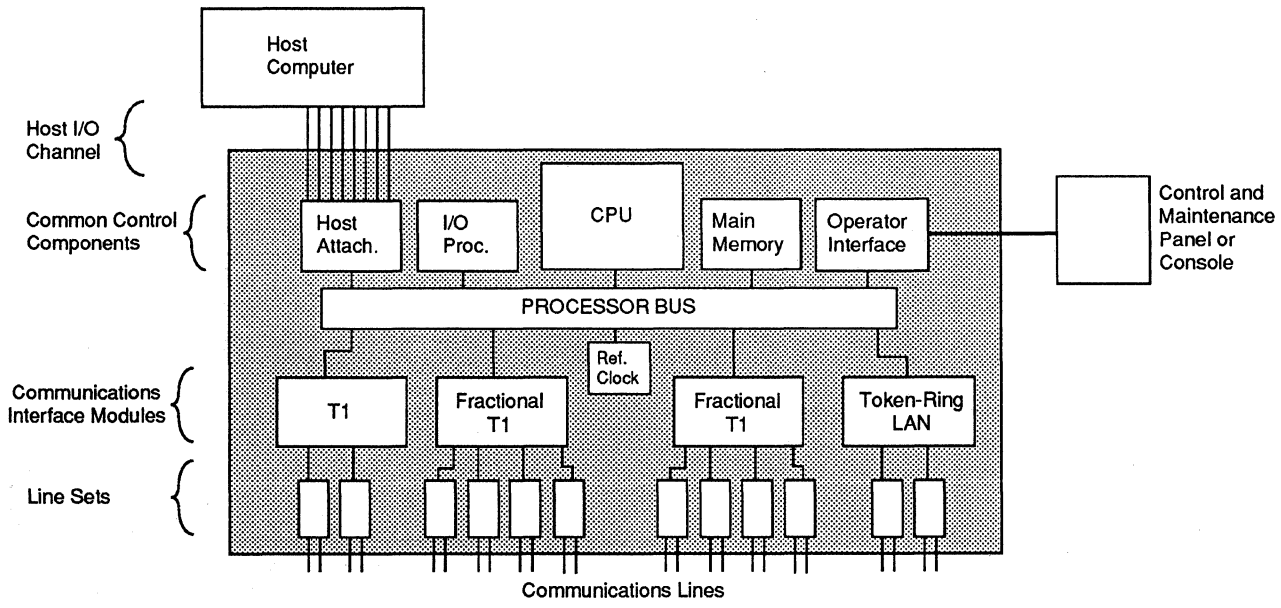
Open Architectures

In an open architecture, such as X.25, the communications processor serves as an intelligent packet switch, implementing the Data Link through Transport layers via a uniform set of complementary protocols. Designed specifically for public data networks, the X.25 protocol establishes virtual circuits, or logical paths, through the network for any vendor's devices. Communicating devices at either end of the virtual circuit must handle the Session, Presentation, and Application layers according to their own protocols.

In a public network, the network provider is responsible for network management. The packet-switching processors in the public network, therefore, bear the load of network access, routing, and error-correction, and flow control functions, along with provisions for statistically recording traffic and usage data for individual users.

Communications processors operating in packet-switching configurations seldom perform gateway functions. The user must comply with the network's protocols, either through a combination of hardware and software

Figure 2.
Communications Processor Architecture



The diagram shows the hierarchical, bus-based architecture of a typical communications processor. Such a processor can contain more than one host interface, several I/O processors, and different types of communications interface modules. Each communications interface module serves lines of a specific synchronization, speed, and protocol.

residing on the front-end processor or through a standalone packet assembler/disassembler that handles the Physical and Data Link layers of the architecture.

Some vendors offer transparent architectures as low-cost alternatives to mainframe architectures and X.25 implementations. These architectures are usually stripped-down versions of X.25 without the network administration and class-of-service overhead necessary to operate a public or large private network. In these architectures, the communications processor functions primarily as a switching concentrator, providing services at the Data Link, Network, and Transport layers. Most of these concentrators evolved at the high ends of statistical multiplexer product lines, adding the crucial routing and flow control features that qualify them as communications processors. Some of these products offer integrated network management functions, such as error logging and performance statistics, but most rely on separate, complementary network management systems.

Evolution of the Communications Processor

Two developments in the late 1960s provided the technical base for the modern communications processor: the minicomputer and ARPANET. The minicomputer performed several functions more efficiently than a mainframe and supplied the bus architecture that gave communications processors modularity and flexibility. ARPANET, the first large-scale packet switched data network, produced the fundamental design principles for current data communications architectures. From these principles originated the intelligent virtual circuit switch, the first functional communications processor.

A later development in minicomputer applications created the distributed processor, a small computer dedicated to part of a larger application that performed communications with its peers in a distributed network. Distributed processing contributed the idea of intelligent communications handling under software control.

The lower cost of dedicated processing in small computers made it feasible to dedicate a small computer for off-loading intelligent communications handling from the mainframe. The first intelligent front ends, such as IBM's 3704, predate modern network architectures and, to a large extent, made such architectures possible.

The microprocessor also contributed to the communications processor's development. The advent of inexpensive silicon intelligence enabled designers to implement the hierarchical scheme of the typical communications architecture in hardware, with dedicated microprocessors performing low-level functions and reporting to larger, more complex processors at higher levels. Indeed, some communications interface modules in present-day communications processors are programmable, receiving downloads from the units' CPUs that describe protocol and synchronization. Some systems consist of entirely redundant, microprocessor-controlled modules that perform the functions of other modules, using the proper software load.

Functions

Front-end processing is the most difficult task performed by a communications processor. In a large, complex network governed by one or more mainframe hosts, a front end must perform the following: physical transmission and reception of data; data buffering and queuing; multiplexing; message framing and unframing; transmission error control; message sequencing; protocol conversion; message pacing and flow control; message or packet assembly and disassembly, route selection; session establishment and disconnection; and data formatting.

Intelligent switching is slightly less complex. When acting as a dedicated switch, the communications processor does not carry on a running dialog with a host computer and is not responsible for end-to-end establishment and disconnection of sessions. Still, an intelligent switch in normal operation must perform several basic functions.

Since *concentration* is the simplest task performed by a communications processor, the processor can be confused with less sophisticated, single-function devices like statistical multiplexers, protocol converters, PADs, and terminal cluster controllers. Indeed, the widespread use of microprocessors and the declining cost of silicon intelligence, have enabled many devices at the high ends of these lines to approach true communications processor functions. In true communications processing like concentration, however, a dynamic process occurs that involves feedback from other intelligent devices in the network. Statistical multiplexing, protocol conversion, and packet assembly/disassembly are basically static processes that do not change as network conditions change.

An intelligent concentrator helps control the network, either under the direction of a master processor or as a peer of other concentrators and switches, receiving status information from the network and changing its behavior accordingly. These changes include accelerating or withholding transmissions; initiating diagnostic procedures for pathways and devices in its local domain; and controlling access to the network from its locally attached devices. Some sophisticated terminal controllers, notably IBM's 3174s, perform some or all of these functions.

Design

As shown in Figure 2, the basic design of almost all communications processors follows a three-tiered, hierarchical plan—a plan that they share in common with digital PBXs and other data communications components. This hierarchical arrangement includes the CPU, various common control components, and communications interface modules. All these components are linked via a common processor bus.

The CPU

The processor's central processing unit (CPU) with its main memory sits at the top of the hierarchy. The CPU controls the communications processor's operation according to the rules and parameters of its operating software and, in front-end configurations, in conjunction with instructions from the host computer. In general, the CPU performs addressing, route selection, protocol conversion, access control, session establishment, application-level formatting, and error logging. It also delegates rote operations to subsidiary components.

Common Control Components

Host Interfaces: Communications processors configured as front ends must have at least one host interface, which handles communications between the front-end processor and the host's byte or block multiplexer, or selector channel. The host interface buffers data from the front end's CPU, assembles it into parallel bit streams of a format specific to the attached host channel, and transmits it up the channel to the host. It performs the same process in reverse

for data from the host. The host interface converts data from the communications processor's internal word size to the host computer's.

Input/Output Processors: Some communications processors contain one or more input/output processors that transfer data between the CPU and attached storage peripherals. In some cases, the I/O processors arbitrate among the various line bases for access to main memory and to the CPU, handling interrupts generated by the line bases or host interfaces to gain the attention of the CPU, or controlling the line bases' or host interfaces' access to main memory. In communications processors with more than one I/O processor, each I/O processor usually controls a set complement of storage units or communications lines.

Reference Clock: The reference clock generates a timing signal for other components of the communications processor. In many systems, the CPU performs reference timing. Some systems have separate reference clocks for timing signals at different data rates.

Operator Interface: The operator interface allows an operator to monitor and control the communications processor and to run diagnostic tests. In newer and more sophisticated systems, the operator interface works under software control from a dedicated console, which usually contains a display unit and a printer for logging. In older communications processors, the operator interface works through a front panel equipped with manual switches and indicator lights.

Communications Interface Modules

All the aforementioned devices perform functions that are shared among all communications lines; they sit just below the CPU in the communications processor's internal hierarchy. On the network side, the "business end" of a communications processor, the line bases and line sets complete the hierarchy.

Communications interface modules handle communications at the Data Link layer between the communications processor and one or more attached communications lines that share a common synchronization pattern, line speed, and protocol. Each module usually contains a dedicated microprocessor that performs framing and stripping, message buffering, message sequencing, synchronization, and error detection under the CPU's direction. Such modules are available for T1, fractional T1, and token-ring and Ethernet LAN connectivity.

Parallel Data Bus

All components of the communications processor communicate with one another over a parallel data bus, usually located along the backplane or a side plane of the processor's cabinet. The physical bus architecture, popularized by minicomputer design, supports easy installation and replacement of parts. In a hierarchical architecture, the bus also accommodates easy reconfiguration. To replace asynchronous communications over voice grade lines with HDLC communications over wideband or satellite circuits for a 16-line network segment, a user needs only to replace 1 line base and 8 line sets, rather than swapping out an entire front-end processor. The hierarchical design extends the communications processor's functionality over time and helps protect the user's investment.

Selection Guidelines

The principal advantage of using a communications processor as a networking tool is to physically and logically separate the networking functions from the host applications programs accessed by the network's end users. To achieve this goal, the communications processor must be capable to transparently provide networking services for any and all host applications. It must provide a modular hardware architecture allowing easy expansion and upgradability to accommodate additional users and networking environments. Additionally, a modular software architecture will allow introduction of support for new networking technologies, such as ISDN, OSI, and frame relay.

Redundancy for added reliability is another key feature to look for in a communications processor. Backup CPUs, communications modules, and network lines can maintain network integrity in the event of a processor component or line failure. Automatic switchover to backup host facilities, another important capability, allows users to continue working or to gracefully terminate their tasks before total system failure occurs.

A third issue to consider in selecting a product is its network management capabilities. Key features include the capability of interacting with major network management systems such as IBM's NetView and Systems Center's Net/Master; software distribution from a central site; online configuration through a user-friendly, menu-driven interface; and performance monitoring and statistics gathering to help plan for future expansion.

Emerging Technologies

Improvements in very large scale integration (VLSI) have enabled vendors to introduce intelligent and increasingly powerful add-on modules providing links to multiple environments without further loading down the processor CPU. Communications processors will continue to be marketed as platforms for integrating host processing systems with X.25 packet switched and frame-relay networks, T1 facilities, token-ring and Ethernet LANs, OSI networks, fiber optic communications facilities, and other environments.

Developments in VLSI technology have also enabled vendors to greatly reduce the total number of internal processor components and to improve their reliability. Greater reliability means less monitoring and maintenance costs for the user.

The communications processor still fulfills its original purpose: relieving the host of the overhead generated by keeping track of a network. Today's networks are larger and more complex than those of the mid-1970s when the first communications processors appeared. Thanks to the declining costs of memory and processing power, many of today's communications processors are faster and more powerful than early mainframes.

The complexity of communications processors, however, poses problems. In an era of user-friendly hardware and software, the communications processor remains a device hospitable only to trained engineers. Most require programs written in an arcane, Assembler-level language, sometimes (but not always) with the benefit of pregenerated macros in the host access method.

Vendors

The following list includes the names, addresses, and phone numbers of vendors that participate in the communications processor market.

Amdahl Communications
1250 E. Arques Avenue
P.O. Box 3470
Sunnyvale, CA 94088-3470 (408) 746-6000, (800) 233-8489

Bull HN Information Systems, Inc.
Technology Park, 2 Wall Street
Billerica, MA 01821-4199 (508) 294-7000

Concurrent Computer Corp.
106 Apple Street
Tinton Falls, NJ 07724 (908) 758-7000, (800) 631-2154

IBM
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

McData Corp.
310 Interlocken Parkway
Broomfield, CO 80021 (303) 460-9200

NCR Corp.
Network Products Group
2700 Snelling Avenue N.
St. Paul, MN 55113 (612) 638-7777

Netlink Inc.
3214 Spring Forest Road
Raleigh, NC 27604 (919) 878-8612, (800) 638-5465

Thomas Engineering Co.
2440 Stanwell Drive
Concord, CA 94520 (415) 680-8640

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424 (215) 986-4011 ■

Communications Processors: Market Overview

Synopsis

Editor's Note

This report examines the communications processor market. For information on the technology, see "Communications Processors: Technology Overview"; for comparison columns detailing the features of key products, see "Communications Processors: Comparison Columns."

Report Highlights

The communications processor industry still exists, not as a shining star in the communications firmament, but as a reliable source of light. Although IBM, NCR, Unisys, and Amdahl dominate the market, other vendors have managed to infiltrate it. The major vendors continue to enhance their products, while NCR and Unisys have added new models.

IBM recently announced that by the middle of 1991, it will be adding DS3, FDDI, and ESCON networking support to the 3745 Communication Controller, making the 3745 front-end processor a vital part in IBM's networking strategy.

NCR added one new system, the 5645-B, and enhanced all the A models to B models. All the B models have been substantially reduced in physical size, number of components, and power and cooling requirements.

Amdahl enhanced the 4745 Series by expanding the memory capacity to 8M bytes, allowing the 4745 to connect up to four 4M bps token-ring networks. Amdahl also expanded the channel connectivity to support four active channel adapters in the base frame and extended the 4745's Integrated Switching Architecture (ISA).

Unisys added three new models: the DCP/25, DCP/35, and DCP/55. Enhancements include support for power-on-pluggable line modules, input/output module (IOM) power supplies, three input/output processors (IOPs) in a single IOM (DCP/50 and DCP/55 models only), the newly designed Maintenance Control Feature (MCF), and an improved power control feature.

—By Barbara Rinehart
Associate Editor/Analyst

Analysis

Market Overview

Although communications processors do not generate bold headlines, the products sustain a steady revenue stream for the four industry leaders: IBM, NCR, Unisys, and Amdahl. The technology is mature, but it still fills a need for these market segments: IBM and plug-compatible communications processors for the IBM mainframe environment, communications processors dedicated to the mainframe architectures of vendors other than IBM, and intelligent concentrators designed to serve in transparent network architectures.

Vendors did not allow their products to stagnate. Instead, the communications processors of the '90s support the hot items of today's communications marketplace: T1, LANs, SNA, TCP/IP, and IBM's NetView.

In 1990, IBM and Amdahl did not introduce new communications processor lines but dusted off existing ones and made them shinier and more up to date with token-ring and T1 capabilities. Amdahl made an announcement in April 1990 about supporting T1, but as of February 1991, this major feature was not available.

Vendor Survey Results

Twenty-eight vendors of communications processors responded to this year's survey requests. They provided details on the principal characteristics of 65 products. The data collected indicates that the communications processors are most widely used as remote line concentrators. Forty-two of the sixty-four products serve in that capacity, and five vendors did not respond to the question. Forty-seven processors can function as front-end processors. In last year's survey, 17 of the 42 communications processors were used as distributed processing nodes; in this year's survey, 27 of the 65 products perform that function. All of the processors perform protocol conversion.

IBM's Systems Network Architecture (SNA) is the company's master plan for communications with and among IBM computers, terminals, and office systems. It is also the company's vehicle for interconnection with other industry-standard networks, such as X.25. Without the capability to communicate with IBM equipment, a product starts its life cycle at a disadvantage. Aware of the importance of penetrating the IBM world, vendors have incorporated support for SNA into 44 of the 64 products included in the survey (see Figure 1).

Open Systems Interconnection (OSI) emerged in the late '70s as an attempt by the International Organization for Standardization (ISO) to resolve compatibility issues. The OSI model for open architecture consists of seven layers. Many vendors have released products that conform to OSI requirements. In the communications processor field, however, OSI conformity does not appear to be a driving force. Of the 64 products in the survey, only 23 adhere to OSI specifications.

The X.25 Recommendation of the CCITT was developed in response to the need for a standard interface between packet-switching networks. The X.25 standard enables terminals and computers to be connected to public and private packet-switching networks. More than half of the communications processors in the survey conform to X.25.

Vendor Strategies

Amdahl

In April 1990, Amdahl enhanced both 4745 models with 4M bps token-ring adapters, extended the memory capacity to a total of 8M bytes, extended the channel connectivity of both models to support up to four active channel adapters in the base frame, and extended the Integrated Switching Architecture (ISA) with automatic backup capabilities. The base prices of the 4745 models have not changed since November 1989.

IBM

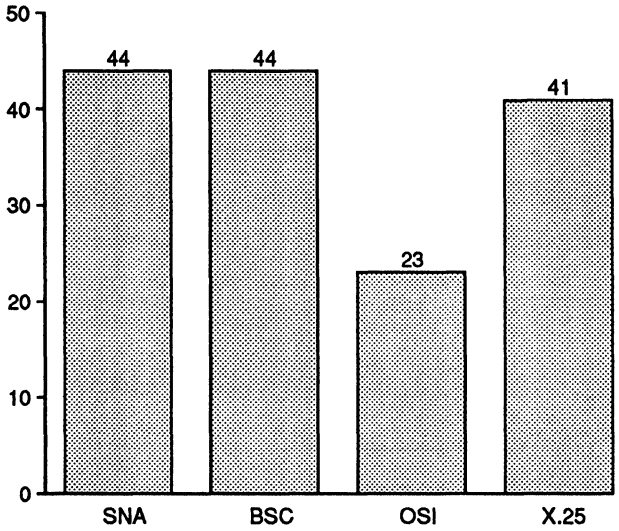
The IBM product line currently consists of the 3745 Models 130, 150, 170, 210, and 410.

IBM 3745 Models 130, 150, and 170 complete IBM's front-end processor line at the low end. Model 130 accommodates four 4M bps or 16M bps

Token-Ring interfaces, two T1 lines, and four host-channel links. Model 150, a remote line concentrator, supports 16 communications ports operating at speeds up to 256K bps, two 4M bps or 16M bps Token-Ring interfaces, and one T1 line. Model 170, a general-purpose controller, supports up to 112 lines at speeds up to 256K bps, two 4M bps or 16M bps Token-Ring interfaces, and two T1 lines.

IBM 3745 Model 210 and Model 410 are high-end models. The Model 210 has a single Central Control Unit (CCU) and is field upgradable to the Model 410. The Model 410 has two independent CCUs, each capable of running a separate Network Control Program (NCP). Both the Model 210 and 410 support 16 or 256 hosts with token-ring simultaneously, and up to 896 medium- and high-speed lines. In the third or fourth quarter of 1991, IBM is expected to add DS3, FDDI, and ESCON networking support to the 3745 Communications Controller, making the 3745 front-end processor a key piece in IBM's networking strategy. Other enhancements to the 3745 are expected sometime during 1991.

Figure 1.
Standards and Architectures



Indicates the number of communication processors, scored on this year's survey, that comply to the standards and architectures featured above.

NCR Network Products Division

In 1990, NCR added one new system and replaced all the A models with B models.

The new model, the NCR 5645-B, was announced in August 1990. This new communications processor supports up to four T1 links, 128 lines, four channel-connected hosts, 4M to 16M bytes of main storage, 80M bytes of fixed disk storage capacity, and support for up to 12 TCP/IP Ethernet LANs and up to 16 token-ring LANs. All of the line, LAN, and host connectivity maximums cannot be achieved simultaneously.

The product line now consists of the *NCR 5645-B, NCR 5655-B, NCR 5665-B, and NCR 5675-B.* NCR enhanced the models by changing the physical size, number of components, and power and cooling requirements.

NCR also improved the processors' hardware design: Instruction Execution Unit (IEU) has been added on a single, 60,000-gate VLSI CMOS chip; cache and main storage are now on a single Printed Circuit Board (PCB); the total number of PCB components has been reduced from 36 to 6; the system cabinet size has been reduced from 9.9 to 4.67 square feet; the bulk power supply is now silicon-based technology; and a Local Communication Interface (LCIF) allows direct attachment of rack-mount, 16-line communications bases and network interface adapters for low-end systems that have no switching requirement.

Unisys

The newest models to Unisys' communications processors product line include the *DCP/25, DCP/35, and DCP/55.* In 1990, Unisys enhanced the DCP/5, DCP/15, DCP/30, and DCP/55. The enhancements made to communications processors include support for power-on-pluggable line modules, redundant IOM power supplies, high-performance IOM capability, three input/output Processors (IOPs) in a single input/output Module (IOM) (DCP/50 and DCP/55 systems only), a newly designed Maintenance Control Feature (MCF), and an improved power control feature.

Future Directions

As long as vendors prime their products for the needs of the '90s, the communications processor market will experience a steady but not spectacular growth. As front-end processors, these machines perform important tasks. As remote concentrators and nodes in networks, they perform functions that are not about to become obsolete.

It is doubtful that many newcomers will arrive on the communications processor scene. Most of the market belongs to IBM, NCR, Unisys, and Amdahl. Taking on these giants is not likely to appeal to start-up companies, which would probably prefer entering a more dynamic field with more possibilities.

Most of the activity in the communications processor field will come from the big four. Currently, NCR and IBM appear to be sparring with each other for supremacy, while Amdahl appears to be banking on the ongoing success of its 4745 communications processor. ■

Communications Processors: Technology Overview

In this report:

Synopsis

Editor's Note
This report examines the technology of communications processors. For information on the market, see "Communications Processors: Market Overview"; for comparison columns detailing the features of key products, see "Communications Processors: Comparison Columns."

Report Highlights
The term "communications processor" describes not only a specific category of equipment but also systems that perform communications processing functions and other services. Datapro's definition of communications processors covers multifunctional, intelligent systems dedicated to communications and serving as nodes in a network. These systems generally include three basic types of products: front-end processors, intelligent switches, and remote concentrators.

In the late 1970s, IBM's SNA and the ISO's OSI model advanced data communications as a function separate from applications processing. SNA and OSI defined a network as a physical entity, separate from its participating hosts and terminals. The implementation of a physically separate communications function occurred through a system of small dedicated computers. Users placed these communications processors at the front end of a mainframe or allowed them to function independently as concentrators and switches within their architectures.

In most communications processors, under the direction of the CPU, some components perform functions for the whole communications processor, while others perform functions for specific groups of lines. Among the former are host interfaces, input/output (I/O) processors, reference clocks, and operator interfaces. Among the latter are the processor's line bases and line sets.

There are two kinds of network architectures: those for communications among computers and terminals from a specific vendor, and those for open communications regardless of the vendor of the communicating devices.

This report discusses communications processor design, evolution, and position in modern network architectures. It concludes with Selection Guidelines for users.

—By Barbara Rinehart
Associate Editor/Analyst

Analysis

Technology Basics

The definition of a communications processor varies greatly. Network designers hold one view of what a communications processor does, but equipment manufacturers hold another. The term "communications processor" has covered equipment ranging from an IBM 3745 to a four-port packet assembler/disassembler (PAD).

A network designer believes that a communications processor should set up connections to transmit and receive data, multiplex and demultiplex data, frame and unframe messages, perform error correction and protocol conversion, choose transmission routes, and collect performance and traffic statistics. Unfortunately, this definition has led many manufacturers to classify their protocol converters, PADs, terminal controllers, and multiplexers as communications processors. Manufacturers consider communications processors as devices that connect terminals to networks and maintain control through changing network conditions. This concept clouds the definition of the equipment—an IBM 3745 and a protocol converter do not belong in the same category.

Datapro defines a communications processor as a multifunctional, intelligent device dedicated to communications and serving as a control point, or node, in a data communications network. It functions as a front end to a mainframe, as an intelligent switch, or as a remote concentrator. As a *front-end processor (FEP)*, the communications processor acts as a peripheral device locally attached to one or more large computers, relieving them of the overhead involved in message handling and network control. An *intelligent switch* routes messages among the network's various end points and participates in the network's control and management, either under the control of a master (usually front-end) processor or as a peer of other intelligent switches. A *concentrator* controls a community of terminals, clusters of terminals, or distributed applications processors; gathers, queues, and multiplexes their transmissions onto one or more high-speed network trunks; and participates in the network's control and management, either under the direction of a master processor or as a peer of other concentrators and switches.

Network Architectures

In general, there are two kinds of network architectures: those designed to provide communications among computers and terminals from a specific vendor, and those designed to provide open communications regardless of the vendor of the communicating devices.

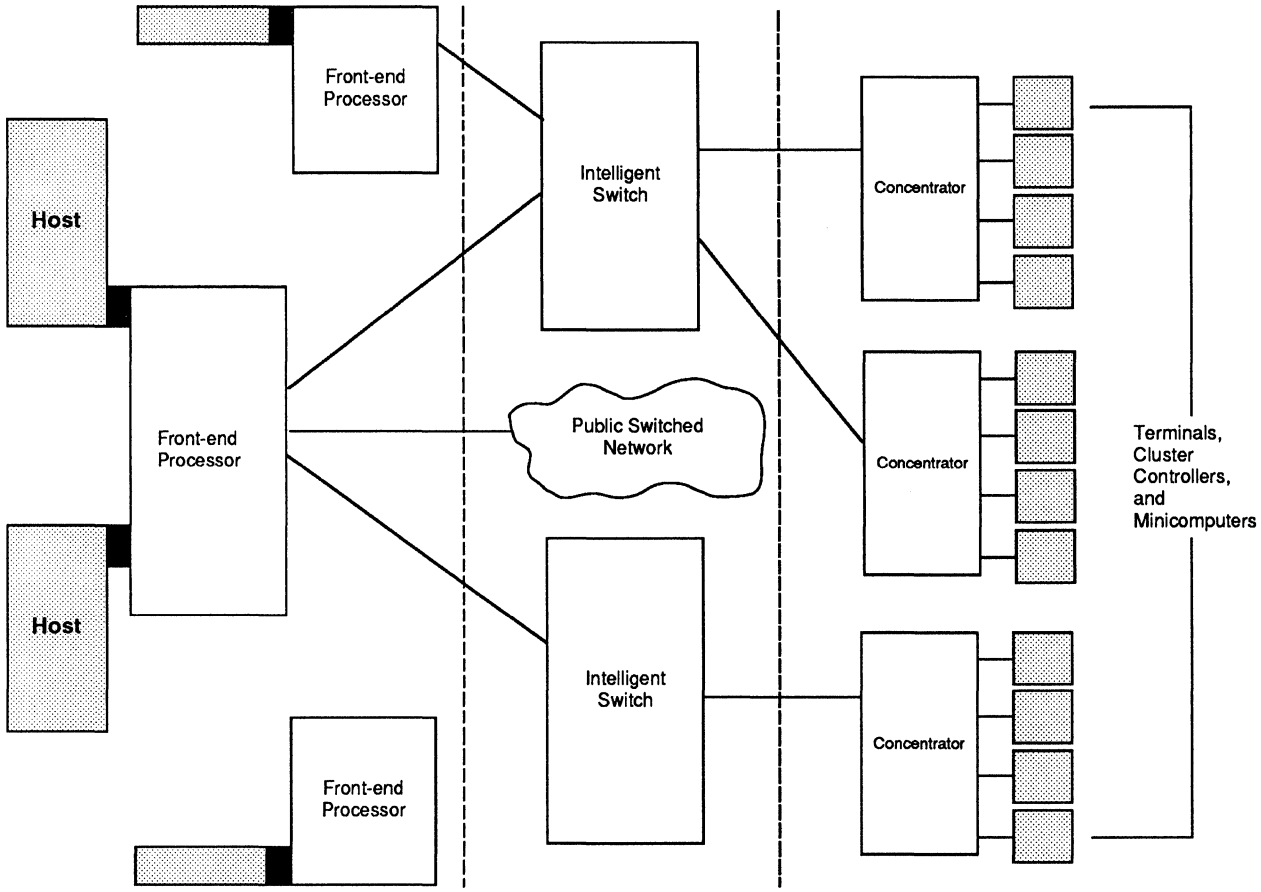
Mainframe vendor architectures include IBM's SNA, Bull's DSA, and Unisys' BNA and DCA. Open architectures include the CCITT X.25 packet-switching specification and several "transparent" network schemes marketed by communications vendors. The communications processor plays an important part in vendor-specific and open architectures. The International Organization for Standardization (ISO) reference model for Open Systems Interconnection (OSI) provides a framework in which to examine the functions performed by communications processors in different kinds of network architectures.

Mainframe Architectures

In network architectures designed by mainframe vendors, the communications processor functions most often as a front end and controls communications in conjunction with one or more software systems in the host computer. In general, the front-end processor handles the Data Link through Session layers of the ISO model, with host software implementing the Presentation and Application layers. The activity in the layers varies, depending on the architecture. In Unisys' DCA, the DCP-Series front end controls many Presentation layer functions, while in IBM's SNA, the host's access method (along with software residing in the terminal controllers) handles communications down to the Session layer, with the 37XX front end acting almost as a channel-attached packet switch. The range of control assigned to front-end processors in other mainframe architectures varies between those extremes.

In all mainframe architectures, the same communications processor models that serve as front ends also function as intelligent switches and as

Figure 1.
Applications



A communications processor can function as a front end for one or more host computers, as an intelligent switching node not attached directly to any applications equipment, or as a remote terminal concentrator.

remote concentrators. In these functions, the communications processors usually appear in smaller configurations than they do as front ends. Communications processors working in mainframe architectures also perform intelligent gateway functions. In this application, the communications processor provides the interface between the mainframe network and communications facilities outside the architecture, particularly public, packet switched data networks using X.25 protocols.

Open Architectures

In an open architecture, such as X.25, the communications processor serves as an intelligent packet switch, implementing the Data Link through Transport layers via a uniform set of complementary protocols. Designed specifically for public data networks, X.25 protocols establish virtual circuits, or logical paths through the network, for devices from any vendor. Communicating devices at either end of the virtual circuit must handle the Session, Presentation, and Application layers according to their own protocols.

In a public network, the network provider is responsible for network management. The X.25 communications processors in such a network, therefore, carry a heavy load of access, error, and class-of-service control, along with provisions for statistically recording traffic and usage data for individual users.

Communications processors operating in full-scale X.25 configurations seldom perform gateway functions. The user must comply with the network's protocols, either through X.25 software residing in a participating host or its front-end processor, or through a packet assembler/disassembler (PAD) that handles the Physical and Data Link layers of the architecture.

Vendors offer transparent architectures as low-cost alternatives to mainframe architectures

and X.25 implementations. These architectures are usually stripped-down versions of X.25 without the network administration and class-of-service overhead necessary to operate a public or large private network. In these architectures, the communications processor functions primarily as a switching concentrator, providing services at the Data Link, Network, and Transport layers. Most of these concentrators evolved at the high ends of lines of statistical multiplexers, adding the crucial routing and flow control features that qualify them as communications processors. Some of these products offer integrated network management functions, such as error logging and performance statistics, but most rely on separate, complementary network management systems for these functions.

Evolution of the Communications Processor

Two developments in the late 1960s provided the technical base for the modern communications processor: the minicomputer and ARPAnet. The minicomputer performed a number of functions more efficiently than a mainframe and supplied the bus architecture that gave communications processors modularity and flexibility. ARPAnet, the first large-scale packet switched data network, produced the fundamental design principles for current data communications architectures. From these principles originated the intelligent virtual circuit switch, the first functional communications processor.

A later development in minicomputer applications created the distributed processor, a small computer dedicated to part of a larger application that performed communications with its peers in a distributed network. Distributed processing contributed the idea of intelligent communications handling under software control.

The lower cost of dedicated processing in small computers made feasible the idea of dedicating a small computer to off-load intelligent communications handling from the mainframe. The first intelligent front ends, such as IBM's 3704, predate modern network architectures and, to a large extent, made such architectures possible.

The microprocessor also contributed to the development of the communications processor. The advent of inexpensive silicon intelligence enabled designers to implement the hierarchical scheme of the typical communications architecture in hardware, with dedicated microprocessors performing low-level functions and reporting to larger, more complex processors at higher levels. Indeed, some line bases in present-day communications processors are programmable, receiving downloads from the units' CPUs that describe protocol and synchronization. Some systems comprise entirely redundant, microprocessor-controlled modules that perform the functions of other modules, using the proper software load.

Products

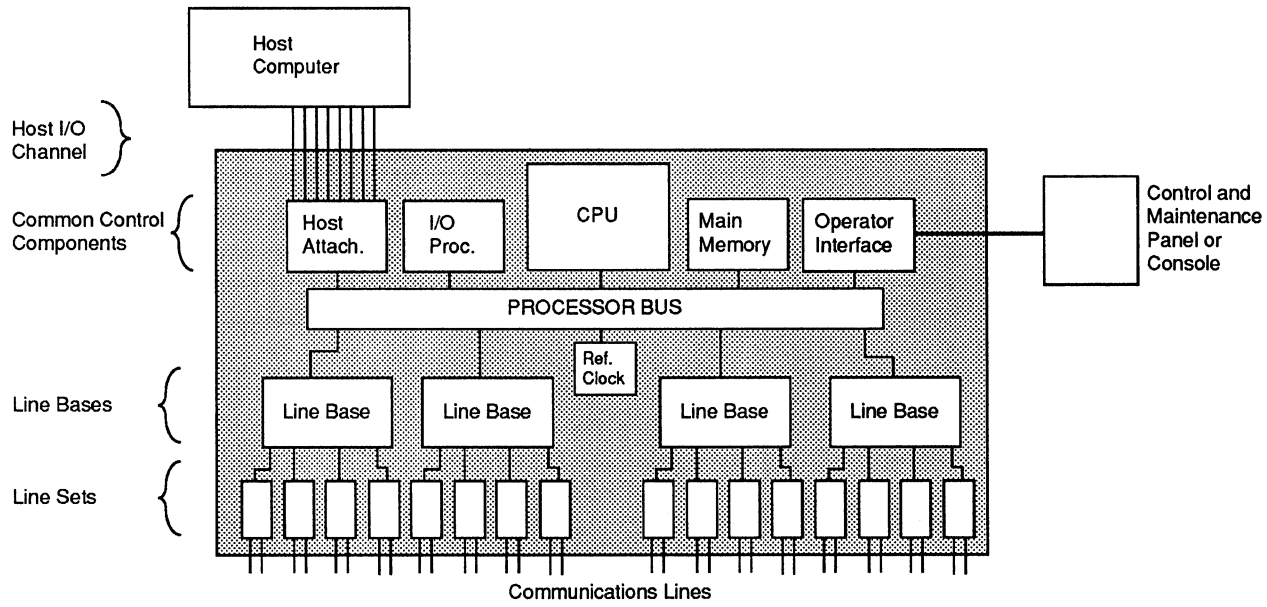
Front-end processing is the most difficult task performed by a communications processor. In a large, complex network governed by one or more mainframe hosts, a front end must perform the following: physical transmission and reception of data; data buffering and queuing; multiplexing; message framing and unframing; control transmission errors; message sequencing; protocol conversion; message pacing and flow control; message or packet assembly and disassembly; route selection; session establishment and disconnection; and data formatting.

Intelligent switching is slightly less complex. When acting as a dedicated switch, the communications processor does not carry on a running dialog with a host computer and is not responsible for end-to-end establishment and disconnection of sessions. Still, an intelligent switch in normal operation must perform several basic functions.

Since *concentration* is the simplest task performed by a communications processor, it can be confused with less sophisticated, single-function devices like statistical multiplexers, protocol converters, PADs, and terminal cluster controllers. Indeed, the widespread use of microprocessors and the declining cost of silicon intelligence, have enabled many devices at the high ends of these lines to approach the functions of true communications processors. In true communications processing like concentration, however, a dynamic process occurs that involves feedback from other intelligent devices in the network. Statistical multiplexing, protocol conversion, and packet assembly/disassembly are basically static processes that do not change as conditions change in the network.

An intelligent concentrator participates in the control of the network, either under the direction

Figure 2.
Hierarchical Architecture



The diagram shows the hierarchical, bus-based architecture of a typical communications processor. Such a processor can contain more than one host interface, several I/O processors, and many line bases. Each line base serves communications lines of a specific synchronization, speed, and protocol. Each line set serves lines with a specific, physical interface. The modular arrangement of line bases and line sets on the processor bus allows easy configuration and reconfiguration.

of a master processor or as a peer of other concentrators and switches, receiving status information from the network and changing its behavior accordingly. These changes include accelerating or withholding transmissions, initiating diagnostic procedures for pathways and devices in its local domain, and controlling access to the network from its locally attached devices. Some sophisticated terminal controllers, notably IBM's 3174s, perform some or all of these functions.

Design

The basic design of almost all communications processors follows a three-tiered, hierarchical plan—a plan that they share in common with digital PBXs and with a number of other data communications components.

The device's central processing unit (CPU) with its main memory sits at the top of the hierarchy. The CPU controls the communications processor's operation according to the rules and parameters of its operating software and, in front-end configurations, in conjunction with instructions from the host computer. In general, the CPU performs addressing, route selection, protocol conversion, access control, session establishment, application-level formatting, and error logging. It also delegates rote operations to subsidiary components.

Front-End Processors (FEPs): Communications processors configured as front ends must have at least one host interface, which handles communications between the front-end processor and the host's byte or block multiplexer, or selector channel. The host interface buffers data from the front-end's CPU, assembles it into parallel bit streams of a format specific to the attached host channel, and transmits it up the channel to the host. For data from the host, it performs the same process in reverse. The host interface converts data from the communications processor's internal word size to that of the host computer.

Input/Output Processors: Some communications processors contain one or more input/output processors that transfer data between the CPU and attached storage peripherals. In some cases, the I/O processors arbitrate among the various line bases for access to main memory and to the CPU, handling interrupts generated by the line bases or host

interfaces to gain the attention of the CPU, or controlling the line bases' and host interfaces' access to main memory. In communications processors with more than one I/O processor, each I/O processor usually controls a set complement of storage units or communications lines.

Reference Clock: The reference clock generates a timing signal for other components of the communications processor. In many systems, the CPU performs reference timing. Some systems have separate reference clocks for timing signals at different data rates.

Operator Interface: The operator interface allows an operator to monitor and control the communications processor and to run diagnostic tests. In newer and more sophisticated systems, the operator interface works under software control from a dedicated console, which usually contains a display unit and a printer for logging. In older communications processors, the operator interface works through a front panel equipped with manual switches and indicator lights.

Line Bases and Line Sets: All of the aforementioned devices perform functions that are shared among all communications lines; they sit just below the CPU in the communications processor's internal hierarchy. On the network side, the "business end" of a communications processor, the line bases and line sets complete the hierarchy.

A line base, sometimes called an attachment base, interface base, or interface module, handles communications at the Data Link layer between the communications processor and a group of attached communications lines that share a common synchronization pattern, line speed, and (sometimes) protocol. Each line base usually contains a dedicated microprocessor that performs framing and stripping, message buffering, message sequencing, synchronization, and error detection under the direction of the CPU. Most current communications processors accommodate from 8 to 32 line bases, each of which handles from two to eight line sets.

A line set handles communications at the Physical layer between its attached line base and from one to eight communications lines. All the communications lines attached to a line set must use the same physical interface at approximately the same data rate. The line set handles serialization of data and interface-level control signaling.

Parallel Data Bus: All components of the communications processor communicate with one another over a parallel data bus, usually located along the backplane or a side plane of the processor's cabinet. The physical bus architecture, popularized by minicomputer design, supports easy installation and replacement of parts. In a hierarchical architecture, the bus also accommodates easy reconfiguration. To replace asynchronous communications over voice grade lines with HDLC communications over wideband or satellite circuits for a 16-line segment of a network, a user might need only to replace one line base and eight line sets, rather than swapping out an entire front-end processor. The hierarchical design extends the communications processor's functionality over time and helps to protect the user's investment. Figure 2 shows the hierarchical configuration of a generalized communications processor.

Selection Guidelines

The principal advantage of a communications processor as a networking tool is the physical and logical separation of the networking function from the applications of its end users. Whatever its architecture, such a network functions for any application, grows in size without qualitative change to accommodate new applications, and runs new applications through the installation of relatively standard, intelligent components. The user need not redesign and rebuild a modular network to change the network's ultimate purpose.

Programmable, software-controlled communications processors are especially useful tools in standalone networks because they accommodate not only changes in application but also the effects of technical progress. A software-controlled communications processor with a good design can survive breakthroughs in networking techniques through relatively simple upgrades. The microprocessor-controlled line bases, and even line sets, provide an even more flexible buffer against obsolescence.

In operation, a network controlled by communications processors survives the total failure of one or more of its host processors. In a multihost network, front-end processors switch users from

applications in a failed host to similar or identical applications in a backup host, perhaps elsewhere on the network. In a single-host network, a functioning front end allows service to degrade gracefully in the event of a host failure, sometimes allowing users to terminate their tasks before total system failure or allowing communications among distributed application processors in the absence of the controlling host.

The communications processor still fulfills its original purpose: relieving the host of the overhead generated by keeping track of a network. Today's networks are orders of magnitude more complex than those of the mid-1970s when the first communications processors appeared. Thanks to the declining costs of memory and processing power, many of today's communications processors are faster and more powerful than mainframes of that era.

The complexity of communications processors, however, poses problems. In an era of user-friendly hardware and software, the communications processor remains a device hospitable only to trained engineers. Most require programs written in an arcane, Assembler-level language, sometimes (but not always) with the benefit of pregenerated macros in the host access method. ■

Communications Processors: Comparison Columns

In this report:

Synopsis

Editor's Note

For information on the communications processor market, see "Communications Processors: Market Overview"; for information on communications processor technology, see "Communications Processors: Technology Overview." To assist readers in researching the communications processor market, this report contains comparison columns listing the principal characteristics of 65 products offered by 28 vendors.

In the Comparison Column Entry Descriptions, we have briefly described and defined the characteristics featured in the columns. We suggest that the reader become familiar with the descriptions of the entries before reading the columns.

The vendors furnished information for the columns during January and February 1991. When a vendor did not provide information for a specific entry, and we could not locate that information in our files, we have listed "Vendor did not specify" on the appropriate line. Datapro wishes to thank the vendors for their cooperation.

In addition to the lines allocated for vendors to indicate specified information for their models, we have added space at the bottom of the columns for vendor notations about options or special features of their products.

The absence of any company or product from these columns means that the company either failed to respond to our repeated requests for information or declined to be part of the survey.

Vendors

Amdahl Communications
1250 E. Arques Avenue, MS: 276
Sunnyvale, CA 94088 (408) 746-6000, (800) 233-8489

Apertus Technologies
7275 Flying Cloud Drive
Eden Prairie, MN 55344 (612) 828-0300

Bull HN Information Systems, Inc.
Technology Park, 2 Wall Street
Billerica, MA 01821-4199 (508) 294-7000

Carse, Woodworth and Associates Int'l.
15750 Winchester Boulevard, Suite 104
Los Gatos, CA 95030 (408) 395-2000

Commtex Inc.
1655 Crofton Boulevard
Crofton, MD 21114-1341 (301) 721-3666

Computer Communications, Inc.
2610 Columbia Street
Torrance, CA 90503 (213) 320-9101, (800) 421-1178

Computer Designed Systems
14050 21st Avenue N.
Minneapolis, MN 55447 (612) 553-2042

Computer Logics Ltd.
31200 Carter Street
Solon, OH 44139 (216) 349-8600, (800) 354-059

Computer Network Technology Corp.
6655 Wedgwood Road
Maple Grove, MN 55369 (612) 420-4466, (800) 638-8324

Computerm Corp.
100 Wood Street
Pittsburgh, PA 15222 (412) 391-7804, (800) 873-0303

Concurrent Computer Corp.
106 Apple Street
Tinton Falls, NJ 07724 (908) 758-7000, (800) 631-2154

Control Data Corp.
Computer Products Div.
8100 34th Avenue S., P.O. Box 0
Minneapolis, MN 55440 (612) 853-8100

Emulex Corp.
3545 Harbor Boulevard, P.O. Box 6725
Costa Mesa, CA 92626 (714) 662-5600, (800) 854-7112

Encore Computer
6901 W. Sunrise Boulevard
Fort Lauderdale, FL 33340-9148 (305) 587-2900

International Business Machines Corp. (IBM.)
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Lemcom Systems, Inc.
2104 W. Peoria Avenue
Phoenix, AZ 85029 (602) 944-1543

Micom Communications Corp.
4100 Los Angeles Avenue
Simi Valley, CA 93063-8100 (805) 583-8600

Morning Star Technologies
1760 Zollinger Road
Columbus, OH 43221 (614) 451-1883, (800) 558-7827

NCR
2700 Snelling Avenue N.
St. Paul, MN 55113 (612) 638-7777

Netlink, Inc.
3214 Spring Forest Road
Raleigh, NC 27604 (919) 878-8612, (800) 638-5465

Periphonics Corp.
4000 Veterans Highway
Bohemia, NY 11716 (516) 467-0500

Simpact Associates, Inc.
9210 Sky Park Court
San Diego, CA 92123-4302 (619) 565-1865, (800) 448-4188

Systech Corp.
6465 Nancy Ridge Drive
San Diego, CA 92121 (619) 453-8970

Thomas Engineering Co.
2440 Stanwell Drive
Concord, CA 94520 (415) 680-8640, (800) 832-8649

TIL Systems, Inc.
225 Stedman Street, Suite 27
Lowell, MA 01851 (508) 970-1189, (800) 752-1736

Tri-Data Corp.
3270 Scott Boulevard
Santa Clara, CA 95054 (408) 727-3270, (800) 874-3282

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424 (215) 986-4011

Communications Processors
Comparison Column Entry Descriptions

Computer Systems Interfaced
Manufacturer/Models. If processors serve IBM and plug-compatible mainframes, the vendor indicated that information here. Vendors of processors operating in open network architectures also listed the computers interfaced here.

Direct Attachment of Host. This entry distinguishes between a front-end processor and a network processor, which does not connect directly to the host.

Functional Characteristics
Front-End Processor. The front-end processor (FEP) intercepts and handles communications activities for the host.

Max. Hosts Attachable to FEP. In this space, the vendor noted the highest number of hosts that can be channel attached to the system.

Max. Hosts Supported Simultaneously. This entry notes the highest number of hosts that can be active at the same time.

PU Type within Network. This entry indicates the physical unit (PU) type within the network. These devices are also known as Node Types (NTs). The most common types are PU Type 1, PU Type 2, PU Type 4, and PU Type 5.

Remote Line Concentrator. A "yes" response indicates that the processor can serve as a line concentrator located remotely from any host processor in its network.

Max. Hosts Served by One Concentrator. Since many concentrators can serve more than one host, vendors noted the maximum number here.

Host-Independent Network Processor. Some models can control a network based on open architecture without the direction of a host computer.

Host Channel Extender. The architectures of some processors enable them to function as host channel extenders.

Terminal Controller. The architectures of some processors enable them to function as terminal controllers.

Store-and-Forward Switching. Some processors can function as standalone, store-and-forward message switching.

Distributed Processing Node. In addition to their principal networking functions, some processors can support distributed applications.

Network Architecture Compliance. Some communications processors function exclusively within their vendors' network architectures; others support open architectures such as X.25. If a processor supports no network architecture, it may be a transparent device.

Native T1 Support. A "yes" response indicates that the T1 was purchased from a carrier and is used on an "as is" basis.

Number of T1 Lines Supported. Indicates the maximum number of T1 lines supported as well as the number of T1 interface modules.

Communications Line Capacity
No. Half-Duplex Lines Attachable. In half-duplex operation, transmission occurs alternately in either direction, but not in both directions simultaneously. This entry lists the number of half-duplex lines attachable to the processor.

Highest Line Speed Supported (bps). Vendors filled in line speeds in bits per second (bps).

Communications Features/Functions
Multiplexing/ Demultiplexing. Multiplexing refers to the division of a transmission facility into two or more channels, either by splitting the frequency band into narrower bands or by allotting a common channel to several different information channels. Demultiplexing restores the datastream to its original number of channels.

Terminal-Initiated Application Switching. This entry indicates that the processor, at the terminal's request, supports the selection of applications within a session between an attached terminal and an attached host.

Dynamic Line Reconfiguration. Vendors noted if the processor can switch a session, without operator intervention, from a connection with a failed line or component to a healthy connection when it senses the failure.

LAN Connectivity. This entry indicates which local area networks (LANs) can be connected to the processor.

Interface to Ethernet LAN. If the processor can connect to an Ethernet Local Area Network (LAN), it is noted here.

Protocol Conversion. Some of the popular forms of protocol conversion are async to 3270 BSC, async to Uniscope, SDLC to X.25, and async to X.25.

Error Control. Some types of error control techniques are parity checking with retransmit, parity checking, longitudinal redundancy check (LRC) and cyclic redundancy check (CRC), and automatic repeat request (ARQ)-cyclic redundancy check (CRC).

System Characteristics

Processor Type. Some of the processors are proprietary. Other widely used processors are Tymnet; Motorola 6800, Z80B, MC68010, MC68020; LSI 11/23, LSI 11/73; and Intel 286, 386, and 486.

Main Memory Word Size (bits). In most cases, the main memory word size is also the width of the processor's internal transmission path along its bus.

Main Memory Storage Capacity (bytes). This entry lists the capacity of main memory in bytes. Large main memory capacity is useful for transmission with high-speed protocols in which large blocks of data must be stored for retransmission in case of error.

Hard Disk Storage Capacity (M bytes). This entry indicates the largest disk capacity available, usually represented in megabytes (MB). The hard disk provides rapid restart and recovery capabilities and allows users to store multiple copies of software.

Data Transferred across I/O Lines. Communications processors configured as front ends transfer data to and from the host through an I/O channel (line). The width, in bits, of the I/O channel, along with the communications processor's main memory word size, yields the level of data transferred (e.g., byte or block).

Type of Data Transfer Supported between Memory and Communication Lines, Mass Storage, and Other Peripherals. In some communications processors, only the CPU has access to main memory, and other components must interrupt the CPU to read from or write information to main memory. In others, microprocessors in the subsidiary components share control of main memory with the CPU and can read and write memory on their own. The latter process is called direct memory access (DMA).

I/O, Backup, and Diagnostic Peripherals. Most communications processors interact only with their attached hosts and terminals, relying on host disk systems for storage and on host software for detailed diagnostics. Some newer models, however, support local disk storage for control software, traffic, and support information and feature diagnostic consoles for direct operator intervention.

Support for Remote Console. Some processors that support local operators' consoles can also support an operator's console attached over communications lines.

Support for X.25 Level 3 Capabilities. X.25 is a CCITT recommendation that specifies the interface between user data terminal equipment (DTE) and packet-switching data circuit-terminating equipment (DCE). X.25 Level 3 defines procedures for call initiation, data transfer, interrupts, reset, restart, and clearing.

Communications Operating Software

Operating System Implemented in. This entry explains how the processor stores its control program: wired directly into the hardware, in software that must be loaded into memory from the outside, in firmware (local read-only memory) on-board the processor, or in some combination.

IPL Method. This entry indicates how the processor receives its initial program load (IPL): from its host processor, from a locally attached diskette activated by an operator, or from on-board read-only memory.

User Programmability. This entry indicates the programming method used.

Network Management/Control

Diagnostic Tests Supported. Examples of diagnostic tests are remote and local loopback, port/link status, and internal diagnostics.

Data Collected. The processor can collect data relating to traffic loading, line outages, line hits, link loading, node/link/software status, port statistics, error rates, accounting, trace, and events.

Pricing and Availability

Purchase Price ($). Vendors provided the price of the unit, excluding any options; monthly maintenance and monthly lease/rental prices may also be listed.

Date of First Commercial Delivery. The date on which the product reached the marketplace.

Serviced by. Usually the vendor offers service on an on-site or factory repair/return basis. In some cases, a third party provides the service.

Comments. This space affords vendors the opportunity to describe significant or unusual features, capabilities, or applications that are not reflected in the standard entries.

	Amdahl Communications	Amdahl Communications	Apertus Technologies	Bull HN Information Systems, Inc.
	4745-110	**4745-210**	**Data Star 5000**	**DATANET 8/05 DPS 7000**
Computer Systems Interfaced				
Manufacturer/Models	370 class mainframes	370 class mainframes	IBM E various unix	Bull DPS 7000
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Vendor did not specify	Yes
Max. Hosts Attachable to FEP	4	8	Vendor did not specify	1
Max. Hosts Supported Simultaneously	2	6	Vendor did not specify	1
PU Type within Network	4	4	2	5, DSA node/FE to host
Remote Line Concentrator	Yes	Vendor did not specify	Yes	No
Max. Hosts Served by One Concentrator	SNA/NCP	SNA/NCP defined	6 or more	1,000
Host-Independent Network Processor	No	No	Yes	No
Host Channel Extender	No	No	No	No
Terminal Controller	No	No	Yes	Yes
Store-and-Forward Switching	No	No	No	No
Distributed Processing Node	No	No	Yes	No
Network Architecture Compliance	SNA, BSC, X.25	SNA, BSC, X.25	SNA, BSC, TCP/IP	BSC, OSI, X.25, DSA
Native T1 Support	No	No	Yes	Vendor did not specify
Number of T1 Lines Supported	Not applicable	Vendor did not specify	4	Not applicable
Communications Line Capacity				
No. Half-duplex Lines Attachable	64	256	12 or more	15
Highest Line Speed Supported (bps)	256K	256K	T-1	64K
Communications Features/Functions				
Multiplexing/Demultiplexing	No	No	No	Yes
Terminal-Initiated Application Switching	No	No	Yes	Yes
Dynamic Line Reconfiguration	No	No	Yes	Yes
LAN Connectivity	Token-ring	4 MB	Token-ring, Ethernet	Ethernet
Interface to Ethernet LAN	No	No	Yes	No
Protocol Conversion	SDLS to X.25, async to X.25	SDLS to X.25, async to X.25	Async to 3270 BSC, async to X.25, 3270 to Async	Async, VIP, DSC, RCI
Error Control	Parity check w/retransmit on error, LRC & CRC detection/correction, parity, ARQ-CRC	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction, parity
System Characteristics				
Processor Type	Proprietary	Proprietary	Intel 286, Asyncmetric Multiprocessing	Proprietary
Main Memory Word Size (bits)	16	16	16, 2M/module	16
Main Memory Storage Capacity (bytes)	8M	8M	2M	2M
Hard Disk Storage Capacity (Mbytes)	67 formatted	67 formatted	40	Not applicable
Data Transferred Across I/O Lines	Byte, block	Byte, block	Byte	Word, 36 bit
Data Transferred Between:				
Memory and Communications Lines	DMA and interrupt	DMA and interrupt	DMA, DMA and interrupt	DMA and interrupt
Memory and Mass Storage	DMA and interrupt	DMA and interrupt	DMA and interrupt	Vendor did not specify
Memory and Other Peripherals	Interrupt	Interrupt	DMA and interrupt	DMA
I/O, Backup, and Diagnostic Peripherals	FEP console, diskette, patch panel, disk	FEP console, diskette, patch panel, disk	Diskette, disk	FEP console, diskette, host/mainframe
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes	No	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software	Software	Software, firmware
IPL Method	Download from host, internal self-load	Download from host, internal self-load	Manual load, internal self-load, IPL diskette	Download from host, IPL diskette, tele-load
User Programmability	No	No	No	No
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status, network management
Data Collected	NPA NetView statistics	NetView/NPA	Node/link/software status, line outages, port statistics, trace, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, error rates, events, link loading
Pricing and Availability				
Purchase Price ($)	100,650.00	132,000.00	5K-50K	12,000.00
Monthly Purchase ($)	303.00	319.00	Vendor did not specify	150.00
Monthly Lease/Rental ($)	Not applicable	Not applicable	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	June 1988	June 1988	June 1989	September 1987
Serviced by	Amdahl	Amdahl	Apertus Technology	Bull Worldwide Info Sys
Comments	Runs both NCP-3 or NCP-4 and NCP-5; runs in 3725 mode or 3745 mode	Runs NCP-3 or NCP-4 and NCP-5; runs in 3725 mode or 3745 mode	Communications server provides various host access by terminals (3270 async)	

	Bull HN Information Systems, Inc.	Bull HN Information Systems, Inc.	Bull HN Information Systems, Inc.	Carse, Woodworth and Associates Int'l.
	DATANET 8/10	**DATANET 8/20**	**DATANET 8/30**	**COM/3X Communication Gateway All TCP\IP UNIX Hosts**
Computer Systems Interfaced				
Manufacturer/Models	Bull DPS7, DPS7000, DPS8, DPS8000, DPS88, DPS90, DPS9000	DPS7, DPS7000, DPS8, DPS88, DPS90, DPS8000, DPS9000	Bull DPS7, DPS7000, DPS8, DPS8000, DPS88, DPS90, DPS9000	Vendor did not specify
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	1 or 2	4	4	1
Max. Hosts Supported Simultaneously	1 or 2	4	4	Unlimited
PU Type within Network	DSA node	2, 4, DSA node	2, 4, DSA node	PU Type 2.1, LU 6.2
Remote Line Concentrator	Yes	Yes	Yes	No
Max. Hosts Served by One Concentrator	1,000	1,000	1,000	Vendor did not specify
Host-Independent Network Processor	Yes	Yes	Yes	No
Host Channel Extender	No	No	No	No
Terminal Controller	Yes	Yes	Yes	Yes
Store-and-Forward Switching	No	No	No	Yes
Distributed Processing Node	No	No	No	No
Network Architecture Compliance	BSC, OSI, DSA	SNA, BSC, OSI, X.25, DSA	SNA, BSC, OSI, X.25, DSA	SNA, X.25, TCP/IP
Native T1 Support	Vendor did not specify	Yes	Yes	No
Number of T1 Lines Supported	Not applicable	Vendor did not specify	Vendor did not specify	Vendor did not specify
Communications Line Capacity				
No. Half-duplex Lines Attachable	31	127	127	24
Highest Line Speed Supported (bps)	64K	2.5M	2.50M	64K
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	No
Terminal-Initiated Application Switching	Yes	Yes	Yes	Yes
Dynamic Line Reconfiguration	Yes	Yes	Yes	Yes
LAN Connectivity	Ethernet	Ethernet	Ethernet	Token-ring, Ethernet
Interface to Ethernet LAN	No	No	No	Yes
Protocol Conversion	Async, VIP, DSC, RSI	SDLS to X.25	SDLS to X.25, async, VIP, BSC, RCI	SDLS to X.25, async to X.25, SNA to TCP/IP
Error Control	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error
System Characteristics				
Processor Type	Proprietary	Proprietary	Proprietary	Intel 186, Intel 286, 186, 386, 486 family
Main Memory Word Size (bits)	16	16	16	16
Main Memory Storage Capacity (bytes)	2M	2M	2M	16M
Hard Disk Storage Capacity (Mbytes)	Not applicable	None	None	120M
Data Transferred Across I/O Lines	Word (36 bit)	Word (36 bit)	Word (36 bit)	Block
Data Transferred Between:				
Memory and Communications Lines	DMA, interrupt	DMA and interrupt	DMA, interrupt	Vendor did not specify
Memory and Mass Storage	Vendor did not specify	Not applicable	Vendor did not specify	Vendor did not specify
Memory and Other Peripherals	DMA	DMA	DMA	Vendor did not specify
I/O, Backup, and Diagnostic Peripherals	FEP console, host/mainframe	FEP console, diskette, Host/mainframe	FEP console, diskette, host/mainframe	FEP console, diskette, magnetic tape, printer
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software, firmware	Software, firmware	Software, firmware	Software, OS/2, Com/3X
IPL Method	Download from host, tele-load	Download from host, IPL diskette, Tele-load	Download from host, IPL diskette, tele-load	IPL diskette
User Programmability	No	No	No	No
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status, network management	Local/remote loopback, internal diagnostics, problem determination, port/line status, Network management	Local/remote loopback, internal diagnostics, problem determination, port/line status, network management	Local/remote loopback, internal diagnostics, port/line status
Data Collected	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, error rates, events, link loading	Line outages, port statistics, line hits, error rates
Pricing and Availability				
Purchase Price ($)	33,890.00	47,990.00	47,990.00	25,000.00
Monthly Purchase ($)	244.00	329.00	329.00	250.00
Monthly Lease/Rental ($)	1,160.00	1,640.00	1,640.00	Not applicable
Date of First Commercial Delivery	September 1985	September 1985	September 1985	September 1987
Serviced by	Bull Worldwide Info Sys	Bull Worldwide Info Sys	Bull Worldwide Info Sys	CWA
Comments				SNA to TCP/IP Gateway supports seven layer protocol translation between user applications

	Commtex Inc.	Computer Communications, Inc.	Computer Designed Systems	Computer Logics Ltd.
	CX-80 Data Exchange	**Data Express**	**Adviser 2390/XX**	**CCP 3205**
Computer Systems Interfaced				
Manufacturer/Models	Two IBM 3270 mainframes (4 opt.) and/or any async hosts (5)	IBM 370 class	IBM, MIPS, Pyramid, Motorola	Unisys
Direct Attachment of Host	No	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	No	Yes	Yes	Yes
Max. Hosts Attachable to FEP	Not applicable	13	4	2
Max. Hosts Supported Simultaneously	4	13	4	2
PU Type within Network	2	2, 2.1-6.2	Optional 1 thru 5	2
Remote Line Concentrator	No	Yes	Yes	Yes
Max. Hosts Served by One Concentrator	Not applicable	128	4	Unlimited
Host-Independent Network Processor	No	Yes	Yes	Yes
Host Channel Extender	No	Yes	Yes	No
Terminal Controller	Yes	Yes	Yes	Yes
Store-and-Forward Switching	No	Yes	Yes	No
Distributed Processing Node	No	Yes	Yes	No
Network Architecture Compliance	SNA, BSC	SNA, DECnet, BSC, OSI, X.25, ALC, SLC, & TCP/IP	SNA, BSC, OSI, X.25	OSI, X.25, TCP/IP
Native T1 Support	No	Yes	Yes	Vendor did not specify
Number of T1 Lines Supported	Vendor did not specify	4	24	Vendor did not specify
Communications Line Capacity				
No. Half-duplex Lines Attachable	4	256	32	16-line expansion
Highest Line Speed Supported (bps)	64K	T1 (1.544M)	56K	64K
Communications Features/Functions				
Multiplexing/Demultiplexing	No	Yes	Yes	Yes
Terminal-Initiated Application Switching	Yes	Yes	Yes	Yes
Dynamic Line Reconfiguration	No	Yes	Yes	Yes
LAN Connectivity	Not applicable	Token-ring, Ethernet	Token-ring, Ethernet	Vendor did not specify
Interface to Ethernet LAN	No	Yes	Yes	Yes
Protocol Conversion	Async to 3270 BSC, SDLS to X.25, async to X.25, async to SNA/SDLC	Async to 3270 BSC, SDLS to X.25	Async to 3270 BSC, SDLS to X.25, async to X.25	Asynch to uniscope
Error Control	Parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity, ARQ-CRC	Parity check w/retransmit on error, LRC & CRC detection/correction	LRC & CRC detection/correction
System Characteristics				
Processor Type	Z80B, MC68010, HD 64180	Proprietary, Motorola 6800	MC68020, Intel 286, 386	Concurrent Computer 3205
Main Memory Word Size (bits)	16	16, 32	32	32
Main Memory Storage Capacity (bytes)	128K, 256K, 512K, 1M	No pract. limit	4M	8M
Hard Disk Storage Capacity (Mbytes)	Not applicable	No practical limit	2.4GB Max.	Vendor did not specify
Data Transferred Across I/O Lines	Block	Byte, file, block	Byte, file, block	Byte
Data Transferred Between:				
Memory and Communications Lines	Interrupt	DMA and interrupt	DMA, DMA and interrupt	DMA, interrupt
Memory and Mass Storage	Not applicable	DMA and interrupt	DMA and interrupt	DMA, or ESI channel
Memory and Other Peripherals	Interrupt	DMA and interrupt	DMA and interrupt	DMA, interrupt
I/O, Backup, and Diagnostic Peripherals	Diskette	FEP console, diskette, patch panel, disk, mag.tape	FEP console, diskette, patch panel, disk, mag.tape	FEP console
Support for Remote Console	Yes	Yes	Yes	Vendor did not specify
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Hardware, software	Firmware	Software
IPL Method	Internal self-load	Download from host, manual load, int.self-load, disk.	Download from host, internal self-load	Host download
User Programmability	Via user-selected parameters	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination	Local/remote loopback, internal diagnostics, problem determination, port/line status, extensive	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, port/line status
Data Collected	Line outages, line hits, error rates	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading	Node/link/software status, port statistics
Pricing and Availability				
Purchase Price ($)	4,950.00	50,000.00	8,500.00	500,000.00
Monthly Purchase ($)	Vendor did not specify	3,500.00	96.00	300.00
Monthly Lease/Rental ($)	Vendor did not specify	Contact vendor	Not applicable	Vendor did not specify
Date of First Commercial Delivery	1982	Vendor did not specify	January 1990	1986
Serviced by	Intelogic Trace	Computer Communications	Various	Computer Logics
Comments	Unrestricted mix up to 50 async ASCII, & Type-A coax terminals & PCs to access two (four opt.) IBM 3270 mainframe hosts, async			Fully compliant TCP/IP and Ethernet support; allows for PC LAN interface to 1100s with full UTS emulation at each PC

	Computer Network Technology Corp.	Computerm Corp.	Concurrent Computer Corp.	Concurrent Computer Corp.
	CHANNELlink	3800/3890 Channel extension system	Procom-2	Procom-8
Computer Systems Interfaced				
Manufacturer/Models	IBM S/370 & compat., Cray Supercomputers, DEC/VAX-B1Bus	IBM S/370, and compatibles	Concurrent Computer Series 3200	Concurrent Computer Series 3200
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	No	Yes	Yes	Yes
Max. Hosts Attachable to FEP	8	7	1	1
Max. Hosts Supported Simultaneously	8	7	1	1
PU Type within Network	All PU types	Not applicable	Not applicable	Not applicable
Remote Line Concentrator	Yes	Yes	No	No
Max. Hosts Served by One Concentrator	Vendor did not specify	28	Vendor did not specify	N
Host-Independent Network Processor	Yes	Yes	No	No
Host Channel Extender	Yes	Yes	No	No
Terminal Controller	No	No	No	No
Store-and-Forward Switching	Yes	No	No	No
Distributed Processing Node	No	No	Yes	Yes
Network Architecture Compliance	SNA, DECnet, BSC, OSI, X.25, TCP/IP	Transparent	OSI, X.25	OSI, X.25
Native T1 Support	Yes	Yes	No	No
Number of T1 Lines Supported	12	4	No	No
Communications Line Capacity				
No. Half-duplex Lines Attachable	16	8	2	8
Highest Line Speed Supported (bps)	100M	1.544M	64K	64K
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	No	Yes	Yes
Terminal-Initiated Application Switching	No	Yes	No	No
Dynamic Line Reconfiguration	Yes	No	No	Vendor did not specify
LAN Connectivity	Ethernet, Proprietary	Token-ring, through gateway	None	None
Interface to Ethernet LAN	Yes	No	No	No
Protocol Conversion	Vendor did not specify	No	No	No
Error Control	Parity check w/retransmit on error, ARQ-CRC	LRC & CRC detection/correction	LRC & CRC detection/correction	LRC & CRC detection/correction
System Characteristics				
Processor Type	MC68020	IBM Series/1 and Z80	Motorola 68000	Motorola 68000
Main Memory Word Size (bits)	32	16	32	32
Main Memory Storage Capacity (bytes)	Up to 10MB	2M	512K	512K
Hard Disk Storage Capacity (Mbytes)	Vendor did not specify	Not applicable	Not applicable	Not applicable
Data Transferred Across I/O Lines	Block	Byte, block	Byte	Byte
Data Transferred Between:				
Memory and Communications Lines	DMA	DMA	DMA, interrupt	DMA, interrupt
Memory and Mass Storage	DMA	None	Not applicable	Not applicable
Memory and Other Peripherals	Vendor did not specify	DMA	None	None
I/O, Backup, and Diagnostic Peripherals	Battery, Back-up, RAM	FEP console, diskette	None	None
Support for Remote Console	Yes	Yes	No	No
Support for X.25 Level 3 Capabilities	No	No	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software, firmware	Firmware	Firmware
IPL Method	Internal self-load	Internal self-load, IPL diskette, optional	Download from host	Download from host
User Programmability	Via console	User configurable	Via user-created programs	Via user-created programs
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Internal diagnostics	Internal diagnostics	Internal diagnostics
Data Collected	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, line outages, trace, error rates, realtime monitor	Node/link/software status, accounting, line outages, trace	Node/link/software status, accounting, line outages, trace
Pricing and Availability				
Purchase Price ($)	Contact vendor	73,000.00	4,000.00	6,000.00
Monthly Purchase ($)	Vendor did not specify	613.00	37.00	58.00
Monthly Lease/Rental ($)	Vendor did not specify	1,621.00	Not applicable	Not applicable
Date of First Commercial Delivery	1987	December 1982	Not available	Not available
Serviced by	StorageTek, IBM	Computerm and IBM	Concurrent Computer Corp.	Concurrent Computer Corp.
Comments	CHANNELink delivers networking solutions for data center consolidation, disaster recovery, multiple data centers	Chan.extension suppt. for print., CRTs, check sorters, Mag tape, and FEPs with satellite-efficient protocols.	Software environment utilizes OS/32 Rev 8.1.3 or higher. Procom board is provided with OS/32 driver support	Software environment utilizes OS/32 Rev 8.1.3 or higher. Procom board is provided with OS/32 driver support

	Concurrent Computer Corp.	Control Data Corp.	Emulex Corp.	Encore Computer
	SCP Serial Communications Processor	**CDCNET 2600 Series**	**DCP-286**	**QSSC (Quad Sync Serial Controller) 8521**
Computer Systems Interfaced				
Manufacturer/Models	Concurrent Computer Series 3200	Control Data Corporation/ CDCNET 2600 Series	ISA, Micro Channel PCs	Concept 32/67, Concept 2040, Concept 32/97
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	1	3	1	1
Max. Hosts Supported Simultaneously	1	3	8	1
PU Type within Network	Not applicable	Not available	Not applicable	Vendor did not specify
Remote Line Concentrator	No	Yes	Yes	No
Max. Hosts Served by One Concentrator	Vendor did not specify	Unlimited	8	Vendor did not specify
Host-Independent Network Processor	No	Yes	No	No
Host Channel Extender	No	No	No	Yes
Terminal Controller	No	Yes	Yes	Yes
Store-and-Forward Switching	No	No	Yes	No
Distributed Processing Node	Yes	Yes	Yes	No
Network Architecture Compliance	X.25	BSC, OSI, X.25, TCP/IP	SNA, BSC, X.25	OSI, X.25
Native T1 Support	No	No	No	Yes
Number of T1 Lines Supported	No	Vendor did not specify	Vendor did not specify	4
Communications Line Capacity				
No. Half-duplex Lines Attachable	4	64	8	4
Highest Line Speed Supported (bps)	56K	256K	1M	2.048M
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	Yes
Terminal-Initiated Application Switching	No	Yes	Yes	Yes
Dynamic Line Reconfiguration	No	Yes	Yes	Yes
LAN Connectivity	None	Ethernet	None	Not applicable
Interface to Ethernet LAN	No	Yes	No	Vendor did not specify
Protocol Conversion	No	Async to X.25	Async to 3270 BSC, SDLS to X.25, async to X.25	Not applicable
Error Control	LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction, parity, ARQ-CRC	LRC & CRC detection/correction
System Characteristics				
Processor Type	Motorola 68000	MC 68030	Intel 286	Thompson 5025
Main Memory Word Size (bits)	32	16	16	32
Main Memory Storage Capacity (bytes)	512K	1M-16M	1M	128K
Hard Disk Storage Capacity (Mbytes)	Not applicable	No disk	Not applicable	Not applicable
Data Transferred Across I/O Lines	Byte	Block	Byte	Block
Data Transferred Between:				
Memory and Communications Lines	DMA, interrupt	DMA, interrupt	DMA and interrupt	DMA and interrupt
Memory and Mass Storage	Not applicable	Not available	Not applicable	DMA
Memory and Other Peripherals	None	Interrupt	Shared memory	Not applicable
I/O, Backup, and Diagnostic Peripherals	None	FEP console	Not applicable	Disk, magnetic tape
Support for Remote Console	No	Yes	Yes	No
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Firmware	Software, firmware	Software	Software
IPL Method	Download from host	Download from host	Download from host	Internal self-load
User Programmability	Via user-created programs	No	Via user-created programs	Via user-selected parameters
Network Management Control				
Diagnostic Tests Supported	Internal diagnostics	Local/remote loopback, internal diagnostics, problem determination, port/line status	None	Local/remote loopback, problem determination, port/line status
Data Collected	Node/link/software status, accounting, line outages, trace	Traffic loading, node/link/software status, accounting, line outages, port statistics, line hits, error rates, events, link loading	Vendor did not specify	Node/link/software status, accounting, line outages, port statistics, events
Pricing and Availability				
Purchase Price ($)	6,500.00	12,000.00	1,695.00	15,000.00
Monthly Purchase ($)	12.00	100.00	Not applicable	67.00
Monthly Lease/Rental ($)	Not applicable	Vendor did not specify	Not applicable	Not applicable
Date of First Commercial Delivery	1987	December 1985	1986	December 1989
Serviced by	Concurrent Computer Corp.	Control Data Corp.	Emulex Corp.	Encore Computer Corp.
Comments	Purchase price is $6,500 without software; $7,500 with software	A modular multinode local area network product with extended features including front-end funct., router, full X.25		

	International Business Machines Corp. (IBM)	International Business Machines Corp. (IBM)	International Business Machines Corp. (IBM)	International Business Machines Corp. (IBM)
	IBM 3745 130	IBM 3745 150	IBM 3745 170	IBM 3745 210
Computer Systems Interfaced				
Manufacturer/Models	IBM 43XX, 937X, 308X, 3090	IBM 43XX, 937X, 308X, 3090	IBM 43XX, 937X, 308X, 3090	IBM S/370, 43XX, 937X, 3033, 308X, 3080
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	4	4	4	16
Max. Hosts Supported Simultaneously	256 with token ring	256 with token ring	256 with token ring	256 with token-ring
PU Type within Network	4	4	4	4
Remote Line Concentrator	Yes	Yes	Yes	Yes
Max. Hosts Served by One Concentrator	256	256	256	256
Host-Independent Network Processor	No	No	No	No
Host Channel Extender	No	No	No	No
Terminal Controller	No	No	No	No
Store-and-Forward Switching	No	No	No	No
Distributed Processing Node	No	No	No	No
Network Architecture Compliance	SNA	SNA	SNA	SNA, X.25
Native T1 Support	Yes	Yes	Yes	Yes
Number of T1 Lines Supported	2	1	2	16
Communications Line Capacity				
No. Half-duplex Lines Attachable	Not applicable	32	112	896
Highest Line Speed Supported (bps)	1.544M	1.544MB	1.544Mb	1.544M
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	Yes
Terminal-Initiated Application Switching	No	No	No	No
Dynamic Line Reconfiguration	Yes	Yes	Yes	Yes
LAN Connectivity	Token-ring	Token-ring	Token-ring	Token-ring
Interface to Ethernet LAN	No	No	No	No
Protocol Conversion	Yes	Yes	Yes	Yes
Error Control	LRC & CRC detection/correction	LRC & CRC detection/correction	LRC & CRC detection/correction	LRC & CRC detection/correction
System Characteristics				
Processor Type	Proprietary	Proprietary	Proprietary	Proprietary
Main Memory Word Size (bits)	8	18	8	8
Main Memory Storage Capacity (bytes)	8M	8M	Vendor did not specify	8M, (per CCU)
Hard Disk Storage Capacity (Mbytes)	67 formatted	67 formatted	67 formatted	67 formatted
Data Transferred Across I/O Lines	Block	Block	Block	Block
Data Transferred Between:				
Memory and Communications Lines	DMA	DMA	DMA	DMA
Memory and Mass Storage	DMA	DMA	DMA	DMA
Memory and Other Peripherals	DMA	DMA	DMA	DMA
I/O, Backup, and Diagnostic Peripherals	FEP console	FEP console	FEP console	Vendor did not specify
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software	Software	Software
IPL Method	Internal self-load	Internal self-load	Internal self-load	Internal self-load
User Programmability	Yes	Yes	Yes	Yes
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Yes	Yes
Data Collected	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events	Yes	Yes
Pricing and Availability				
Purchase Price ($)	21,420.00	31,590.00	26,780.00	147,050.00
Monthly Purchase ($)	220.00	232.00	220.00	350.00
Monthly Lease/Rental ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	1989	1989	1989	March 1988
Serviced by	IBM	IBM	IBM	IBM
Comments	Contact local IBM rep.	Contact local IBM rep.	Contact local IBM rep.	Max. hosts supported simultaneously using token ring is 256

	International Business Machines Corp. (IBM)	Lemcom Systems, Inc.	Lemcom Systems, Inc.	Micom Communications
	IBM 3745 410	**Distributed Network Processor**	**DNP 9000**	**Micom/MBE**
Computer Systems Interfaced				
Manufacturer/Models	IBM S/370, 43XX, 937X, 3033, 308X, 3080	IBM 43XX, 30XX, 937X	IBM 43XX, 30XX, 937X	370 class mainframes
Direct Attachment of Host	Yes	Yes	Yes	No
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	No
Max. Hosts Attachable to FEP	16	32	16	33
Max. Hosts Supported Simultaneously	256 with token-ring	32	16	33
PU Type within Network	4	2, 4	2, 4	1 and 2
Remote Line Concentrator	Yes	Yes	Yes	Yes
Max. Hosts Served by One Concentrator	Up to 256	32	16	33
Host-Independent Network Processor	No	Yes	Yes	Yes
Host Channel Extender	No	No	No	No
Terminal Controller	No	No	Yes	Yes
Store-and-Forward Switching	No	No	No	No
Distributed Processing Node	No	Yes	Yes	Yes
Network Architecture Compliance	SNA, X.25	SNA, BSC	SNA, BSC	SNA, BSC, OSI, X.25 HDLC, TCP/IP
Native T1 Support	Yes	No	Yes	No
Number of T1 Lines Supported	16	Vendor did not specify	Vendor did not specify	Vendor did not specify
Communications Line Capacity				Vendor did not specify
No. Half-duplex Lines Attachable	896	1,024	1,000	Vendor did not specify
Highest Line Speed Supported (bps)	1.544M	64K	2.0486M	128K
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	Yes
Terminal-Initiated Application Switching	No	Yes	Yes	Yes
Dynamic Line Reconfiguration	Yes	Vendor did not specify	Yes	Yes
LAN Connectivity	Token-ring	Vendor did not specify	Token-ring	Ethernet
Interface to Ethernet LAN	No	No	No	Yes
Protocol Conversion	Yes	Async to 3270 BSC, async to 3270 SDLC	Async to 3270 BSC, BSC to SDLC	SDLC to X.25, async to X.25 async to 3270, BSC, HDLC to X.25
Error Control	LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction, parity, ARQ-CRC	LRC & CRC detection/correction, parity, ARQ-CRC	LRC and CRC detection/correction
System Characteristics				
Processor Type	Proprietary	MC6809	MC68020	Motorola 6800
Main Memory Word Size (bits)	Vendor did not specify	32	32	16
Main Memory Storage Capacity (bytes)	8M, (per CCU)	4M	2M, per MC68020	2M
Hard Disk Storage Capacity (Mbytes)	67 formatted	Vendor did not specify	Non-volatile RAM	Vendor did not specify
Data Transferred Across I/O Lines	Block	Byte, block	Byte, block	Block
Data Transferred Between:				
Memory and Communications Lines	DMA	DMA and interrupt	DMA and interrupt	DMA
Memory and Mass Storage	DMA	DMA and interrupt	DMA	Interrupt
Memory and Other Peripherals	DMA	Not applicable	Not available	DMA
I/O, Backup, and Diagnostic Peripherals	Vendor did not specify	FEP console, diskette	FEP console, diskette	PC-based network management system
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	No	No	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software	Software	Firmware
IPL Method	Internal self-load	Internal self-load	Internal self-load	Internal self-load
User Programmability	Yes	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console	Yes, via console
Network Management Control				
Diagnostic Tests Supported	Yes	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, port/line status, internal diagnostics, problem determination
Data Collected	Yes	Traffic loading, node/link/software status, line outages, trace, line hits, error rates, link loading	Traffic loading, node/link/software status, line outages, trace, line hits, error rates, events, link loading	Traffic loading, line outages, line hits, link loading, node/link/ software status port statistics, error rates, accounting, trace, events
Pricing and Availability				
Purchase Price ($)	221,450.00	18,450.00	20,000.00	9,700
Monthly Purchase ($)	538.00	Vendor did not specify	150.00	200
Monthly Lease/Rental ($)	Vendor did not specify	632.00	685.00	Vendor did not specify
Date of First Commercial Delivery	March 1988	1980	1991	1988
Serviced by	IBM	HDS)Hitachi Data Systems	Hitachi Data Systems	Micom
Comments	Max. hosts supported simultaneously using token-ring is 256	Appears to host as locally attached IBM 3274-1A, IBM 3274-1D, or IBM 3737. Upgraded version 1986	Concurrently used as IBM-compatible FEP and RCTCA, as concentrator for networking IBM compatible DES Encryption	Runs NCP-3 or NCP-4 and NCP-5; runs in 3725 mode or 3745 mode

	Morning Star Technologies	Morning Star Technologies	Morning Star Technologies	NCR
	Horizon 240V	Horizon 482V	Horizon 840	NCR 5620-XP
Computer Systems Interfaced				
Manufacturer/Models	Board-level that installs in VMEbus UNIX computers	Board-level that installs in VMEbus UNIX computers	Board-level that installs in Multibus UNIX computers	IBM 360/370, 303X, 308X, 3090, 43XX, plus compatible Amdahl & Hitachi (NAS)
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	Not applicable	Not available	Not available	2
Max. Hosts Supported Simultaneously	Not applicable	Not available	Not available	2
PU Type within Network	2, SNA or BSC 3270	2, SNA or BSC 3270	2, SNA or BSC 3270	4, 5
Remote Line Concentrator	No	No	No	Yes
Max. Hosts Served by One Concentrator	Vendor did not specify	Vendor did not specify	Vendor did not specify	Throughput dependent
Host-Independent Network Processor	Yes	Yes	Yes	No
Host Channel Extender	No	No	No	Yes
Terminal Controller	No	No	No	Yes
Store-and-Forward Switching	No	No	No	Yes
Distributed Processing Node	No	No	No	Yes
Network Architecture Compliance	SNA, BSC, X.25	SNA, BSC, X.25	SNA, BSC, X.25	SNA, BSC, OSI, X.25
Native T1 Support	No	No	No	No
Number of T1 Lines Supported	0	Vendor did not specify	0	Vendor did not specify
Communications Line Capacity				
No. Half-duplex Lines Attachable	2 full-duplex lines	4 full-duplex	8 full-duplex	64
Highest Line Speed Supported (bps)	64K each line	64K	64K	56/64K
Communications Features/Functions				
Multiplexing/Demultiplexing	No	No	No	Yes
Terminal-Initiated Application Switching	No	No	No	Yes
Dynamic Line Reconfiguration	Yes	Yes	Yes	Yes
LAN Connectivity	Not applicable	Not available	Not available	Token-ring, Ethernet, 4Mb
Interface to Ethernet LAN	Yes	Yes	Yes	Yes
Protocol Conversion	Not applicable	Not available	Vendor did not specify	Async to 3270 BSC, SDLS to X.25, async to X.25
Error Control	Vendor did not specify	Vendor did not specify	Vendor did not specify	LRC & CRC detection/correction
System Characteristics				
Processor Type	10M Hz 68000	MC68020, 20M Hz	10M Hz 68000	Proprietary
Main Memory Word Size (bits)	Vendor did not specify	Vendor did not specify	3M optional	32
Main Memory Storage Capacity (bytes)	1M, 2M optional	1M, 4M, optional	1M, standard	4M
Hard Disk Storage Capacity (Mbytes)	Not available	Vendor did not specify	Vendor did not specify	10M
Data Transferred Across I/O Lines	Frame	Frame	Frame	Byte
Data Transferred Between:				
Memory and Communications Lines	DMA	DMA	DMA	DMA and interrupt
Memory and Mass Storage	Not available	Not available	Not available	DMA
Memory and Other Peripherals	Not available	Not available	Not available	DMA
I/O, Backup, and Diagnostic Peripherals	Vendor did not specify	Not available	Vendor did not specify	FEP console, diskette, disk, printer
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software	Software	Software
IPL Method	Set with jumpers	Configured via software	Set by wire-wrap	Download from host, manual load, internal self-load,
User Programmability	Via user-selected parameters, via user-created programs, via console,	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics	Local/remote loopback, internal diagnostics	Local/remote loopback, internal diagnostics	Local/remote loopback, internal diagnostics, problem determination, port/line status
Data Collected	Traffic loading, accounting, port statistics, trace, error rates	Traffic loading, accounting, port statistics, trace, error rates	Traffic loading, accounting, trace, error rates	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading
Pricing and Availability				
Purchase Price ($)	2,690.00	3,817.00	2,748.00	Vendor did not specify
Monthly Purchase ($)	Not applicable	Not applicable	Not applicable	Vendor did not specify
Monthly Lease/Rental ($)	Not applicable	Not applicable	Not applicable	Vendor did not specify
Date of First Commercial Delivery	1986	1990	1985	1987
Serviced by	Morning Star Technologies	Morning Star Technologies	Morning Star Technologies	NCR
Comments	Both serial sync ports support RS-232 signal & a 2 port ribbon cable with DB25 female connectors. Runs MST X.25, SNA, or BSC prot.sft.	Four serial sync ports can be individually set up for either RS-232, RS-422/449 or V.35 signals. Runs MST X.25, SNA, or BSC prot.sft.	Serial sync ports can be individually setup for either RS-232, RS-422/449 or V.35 signals. Runs MST X.25, SNA or BSC prot.sft.	NCR 8500/8600 and 9800 are other computer systems interfaced

	NCR	NCR	NCR	NCR
	NCR 5645-B	**NCR 5655-B**	**NCR 5665-B**	**NCR 5675-B**
Computer Systems Interfaced				
Manufacturer/Models	IBM 360/370, 303X, 308X, 3090, 43XX, plus compatible Amdahl & Hitachi (NAS)	IBM 360/370, 303X, 308X, 3090, 43XX, plus compatible Amdahl & Hitachi (NAS)	IBM 360/370, 303X, 308X, 3090, 43XX, plus compatible Amdahl & Hitachi (NAS)	IBM 360/370, 303X, 308X, 3090, 43XX, plus compatible Amdahl & Hitachi (NAS)
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	4	8	8	16
Max. Hosts Supported Simultaneously	4	8	8	16
PU Type within Network	4, 5	4, 5	4, 5	4, 5
Remote Line Concentrator	Yes	Yes	Yes	Yes
Max. Hosts Served by One Concentrator	Throughput dependent	Throughput dependent	Throughput dependent	Throughput dependent
Host-Independent Network Processor	No	No	No	No
Host Channel Extender	Yes	Yes	Yes	Yes
Terminal Controller	Yes	Yes	Yes	Yes
Store-and-Forward Switching	Yes	Yes	Yes	Yes
Distributed Processing Node	Yes	Yes	Yes	Yes
Network Architecture Compliance	SNA, BSC, OSI, X.25	SNA, BSC, OSI, X.25	SNA, BSC, OSI, X.25	SNA, BSC, OSI, X.25
Native T1 Support	Yes	Yes	Yes	Yes
Number of T1 Lines Supported	4	16	16	24
Communications Line Capacity				
No. Half-duplex Lines Attachable	1284 - 9.6K FDX line	512 - 9.6K FDX lines	512	1,024
Highest Line Speed Supported (bps)	T-1 (1.544/2.048M)	T-1 (1.544/2.048M)	T-1 (1.544/2.048M)	T-1 (1.544/2.048M)
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	Yes
Terminal-Initiated Application Switching	Yes	Yes	Yes	Yes
Dynamic Line Reconfiguration	Yes	Yes	Yes	Yes
LAN Connectivity	Token-ring, Ethernet	Token-ring, Ethernet	Token-ring, Ethernet	Token-ring, Ethernet
Interface to Ethernet LAN	Yes	Yes	Yes	Yes
Protocol Conversion	Async to 3270 BSC, SDLS to X.25, async to X.25	Async to 3270 BSC, SDLS to X.25, async to X.25	Async to 3270 BSC, SDLS to X.25, async to X.25	Async to 3270 BSC, SDLS to X.25, async to X.25
Error Control	LRC & CRC detection/correction	LRC & CRC detection/correction	LRC & CRC detection/correction	LRC & CRC detection/correction
System Characteristics				
Processor Type	Proprietary	Proprietary	Proprietary	Proprietary
Main Memory Word Size (bits)	32	32	32	32
Main Memory Storage Capacity (bytes)	16M	16M	16M	16M
Hard Disk Storage Capacity (Mbytes)	80	80	80	80
Data Transferred Across I/O Lines	Byte, file, block	Byte, file, block	Byte, file, block	Byte, file, block
Data Transferred Between:				
Memory and Communications Lines	DMA and interrupt	DMA, interrupt, both	DMA, interrupt,	DMA, interrupt
Memory and Mass Storage	DMA	DMA	DMA	DMA
Memory and Other Peripherals	DMA	DMA	DMA	DMA
I/O, Backup, and Diagnostic Peripherals	FEP console, disk, printer	FEP console, disk, printer, universal comm. adapter	FEP console, disk, printer, universal comm. adapter	FEP console, disk, printer, universal comm. adapter
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software	Software	Software
IPL Method	Download from host, manual load, internal self-load,	Download from host, manual load, internal self-load	Download from host, manual load, internal self-load,	Download from host, manual load, internal self-load,
User Programmability	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status
Data Collected	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, accounting, line outages, port statistics, trace, line hits, error rates, events, link loading
Pricing and Availability				
Purchase Price ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Monthly Purchase ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Monthly Lease/Rental ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	September 1990	September 1990	April 1991	April 1991
Serviced by	NCR	NCR	NCR	NCR
Comments	NCR 8500/8600 and 9800 are other computer systems interfaced	NCR 8500/8600 and 9800 are other computer systems interfaced	NCR 8500/8600 and 9800 are other computer systems interfaced	NCR 8500/8600 and 9800 are other computer systems interfaced

	Netlink, Inc.	Netlink, Inc.	Peripheonics Corp.	Peripheonics Corp.
	SNA Link	SNA-Hub	VPS 7000	VPS 7500
Computer Systems Interfaced				
Manufacturer/Models	IBM (and compatible) SNA hosts	IBM (and compatible) SNA hosts	IBM 3274 SNA/SDLC/Bisync, IBM 5251 SDLC, Async	IBM 3274 SNA/SDLC/Bisync, IBM 5251 SDLC, Async
Direct Attachment of Host	No	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	No	No	Yes	Yes
Max. Hosts Attachable to FEP	Vendor did not specify	Vendor did not specify	4	4
Max. Hosts Supported Simultaneously	Vendor did not specify	Vendor did not specify	4	4
PU Type within Network	2, PU 5	2, PU 5	2	2
Remote Line Concentrator	Yes	Yes	Yes	Yes
Max. Hosts Served by One Concentrator	2	Up to 8	4	4
Host-Independent Network Processor	No	No	Yes	Yes
Host Channel Extender	No	No	Yes	Yes
Terminal Controller	No	No	Yes	Yes
Store-and-Forward Switching	No	No	No	No
Distributed Processing Node	No	No	Yes	Yes
Network Architecture Compliance	SNA	SNA	SNA, BSC, async	SNA, BSC, async
Native T1 Support	No	No	No	No
Number of T1 Lines Supported	Vendor did not specify	Vendor did not specify	Can be upgraded	Can be upgraded
Communications Line Capacity				
No. Half-duplex Lines Attachable	8	16	64	64
Highest Line Speed Supported (bps)	64K	64K	19.2K	19.2K
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	Yes
Terminal-Initiated Application Switching	Yes	Yes	Yes	Yes
Dynamic Line Reconfiguration	No	No	Yes	Yes
LAN Connectivity	Vendor did not specify	Token-ring	Token-ring	Token-ring
Interface to Ethernet LAN	No	No	No	No
Protocol Conversion	No	IBRO 30/40 to SNA, async to SNA	Async to 3270 BSC	Async to 3270 BSC
Error Control	Parity check w/retransmit on error, LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Vendor did not specify	Vendor did not specify
System Characteristics				
Processor Type	Intel 186, Intel 286, 8086	8086	Motorola 68000/68030	Motorola 68000/68030
Main Memory Word Size (bits)	16	16	32	32
Main Memory Storage Capacity (bytes)	1M	1M	8M, 32MB voice	8M, 32MB voice
Hard Disk Storage Capacity (Mbytes)	20	Vendor did not specify	43MB min.; 600MB max.	43MB min.; 600MB max.
Data Transferred Across I/O Lines	Block	Block	Byte	Byte
Data Transferred Between:				
Memory and Communications Lines	DMA and interrupt	DMA and interrupt	Interrupt	Interrupt
Memory and Mass Storage	DMA and interrupt	Interrupt	Interrupt	Interrupt
Memory and Other Peripherals	Interrupt	Vendor did not specify	Interrupt	Interrupt
I/O, Backup, and Diagnostic Peripherals	Disk	ROM	Diskette, magnetic tape	Diskette, disk, magnetic tape
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	No	No	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software, firmware	Proprietary software	Proprietary software
IPL Method	Download from host, internal self-load	Download from host	Internal self-load	Internal self-load
User Programmability	Via user-selected parameters	Via user-selected parameters	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, port/line status	Local/remote loopback, internal diagnostics, port/line status
Data Collected	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, line outages, port statistics, line hits, error rates, events	Traffic loading, node/link/software status, line outages, port statistics, line hits, error rates, events, link loading
Pricing and Availability				
Purchase Price ($)	4,500.00	6,000.00	35K to 150K	35K to 150K
Monthly Purchase ($)	Vendor did not specify	Vendor did not specify	Of purchase price	Vendor did not specify
Monthly Lease/Rental ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	Vendor did not specify	August 1987	1987	1987
Serviced by	Dictaphhone	Dictaphhone	Peripheonics Corp.	Peripheonics Corp.
Comments	SNA PU and Line Concent.; Multiple host access; supp.for SNA dial-in devices; LU priority scheduling.	SNA PU and Line Concentration; Host-based confg.mang;. LU priority sched.	Supports analog telephone conn. & can be expanded to 64 lines per unit, vocab.& appl.develop. tools	Supports analog telephone conn. & can be expanded to 64 lines per unit, vocab. & appl. development

	Periphonics Corp.	Periphonics Corp.	Simpact Associates, Inc.	Simpact Associates, Inc.
	VPS 9000	**VPS 9500**	**CNS 6000 Programmable Communications Network Serve**	**ICP1622 Q-bus Systems**
Computer Systems Interfaced				
Manufacturer/Models	IBM 3274 SNA/SDLC/Bisync, IBM 5251 SDLC, Async	IBM 3274 SNA/SDLC/Bisync, IBM 5251 SDLC, Async	All models of IBM	Q-bus systems
Direct Attachment of Host	Yes	Yes	No	Yes
Functional Characteristics				
Front-end Processor	No	No	Yes	Yes
Max. Hosts Attachable to FEP	4	4	256	Not applicable
Max. Hosts Supported Simultaneously	4	4	256	1 unit is board level
PU Type within Network	2	2	Vendor did not specify	2, Software dependent
Remote Line Concentrator	Yes	Yes	Vendor did not specify	No
Max. Hosts Served by One Concentrator	4	4	Vendor did not specify	Not applicable
Host-Independent Network Processor	Yes	Yes	Yes	No
Host Channel Extender	Yes	Yes	Vendor did not specify	No
Terminal Controller	Yes	Yes	Vendor did not specify	No
Store-and-Forward Switching	No	No	Vendor did not specify	No
Distributed Processing Node	Yes	Yes	Yes	No
Network Architecture Compliance	SNA, BSC, async	SNA, BSC, async	BSC, X.25, TCP/IP	BSC, X.25
Native T1 Support	Yes	Yes	Yes	No
Number of T1 Lines Supported	2	2	1	None
Communications Line Capacity				
No. Half-duplex Lines Attachable	2 T-1 SPANS	2 T-1 SPANS	8	4 or 16 w/expander
Highest Line Speed Supported (bps)	19.2K	19.2K	1.544M	1M
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Vendor did not specify	No
Terminal-Initiated Application Switching	Yes	Yes	Vendor did not specify	Vendor did not specify
Dynamic Line Reconfiguration	Yes	Yes	Yes	Vendor did not specify
LAN Connectivity	Token-ring	Token-ring	Ethernet	None
Interface to Ethernet LAN	No	No	Yes	No
Protocol Conversion	Async to 3270 BSC	Async to 3270 BSC	X.25 to TCP/IP	No
Error Control	Vendor did not specify	Vendor did not specify	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity
System Characteristics				
Processor Type	Motorola 68030/68000	Motorola 68030/68000	MC68010	DEC MICRO/T-11
Main Memory Word Size (bits)	Vendor did not specify	Vendor did not specify	16	16
Main Memory Storage Capacity (bytes)	8M, 32 voice	8M, 32M voice	1M, 2M, 8M	512K
Hard Disk Storage Capacity (Mbytes)	4.3MB min.; 600 MB max.	4.3MB min.; 600 MB max.	Not applicable	Not applicable
Data Transferred Across I/O Lines	Byte	Byte	Byte, block	Software dependent
Data Transferred Between:				
Memory and Communications Lines	Interrupt	Interrupt	Interrupt	DMA, interrupt,
Memory and Mass Storage	Interrupt	Interrupt	Vendor did not specify	Not applicable
Memory and Other Peripherals	Interrupt	Interrupt	DMA, interrupt	Not applicable
I/O, Backup, and Diagnostic Peripherals	Diskette, magnetic tape	Diskette, magnetic tape	FEP console	FEP console
Support for Remote Console	Yes	Yes	Yes	No
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Proprietary	Proprietary	Software	Hardware, RAM
IPL Method	Internal self-load	Download from host, internal self-load	Download from host	Download from host
User Programmability	Via user-selected parameters, via user-created programs, via console	Via user-selected parameters, via user-created programs, via console	Via user-created programs	Via user-selected parameters, via user-created programs
Network Management Control				
Diagnostic Tests Supported	Internal diagnostics, port/line status	Internal diagnostics	Local/remote loopback, internal diagnostics, port/line status	Local/remote loopback, internal diagnostics, port/line status
Data Collected	Traffic loading, node/link/software status, line outages, port statistics, line hits, error rates, events	Traffic loading, node/link/software status, line outages, port statistics, line hits, error rates, events	Traffic loading, port statistics, link loading	Node/link/software status, port statistics, trace, line hits, error rates, events
Pricing and Availability				
Purchase Price ($)	150,000.00	35K to 150K	Vendor did not specify	Vendor did not specify
Monthly Purchase ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	295.00
Monthly Lease/Rental ($)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Not applicable
Date of First Commercial Delivery	1987	1987	September 1990	Vendor did not specify
Serviced by	Periphonics	Periphonics	Simpact	Simpact & Digital Equip.
Comments	Connects directly to digital speech netwk. or digital PBX unit.	Connects directly to digital speech netwk. or digital PBX unit, Main memory storage 32 MB voice		Hardware includes board, distribution panel, and cables

	Simpact Associates, Inc.	Simpact Associates, Inc.	Simpact Associates, Inc.	Simpact Associates, Inc.
	ICP1632 VAXBI Systems	ICP3222	ICP3232 VAXBI Systems	ICP6000/9000 VMEbus
Computer Systems Interfaced				
Manufacturer/Models	VAXBI Systems	Vendor did not specify	Vendor did not specify	Vendor did not specify
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	Not applicable	Not applicable	Not applicable	1
Max. Hosts Supported Simultaneously	1	1	1	1
PU Type within Network	2, Software dependent	2, Software dependent	2, 4, software dependent	Not applicable
Remote Line Concentrator	No	No	No	Vendor did not specify
Max. Hosts Served by One Concentrator	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Host-Independent Network Processor	No	No	No	No
Host Channel Extender	No	No	No	Yes
Terminal Controller	No	No	No	No
Store-and-Forward Switching	No	No	No	No
Distributed Processing Node	No	No	No	No
Network Architecture Compliance	BSC, X.25	BSC, X.25	BSC, X.25	BSC, OSI, X.25
Native T1 Support	No	No	No	Yes
Number of T1 Lines Supported	Not applicable	Not applicable	Not applicable	1
Communications Line Capacity				
No. Half-duplex Lines Attachable	4	4	4	16
Highest Line Speed Supported (bps)	1M	1M	1M	1.8M
Communications Features/Functions				
Multiplexing/Demultiplexing	No	No	No	No
Terminal-Initiated Application Switching	No	No	No	No
Dynamic Line Reconfiguration	Vendor did not specify	Yes	No	Yes
LAN Connectivity	Not applicable	None	None	Vendor did not specify
Interface to Ethernet LAN	No	No	No	Vendor did not specify
Protocol Conversion	No	No	No	Vendor did not specify
Error Control	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction, parity
System Characteristics				
Processor Type	DEC MICRO/T-11	MC68020	MC68020	MC68020
Main Memory Word Size (bits)	16, 18, 32	32	32	32
Main Memory Storage Capacity (bytes)	512K	1M	1M	1M
Hard Disk Storage Capacity (Mbytes)	Not applicable	Not applicable	Vendor did not specify	Vendor did not specify
Data Transferred Across I/O Lines	Byte	Byte	Byte	Block
Data Transferred Between:				
Memory and Communications Lines	DMA, interrupt,	DMA, interrupt	DMA, interrupt	DMA
Memory and Mass Storage	Not applicable	Not applicable	Not applicable	Vendor did not specify
Memory and Other Peripherals	Not applicable	Not applicable	Not applicable	Vendor did not specify
I/O, Backup, and Diagnostic Peripherals	FEP console	FEP console	FEP console	Vendor did not specify
Support for Remote Console	No	No	No	Vendor did not specify
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Hardware, RAM	Hardware, RAM	Hardware, RAM	Software
IPL Method	Download from host	Download from host	Download from host	Download from host
User Programmability	Via user-selected parameters, via user-created programs	Via user-selected parameters, via user-created programs	Via user-selected parameters, via user-created programs	Via user-selected parameters, via user-created programs
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, port/line status	Local/remote loopback, internal diagnostics port/line status	Local/remote loopback, internal diagnostics, port/line status	Local/remote loopback, internal diagnostics
Data Collected	Node/link/software status, port statistics, trace, line hits, error rates, events	Node/link/software status, port statistics, trace, line hits, error rates, events	Node/link/software status, port statistics, trace, line hits, error rates, events	Port statistics, line hits, error rates, link loading
Pricing and Availability				
Purchase Price ($)	Contact vendor	Contact vendor	Contact vendor	Contact vendor
Monthly Purchase ($)	295.00	295.00	295.00	Vendor did not specify
Monthly Lease/Rental ($)	Not applicable	Not applicable	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	Vendor did not specify	Vendor did not specify	Vendor did not specify	November 1989
Serviced by	Digital Equip. & Simpact	Simpact	Simpact	Simpact
Comments				

	Systech Corp.	Thomas Engineering Co.	Thomas Engineering Co.	TIL Systems, Inc.
	DCP 8820	**LAN-TEC**	**UNI-TEC**	**PDX Plus**
Computer Systems Interfaced				
Manufacturer/Models	VME Bus compatible systems	LAN-Tec	Uni-Tec	TIL Systems with SNA HPAD, X.25, SDLC TPAD, Bisyn HPAD
Direct Attachment of Host	Yes	No	No	No
Functional Characteristics				
Front-end Processor	Yes	No	No	No
Max. Hosts Attachable to FEP	Vendor did not specify	None	None	None
Max. Hosts Supported Simultaneously	Vendor did not specify	8	4 with 32 users, 12 with 16	Vendor did not specify
PU Type within Network	Vendor did not specify	Vendor did not specify	2	2
Remote Line Concentrator	Vendor did not specify	No	Yes	Yes
Max. Hosts Served by One Concentrator	Vendor did not specify	Vendor did not specify	20 SNA or X.25	Vendor did not specify
Host-Independent Network Processor	No	Yes	Yes	Yes
Host Channel Extender	Yes	No	No	No
Terminal Controller	Yes	Yes	Yes	Yes
Store-and-Forward Switching	No	No	No	Yes
Distributed Processing Node	Yes	No	No	No
Network Architecture Compliance	SNA, BSC, X.25	BSC, VIP, Uniscope	SNA, BSC, X.25, VIP, Uniscope, IPARS	SNA, BSC, X.25
Native T1 Support	Vendor did not specify	No	No	No
Number of T1 Lines Supported	Vendor did not specify	Not applicable	Vendor did not specify	Vendor did not specify
Communications Line Capacity				
No. Half-duplex Lines Attachable	4	8	44	32
Highest Line Speed Supported (bps)	1.6Mb	19.2K	56K	64K
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	No
Terminal-Initiated Application Switching	No	Yes	Yes	No
Dynamic Line Reconfiguration	Yes	No	Yes	Vendor did not specify
LAN Connectivity	Vendor did not specify	Token-ring, Arcnet	Vendor did not specify	Vendor did not specify
Interface to Ethernet LAN	Vendor did not specify	Yes	No	No
Protocol Conversion	Async to 3270 BSC, SDLS to X.25, async to X.25	Async to TCP/IP	Async to 3270 BSC, asynch to uniscope, SDLS to X.25, async to X.25, Async to VIP	Async to 3270 BSC, SDLS to X.25, async to X.25
Error Control	Parity	LRC & CRC detection/correction, parity	Parity check w/retransmit on error, LRC & CRC detection/correction	Vendor did not specify
System Characteristics				
Processor Type	Intel 186	Z80B, Intel 286	Z80B, MC68010, MC68000	NS32532
Main Memory Word Size (bits)	8	Vendor did not specify	16	32
Main Memory Storage Capacity (bytes)	512K	2M	512K to 8M	16 max.
Hard Disk Storage Capacity (Mbytes)	Not applicable	20, 40, 80	No hard disk, 1.2M floppy	Vendor did not specify
Data Transferred Across I/O Lines	Byte	Byte, block	Byte	Byte
Data Transferred Between:				
Memory and Communications Lines	DMA, interrupt	Interrupt	Interrupt	Interrupt
Memory and Mass Storage	DMA, interrupt	DMA	Interrupt	Interrupt
Memory and Other Peripherals	DMA, interrupt	Interrupt	Not applicable	Interrupt
I/O, Backup, and Diagnostic Peripherals	Not applicable	Diskette	Diskette, printer	Diskette
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	No	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Firmware	Software	Software	Software
IPL Method	Download from host	IPL diskette	IPL diskette	IPL diskette
User Programmability	Via user-selected parameters, via user-created programs	Via user-created programs	Via user-selected parameters, via console	Via user-selected parameters, via console
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Internal diagnostics, problem determination, port/line status	Port/line status
Data Collected	Vendor did not specify	Traffic loading, accounting, port statistics, trace, events, link loading	Node/link/software status, trace, events	Accounting, port statistics, trace, line hits, error rates
Pricing and Availability				
Purchase Price ($)	Vendor did not specify	2,995.00	3,495.00	Vendor did not specify
Monthly Purchase ($)	Not applicable	25.00	90.00	Vendor did not specify
Monthly Lease/Rental ($)	Not applicable	Not applicable	Not applicable	Vendor did not specify
Date of First Commercial Delivery	January 1987	July 1990	1985	Vendor did not specify
Serviced by	Systech Corp.	Vendor did not specify	Thomas Engineering	Vendor did not specify
Comments	Flexible channel configurations: RS-232, RS-449/422, V.11, and V.35	Protocol conversion also includes to BSC, VIP, and Uniscope	Maximum number of hosts served by one concentrator 40 VIP, Protocol convers.are Uniscope VIP to X.25	

	Tri-Data Corp.	Tri-Data Corp.	Unisys Corp.	Unisys Corp.
	Netway 1000	**Netway 2000**	**CP2000**	**DCP/5**
Computer Systems Interfaced				
Manufacturer/Models	Most IBM systems	Most IBM systems	Unisys A & V series mainframes	All models of Unisys 1100/2200 and System 80
Direct Attachment of Host	Yes	Yes	Yes	No
Functional Characteristics				
Front-end Processor	No	No	Yes	No
Max. Hosts Attachable to FEP	Vendor did not specify	Vendor did not specify	99	No
Max. Hosts Supported Simultaneously	Vendor did not specify	Vendor did not specify	99	Vendor did not specify
PU Type within Network	2	2	2, 5	2, 4, 5
Remote Line Concentrator	No	No	Yes	Yes
Max. Hosts Served by One Concentrator	Vendor did not specify	Vendor did not specify	Unlimited	Any host in network
Host-Independent Network Processor	Yes	Yes	No	Yes
Host Channel Extender	No	No	No	No
Terminal Controller	No	No	Yes	No
Store-and-Forward Switching	No	No	No	Yes
Distributed Processing Node	Yes	Yes	No	No
Network Architecture Compliance	SNA	SNA	SNA, OSI, X.25, Unisys BNA, TCP/IP	SNA, BSC, OSI, X.25, DDN, X.21, Uni DCA
Native T1 Support	No	Vendor did not specify	Vendor did not specify	No
Number of T1 Lines Supported	Vendor did not specify	4	Vendor did not specify	11
Communications Line Capacity				
No. Half-duplex Lines Attachable	Vendor did not specify	4	56	11 (V.35)
Highest Line Speed Supported (bps)	19.2K	56/64K	64K	64K
Communications Features/Functions				
Multiplexing/Demultiplexing	No	No	Yes	Yes
Terminal-Initiated Application Switching	Yes	Yes	Yes	Yes
Dynamic Line Reconfiguration	Yes	Yes	Yes	Yes
LAN Connectivity	LocalTalk (AppleTalk)	Token-ring,LocalTalk	Vendor did not specify	Ethernet
Interface to Ethernet LAN	No	Yes	Yes	Yes
Protocol Conversion	SNA	SNA	SDLS to X.25, BDLC to ET X.25	Asynch to uniscope, SDLS to X.25, async to X.25, 3270/Uni, Uni/3270
Error Control	LRC & CRC detection/correction	LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC
System Characteristics				
Processor Type	Z80 clone, HD64180	SPARC	Intel 80386	Proprietary
Main Memory Word Size (bits)	32	32	16	16
Main Memory Storage Capacity (bytes)	4M	4M	5M	2M
Hard Disk Storage Capacity (Mbytes)	N/A	Vendor did not specify	Vendor did not specify	80
Data Transferred Across I/O Lines	Byte	Byte	Byte	Byte
Data Transferred Between:				
Memory and Communications Lines	DMA	DMA	DMA, DMA and interrupt	DMA
Memory and Mass Storage	N/A	N/A	DMA and interrupt	DMA
Memory and Other Peripherals	DMA and interrupt	DMA and interrupt	Not applicable	DMA
I/O, Backup, and Diagnostic Peripherals	MAC/PC	MAC/PC	Disk	FEP console, diskette, patch panel, disk, printer
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Vendor did not specify	No	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software	Software	Software, firmware	Software
IPL Method	Across-LAN automatic	AcrossLAN; automatic	Download from host	Download from host, IPL diskette
User Programmability	Via console	Via console	No	Via user-created programs
Network Management Control				
Diagnostic Tests Supported	Internal diagnostics, problem determination, port/line status	Internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status
Data Collected	Node/link/software status, line outages, port statistics, trace, line hits, events	Node/link/software status, line outages, port statistics, trace, line hits, events	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, link loading	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, link loading
Pricing and Availability				
Purchase Price ($)	2,195.00 to 3,195.00	14,995.00	18,888.00	9,800.00
Monthly Purchase ($)	Vendor did not specify	Not applicable	141.50	172.00
Monthly Lease/Rental ($)	Vendor did not specify	Not applicable	705.00	Vendor did not specify
Date of First Commercial Delivery	May 1986	May 1989	1986	March 1989
Serviced by	DEC	DEC	Unisys	Unisys
Comments			When used as a front-end processor, multiple CP2000s are connected to the A & V series mainframes via 802.3 LAN	

	Unisys Corp.	Unisys Corp.	Unisys Corp.	Unisys Corp.
	DCP/15	DCP/25	DCP/30	DCP/35
Computer Systems Interfaced				
Manufacturer/Models	All models of Unisys 1100/2200 and System 80	All models of Unisys 1100/2200 and System 80	All models of Unisys 1100/2200 and System 80	All models of Unisys 1100/2200 and System 80
Direct Attachment of Host	Yes	Yes	Yes	Yes
Functional Characteristics				
Front-end Processor	Yes	Yes	Yes	Yes
Max. Hosts Attachable to FEP	2	6	21	21
Max. Hosts Supported Simultaneously	2	6	21	21
PU Type within Network	2, 4, 5	2, 4, 5	2, 4, 5	2, 4, 5
Remote Line Concentrator	Yes	Yes	Yes	Yes
Max. Hosts Served by One Concentrator	Any host in network	Any host in network	Vendor did not specify	Any host in network
Host-Independent Network Processor	Yes	Yes	Yes	Yes
Host Channel Extender	No	No	No	No
Terminal Controller	No	No	No	No
Store-and-Forward Switching	No	No	No	No
Distributed Processing Node	No	No	No	No
Network Architecture Compliance	SNA, BSC, OSI, TCP/IP, X.21 clr.sw.	SNA, BSC, OSI, X.25, TCP/IP, X.21 clr.sw.	SNA, BSC, OSI, X.25, TCP/IP, X.21 clr.sw.	SNA, BSC, OSI, X.25, ICP/IP, X.25 clr.sw.
Native T1 Support	Vendor did not specify	Yes	Yes	Yes
Number of T1 Lines Supported	Vendor did not specify	2	3	3
Communications Line Capacity				
No. Half-duplex Lines Attachable	52	184	680	672
Highest Line Speed Supported (bps)	64K WAN, 10M LAN	256K WAN, 10M LAN	1.544M/2.048M, T1/E1	1.544M/2.048M
Communications Features/Functions				
Multiplexing/Demultiplexing	Yes	Yes	Yes	Yes
Terminal-Initiated Application Switching	Yes	Yes	Yes	Yes
Dynamic Line Reconfiguration	Yes	Yes	Vendor did not specify	Yes
LAN Connectivity	Vendor did not specify	Vendor did not specify	Ethernet	Ethernet
Interface to Ethernet LAN	Yes	Yes	Yes	Yes
Protocol Conversion	Asynch to uniscope, SDLS to X.25, async to X.25, 3270/Uni, Uni/3270	Asynch to uniscope, SDLS to X.25, async to X.25, 3270/Uni, Uni/3270	Asynch to uniscope, SDLS to X.25, async to X.25, Uni/3270, 3270/Uni	Asynch to uniscope, SDLS to X.25, async to X.25, 3270/Uni, Uni/3270
Error Control	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC
System Characteristics				
Processor Type	Proprietary	Proprietary	Proprietary	Proprietary
Main Memory Word Size (bits)	16	32	32	32
Main Memory Storage Capacity (bytes)	4M	8M	8M	8M
Hard Disk Storage Capacity (Mbytes)	Vendor did not specify	2) 20MB per I/O module	20, 20MB per I/O module	2) 20 MB per I/O module
Data Transferred Across I/O Lines	Byte, block, word	Byte, block, word	Byte, block, word	Byte, block, word
Data Transferred Between:				
Memory and Communications Lines	DMA	DMA	DMA	DMA
Memory and Mass Storage	DMA	DMA	DMA	DMA
Memory and Other Peripherals	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
I/O, Backup, and Diagnostic Peripherals	FEP console, diskette, patch panel, disk, printer	FEP console, diskette, patch panel, disk, printer	FEP console, diskette, patch panel, disk, printer	FEP console, diskette, patch panel, printer
Support for Remote Console	Yes	Yes	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes	Yes	Yes
Communications Operating Software				
Operating System Implemented in	Software, firmware	Software, firmware	Software, firmware	Software, firmware
IPL Method	Download from host, IPL diskette	Download from host, IPL diskette	Download from host, IPL diskette	Download from host, IPL diskette
User Programmability	Via user-created programs	Via user-selected parameters	Via user-created programs	Via user-created programs
Network Management Control				
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, problem determination, port/line status
Data Collected	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, events, link loading	Traffic loading, node/link/software status, line outages, port statistics, line hits, error rates, link loading	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading
Pricing and Availability				
Purchase Price ($)	55,000.00	31,000.00	55,000.00	125,500.00
Monthly Purchase ($)	89.10	Vendor did not specify	175.00	Vendor did not specify
Monthly Lease/Rental ($)	600.00	Vendor did not specify	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	April 1987	Vendor did not specify	October 1988	Vendor did not specify
Serviced by	Unisys	Vendor did not specify	Unisys	Vendor did not specify
Comments		Up to 31 line module slots	Up to 93 line module slots	Required software is DCP/OS plus Telcom 8R2 or higher release level. Up to 92 line module slots

	Unisys Corp. DCP/50	Unisys Corp. DCP/55
Computer Systems Interfaced		
Manufacturer/Models	All models of Unisys 1100/2200 and System 80	All models of Unisys 1100/2200 and System 80
Direct Attachment of Host	Yes	Yes
Functional Characteristics		
Front-end Processor	Yes	Yes
Max. Hosts Attachable to FEP	56	46
Max. Hosts Supported Simultaneously	56	Unlimited
PU Type within Network	2, 4, 5	2, 4, 5
Remote Line Concentrator	Yes	Yes
Max. Hosts Served by One Concentrator	Any host in network	Any host in network
Host-Independent Network Processor	Yes	Yes
Host Channel Extender	No	No
Terminal Controller	No	No
Store-and-Forward Switching	No	No
Distributed Processing Node	No	No
Network Architecture Compliance	SNA, BSC, OSI, X.25, X.21 circuit switch	SNA, BSC, OSI, X.25, ICP/IP, X.21 cir.sw.
Native T1 Support	Yes	Yes
Number of T1 Lines Supported	12	12
Communications Line Capacity		
No. Half-duplex Lines Attachable	1912	1536
Highest Line Speed Supported (bps)	1.544M/2.048M	1.544M/2.048M
Communications Features/Functions		
Multiplexing/Demultiplexing	Yes	Yes
Terminal-Initiated Application Switching	Yes	Yes
Dynamic Line Reconfiguration	Yes	Yes
LAN Connectivity	Ethernet	Ethernet
Interface to Ethernet LAN	Vendor did not specify	Yes
Protocol Conversion	Asynch to uniscope, SDLS to X.25, async to X.25, 3270/Uni, Uni/3270	Asynch to uniscope, SDLS to X.25, async to X.25, 3270/Uni, Uni/3270
Error Control	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC	Parity check w/retransmit on error, LRC & CRC detection/correction, ARQ-CRC
System Characteristics		
Processor Type	Proprietary	Proprietary
Main Memory Word Size (bits)	32	32
Main Memory Storage Capacity (bytes)	8M	16
Hard Disk Storage Capacity (Mbytes)	2) 20M per I/O module	2)20M per I/O
Data Transferred Across I/O Lines	Byte, block, word	Byte, block, word
Data Transferred Between:		
Memory and Communications Lines	DMA	DMA
Memory and Mass Storage	DMA	DMA
Memory and Other Peripherals	DMA	Vendor did not specify
I/O, Backup, and Diagnostic Peripherals	FEP console, diskette, patch panel, disk, printer	FEP console, diskette, patch panel, mag.tape,
Support for Remote Console	Yes	Yes
Support for X.25 Level 3 Capabilities	Yes	Yes
Communications Operating Software		
Operating System Implemented in	Software, firmware	Software, firmware
IPL Method	Download from host, IPL diskette	Download from host
User Programmability	Via user-created programs	Via user-created programs
Network Management Control		
Diagnostic Tests Supported	Local/remote loopback, internal diagnostics, problem determination, port/line status	Local/remote loopback, internal diagnostics, problem determination, port/line status
Data Collected	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading	Traffic loading, node/link/software status, line outages, port statistics, trace, line hits, error rates, events, link loading
Pricing and Availability		
Purchase Price ($)	275,000.00	396.00
Monthly Purchase ($)	595.00	Vendor did not specify
Monthly Lease/Rental ($)	4,680.00	Vendor did not specify
Date of First Commercial Delivery	December 1987	Vendor did not specify
Serviced by	Unisys	Vendor did not specify
Comments	Up to 247 line module slots; three IOP in a single IOM	Required software is DCP/OS Telcom 9R/or highest release level. Three IOP in a single IOM

An Overview of Terminal Controllers

In this report:

Synopsis

Editor's Note
Terminal controllers provide IBM and non-IBM host access for synchronous and asynchronous devices, such as terminals, printers, and personal computers emulating displays. This report provides a technical overview of terminal controllers. It also analyzes present and future market trends, identifies leading vendors, and compares the features of the major products on the market.

Report Highlights
The first generation of terminal controllers, released by IBM in 1972, was designed to provide communications only between an IBM host and multiple 3270 devices. Over the years, the terminal controller has evolved into a device that provides connectivity with other non-3270 environments, including asynchronous hosts and devices, token-ring and Ethernet LANs, and packet switched and ISDN networks.

IBM and vendors of IBM-compatible controllers have made these enhancements to keep their host-based display products in demand. For years, steadily declining prices and increased processing power of PCs have resulted in a shift away from the master-slave relationship dictated by host-to-terminal communications in favor of the distributed networking approach of LAN-based systems.

This shift may accelerate in the next two years, as major LAN router vendors begin to offer support for IBM's SNA protocol and peer-to-peer communications capability in their products. Major industry experts confirm this trend with projections that the market for routers and other internetworking products could increase by nearly 200 percent between 1990 and 1995.

—By Martin Dintzis
Assistant Editor

Analysis

The Functions of Terminal Controllers

Terminal controllers, also referred to as cluster controllers or communications controllers, provide access to IBM and non-IBM host computers for a variety of synchronous and asynchronous devices, including display terminals, printers, standalone personal computers configured for terminal emulation, and LAN workstations.

Like front-end processors, terminal controllers relieve the host of much of the work involved in monitoring and controlling network devices. This arrangement frees more computing resources to the applications that serve those devices and speeds up host-to-device communications. While a front-end processor is always located in close proximity to the host computer it serves, the terminal controller may be a local or remote processor.

Functions commonly performed by terminal controllers include device polling, device control, data buffering, line concentration and multiplexing, protocol conversion, collecting performance statistics, gateway services, and physical media conversions.

Market Overview

Market Trends

IBM delivered the first generation of 3270 displays, controllers, and printers in 1972. (For a detailed summary of the evolution of the IBM 3270 family, see Table 1.) Over the years, IBM has expanded and revamped its family of 3270 controllers (and displays) several times to provide improved price/performance, added functionality, and support for a greater number and range of devices. IBM has made these changes to remain competitive with third-party vendors that offer 3270-compatible controllers at a lower price—often with unique features not yet supported by IBM.

One major feature IBM's competitors exploited in the early 1980s was direct attachment of asynchronous display terminals to the controller. In the middle of that decade, access to multiple asynchronous hosts and support for multiple IBM synchronous host connections became key competitive issues. In recent years, third-party vendors have offered features such as multiple synchronous and asynchronous host sessions with windowing, greater internal memory capacity, a more user-friendly configuration system, and support for a greater range of networking protocols—to weaken IBM's position.

The immediate popularity of IBM's AS/400 midrange host, which was released in June 1988, served as a shot in the arm for both IBM and vendors of 5250-compatible display terminals. To support communications between the AS/400 and up to 16 remote devices, IBM markets the 5394 Remote Control Unit. The need for terminal controllers is far less in midrange systems, however, since display terminals can connect directly to the AS/400.

Unable to match IBM's moves and maintain a respectable profit, numerous competitors have withdrawn from the 3270- and 5250-compatible display systems markets over the years. In 1990, AT&T sold its 3270-compatible product line to Memorex Telex, while Lee Data's product line was divided among Intelligent Information Systems and Apertus Technologies. The fallout has left IBM with approximately 70% of the 3270 display systems market, about 80% of the midrange display systems market, and only five major competing terminal controller vendors: Apertus Technologies, IDEA Courier, IDEAssociates, McData, and Memorex Telex.

Competition among themselves is only part of the difficulty these terminal controller vendors face. As personal computers become more and more affordable, users continue to shift away from the master-slave processing arrangement dictated by host-to-terminal transmission systems in favor of local area networks (LANs), which support resource sharing, distributed processing, and peer-to-peer networking.

Determined to keep their display systems in demand, vendors now market their terminal controllers as products capable of linking multiple, dissimilar environments. All terminal controllers, for example, support attachment of one or more token-ring networks, providing LAN workstations

Table 1. The Evolution of the IBM 3270 Family

1972	IBM delivered the first generation of 3270 devices: the 3270 Control Unit, the 3272 Control Unit, the 3275 Standalone Display Station, the 3277 Cluster Display Station, the 3284 Matrix Printer, the 3286 Matrix Printer, and the 3288 Belt Printer.
1977	IBM introduced a new generation of components offering increased capabilities at much lower prices, including the 3274 Control Unit, the 3276 Control Unit Display Station, and the 3278 Cluster Display Station.
1979	IBM added the first color products: the 3279 Color Display Station and color versions of the 3278 Printer.
1983	March: IBM announced several additions to the 3270 product line, including the 3178 Display Station (a smaller and less expensive version of the popular 3278 Model 2 Display); the 3290 Information Panel, a gas plasma display; four new 3274 Control Unit models (41A, 41C, 41D, and 61C); the 3299 Terminal Multiplexer, a coaxial cable eliminator; and an option permitting the attachment of the IBM PC to the 3278 Display Station. October: IBM introduced the 3270 Personal Computer, a version of IBM's PC capable of supporting up to seven concurrent sessions: four 3270 sessions, one DOS session, and two notepad sessions. IBM also introduced the 3279 Personal Computer Attachment.
1984	IBM unveiled the 3180 Display Station and 3179 Color Display Station.
1985	IBM unveiled two graphics versions of the 3179 Color Display Station, Models G1 and G2, supporting selectable screen formats and all-points-addressable graphics.
1986	IBM realigned the 3270 family to highlight the 3174 Subsystem Control Unit, the first processor to support a token-ring connection and communications with asynchronous hosts. IBM released 3174 controller Models 1L, 1R, 2R, 51R, and 52R that year. The vendor also announced the 3191, 3192, 3193, and 3194 Display Station series.
1987	IBM released 3174 controller Models 3R and 53R and announced Models 81R and 82R.
1989	IBM introduced the 3174 Establishment Controller Models 11L, 11R, 12R, 13R, 61R, 62R, 63R, 91R, and 92R. These models provide greater speed and memory capacity and more connectivity options than the older 3174 units. IBM also introduced the InfoWindow 3471 and 3472 families of displays.
1990	IBM unveiled its new System/390 Enterprise Systems Connection (ESCON) architecture, which implements high-speed, fiber optic channels and supports dynamic connectivity through switched point-to-point topology. IBM introduced 3274 Models 12L and 22L, both of which support fiber optic connections to a System/390 host. At the same time, IBM increased from 32 to 64 the number of 3270 devices capable of connecting to large 3174 models through the release of the 3299 Terminal Multiplexer Model 32, which also provides the means to attach devices via fiber optic cable.
1991	In June, IBM released the ISDN Interface Co-Processor/2 Model 2 Adapter, a board-level product for the PS/2 providing access to the ISDN basic rate interface. In September, IBM is scheduled to introduce the 3174 ISDN Basic Rate Interface Adapter, which provides downstream communications at 64K bps for PS/2s equipped with the co-processor card.

with a high-speed channel to controller-attached IBM hosts. Improved functionality and lower prices for display terminals have helped to preserve the place of controller-based display products as well.

Market Leaders

Apertus Technologies

Apertus Technologies provides hardware and software solutions based on industry standards and an open-architecture philosophy. The company's offerings include the Coax L (Lee Data System compatible) windowing terminals, intelligent workstations, and printers; the Datastar 5000 Communications System, the vendor's multiprotocol communications controller; and applications software systems, including database management and synchronization products.

The Datastar 5000 is available in three sizes, with 16 module slots in the large version, 8 in the midsize version, and 4 in the smallest cabinet. The Datastar 5000 features separate system modules for devices, host computers, and network connections. By selecting the appropriate device modules, the system can be customized to support IBM and non-IBM hosts and the terminals and printers of a number of vendors. The **Remote 3270 Communications Module (RCM)** provides access to one or two 3270 BSC or SNA hosts. Up to two cards can be installed, for a maximum of four remote IBM hosts. The **Async Communications Module (ACM)** provides eight async host communications lines. A maximum of four ACMs provide 32 async host connections. Other modules provide token-ring LAN, Ethernet TCP/IP LAN, and X.25 WAN access. Each device module supports 16 IBM or non-IBM devices via coax or twisted-pair wire. Up to 300 synchronous devices and 88 asynchronous devices can be supported concurrently.

IBM

IBM's spotlight is clearly focused on the 3174 Establishment Controller. Released in 1986, the 3174 was the first IBM controller supporting communications with asynchronous hosts and token-ring networks. In 1989, IBM introduced a new generation of 3174s incorporating a faster microprocessor, more memory capacity, and the capability to connect to as many as three synchronous mainframe hosts. In 1990, IBM introduced versions of the 3174 supporting IBM's new System/390 Enterprise Systems Connection (ESCON) architecture, which utilizes fiber optic media, and a new terminal multiplexer that raises the maximum number of attachable 3270 terminals from 32 to 64.

This year, IBM has introduced an ISDN Basic Rate Interface Adapter for the 3174, enabling it to accommodate up to eight PS/2s configured for ISDN communications. IBM also announced future enhancements to the 3174 operating code, Configuration Support-C, which will add advanced peer-to-peer networking (APPN) capability to the controller.

No longer just a shared logic controller for IBM host-to-terminal communications, the 3174 is being touted by IBM as a connectivity device for multivendor host access, local area network interaction, and routing services for wide area networks.

The 3174 is available in over 14 different versions. Included in this family are local and remote models that are available in three sizes: large floorstanding, medium-size floorstanding, and tabletop or rack-mounted units. The 3174 supports a variety of interfaces, up to 64 synchronous devices and 24 asynchronous hosts and/or devices, and a 16M bps or 4M bps token-ring gateway. Terminal users can access up to three remote IBM hosts over an SNA or X.25 network; optionally, they can access up to eight IBM hosts via other 3174s connected to a token-ring network.

In IBM midrange (AS/400 and System/3X) environments, 5250-type terminals can connect directly to the host or indirectly via the 5394 Remote Control Unit, which accommodates up to 16 devices and one host connection. Remote communications over an SNA or X.25 network is supported.

IDEA Courier and IDEAssociates

IDEA is a leading supplier of controllers, terminals, printers, terminal emulation cards, and related products for communications with IBM environments. IDEA Courier markets products for IBM mainframe systems; its sister company, IDEAssociates, concentrates on IBM midrange products. In 1990, IDEA introduced multiple models of the Concert Controller, a communications platform capable of linking multiple IBM and non-IBM environments. Models 10300, 10400, and 10500, marketed by IDEA Courier, compete with the IBM 3174; the IDEA Concert 394, marketed by IDEAssociates, competes with the IBM 5394.

Model 10300, a compact unit, supports remote or token-ring environments where up to eighteen 3270, fourteen 5250, sixteen ASCII, or twenty-four Ethernet Digital Local Area Transport (LAT) devices need to access a single host.

Model 10400, a mid-sized unit, provides dual-host access (any combination of IBM System/370, IBM AS/400, IBM System/3X, and Digital VAX hosts) for up to thirty-two 3270 devices, twenty-eight 5250 devices, sixteen ASCII, or forty Digital LAT devices. Up to two token-ring connections are supported.

Model 10500, a large floorstanding model, provides access to any combination of four IBM System/370, IBM AS/400, IBM System/3X, and Digital VAX hosts for up to sixty-four 3270 devices, forty-two 5250 devices, thirty-two ASCII, or an unlimited number of Digital LAT devices. Up to two token-ring connections are supported.

The **IDEA Concert 394** provides concurrent access to as many as four IBM AS/400s and/or System/3Xs for up to 42 midrange terminals and printers. Both SNA/SDLC and X.25 communications protocols are supported.

A major strength of the Model 10X00 Concert Controllers is concurrent support for Ethernet IEEE 802.3, token-ring IEEE 802.2, Digital LAT, SNA/SDLC, TCP/IP, and X.25 protocols. An Ethernet LAT connection provides 10M bps transmission speeds; the use of the LAT protocol creates less overhead for the VAX than is common with asynchronous communications.

The IDEA Concert 394 many be configured to appear to the IBM midrange host as multiple IBM 5294/5394 controllers or physical units (PUs), allowing the controller to support a greater number of devices and concurrent sessions than the IBM 5394.

McData

McData markets families of wide and local area channel extenders, host-to-host and host-to-Ethernet network processors, and 3270-compatible communications controllers. Its Linkmaster 7100 Network Controller, released this year as a competing product to IBM 3174, comes in two local and three remote models.

Models **10L** and **20L** provide one to four IBM mainframe host connections (up to two of which can be local hosts). Model 10L supports up to 128 coax devices and up to 34 asynchronous devices or hosts. Model 20L can accommodate 64 coax devices and 10 asynchronous devices or hosts. Both models provide an optional token-ring connection, support IBM's System/390 ESCON architecture, and can communicate with remote hosts over an X.25 network.

Models **10R**, **20R**, and **60R** all provide four remote IBM mainframe host connections. Model 10R supports up to 128 coax devices and 34 asynchronous devices or hosts. Model 20R can accommodate up to 64 coax devices and 10 asynchronous devices or hosts. Model 60R, a tabletop controller, is designed for up to 32 coax devices and 3 asynchronous devices or hosts. All three models support a token-ring connection, Digital Ethernet local area transport (LAT) connectivity, IBM's System/390 ESCON architecture, and X.25 communications.

McData's controllers provide up to five concurrent sessions with windowing for attached 3270 and asynchronous terminals. An ASCII Definition Utility (ADU) allows the user to define the characteristics of any nonstandard asynchronous device. McData provides an online system customization capability, although the controllers also support IBM's Central Site Customization (CSC) and Central Site Change Management (CSCM) utilities.

Memorex Telex

Memorex Telex is the world's largest supplier of 3270 plug-compatible computer equipment and accessories. The company also markets intelligent workstations, local area network products, airline reservation systems, PBX equipment, and a variety of other products.

Memorex Telex' flagship hardware platform, the 1174 Network Controller, comes in four models: 10L, 10R, 60R, and 90R. In 1990, Memorex Telex purchased the 3270-compatible display system of AT&T, which includes the 6544 Multifunction Communication Controller and the 6541 Controller.

The 1174 Network Controller Model 10L, a local floorstanding controller, is designed to provide access to one local and three remote IBM mainframe hosts for up to 96 (64 coax and 32 asynchronous) devices, with up to two token-ring connections. **Model 10R**, a remote floorstanding model, provides the same device support with four remote IBM host connections. **Model 60R**, a midsize controller, provides access to four remote hosts for up to 32 coax and 8 asynchronous devices, with dual token-ring connections. **Model 90R**, the entry-level model, supports dual host connections for up to 16 coax devices and 4 asynchronous devices. Protocols supported by these controllers include async, token-ring IEEE 802.2, SNA/SDLC, BSC 3270, and X.25.

With the 1174, asynchronous device ports can also be used for asynchronous host access. Users have access to up to five concurrent host sessions on both asynchronous and 3270 displays with windowing or "hot key" session switching. A modular architecture allows multiple microprocessors and memory modules to be added to the system as more terminals are added. Memorex Telex provides ongoing support for IBM's NetView and Central Site Change Management facility.

The 6544 Multifunction Controller, part of AT&T's former 6500 Multifunction Communication System, provides up to four synchronous IBM host connections. It supports 32 synchronous devices and 32 asynchronous devices or hosts. Up to two IBM host connections can be local channel attachments. The 6544 supports a token-ring connection and an X.25 packet-switching interface. Personal computers equipped with an ISDN basic rate interface (BRI) adapter can access a remote IBM host over an ISDN network through the 6544's optional ISDN gateway module.

Attached IBM plug-compatible displays can access up to four host sessions concurrently via "hot key" switching; 6500 system-compatible displays (not IBM plug compatible) can access any combination of four synchronous/asynchronous host sessions concurrently in customizable windows. Displays can attach to the 6544 using either coaxial wire or twisted-pair wire.

The 6541 is a tabletop controller, supporting connections to as many as eight IBM plug-compatible devices, one remote host, and up to two asynchronous hosts or devices.

Future Directions

Third-party vendors attract users by offering lower prices, greater capacity, and a greater range of networking and connectivity options in their controllers. IBM, however, maintains a key technical and psychological advantage: only IBM's genuine 3270 products can guarantee full compatibility with IBM's Systems Network Architecture (SNA), which is in a constant state of evolution. Fearful of unknown interoperability problems and lack of immediate support for IBM's latest network enhancements, the majority of users continue to stick with IBM for their 3270 communications solutions.

The movement away from dumb, host-controlled terminals in favor of intelligent workstations capable of functioning as peers with hosts and other workstations spells ultimate doom for traditional display terminals and the terminal controllers that serve them. Fortunately for vendors, the large installed base of terminals and controllers, and the investment users have made in host-to-terminal applications programs, have kept the market alive. Companies are unwilling to scrap an investment that still works. Changing the workstation platform, moreover, would require modification of the host applications, which were designed originally for dumb terminals.

Enhancements such as multiprotocol conversion, token-ring and Ethernet gateways, multihost access, and support for multiple media have helped extend the life of the terminal controller by transforming it into an internetworking device. Support for the Open Systems Interconnection (OSI) model is another connectivity option for terminal controllers that is destined to emerge. Already, IBM markets the 3172 Interconnect Controller, which provides multivendor host access for a variety of LAN-attached devices using the TCP/IP or MAP protocol. Apertus Technologies is also hot on the trail of OSI and plans to introduce OSI functionality in the Datastar 5000.

Another area of growth may be in the use of terminal controllers for distributed and cooperative processing applications. This year, IBM announced future support for advanced peer-to-peer networking (APPN) on the 3174 Establishment Controller. APPN allows points on the network to be defined as network nodes (e.g., 3174s and IBM FEPs) or end nodes (e.g., IBM PS/2s). Multiple network nodes serve as the backbone of the APPN network by providing directory services, routing functions, and control functions through each other to attached end nodes. The network nodes, therefore, share in many of the functions that are ordinarily handled by host software.

APPN has the potential to free workstations from dependency upon the host and to provide dynamic routing capability. At present, however, APPN provides routing only for software programs that implement IBM's LU6.2 protocol, such as cooperative processing applications. Most SNA traffic is not based on LU6.2, but on 3270 terminal emulation (LU2.0). IBM's lack of support in APPN for other non-SNA protocols, such as NETBIOS and Novell's IPX, is another area of disappointment to users.

Aware of the present limitations of IBM's communications controllers for peer-to-peer networking, several router vendors—including Cisco Systems, Vitalink Communications Corp., and Proteon—plan to add IBM's SNA to the numerous protocols they already support. These products could provide greater flexibility than IBM's FEPs and terminal controllers at a fraction of the cost, eventually making IBM's display system products obsolete for LAN and WAN networking.

Studies performed by industry experts, such as Frost and Sullivan, Inc. of New York and Forrester Research, Inc. of Cambridge, MA, confirm that the steady growth in local area networking could nearly triple the demand for internetworking products—including routers—from 1990 to 1995. According to Frost and Sullivan, for example, the number of LANs will grow from 3.7 million in 1990 to 12.7 million in 1995, causing a rise in the sale of internetworking products from $607 million in 1990 to $1.8 billion in 1995. Forrester Research projects that the sale of routers will increase from $156 million in 1990 to $565 million in 1995.

In the PC-based networks of the future, users will have a variety of reliable, LAN-based solutions for handling SNA and non-SNA traffic. For the multivendor environments of today, however, which often consist of clusters of dumb terminals as well as LAN-based devices, communications controllers remain the most popular solution for linking disparate display systems. ■

Channel Extenders: Overview

In this report:

Note: This report provides an overview of channel extenders. It identifies the major equipment vendors, discusses market and technology trends, explains channel extension concepts and techniques, and provides selection guidelines.

Market Analysis

Market Highlights

As more corporations disperse their operations, channel extension is becoming a more vital link in private corporate networks. Channel extension bypasses the front-end processor (FEP), allowing local or remote hosts, LANs, and peripheral devices to access the mainframe directly at speeds equal or close to those normally supported over short distances between the mainframe and the FEP.

Traditionally, users have linked the mainframe to terminals, remote peripherals, LANs, and other remote mainframes through front-end processors (FEPs), which connect directly to the mainframe's I/O channel. These communications processors, however, typically support relatively low data rates (56K to 256K bps) because of the overhead inherent in the communications protocols used. Vendors have introduced T1/E1 interfaces for front-end processors. Even if the FEP can handle T1 (or T3) data rates effectively, however, the communications protocols cannot.

The increased use of PCs, particularly those operating in a peer-to-peer environment (such as in an LU6.2 configuration), has created the need to move data files much more frequently and efficiently. PC-to-host file transfer using 3270 terminal emulation is not efficient, since dumb terminals receive only a single screen of data at a time. Users with applications requiring high data rates (large file transfers, high-resolution graphics, CAD/CAM, and so on) may need to bypass the FEP and achieve direct host-channel communication.

The proliferation of LANs has also contributed to market growth for channel extenders. In recent years, LAN-attached PCs have not only replaced dumb terminals, but have off-loaded much of the computing that formerly took place on the mainframe. LAN routers, at the same time, have begun to replace terminal controllers and FEPs. The routers provide a more efficient way to interconnect populations of PCs than terminal controllers, and they can operate at speeds ranging from 1M to 100M bps for new backbone implementations, including FDDI.

The mainframe, however, continues to be the central resource for a company's database, programs, and utilities. The host provides the processing power for sorting the data and preparing individualized reports. Large corporations are expanding mainframe I/O channels to support these higher speeds, and channel extension is a key strategy for improving host access.

Interest in channel extension technology has recently increased for two additional reasons. Many organizations are expanding geographically and must link multiple computing facilities and resources via high-speed links. Second, organizations that are downsizing or merging with other firms must consolidate existing computing resources.

Point-to-point channel extension products (supporting communications between a mainframe and a single remote device) have been on the market since the early 1970s. In recent years, however, the market for this type of mainframe connectivity product began to dwindle somewhat as an increasing number of firms began moving their data processing off the mainframe and onto LAN PCs. Now it seems that channel

—By Martin Dintzis
Assistant Editor

extenders have made a comeback. A new breed of multipoint channel extender networking products goes beyond point-to-point solutions, offering a cost-effective way for a mainframe to form multiple concurrent links with remote peripheral devices and other mainframes. Vendors offering multipoint networking capabilities include AT&T, Computerm Corp., Computer Network Technology, Data Switch Corp., and Network Systems Corp. These enhancements, directed at the growing need for high-speed links between geographically dispersed computing facilities, have injected new life into the channel extension market.

Applications

Channel extenders are used in two types of applications: local area extension, typically in a multibuilding or campus environment, and wide area extension, across town or across country. Common applications are discussed here.

- **Centralized Data Storage:** Two or more mainframe facilities can share access to a single data storage system (tape or DASD). For companies that have downsized or merged, dual storage systems may be unnecessary and too expensive.
- **Remote Data Storage:** In some cases, real estate expenses make it too costly to install all equipment near the mainframe.
- **Data Backup for Disaster Recovery:** Large amounts of data can be dumped in realtime to a secure location mirroring all operations, eliminating the need to generate, manage, and ship tapes—labor-intensive activities. This also eliminates the current bottlenecks of occasional dumps of small selected data sets over slow communications lines.
- **LAN Integration:** Channel-to-channel attachment offers the possibility of using computers as true servers while at the same time retaining the hierarchical control within the system.
- **Improving the Performance of Peripherals:** Connecting remote terminals using channel extension can provide subsecond response time. Linking a mainframe and a high-speed printer can speed up the printing process.
- **Distributed Data Processing:** Users can connect remote host processors in a high-speed network. If desired, different portions of the data can reside in different hosts' disk drive systems, spread throughout the country. With channel extenders and T1/E1 or T3/E3 links, all hosts have quick access to all the information.
- **Dual Center Transaction Processing:** With appropriate programming, each transaction can be maintained in two or more hosts for fully mirrored operation with negligible delays.
- **Facilities Relocation:** Since real estate costs are soaring in many cities, many companies are moving their data centers to lower-cost facilities. A number of New York banks have built data centers in New Jersey. Through channel extenders, terminals in New York accessing a host in New Jersey appear to be making a local connection.

Channel extension equipment is not cheap; a user needs a channel extension unit at each end of the link. But organizations using channel extension technology have reported substantial financial advantages. The cost to extend a mainframe channel ranges between $30,000 and $90,000. (Installing an IBM 3745 FEP to increase remote throughput, in contrast, could cost between $125,000 and $1.2 million.)

Offsetting the initial cost of channel extenders are the resulting savings obtained by reducing the number of hosts supported, the number of systems operators at each of the remote sites, and the license fees for duplicating software. With so many data centers consolidating, channel extender vendors are not feeling the crunch as are other industry market segments.

Market Leaders

AT&T Paradyne

AT&T Paradyne markets the **PIXNET-XL Model XL/1000** and **Model XL/2000** channel connectivity units. The products use a multiple-processor architecture, and the software is based on the Open Systems Interconnection (OSI) model. The Pixnet-XL/1000, the entry-level product, supports one channel connection and accommodates up to eight RS-232-C, four V.35, or two X.21 extended links. It provides a maximum aggregate throughput of 2.6M bps. The PIXNET-XL/2000 supports dual channel connections, providing a maximum aggregate throughput of 5.2M bps. It accommodates up to 16 RS-232-C, 8 V.35, or 4 X.21 extended links.

Both models support both analog and digital communications, including leased line, satellite, and microwave facilities, at speeds up to T1/E1 per link. Devices supported include IBM and plug-compatible mainframes, 3270-type controllers, high-speed laser printers, low-speed printers, check sorters, microfiche units, and tape drives. Options include NetView/PC support, a redundant power supply, application/CPU switching, and multilink protocol (MLP) support.

Late in 1991, AT&T and IBM announced that they had signed a contract to jointly develop new channel extension products that work with the IBM 3172 Model 2 Interconnect Controller. The XL/4000 and XL/5000 models, to be marketed and serviced by AT&T, will extend IBM's ESCON capabilities for connecting tape drives and printers over T3 lines at speeds of up to nearly 45M bps.

Beall Technologies, Inc.

Beall's **CHAN-X 400** channel extender provides extensions up to 400 feet per unit (multiple units can be daisy-chained for greater distances) using bus and tag mainframe cable connections. Data transfer rates up to 4.5M bps are possible. It can be used as a standalone device for one point-to-point link, or in rackmounted configurations consisting of 4, 8, or 16 units supporting multiple, independent links. Peripherals supported include IBM 3270-type terminal controllers, 37XX FEPs, DASD and tape systems, impact printers, and laser printers.

The vendor's **CHAN-X** product line includes three channel extenders for IBM mainframe environments supporting transmission over T1 carrier facilities at distances up to 120 miles. The *T-1/A1* and the *T-1/A2* both support serial data rates of 1.544M bps and block transfer rates up to 96K bps. The T-1/A1 provides a DS-1 serial interface, whereas the T-1/A2 utilizes a DS-1/D4 serial interface. D4 framing may be required when the T1 service utilizes a digital access and cross-connect system (DACS). The *T-1/V* provides a V.35 interface for variable data rates; serial speeds from 112K to 10M bps or block transfer rates from 2.7K to 550K bps are supported.

Beall's **D-2000 Series** consists of three models providing single- or multimode fiber optic links between IBM System/370 or System/390 block/byte multiplexer channels and peripherals. Data rates from 76K bps to 4.5M bps and distances from three to seven kilometers, depending upon the model, are supported. D-2000 products are based on application-specific integrated circuits (ASICs); fewer internal components increases reliability. They feature redundant power supplies and compatibility with a full range of IBM peripherals, including DASD, laser printers, terminals, check sorters, and tape drives.

Beall will be introducing a "store and forward" extender utilizing frame-relay technology in the fourth quarter of 1992. This product will support unlimited distance extensions over any public frame-relay network with no software patch. It will be capable of automatically switching between a primary, private network line and a backup public line.

Computerm Corp.

The Computerm **3800/3890 Channel Extension System** includes three low-speed models providing up to 56K bps of throughput per line and three high-speed models providing fractional to full T1 data rates. The largest model supports up to six extended channels and up to 256 channel addresses.

Both host channel-attachment and remote device attachment configurations are supported. Users can attach the 3800/3890 to networks over copper-based wire, fiber optic cable, microwave systems, and satellite links. The 3800/3890 supports IBM or plug-compatible line printers, laser printers, CRT controllers, document processors, card readers, tape drives, and front-end processors.

The system is completely transparent to all operating systems and applications software and requires no alterations or modifications to existing software. The system's redundancy allows an operator to switch the external systems from the primary to a completely separate backup unit.

Computer Network Technology (CNT) Corp.

CNT markets the **CHANNELink** networking channel extender, which is available in two sizes: the *Small Access Unit (SAU),* supporting 4 function modules, and the *Extended Access Unit (XAU),* supporting 12 function modules. Each module, an independent processing unit equipped with from 2M- to 10MB of RAM, manages its own extended channel, but all modules are linked by a high-speed VME bus. Connectivity options offered by the vendor include the following:

- *Host Attachment:* Host Modules provide IBM System/370 byte/block multiplexer attachment at data rates up to 4.5M bps, Digital VAX-to-Digital VAX links supporting memory-to-memory transfer at data rates up to 20M bps and 100M bps channels to Cray computers.
- *LAN Attachment:* A Coax Module supports 50M bps data rates over distances up to 3,500 feet, an Ethernet Module, a 100M bps Fiber Module supporting distances up to two kilometers, and an FDDI Module. Token-ring LANs are accommodated via an IBM-compatible communications processor.
- *Wide Area Networking:* WAN interfaces provide access to fractional T1, T1/E1, and T3/E3 common carrier facilities; a High Speed Serial Interface (HSSI) allows multiple hosts and/or devices to share the bandwidth available on a single T3 channel. Versions of this interface are available for both DTEs and DCEs.
- *Device Attachment:* CHANNELink supports interfaces compatible with a variety of tape controllers, printers, terminal controllers, graphics controllers, and other devices; in the third quarter of 1992, CNT will release a new DASD Interface providing connectivity to commonly used mainframe DASD systems, disk arrays, and solidstate disk systems.

CHANNELink provides dynamic load leveling, a feature enabling distribution of bandwidth among multiple data paths when more than one path exists between any two network points. The system also supports alternate path assignment, automatic error recovery, and pipelining.

CNT's *Network Curator* network management software, available in both host- and PC-based versions, provides generic alerts to IBM NetView and Systems Center Net/Master, and it supports interfaces to most high-level network management protocols such as SNMP, CMIP, UNMA, and EMA.

Data Switch Corp.

Data Switch markets the ChannelNet family of channel extenders, the Distributed Director System, and the Model 3600 Multi-Architecture Director.The

The **ChannelNet** family consists of Models 9040, 9044, 9045, 9200, and 9400. This product line includes channel extenders for CPU-to-control units for extending tapes, direct access storage devices (DASDs), graphic workstations, and printers over private fiber or public transmission facilities; integrated host networking; and channel switching and channel extension systems to connect distributed CPUs and control units.

ChannelNet Model 9040 and *9045* fiber optic channel extenders support both single-mode and multimode fiber optic cabling. They are configured in pairs, with an extender attaching to an IBM (or compatible) CPU channel and the other attaching to a communications processor, terminal, printer, tape drive, DASD, or other peripheral device. Model 9040 can be attached to a byte or block multiplexer channel operating either in datastreaming or non-datastreaming mode. It offers channel extension capabilities of up to three kilometers and channel data rates up to 4.5MB per second.

Attaching to the block multiplexer mainframe channel, Model 9044 extends datastreaming and non-datastreaming control units up to seven kilometers using multimode fiber optic cabling and 40 kilometers using single-mode fiber optic cabling, with channel rates up to 4.5MB per second. An optional system controller provides a central point of control for up to eight extended channels.

ChannelNet Model 9200 ChannelPlexer multiplexes data from one or two mainframe channels over a single carrier facility (T1/E1 or T3/E3) for communications with tape drives, printers, graphic workstations, and communications processors. *ChannelNet Model 9400 ChannelPlexer* multiplexes up to four computer channels over one or two T1/E1 or T3/E3 communications links. Both models increase link efficiency by up to 40% through data compression; variable V.35 interfaces support data rates from 500K bps to 10M bps. The 9400 supports automatic switchover from one line to another in the event of a line

failure. Both models are completely transparent to the computer channel, requiring no software modifications to attached systems. Model 9200 can be upgraded to the 9400.

The **Distributed Director System (DDS)** provides multipoint, distributed nodal networking for information sharing among IBM data centers. DDS supports bus and tag, fiber, and public T1/E1 and T3/E3 carrier facilities. Six internal buses connect multiple processors and interface cards. Any channel interface can be configured as a backup for another link. DDS offers features such as automatic data rerouting, line sharing with dynamic bandwidth allocation, and redundant components.

A Remote Dial-In Facility (RDF) allows testing and diagnostics of any network element from a single network management center. An *On-Line Channel Analyzer and Trace (CAT) Diagnostic Interface* provides a window for channel fault determination and isolation, and troubleshooting problems. *TotalNet,* Data Switch's control system, processes alerts from a central site and provides a universal interface to NetView and other host-based management systems.

This year, Data Switch introduced the **Model 3600 Multiarchitecture Director**, a modular data path management platform that integrates multiple System/370 bus and tag channels and IBM System/390 (ESCON) fiber channels. The product supports four different switching and conversion modules. The *Director Array Module* interconnects fiber channel equipment and provides dynamic channel switching. An optional *Sparing Module* allows rerouting of data to a backup Director Array module. The *Bus and Tag Module* provides static matrix switching between bus and tag computers and control units. The Conversion Module provides conversion between ESCON and bus and tag channels. A single Model 3600 system supports as many as 128 fiber channels and control unit interfaces in 16-port increments. The unit can also manage up to 48 bus and tag channels and 96 peripheral device links.

IBM

IBM's **Enterprise Systems Connection (ESCON)** architecture represents a dramatic new direction in CPU-to-channel connectivity. ESCON provides fiber optic channels for CPU communications. The new channel speeds range to 17MB per second (about 140M bps). Distances between the CPU and devices were initially announced at 5.5 miles, and then increased to 37.2 miles, far exceeding the current 400-foot restriction of bus and tag cables.

The ESCON offerings include ESCON Directors, ESCON Converters, an ESCON Manager (ESCM), and an ESCON Monitor System (ESCMS). *ESCON Directors* provide connection and switching capabilities among channels and control units. Two models are available: one allowing up to 16 connections and the other offering from 28 to 60 connection ports. *ESCON Converters* allow System/370 parallel channels to be attached to the new ESCON channels. The *ESCON Manaager* is a program product enabling customers to manage ESCON Director connections. The *ESCON Monitor System* enables customers to monitor the operating environments of both local and remote installations from a single location. IBM peripheral devices supported by ESCON include the 3172 Interconnect Controller, the 3174 Establishment Controller, the 3990 disk drive, the IBM 9343 storage controller, and the 3490 tape drive.

IBM has announced that its **3044 Fiber Optic Channel Extender Link**, an older channel extension solution, is scheduled to be withdrawn from the market in September 1992. Available in four models, the 3044 extends processor and peripheral channels to distances up to 6,000 feet using fiber optic cables.

IBM's **3088 Multisystem Channel Communication Unit**, available in three models, is a standalone I/O control unit interconnecting two, four, or eight processors via 4.5M bps block multiplexer channels. *Model A1* interconnects up to two processors and supports up to 63 logical channel-to-channel adapters. *Model 1* supports up to 126 logical CTCAs distributed across four CPU interfaces, while *Model 2* supports up to 252 logical CTCAs distributed across eight interfaces.

McDATA Corp.

McDATA offers the LinkMaster Series of channel extenders, which include the LinkMaster 5200F local area fiber optic channel extender, the LinkMaster 5200T and 5300T wide area channel extenders, the LinkMaster HSSI Channel Extension System, and the LinkMaster CX Controller Extension System. A short summary of each model with some characteristics follows.

The **LinkMaster 5200F** supports IBM System/370-compatible block multiplexer channels and provides full-duplex data rates up to 72M bps over fiber optic media. It is interoperable with IBM 43XX, 30XX, and IBM plug-compatible mainframes. The 5200F offers four interchangeable interface boards: multimode to 1.5 miles, multimode to 3 miles, single mode to 6 miles, and single mode to 25 miles. It automatically performs an end-to-end loopback test each time the system is powered up, and it supports a single, centralized network management system providing a direct interface to IBM NetView.

The **LinkMaster 5200T** attaches to an IBM System/370-compatible block multiplexer channel, providing transmission speeds ranging from 56K to 2.048M bps in full-duplex mode over T1, fractional T1, and other digital communications facilities. The system provides a secondary link that can be used as an alternate route in the event of a failure in the primary line. The 5200T, when combined with an inverse multiplexer, allows multiple mainframe channels to share a single T1/E1 link. Users can also share T1 bandwidth with LAN bridges and routers. Up to 256 SNA or non-SNA devices are addressable on one channel.

Features of the 5200T include a full range of WAN communications interfaces (V.35, X.21, RS-449/RS-530, RS-232-C, U.S. DS-1, and European E1/G.703 twisted pair or coax), automatic end-to-end loopback tests during system power-up, a dual power supply option, and optional NetView Command Processor software.

The **LinkMaster 5300T** supports IBM System/370-compatible block multiplexer channels, allowing high-speed peripherals to be remotely located and accessed through a public or private T3 communications facility. Users can select either of two interface modules: a DS-3 interface for full T3/E3 data rates or a High-Speed Serial Interface (HSSI) supporting both fractional and full T3/E3 data rates. The HSSI interface also allows multiple mainframe channels, LAN bridges, and LAN routers to share line bandwidth through TDM multiplexing.

Features of the 5300T include a channel trace facility, remote diagnostic capabilities, optional dual power supplies, and optional NetView Command Processor software. The 5300T is available in rack-mounted configurations capable of supporting up to four simultaneous full-duplex T3/E3 links. McDATA offers this configuration as the *LinkMaster HSSI Channel Extension System.*

The **LinkMaster CX Controller Extension System** links IBM System/370 hosts to remote 3270 equipment, providing higher throughput than terminal controllers can support. The LinkMaster CX is available in two models: a T1/E1 model, which takes advantage of T1/E1 carrier facilities, and a fiber optic model providing serial 72M bps data rates over a maximum distance of six miles. Both models provide standard bus and tag support, remote diagnostics capabilities, optional dual power supplies, a channel trace utility, and optional NetView Command Processor software.

Network Systems Corp. (NSC)

NSC's **Remote Device System** includes the 9360 EnterpriseChannel Fiber Extender, the 9520 EnterpriseChannel Extender family, and the 7200 Host and 7250 Device Controllers.

The 9360 EnterpriseChannel Fiber Extender is available in models supporting distances up to 1.5 miles or 3 miles using multimode fiber, as well as versions supporting distances up to 6 miles or 25 miles using single-mode fiber. The 9360 attaches to the mainframe using standard bus and tag cables and provides full-duplex throughput at data rates up to 50M bps. Peripherals supported include high-speed printers and plotters, terminal controllers, tape drives, and front-end processors.

The 9360 is software upgradable via a plug-in ROM card. It provides automatic diagnostics, centralized network management with a direct interface to NetView, and dual power supplies.

The 9520 EnterpriseChannel Extender links any IBM System/370-compatible mainframe's block multiplexer channel to a remote device at data rates from 56K to 2.048M bps over fractional or full T1/E1 carrier facilities. Communications between the local and remote 9520 units use a subset of the standard HDLC protocol for error detection and correction. Like the 9360, the 9530 provides automatic diagnostics and an interface to NetView.

The *7200 Series* of host controllers and the *7250 Series* of device controllers support multiple communications links over T1/E1 or T3/E3 carrier facilities, as well as transmission over coaxial or fiber optic (including FDDI) media at data rates from 50M bps to 100M bps. The host controller resides at the host end of the network. It supports the System/370/FIPS channel protocol and presents itself to the host as a control unit. The device controller interfaces with IBM/FIPS or compatible peripherals at the remote end of the network. In addition to tape systems, terminals, communications processors, and printers, the controllers support solidstate DASD and disk arrays.

RDS software manages the logical data paths for all traffic on the 7200/7250 network. While NSC offers a version of RDS that runs on the controllers, the vendor has chosen a host-based software implementation as its primary product offering. NSC claims that its host-based software provides higher performance than competing high-end solutions that run the communications software in the channel extender. With RDS running in the host, all information is packaged in a single envelope and transmitted in one step through the network. This scheme reduces the number of steps required to transmit the data, enabling more efficient use of the host channel (and the high-speed communications link). RDS software automatically reroutes traffic to alternate paths in the event that a primary path fails, and it provides load sharing across multiple communications lines. Multiple hops from one computer center to another are possible, reducing the need for extremely long carrier lines. Statistics for capacity planning and a direct interface to NetView are other software features.

Future Directions

Channel extension products have evolved far beyond simple point-to-point solutions. Newer products are designed to provide multiple users, located virtually anywhere, with shared access to mainframe resources. With T3/E3 carrier facilities more readily available, users can obtain speeds of 45M bps for a single mainframe link. Using TDM multiplexing, users can support multiple devices through a high-speed network facility.

With features such as automatic load balancing and dynamic bandwidth allocation, channel extenders can maximize the use of a limited number of communications lines. Fault tolerance is ensured through an alternate routing capability, which provides automatic switchover to a backup line or a backup mainframe in the event of a network or computer failure.

Although channel extenders offer a viable alternative to FEPs for high-speed communications, they still have their limitations. They cannot handle gateway functions or sophisticated switching. FEPs and terminal controllers, on the other hand, are well suited to linking multiple, incompatible hosts, LANs, and terminals. For the same reason, channel extenders cannot replace LAN bridges and routers. Still, users can overcome some of these switching limitations by configuring channel extenders with separately targeted channels to feed more than one host.

T3 carrier facilities, providing a throughput of 45M bps, are currently available for channel extension applications. In the future, users may wish to extend the CPU bus—not just the channel—putting the process somewhere in the range of 150M bps. Some are looking at bundled T3 lines to extend the bus. This trend is consistent with the FDDI and MAN activities being discussed and implemented in the industry.

Better than bundled DS3s, however, is the promise of broadband ISDN, which will extend bandwidth to 600M bps. During the summer of 1988, the Consultative Committee on International Telephony and Telegraphy (CCITT) approved the draft standard for broadband ISDN, I.121. This draft standard is consistent with the Synchronous Optical Network (SONET) bandwidth concept, which provides a modern digital transmission hierarchy built on approximately 50M bps multiples.

Vendors will continue to increase channel extension options and reduce the prices of their products. Support for multivendor networking, fault tolerance, and LAN connectivity are examples of key features that will be emphasized by vendors in the months to come.

Technology Basics

Channel Extender Equipment

A channel extender is a communications controller that attaches to a host's channel, providing one or more links to remote devices or host computers. Many high-end channel

extenders offer a modular architecture, enabling them to support several independent point-to-point links concurrently. Some products can use telecommunications facilities for virtually unlimited distances; others interconnect computing environments within only a few miles.

A channel extender is required at both ends of each communications link. The two extenders are transparent, except for a possible reduction in throughput due to limitations of the communications link. Many products require no changes to host software.

A channel extender performs the following functions:

- Emulation of the remote device or host, making the locally attached system believe that the remote system is only a few feet away; channel extenders typically emulate front-end processors, data storage systems such as tape or DASD, and high-speed printers.
- Conversion between the host's parallel data format, which implements the channel block or byte multiplex protocol, and the serial data format used over the high-speed link; the channel extender also provides an interface to a high-speed communications link such as a T1 or T3 public carrier facility, a fiber optic line, or a coaxial line.
- Data buffering for instances in which the remote device cannot receive the transmission immediately.
- In some cases, conversion between incompatible computer systems such as those of Digital and IBM; Digital host computers cannot easily emulate an IBM channel directly; it is possible, however, to achieve the equivalent of channel-to-channel communication through a channel extender.

Emulation enables the channel extender to exchange data with the host exactly as a locally attached front-end processor, peripheral device, or mainframe would. Once the extender has received one or more blocks of data from its locally attached host, it can return a confirmation that the data has been received at the destination—even if the remote system has not fully received the information. Although device emulation isolates the host from throughput limitations and network traffic delays, it can cause difficulties in the event of a communications link failure. In such a situation, the host would not be aware of the fact that some or all of the information never reached the intended destination. Automatic switchover to a backup communications link, a feature available in many channel extension products, can safeguard against this potential problem.

Related Equipment

Related equipment includes channel extender matrices, often available from channel extender manufacturers, which offer highly sophisticated channel switching functions. These products might incorporate channel extension functionality, or they may be used with channel extension equipment in some applications.

Channel extender matrices should not be confused with electronic digital matrix switches that interconnect mainframe digital ports on the FEP to the digital side of a bank of modems. These systems provide automated intermediate electronic patching functions.

Channel extender matrices are targeted for very large corporations that need to transfer data between a complex of mainframes. They come in static and dynamic switching versions. A static switch eliminates the need to disconnect and reconnect cables. It can be used to switch to a spare FEP, for example, when the primary FEP needs repair. A dynamic channel switch provides mainframe-to-mainframe internetworking. Examples of channel extender matrices are IBM's 3088 Multisystem Channel Communication Unit and Data Switch Corp.'s Model 3600 Multiarchitecture Director.

Channels, Buses, and Networks

A computer system consists of a number of distinct components, including mainframes, storage devices, communications processors, printers, and terminals. These components share and exchange information consisting of either instructions or data. This process requires a physical means of transferring the information and a mutually accepted set of rules for the transfer. The combination of protocols and a physical medium for electrical signals constitutes a data path.

A host's two key data paths are the bus and the channel. The bus normally interconnects computer components such as the central processing unit (CPU), the arithmetic and logical unit (ALU), main memory, cache memory, and the I/O processor. The channel normally connects the computer with external peripherals, such as disk and tape drives, printers, and communications devices. Typically, the bus speed is higher than the channel speed (500M bps and 36M bps, respectively). In some computer systems, the bus and the channel are the same.

Buses, channels, LANs, metropolitan area networks (MANs), and wide area networks (WANs) are all components of the continuum of technology used to interconnect computers and computing equipment over a wide range of distances and speeds. Buses generally connect hardware cards and submodules to form a computer system, while LANs, channels, and WANs interconnect systems. The distinction between buses, channels, and LANs, however, is becoming more blurred as time goes on. For example, several modern, high-performance buses include features for passing blocks of data between devices, a process that resembles a form of message passing.

Network Topologies

Channel extension occurs in two ways: through a point-to-point or point-to-multipoint architecture, or over high-speed LANs. In the first approach, shown in Figure 1, each remote system has its own point-to-point facility connecting it to the IBM host.

In the backbone LAN approach, shown in Figure 2, each processor in a given location connects to a high-capacity LAN through channel adapters. The LAN is then connected to other LANs supporting hosts, peripherals, or servers at other locations. The LAN approach offers a high degree of flexibility for interconnecting many peripherals with various hosts and providing host-to-host interconnections. Applications and processors can also share the T1 or T3 transmission facilities required by these networks.

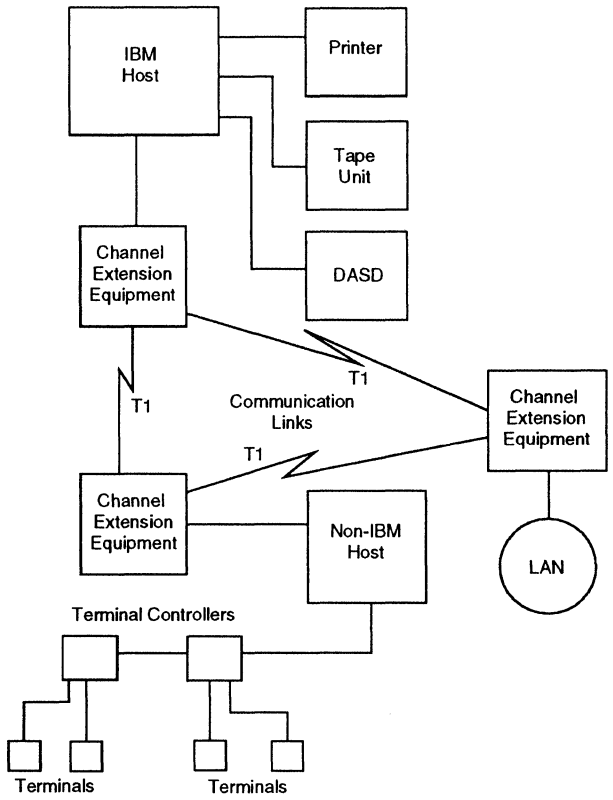
The LAN approach has certain drawbacks, despite its greater level of interconnectivity. These disadvantages include costs higher than straight point-to-point solutions and increased management complexity.

For a more complete understanding of the environment in which channel extenders operate, it is necessary to review the IBM channel attachment process.

Channel Attachment

Channel attachment is an IBM term for communications between the host processor and other devices. An IBM interface, known as a channel adapter on the host end and a

Figure 1.
A Multipoint Channel Extension Network Linking Dissimilar Hosts and a LAN



device adapter on the peripheral end, implements channel attachment. The two adapters connect via the bus and tag cable, a large, round cable (about one inch) with paddle-shaped connectors on the ends. Signal degradation and protocol requirements impose distance limitations on these connections.

Although direct channel attachment sounds simple, such an interface might require extensive reprogramming, particularly for a network of diverse hosts. This situation could involve modifying the operating system and/or the communications access method software, such as VTAM. Such programming can be difficult and, at times, risky. The host vendor may also object to these modifications and may require that the user back out all changes before modifications or troubleshooting can be performed.

Traditional IBM System/370 Channels

The IBM System/370 channel is a parallel facility carrying eight information bits and one control bit. The channel typically operates at 3MB per second (3M bps connections for each of the 8 bits of the byte) with a serial data rate of 24M bps (27M bps if one includes the control bit). The actual bus has 32 cable conductors, which handle the I/O in arrays of 32-bit words. Remote channel extender devices take the 32 concurrent inputs and align them in a serial stream for transmission.

IBM System/370 computers have used a number of channel types to communicate with the outside world: byte multiplexer channel, selector channel, and block multiplexer channel.

Byte Multiplexer Channel. This channel transfers bytes interleaved between storage and several I/O devices (byte mode) or transfers a byte string to one device (burst mode). The channel consists of a number of subchannels, each of which can control one device and has one unit control word (UCW) implemented in control storage. Microprogram controlled, the channel has only one active UCW. During multiplex mode operation, subchannel UCWs are fetched into the active UCW, updated, and returned to control storage. In some implementations, all storage access for byte multiplexer channel operation interferes with processor operation.

The byte multiplexer channel connects to a number of slow- and medium-speed devices and can operate with a number of I/O devices simultaneously. The computer system can have a number of channels, each assigned an address. Similarly, each channel can connect to several devices, and each device is assigned an address.

In byte multiplexer operations, channels can function in byte multiplex or burst modes. In byte multiplex mode, several relatively slow-speed I/O devices can operate concurrently. Each byte multiplexer can operate with an aggregate data rate in the range of 90KB per second to 300KB per second for data transfer burst sizes of four bytes or more. Configurations consisting of control units with faster I/O interface tags and larger data transfer burst sizes can achieve the higher performance level.

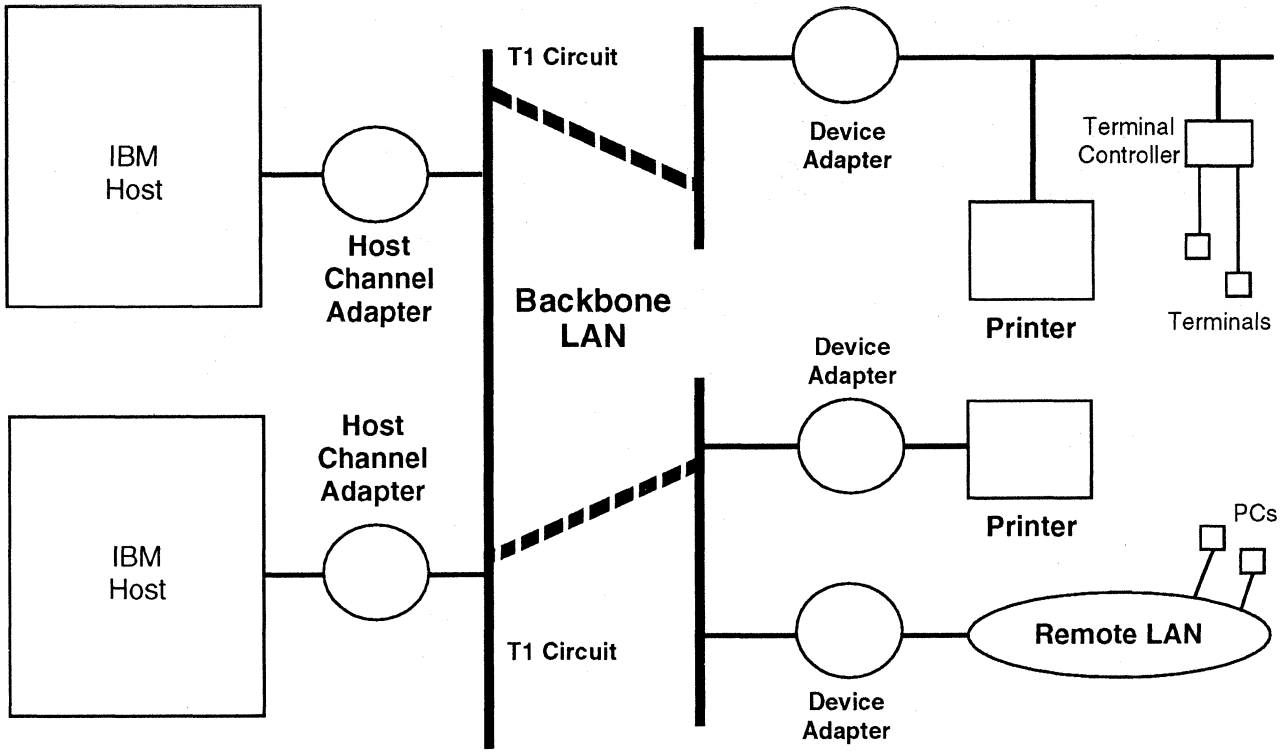
Selector Channel. Designed for devices with high data transfer rates, selector channels operate only one device at a time in the burst mode. These channels are typically implemented in circuit registers and by microprogram routines. They are faster than byte multiplexer channels because operating data remains in the operating register during the entire operation. Older systems increased the speed of the selector channel through the word buffer feature, which placed a four-byte buffer in the data path between a channel and storage, thus reducing by 75% the number of storage access cycles required for an I/O data transfer.

Block Multiplexer Channel. By interleaving blocks of data, this type of channel allows concurrent operation of several burst-mode devices on the channel's single data path. The block multiplexer channel combines the features of the byte multiplexer and selector channels. It provides a connection to a number of high-speed devices, but all I/O operations transfer an entire block of data, unlike a byte multiplexer channel that transfers only one byte at a time. In block multiplex operation, channels can operate in high-speed transfer mode or in datastreaming mode. In datastreaming mode, a block multiplex channel can transfer at a rate up to 3MB per second.

Like the selector channel, the block multiplexer channel has a high data rate and operates only one device at a time. It can, however, have several active channel programs. Devices using block multiplexer operation logically disconnect from the channel when not prepared for data transfer; they reconnect via the interrupt system when the channel is no longer busy transferring data to another device. Channel extenders usually support the block multiplexer data transfer protocol.

In a large host processor setup, processors in a multimodule complex communicate with one another over channel connections under a block-oriented protocol. These connections are referred to as *block channel attachments.* Datastreaming supports data transfer rates up to 4.5MB

Figure 2.
Channel Extension Using a LAN Configuration



per second on block multiplexer channels. All printers, terminal controllers, and disk and tape controllers co-located with the data center connect with the processors via channel attachments.

Newer Systems

Even newer mainframe systems, using a separate processor to handle I/O, still use channels to communicate with the outside world. Modern computers have integrated I/O channels, normally within an I/O processor, that contain and control channels. Users can configure the channels for byte or block multiplexer operation.

The IBM 3090, for example, employs a Channel Subsystem (CSS) to handle all I/O operations for the CPU. The CSS controls communications between a configured channel, control unit, and device. The I/O Configuration Data Set (IOCDS), selected at system initialization, identifies channels, control units, and device configurations to the channel subsystem. The I/O Configuration Program creates the IOCDS, which is stored on disk drives attached to the processor controller. During initialization, the IOCDS information builds necessary control blocks in the hardware system area of central storage. In addition, the CSS contains a channel control element, which interacts with central storage, the central processors, and the channels. In operation, the channel control element initiates and ends channel operations, provides central storage access control, and sets priorities for I/O operations.

Channel extension units are increasingly becoming small programmed processors. Unisys A, B, and V systems, for example, use microprogrammed data link processors.

Selection Guidelines

Since users have many options to consider when choosing channel extension products, asking these key questions can be helpful.

- Does the product meet the user's throughput requirements? Where there is a time-critical element to the data flow, such as in engineering and scientific environments, one should look for a high-speed interface of at least 3MB-per-second transmission in a datastreaming mode.
- What range of communications media and public carrier services is supported?
- For point-to-multipoint networking products, can multiple devices or hosts share the bandwidth available on a single communications line? Is dynamic bandwidth allocation offered?
- What range of hosts and peripheral devices is supported? Does the system accommodate LAN connections? Support for multiple device types avoids the expense and performance inefficiency of multiple layers of protocol conversion software on the mainframe, and it reduces development time for application-specific solutions.
- Does the product require modifications to existing host software?
- Does it provide integration with existing network management systems such as IBM's NetView or Systems Center Net/Master?
- For fault-tolerant networking, are features such as alternate path rerouting, automatic switchover to a backup host, and redundant power supplies offered?

When evaluating potential vendors, users should check for vendor-sponsored development facilities. Where such resources exist, users can speak to technically knowledgeable personnel who can help with testing implementations and provide application development. Another criterion is vendor experience in providing mainframe-related products and support.

Vendors

The following list includes the names, addresses, and phone numbers of vendors that participate in the channel extender market.

AT&T Paradyne
8545 126th Avenue North
Largo, FL 34649-2826 (800) 482-3333

Beall Technologies, Inc.
9103 Third Avenue
North Bergen, NJ 07047-5299 (201) 854-3562

Computer Network Technology Corp.
6500 Wedgwood Road
Maple Grove, MN 55369 (612) 550-1500

Computerm Corp.
111 Wood Street
Pittsburgh, PA 15222 (412) 394-1091

Data Switch Corp.
One Enterprise Drive
Shelton, CT 06484 (203) 926-1801

IBM Corp.
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

McDATA Corp.
310 Interlocken Parkway
Broomfield, CO 80021 (303) 460-9200

Network Systems Corp.
7600 Boone Avenue North
Minneapolis, MN 55428 (612) 424-4888 ■

An Overview of Channel Extenders

In this report:

Synopsis

Editor's Note
Channel attachment minimizes the processing time required for communications between users and applications. The technology allows bypass of the front-end processor (FEP) and attachment directly to a mainframe channel, thus offering significant cost savings for the creation of high-speed links to local area networks (LANs) or other mainframes.

Report Highlights
As more corporations disperse their operations, channel extension networking becomes a vital link in private, corporate networks. Channel networking offers organizations a cost-effective way to give more users access to existing mainframes and high-powered peripherals.

This report discusses channel extension technology and applications. It includes information on the purpose and types of mainframe channels, channel extender features, and typical applications. It also lists key considerations for users to keep in mind when choosing a system. Future trends are also presented.

To round out the subject, the report includes an explanation of related equipment, which includes channel extender matrices. These devices perform sophisticated channel switching functions, supporting multiplex connections in a switching arrangement.

The report includes current summaries of channel extension products from leading vendors, such as AT&T Paradyne's Pixnet/XL Series, Computer Network Technology's CHANNELink Series, Computerm's 3800/3890 System, Data Switch's ChannelNet Series, IBM's 3044 and 3088, McDATA's LinkMaster Series, and Network Systems Corp.'s Remote Device Systems (RDS).

—By Barbara Rinehart
Associate Editor/Analyst

Analysis

Datapro Opinion

Although channel extenders constitute only a small segment of the data communications market, Datapro believes they are valuable assets to many types of installations. One of the key reasons users install channel extenders is to minimize the risks by relocating peripherals away from the mainframe computer. Thus, channel extenders have been used extensively for "hot" Disaster Recovery sites to download backup databases.

Even though the initial cost of channel extenders may seem costly, savings can be made by the reduction in the number of hosts supported, need for systems operators at each of the remote sites, and the savings of the cost of license fees for duplicating software. With so many data centers consolidating, the channel extender vendors are not feeling the crunch as other environments are. What the products need, however, is less proprietary architectures and more open units and interfaces.

Channel Extension

Channel extenders facilitate distributed processing by extending the mainframe's channel geographically, thereby supporting the remote location of high-speed peripherals. Speed-preserving extenders can stretch the channel to about 6,000 feet; other extenders, with a speed-reduction link such as DS1/T1, can extend the channel over thousands of miles. The technology is not new. In the mid-1970s, vendors offered systems that extended the channels of remote mainframes over high-speed circuits. Recently, interest in the technology has increased because organizations are dispersing their networks, and many new products address the problem.

Remote channel extension serves four basic purposes:

- connecting remote host processors in a high-speed network;
- connecting remote terminals requiring subsecond response time;
- connecting remote high-speed printers; and
- connecting remote tape or disk drive units for disaster recovery applications.

Channels, Buses, and Networks

A computer system consists of a number of distinct components: processors, memories, and peripherals. These components share and exchange information consisting of either instructions or data. This process requires a physical means of transferring the information and a mutually accepted set of rules for the transfers. The combination of protocols and physical medium for electrical signals constitutes a data path.

A computer's two key data paths are the bus and the channel. The bus normally interconnects computer components, such as the central processing unit (CPU), the arithmetic and logical unit (ALU), main memory, cache memory, and the I/O processor. The channel normally connects the computer with external peripherals, such as disk and tape drives, printers, and communication devices. Typically, the bus speed is higher than the channel speed (500M bps and 36M bps, respectively). In some computer systems, the bus and the channel are the same.

Buses, channels, LANs, metropolitan area networks (MANs), and wide area networks (WANs) are all components of the continuum of technology used to interconnect computers and computing equipment over a wide range of distances and speeds. Each of these technologies has a characteristic, but not rigidly defined, set of features, as shown in Table 1. Buses generally connect hardware cards and submodules to form a computer system, while LANs, channels, and WANs interconnect systems. The distinction between buses, channels, and LANs, however, is becoming more blurred as time goes on. For example, several modern, high-performance buses include features for passing blocks of data between devices, a process that resembles a form of message passing.

Large corporations are expanding mainframe I/O channels to prepare for the avalanche of I/O activities expected to accompany the emergence of new data-intensive business applications. Mainly,

connectivity used to mean the interconnection of dumb terminals and host processors. Although PCs have proliferated, the mainframe continues to be the central resource for a company's database, programs, and utilities. The host provides the processing power for sorting the data and preparing individualized reports. In addition, mainframe connection allows multiple workstations to simultaneously run the same complex application program and accomplish tasks cooperatively with it.

Traditionally, users achieve the mainframe connection by linking the mainframe's I/O channel through a FEP and related access software. These links connect terminals, remote peripherals, and remote mainframes to the central mainframe at relatively low data rates. Connection through the FEP allows remote users to move screen images of data interactively; file transfers, however, are not efficient. Dumb terminals receive only single screens of data at one time. The increased use of PCs, particularly those operating in a peer-to-peer environment (such as in an LU6.2 configuration), has created the need to move data files much more frequently and efficiently.

It takes over 12 minutes to transmit a 1M-byte file over a 56K bps Digital Data Service (DDS) link between a PC and the mainframe. This delay is due partially to the transmission speed of the line. Higher speed facilities, such as T1 (1.554M bps), are becoming increasingly available. But the delay may also occur because data is being sent to the PC in a 3270-emulation mode rather than in some form of sophisticated file transfer protocol. Bottlenecks interjected by the FEP also cause delays.

Channel extenders solve many of the problems inherent in the typical mainframe link through a FEP. They provide host-to-host, high-volume data transfers at high speeds, allowing users to access many different hosts as if they were a single host. Channel extenders also support the remote location of peripherals, such as high-speed laser printers, storage devices, tape units, and FEPs.

Glossary of Terms

Block multiplexer channel—a multiplexer channel that interleaves blocks of data. Contrasts with selector channel.

Bus—a circuit over which data or power is transmitted. Often one which acts as a common connection among a number of locations.

Byte multiplexer channel—a multiplexer channel that interleaves bytes of data. Contrasts with selector channel.

Channel—path for transmission of signals between two or more points. Also called circuit, line link, path, or facility.

Channel Adapter—a device that permits the connection between data channels of differing equipment. The device allows data transfer at the rate of the slower channel.

Channel Extender—communication controllers that attach to a host's channel and communicate with another host, channel-to-channel, over great distances. Channel extenders operate in pairs—one at each end of the communication link.

Fiber Distributed Data Interface (FDDI)—a LAN standard specifying a LAN-to-LAN backbone for transmitting at 100M bps speeds over fiber optic media.

High-Level Data Link Control (HDLC)—a bit-oriented communication protocol developed by the ISO.

Multipoint-to-Multipoint (dynamic) Channel Extender Matrix—a dynamic channel switch that provides mainframe-to-mainframe internetworking.

Point-to-Point (static) Channel Matrix—switches that connect the IBM channel to a number of possible devices. They are typically small and generally use mechanical crosspoint technology, though some solidstate products exist.

Selector Channel—used where high-speed devices are to be attached to a system. A single channel can operate only one I/O device at a time.

Connectivity Challenges

Traditionally, co-located IBM computers communicate with one another via a channel-to-channel adapter (CTCA). According to standard specifications, the connection between mainframe and control unit (or other peripherals) is a bus and tag cable that limits distance to 200 feet. In some situations, this limitation is 400 feet.

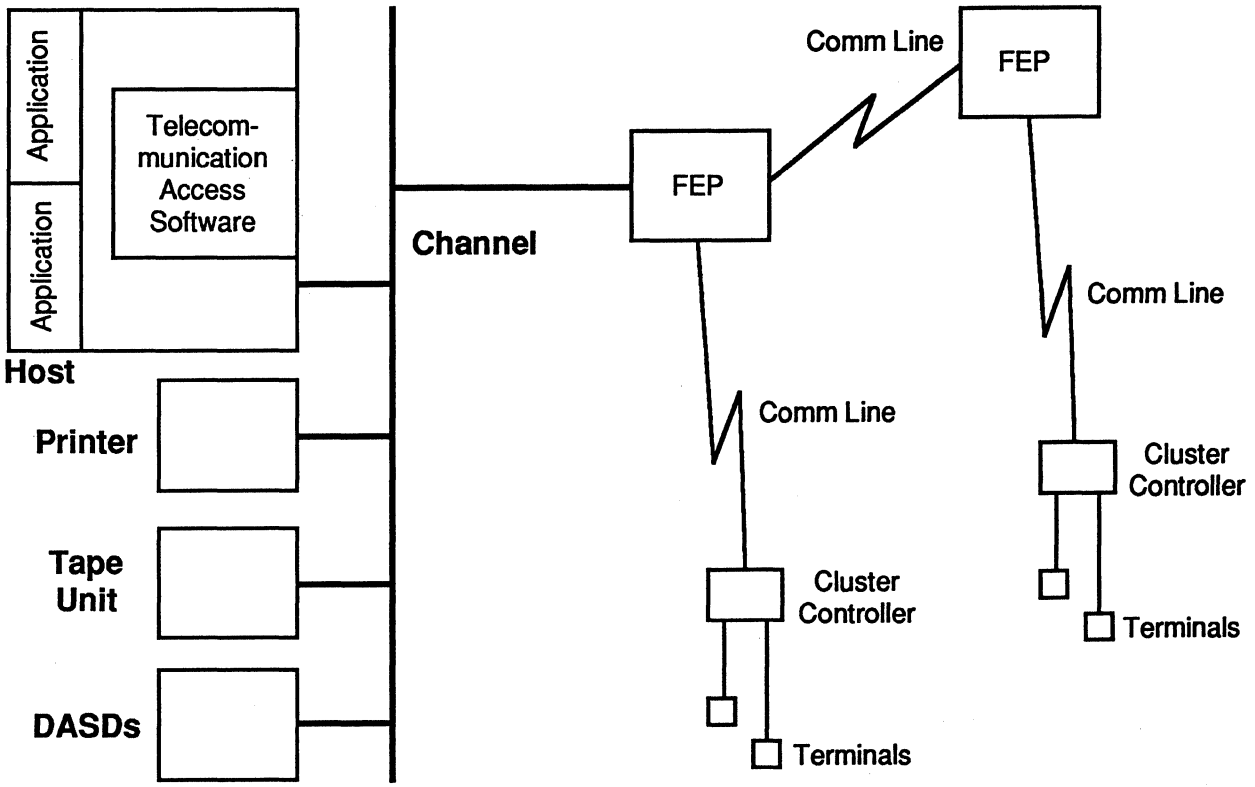
Table 1. Comparison between Channels and Other Computer Networks

Feature	Bus	Channel	LAN	MAN/WAN
Distance Covered	A few tens of feet in a backplane or among cabinets	200 feet within a building	A few miles within a building or campus	Hundreds or thousands of miles
Type of Devices Interconnected	Parts of a computer system	Peripherals of a computer	Computer systems, servers, workstations	Computer systems and terminals
Address Granularity	Fine (a memory location)	Fine (peripherals)	Coarse (different computers and terminals)	Coarse (different computers and terminals)
Data Rate	High (10M to 500M bps)	High (24M to 36M bps)	Medium (1M to 100M bps)	Low (1K to 1.5M bps)
Ownership of Facility	Private	Private, but may also employ carriers' links	Private, but may also employ carriers' links	Typically carrier based
Cable	10 to 100 wires, parallel transmission	10 to 30 wires, parallel transmission	1 channel, serial transmission	1 channel, serial transmission
Topology	Bus	Bus	Bus, ring, star, tree	Star, mesh
Error Rate of Cable	Very low	Low	Medium (depends on communications medium used)	Higher
Error Detection	Usually not implemented	Implemented by channel-extender hardware	Always implemented	Always implemented
Device Relationship	Hierarchical	Hierarchical	Peer-to-peer	Master-slave and peer-to-peer
Response Time	Media inherent	Very low, 10-30 milliseconds	1-3 seconds	1-10 seconds
Data Unit	Word	Byte	Message or file	Message or file

Off-site telecommunications have traditionally taken place via FEPs, also called communication processors. Examples of these include Amdahl's 4745, NCR's 56XX Series, and the IBM 3745/3746. The IBM 3745 employs cache memory, datastreaming in channel adapters, and direct memory access; it can accommodate up to 16 T1 lines, 512 data communications lines with speeds up to 256K bps, and eight token-ring networks operating at 4M bps. FEP connections are optimized for transaction processing through terminals. In spite of its impressive array of features, however, the 3745 is still relatively slow for some applications. In today's computing environment, a broader set of communications requirements has emerged; in particular, diverse computer networks and peripherals require connection in a more symmetrical, peer-to-peer manner.

Figure 1 depicts the traditional IBM teleprocessing environment in which FEPs mediate access between terminal cluster controllers and the host. Communication links operating at 9600 bps have been standard, with some use of DDS at 56K bps. Until recently, the maximum data rate between

Figure 1.
A Traditional Teleprocessing Environment



two FEPs was 256K bps. Such speeds are becoming inadequate for today's business applications. Also, the additional software required by these processors—Network Control Program, Network Packet Switched Interface, and other native and emulation software—also increases the total transmission delay. That added delay can make subsecond response time on terminals unachievable.

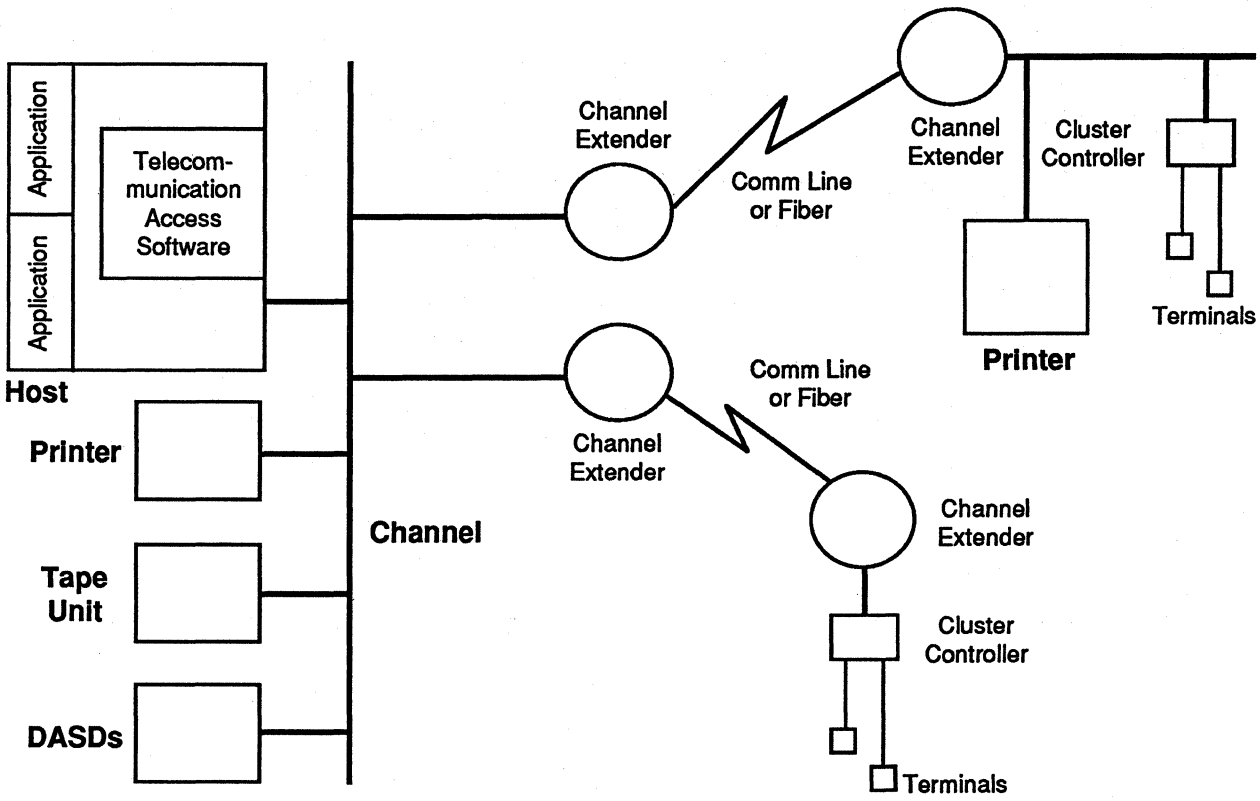
Today, LANs connected to the mainframe provide a more efficient way to interconnect a local population of peer-to-peer PCs and/or 3270-emulation PCs. In many new installations, LANs are replacing traditional cluster controllers, eliminating the cabling constraints of the older technology. LANs operate at speeds ranging from 1M to 100M bps for new backbone products, including FDDI. The mainframe link must accommodate these higher LAN transmission speeds.

Recognizing the growing need to make the mainframe easier to access as a node on a network, IBM now offers built-in connectivity on its 9370 computers. The 9370's integrated communication controllers enhance LAN-to-mainframe connectivity by opening the latest IBM mainframe architecture to a broad range of users. The built-in controllers interface directly to LANs and other computers without going through FEPs. These built-in connectivity devices are not available, however, for the entire family of IBM computers. Channel extenders can connect devices beyond the 200-foot limit. DS1/T1 circuits over copper, fiber, or microwave provide the links to remote peripherals.

As noted earlier, channel extenders allow host processors to pass information directly to each other on a channel-to-channel basis and permit remote terminal devices to attach directly to a host computer channel, bypassing the communication processor. For a number of years, FEPs have connected the mainframe to a DS1/T1 facility. FEPs, however, do not use the DS1 link efficiently.

In 1987, a new crop of FEPs emerged, all aimed at increasing back-end throughput while interfacing with new higher rate communications lines and LANs at the front end. Vendors are pushing the DS1/T1 interfaces, but the FEPs may not

Figure 2.
Typical Point-to-Point Channel Extender Usage



have the power to handle data in the 3M bps range and still provide reasonable performance. Even if the processor handles T1 or T3/DS3 rates (45M bps) effectively, the communications protocol typically does not. Common protocols handle low to medium speeds—up to 56K bps or at best 256K bps—and are not efficient at higher speeds. Users with applications requiring high data rates (large file transfers, high-resolution graphics, CAD/CAM, and so on) may need to bypass the FEP and achieve direct host-channel communication. This is the type of situation for the channel extender.

Applications

Channel extenders perform two types of applications: local area extension, typically in a multibuilding or campus environment, and wide area extension, across town or across country. Applications of the technology are summarized in Table 2.

Users install channel extenders to minimize the risks of relocating peripherals away from the mainframe computer. Thus, channel extenders have been used extensively for "hot" disaster recovery sites to download backup databases. To many financial services companies, such as banks and brokerage firms, any downtime or loss of data can cause serious problems. With a remote host or storage device at a separate site, the potential disaster that could result from a host failure is minimized.

Economics also plays an important part in the choice of channel extenders. A user can maintain the same quality of service at a remote location as at the mainframe location. This arrangement is particularly attractive for users relocating a city data center to a suburban location. Since real estate costs are soaring in many cities, many companies are moving their data centers to lower cost facilities. A number of New York banks have built data centers in New Jersey. Through channel extenders, terminals in New York accessing a host in New Jersey appear to be making a local connection.

Table 2. Applications of Channel Extender Technology

Application	Explanation
Distributed Data Processing	Different portions of the data can reside in different hosts' disk drives, spread throughout the country. With channel extenders and DS1/T1 links, all hosts have quick access to all the information.
Instantaneous Data Backup	Large amounts of data can be dumped in realtime to a secure location mirroring all operations, eliminating the need to generate, manage, and ship tapes—labor-intensive activities. This also eliminates the current bottlenecks of occasional dumps of small selected data sets over slow communications lines.
Dual Center Transaction Processing	With appropriate programming, each transaction can be maintained in two or more hosts for fully mirrored operation with negligible delays.
Unmarked Data Center (for security)	All the primary mainframe equipment is placed in a remote, secure, and unmarked facility. DS1/T1 or fiber channel extenders connect remote users. Minimum personnel are needed.
LAN Integration	Channel-to-channel attachment offers the possibility of using computers as true servers, while at the same time retaining the hierarchical control within the system.

Topologies

Channel extension occurs in two ways: through a simple point-to-point architecture or on a high-speed backbone LAN. In the first approach, shown in Figure 2, each remote device (host, printer, cluster controller) has its own point-to-point facility connecting it to a host channel. Each host channel connects to a channel adapter that communicates with the device adapter at the remote end.

In the backbone LAN approach, shown in Figure 3, each processor in a location connects to a high-capacity LAN through channel adapters. The LAN is then connected to other LANs supporting hosts, peripherals, or servers at other locations. The LAN approach offers a high degree of flexibility for interconnecting many peripherals with various hosts and providing host-to-host interconnections. Applications and processors can also share the DS1/T1 transmission facilities required by these networks.

The LAN approach has certain drawbacks, despite its greater level of interconnectivity. These disadvantages include costs higher than a straight point-to-point solution and increased management complexity.

IBM Channel Attachment

For a more complete understanding of the environment in which channel extenders operate, it is necessary to review the IBM channel attachment process.

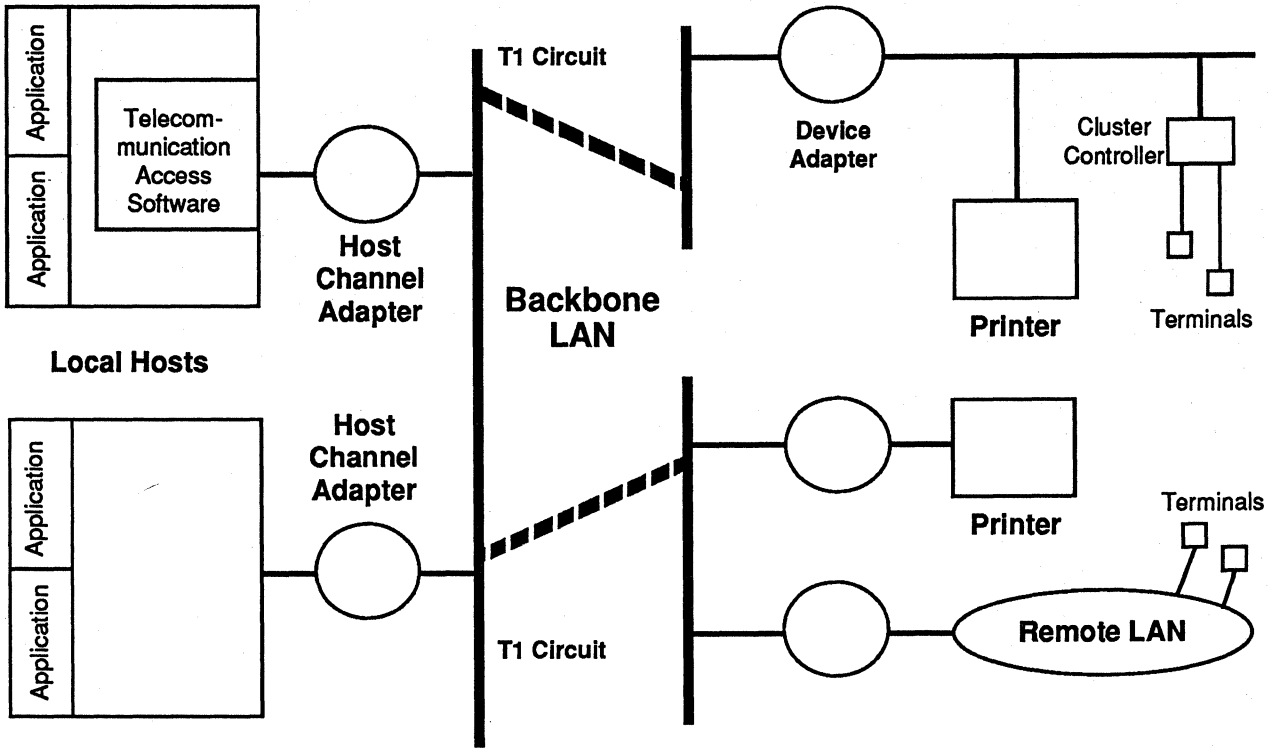
Channel attachment is an IBM term for communications between the host processor and other devices. An IBM interface, known as a channel adapter on the processor end and a device adapter on the peripheral end, implements channel attachment. The two adapters connect via the bus and tag cable, a large, round cable (about one inch) with paddle-shaped connectors on the ends. Signal degradation and protocol requirements impose distance limitations on these connections.

Although direct channel attachment sounds simple, such an interface might require extensive programming, particularly for a network of diverse hosts. This situation could involve modifying the operating system and/or the communications access method software, such as VTAM. Such programming can be difficult and, at times, risky. The host vendor may also object to these modifications, and may require that the user back out all changes before modifications or troubleshooting can be done.

Types of Channels

Traditional IBM System/370 computers have used a number of channels to communicate with the

Figure 3.
Typical Channel Extender in a LAN Configuration



outside world: byte multiplexer channel, selector channel, and block multiplexer channel.

Byte Multiplexer Channel. This channel transfers bytes interleaved between storage and several I/O devices (byte mode) or transfers a byte string to one device (burst mode). The channel consists of a number of subchannels, each of which can control one device and has one unit control word (UCW) implemented in control storage. Microprogram controlled, the channel has only one active UCW. During multiplex mode operation, subchannel UCWs are fetched into the active UCW, updated, and returned to control storage. In some implementations, all storage access for byte multiplexer channel operation interferes with processor operation.

The byte multiplexer channel connects to a number of slow- and medium-speed devices, and can operate with a number of I/O devices simultaneously. The computer system can have a number of channels, each assigned an address. Similarly, each channel can connect to several devices, and each device is assigned an address.

In byte multiplexer operations, channels can function in byte multiplex or burst modes. In byte multiplex mode, several relatively slow-speed I/O devices can operate concurrently. Each byte multiplexer can operate with an aggregate data rate in the range of 90K bytes per second to 300K bytes per second for data transfer burst sizes of four bytes or more. Configurations consisting of control units with faster I/O interface tags and larger data transfer burst sizes can achieve the higher performance level.

Selector Channel. Designed for devices having high data transfer rates, selector channels operate only one device at a time in the burst mode. These channels are typically implemented in circuit registers and by microprogram routines. They are faster than byte multiplexer channels because operating data remains in the operating register during the entire operation. Older systems increased the speed of the selector channel through the word buffer feature, which placed a four-byte buffer in the data path between a channel and storage, thus reducing by 75% the number of storage access cycles required for an I/O data transfer.

Block Multiplexer Channel. By interleaving blocks of data, this type of channel allows concurrent operation of several burst-mode devices on the channel's single data path. The block multiplexer

channel combines the features of the byte multiplexer and selector channels. It provides a connection to a number of high-speed devices, but all I/O transfers take place with an entire block of data, unlike a byte multiplexer channel that transfers only one byte at a time. In block multiplex operation, channels can operate in high-speed transfer mode or in datastreaming mode. In datastreaming mode, a block multiplex channel can transfer at a rate up to 3M bytes per second.

Like the selector channel, the block multiplexer channel has a high data rate and operates only one device at a time. It can, however, have several active channel programs. Devices using block multiplex operation logically disconnect from the channel when not prepared for data transfer; they reconnect when the channel is no longer busy transferring data to another device via the interrupt system. Channel extenders usually support the block multiplexer data transfer protocol.

In a large host processor setup, processors in a multimodule complex communicate with one another over channel connections under a block-oriented protocol. These connections are referred to as block channel attachments. Datastreaming supports data transfer rates up to 4.5M bytes per second on block multiplexer channels. All printers, terminal controllers, and disk and tape controllers co-located with the data center connect with the processors via channel attachments.

Even newer systems, using a separate processor to handle I/O, still use channels to communicate with the outside world. Modern computers also have integrated I/O channels, normally within an I/O processor, that contain and control channels. Users can configure the channels for byte or block multiplexer operation. Channel extension units are increasingly becoming small programmed processors. For example, the Unisys A, B, and V systems use microprogrammed data link processors.

In the System/370 environment, any channel can be assigned any valid channel address without concern for priority. In the System/370 Extended Architecture environment, up to four channel paths are available to any attached I/O device. During any I/O operation, one of the available channel paths to any specific I/O device is selected as a hardware function rather than a system control function.

The IBM channel is a parallel facility, carrying eight information bits and one control bit. The channel typically operates at 3M bytes per second (3M bps connections for each of the 8 bits of the byte) with a serial data rate of 24M bps (27M bps if one includes the control bit). The actual bus has 32 cable conductors, which handle the I/O in arrays of 32-bit words. Remote channel extender devices take the 32 concurrent inputs and align them in a serial stream for transmission.

The IBM 3090 employs a Channel Subsystem (CSS) to handle all I/O operations for the CPU. The CSS controls communications between a configured channel, control unit, and device. The I/O Configuration Data Set (IOCDS), selected at system initialization, identifies channels, control units, and device configurations to the channel subsystem. The I/O Configuration Program creates the IOCDS, which is stored on disk drives attached to the processor controller. During initialization, the IOCDS information builds necessary control blocks in the hardware system area of central storage. In addition, the CSS contains a channel control element, which interacts with central storage, the central processors, and the channels. In operation, the channel control element initiates and ends channel operations, provides central storage access control, and sets priorities for I/O operations.

Channel Extender Equipment

Channel extenders are communication controllers that attach to a host's channel and communicate with another host, channel to channel, over great distances. Channel extenders operate in pairs—one at each end of the communications link. Each unit emulates the remote computer to its channel-attached host so that the two extenders are transparent, except for some reduction in throughput because of the communication link's limitation of approximately 1.5M bps. An extended pair provides a channel-to-channel connection between two host CPUs with no changes to VTAM or any other host CPU software. Also, the channel extenders must make use of a 1.544M bps terrestrial or satellite link.

Although some products use telecommunications facilities with various degrees of distance limitations, others can connect hosts within only a few miles. A way to evaluate channel extension products is to determine if they interconnect hosts only

Table 3. Comparison of Channel Extenders, Channel Switches, and Electronic Matrix Switches

	Channel Extender	Channel Switch	Electronic Matrix Switch
Location	Channel side	Channel side	FEP side
Speed (per sec.)	3M bytes	3M bytes	9.6K bps
Purpose	Extend channel	Extend and switch channel	Facilitate modem sparing
Size	1 x 1	n x n, n≤16	n x n, n≤256

or allow interconnection of a group of high-speed peripherals (e.g., laser printers). To date, the most popular application has been for host-to-peripheral channel extension.

The high-end channel extender products incorporate microprocessors, memory buffers, and control logic to operate locally and over wide geographic areas. These sophisticated channel extenders can perform a number of communication functions by re-creating the block multiplexed channel of an IBM mainframe. Manufacturers include AT&T Paradyne (Largo, FL), Computer Network Technology (Minneapolis, MN), Computerm (Pittsburgh, PA), Network Systems Corp. (Minneapolis, MN), and NTX Communications Corp. (Sunnyvale, CA).

Channel extension equipment performs the following functions:

- Supports the channel data transfer block or byte multiplex protocol.
- Serializes the parallel data.
- Provides buffering where speed transparency is not maintained.
- Interfaces to the communications link (DS1/T1 or fiber).

The three basic types of channel extenders, each with its specific applications, are fiber optic channel extenders, wide area extenders, and channel/device emulation extenders. These types differ in amount of intelligence within the system, capabilities, and price.

Related Equipment

Related equipment includes channel extender matrices that offer highly sophisticated channel switching functions. While channel extenders offer connections from Point A to Point B, channel extender matrix equipment allows multiplex connections in a switching arrangement. Often available from channel extender manufacturers, these products might incorporate channel extension functionality, or they may be used with channel extension equipment in some applications.

Channel extender matrices should not be confused with electronic digital matrix switches that interconnect mainframe digital ports on the FEP to the digital side of a bank of modems. These systems provide automated intermediate electronic patching functions. The electronic matrix switch differs from the channel switch/extender by operating at FEP data speeds, ranging from 4800 bps to 19.2K bps, while the channel switch operates at the channel speed (i.e., 3M bytes per second and higher). The two types of equipment differ in scope, application, functionality, and technology.

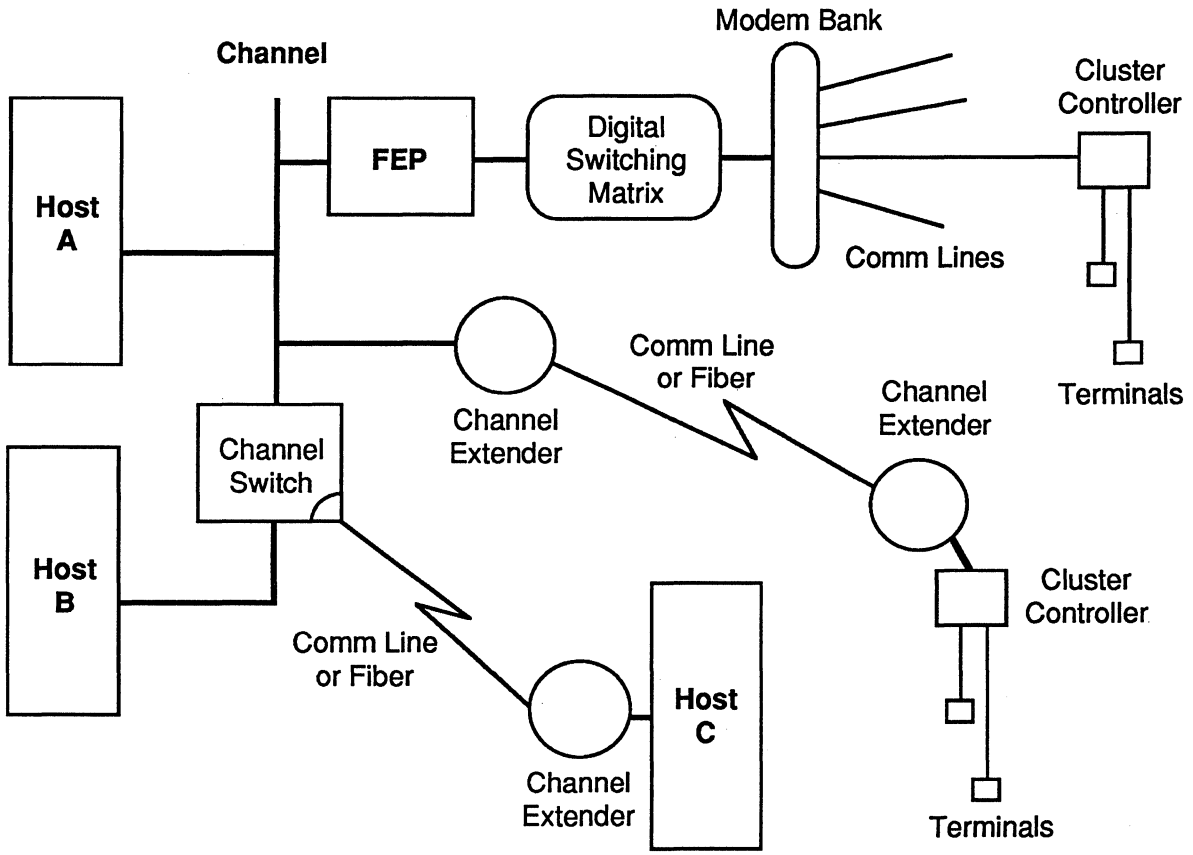
See Table 3 for a comparison of channel extenders, channel switches, and electronic matrix switches. Also see Figure 4, which shows where each type of system resides, relative to the host, in a network.

Channel extender matrices come in either point-to-point or multipont-to-multipoint versions. (See Figure 5 for a graphic illustration of these systems.)

Point-to-Point (static) Channel Matrix. These switches connect the IBM channel to a number of possible devices. They are typically small (2 x 2 or 16 x 16 inches) and generally use mechanical crosspoint technology, though some solidstate products exist. Typical applications involve putting spare FEPs online when one of the same FEPs needs repair. The switch eliminates the need to disconnect and reconnect cables. The equipment operates as a patch panel on the channel side. Some examples are the IBM 3814 Switching Management System and the Data Switch 1200 Intelligent Peripheral Switch.

Multipoint-to-Multipoint (dynamic) Channel Extender Matrix. This dynamic channel switch provides mainframe-to-mainframe internetworking. The mainframes, however, must be relatively near to each other for this technology to apply.

Figure 4.
Component Placement



Placement of channel switches, channel extenders, and digital electronic matrix switching in a computer installation.

Otherwise, channel extenders can be used in conjunction with the switch.

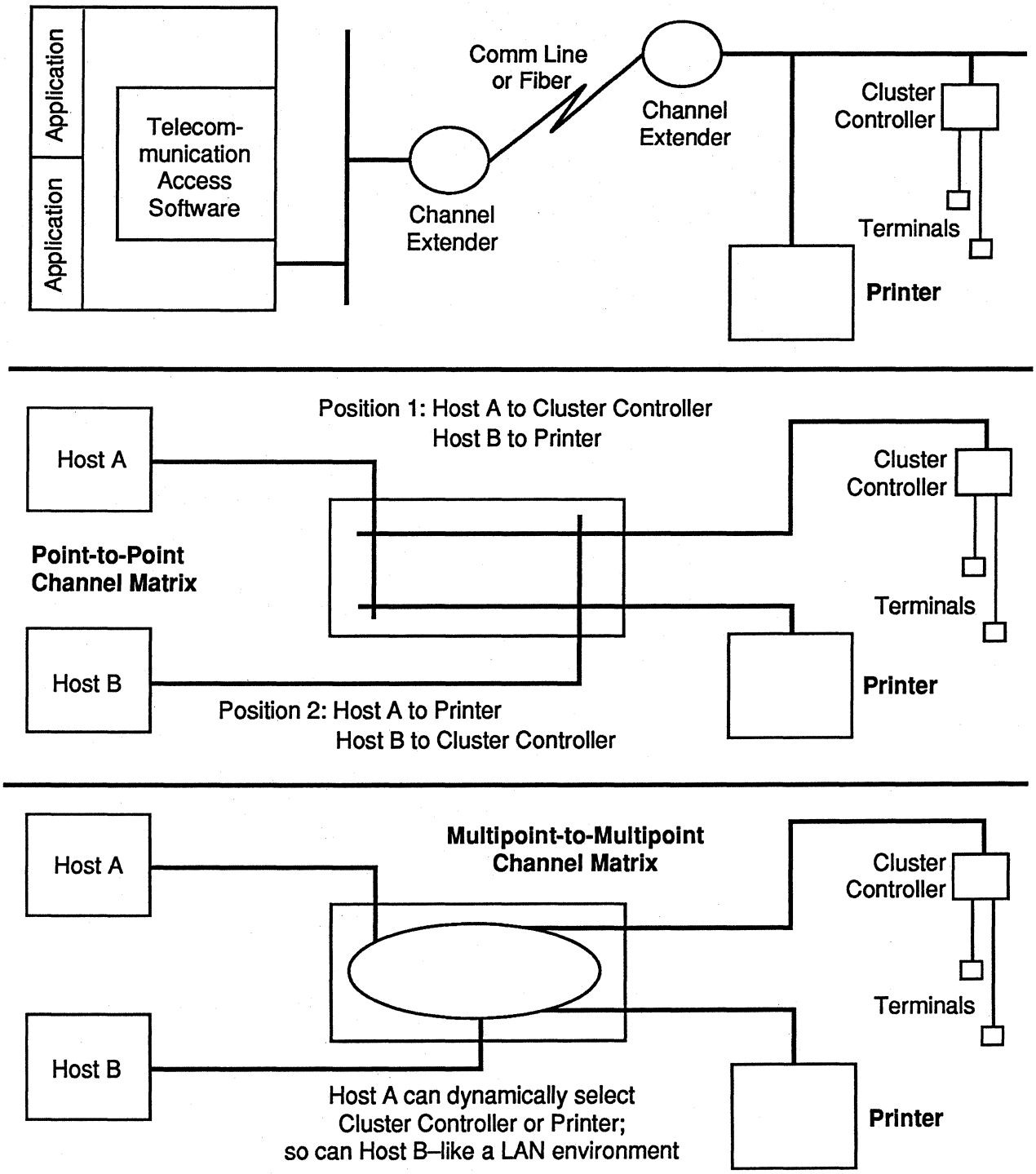
Multipoint channel switches are similar in operation to the LAN version of a channel extender, except that instead of a LAN with a serial bus, the core consists of a parallel bus. Examples of the technology are the IBM 3088 and Data Switch's Model 9088 Multisystem Interconnect Unit (MIU).

Until the introduction of the IBM 3088 in the early '70s, users could directly connect only two mainframes within 50 feet. The 3088 allows the connection of up to eight mainframes within 200 feet. Data Switch's 9088 MIU increased that distance to 800 feet and the number of mainframes to 16. To accommodate the large throughput necessary to handle 16 mainframes, the MIU supports six data buses, sending data in parallel at 3M or 4.5M bytes per second. (IBM's 3088 has only two buses.) The allowable distances between mainframes will grow to about 4,000 feet when IBM adds fiber optic channels to its mainframes. Multipoint channel extender matrices are targeted for very large corporations that need to transfer data between a complex of mainframes. The technology is expensive.

IBM-Digital Equipment Interconnectivity. IBM and Digital Equipment computers can also be interconnected. As already discussed, the IBM parallel connection port is a channel, combining a processor and a parallel port; the processor executes programs and can transfer data from the memory of the host computer to the device attached to the channel without involving the CPU.

Digital systems cannot easily emulate an IBM channel; fortunately, other computers and channel extender devices can. Hence, it is possible to achieve the equivalent of channel-to-channel communication by linking the IBM channel to certain supermicros and minis through a channel extender device. Users can then link this device to Digital systems via a conventional parallel port.

Figure 5.
Comparison of Various Types of Channel Equipment



Future Trends

Some observers believe that channel extenders represent a threat to FEPs. Figure 6 depicts a potential evolution over the next three to five years. Although channel extenders provide a competitive avenue for high-speed, point-to-point applications, they cannot handle gateway functions and sophisticated switching. Users can configure channel extenders, however, with separately targeted channels to feed more than one host.

In the future, users may wish to extend the CPU bus—not just the channel—putting the process somewhere in the range of 150M bps. Some are looking at bundled DS3/T3 lines (operating at 45M bps) to extend the bus. IBM may also be planning a channel extension solution at the DS3 rate. This trend is consistent with the FDDI and MAN activities being discussed and implemented in the industry.

Better than bundled DS3s, however, is the promise of broadband ISDN, which will extend present bandwidths of 150M bps up to 600M bps. During the summer of 1988, the Consultative Committee on International Telephony and Telegraphy (CCITT) approved the new draft standard for broadband ISDN, I.121. This draft standard is consistent with the Synchronous Optical Network (SONET) bandwidth concept, which provides a modern digital transmission hierarchy built on approximately 50M bps multiples. In addition to such dedicated high-speed links, one might see the introduction of switched facilities of comparable speeds, which allow channel connections, but at a more cost-effective rate.

Until recently, most channel extenders had proprietary interfaces, restricting users to connecting only those products offered by the channel extender vendor. Both local and remote units must be purchased from the same vendor and be of the same model type. In addition, most of the equipment has been special-purpose connectivity products capable of handling only one type of connection; they have not supported general attachment for multiple devices.

Users need a multisource channel extension product. A nonproprietary, open-architecture unit could bring less limiting solutions to users and serve as a connectivity "platform." An open-architecture channel unit, a generic interface device, would attach directly to the mainframe channel at channel speed. Thus, the unit would allow users to "really" connect multiple applications through standard protocols, such as IEEE 796, without changing software at the application level.

Equipment Selection

Since users have many options to consider when choosing channel extension products, asking these eight key questions can be of assistance.

- Does the product need host-based software?
- Does the product require modifications to VTAM and/or the operating system?
- Does the product provide full networking capabilities?
- How much control can a remote operator have?
- Does the product provide full automatic alternate path routing?
- Does the equipment support multiple hosts?
- How many and what types of peripherals are supported?
- Does this product operate with an integrated network management system, such as IBM's NetView?

When evaluating potential vendors, users should check for vendor-sponsored development facilities. Where such resources exist, users can speak to technically knowledgeable personnel who can help with testing implementations and provide application development. Another criterion is vendor experience in providing mainframe-related products and support. An important consideration is the capability of supporting multiple device types to avoid the expense and performance inefficiency of multiple layers of protocol conversion software on the mainframe. A channel extension product should be readily configured with a wide range of adapter boards to support standard applications, reducing development time for application-specific solutions. Where there is a time-critical element to the data flow, such as in engineering and scientific environments, one should look for a high-speed interface of at least 3M bytes per second transmission in a datastreaming mode (not limiting transmission to a predetermined amount).

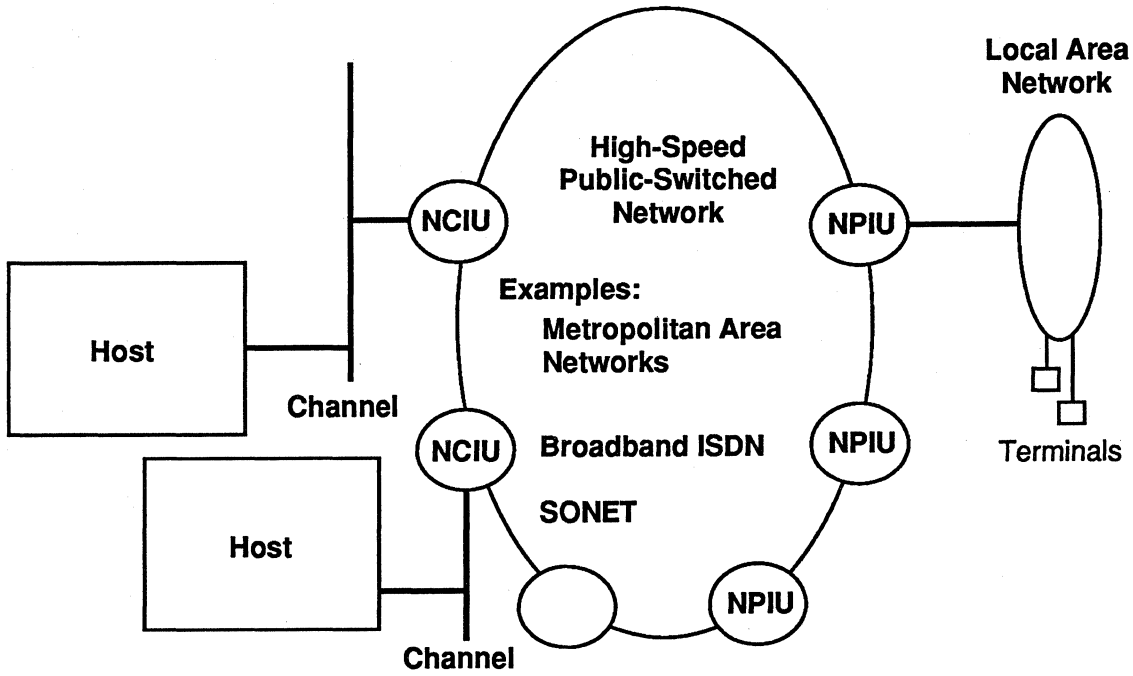
Products

These vendors offer channel extension products.

AT&T Paradyne

AT&T Paradyne (8550 Ulmerton Road, P.O. Box 2826, Largo, FL 34649-2826. Telephone 813/530-2000) offers the Pixnet-XL channel connectivity units, which are comprised of the Pixnet-XL/1000 and -XL/2000. The products use multiple-processor architecture, and the software is based on the Open Systems Interconnection (OSI) model.

Figure 6.
Possible Future Remote-Peripherals Configuration



NCIU–Network-Channel Interface Unit.

NPIU–Network Peripheral Interface Unit.

A short summary of Pixnet family characteristics is described below:

Pixnet-XL/1000

- Entry-level product.
- Maximum throughput is 2.6M bps.
- Supports one channel connection.
- Supports DC Interlock.
- The communication media supported are RS-232-C with speed ranges from 9.6K bps to 19.2K bps, and V.35 with speed ranges from 56K bps to 2.048M bps.
- The maximum number of link connections are eight RS-232-Cs, four V.35s, two V.35 (T1/E1) interfaces; and two X.21s.
- Supports analog and digital communications, such as leased line, satellite, and microwave, at speeds up to T1/E1.
- The options are NetView/PC support, redundant power supply, application/CPU switching, and multi-link protocol (MLP).
- Supports up to two T1 lines.
- The devices supported are IBM and plug-compatible mainframes, 3270-type CRT controllers, high-speed laser printers, low-speed printers, check sorters, microfiche units, and tape drives.

Pixnet-XL/2000

- Midrange product.
- Maximum throughput is 5.2M bps.
- Supports two channel connections.
- Each device attachment supports eight control units.
- Supports the same devices and options as the Pixnet-XL/1000.
- The maximum number of link connections are 16 RS-232-Cs, eight V.35s, four V.35 (T1/E1) interfaces, and four X.21s.

Computer Network Technology

Computer Network Technology (CNT) (6500 Wedgewood Road, Maple Grove, MN 55369. Telephone 612/550-8000) offers the Extended Channel Network that is comprised of the four following components: Channels, LAN/WAN, Network Curator, and the CHANNELink. The CHANNELink, a channel-attached network processor, forms the core of CNT's Extended Network Channel Network.

The CHANNELink currently consists of three models: the 5100/R, 5137, and the 5188.

Some of the features of the CHANNELink include:

- Each CHANNELink network processor is configured with 2M to 10M bytes of RAM which is used as data buffer memory.
- CHANNELink network processors connect remote CPUs and peripherals for unlimited distances over T1 and DS3 links, up to 3,500 feet over coax, and 2 kilometers over fiber.
- The CNT Extended Channel Network solution is transparent to the channel and requires no host software.
- CHANNELink offers 50M bps Coax Module, Ethernet Module, 100M bps Fiber Module, Variable Interface Module, and a DS3 module as a means to provide local connectivity for data center, building, and campus-wide configurations.
- The CHANNELink Network Processor and its modules are based on Motorola 680X0 technology and the VMEbus.
- The peripheral function modules provides local and remote transparent connectivity.
- The peripheral devices include tape drives, printers, check sorters, microfiche recorders, terminal controllers, graphics subsystems, Terdata DBCs, and front-end processors.
- Communication between network processors is achieved by a software distribution program called the MDM Software.
- To provide remote connectivity between future channels and devices, CNT has developed a Generic Control Unit Interface (GCUI), which responds to common interrupts and command sequences, providing a common interface for channels and devices and a growth path for meeting future user requirements.
- CNT offers a network management package called Network Curator, which interfaces with IBM NetView and can be either PC based or IBM host based.

Computerm (100 Wood Street, Pittsburgh, PA 15222. Telephone 412/391-7804) offers six host models and six remote models. Users can attach the 3800/3890 to networks over copper-based wire, fiber optic cable, microwave, and satellite links. Users can also extend the capacity of a CPU in an IBM mainframe from its central site to remote sites, without relocating the CPU or adding on another one.

Computerm has been in the channel extension business for 20 years. The company introduced the 3800/3890 in 1983, using Series/1 processors. As the Series/1 CPUs were enhanced and higher speed microprocessors became available for system components, the 3800/3890 systems' capabilities grew. The system's redundancy allows an operator to switch the external systems from the primary to a completely separate backup unit.

A basic Computerm system consists of a central processing unit; memory; and Computerm-designed boards, which are Channel Adapter (host) or Channel Emulators (remote), Monitor, Communications Adapter, and PROM Load.

Features of the 3800/3890 include:

- Hosts supported are IBM 43XX, 30XX, and IBM plug compatibles.
- Seven channels are supported.
- Maximum number of channels addressed per system is 256.
- The line speeds range from 9600 bps to 1.544M bps.
- The data unit transferred across the I/O channel is byte and block multiplexed.
- The 3800/3890 supports IBM or plug-compatible line printers, laser printers, CRT controllers, document processors, card readers, tape drives, and front-end processors.
- The 3800/3890 system is completely transparent to all operating systems and applications

software, and requires no alterations or modifications to existing software.

Data Switch

Data Switch (One Enterprise Drive, Shelton, CT 06484. Telephone 203/926-1801) offers six channel extension products: ChannelNet Models 9014, 9040, 9044, 9045, 9200, and 9400. The product line includes channel extenders for CPU-to-control units for extending tapes, direct access storage devices (DASDs), graphic workstations, and printers over private fiber or public transmission facilities; integrated host networking; and channel switching and channel extension systems to connect distributed CPUs and control units. Data Switch offers the Channel Plexers models that offer a significant savings in line charges.

A short summary of each model with some characteristics is described below.

Telecommunications Links

ChannelNet Model 9014 is a channel extender for subrate and fractional T1.

- The model supports V.35 interfaces.
- The line rates range from 56K bps to 2.048M bps.
- Completely transparent to the host and extended control units.
- Redundant power supply.
- The configuration components are made up of two 9014 extender units.

ChannelNet Model 9200 ChannelPlexer "multiplexes" one or two computer channels over a telecommunications circuit (V.35, T1/CEPT1, T3/CEPT3).

- A variable-speed interface for V.35 supports lines speeds from 500K bps to 10M bps.
- Is field-upgradable to the Model 9400.
- Supports bidirectional CPU and control unit communications.
- Transparent to all host and control unit software.
- Supports on-line, realtime disaster recovery systems.
- Supports DCI (DC-Interlock) and datastreaming channel protocols.
- Maximum burst rate speed is 4.5M bytes per second in datastreaming mode.
- Configuration components are two integrated link adapters, up to four channel adapters, rack assembly (standard), and dual power supplies (standard).

ChannelNet Model 9400 ChannelPlexer extends up to four computer channels over one or two communications links, including V.35, T1/CEPT1, and T3/CEPT3.

- A variable interface for V.35 supports line speeds from 500K bps to 10M bps.
- Supports automatic switchover from one communications line to another in the event of a line failure.
- Allows bidirectional communications between devices at both ends of the link.
- Supports DCI (DC-Interlock) and datastreaming channel protocols.
- Maximum burst rate speed is 4.5M bytes per second in datastreaming mode.
- Configuration components are two integrated link adapters, supporting one or two communications links, up to eight channel adapters, rack assembly (standard), dual power supplies (standard), and a system controller.

Fiber Optics

ChannelNet Model 9040

- Handles DCI and datastreaming channel protocols.
- It extends tape; printers; terminals; workstations; and DASD 3990 Models 1, 2, and 3, as well as DASD Model CJ2 control units.
- Maximum burst rate speeds of 4.5M bytes per second in datastreaming mode are supported at a 3-kilometer distance.
- DASD extension is possible up to 800 feet.

ChannelNet Model 9044 extends print spools, graphic workstations, and terminals over fiber, up to 7 kilometers from the computer channel.

- Supports data rates up to 1M byte per second, without degradation of data transfer rates as distance increases.

- Is totally transparent to all host and applications software, and has a redundant power supply.
- The configuration components are comprised of two 9044 extender units, a system controller (optional), power supply redundancy (standard), and are standalone or rack mountable in Data Switch cabinets.

ChannelNet Model 9045 is a mainframe channel extender for high-speed control units over dedicated fiber networks.

- Supports datastreaming and nondatastreaming control units up to 7 kilometers from the host computer.
- Supports both datastreaming and nondatastreaming devices.
- The optional system controller provides a central point of control for up to eight extended channels.
- Offers a laser enhancement that supports single-mode fiber at distances up to 40 kilometers and has a high fiber-loss tolerance.
- Maximum burst data rate of 1.8M bytes per second in DC-Interlock mode, and a maximum burst data rate of 4.5M bytes per second in datastreaming mode.
- The configurations components are comprised of two 9045 extender units, a system controller, power supply redundancy, and are standalone or rack mountable in Data Switch cabinets.

IBM

IBM (Old Orchard Road, Armonk, NY 10504. Contact your local IBM representative.) offers the 3044 Fiber Optic Channel Extender Link and the 3088 Multisystem Channel Communication Unit.

3044 Fiber Optic Channel Extender Link consists of four units: the Models CO1 and DO1 and Models CO2 and DO2, which are interconnected by up to 3 km. of fiber optic cables. The 3044 Model COX attaches the processor channel to one end of the fiber cable. The 3044 Model DOX attaches the other end of the fiber optic cable to the "remote" I/O control units.

3044 Fiber Optic Channel Extender Link Models CO1 and DO1

- Consists of two units interconnected by up to 2 km. (6,600 ft.) of fiber optic cable.
- Handles datastreaming of up to 1.25M bytes per second at any distance up to 2 km.
- Nondatastreaming rates of up to 43K bytes per second at 2 km., and up to 76K bytes per second at 1 km.
- Requires no modification of existing operating systems and user programs.
- Extends distances for channel-to-channel processor communications to 4 km. (13,000 ft.) through use of the 3088 Multisystem Channel Communication Unit (MCCU).
- Operates with selected models of a broad range of I/O units, such as printers, card readers/punches, control units with displays, magnetic/optical character readers, switches, and other devices.

Models DO1 and DO2

- Allows IBM 3990 Models 1, 2, and 3, and IBM 3380 Model CJ2 DASD control units to be placed up to 245 m. (800 ft.) from the channel.
- Allows IBM 3480 Enhanced Tape Subsystem (ETS) to be placed up to 3 km. from the channel.
- Can be used with optical fiber trunk installed for the 3044 Models CO1 and DO1.

3088 Multisystem Channel Communication Unit offers the Model A1, Model 1, and Model 2.

- Model A1 interconnects up to two processor channels.
- Model A1 provides up to 63 logical channel-to-channel adapter (CTCA) links.
- Model 1 interconnects up to four processor channels.
- Model 1 provides up to 252 logical CTCA links.
- Model 2 interconnects up to eight processor channels.
- Field upgradability from the Model 1 to the Model 2.
- Up to two simultaneous data transfers.
- Datastreaming capability providing 4.5M bytes per second transfer rate.
- Up to 126 logical CTCA links connecting a maximum of four processor channels via the Model 1.

- Up to 252 logical CTCA links connecting a maximum of eight processor channels via the Model 2.

McDATA

McDATA (310 Interlocken Parkway, Broomfield, CO 80021-3464. Telephone 303/460-9200) offers the LinkMaster Series channel extenders, which include the LinkMaster 5200F local area channel extender, LinkMaster 5200T wide area channel extender, and LinkMaster 5300T wide area channel extender.

A short summary of each model with some characteristics is described below:

LinkMaster 5200F

- Supports IBM System/370-compatible block multiplexer channels.
- Utilizes fiber optic technology.
- Supports IBM 43XX, 30XX, and IBM plug-compatible mainframes.
- Serial data rate up to 72M bps (full duplex).
- Offers four interchangeable interface boards as an option: multimode to 1.5 miles, multimode to 3 miles, single mode to 3 miles, and single mode to 6 miles.
- Automatically performs an end-to-end loopback test each time the system is powered up.
- Three basic software-programmable channel protocols and IBM NetView options.
- The hardware components are comprised of a 5012F local unit, a 5002F remote unit, two plug-in ROMs with required software, two 6-foot power cords, two 20-foot link adapter cables, and an installation guide.

LinkMaster 5200T

- Supports the IBM System/370-compatible block multiplexer channel.
- Offers speeds ranging from 56K to 2.048M bps in full-duplex mode over T1, fractional T1, and other digital communications facilities.
- Up to 256 SNA or non-SNA devices are addressable on one channel.
- Options include various line interface options, a rack-mount kit, a second power supply, IBM NetView Command Processor software, adapter cables, and additional channel cables.
- Automatically performs an end-to-end loopback test each time the system is powered up.
- Full range of WAN communications interface options: V.35, X.21, RS-449/RS-530, RS-232-C, U.S. DS1, European T1/CEPT G.703 twisted pair, and T1/CEPT G.703/6 coax.

LinkMaster 5300T

- Supports high-speed peripherals to be remotely located and accessed through public or private T3 communications facilities.
- Supports IBM System/370-compatible block multiplexer channels.
- Offers two interface modules, direct DS3 and High Speed Serial Interface (HSSI).
- Peripherals supported by the channel extenders include line printers, laser printers, check sorters, CAD/CAM terminals, and CAD/CAM plotters.

Network Systems Corp.

The RDS Channel Device Systems products manufactured by Network Systems Corp. (7600 Boone Avenue N., Minneapolis, MN 55428-1099. Telephone 612/424-4888) include the 9300 Series of Enterprise Channel Extenders, 9500 Series Enterprise Channel Extenders, and the 7200/7250 RDS Host and Device Controllers.

A short summary of each of the models' characteristics is described below.

The **9300 Enterprise Channel Extender Family** consists of two units: the 9300-1L, which is designed to operate as as IBM/FIPS control unit attached to a single-host channel, and the 9300-1R, designed to operate as a remote IBM/FIPS channel attached to a device controller.

- The 9300 family are fiber optic channel extenders supporting channel speeds up to 3M bytes per second to distances up to 40 km.
- The 9300-1L supports up to eight control units.
- The 9300 units perform six levels of error checking.
- Peripherals supported by the 9300-1R include most IBM and IBM plug-compatible printers, display controllers, tape subsystems, channel switches, check sorters, and graphic devices.
- The 9300 products do not use host-based software.

The **9500 Enterprise Channel Extender Family** consists of two units: the 9500-1L, which is the local unit or channel-attached unit; and the 9500-1R, which is the remote unit or device controller-attached unit.

- The 9500-1L unit takes one control-unit position on a processor channel, but it is not addressable.
- Up to eight 9500-1L hosts units may be attached to one channel.
- The 9500 communicates via standard digital communications links at speeds up to 2.048M bps.
- The extenders interface with the link equipment via a V.35, RS-449, or RS-232-C interface.
- Through the direct interface of the 9500 to IBM's NetView, an operator on a 3270 NetView console can receive generic alerts; perform a centralized configuration; and analyze configuration information, such as link statistics and operating status of the 9500.

The **7200 and 7250 RDS Host and Device Controllers** provide the flexibility with any channel extension requirement. This could be from a simple point-to-point solution over a single low-speed communications link, to a highly complex network of multiple hosts and devices connected over a network of FDDI rings, multiple high-speed communications links, or HYPERchannel 50/100 local trunks.

- The 7200 connects to the IBM/FIPS host channel, and can be configured with a number of different options, such as FDDI, high-speed communications links, HYPERchannel trunks, and other CPU interfaces.
- The 7250 connects to the remote peripheral device and can be configured with any of the 7200 options.
- The 7200 can be configured to operate with or without host-resident software.
- Optional software is available for a direct IBM NetView interface or a Host Operators Command Console. ■

Communications Processor Interoperability

In this report:

Datapro Summary

This report explains how to interpret the Interoperability Matrices featured in the Datapro product reports included in this tab. In the context of this report, communications processors are proprietary devices. Standards-based architectures, such as TCP/IP and OSI, have devices that perform routing and concentration functions, but they are treated as separate device classes.

Most communications devices purchased by users operate at lower OSI levels, but vendor network architectures define OSI functions at higher levels as well, and communications processors are elements of vendor network architectures. Other devices, such as routers and packet switches conforming to standards-based architectures, can also perform routing and concentration functions, but they are considered as different device classes because of the unique relationship between the communications processor and the remainder of the vendor's network products.

A communications processor is a data network product designed for one or more of the following functions:

- To off-load communications overhead from an expensive computer system (front-end processor).
- To perform intelligent routing within a data network.
- To concentrate data from multiple hosts, terminals, and other processors into one or more high-speed lines.

The distinction between a communications processor and a multiplexer can be subtle: both can concentrate traffic and route information; but communications processors are devices that are tightly integrated into the computer vendor's network architecture. Often, as in the case of IBM's SNA, the devices have a specific role to play and a specific relationship to both internal protocols and other network elements.

The higher-level interface to a communications processor is normally a high-speed channel to a large computer system and specific software to support that channel on the host. The communications processor, via that interface, can be the first actual network device in the vendor's highest-level architecture—the application architecture, which defines how programs relate to network devices.

At the peer level, communications processors can be interconnected to each other or to other devices defined by the vendor's network architecture. In virtually every case, there is a "smart" interaction between these elements; communications processors cooperate with companion products, not just connect to them. End systems, computers or terminals, are considered network architecture elements.

Communications Processors and Higher-Level Architectures

Communications processors, as network architecture elements, play a specific role in a network, vis-à-vis the host computer, terminals, and other devices. In some cases, this role includes the actual interfacing with applications software running in the host and communicating with the remainder of the network. In most cases, however, the communications processor's relationship is with the central computer system, or systems, it supports.

A host-to-processor relationship includes many factors beyond simple data exchange. Processors are often loaded with programs and configuration data by the host. Communications processor operation is controlled by host network management. Processors often maintain statistics and status data, which is "read" by the host periodically. All these functions must be performed by a communications processor, or the host will be incapable of interacting with it properly.

This multiplicity of functions has made it inconvenient to describe a communications processor in terms of the protocols or standards it supports because there would be many such standards and protocols. Instead, the industry has adopted the policy of describing communications processors either by reference to the name of a type of device within a vendor's network architectures (in SNA, a processor is a Physical Unit Type 4) or by asserting compatibility with a device type supplied by the "owner" of the network architecture (IBM 3705 compatible).

This approach, unfortunately, is not wholly adequate to ensure interoperability. What follows are several detailed issues on communications processors which must be examined to ensure that a given product will interoperate with the central computer complex.

Position in Network Architecture relates to the role which the device plays in the vendor network architecture it is designed to support. This role would be stated in as specific terms as the architecture defines. For example, an IBM-compatible communications processor would be described as an SNA PU 4.

Compatibility indicates the device or devices in the vendor's network architecture which the referenced product is intended to replace. For example, the device might be an "IBM 3705 replacement" or a "Unisys DCP-compatible" system.

Host Software Required indicates the program/version of host computer software, such as the operating system or communications access method required to use the product. Normally, this information will be stated as "Version 1 or later."

Host Software Supported indicates the communications programs/facilities supported by the processor. The device may support all the features of the compatible device or may exclude some features, specifying, for example, "OSI Communications Subsystem not supported."

Communications Processor Software Required indicates the source, identity, and version of software for the communications processor itself. In most cases, the software is provided by the communications processor's vendor.

Software Load indicates if the software can be loaded locally from a disk/tape or if it must be host loaded. In the latter case, the communications processor vendor must supply a utility or stipulate a load mechanism.

Host Attachment Support indicates if the communications processor is attached to the host computer via a LAN, channel, serial interface, or other method. The attachment support matrix entry is divided into *Local* and *Remote*. Remote attachment normally occurs via a data communications interface.

Network Management Support indicates how the communications processor integrates with host network management features of the network architecture. For example, the product could be NetView compatible or DECmcc compatible. Management support can be optional.

Since communications processors are so closely tied to the host network architecture, they are very vulnerable to vendor changes in communications direction. Most third-party compatible processors lag behind the primary vendor by six months to a year, and some never support all the features of the primary product. On the other hand, third-party processors may offer features and facilities that the primary vendor has not elected to offer. Specific software and terminal support features should be explored, once overall compatibility with the computer system has been ensured.

Relationships Within the Network Architecture

Communications processors normally interface with one of the following elements:

- Other communications processors, for the purposes of cooperating in nodal routing of data.
- Terminals, terminal controllers, and PC LANs.
- Remote computer systems, such as departmental computers.

In most cases, third-party communications processors are compatible with terminal and remote computer interconnection, but they may not be capable of full participation in internodal routing. But any relationship within the network architecture is considered peer. Thus, the processor must have explicit compatibility with any other device, including an end system.

The following are the peer-level interoperability issues for communications processors.

Compatible Communications Processors indicates the communications processor models to which the product can be interconnected in both *internodal* and *interdomain* segments. The former relates to compatible processors for node-to-node routing within a host domain/network. The latter relates to compatible processors for interdomain (host-to-host) routing.

This section also covers the terminal controller models and terminal models that can be attached to the device. If the terminal or controller has multiple operating modes, such as 3270 CUT or DFT, all modes are supported unless stated otherwise.

Logical Unit Connections Supported indicates for IBM-compatible processors the LU types that the processor can support.

Gateways Supported indicates the identity of other network architectures for which the product offers gateway support, such as OSI, TCP/IP, DECnet, and SNA. If the gateway has specific limitations, such as 3270 to TCP/IP Telnet only, the limitations are also listed here.

Transport Architectures Supported identifies the type of transmission facilities/services which can be supported by the processor, such as leased line, dial-up, public/private packet, frame relay, and SMDS. If a given transport architecture is supported for only one type of peer connection, the restriction is noted. For example, "Frame-relay support (processor to processor only)." When the specified architecture is supported by an interface standard, the interface standard is cited, e.g., "Public/private packet, via X.25 with X.29 PAD support."

Communications processor compatibility is reduced by the "mixing" of several third-party vendors in the same network, either at the communications processor level or below. Most processor vendors will test thoroughly with products of the primary network architecture vendor, but they may not test with all their compatible competitive products.

Communications Processors and Transport Architectures

The communications processor will attach to other elements in the network via a transport circuit or network. This may be a carrier analog circuit and modem, digital circuit, private network multiplexer circuit, or microwave circuit. Some processors will also accept value-added network connection via packet, frame

relay, or SMDS. Finally, processors can support LAN connections to local PCs or other types of systems.

"Transparent" types of multiplexing can be used to create a private, integrated transport network that can carry communications processor traffic. When a nontransparent technology, such as packet switching, is to be used, it must be supported not only by the communications processor but also by the partner devices.

The following are the interoperability issues for communications processors at the transport connection level.

Leased Line Support describes the interface, data rates, and relationship limitations, if any, for attachment of devices to the processor via leased lines or equivalent private network services. For example, a processor might support "56/64K bps digital V.35, for links to other processors only."

Switched (dial-up) Line Support describes the interface, data rates, and relationship limits, if any, for attachment of devices to the processor via dial-up lines.

Public Data Network Support describes the interface, standards version, data rates, and relationship limits for attachment via public or private packet networks. For example, the processor might support "X.25 1980 version, via RS-232-C to 19.2K bps, V.35 to 64K bps, to any compatible device."

LAN Attachment Support describes the processor's support for an interface to a local area network. This notation includes the type (and data rate, if appropriate) of the LAN, and the device restrictions on partner devices, if those restrictions are other than any device which also supports the LAN. For example, a processor might provide "PC attachment via Token Ring (4M or 16M bps), via 3174-compatible emulation gateway software."

Communications processors often have plug-in modules, which provide specific port interfaces. There may be limitations on the combination of modules per unit or on the data rate per port or in aggregate. These limitations may be different on various brands of processor, even though the processors are "compatible" with the same target device. Modules are not generally plug compatible among various vendors.

For devices connected over leased-line or switched-line facilities, the data rates of the partners must match, but the physical interfaces might not be the same. For example, a communications processor might employ a V.35 interface to connect to a modem/leased line operating at 9600 bps, which connects to a compatible modem and a terminal through an RS-232-C interface.

Devices connected via packet or frame-relay service might be capable of communicating even if the access data rate for the two devices is not the same. Thus, a communications processor with a 56K bps packet network interface can communicate with a cluster controller attached to the same network with a 9600 bps line. Flow control requirements for the network must be met, however.

Users should be advised that most communications processor interconnections occur via leased lines or equivalent private network services. The use of a public data network is likely to expose the user to operating issues with which the third-party vendor will have little experience. Problems in multivendor interconnection under these conditions may result in fingerpointing among the vendors and with the carrier. It is advisable to seek reference accounts for such applications.

Special Issues

The greatest risk users face in the selection of third-party communications processor products is the failure of the vendor to track product releases for the network architecture with which the processor is associated. An IBM 3745-compatible processor may not remain so if IBM makes rapid product releases which enhance features, and the "compatible" vendor fails to keep up.

There is no way to ensure that products will be promptly enhanced in the future, even if they were in the past. In general, users who regularly upgrade to new communications features as soon as they are released, or who are on the leading edge of their vendor's network and application architectures, should avoid third-party communications processors. ■

Communications Controller Interoperability

In this report:

Datapro Summary

This report explains how to interpret the Interoperability Matrices featured in the Datapro product reports included in this tab. In the context of this report, communications controllers are proprietary devices. Standards-based architectures, such as TCP/IP and OSI, have devices that perform routing and concentration functions, but they are treated as separate device classes.

Connections from the communications controller to other elements occur through a transport network structure that can be based on carrier leased line or dial-up services, public or private packet service, frame relay, SMDS, or other facilities.

Because communications controllers are part of a vendor's network architecture, they are also generally part of the vendor's system/network management framework. This arrangement makes the device inherently more "management ready" than a multiplexer or other transparent concentration/routing device. Networks made up entirely of products that have specific vendor network architecture roles require little special attention to "integrated management."

Analysis

Most communications devices purchased by users operate at lower OSI levels, but vendor network architectures define OSI functions at higher levels as well, and communications controllers are elements of vendor network architectures. Other devices, such as routers and packet switches conforming to standards-based architectures, can also perform routing and concentration functions, but they are considered as different device classes because of the unique relationship between the communications controller and the remainder of the vendor's network products.

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The distinction between a communications controller and a multiplexer can be subtle: both can concentrate traffic and route information; but communications controllers are devices that are tightly integrated into the computer vendor's network architecture. Often, as in the case of IBM's SNA, the devices have a specific role to play and a specific relationship to both internal protocols and other network elements.

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—By Martin Dintzis
Assistant Analyst

architecture, which defines how programs relate to network devices.

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Communications controllers, as network architecture elements, play a specific role in a network, vis-à-vis the host computer, terminals, and other devices. In some cases, this role includes the actual interfacing with applications software running in the host and communicating with the remainder of the network. In most cases, however, the communications controller's relationship is with the central computer system, or systems, it supports.

A host-to-controller relationship includes many factors beyond simple data exchange. Controllers are often loaded with programs and configuration data by the host. Controller operation is controlled by host network management. Controllers often maintain statistics and status data, which is "read" by the host periodically. All these functions must be performed by a controller, or the host will be incapable of interacting with it properly.

This multiplicity of functions has made it inconvenient to describe a controller in terms of the protocols or standards it supports because there would be many such standards and protocols. Instead, the industry has adopted the policy of describing controllers either by reference to the name of a type of device within a vendor's network architectures (in SNA, a communications controller is a Physical Unit Type 4) or by asserting compatibility with a device type supplied by the "owner" of the network architecture (IBM 3705 compatible).

This approach, unfortunately, is not wholly adequate to ensure interoperability. What follows are several detailed issues on communications controllers which must be examined to ensure that a given product will interoperate with the central computer complex.

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Host Software Required indicates the program/version of host computer software, such as the operating system or communications access method required to use the product. Normally, this information will be stated as "Version 1 or later."

Host Software Supported indicates the communications programs/facilities supported by the controller. The device may support all the features of the compatible device or may exclude some features, specifying, for example, "OSI Communications Subsystem not supported."

Communications Controller Software Required indicates the source, identity, and version of software for the communications controller itself. In most cases, the software is provided by the communications controller's vendor.

Software Load indicates if the software can be loaded locally from a disk/tape or if it must be host loaded. In the latter case, the communications controller vendor must supply a utility or stipulate a load mechanism.

Host Attachment Support indicates if the controller is attached to the host computer via a LAN, channel, serial interface, or other method. The attachment support matrix entry is divided into *Local* and *Remote.* Remote attachment normally occurs via a data communications interface.

Network Management Support indicates how the controller integrates with host network management features of the network architecture. For example, the product could be NetView compatible or DECmcc compatible. Management support can be optional.

Since communications controllers are so closely tied to the host network architecture, they are very vulnerable to vendor changes in communications direction. Most third-party compatible controllers lag behind the primary vendor by six months to a year, and some never support all the features of the primary product. On the other hand, third-party controllers may offer features and facilities that the primary vendor has not elected to offer. Specific software and terminal support features should be explored, once overall compatibility with the computer system has been ensured.

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Communications controllers normally interface with one of the following elements:

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This section also covers the terminal controller models and terminal models that can be attached to the device. If the terminal or controller has multiple operating modes, such as 3270 CUT or DFT, all modes are supported unless stated otherwise. If the network architecture uses a specific

device nomenclature for these devices, such as Physical Unit Type 2, the devices supported are grouped by that nomenclature.

Logical Unit Connections Supported indicates for IBM-compatible controllers the LU types that the controller can support.

Gateways Supported indicates the identity of other network architectures for which the product offers gateway support, such as OSI, TCP/IP, DECnet, and SNA. If the gateway has specific limitations, such as 3270 to TCP/IP Telnet only, the limitations are also listed here.

Transport Architectures Supported identifies the type of transmission facilities/services which can be supported by the controller, such as leased line, dial-up, public/private packet, frame relay, and SMDS. If a given transport architecture is supported for only one type of peer connection, the restriction is noted. For example, "Frame-relay support (controller to controller only)." When the specified architecture is supported by an interface standard, the interface standard is cited, e.g., "Public/private packet, via X.25 with X.29 PAD support."

Communications controller compatibility is reduced by the "mixing" of several third-party vendors in the same network, either at the communications controller level or below. Most controller vendors will test thoroughly with products of the primary network architecture vendor, but they may not test with all their compatible competitive products.

Communications Controllers and Transport Architectures

The communications controller will attach to other elements in the network via a transport circuit or network. This may be a carrier analog circuit and modem, digital circuit, private network multiplexer circuit, or microwave circuit. Some controllers will also accept value-added network connection via packet, frame relay, or SMDS. Finally, controllers can support LAN connections to local PCs or other types of systems.

"Transparent" types of multiplexing can be used to create a private, integrated transport network that can carry communications controller traffic. When a nontransparent technology, such as packet switching, is to be used, it must be supported not only by the communications controller but also by the partner devices.

The following are the interoperability issues for communications controllers at the transport connection level.

Leased Line or Equivalent Support describes the interface, data rates, and relationship limitations, if any, for attachment of devices to the controller via leased lines or equivalent private network services. For example, a controller might support "56/64K bps digital V.35, for links to other controllers only."

Switched Line or Equivalent Support describes the interface, data rates, and relationship limits, if any, for attachment of devices to the controller via dial-up lines or equivalent.

Packet Network Support describes the interface, standards version, data rates, and relationship limits for attachment via public or private packet networks. For example, the controller might support "X.25 1980 version, via RS-232-C to 19.2K bps, V.35 to 64K bps, to any compatible device."

Special Data Network Support describes the interface, standards and version, data rates, and relationship limits for the attachment of the controller to a partner device via a special data network such as frame relay or SMDS.

LAN Attachment Support describes the controller's support for an interface to a local area network. This notation includes the type (and data rate, if appropriate) of the LAN, and the device restrictions on partner devices, if those restrictions are other than any device which also supports the LAN. For example, a controller might provide "PC attachment via Token Ring (4M or 16M bps), via 3174-compatible emulation gateway software."

Communications controllers often have plug-in modules, which provide specific port interfaces. There may be limitations on the combination of modules per unit or on the data rate per port or in aggregate. These limitations may be different on various brands of controller, even though the controllers are "compatible" with the same target device. Modules are not generally plug compatible among various vendors.

For devices connected over leased-line or switched-line facilities, the data rates of the partners must match, but the physical interfaces cannot be the same. For example, a communications controller might employ a V.35 interface to connect to a modem/leased line operating at 9600 bps, which connects to a compatible modem and a terminal through an RS-232 interface.

Devices connected via packet or frame-relay service may be capable of communicating even if the access data rate for the two devices is not the same. Thus, a communications controller with a 56K bps packet network interface can communicate with a cluster controller attached to the same network with a 9600 bps line. Flow control requirements for the network must be met, however.

Users should be advised that most communications controller interconnections occur via leased lines or equivalent private network services. The use of a packet or special data network is likely to expose the user to operating issues with which the third-party vendor will have little experience. Problems in multivendor interconnection under these conditions may result in fingerpointing among the vendors and with the carrier. It is advisable to seek reference accounts for such applications.

Special Issues

The greatest risk users face in the selection of third-party communications controller products is the failure of the vendor to track product releases for the network architecture with which the controller is associated. An IBM 3745-compatible controller may not remain so if IBM makes rapid product releases which enhance features, and the "compatible" vendor fails to keep up.

There is no way to ensure that products will be promptly enhanced in the future, even if they were in the past. In general, users who regularly upgrade to new communications features as soon as they are released, or who are on the leading edge of their vendor's network and application architectures, should avoid third-party communications controllers. ■

Communications Controller Interoperability

In this report:

Synopsis

Editor's Note

In the context of this report, communications controllers are proprietary devices. Standards-based architectures, such as TCP/IP and OSI, have devices that perform routing and concentration functions, but they are treated as separate device classes.

This report explains how to interpret the Interoperability Matrices featured in the Datapro product reports included in this tab.

Highlights

Connections from the communications controller to other elements occur through a transport network structure that can be based on carrier leased line or dial-up services, public or private packet service, frame relay, SMDS, or other facilities.

Because communications controllers are part of a vendor's network architecture, they are also generally part of the vendor's system/network management framework. This arrangement makes the device inherently more "management ready" than a multiplexer or other transparent concentration/routing device. Networks made up entirely of products that have specific vendor network architecture roles require little special attention to "integrated management."

Analysis

Most communications devices purchased by users operate at lower OSI levels, but vendor network architectures define OSI functions at higher levels as well, and communications controllers are elements of vendor network architectures. Other devices, such as routers and packet switches, conforming to standards-based architectures, can also perform routing and concentration functions, but they are considered as different device classes because of the unique relationship between the communications controller and the remainder of the vendor's network products.

A communications controller is a data network product designed for one or both of two functions:

- To off-load communications overhead from an expensive computer system (front-end processor)
- To provide concentration and routing within a data network, using the facilities which the vendor's network architecture defines for such purposes

The distinction between a communications controller and a multiplexer can be subtle: both can concentrate traffic and route information; but communications controllers are devices that are tightly integrated into the computer vendor's network architecture. Often, as in the case of IBM's SNA, the devices have a specific role to play and a specific relationship to both internal protocols and other network elements.

The higher level interface to a communications controller is normally a high-speed channel to a large computer system and specific software to support that channel on the host. The communications controller, via that interface, can be the first actual network device in the vendor's highest level architecture—the application architecture, which defines how programs relate to network devices.

At the peer level, communications controllers can be interconnected to each other or to other devices defined by the vendor's network architecture. In virtually every case, there is a "smart" interaction between these elements; communications controllers cooperate with companion products,

not just connect to them. End systems, computers or terminals, are considered network architecture elements.

Communications Controllers and Higher Level Architectures

Communications controllers, as network architecture elements, play a specific role in a network, vis-à-vis the host computer, terminals, and other devices. In some cases, this role includes the actual interfacing with application software running in the host and communicating with the remainder of the network. In most cases, however, the communications controller's relationship is with the central computer system, or systems, it supports.

A host-to-controller relationship includes many factors beyond simple data exchange. Controllers are often loaded with programs and configuration data by the host. Controller operation is controlled by host network management. Controllers often maintain statistics and status data, which is "read" by the host periodically. All these functions must be performed by a controller, or the host will be incapable of interacting with it properly.

This multiplicity of functions has made it inconvenient to describe a controller in terms of the protocols or standards it supports because there would be many such standards and protocols. Instead, the industry has adopted the policy of describing controllers either by reference to the name of a type of device within a vendor's network architectures (in SNA, a communications controller is a Physical Unit Type 4) or by asserting compatibility with a device type supplied by the "owner" of the network architecture (IBM 3705 compatible).

This approach, unfortunately, is not wholly adequate to ensure interoperability. What follows are several detailed issues on communications controllers which must be examined to ensure that a given product will interoperate with the central computer complex.

Position in Network Architecture relates to the role which the device plays in the vendor network architecture it is designed to support. This role would be stated in as specific terms as the architecture defines. For example, an IBM-compatible communications controller would be described as an SNA PU 4.

Compatibility indicates the device or devices in the vendor's network architecture which the referenced product is intended to replace. For example, the device might be an "IBM 3705 replacement" or a "Unisys DCP-compatible" system.

Host Software Required indicates the program/version of host computer software, such as the operating system or communications access method required to use the product. Normally, this information will be stated as "Version 1 or later."

Host Software Supported indicates the communications programs/facilities supported by the controller. The device may support all the features of the compatible device or may exclude some features, specifying, for example, "OSI Communications Subsystem not supported."

Communications Controller Software Required indicates the source, identity, and version of software for the communications controller itself. In most cases, the software is provided by the communications controller's vendor.

Software Load indicates if the software can be loaded locally from a disk/tape or if it must be host loaded. In the latter case, the communications controller vendor must supply a utility or stipulate a load mechanism.

Host Attachment Support indicates if the controller is attached to the host computer via a LAN, channel, serial interface, or other method. The attachment support matrix entry is divided into *Local* and *Remote.* Remote attachment normally occurs via a data communications interface.

Network Management Support indicates how the controller integrates with host network management features of the network architecture. For example, the product could be NetView compatible or DECmcc compatible. Management support can be optional.

Since communications controllers are so closely tied to the host network architecture, they are very vulnerable to vendor changes in communications direction. Most third-party compatible controllers lag behind the primary vendor by six months to a year, and some never support all the features of the primary product. On the other hand, third-party controllers may offer features and facilities that the primary vendor has not elected to offer. Specific software and terminal support features should be explored, once overall compatibility with the computer system has been ensured.

Relationships within the Network Architecture

Communications controllers normally interface with one of the following elements:

- Other communications controllers, for the purposes of cooperating in nodal routing of data
- Terminals, terminal controllers, and PC LANs
- Remote computer systems, such as departmental computers

In most cases, third-party controllers are compatible with terminal and remote computer interconnection, but they may not be capable of full participation in internodal routing. But any relationship within the network architecture is considered peer. Thus, the controller must have explicit compatibility with any other device, including an end system.

The following are the peer-level interoperability issues for communications controllers.

Compatible Communications Controllers indicates the communications controller models to which the product can be interconnected. This matrix heading is divided into *internodal* and *interdomain* segments. The former relates to compatible controllers for node-to-node routing within a host domain/network. The latter relates to compatible controllers for interdomain (host to host) routing.

Compatible Terminals/Terminal Controllers indicates the terminal controller models and terminal models that can be attached to the device. If the terminal or controller has multiple operating modes, such as 3270 CUT or DFT, all modes are supported unless stated otherwise. If the network architecture uses a specific device nomenclature, such as Physical Unit Type 2, for these devices, the devices supported are grouped by that nomenclature.

Logical Unit Connections Supported indicates for IBM-compatible controllers the LU types that the controller can support.

Gateways Supported indicates the identity of other network architectures for which the product offers gateway support, such as OSI, TCP/IP, DECnet, and SNA. If the gateway has specific limitations, such as 3270 to TCP/IP Telnet only, the limitations are also listed here.

Transport Architectures Supported identifies the type of transmission facilities/services which can be supported by the controller, such as leased line, dial-up, public/private packet, frame relay, and SMDS. If a given transport architecture is supported for only one type of peer connection, the restriction is noted. For example, "Frame-relay support (controller to controller only)." When the specified architecture is supported by an interface standard, the interface standard is cited, e.g., "Public/private packet, via X.25 with X.29 PAD support."

Communications controller compatibility is reduced by the "mixing" of several third-party vendors in the same network, either at the communications controller level or below. Most controller vendors will test thoroughly with products of the primary network architecture vendor, but they may not test with all their compatible competitive products.

Communications Controllers and Transport Architectures

The communications controller will attach to other elements in the network via a transport circuit or network. This may be a carrier analog circuit and modem, digital circuit, private network multiplexer circuit, or microwave circuit. Some controllers will also accept value-added network connection via packet, frame relay, or SMDS. Finally, controllers can support LAN connections to local PCs or other types of systems.

"Transparent" types of multiplexing can be used to create a private, integrated transport network that can carry communications controller traffic. When a nontransparent technology, such as packet switching, is to be used, it must be supported not only by the communications controller but also by the partner devices.

The following are the interoperability issues for communications controllers at the transport connection level.

Leased Line or Equivalent Support describes the interface, data rates, and relationship limitations, if any, for attachment of devices to the controller via leased lines or equivalent private network services. For example, a controller might support "56/64K bps digital V.35, for links to other controllers only."

Switched Line or Equivalent Support describes the interface, data rates, and relationship limits, if any, for attachment of devices to the controller via dialup lines or equivalent.

Packet Network Support describes the interface, standards version, data rates, and relationship limits for attachment via public or private packet networks. For example, the controller might support "X.25 1980 version, via RS-232-C to 19.2K bps, V.35 to 64K bps, to any compatible device."

Special Data Network Support describes the interface, standards and version, data rates, and relationship limits for the attachment of the controller to a partner device via a special data network such as frame relay or SMDS.

LAN Attachment Support describes the controller's support for an interface to a local area network. This notation includes the type (and data rate, if appropriate) of the LAN, and the device restrictions on partner devices, if those restrictions are other than any device which also supports the LAN. For example, a controller might provide "PC attachment via Token Ring (4M or 16M bps), via 3174-compatible emulation gateway software."

Communications controllers often have plug-in modules, which provide specific port interfaces. There may be limitations on the combination of modules per unit or on the data rate per port or in aggregate. These limitations may be different on various brands of controller, even though the controllers are "compatible" with the same target device. Modules are not generally plug compatible among various vendors.

For devices connected over leased-line or switched-line facilities, the data rates of the partners must match, but the physical interfaces cannot be the same. For example, a communications controller might employ a V.35 interface to connect to a modem/leased line operating at 9600 bps, which connects to a compatible modem and a terminal through an RS-232 interface.

Devices connected via packet or frame-relay service may be capable of communicating even if the access data rate for the two devices is not the same. Thus, a communications controller with a 56K bps packet network interface can communicate with a cluster controller attached to the same network with a 9600 bps line. Flow control requirements for the network must be met, however.

Users should be advised that most communications controller interconnections occur via leased lines or equivalent private network services. The use of a packet or special data network is likely to expose the user to operating issues with which the third-party vendor will have little experience. Problems in multivendor interconnection under these conditions may result in fingerpointing among the vendors and with the carrier. It is advisable to seek reference accounts for such applications.

Special Issues

The greatest risk users face in the selection of third-party communications controller products is the failure of the vendor to track product releases for the network architecture with which the controller is associated. An IBM 3745-compatible controller may not remain so if IBM makes rapid product releases which enhance features, and the "compatible" vendor fails to keep up.

There is no way to ensure that products will be promptly enhanced in the future, even if they were in the past. In general, users who regularly upgrade to new communications features as soon as they are released, or who are on the leading edge of their vendor's network and application architectures, should avoid third-party communications controllers. ■

Amdahl 4745 Communications Processor

In this report:

Note: A new High-Performance Feature (HPF) for the 4745 increases external throughput by up to 90%. HPF adds static random access memory (SRAM) for main storage, which reduces data access time, and a higher speed channel adapter.

Amdahl has also introduced T1/E1 communications adapters for leased SNA/SDLC lines, has increased the maximum number of channel-attached hosts from six to eight, and has added support for IBM's ESCON (fiber optic) channel interface.

The 4745 communications processor family consists of Models 110 and 210. These processors are designed for use in SNA networks as remote concentrators or front ends for hosts. Model 210 supports up to eight channel-attached IBM hosts, 256 communications lines, four T1/E1 links, and four 4M bps token-ring LANs.

Plug compatible with the IBM 3745, the Amdahl 4745 runs IBM ACF/NCP and other IBM processor software and can be fully integrated into NetView.

Strengths

- Amdahl claims that the 4745-210 can provide up to 13% greater internal throughput than the IBM 3745-210.
- Fiber optic cabling supports higher channel throughput and increases the maximum distance from the host to over five miles.
- Amdahl's communications processors are easily upgradable, which preserves the user's investment.
- The 4745 can run multiple versions of IBM ACF/NCP (Releases 3, 4, and 5) without software or hardware modification; switching from one software release to another is as simple as executing a single console command.

Limitations

- An IBM plug-compatible product, the 4745 does not support some of the open networking options available from NCR's Comten 5600 processor family, such as connections with Ethernet LANs and support for TCP/IP communications.
- The 4745 does not provide as much capacity as the IBM 3745 for both host and token-ring attachments, and it does not yet support 16M bps token-ring LANs. However, Amdahl does plan to offer 16M bps support in the future.

Vendor

Amdahl Corp.
1250 East Arques Avenue
P.O. Box 3470
Sunnyvale, CA 94088-3470
(408) 746-6000
In Canada:
Amdahl Canada Ltd.
1 First Canadian Place, 5th Floor
P.O. Box 123
Toronto, ON M5X 1A4
(416) 862-7479

Competition

IBM and NCR Corp.

Prices

Base configurations for 4745 Models 110 and 210 are $100,650 and $132,000, respectively. **GSA Schedule:** Yes.

—By Martin Dintzis
Assistant Editor

Product Analysis

Founded in 1970, Amdahl designs, develops, manufactures, markets, and services large-scale data processing systems. The company's product line includes large, general-purpose mainframe computers, data storage subsystems, data communications products, and software for IBM System/370-compatible environments.

Amdahl introduced the 4745 communications processor Models 110 and 210 in May 1988. Plug-compatible with the IBM 3745, the 4745 models relieve the host of communications processing, functioning either as remote controllers or front ends. They concentrate host-bound data into one or more high-speed links; provide access to multiple IBM hosts for processor-attached devices; perform routing and switching among multiple network paths; sequence messages; and participate in network management functions.

Since our last update to this report, Amdahl has improved the processing power of the 4745 in several ways. The processor's central control unit now incorporates static random access memory (SRAM) chip technology, reducing the number of cycles required to access memory. Performance has also been increased with the addition of a new channel adapter equipped with a large-scale integration (LSI) interface to the 4745's internal bus, which minimizes internal delays on the bus. The channel adapter also implements a more efficient bus-and-tag procedure, increasing channel availability for data transfer operations. These enhancements, available for both newer and older 4745 processor models as the *High-Performance Feature (HPF)*, provide up to 1.9 times the external throughput and 1.8 times the internal throughput capacity previously supported.

Amdahl has also introduced T1/E1 communications adapters for leased SDLC lines, has increased the maximum number of channel-attached hosts from six to eight, and has added support for a fiber optic host channel using the IBM ESCON channel interface.

Target Applications

The 4745 processors are designed to meet the traffic needs of SNA networks. Model 110, best suited for smaller, remote environments, can perform routing, concentration, and isolation of security-sensitive applications. Model 210 can manage communications traffic for medium-to-large SNA installations.

Strengths

Amdahl claims that in a benchmark program, the 4745-210, equipped with HPF, provided 1.13 times the performance established in a similar test for an IBM 3745 equipped with the Buffer Chaining Channel Adapter (BCCA). With a base price of $132,000, the 4745-210 is also competitively priced with IBM's 3745-210, which starts at $147,550.

IBM's ESCON channel interface supports higher channel throughput, increases the maximum distance from the host to as much as 5.6 miles, and provides virtually error-free communications.

Amdahl's communications processors are easily upgradable, which preserves the user's investment. The Amdahl 4725, an older processor, can be upgraded to a 4745-110 which, in turn, can be upgraded to a 4745-210 with the High-Performance Feature.

In developing the 4745, Amdahl made use of very large-scale integration (VLSI) technology. By reducing the number of internal components, Amdahl has created an extremely reliable product.

Another attractive feature of the 4745 is its *Integrated Switching Architecture,* which provides automatic or manually controlled switchover to backup host facilities in the event of a host or network failure.

The 4745 can run multiple versions of IBM ACF/NCP (Releases 3, 4, and 5) without software or hardware modification; switching from one software release to another is as simple as executing a single console command.

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Amdahl's processors presently support up to eight hosts and four token-ring LANs. The IBM 3745, however, supports up to 16 hosts and eight token-ring LANs. While Amdahl's products currently support only 4M bps token-ring networks, the IBM 3745 supports both 4M bps and 16M bps LAN environments. Amdahl has indicated, however, that it will offer support for 16M bps LANs in the future.

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Amdahl competes with IBM Corp. and NCR Corp. IBM surpasses Amdahl in its support of both 4M bps and 16M bps LAN environments. Unlike Amdahl, which is locked into IBM support, NCR supports open networking.

Overview

Model	Design	Date Announced	Date Delivered	Base Price ($)
4745-110	Floorstanding processor	May 1988	June 1988	100,650
4745-210	Floorstanding processor with an optional expansion unit	May 1988	June 1988	132,000
4747 Console	Alphanumeric display	May 1988	June 1988	2,310

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Decision Points

Models	Requirements	Comments
4745 Processor Family	High Throughput	Supports T1/E1 speeds, as well as a fiber optic host channel
	Price/Performance	The 4745-210 does not provide the host- and LAN-attachment capacity of the larger IBM 3745 models, nor does it support 16M bps token-ring LANs; it is, however, competitive in price and throughput capability with the 3745-210
	Upgradability	Through optional modules, any Model 4725 processor (an older Amdahl product) can be upgraded to a 4745; similarly, any 4745-110 can be upgraded to a 4745-210; the 4745 can run multiple versions of IBM ACF/NCP (Releases 3, 4, and 5) without software or hardware modification
	Multivendor Networking Capability	Designed primarily for IBM SNA/SDLC environments, the 4745 does not provide a migration path to non-SNA environments such as Ethernet LANs, TCP/IP networks, frame-relay WANs, or ISDN carrier services
	Network Management	Fully integratable into NetView; can be diagnosed remotely by an *Amdahl Diagnostic Assistance Center (AMDAC)*

Vendor Analysis

Marketing Strategy

Amdahl concentrates primarily on one segment of the computer industry: users of large systems who have standardized their operating environment on System/370 software and its extensions. This makes Amdahl a manufacturer of IBM-compatible systems dedicated to protecting the user's investment in data processing equipment and software.

In addition to communications processors, Amdahl markets the 5890, 5990, and 5995 Series of large-scale, IBM-compatible mainframes, and a line of IBM-compatible disk subsystems.

Target Markets

A general-purpose product supporting communications between any two or more SNA environments, the 4745 is used by private and public corporations, financial institutions, governmental bodies, universities, and research foundations around the world.

Market Position

Amdahl is one of the top three vendors in the communications processor market, which is dominated by IBM. Amdahl is also a major player in each of the other IBM-compatible market segments in which it competes.

Major Competitors

NCR Corp., which trails behind IBM in sales of communications processors, is Amdahl's other major rival.

Sales and Distribution Strategy

Sales

Amdahl has sales/support offices in major cities throughout the U.S., Canada, Europe, and Pacific Basin. This customer support force includes about 2,000 service representatives.

Distribution

Amdahl markets its products directly from its sales offices worldwide. In the U.S., the company also has agreements with system integrators.

Support

Policies and Programs

Warranty

Amdahl backs the 4745 with a 12-month warranty, which includes all parts and labor.

Support Services

Amdahl Customer Services offers both installation services and ongoing product support. Support programs for the 4745 include on-site maintenance, remote diagnostics through the *Amdahl Diagnostic Assistance Center (AMDAC)*, and software updates by remote transmission.

Amdahl also offers a complimentary analysis that compares a customer's current computing configuration with

Interoperability Matrix

Products	4745 Processor (Models 110 and 210)
Product Classification	Proprietary network router/gateway device
Relationship With Higher Level Elements	
Position in Network Architecture	Appears to the IBM host as an SNA physical unit (PU) type 4 device
Host Software Required:	
Operating Systems	MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP
Access Methods	VTAM , BTAM, BTAM-ES, or RTAM
Communications Processor Software Load	From the host, the processor's diskette, the processor's hard disk, or a remote Amdahl support center
Host Access	Direct connection via a System/370 block/byte multiplexer channel or fiber optic channel, remote access via a dial-up or leased line, or indirect host access via a token-ring LAN
Network Management Support	Relies upon IBM NetView; the 4745 also supports remote diagnostics from the *Amdahl Diagnostic Assistance Center (AMDAC)*
Relationship With Peer Level Elements	
Compatible Communications Processors	Plug compatible with the IBM 3745 channel-attached or remote processor
Transport Architectures Supported	Async, IBM SNA/SDLC, IBM 3270 BSC, and X.25
Relationship With Lower Level Elements	
Leased Line Support	Provides access to T1/E1 facilities via a V.35 or EIA-547 interface
Packet Switched Network Support	Supports access to an X.25 packet switched network using an X.21 interface
LAN Attachment Support	Supports up to four 4M bps token-ring networks concurrently

projected capacity needs. This analysis can result in improved network efficiency and provide key information for future network planning.

Service Providers

Amdahl uses its own service team, which provides 24-hour, 7-day assistance through the vendor's *Customer Service Centers.*

Service Locations

Domestically, Amdahl has service and support centers in each of the 50 states. Internationally, customer services are organized along Field Business Unit boundaries—Europe, Canada, and the Pacific Basin—to provide for the unique needs of customers in these geographic areas.

Training and Education

Amdahl offers a series of educational courses for network administrators, network managers, and maintenance personnel. Areas covered include overviews of ACF/NCP software, VTAM, SNA, and NetView; network planning and design; and hardware-specific technical training for customers who want to perform their own maintenance.

Competitors' Programs

IBM's service plan allows users to order any or all IBM services through a single document, including maintenance, invoicing, end-user support, site-planning, installation, and network services. Round-the-clock maintenance is provided through customer engineers (CEs), customer assistance groups (CAGs), remote diagnostics services, and technical support teams. In addition, IBM offers Technical Services Management (TSM), which provides maintenance for customers in a mixed-vendor environment.

Through its worldwide support organization, NCR provides remote diagnostics; on-site service; consulting and engineering services for complex networks; multivendor solutions; and customer education and training. A support hot line, in service 24 hours a day, 7 days a week, dispatches field service personnel as needed.

NCR provides in-depth, technical support services for complex and leading-edge technology products. It also assists customers in the integration of NCR products into multivendor environments by subcontracting NCR third-party resources for each customer project.

Specifications

Enhancements

Date	Event
Third-quarter 1991	Amdahl improved the throughput and processing capabilities of the 4745 communications processor with the *High Performance Feature (HPF)*; enhancements in HPF include static random access memory (SRAM) technology for main memory, which cuts the number of cycles needed to access stored data; a new channel adapter equipped with a large-scale integration (LSI) interface to the 4745's internal bus, which minimizes internal delays on the bus; and a more efficient bus and tag procedure for the channel adapter microcode, which increases channel availability for data transfer. Amdahl also introduced support for T1/E1 data rates over SDLC leased lines through the *High-Speed Communications Scanner (HSS)* and increased the maximum number of channel-attached hosts from six to eight.
First-quarter 1992	Amdahl introduced support for the IBM ESCON (fiber optic) channel interface on the 4745.

Features/Functions

Models	**4745-110**	**4745-210 Base Configuration**	**4745-210 Expanded Configuration**
Functions Performed	Concentrates host-bound data into one or more high-speed links; provides access to multiple IBM hosts for processor-attached devices; performs routing and switching among multiple network paths; sequences messages; and participates in network management functions	Concentrates host-bound data into one or more high-speed links; provides access to multiple IBM hosts for processor-attached devices; performs routing and switching among multiple network paths; sequences messages; and participates in network management functions	Concentrates host-bound data into one or more high-speed links; provides access to multiple IBM hosts for processor-attached devices; performs routing and switching among multiple network paths; sequences messages; and participates in network management functions
Hardware Features			
Design	A floorstanding unit	A floorstanding unit without the optional expansion unit	A floorstanding base unit with the optional expansion unit; both the base and expansion units are installed side by side
Internal Memory Capacity (bytes RAM)	4M-8M *(1)*	4M-8M *(1)*	4M-8M *(1)*
Hard Drive Capacity (bytes)	67M	67M	67M
Diskette Drive Capacity (bytes)	1.2M	1.2M	1.2M
Transmission Features			
Max. No. of Lines	64	128	256
Max No. of T1/E1 Links	2	4	4
Max. No. of Host Connections	4	4	8
Max. No. of Token-Ring LAN Connections	2	4	4
Physical Interfaces Supported	EIA-547, RS-232-C/V.24, RS-366/V.25 (auto dial), V.35, X.21, IBM ESCON (fiber optic)	EIA-547, RS-232-C/V.24, RS-366/V.25 (auto dial), V.35, X.21, IBM ESCON (fiber optic)	EIA-547, RS-232-C/V.24, RS-366/V.25 (auto dial), V.35, X.21, IBM ESCON (fiber optic)
Software Features			
IBM Software Support	Plug compatible with the IBM 3745; runs under IBM Advanced Communications Function/Network Control Program (ACF/NCP) Release 3, 4, or 5; Partitioned Emulator Program (PEP); or Emulation Program (EP)	Plug compatible with the IBM 3745; runs under IBM Advanced Communications Function/Network Control Program (ACF/NCP) Release 3, 4, or 5; Partitioned Emulator Program (PEP); or Emulation Program (EP)	Plug compatible with the IBM 3745; runs under IBM Advanced Communications Function/Network Control Program (ACF/NCP) Release 3, 4, or 5; Partitioned Emulator Program (PEP); or Emulation Program (EP)

Features/Functions (Continued)

Models	4745-110	4745-210 Base Configuration	4745-210 Expanded Configuration
Control Program Migration Feature (CPMF)	Allows transparent movement between ACF/NCP Releases 3, 4, and 5 with a single console command	Allows transparent movement between ACF/NCP Releases 3, 4, and 5 with a single console command	Allows transparent movement between ACF/NCP Releases 3, 4, and 5 with a single console command
Protocols Supported	Async, SNA/SDLC, 3270 BSC, HDLC, X.25	Async, SNA/SDLC, 3270 BSC, HDLC, X.25	Async, SNA/SDLC, 3270 BSC, HDLC, X.25
Redundancy	Amdahl's Integrated Switching Architecture (ISA) provides automatic or manually controlled switchover to backup host channels	Amdahl's Integrated Switching Architecture (ISA) provides automatic or manually controlled switchover to backup host channels	Amdahl's Integrated Switching Architecture (ISA) provides automatic or manually controlled switchover to backup host channels

(1) IBM ACF/NCP Releases 3 and 4 support no more than 3M bytes of internal memory; Release 5 can support up to 8M bytes, however.

Network Management Functions

Fault and Problem Management	The IBM NetView Session Monitor permits the user to examine information related to the SNA network and to identify network problems; NetView's Hardware Monitor provides access to problem determination information generated at network nodes.
Configuration Management	With Amdahl's 4747 Console, an alphanumeric display locally or remotely connected to the 4745 processor, the user can access the maintenance and operator subsystem (MOSS), basic systems operations, and hard disk functions of the 4745; the processor can also be reconfigured remotely from the user's host computer or from an Amdahl support center.
Performance Management	The NetView Command Facility allows the user to control, record, and automate various operator tasks; the facility can also be used as an operator's interface to VTAM in a data communications network; additionally, performance management is supported by NetView Performance Monitor (NPM) under VM or MVS.
Security Management	NetView supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF); RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Configuration

Standard Components

Module	Description
Amdahl Diagnostic Assistance Center (AMDAC) Modem	An error-correcting, asynchronous, auto answer, full-duplex device that runs at data rates of 1200 or 2400 bps; it enables Amdahl support personnel to remotely view error messages and system status information.
Communications Control Unit (CCU)	The heart of the 4745, the CCU collects instructions from main memory and decodes them for execution; it also supports I/O functions, controls data communications to terminals, manages main memory, and sends error and status information to the Maintenance and Operator Subsystem (MOSS).
Main Storage	Residing in the base unit, main storage supplies memory space for the control program, software configuration tables, and data buffers; it enables all major processor components to communicate with each other, since they all share this memory.
Channel Adapter (CA)	Each channel adapter furnishes one physical connection between the host processor and the 4745 via a block multiplexer channel, a selector channel, or a byte multiplexer channel; through internal microcode, the CA controls and manages data transfer. Amdahl supports both the Type 5 Channel Adapter (CA5) and the newer *High-Performance Feature Channel Adapter (HPF/CA)* (see the "Options" section).
Line Interface Coupler (LIC)	Each LIC provides one or more physical interfaces for attachment of communications lines; each port on a LIC1 can handle a unique protocol, interface type, duplex type, and line speed; each port on a LIC4 can support a unique duplex type and line speed.
Communications Scanner	This module controls data transfer through attached communications lines; the scanner manages line protocols by executing link-control functions, serializes/deserializes data characters, provides character buffering, performs error detection and correction, and controls DTEs in the network. The 4745 supports two types of scanners: the Type 4 Communications Scanner (CS4) and the High-Speed Communications Scanner (HSS); CS4 supports async, IBM BSC and SDLC, HDLC, and X.25 communications using LICs, with up to 32 lines per scanner; HSS supports SDLC communications at speeds up to T1/E1 over leased lines, using V.35 and EIA-547 physical interfaces.
Maintenance and Operator Subsystem (MOSS)	An independent microprocessor-based subsystem, MOSS maintains independent paths to all major system components; it performs microcode program load, and starts up diagnostic programs during power-up; it also furnishes network operators with an interface to the 4745, thereby providing a flexible system for isolating problems, implementing diagnostic procedures, and performing maintenance.

Configuration (Continued)

Standard Components

Module	Description
Token-Ring Adapter (TRA)	Each TRA supports up to two independent 4M bps token-ring networks concurrently; it uses standard NCP Token-Ring Interconnection (NTRI) software within NCP to manage data transfer, and conforms to the IEEE 802.5 LAN standard.

Configuration Rules

Models	Description
4745-110	Supports one CCU, one main storage unit, one MOSS, one control panel, and one AMDAC modem, along with the following: • Up to four CA5 or HPF/CA Channel Adapters; • Up to two CS4 or HSS scanners; • One Token-Ring Adapter; and • Up to two Two-Processor Switch modules.
4745-210 Base Config.	Supports one CCU, one main storage unit, one MOSS, one control panel, and one AMDAC modem, along with the following: • Up to four CA5 or four HPF/CA Channel Adapters; • Up to four CS4 or four HSS scanners; • Up to two Token-Ring Adapters; and • Up to two Two-Processor Switch modules.
4745-210 Expanded Config.	Supports one CCU, one main storage unit, one MOSS, one control panel, and one AMDAC modem, along with the following: • Up to six CA5 or eight HPF/CA Channel Adapters; • Up to eight CS4 or four HSS scanners; • Up to two Token-Ring Adapters; and • Up to two Two-Processor Switch modules.

Physical Environment

	4745-110 4745-210 Base Unit	4745-210 Expansion Unit	4747 Console
Physical Specifications (H x W x D, in.)	55.1 x 35.4 x 31.5	55.1 x 33.5 x 31.5	14.6 x 17.7 x 22.0
Electrical Specifications	208 V-240 V AC, 1.7K watts	208 V-240 V AC, 1.7K watts	120 V or 240 V AC, 100 watts
Environmental Specifications	Operating temp.: 41°F-100°F; operating humidity: 20%-80%	Operating temp.: 41°F-100°F; operating humidity: 20%-80%	Operating temp.: 32°F-104°F; operating humidity: 20%-80%

Options

Product	Description
Upgrade Options	
High-Performance Feature (HPF)	HPF adds static random access memory (SRAM) chip technology to main memory, which reduces the number of cycles required to access data. HPF also includes a new channel adapter equipped with a large-scale integration (LSI) interface to the 4745's internal bus, which minimizes internal delays on the bus. The channel adapter implements a more efficient bus-and-tag procedure, increasing channel availability for data transfer operations. These enhancements provide up to 1.9 times the external throughput and 1.8 times the internal throughput capacity previously supported.
System Extension Feature (FEF)	SEF is an advanced backpanel that is now standard on all new processor models, and which can be added to earlier models; SEF is a prerequisite for the Integrated Switching Architecture (described below), memory expansion to 8M bytes of SRAM, token-ring functionality, the High-Performance Feature (HPF), the High-Speed Scanner (HSS), and support for four or more host channel adapters.
Expansion Options	
Expanded Channel Connectivity Feature (ECCF)	ECCF allows the attachment of up four additional channel adapters for the 4745-210 in the expanded configuration, for a total of eight channels.
Two-Processor Switch	This component provides a second channel interface (to the same host or a different host) for a channel adapter; access to a secondary host ensures network integrity in the event of a failure of the primary host; the switch does not provide hardware or software multiplexing of data from both channels; usually, only one channel at a time is enabled.

Pricing

Equipment Prices

Model	Description	Base Price ($)
4745-110	Includes 4M bytes of SRAM, two scanners, and the AMDAC Modem	100,650
4745-210	Includes 4M bytes of SRAM, two scanners, eight LICs, and the AMDAC Modem	132,000
4747 Console	Alphanumeric display	2,310

■

Amdahl 4745 Communications Processor

In this report:

Product Summary

Editor's Note

In April 1990, Amdahl enhanced Models 4745-110 and 4745-210 with 4M bps token- ring adapters, extended the memory capacity to a total of 8M bytes, extended the channel connectivity of both models to support up to four active channel adapters in the base frame, and extended the Integrated Switching Architecture (ISA) with operation of automatic backup capabilities. The base prices have not changed since November 1989.

Description

The 4745 line of communications controllers consists of Models 110 and 210. The controllers are primarily designed for use in large networks as remote concentrators or front ends for remote hosts. The Model 4745-110 can support up to 64 lines and four channel adapters. The Model 210 handles the traffic volume in medium-to-large SNA networks, and can handle up to 256 lines and six channel adapters. Both models run ACF/NCP Versions 3, 4, and 5.

—By Barbara Rinehart
Associate Editor/Analyst

Strengths

Amdahl's Integrated Switching Architecture (ISA) provides a multilevel component backup and multiprocessor backup for high network availability.

Limitations

At this time, the 4745 does not support T1.

Competition

NCR and IBM.

Vendor

Amdahl Corp.
1250 East Arques Avenue
P.O. Box 3470
Sunnyvale, CA 94088-3470
(408) 746-6000

Price

Base unit price is $100,650 for the Model 110, and $132,000 for the Model 210.

Analysis

In May 1988, Amdahl introduced the 4745 front-end communications processors, which consist of two models: the 4745-110 and 4745-210. Initially, the two models ran IBM's ACF/NCP Version 2, 3, or 4 software, but in April 1989, Amdahl incorporated the capability of running NCP Version 5 into the models. The 4745 replaced Amdahl's earlier communications processor, the 4725. Both the 4745-110 and 4745-210, can be field upgraded to run ACF/NCP Version 5.

The 4745-210 is designed to meet the traffic needs of SNA networks. The 4745-110 is suited for smaller, high-speed requirements, serving as a remote concentrator, a network node, or an application controller for security or other reasons.

The 4745s can run ACF/NCP Version 2, 3, 4, or 5 on the same hardware, without modification. To make the transition from one version to another, the operator need only to type simple commands on the 4745's console and to load the appropriate ACF/NCP module across the channel or from the 4745's disk drive, a process that takes about five minutes.

In 1990, Amdahl made the following enhancements:

- Introduced the Token-Ring Adapter that allows the 4745 to connect to as many as four 4M bps token-ring LANs, and to manage data transfer between the token-ring LANs and host applications.
- Expanded the memory capacity of the communications processors to 8M bytes.
- Expanded the processors' channel connectivity to support up to four active channel adapters in the base frame.
- Extended the 4745's Integrated Switching Architecture (ISA) to provide the option of automatic backup operations.

The Amdahl systems are IBM compatible. As such, the IBM installed base is a target market.

Competitive Position

Communications processors are a commodity product. IBM, NCR, and Amdahl dominate the market. In terms of market share in the communications processor field, Amdahl still ranks third behind IBM and NCR.

When we compared Amdahl's revenue form 1988 and 1989, we found that the communications product line's revenue contribution dropped from 5 percent in 1988 to 3 percent in 1989.

Decision Points

Even though communications processors are commodity items, the Amdahl 4745 processors offer the following benefits: fit into the mainstream of SNA networks, are compatible with the IBM 3745, and are easily upgraded from the NCP v4 to NCP v5. According to Amdahl, the 4745's throughput is up to 1.4 times that of the IBM 3745-210.

In April 1990, Amdahl made an announcement that it planned to support the T1/CEPT. As of this writing, this feature is still not available.

Characteristics

Models: Model 4745-110; Model 4745-210.

Date of Announcement: Models 110 and 210—May 1988.

Date of First Delivery: Models 110 and 210—June 1988.

Number Installed: Information not available.

Overview

The 4745 Communications Processor consists of the 4745 base unit and the 4747 console. Amdahl offers an optional expansion frame, the 5203, for the Model 210. The 4745 base unit contains the Communications Control Unit (CCU), Maintenance and Operator Subsystem (MOSS), and main storage.

Company Profile
Amdahl Corporation

Corporate Headquarters
1250 East Arques Avenue
Sunnyvale, CA 94088-3470
(408) 746-6000

In Canada
Amdahl Canada Limited
One First Canadian Place
P.O. Box 123
Toronto, ON M5X 1A4
(416) 862-7479

Officers
Chairman of the Board/ CEO: John C. Lewis
Vice Chairman of the Board: Eugene R. White
President/Chief Operating Officer: E. Joseph Zemke

Company Background
Amdahl Corp. was formed in October 1970 by Dr. Gene Amdahl, and immediately attracted a group of engineers familiar with large-scale systems. Five years later, with $47 million invested on research and development, the company installed its first product, the Amdahl 470V/6 computer.

On October 1980, the 4705 front-end communications processor was announced, and in September 1987, the 4725 Series of front-end processors was introduced offering up to 80 percent more throughput than the 4705 models.

Amdahl designs, develops, manufactures, markets, and services large-scale, high-performance data processing systems. The company's product line includes large, general-purpose mainframe computers, data storage subsystems, data communications products, and software. Amdahl also provides educational and consulting services.

As of 1990, Amdahl had customers in more than 25 countries with approximately 120 sales offices and 8,200 employees. Manufacturing activities are centered in northern California, Dublin, Ireland, and the Canadian province of Ontario. In 1990, Amdahl ranked 201 on ***Fortune*** magazine's list of the 500 largest U.S. companies.

Financial Profile
Net income for the year ended December 28, 1990 amounted to $183,954,000 or $1.66 per share, up from $152,972,000 or $1.39 a share in 1989. Revenue totaled $2,159 billion in 1990, compared to $2,101 billion in 1989.

In the fourth quarter of 1990, net income was $61,314,000 or 55 cents per share on revenues that increased to $625,847,000.

Sources of Revenues
Amdahl's revenue sources for 1989 were broken down into the following areas: processors—70 percent; maintenance—13 percent; software/ educational services—2 percent; communications products—3 percent; and storage products—12 percent.

The base unit of the 4745-110 has two scanners with up to 64 lines. The base unit of the 4745-210 can support up to four scanners with up to 128 lines. The base unit for either model can support up to two channel adapters.

The 4745 resides between the host processor(s) and the network terminals. Under the control of an NCP program in main storage, it can connect and disconnect terminals; transmit and receive data between the terminals and host processor(s); and operate and monitor modems, automatic calling units (ACUs), and other communication units.

Attachment to the network can take place locally or remotely. Local attachment occurs via a selector, byte multiplexer, or block multiplexer channel. Remote attachment occurs via a telecommunications link with another, Amdahl (4745, 4725, 4705) or IBM (3705, 3720, 3725, 3745) communications controller. Channel adapters control the data transfer between the host and the 4745, and line interface couplers support the attachment between the 4745 and the network.

Configurations

The minimum configuration for a 4745-110 consists of one base unit; two communications scanners; one console; and one line interface coupler (LIC). This configuration is suitable for a link-attached system. If the user requires channel attachment, the system must have at least one channel adapter.

The minimum configuration for a 4745-210 consists of one base unit; two communications scanners; eight LICs; and one console.

The maximum configuration for the 4745-110 includes of one base unit; two communications scanners; 16 LICs; one console; and four channel adapters.

The maximum configuration for the 4745-210 includes one base unit; one expansion unit; eight communications scanners; 64 LICs; six channel adapters with 2 two-processor switches, or five channel adapters with 3 two-processor switches, or four channel adapters with 4 two-processor switches; and one console with an alternate console.

Table 1. Specifications Summary

Configurations

	4745 Base Unit	Expansion Unit	Maximum Configuration
Main Storage	3MB with NCP 4	NA	3MB with NCP 4
4745-110	4 or 8MB with NCP 5	Yes	8MB with NCP 5
4745-210	3MB with NCP 4		3MB with NCP 4
	4 or 8MB with NCP 5		8MB with NCP 5
Active Channel Connections (Byte, Block, or Selector)			
4745-110	0-4	NA	4
4745-210	0-4*	0-4*	6
Total Channel Connections			
4745-110	0-4	NA	4
4745-210	0-4 (with TPS)	0-4	8
Two-Processor Switches (TPS)			
4745-110	0-2	NA	2
4745-210	0-2	0-2	4
Token-Ring Adapters (4M bps)			
4745-110	0-1	NA	1
4745-210	0-2	NA	2
Token-Ring Attachments			
4745-110	0-2	NA	2
4745-210	0-4	NA	4
HDX and FDX Lines			
4745-110	1-64	NA	64
4745-210	1-128	0-128	256
Scanners			
4745-110	2	NA	2
4745-210	2-4	0-4	8
Consoles†	NA	NA	2

NA—Not available.
**The maximum total number of active channel connections in the base and expansion frames, taken together, is six.*
†One console, including keyboard and display station, is required and is housed separately. Electronic interfaces for both local and remote consoles are contained in the 4745 base unit.

Components

Communications Control Unit (CCU)

The heart of the 4745, the CCU, based on emitter-coupled logic (ECL) technology, offers a cycle time of 30 nanoseconds. The CCU performs the following:

- Collects instructions from main storage and decodes them for execution.
- Executes I/O instructions to the channel adapters and communications scanners.
- Processes interrupts.
- Manages main storage shared by all 4745 components.
- Interfaces with maintenance and operator subsystem (MOSS) and the control panels on the base unit and expansion unit.

To facilitate future upgrades, some components are based on extensive microcoding.

Main Storage

The main storage for the 4745 supplies memory space for the control program, software configuration tables, and data buffers. Shared by all major 4745 components, it enables them to communicate with each other. The main storage resides entirely in the base unit.

Maintenance and Operator Subsystem (MOSS)

The 4745 MOSS, an independent microprocessor-based subsystem, maintains separate connections to all major system components. It furnishes the 4745 with a flexible system for isolating problems and implementing diagnostic procedures. MOSS also gives operation and

maintenance personnel an interface to the system via the console or the control panels located on the base and expansion units.

Additional MOSS features are:

- Independent paths to all major system components.
- Support of 4745 operations.
- Monitoring and diagnosing of subsystem problems.
- Communication with the 4745 control program.
- Provision of maintenance support, as required.

System Extension Feature (SEF)

SEF refers to an extension of the basic 4745 system. The SEF includes a larger hard disk (67M bytes); an enhanced set of printed circuit boards for the maintenance and operator subsystem (MOSS); a new back panel; and other, related modifications. The SEF can be applied to existing 4745s as a field upgrade.

The 67M-byte hard disk contains programs that control configurations and enhance diagnostic tests. The hard disk frees the host processor from performing certain operational functions, accelerates program loading, and sends fast prompts to the console. The hard disk can also store two operational NCP load modules and one dump module when the 4745 serves as a remote concentrator. The 4745 is also equipped with a 5.25-inch, 1M-byte diskette drive that loads start-up diagnostics, microcode, system configurations, and the bootstrap program.

The Expanded Channel Connectivity

This extends the channel connectivity of the 4745-110 and 4745-210 to support up to four active channel adapters in the base frame. This provides increased host connectivity. The previous maximum for both models was two channel adapters in the base frame.

Channel Adapters

The channel adapters (CAs) furnish the physical connections and control the data transfer between the host processors and the 4745. Each channel is a CMOS VLSI device that uses microcode to manage data over IBM-compatible block multiplexer channels, selector channels, or byte multiplexer channels. When equipped with the two-processor switch option, a channel adapter can supply a second channel connection to the same host processor or to a different processor.

Token-Ring Adapter

The Token-Ring Adapter (TRA) allows the 4745-210 to connect to as many as four independent token-ring LANs, running at 4M bps. Each Amdahl TRA can connect two independent token-ring networks; there can be as many as two TRAs (four token-ring LAN connections) installed in the 4725-210, or one TRA (two token-ring LAN connections) installed in the 4745-110. The 4745 uses standard NCP Token-Ring Interconnection (NTRI) software within NCP to manage data transfer. The Amdahl 4745 TRA feature is compatible with industry-standard hardware and software, and conforms to the IEEE 802.5 LAN standard.

Table 2. LIC Specifications

Type	Lines per LIC	Interfaces	Maximum Speeds (K bps)
LIC1	4	RS-232-C/V.24, RS-366/V.25	19.2
LIC2	1	Bell 303	230.4
LIC3	1	V.35	256.0
LIC4A	4	X.21	19.2
LIC4B	1	X.21	256.0

Two-Processor Switch

In case of a host system failure, the optional two-processor switch is used to connect the processor to a backup host. It works with a channel adapter to provide a second channel interface for that adapter. This second channel interface can be connected to a different channel on the same host or to a second host. Users engage the interfaces by a switch on the control panel of the base unit. The operator can engage either interface or both simultaneously. The switch does not provide hardware or software multiplexing of data from the channel(s). Usually, only one channel is enabled at a time.

Integrated Switching Architecture

Functions of the Integrated Switching Architecture (ISA) are:

- Allows backup of the central control unit/main storage (CCU/MS).
- Allows backup of the line interface couplers (LICs), communications scanners, channel adapters, the maintenance and operator subsystem (MOSS), buses, and power supplies.
- Enables one system to back up as many as four systems.
- Operates in four modes of backup: twin-in-dual, twin-in-standby, twin-in-backup, and multiple backup.
- Provides limited online maintenance and maintenance scheduling.

Communications Scanners

These devices control data transfer between the 4745 and the terminal equipment in the network. Since the 4745 uses only one type of scanner, users can easily configure and reconfigure the system. The scanner is a high-performance device that contains a VLSI microprocessor with integrated RAM and a VLSI front-end scanner. The communications scanner controls the line interface couplers that form the actual connections to

Table 3. Specifications Summary

Physical Characteristics

	4745 Base Unit	Expansion Unit	Console
Weight (lb.)	858	299 660	11 24
Width (in.)	35.4	85 33.5	45 17.7
Depth (in.)	31.5	80 31.5	56 22.0
Height (in.)	55.1	140 55.1	37 14.6
Heat Dissipation (Btu/h.)	5794	940 3730	85 337
Airflow (f^3/min.)	525	12 420	NA NA
Operating Temperature (° F)	41-100*	5-38* 41-100*	0-40 32-104
Operating Humidity (%)	20-80	20-80	20-80
Power Consumption (Hz) (kVA) (V)	50/60 1.7 208-240	50/60 1.1 208-240	50/60 0.1 120 (U.S.), 240 (Intl.)
Phase	1	1	1

NA—Not applicable.
**Reduced to 26° C/78° F at 10,000 feet (3.048 meters).*

the communications lines. One scanner can attach up to 32 lines through a maximum arrangement of eight line interface couplers.

The communications scanner manages line protocol by executing link control functions, serializes and deserializes data characters, provides character buffering, and controls data circuit-terminating equipment (DCEs). It also performs error detection and correction.

Line Interface Couplers (LIC)

The LICs supply ports for connecting communications lines to the 4745. They receive data coming from the lines and transmit it to the scanner, and send information from the scanner back to the lines. For details on the five types of LICs for the 4745, please refer to Table 2.

Line interface couplers can attach half- or full-duplex lines. Each port on a LIC1 can handle a unique protocol, interface type, duplex type, and line speed. Each port on a LIC4 can support a unique duplex type and line speed. In addition, each port on a LIC1, LIC3, LIC4A, or LIC4B can support either direct-attached or DCE-attached devices.

Operator Interface

4747 Console

The 4745 supports up to two 4747 consoles: a primary console (required) and an alternate console (optional). The console consists of a 14-inch, 25-line, 2,000-character monochrome display with attached keyboard. The operator can perform a wide range of operations and diagnostic functions with the help of a series of selectable full-page screens.

Users must place the primary console within approximately 13.5 meters (44 feet) of the base unit. The alternate console can be located approximately 150 meters (492 feet) from the base unit if it is connected directly, or placed at a remote site and attached via modems. The alternate console port can be optionally switched to a modem to give Amdahl Diagnostic Assistance Center (AMDAC) access to the 4745 for remote diagnostics and maintenance activities. The user can switch between an alternate console and an AMDAC connection via a switch in the base control panel. Primary and alternate consoles can operate concurrently.

Control Panel

The 4745 base unit is equipped with front-mounted control panels that allow access to critical system functions. These panels also contain backup controls for use in case the 4747 console does not operate. Each control panel consists of system status control switches and indicators. The controls enable the operator or maintenance person to power the unit on or off, reset the system, and enable or disable channel interfaces. The base unit control panel has a key for use by the operator to place MOSS in customer mode for normal operation or in customer engineer (CE) mode for maintenance.

Software

Both models of the Amdahl 4745 Communications Processor can run IBM Advanced Communications Function/Network Control Program (ACF/NCP) software. The ACP/NCP allows Node Type (NT) 2.1 devices to use the LU 6.2 protocol for peer-to-peer sessions over SNA networks with minimal host intervention.

The Amdahl 4745 can also run PEP, EP, as well as program products written for the IBM 3745.

Pricing and Support

Remote diagnostic service is available through the Amdahl Diagnostic Assistance Center (AMDAC).

Amdahl Customer Services offers installation services, as well as on going local and regional product services. Several support plans are available for the 4745.

The pricing is for the base system only. The 4745-110 costs $100,650 and the 4745-210 costs $132,000. ■

Harris Adacom Challenger ES/174 Extended Systems Controller

New Product Announcement

Vendor
Harris Adacom Corp.
16001 Dallas Parkway
P.O. Box 809002
Dallas, TX 75248-3399
(214) 386-2000

Product
The Challenger ES/174 is an IBM 3174-compatible communications controller that is compliant with Government Open Systems Interconnection Profile (GOSIP) requirements. Since August 1990, all new computer equipment purchased by the government must support multivendor connectivity using the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) protocols as specified by GOSIP guidelines.

Date Announced
November 1991.

Date Released
Fourth-quarter 1991.

Price
$3,000 for a base configuration. Options are modular and can be added as required.

Relationship to Current Product Line
Harris Adacom provides multivendor networking equipment and systems integration services. The vendor is an established leader in token-ring and Ethernet LAN and IBM 3270 connectivity solutions. Products marketed by the vendor include:

- multifunction gateways;
- distributed processing systems;
- interconnect and communications hardware and software; and
- IBM-compatible, interactive devices, such as 3270-compatible displays and terminal controllers, and remote job entry (RJE) products.

—By Martin Dintzis
Assistant Editor

Specifications

Overview
The Challenger ES/174 Extended Systems Controller is available in three models. *Model 10*, a floorstanding unit, supports 128 coaxial devices along with 34 async devices or hosts. *Model 20* and *Model 60* are desktop units that can also be rack-mounted. Model 20 accommodates up to 64 coaxial devices and 10 async devices or hosts. Model 60 supports clusters of up to 32 coax devices and 3 async devices.

Features

- Full compatibility with IBM 3174 Establishment Controller models.
- All models support up to four concurrent IBM host connections. On Model 10, up to two of these connections can be channel attached.
- Multiple Logical Windowing (MLW) provides up to five concurrent windows on synchronous and asynchronous display terminals. Protocol conversion functionality allows any attached display to access any attached host. Zoom and session-to-session cut/paste functions are also provided.
- Token-ring LAN connectivity allows the ES/174 to function as a gateway or a

downstream processing node. As a gateway, the ES/174 provides access to up to four different IBM hosts for controller-attached and downstream LAN devices. As a downstream controller node, it provides access to up to four IBM hosts via multiple LAN-attached gateway controllers. Both 4M and 16M bps token-ring networks are supported.

- Includes an online, menu-driven configuration utility. Software distribution to multiple remote controllers from a single personal computer is supported.
- The ES/174 interfaces directly with IBM's NetView network management system and supports IBM's *Network Asset Management* and *Vital Product Data* features. ■

IBM 3172 Interconnect Controller

In this report:

Note: The 3172 Model 3 now optionally supports a 66MHz Pentium processor. The *3172 SNA Communications Program*, a software product released in 1994, enables network users to access VTAM/SNA host applications from token-ring, Ethernet, and FDDI LANs over frame-relay and SDLC networks. This software works with new LAN and WAN adapters providing higher performance for multimedia and interactive data communications applications.

Datapro Summary

The IBM 3172 Interconnect Controller is a multivendor networking product capable of consolidating multiple, dissimilar LANs and IBM hosts over a LAN backbone, an ESCON fiber link, or a wide area network. Through the 3172, IBM hosts can function as LAN superservers, providing shared access to storage, printing, data distribution, management, and other mainframe services.

Strengths

- The 3172 supports wide area networking between host computers using frame-relay, TCP/IP, and SNA/SDLC protocols.
- Consolidation of multiple hosts and incompatible LANs makes possible resource sharing, data backup, and centralized network management.
- By taking advantage of the higher speeds of ESCON and FDDI, users can improve performance in highly interactive forms of communication, such as host-to-graphics workstation and host-to-host links.
- The TCP/IP Offload feature streamlines host data processing.

Limitations

- The 3172 does not support ESCON and System/370 parallel channel connections concurrently.
- The 3172 is designed for small- to medium-sized networks. Large networking implementations require multiple 3172s or IBM's 3745 Communication Controller.

Competition

CompuTerm Corp.'s ENTREX 6000 Series and multiprotocol communications processors from Apertus Technologies and IDEA.

Corporate Headquarters

IBM
Old Orchard Road
Armonk, NY 10504
(800) 426-3333
In Canada: Contact your local IBM representative.

Price

Model 3 carries a base price of $9,970 (U.S.). Interconnect Controller Program (ICP) costs $6,665 (U.S.). See the Pricing section for additional details.

—By Martin Dintzis
Assistant Analyst

Product Analysis

IBM is pursuing a more aggressive role in enterprise networking by increasing support for multivendor connectivity. The 3172 Interconnect Controller is one of IBM's flagship products for interconnecting System/370 and IBM ESCON host computers and multiple, incompatible LANs via SNA/SDLC, frame-relay, or X.25 wide area networks.

In 1994 IBM withdrew 3172 Models 1 and 2. The vendor continues to market and enhance 3172 Model 3, a PS/2-based controller. A rack-mounted or tabletop unit with four option slots, the 3172 Model 3 can establish the following connections:

- Up to four token-ring or Ethernet LANs (one per option slot).
- Up to four WAN connections: two fractional or full T1/E1 and two 64K bps or subrate connections.
- One FDDI LAN (uses two option slots).
- WAN access for up to thirty-two 64K bps or twenty-four 256K bps device ports (eight or six per option slot, respectively).
- Dual System/370 parallel or one ESCON channel connection per controller (each uses one option slot).

Interconnect Controller Program (ICP) software, running on the 3172, allows Model 3 to support both SNA/VTAM and TCP/IP host applications and data flows concurrently over the same or different LANs and to bridge both SNA and NETBIOS LAN protocols (using frame relay or X.25) over wide area connections to TCP/IP hosts. By running IBM's TCP/IP Offload software, the 3172 performs TCP/IP protocol processing, thereby reducing host communications overhead. Interconnect Controller Program (ICP) software includes IBM's Operator Facility/2, a PS/2-based configuration and control software product that works with IBM NetView.

IBM has positioned the 3172 to function as a LAN server for System/370 or ES/9000 hosts via either of two software products. *LAN Resource Extension and Service* lets Novell NetWare clients access mainframe file, printing, data distribution, and administrative services. *LAN File Services/ESA* provides high-performance workstation access to ES/9000 host resources via ESCON.

In the second quarter of 1994, IBM introduced the following enhancements to the 3172:

- An optional 66MHz Pentium processor.
- Two new Micro Channel LAN adapters, *Auto LANStreamer MC 32* (token-ring) and *EtherStreamer MC 32* (Ethernet), provide enhanced performance in multimedia and interactive LAN/WAN applications.
- The *Wide Area Connector (WAC)* now supports dual communications interfaces: one fractional or full T1/E1 and one 64K bps or subrate connection.
- The new *ARTIC Portmaster* card, based on IBM's Real Time Interface Co-Processor Card for Micro Channel bus systems, provides wide area access to as many as eight SDLC devices.
- IBM has introduced the 3172 SNA Communications Program, which provides access to VTAM/SNA host applications from LANs over frame-relay, X.25, and SDLC networks.
- Version 3 Release 3 of the Interconnect Controller Program (ICP) adds support for the ESCON Multiple Image Facility for sharing of ESCON channels by multiple logical (or physical) hosts.
- IBM now offers its system software preloaded on the controller's hard drive, which simplifies user setup.

Target Markets

The 3172 is a general-purpose product supporting communications between an SNA host environment and multiple LANs and/or remote SNA hosts. It is aimed at private and public corporations, financial institutions, governmental bodies, and universities.

The 3172 can provide the following key capabilities:

- Consolidating multiple, incompatible LAN environments;
- Improving performance and throughput in host-to-host or host-to-LAN communications applications by using FDDI or ESCON channels;
- Interconnecting remote IBM hosts over wide area networks;
- Providing shared workstation access to mainframe application and hardware resources; and
- Developing a migration path to open systems computing through TCP/IP and frame relay.

Strengths

Supporting several LAN and WAN protocols, the 3172 can consolidate multiple, incompatible LANs and hosts, making possible resource sharing, data backup, and centralized network management.

By taking advantage of the higher speeds of ESCON and FDDI, users can improve performance in highly interactive forms of communication, such as host-to-graphics workstation and host-to-host links. The TCP/IP Offload feature streamlines host data processing.

Overview

Model	3172 Model 3
Product Type	LAN router and host-to-LAN gateway.
Design	Rackmount or tabletop.
Date Announced	June 1992
Date Released	September 1992
Base Purchase Price (US$)	9,970

Interoperability Matrix

Product	IBM 3172 Interconnect Controller
Product Classification	Proprietary network router/gateway device.
Relationship With Higher-Level Elements	
Position in Network Architecture	Transparent to the IBM host.
Host Software Required:	
Operating Systems	MVS/ESA, VM/ESA, VM/SP, or VSE/ESA.
Access Method	ACF/VTAM Version 3.4 or later.
Other Software	For TCP/IP connectivity, IBM TCP/IP for VM Version 2 Release 2 or later, or IBM TCP/IP for MVS Version 2.0 or later.
Communications Controller Software Required	3172 Interconnect Controller Program (ICP), TCP/IP Offload software, and 3172 SNA Communications Program, all provided by IBM.
Software Load	From the host, the 3172 controller's diskette drive or hard drive, or a remote IBM support center.
Host Attachment Support	Direct connection via a System/370 parallel or ESCON channel; indirect access via an FDDI, Ethernet, or token-ring LAN leading to another 3172; or remote access via a subrate, fractional T1/E1, or full T1/E1 wide area networking facility.
Network Management Support	Configuration, monitoring, and control are provided by Operator Facility/2 software for the PS/2. Centralized management can be provided by IBM NetView or a remote IBM support center. Also provides a Simple Network Management Protocol (SNMP) agent.
Relationship With Peer-Level Elements	
Compatible Communications Processors	IBM 3174 Establishment Controller, 3745 Communication Controller, and compatibles.
Gateways Supported	Supports bidirectional gateways between IBM ES/9000 and System/370 hosts and token-ring, TCP/IP Ethernet, and FDDI LANs. It establishes these links across ESCON fiber optic links and SNA/SDLC, X25, TCP/IP, and frame-relay wide area networks.
Relationship With Lower-Level Elements	
Leased-Line Support	Provides access to fractional and full T1/E1 carrier services via V.35, X.21, and RS-449 interfaces.
X.25 Packet Switched Network Support	Not supported directly.
LAN Attachment Support	Provides gateways to Ethernet, FDDI, and token-ring LANs.

Limitations

While ESCON promises host channel data rates up to 200M bps, not all users can cost justify replacing existing parallel channels with ESCON channels. The 3172 does not support ESCON and System/370 parallel channel connections concurrently.

The 3172 is designed for small- to medium-sized networks. Large networking implementations require multiple 3172s or IBM's 3745 Communication Controller.

Competitive Analysis

The 3172 competes with CompuTerm Corp.'s ENTREX 6000 Series and multiprotocol communications processors from Apertus Technologies and IDEA. To a lesser extent, the 3172 also competes with multiprotocol LAN routers from vendors such as Cisco Systems, Wellfleet Communications, and Vitalink Communications. These routers, however, require an IBM controller to provide LAN access to the System/370 or ES/9000 host.

Vendor Analysis

IBM, the world's largest computer company, is involved in all aspects of information technology. It offers all types of computer and communications hardware and software, including mainframes, midrange systems, workstations, personal computers, peripherals, and associated systems and applications software.

IBM began in 1911 as Computer-Tabulating-Recording, and took the name International Business Machines in 1924, with Thomas J. Watson as president. By the 1950s, it held 95% of the punch-card business in North America. This gave it a tremendous advantage when it entered the computer market in 1952 with its first vacuum tube computer.

Building on the success of its first computer, and benefiting from international marketing and manufacturing ventures set up as early as 1923, IBM began to establish a clear lead in the global computer market. The System/360 mainframe, launched in 1964, quickly took 70% of the data processing market in the U.S., knocking out competition from General Electric and RCA. IBM went on to dominate the world computer market for the next 25 years.

Today, however, IBM, like most major computer manufacturers, is suffering from the slowdown in the major information technology markets, and from the effects of worldwide recession. IBM's heavily centralized management structure and huge international sales and marketing workforce, which contributed to the vendor's near monopolistic position in the 1970s and 1980s, led to poor financial performance in the early 1990s and forced the vendor to streamline its workforce. The movement away from larger systems—upon which IBM's revenues depended for so long—in favor of smaller systems has also caused IBM to redefine its role in computing and networking.

IBM's strategy now is to move from proprietary networking solutions to open and distributed environments. IBM is accomplishing this by adhering to industry standards; introducing networking and computing systems that interface with its older platforms as well as other vendors' products; designing networks and applications for system integration; and providing service and support for its own as well as other vendors' products.

IBM is divided into a number of business units:

- The **Advanced Workstations and Systems Div. (AWSD)** is responsible for developing workstations and servers based on IBM's RISC System/6000 technology.
- The **Application Business Systems Unit** develops and manufactures processors and related software for IBM's AS/400 midrange products.
- The **Enterprise Systems (ES) Business Unit** is responsible for developing IBM's mainframes and related software (MVS, VM, VSE, and AIX/ESA), and for the development of System/390 for use in distributed computing and client/server environments.
- **IBM Personal Computer Co. (IPCC)** is responsible for all IBM's Personal Computers, the highly successful ThinkPad portables, the low-cost PS/VP (Value Point) products, and the high-end PS/2 PCs and PC servers.
- The **Networking Systems Unit** provides products and services for operating and managing networks, including client/server systems. It is divided into seven segments, each responsible for a set of hardware or software products. It has recently changed its emphasis from mainframe-related networking products to local area networks (LANs) and open, multivendor, client/server computing and is increasingly active in the OEM market.
- **Pennant Systems** manufactures and markets impact and advanced-function printers.
- The **Power Parallel Systems Unit**, formed by the ES and AWSD, is responsible for the development of scalable, parallel processing systems based IBM's RISC System/6000 technology and System/390-based supercomputing systems.
- **Storage Systems Div.** manufactures direct-access storage devices, disk arrays, diskette drives, magnetic tape drives and libraries, optical storage and libraries, storage controllers, and related storage management software.

Regional Addresses

IBM Canada Ltd.
3500 Steeles Avenue East
Markham, ON, Canada L3R 2Z1
Tel: +1 416 474 2111

IBM Europe
Tour Pascal, La Defense 7 Sud
Cedex 40 F-92075
Paris La Defense, France
Tel: +33 1 47 67 60 00
Fax: +33 1 47 67 69 69

IBM Tokyo, Shuwa Kamiyacho Building
3-13 Toranomon, 4 Chome, Minato-ku
Tokyo 105 Japan
Tel: +81 3 3438 5736
Fax: +81 3 3433 7690

Marketing Strategy

IBM faces the challenge of maintaining full support for SNA host-based networking while providing a migration path to open and distributed environments. IBM is accomplishing this through ongoing enhancements to the 3172, which now supports TCP/IP, X.25, and frame-relay transport of multiprotocol traffic between hosts and LANs.

Market Position

IBM is the leading vendor in the communications processor market. All major communications processors, including those of Amdahl, NCR, Unisys, CompuTerm, Apertus Technologies, and IDEA, offer compatibility with IBM's Systems Network Architecture.

Sales & Distribution Strategy

The IBM 3172 Interconnect Controller is sold worldwide through IBM's direct sales force. IBM offers both purchase and leasing arrangements. The vendor also offers a Government Services Administration (GSA) schedule for units sold in the U.S.

Support

IBM offers a comprehensive array of support services for its customers. The vendor's technical service representatives and Customer Engineers (CEs) handle everything from network design and installation to ongoing hardware and software maintenance, planning for future growth, migration, and systems integration support.

Warranty

IBM offers a one-year warranty for the 3172. The warranty service is for IBM On-Site Repair (IOR).

Support Services

Under the IBM Service Plan, customers can order any or all of a broad range of IBM services using a single-page document. IBM's network services are available for data, voice, and T1 networks with customized support options to suit various needs. Network services include network evaluation, design, implementation, management, and operations.

IBM provides two broad categories of hardware maintenance: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services (MVS) covers maintenance and repair coordination of co-located non-IBM equipment.

IBM Maintenance Services

Under this agreement, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

- National geographic coverage.
- Twenty-four hour access to IBM parts inventory.
- A Customer Engineer (CE) assigned to each account.
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs.
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance.
- An online service database.
- Engineering changes management.

Martin Dintzis researches and analyzes wide area networking products, technology developments, and market trends for Datapro. He reports on newer networking solutions such as ATM, frame relay, channel extension, inverse multiplexing, and remote LAN access while maintaining coverage of traditional systems using X.25 packet switches, TDM circuit switches, and front-end processors. Martin has a background in both technical writing and electrical engineering technology.

Multiple Vendor Services (MVS)

MVS is tailored to meet the customer's hardware maintenance requirements in a mixed-vendor environment. IBM provides these services in three modular offerings:

- *Repair Coordination.* IBM provides a single phone number (800/IBM-SERV) for all service requests, dispatches service vendors for non-IBM product repair, coordinates maintenance activities, and tracks the status of each problem.
- *Maintenance Coordination.* IBM takes a leadership role in scheduling and coordinating hardware maintenance activities to minimize network outages.
- *Service Management.* IBM identifies expert maintenance vendors, negotiates and administers service contracts, and reconciles invoices, relieving the customer of the burden of these management activities.

Service Providers

IBM technical service representatives and customer engineers serve customers directly.

Service Locations

IBM maintains over 300 service locations in all parts of the word, staffed by more than 17,000 service personnel. IBM customer engineers are linked to dispatch centers, online databases, and parts availability and ordering systems by handheld digital terminals connected to the IBM Digital Communications System.

Service Hours

IBM Service can be obtained 24 hours per day, 7 days per week by calling (800) IBM-SERV (800/426-7378).

Training/Education

IBM offers a broad range of educational programs for its customers throughout the world. In addition, it also provides system-delivered (online) education for both basic- and advanced-level users and system administrators.

Specifications

Enhancements

Date	Enhancement	Description
August 1994	Hardware enhancements.	The 3172 was enhanced to support an optional 66MHz Pentium processor; two new LAN adapters (*Auto LANStreamer MC 32* and *EtherStreamer MC 32*); a new dual-port Wide Area Connector (WAC) interface card; and *ARTIC Portmaster*, a new eight-port interface card for SDLC devices.
August 1994	Introduced the 3172 SNA Communications Program Version 1 Release 1	Running under OS/2 on the 3172, this program enables network users to access VTAM/SNA host applications from token-ring, Ethernet, and FDDI LANs over frame-relay and SDLC networks.

Enhancements (Continued)

Date	Enhancement	Description
August 1994	Introduced Interconnect Controller Program (ICP) Version 3 Release 3	ICP Version 3 Release 3 adds the following capabilities: Use of the *ESCON Multiple Image Facility (EMIF)*, for sharing of ESCON channels across multiple logical (or physical) hosts. Remote control of 3172s via the 3172 Operator Facility/2 (OF/2). Compatibility with the Pentium processor. Support for IBM's Auto LANStreamer MC 32 and EtherStreamer MC 32 adapters.
August 1994	3172 preload software options.	IBM began to offer TCP/IP Offload, SNA Communications Program, and other software products preloaded on the 3172's hard drive, which reduces customer setup time.

Features/Functions

Models	3172 Model 3
Transmission Features	
Max. Number of Device Ports	32 (eight per option slot).
Max. Number of Wide Area Links	Two fractional or full T1/E1 connections (X.21, V.35, or RS-422/-449). Optionally, two additional 64K bps or subrate connections (X.21, V.35, or RS-422/-449) can be installed.
Max. Number of Host Channels	Dual System/370 parallel channel adapters (one active and one backup) or one ESCON adapter. (Both ESCON and parallel channel types cannot coexist in the same controller.)
Max. Number of LAN Connections	Up to four token-ring or Ethernet LANs. Up to two token-ring or Ethernet LANs and one FDDI LAN.
Software Features	
Multivendor Networking Capability	Provides concurrent support for SNA and TCP/IP data flows. Supports simultaneous bridging of SNA and multiprotocol token-ring LAN, Ethernet LAN, and FDDI LAN traffic.
Frame-Relay Networking Support	Supports frame-relay and X.25 transport of SNA and multiprotocol LAN traffic.
Off-Loading Processing From Host	Processes portions of TCP/IP protocols, thereby reducing host CPU cycles.
Network Management Features	
Fault/Problem Management	The 3172 provides generic alerts to IBM NetView.
Configuration Management	IBM's *Operator Facility/2*, an OS/2-based Presentation Manager application that comes with the *Interconnect Controller Program (ICP)*, enables a system administrator to install, configure, monitor, and control up to sixteen 3172s. *NetView Network Asset Management Facility* allows the administrator to display the machine type, serial number, model number, program common name, and program level for each 3172. Software downline loading using IBM's *Central Site Control Facility (CSCF)* is supported. An SNMP host subagent provides a distributed network management solution for multivendor environments.
Performance/Accounting Management	NetView permits control, recording, and automation of various operator tasks. It also provides performance management and problem determination, measuring line capacity and response time, generating reports, and providing accounting data. The 3172 supports *NetView Network Asset Management Facility (NAMF)* and *NAMF Vital Product Data*.
Security Management	NetView supports security management by restricting access to NetView, and by providing an interface to IBM's *Resource Access Control Facility (RACF)*. RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Options

Product	Description
Software	
LAN Resource Extension and Services/VM (LANRES/VM) or LANRES/MVS	Software for a Novell LAN server establishing server environments on ES/9000 or System/370 hosts. Allows NetWare clients to transparently access mainframe storage, printing, data distribution, and LAN administration services.
LAN File Services/ESA (LFS/ESA)	Software for the ES/9000 providing workstation client access to System/390 storage capacity and other host resources at high data rates.
RouteXpander/2 Version 2.0	Provides routing and bridging through frame-relay WAN links.
RouteXpander X.25 Support/2	Provides routing and bridging through X.25 WAN links.

Options (Continued)

Product	Description
Software (Continued)	
Multiprotocol Networking Software Solution (MPNS)	A combination of preinstalled software: OS/2 TCP/IP Offload and TCP/IP for OS/2 RouteXpander/2 Network Transport Services (NTS)/2 NetView Distribution Manager (NDM)/2. This software supports TCP/IP off-load functions and host and multiprotocol LAN interconnections across frame-relay wide area networks.
3172 SNA Communications Program	Running under OS/2, this program establishes interoperability between VTAM/SNA host applications; token-ring, Ethernet, and FDDI LANs; and frame-relay and SDLC networks.
TCP/IP Offload for VM and MVS	Running under OS/2 on the 3172, TCP/IP Offload software processes TCP/IP traffic destined for the host computer, thereby reducing host TCP/IP processing by 30% to 50%.
Hardware	
Internal Microprocessor	A base 3172 configuration provides a 25MHz 80486SX processor. A 50MHz 80486DX or 66MHz Pentium processor is optionally available.
High-Capacity Hard Drive	Optional 1GB external hard drive with SCSI interface.

Configuration

Components

Product	Description
Enclosure	A PS/2-based chassis housing a system board and processor card; a power supply; a fixed disk and adapter; 16MB of memory; a diskette drive; and four option slots for host, LAN, and WAN modules.
Host Channel Attachment Modules	
Parallel Channel Adapter	Provides a parallel interface to an IBM System/370-compatible host, with data rates up to 4MB per second. A maximum of two adapters per controller are supported. Both ESCON and parallel channels cannot be installed simultaneously in the same 3172 unit.
ESCON Adapter	Provides a fiber optic connection to an IBM ES/9000 host, with data rates up to 200M bps. Distances as great as 26.7 miles between a 3172 and an ES/9000 host are possible.
LAN Attachment Modules	
Auto LANStreamer MC 32 Adapter	A high-performance token-ring adapter featuring IBM's LANStreamer chip set and a 32-bit Micro Channel (MC) bus interface, this adapter is designed for full-duplex communications in multimedia and I/O-intensive networking applications. Works with shielded or unshielded twisted-pair wire. Occupies one feature slot; up to four can be installed.
Dual EtherStreamer MC 32 Adapter	A 32-bit Ethernet 10BASE-T Micro Channel (MC) adapter featuring 40MB datastreaming capability. The adapter supports full-duplex or half-duplex transmission mode and performs transparent or source routing Ethernet bridging.
Ethernet Adapter	Attaches to an IEEE 802.3-compatible, 10M bps thick or thin Ethernet LAN. Occupies one feature slot; up to four can be installed.
FDDI Adapter	Provides connection to a 100M bps FDDI LAN. It occupies only two feature slots; only one per 3172 controller is supported.
Token-Ring 16/4M bps Adapter (Feature Code 2210)	Attaches to an IEEE 802.5-compatible, 16M bps or 4M bps token-ring network. Occupies one option slot; up to four can be installed.
Token-Ring 16/4M bps Adapter (Feature Code 2215)	Used with the WAC Adapter in TCP/IP off-load applications. Attaches to either a 16M or 4M bps token-ring network, enabling NETBIOS traffic to be carried over the WAC Adapter wide area link. Occupies one option slot; up to four can be installed.
Wide Area Connection Modules	
X.21 Wide Area Connector (WAC) Adapter	Used in TCP/IP off-load applications, this adapter provides one X.21 interface supporting data rates up to T1/E1 and one optional 64K bps or subrate interface. Requires an external CSU/DSU. Up to two adapters can be installed.
V.35 Wide Area Connector (WAC) Adapter	Used in TCP/IP off-load applications, this adapter provides one V.35 interface supporting data rates up to T1/E1 and one optional 64K bps or subrate interface. Requires an external CSU/DSU. Up to two adapters can be installed.
RS-422/-449 Wide Area Connector (WAC) Adapter	Used in TCP/IP off-load applications, this adapter provides one RS-422/-449 interface supporting data rates up to T1/E1 and one optional 64K bps or subrate interface. Requires an external CSU/DSU. Up to two adapters can be installed.
ARTIC Portmaster X.21	A Real Time Interface Co-Processor for Micro Channel bus systems providing six full-duplex X.21 port interfaces each transmitting at 256K bps or a single X.21 interface transmitting at 2.048M bps. Up to four adapters can be installed.

Configuration (Continued)

Components (Continued)

Product	Description
Wide Area Connection Modules (Continued)	
ARTIC Portmaster V.35	A Real Time Interface Co-Processor for Micro Channel bus systems providing six full-duplex V.35 port interfaces each transmitting at 64K bps or a single V.35 interface transmitting at 2.048M bps. Up to four adapters can be installed.
ARTIC Portmaster RS-422	A Real Time Interface Co-Processor for Micro Channel bus systems providing eight full-duplex RS-422 port interfaces each transmitting at 64K bps or a single RS-422 interface transmitting at 2.048M bps. Up to four adapters can be installed.

Sample Configuration

Model	Description
3172 Model 3	Model 3 can link single or dual IBM hosts to as many as four TCP/IP Ethernet LANs, minimizing host communications processing overhead through its TCP/IP Offload feature.

Physical Specifications

Product	3172 Model 3
Physical Dimensions:	
H x W x D, in.	12.0 x 19.0 x 19.1
H x W x D, mm.	306 x 483 x 484
Electrical Requirements	200 to 240 V AC, 2.5 Amp, 50 to 60 Hz
Environmental Environment:	
Operating Temperature (°F)	61 to 84
Operating Temperature (°C)	16 to 32
Relative Humidity (% noncondensing)	20 to 80

Pricing

IBM 3172 Interconnect Controller

Product	Description	Purch. Price (US$)	Annual Onsite Maint. (US$)
3172 Model 3		9,970	957
Options			
2005	4MB Memory Expansion	2,150	665
2210	16/4M bps Token-Ring Adapter	921	29
2215	16/4M bps Token-Ring Adapter (WAC compatible)	1,060	179
2225	Ethernet Adapter	809	84
2235	Auto LANStreamer MC 32	1,060	179
2245	EtherStreamer MC 32	809	109
2300	FDDI Adapter	6,165	221
2501	System/370 Parallel Channel Adapter	5,250	84
2500	Rack Mounting Assembly	230	—
2700	TCP/IP Offload Hardware	2,860	—
2800	IBM ESCON Adapter	15,990	2,065
2810	16M Memory Upgrade	2,990	58
2830	50MHz 80486 Processor	5,990	592
2850	66MHz Pentium Processor	5,990	592

IBM 3172 Interconnect Controller (Continued)

Product	Description	Purch. Price (US$)	Annual Onsite Maint. (US$)
Options (Continued)			
2900	X.21 Wide Area Connector (WAC) Adapter	1,150	104
2910	V.35 Wide Area Connector (WAC) Adapter	1,150	104
2920	RS-422/-449 Wide Area Connector (WAC) Adapter	1,150	104
2930	ARTIC Portmaster RS-232	3,235	500
2940	ARTIC Portmaster X.21	3,285	500
2950	ARTIC Portmaster V.35	3,600	500
2960	ARTIC Portmaster RS-422	3,050	500

Software Prices

Order Number/Feature Code		Purch. Price (US$)
5621-425/9001	IBM 3172 Interconnect Controller Program Version 3 Release 3, Basic License	6,665
5696-865/1000	SNA Communications Program	9,500
5735-FAL/1000	TCP/IP Offload Software for VM Version 2 Release 2	3,150
5735-HAL/1001	TCP/IP Offload Software for MVS Version 2 Release 2.1	3,150
5871-P01/4999	OS/2 2.1	4,999
5875-P01/5547	TCP/IP Version 2.0 for OS/2	230
5871-P01/3787	Network Transport Services/2	85
5781-P01/2902	RouteXpander/2	785

■

IBM 3172 Interconnect Controller

In this report:

Note: IBM enhanced the 3172 Model 3 in several ways. For example, it now provides more than 50% greater throughput; higher RAM and disk storage capacity; ESCON and FDDI support; TCP/IP off-load capability for remote hosts; and concurrent support for SNA/VTAM, TCP/IP, frame relay, and NETBIOS LAN data flows over a wide area link.

Datapro Summary

The IBM 3172 Interconnect Controller is a multivendor networking product capable of consolidating multiple, dissimilar LANs; interconnecting multiple IBM hosts over a LAN backbone; or linking multiple IBM hosts over a T1 wide area network. Through the 3172, IBM hosts can function as LAN superservers, providing shared access to storage, printing, data distribution, management, and other mainframe services.

Strengths

- The 3172 supports wide area networking between host computers using frame-relay, TCP/IP, and SNA protocols.
- Consolidation of multiple, incompatible LANs and multiple hosts makes possible resource sharing, data backup, and centralized network management.
- By taking advantage of the higher speeds of ESCON and FDDI, users can improve performance in highly interactive forms of communication, such as host-to-graphics workstation and host-to-host links. The TCP/IP Offload feature streamlines host data processing.

Limitations

- The 3172 does not support ESCON and System/370 parallel channel connections concurrently.
- Only users with high throughput requirements can cost justify replacing existing parallel channels with ESCON channels.
- The 3172 is designed for small- to medium-sized networks. Very large networking implementations require IBM's 3745 Communication Controller.

Competition

Major IBM-compatible communications processor vendors such as McDATA Corp. and Apertus Technologies, and leading multiprotocol LAN router vendors.

Corporate Headquarters

IBM
Old Orchard Road
Armonk, NY 10504
Tel: +1 914 765-1900
Contact your local IBM representative.

Prices

Base prices for Models 1, 2, and 3 (in the U.S.) are $16,700, $52,440, and $9,970, respectively. Interconnect Controller Program costs $6,665.

—By Martin Dintzis
Assistant Analyst

Product Analysis

Moving toward a future where speed, volume, and communications capabilities dictate the creation of product lines and their marketing, IBM offers ESCON, an architecture that uses wideband, high-speed fiber optic channels. ESCON extends the data center walls by working with communications controllers located up to 60 km. away, and it increases the maximum channel throughput rate to as high as 200M bps. IBM is also pursuing a more aggressive role in enterprise networking by increasing support for multivendor connectivity. The 3172 Interconnect Controller is one of IBM's flagship products for networks based on Systems Network Architecture (SNA) and expanding into token-ring, Ethernet, FDDI, and ESCON local area networks as well as non-SNA wide area networks.

The 3172 Model 1 operates in either of two modes. In the Channel-to-Channel configuration, it links remote IBM hosts via up to four T1 lines. As a host-to-LAN gateway, it consolidates up to four token-ring and/or Ethernet LANs, or one IBM PC Network LAN and one token-ring or Ethernet LAN. Model 1 also supports dual System/370 parallel or dual ESCON host channels.

The 3172 Model 2 consolidates up to four token-ring and/or Ethernet LANs, or it links one FDDI LAN and three token-ring and/or Ethernet LANs. Like Model 1, it supports dual System/370 parallel or dual ESCON host channels.

Model 3, a PS/2-based controller, supports the same LAN connectivity options as Model 2, while providing one ESCON or dual System/370 parallel channel attachments. Model 3 can also run IBM's *TCP/IP for MVS Off-load* software, which works with IBM's host software to off-load TCP/IP protocol processing from the host.

Interconnect Controller Program (ICP) software includes IBM's Operator Facility/2, a PS/2-based configuration and control software product that works with IBM NetView.

IBM's latest enhancements to the 3172 center around Model 3. IBM now offers an optional 50MHz 80486DX processor improving throughput by up to 55% for SNA traffic and 45% for TCP/IP traffic over the standard 80486SX processor. IBM also offers 16MB of standard memory, expandable to 64MB, and an optional 1GB SCSI hard drive. Model 3 now supports FDDI LAN connectivity and connections to a remote host for TCP/IP off-load applications via any of three new Wide Area Connector (WAC) Adapters (X.21, V.35, and RS-422/-449).

The 3172 Model 3 can access ESCON host channels with the latest software version of the Interconnect Controller Program: Version 3 Release 2. The software also allows Model 3 in TCP/IP Offload operating mode to support both SNA/VTAM and TCP/IP host applications and data flows concurrently over the same or different LANs, which is already possible in other controller operating modes. IBM added support for frame relay on Model 3 and enabled it to bridge both SNA and NETBIOS (LAN) protocols (using frame relay) over the wide area connection to the TCP/IP host.

IBM has positioned the 3172 Model 3 to function as a LAN server for System/370 or ES/9000 hosts via either of two software products. *LAN Resource Extension and Services (LANRES/VM or LANRES/MVS)* lets Novell NetWare clients to access mainframe file, printing, data distribution, and administrative services. *LAN File Services/ESA* provides high-performance workstation access to ES/9000 host resources via ESCON.

Target Markets

The 3172 is a general-purpose product supporting communications between an SNA host environment and multiple LANs and/or remote SNA hosts. It is aimed at private and public corporations, financial institutions, governmental bodies, and universities.

The 3172 can provide the following key capabilities:

- Consolidating multiple, incompatible LAN environments;
- Improving performance and throughput in host-to-host or host-to-LAN communications applications by using FDDI or ESCON channels;
- Interconnecting remote IBM hosts over wide area networks;
- Providing shared workstation access to mainframe application and hardware resources; and
- Developing a migration path to open systems computing through TCP/IP.

Strengths

Supporting multiple protocols, the 3172 can consolidate multiple, incompatible LANs and hosts, making possible resource sharing, data backup, and centralized network management.

By taking advantage of the higher speeds of ESCON and FDDI, users can improve performance in highly interactive forms of communication, such as host-to-graphics workstation and host-to-host links. The TCP/IP Offload feature streamlines host data processing.

Limitations

While ESCON promises host channel data rates up to 200M bps, few users can cost justify replacing existing parallel channels

Overview

Models	3172 Model 1	3172 Model 2	3172 Model 3
Product Type	Host wide area networking controller, LAN router, and host-to-LAN gateway.	LAN router and host-to-LAN gateway.	LAN router and host-to-LAN gateway.
Design	Rackmount or tabletop.	Rackmount or tabletop.	Rackmount or tabletop.
Date Announced	October 1989	September 1990	June 1992
Date Released	September 1990	December 1991	September 1992
Base Purchase Price ($)	16,700	52,440	9,970

Interoperability Matrix

Product	IBM 3172 Interconnect Controller
Product Classification	Proprietary network router/gateway device.
Relationship With Higher-Level Elements	
Position in Network Architecture	Transparent to the IBM host.
Host Software Required:	
Operating Systems	MVS/ESA, VM/ESA, VM/SP, or VSE/ESA.
Access Method	ACF/VTAM Version 3.4 or later.
Other Software	For TCP/IP connectivity, IBM TCP/IP for VM Version 2 Release 2 or later, or IBM TCP/IP for MVS Version 2.0 or later. For TCP/IP Offload feature, TCP/IP for MVS Version 2.2 or later is required.
Communications Controller Software Required	3172 Interconnect Controller Program (ICP) and TCP/IP Offload software, both provided by IBM.
Software Load	From the host, the 3172 controller's diskette drive or hard drive, or a remote IBM support center.
Host Attachment Support	Direct connection via a System/370 parallel channel; indirect access via an FDDI, Ethernet, or token-ring LAN leading to another 3172; or remote access via an ESCON channel or a T1 wide area networking facility.
Network Management Support	Configuration, monitoring, and control are provided by Operator Facility/2 software for the PS/2. Centralized management can be provided by IBM NetView or a remote IBM support center. Also provides a Simple Network Management Protocol (SNMP) agent.
Relationship With Peer-Level Elements	
Compatible Communications Controllers	McDATA's 6200 Network Gateway.
Gateways Supported	Supports bidirectional gateways between token-ring LAN, TCP/IP Ethernet LAN, FDDI LAN, IBM PC Network LAN, and SNA/SDLC environments.
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to public T1 carrier services via an RS-449 interface.
X.25 Packet Switched Network Support	Not supported directly.
LAN Attachment Support	Ethernet, FDDI, token-ring, and IBM PC Broadband Network LANs.

with ESCON channels. The 3172 does not support ESCON and System/370 parallel channel connections concurrently.

IBM's ongoing enhancements to the 3172 are enabling it to replace the IBM 3745 in small- and medium-sized networks. For large host and network implementations, however, users may need the power of the 3745 Communication Controller.

Competitive Analysis

The 3172 competes with multiprotocol communications controllers from McDATA and Apertus Technologies, allowing different LAN environments to access IBM and non-IBM hosts. To a lesser extent, the 3172 also competes with multiprotocol LAN routers from vendors such as Cisco Systems, Wellfleet Communications, and Vitalink Communications. These routers, however, require an IBM controller to provide LAN access to the System/370 or ES/9000 host.

IBM faces increasing competition from other equipment suppliers offering new solutions for integrating computing environments throughout a business enterprise. By enhancing the 3172, IBM has managed to keep pace with its competitors.

Vendor Analysis

Marketing Strategy

IBM's 3172 offers a subset of the 3745's networking capabilities for integrating LANs and host computers in small- to medium-sized networks. Recent enhancements to the 3172—FDDI LAN and ESCON connections, frame-relay support, and transparent bridging of SNA and NETBIOS traffic—demonstrate the vendor's commitment to providing enterprise-wide interoperability.

Market Position

IBM is the leading vendor in the communications processor market. All major communications processors, including those of

Amdahl, NCR, Unisys, McDATA, Apertus Technologies, and IDEA, offer compatibility with IBM's Systems Network Architecture.

Sales and Distribution Strategy

The IBM 3172 Interconnect Controller is sold worldwide through IBM's direct sales force. IBM offers both purchase and leasing arrangements. The vendor also offers a Government Services Administration (GSA) schedule for units sold in the U.S.

Support

Warranty

IBM offers a one-year warranty for the 3172. The warranty service is for IBM On-Site Repair (IOR).

Support Services

IBM has consolidated all services under a simplified contract called the IBM Service Plan. Customers can order any or all of a broad range of IBM services using a single-page document. IBM's network services are available for data, voice, and T1 networks with customized support options to suit various needs. Network services include network evaluation, design, implementation, management, and operations.

IBM provides two broad categories of hardware maintenance: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services (MVS) covers maintenance and repair coordination of co-located non-IBM equipment.

IBM Maintenance Services

Under this agreement, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

- National geographic coverage.
- Twenty-four hour access to IBM parts inventory.
- A Customer Engineer (CE) assigned to each account.
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs.
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance.
- An online service database.
- Engineering changes management.

Multiple Vendor Services (MVS)

MVS is tailored to meet the customer's hardware maintenance requirements in a mixed-vendor environment. IBM provides these services in three modular offerings:

- *Repair Coordination.* IBM provides a single phone number (800/IBM-SERV) for all service requests, dispatches service vendors for non-IBM product repair, coordinates maintenance activities, and tracks the status of each problem.
- *Maintenance Coordination.* IBM takes a leadership role in scheduling and coordinating hardware maintenance activities to minimize network outages.
- *Service Management.* IBM identifies expert maintenance vendors, negotiates and administers service contracts, and reconciles invoices, relieving the customer of the burden of these management activities.

Service Hours

IBM Service can be obtained 24 hours per day, 7 days per week by calling (800) IBM-SERV (800/426-7378).

Specifications

Enhancements

Date	Enhancement	Description
July 1993	New host server options.	IBM enabled its hosts to function as LAN servers through the 3172 Model 3 and either of two software products. *LAN Resource Extension and Services (LANRES/VM or LANRES/MVS)* and *LAN File Services/ESA* (see Options section).
	Controller hardware upgrades.	Began offering the 3172 Model 3 with an optional 50MHz 80486DX processor, which improves throughput up to 55% for SNA traffic and up to 45% for TCP/IP traffic compared to the standard 80486SX processor. IBM also began offering 16MB of standard memory, expandable up to 64MB, and an optional 1GB SCSI hard drive.

Enhancements (Continued)

Date	Enhancement	Description
August 1993	New Interconnect Controller Program (ICP) software release.	Introduced IBM ICP Version 3 Release 2. With this new software release, 3172 Model 3 can access ESCON VTAM host channels. It can also support VTAM (SNA) and TCP/IP host applications concurrently; LAN-based VTAM and TCP/IP workstations and their applications share LAN adapters within the 3172. Through ICP Version 3 Release 2, the 3172 Model 3 also supports FDDI LANs.
September 1993	Additional WAN features.	The 3172 Model 3 supports frame-relay network connections; a new set of Wide Area Connector (WAC) adapters (X.21, V.35, and RS-422/-449) supporting TCP/IP off-load services for remotely located host computers; and simultaneous bridging of SNA and NETBIOS protocols across a frame-relay wide area link.

Features/Functions

Models	3172 Model 1	3172 Model 2	3172 Model 3
Hardware Features			
Internal Microprocessor	80386	80486	25MHz 80486 or 50MHz 80486DX.
Internal Memory Capacity (bytes RAM)	8M standard; 16M optional.	8M standard; 16M optional.	16M standard; up to 64M optional.
Diskette Drive Capacity (bytes)	1.544M	1.544M	1.544M
Hard Drive Capacity (bytes)	30M	80M	80M standard; optional 1GB SCSI hard drive.
Transmission Features			
Maximum Number of T1/E1 Links	4	Not supported	One X.21, V.35, or RS-422/-449 WAC Adapter supporting TCP/IP off-load for a remote host.
Maximum Number of Host Channels	One or two System/370 parallel channels. Single or dual ESCON channels can be installed instead. Both channel types, however, cannot coexist in the same controller.	One or two System/370 parallel channels. Single or dual ESCON channels can be installed instead. Both channel types, however, cannot coexist in the same controller.	Dual System/370 parallel channel adapters or one ESCON adapter. Both channel types cannot coexist in the same controller.
Maximum Number of LAN Connections	Up to four token-ring or Ethernet LANs; or one token-ring or Ethernet LAN and one IBM PC Network LAN.	Up to four token-ring or Ethernet LANs; up to three Ethernet or token-ring LANs and one FDDI LAN.	Up to four token-ring or Ethernet LANs; up to two token-ring or Ethernet LANs and one FDDI LAN.
Software Features			
Multivendor Networking Capability	*3172 ICP* provides concurrent support for SNA and TCP/IP data flows.	*3172 ICP* provides concurrent support for SNA and TCP/IP data flows.	*3172 ICP* provides concurrent support for SNA and TCP/IP data flows. Supports simultaneous bridging of both SNA and NETBIOS protocols through a WAC-compatible Token-Ring 16/4 adapter.
Frame-Relay Networking Support	Supports frame-relay transport of SNA traffic.	Does not apply.	Supports frame-relay transport of both SNA and NETBIOS traffic.
Off-loading Processing From Host	Does not apply.	Does not apply.	Running *TCP/IP for MVS Offload Software* under OS/2, Model 3 processes portions of TCP/IP protocols, thereby reducing host CPU cycles.
Network Management	Supports NetView Network Asset Management Facility (NAMF) and NAMF Vital Product Data.	Supports NetView Network Asset Management Facility (NAMF) and NAMF Vital Product Data.	Supports NetView Network Asset Management Facility (NAMF) and NAMF Vital Product Data.

Options

Product	Description
Software Options	
LAN Resource Extension and Services/VM (LANRES/VM) or LANRES/MVS	Software for a Novell LAN server establishing server environments on System/390 or System/370 hosts. Allows NetWare clients to transparently access mainframe storage, printing, data distribution, and LAN administration services.
LAN File Services/ESA (LFS/ESA)	Software for the ES/9000 providing workstation client access to System/390 storage capacity and other host resources at high data rates.
3172 Multiprotocol Networking Software Solution Release 1.0	Preloaded software for Model 3 providing a frame-relay link for a TCP/IP Offload Gateway with SNA and NETBIOS traffic bridging.
Hardware Options	
Hardware Package 1	A 3172 Model 3 kit supporting LFS/ESA, LANRES/VM, and LANRES/MVS. To be used when a minimal amount of workstation data is stored on the controller. Provides 16M RAM.
Hardware Package 2	A 3172 Model 3 kit supporting LFS/ESA, LANRES/VM, and LANRES/MVS. To be used when workstation data is stored on both the controller and/or the host. Provides 32M RAM and a 1GB hard drive with an enhanced SCSI adapter.

Network Management Functions

Fault/Problem Management	The 3172 provides generic alerts to IBM NetView.
Configuration Management	IBM's *Operator Facility/2*, an OS/2-based Presentation Manager application that comes with ICP Version 3.2, enables a system administrator to install, configure, monitor, and control up to sixteen 3172s. NetView Network Asset Management Facility allows the administrator to display the machine type, serial number, model number, program common name, and program level for each 3172. Software downline loading, using IBM's Central Site Control Facility (CSCF), is supported. An SNMP host subagent provides a distributed network management solution for multivendor environments.
Performance/Accounting Management	NetView permits control, recording, and automation of various operator tasks. It also provides performance management and problem determination, measuring line capacity and response time, generating reports, and providing accounting data.
Security Management	NetView supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF). RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Configuration

Components

Product	Description
Host Connections:	
System/370 Parallel Channel Adapter	Provides a parallel interface to an IBM System/370-compatible host, with data rates up to 4MB per second. A maximum of two per controller are supported.
ESCON Adapter	Provides a fiber optic connection to an IBM ES/9000 host, with data rates up to 200M bps. Distances as great as 26.7 miles between a 3172 and an ES/9000 host are possible.
TP Adapter Type T1	Supported on Model 1 only, this adapter provides a connection to a T1 common carrier facility for remote host communications; the output of this adapter must pass through a CSU/DSU or a multiplexer with an RS-422 interface.
Wide Area Connector (WAC) Adapter	For Model 3 in TCP/IP off-load applications. Provides one X.21, V.35, or RS-422/-449 interface supporting data rates up to T1. Requires an external CSU/DSU.
LAN Connections:	
Ethernet Adapter	Attaches to an IEEE 802.3-compatible, 10M bps thick or thin Ethernet LAN. Up to four can be installed in the 3172.
FDDI A Station Adapter	For 3172 Models 2 and 3 only, this adapter provides an FDDI class A connection to a 100M bps FDDI LAN. Although it occupies only one feature slot, only one per 3172 controller is supported.
WAC-Compatible Token-Ring 16/4 Adapter	Used only on a 3172 Model 3 with the X.21 WAC Adapter in TCP/IP off-load applications. Attaches to either a 16M or 4M bps token-ring network, enabling NETBIOS traffic to be carried over the WAC Adapter wide area link.
Token-Ring 16/4 Adapter	Standard token-ring adapter. Attaches to an IEEE 802.5-compatible, 16M bps or 4M bps token-ring network. Up to four can be installed in the 3172.
PC Network Baseband Adapter/A	Provides connection to a 1M bps baseband IBM PC Network.
PC Network Adapters II/A, II/A Frequency 2, and II/A Frequency 3	Provide connections to 2M bps broadband IBM PC Networks operating at different frequencies.

Configuration (Continued)

Sample Configuration

Model	Description
3172 Model 1	In the Channel-to-Channel configuration, Model 1 can support links between two locally attached System/370 hosts and up to four remote hosts via T1 lines.
3172 Model 2	This model can consolidate any combination of three Ethernet and/or token-ring LAN networks, linking them to a remote IBM ES/9000 host over an FDDI network.
3172 Model 3	Model 3 can link single or dual IBM hosts to as many as four TCP/IP Ethernet LANs, minimizing host communications processing overhead through its TCP/IP Offload feature.

Physical Specifications

Product	3172 Model 1	3172 Model 2	3172 Model 3
Physical Dimensions (H x W x D, inches)	10.0 x 19.0 x 18.0	12.25 x 19.0 x 26.0	12.0 x 19.0 x 19.1
Weight (lb.)	31	86	31
Electrical Requirements	200/240 V AC, 2.8 Amp, 50-60 Hz	200/240 V AC, 2.8 Amp, 50-60 Hz	200/240 V AC, 2.5 Amp, 50-60 Hz
Operating Temperature (°F)	50-105	50-105	60-85

Pricing

IBM 3172 Interconnect Controller

Models		Purch. Price ($)	Annual Onsite Maint. ($)
3172 Model 1		16,700	832
3172 Model 2		52,440	3,095
3172 Model 3		9,970	832
Options:			
2005	4MB Memory Expansion	2,150	—
2210	WAC-compatible Token-Ring 16/4M Adapter	921	25
2215	Token-Ring 16/4M Adapter	1,060	156
2220	Ethernet Adapter	809	73
2250	FDDI A Station Adapter	27,030	4,284
2260	TP Adapter Type T1	3,300	—
2270	IBM PC Network Adapter	339	—
2271	IBM PC Network Adapter II/A	689	—
2272	IBM PC Network Adapter II/A Freq. 2	689	—
2273	IBM PC Network Adapter II/A Freq. 3	689	—
2501	System/370 Parallel Channel Adapter	5,250	73
2510	Rack Mounting Assembly	230	—
2700	TCP/IP Offload Hardware	2,860	—
2710	Hardware Package 1	3,490	—
2720	Hardware Package 2	7,490	—
2800	IBM ESCON Adapter	15,990	1,795
2810	16M Memory Upgrade (for Model 3 in TCP/IP off-load applications)	2,990	50
2830	50MHz 80486 Processor (for Model 3)	5,990	592
2900	X.21 Wide Area Connector (WAC) Adapter	1,150	104
2910	V.35 Wide Area Connector (WAC) Adapter	1,150	104
2920	RS-422/-449 Wide Area Connector (WAC) Adapter	1,150	104

		Purch. Price ($)
Software Prices		
5621-425	IBM 3172 Interconnect Controller Program Version 3 Release 2	6,665
5735-HAL-0421	TCP/IP Offload Diskette for MVS	3,150
65G1-220	TCP/IP Version 2.0 for OS/2	*(1)*
Feature 3000	Multiprotocol Networking Software Solution (preloaded software) for VM	300
Feature 3010	Multiprotocol Networking Software Solution (preloaded software) for MVS	300

(1) Information not available at the time of this writing.

Note: U.S. pricing is given in US$. ■

IBM 3172 Interconnect Controller

In this report:

Note: This year, IBM introduced support for 100M bps FDDI LANs. The vendor also released the 3172 Model 3, a PS/2-based, host-to-LAN gateway capable of off-loading TCP/IP protocol processing from the host computer.

The IBM 3172 Interconnect Controller is a multivendor networking product capable of consolidating multiple, dissimilar LANs; interconnecting multiple IBM hosts over a LAN backbone; or linking multiple IBM hosts over a T1 wide area network.

Strengths

- Consolidation of multiple, incompatible LANs makes possible resource sharing, data backup, and centralized network management.
- The 3172 supports both TCP/IP and SNA data flows concurrently.
- By taking advantage of the higher speeds of ESCON and FDDI, users can achieve higher performance in highly interactive forms of communication, such as host-to-graphics workstation and host-to-host links. The TCP/IP Offload feature enhances performance even further.

Limitations

- The 3172 does not support LAN Gateway and Remote Host Channel-to-Channel modes concurrently.
- At present, there are few communications products that can take full advantage of IBM's ESCON high-speed pipeline.
- The 3172 does not include an internal CSU/DSU for T1 wide area network connections.

Vendor

IBM
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Competition

Major IBM-compatible communications processor vendors such as McDATA Corp., NCR Corp., Apertus Technologies, and major multiprotocol LAN router vendors.

Prices

Base prices for Models 1, 2, and 3 are $16,700, $52,440, and $9,970, respectively. Interconnect Controller Program costs $6,665. **GSA Schedule:** Yes.

—By Martin Dintzis
Assistant Analyst

Product Analysis

In 1990, preparing for a future in which speed, volume, and communications capabilities will dictate the creation of product lines and their marketing, IBM introduced ESCON, an architecture making use of wideband, high-speed fiber optic channels. In effect, ESCON extends the walls of the data center by allowing communications controllers to be located up to 26.7 miles away, and it increases the maximum channel throughput rate to as high as 200M bps. IBM also began to pursue a more aggressive role in enterprise networking, with increased support for multivendor connectivity. Thrust into the limelight of these announcements, the 3172 Interconnect Controller is assuming more responsibility in networks based on Systems Network Architecture (SNA) and expanding into token-ring, Ethernet, FDDI, and ESCON local area networks as well as non-SNA wide area networks.

The 3172 Model 1 operates in either of two modes. In the Channel-to-Channel configuration, it links remote IBM hosts via up to four T1 lines. As a host-to-LAN gateway, it consolidates up to four token-ring and/or Ethernet LANs, or one IBM PC Network LAN and one token-ring or Ethernet LAN. Model 1 also supports dual System/370 parallel or dual ESCON host channels.

The 3172 Model 2 consolidates up to four token-ring and/or Ethernet LANs, or it links one FDDI LAN and three token-ring and/or Ethernet LANs. Like Model 1, it supports dual System/370 parallel or dual ESCON host channels.

Model 3, a PS/2-based controller introduced in September 1992, supports the same LAN connectivity options as Model 2, while providing single or dual System/370 parallel channel attachments. Model 3 can run IBM's *TCP/IP for MVS Off-load* software, which works with IBM's host software to off-load TCP/IP protocol processing from the host.

Version 3.0 of IBM's 3172 Interconnect Controller Program (ICP) supports the new TCP/IP Offload feature. Like ICP Version 2.0, Version 3.0 allows concurrent implementation of SNA and TCP/IP data flows over combinations of token-ring, Ethernet, and IBM PC Network LANs and over wide area networks. ICP includes IBM's Operator Facility/2, a PS/2-based configuration and control software product for the PS/2.

Target Applications

The 3172 can provide the following key capabilities:

- Consolidation of multiple, incompatible LAN environments;
- Improving performance and throughput in host-to-host or host-to-LAN communications applications by using FDDI or ESCON channels;
- Interconnection of remote IBM hosts over wide area networks; and
- Development of a migration path to open systems computing through TCP/IP.

Strengths

The ability to connect multiple LANs or IBM hosts permits sharing of hardware and software resources among users of different systems as well as data backup capability.

Through fiber optic connections, users can obtain faster performance and increased bandwidth for engineering or scientific applications. With ESCON, it is possible to install a 3172 up to 26.7 miles from an IBM mainframe.

Support for both TCP/IP and SNA data flows provides a development platform for multivendor networking.

Limitations

The 3172 does not function as a LAN Gateway and a Remote Channel-to-Channel controller simultaneously. Multiple 3172s, however, can be rack mounted to support any combination of local and remote links.

Although ESCON promises data rates up to 200M bps, there is presently a dearth of computer and communications products that can take full advantage of such a high-speed pipeline.

Competitive Analysis

With the 3172, IBM has managed to keep in step with its competitors in the realm of multivendor LAN connectivity. IBM faces increasing competition from suppliers of multiprotocol communications controllers, as well as numerous vendors of multiprotocol LAN bridges and routers. Both classes of products provide IBM host access to different types of LANs.

IBM originally entered the heterogeneous LAN communications market with the introduction of its 8209 LAN bridge (now withdrawn), which supported both token-ring and Ethernet. That approach continues and expands in the 3172 controller, which supports token-ring, TCP/IP Ethernet, IBM PC Network, and FDDI LAN environments.

Overview

Models	3172 Model 1	3172 Model 2	3172 Model 3
Product Type	Host wide area networking controller, LAN router, host-to-LAN gateway.	LAN router, host-to-LAN gateway.	LAN router, host-to-LAN gateway.
Design	Rack mount or tabletop	Rack mount or tabletop	Rack mount or tabletop
Date Announced	October 1989	September 1990	June 1992
Date Released	September 1990	December 1991	September 1992
Base Purchase Price ($)	16,700	52,440	9,970

Decision Points

Product	Requirements	Comments
IBM 3172 Interconnect Controller	High Throughput	Supports T1 speeds for remote hosts and up to 200M bps ESCON, 100M bps FDDI, 10M bps Ethernet, and 16M bps token-ring connections.
	Multivendor Networking	Supports FDDI, TCP/IP Ethernet, token-ring, and baseband and broadband IBM PC Network LAN architectures, providing interoperability between all of them. Allows concurrent operation of SNA, TCP/IP, and other non-SNA data flows over connected LANs.
	Network Management	Provides alerts to NetView; supports features such as Central Site Control Facility, Network Asset Management Facility, and Vital Product Data; configuration and control are available through the Operator Facility/2 for the PS/2.

If IBM believes in fiber, and sets the stage for its widespread deployment through ESCON, users can bet that other vendors will follow. IBM will continue to support the 3172, enhancing it for frontline service in the company's movement toward enterprise networking and multivendor connectivity.

Vendor Analysis

Marketing Strategy

IBM's installed base of computing facilities based on its Systems Network Architecture (SNA) gives the vendor a strategic position in the communications processor market. With the 3172, IBM has positioned itself to provide solutions for integrating SNA host, non-SNA host, and multiple LAN architectures, and bringing the speed of fiber to these environments.

Target Markets

The 3172 is a general-purpose product supporting communications between an SNA host environment and multiple LANs remote SNA hosts. It is aimed at private and public corporations, financial institutions, governmental bodies, and universities.

Market Position

IBM is the leading vendor in the communications processor market. All major competitors offer compatibility with IBM's Systems Network Architecture in their front-end processors and terminal controllers.

Major Competitors

McDATA Corp.'s 6100 Network Controller supports IBM 3172 compatibility. Additionally, the IBM-compatible communications processors of NCR Corp. and Apertus Technologies support both token-ring and TCP/IP Ethernet LANs. The 3172 also competes with multiprotocol LAN routers of vendors such as Cisco Systems and Vitalink Communications. These routers provide IBM host access to different LAN environments via an IBM 3745 front-end processor.

Sales and Distribution Strategy

The IBM 3172 Interconnect Controller is sold worldwide through IBM's direct sales force.

Support

Policies and Programs

IBM's Systems Services Div. (SSD) is a wholly owned subsidiary called Integrated Systems Solutions Corp. (ISSC). Through ISSC, IBM addresses its customers' growing needs for outsourcing in systems operations, business applications, and data services. IBM offers a variety of support and services.

Warranty

IBM offers a one-year warranty for the 3172. The warranty service is for IBM On-Site Repair (IOR).

Support Services

Hardware Support

IBM provides two kinds of hardware support: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services covers maintenance and repair coordination of non-IBM equipment.

IBM Maintenance Services

Under Maintenance Services, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

- National geographic coverage;

- Twenty-four hour access to IBM parts inventory;
- A Customer Engineer (CE) assigned to each account;
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs;
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance;
- An online service database; and
- Engineering changes management.

Network Custom Services

IBM's network services are available for data, voice, and T1 networks with customized support options to suit a variety of needs. Network services include network evaluation, design, implementation, management, and operations.

Service Hours

The IBM Service can be obtained 24 hours per day, 7 days per week by calling (800) IBM-SERV (800/426-7378).

Competitors' Programs

Support offered by NCR, Amdahl, Unisys, and McDATA is closely patterned after IBM support services. No vendor seeking to compete in the market for SNA-compatible networking products could succeed otherwise. Support includes installation, round-the-clock maintenance and hot line support, remote diagnostics, education, and other services.

Interoperability Matrix

Product	IBM 3172 Interconnect Controller
Product Classification	Proprietary network router/gateway device.
Relationship With Higher-Level Elements	
Position in Network Architecture	Transparent to the IBM host.
Host Software Required:	
Operating Systems	MVS/ESA, VM/ESA, VM/SP, or VSE/ESA.
Access Method	ACF/VTAM Version 3.4 or later.
Other Software	For TCP/IP connectivity, IBM TCP/IP for VM Version 2 Release 2 or later, or IBM TCP/IP for MVS Version 2.0 or later. For TCP/IP Offload feature, TCP/IP for MVS Version 2.2 or later is required.
Communications Controller Software Required	3172 Interconnect Controller Program (ICP) Version 3.0 and TCP/IP Offload software, both provided by IBM.
Software Load	From the host, the 3172 controller's diskette drive or hard disk, or a remote IBM support center.
Host Attachment Support	Direct connection via a System/370 parallel channel; indirect access via an FDDI, Ethernet, or token-ring LAN leading to another 3172; or remote access via an ESCON channel or a T1 wide area networking facility.
Network Management Support	Configuration, monitoring, and control are provided by Operator Facility/2 software for the PS/2. Centralized management can be provided by IBM NetView or a remote IBM support center. Also provides a Simple Network Management Protocol (SNMP) agent.
Relationship With Peer-Level Elements	
Compatible Communications Controllers	McDATA's 6100 Network Gateway-Server.
Gateways Supported	Supports bidirectional gateways between token-ring LAN, TCP/IP Ethernet LAN, FDDI LAN, IBM PC Network LAN, and SNA/SDLC environments.
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to public T1 carrier services via an RS-449 interface.
X.25 Packet Switched Network Support	Not supported directly.
LAN Attachment Support	Ethernet, FDDI, token-ring, and IBM PC Broadband Network LANs.

Specifications

Enhancements

Date	Event
August 1991	IBM increased the amount of standard memory for the 3172 controller from 4M bytes to 8M bytes.
August 1991	IBM released Version 2.0 of the 3172 Interconnect Controller Program (ICP), supporting both SNA and TCP/IP data flows concurrently across LANs. Version 2.0 also added an Operator Facility, OS/2-based software for the PS/2 supporting installation, configuration, monitoring, and control of multiple 3172 controllers by a network operator. It also added NetView-related network management features.
December 1991	IBM introduced *Remote Channel-to-Channel (CTC)* communications capability, enabling the 3172 to link remote IBM hosts via T1 lines. At the same time, IBM introduced a T1 adapter for CTC communications, baseband and broadband LAN adapters for the IBM PC Network, and support for ES/9000 host access via an ESCON (fiber optic) adapter. Version 2.1 of ICP, also released in December 1991, added CTC functionally.
December 1991	IBM released the 3172 Interconnect Controller Model 2. This model supports an FDDI LAN adapter, available since March 1992.
September 1992	IBM Released the 3172 Model 3, a PS/2-based product. Operating as a LAN-to-host gateway, Model 3 can off-load host TCP/IP processing cycles using a new TCP/IP Off-load application. Interconnect Controller Program (ICP) Version 3, released at the same time, supports this new feature.

Features/Functions

Models	3172 Model 1	3172 Model 2	3172 Model 3
Hardware Features			
Internal Microprocessor	80386	80486	80486
Internal Memory Capacity (bytes RAM)	8M standard; 16M optional	8M standard; 16M optional	16M standard
Diskette Drive Capacity (bytes)	1.544M	1.544M	1.544M
Hard Disk Capacity (bytes)	30M	80M	80M
Transmission Features			
Maximum Number of T1/E1 Links	4	Not supported	Not supported
Maximum Number of Host Channels	One or two System/370 parallel channels. Single or dual ESCON channels may be installed instead. Both channel types, however, may not coexist in the same controller.	One or two System/370 parallel channels. Single or dual ESCON channels may be installed instead. Both channel types, however, may not coexist in the same controller.	One or two System/370 parallel channel adapters.
Maximum Number of LAN Connections	Up to four token-ring or Ethernet LANs; or one token-ring or Ethernet LAN and one IBM PC Network LAN.	Up to four token-ring or Ethernet LANs; up to three Ethernet or token-ring LANs and one FDDI LAN.	Up to four token-ring or Ethernet LANs; up to two token-ring or Ethernet LANs and one FDDI LAN.
Software Features			
Multivendor Networking Capability	*3172 Interconnect Controller Program (ICP)* provides concurrent support for SNA and TCP/IP data flows.	*3172 Interconnect Controller Program (ICP)* provides concurrent support for SNA and TCP/IP data flows.	*3172 Interconnect Controller Program (ICP)* provides concurrent support for SNA and TCP/IP data flows.
Other Features	Supports NetView Network Asset Management Facility (NAMF) and NAMF Vital Product Data.	Supports NetView Network Asset Management Facility (NAMF) and NAMF Vital Product Data.	Supports NetView Network Asset Management Facility (NAMF) and NAMF Vital Product Data. Running *TCP/IP for MVS Offload Software* under OS/2, Model 3 processes portions of TCP/IP protocols, thereby reducing CPU host cycles by 30%.

Network Management Functions

Fault/Problem Management	The 3172 provides generic alerts to IBM NetView.
Configuration Management	IBM's *Operator Facility/2*, an OS/2-based Presentation Manager application that comes with ICP Version 3.0, enables a system administrator to install, configure, monitor, and control up to sixteen 3172s. NetView Network Asset Management Facility allows the administrator to display the machine type, serial number, model number, program common name, and program level for each 3172. Software downline loading, using IBM's Central Site Control Facility (CSCF), is supported. An SNMP host subagent provides a distributed network management solution for multivendor environments.
Performance and Accounting Management	NetView permits control, recording, and automation of various operator tasks. It also provides performance management and problem determination, measuring line capacity and response time, generating reports, and providing accounting data.
Security Management	NetView supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF). RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Configuration

Components

Product	Description
Host Connections:	
System/370 Parallel Channel Adapter	Provides a parallel interface to an IBM System/370-compatible host, with data rates up to 4M bytes per second. A maximum of two per controller are supported.
ESCON Adapter	Supported on Models 1 and 2, it provides a fiber optic connection to an IBM ES/9000 host, with data rates up to 200M bps. Distances as great as 26.7 miles between a 3172 and an ES/9000 host are possible.
TP Adapter Type T1	Supported on Model 1 only, this adapter provides a connection to a T1 common carrier facility for remote host communications; the output of this adapter must pass through a CSU/DSU or a multiplexer with an RS-422 interface.
LAN Connections:	
Ethernet Adapter	Attaches to an IEEE 802.3-compatible, 10M bps thick or thin Ethernet LAN. Up to four can be installed in the 3172.
FDDI A Station Adapter	For 3172 Model 2 and 3 only, this adapter provides a FDDI class A connection to a 100M bps FDDI LAN. Although it occupies only one feature slot, only one per 3172 controller is supported.
Token-Ring 16/4M bps Adapter	Attaches to an IEEE 802.5-compatible, 16M bps or 4M bps token-ring network. Up to four can be installed in the 3172.
PC Network Baseband Adapter/A	Provides connection to a 1M bps baseband IBM PC Network.
PC Network Adapters II/A, II/A Frequency 2, and II/A Frequency 3	Provide connections to 2M bps broadband IBM PC Networks operating at different frequencies.

Sample Configuration

Model	Description
3172 Model 1	In the Channel-to-Channel configuration, Model 1 can support links between two locally attached System/370 hosts and up to four remote hosts via T1 lines.
3172 Model 2	This model can consolidate any combination of three Ethernet and/or token-ring LAN networks, linking them to a remote IBM ES/9000 host over an FDDI network.
3172 Model 3	Model 3 can link single or dual IBM hosts to as many as four TCP/IP Ethernet LANs, minimizing host communications processing overhead through its TCP/IP Offload feature.

Physical Specifications

Product	3172 Model 1	3172 Model 2	3172 Model 3
Physical Dimensions (H x W x D, inches)	10.0 x 19.0 x 18.0	12.25 x 19.0 x 26.0	12.0 x 19.0 x 19.1
Weight (lb.)	31	86	31
Electrical Requirements	200/240 V AC, 2.8 Amp, 50-60 Hz	200/240 V AC, 2.8 Amp, 50-60 Hz	200/240 V AC, 2.5 Amp, 50-60 Hz
Operating Temperature (°F)	50-105	50-105	60-85

Pricing

		Purch. Price ($)	Annual On-Site Maint. ($)
Models			
3172 Model 1		16,700	832
3172 Model 2		52,440	3,095
3172 Model 3		9,970	832
Options:			
2002	ESCON Channel Adapter	12,430	665
2005	4MB Memory Expansion	2,150	—
2215	Token-Ring 16/4M bps Adapter	1,060	156
2220	Ethernet Adapter	809	73
2250	FDDI A Station Adapter	27,030	4,284
2260	TP Adapter Type T1	3,300	—
2270	IBM PC Network Adapter	339	—
2271	IBM PC Network Adapter II/A	689	—
2272	IBM PC Network Adapter II/A Freq. 2	689	—
2273	IBM PC Network Adapter II/A Freq. 3	689	—
2501	System/370 Parallel Channel Adapter	5,250	73
2510	Rack Mounting Assembly	230	—
2700	TCP/IP Offload Hardware	2,860	—
Software Prices			
5621-425	IBM 3172 Interconnect Controller Program Version 3.0	6,665	—
5735-HAL	TCP/IP Offload Diskette for MVS	3,000	—
5871-BBB	TCP/IP Version 1.2 for OS/2	200	—

■

IBM 3172 Interconnect Controller

In this report:

Note: In December 1991, IBM plans to introduce the 3172 Model 2, an 80486-based controller capable of supporting a 100M bps FDDI LAN interface. IBM is also releasing multiple enhancements to the 3172 Model 1, including T1 connections to remote IBM hosts (Remote Channel-to-Channel Support), IBM ESCON (fiber optic) host channel support, and concurrent operation of SNA and TCP/IP.

The IBM 3172 Controller is a multivendor networking product capable of linking multiple, dissimilar LANs or multiple remote IBM hosts.

Strengths

The ability to link multiple environments makes possible resource sharing, data backup, and other important networking capabilities.

Limitations

The 3172 does not support LAN Gateway and Remote Channel-to-Channel modes concurrently.

Vendor

IBM
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

In Canada:
IBM Canada Ltd.,
Markham
3500 Steeles Avenue E.
Markham, ON L3R 2Z1
(416) 474-2111

Competition

Major communications controller and LAN internetworking vendors.

Base Prices

Model 1: $16,220; Model 2: $50,920.

—By Martin Dintzis
Assistant Editor/Analyst

Product Analysis

Last year, IBM bombarded the media with announcements that will affect the computer industry for years to come. Gearing up for a future in which speed, volume, and communications capabilities will dictate the creation of product lines and their marketing, the company introduced ESCON, an architecture that makes use of wideband, high-speed fiber optic channels. In effect, ESCON extends the walls of the data center by allowing equipment to be located more than five miles away, and increases the maximum channel throughput rate to as high as 200M bps.

Thrust into the limelight of the announcements, the 3172 Interconnect Controller is assuming more responsibility in networks based on Systems Network Architecture (SNA) and expanding into fiber networks. Model 1 supports fiber optic host communications through an optional IBM ESCON adapter. In December of this year, IBM will release Model 2, which supports a 100M bps FDDI LAN adapter (available in March 1992).

Added to the new product introduction are a number of hardware and software enhancements for Model 1. In December 1991, IBM is releasing a T1 remote host adapter and multiple LAN adapters for IBM PC Networks. The standard amount of memory for the controller has been increased from 4M to 8M bytes.

Version 2.0 of IBM's 3172 Interconnect Controller Program (ICP), when supported by VTAM Version 3.4 software, enables the 3172 to function as a remote channel-to-channel controller, communicating with remote IBM hosts via up to four T1 lines. The same software now allows concurrent implementation of SNA, TCP/IP, and other (non-SNA) data flows over combinations of Ethernet, IBM PC Network, MAP 3.0, and token-ring LAN networks; includes the Operator Facility, a new PS/2-based configuration and control software product for the PS/2; and further integrates the controller into NetView.

Target Applications

The 3172 can provide the following key capabilities:

- Consolidation of multiple, separated LANs;
- Interconnection of remote IBM hosts; and
- Development of a migration path to open systems computing.

Strengths

The ability to connect multiple LANs or IBM hosts permits sharing of hardware and software resources among users of different systems as well as data backup capability. Through fiber optic connections, users can obtain faster performance and increased bandwidth for engineering or scientific applications and install channel-attached computing equipment more than five miles from the IBM mainframe.

Limitations

The 3172 cannot function simultaneously as a LAN Gateway and a Remote Channel-to-Channel controller. Although support for fiber optic connections is an important capability, there is presently a dearth of computer and communications products from other vendors that can take advantage of fiber optics.

Vendor Analysis

Product Strategy

With the 3172, IBM is catching up to its competitors in the realm of multivendor LAN connectivity. IBM faces increasing competition from suppliers of multiprotocol communications controllers, as well as numerous vendors of multiprotocol LAN bridges and routers. Both classes of products provide IBM host access to different types of LANs.

IBM originally entered the heterogeneous LAN communications market with the introduction of its 8209 LAN bridge (now withdrawn), which supported both token-ring and Ethernet. That approach continues and expands in the 3172 controller, which supports Ethernet, IBM PC Network, MAP 3.0 (token-bus), and token-ring LAN environments.

If IBM believes in fiber, and sets the stage for its widespread deployment through ESCON, users can bet that other vendors will follow. IBM will continue to support the 3172, enhancing it for frontline service in the company's movement toward T3, FDDI, and OSI.

Overview

Product	3172 Model 1	3172 Model 2
Design	Rack mountable or standalone unit	Rack mountable or standalone unit
Operational Modes Supported	LAN Gateway or Remote Channel-to-Channel (CTC)	LAN Gateway or Remote Channel-to-Channel (CTC)
Base Price	$16,220 (price excludes LAN and T1 adapters, which are optional)	$50,920 (price excludes LAN and T1 adapters, which are optional)
Date Announced	October 1989	September 1990
Date Released	September 1990	December 1991

Decision Points

Requirements	Performance	Comments
Throughput	Supports T1 speeds for remote hosts and up to 200M bps transmission speeds for ESCON (fiber optic) host channels, 10M bps Ethernet LANs, and 16M bps token-ring LANs; the FDDI (fiber optic) LAN adapter, when available in March 1992, will support up to 100M bps transmission speeds.	Meets high-speed networking requirements.
Multivendor Networking	Supports Ethernet, baseband and broadband IBM PC Network, MAP 3.0 (token-bus), and token-ring LAN architectures; allows concurrent operation of SNA, TCP/IP, and other (non-SNA) data flows over connected LANs.	Provides interoperability between major types of LAN environments.
Network Management	Provides alerts to NetView; supports features such as Central Site Control Facility, Network Asset Management Facility, and Vital Product Data; configuration and control are available through PS/2 software.	IBM provides full network management capability for the 3172.

Competitive Analysis

Apertus Technologies' Datastar 5000, IDEA Courier's Concert Controller, and McData Corp.'s LinkMaster 7100 are IBM 3270-compatible controllers that provide IBM host access to Ethernet LAN, token-ring LAN, X.25, and other environments concurrently. McData's LinkMaster 7100 features IBM ESCON (fiber optic host channel) support. LAN bridges and routers from Cisco Systems, Vitalink Communications, and other vendors can provide LAN access to an IBM host via a 3745 front-end processor.

Competitors intent on providing a LAN-based alternative to IBM's communications controllers for SNA connectivity must have experienced an early frost from IBM's announcements of enhancements to the 3172. IBM's statements of direction for the 3172 have reinforced the communications controller as an important tool in LAN internetworking.

Sales and Distribution Strategy

The IBM 3172 Interconnect Controller is sold worldwide through IBM's direct sales force.

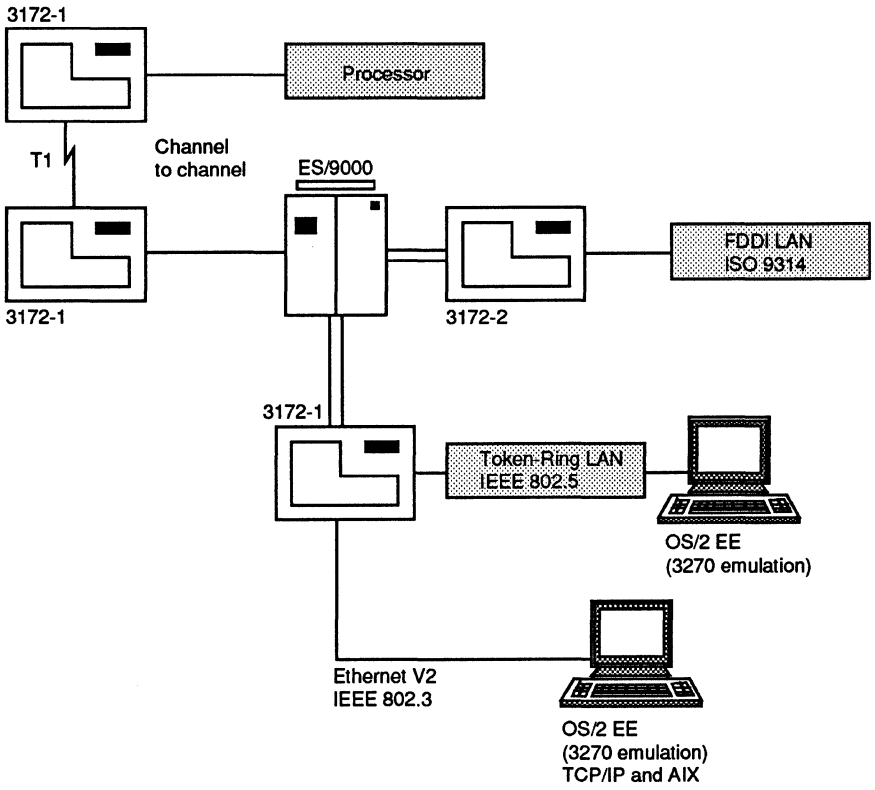

Figure 1.
Capabilities of the IBM 3172

The 3172 links multiple host and LAN environments through LAN Gateway and Remote Channel-to-Channel connectivity.

Interoperability Matrix

Product	3172 Model 1	3172 Model 2
Product Classification	Proprietary network router/gateway device	Proprietary network router/gateway device
Network Layer		
Position in Network Architecture	Transparent to the IBM host	Transparent to the IBM host
Host Software Required	One or more of the following: IBM ACF/VTAM Version 3.4; IBM TCP/IP (Version 2.0 for VM or Version 1.0 for MVS); and IBM OSI/Manufacturing Message Services for VM	One of the following: IBM ACF/VTAM Version 3.4; IBM TCP/IP (Version 2.0 for VM or Version 1.0 for MVS); and IBM OSI/Manufacturing Message Services for VM
Host Attachment Support	Via a System/370 block multiplexer channel or an ESCON (fiber optic) channel	Via a System/370 block multiplexer channel or an ESCON (fiber optic) channel
Network Management Support	NetView compatible	NetView compatible
Transport Layer		
Transport Architectures Supported	Remote host access is supported via public or private T1 lines; IBM SNA and TCP/IP data flows are supported concurrently.	Remote host access is supported via public or private T1 lines; IBM SNA and TCP/IP data flows are supported concurrently.
LAN Attachment Support	Supports attachment of any combination of Ethernet Version 2 (IEEE 802.3), IBM PC Network baseband or broadband (IEEE 802.2), MAP 3.0 (IEEE 802.4 token bus), and 16M/4M bps token-ring (IEEE 802.5) LANs	Supports attachment of any combination of Ethernet Version 2 (IEEE 802.3), IBM PC Network baseband or broadband (IEEE 802.2), MAP 3.0 (IEEE 802.4 token bus), 16M/4M bps token-ring (IEEE 802.5), and Fiber Distributed Data Interface (FDDI) LANs
Data Link/Physical Layers	Compatible with Logical Link Control (IEEE 802.2 LLC) and Media Access Control (IEEE 802.4 MAC) standards; supports thick or thin Ethernet coax; RG-59 coax; and unshielded or shielded twisted-pair wire	Compatible with Logical Link Control (IEEE 802.2 LLC), Media Access Control (IEEE 802.4 MAC) standards, and Fiber Distributed Data Interface (FDDI) standards; supports thick or thin Ethernet coax; RG-59 coax; unshielded or shielded twisted-pair wire; and fiber optic media

Support

Policies and Programs

Warranty

IBM offers a one-year warranty for the 3172. The warranty service is for IBM On-Site Repair (IOR).

Support Services

Hardware Support

IBM provides two kinds of hardware support: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services covers maintenance and repair coordination of non-IBM equipment.

IBM Maintenance Services

Under Maintenance Services, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

- Coverage hours: 24 hours per day, 7 days per week;
- Geographic coverage: national;
- Parts availability: 24-hour access to IBM parts inventory;
- Customer Engineer (CE): assigned to each account;
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs;
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance;
- An online service database; and
- Engineering changes management.

Network Custom Services

IBM's network services are available for data, voice, and T1 networks with customized support options to suit a variety of needs. Network services include network evaluation, design, implementation, management, and operations.

Service Hours

The IBM Warranty Service, Maintenance Service, or Hourly Service can be obtained by calling (800) IBM-SERV (800/426-7378). IBM Hourly Service is available at the applicable rate and terms, including an element exchange price if applicable.

Specifications

Enhancements

Date	Event
September 1990	IBM released the 3172 Interconnect Controller Model 1, with support for Ethernet, token-ring, and MAP 3.0 (token-bus) LAN connections; TCP/IP communications; and IBM System/370 host access. IBM also announced that the 3172 Model 2, offering FDDI LAN connectivity, would be available in December 1991.
August 1991	IBM increased the amount of standard memory for the 3172 controller from 4M bytes to 8M bytes.
August 1991	IBM released Version 2.0 of the 3172 Interconnect Controller Program (ICP), which now supports concurrent operation of IBM SNA, TCP/IP, and other (non-SNA) data flows across LANs. Version 2.0 includes an Operator Facility, OS/2 EE-based software for the PS/2 that supports installation, configuration, monitoring, and control of multiple 3172 controllers by a network operator. It also provides additional NetView-related network management features.
December 1991	IBM will introduce a number of enhancements to the 3172. Remote Channel-to-Channel (CTC) communications capability enables the controller to link remote IBM hosts via T1 lines. IBM introduced a T1 adapter for CTC communications, baseband and broadband LAN adapters for the IBM PC Network, and support for ES/9000 host access via an ESCON (fiber optic) adapter. Version 2.1 of ICP, available in December, provides CTC functionality.
December 1991	IBM plans to release the 3172 Interconnect Controller Model 2. The FDDI LAN adapter for Model 2 will be available in March 1992.

Operating Requirements

Hardware

Product	3172 Model 1	3172 Model 2
Internal Memory Capacity (bytes RAM)	8M	8M
Diskette Drive Capacity (bytes)	1.544M byte	1.544M byte
Hard Disk Capacity (bytes)	30M	80M

Software

Product	Description
3172 Interconnect Controller Program (ICP)	ICP controls the data flow from a LAN adapter to a channel adapter and/or from a channel adapter to a LAN adapter; integrated into NetView, ICP supports features such as generic alerts, Central Site Control Facility (CSCF), NetView Network Asset Management Facility (NAMF), and NAMF Vital Product Data; Version 2.0 provides concurrent support for IBM SNA and TCP/IP data flows in the LAN Gateway configuration; Version 2.1 of ICP supports remote host connections in the Remote Channel-to-Channel configuration.
Operator Facility	A Presentation Manager application that runs on a PS/2 with OS/2 Extended Edition Version 1.2. It enables users to install, configure, monitor, and control up to sixteen 3172s from the PS/2. For 3172s configured as LAN gateways, the PS/2 station may be a LAN-attached workstation; for remote channel-to-channel configurations, the PS/2 must access the 3172 as a standalone computer—through one of the optional ports.

Transmission Features

Number and Types of Communications Channels Supported

Model	3172 Model 1	3172 Model 2
Standard	One System/370 block multiplexer channel	One System/370 block multiplexer channel
Optional	One add'l. System/370 channel or one ESCON fiber optic channel; up to four LAN channels *(1)* or four CTC channels	One add'l. System/370 channel or one ESCON fiber optic channel; up to four LAN channels *(1)* or four CTC channels

(1) Each MAP 3.0 Broadband Adapter uses two ports; each broadband IBM PC Network Adapter uses three ports; all other types of LAN adapters use one port each.

Transmission Features (Continued)

Adapters

Product	Function	Maximum Communications Speed Supported
System/370 block multiplexer channel adapter	Provides connection to an IBM System/370-compatible host	4.5M bytes per sec.
ESCON Adapter	Supports a fiber optic connection to an IBM ES/9000 host	200M bps
TP Adapter Type T1	Supports connection to a T1 common carrier facility for remote host communications; the output of this adapter must pass through a DSU/CSU or a multiplexer with an RS-422 interface	1.544M bps
Ethernet Adapter	Provides attachment to a thick or thin Ethernet LAN; conforms to the IEEE 802.3 architecture	10M bps
FDDI A Station Adapter	(For 3172 Model 2 only) Provides FDDI class A connection to an FDDI LAN	100M bps
MAP 3.0 Broadband Adapter	Provides connection to a MAP Version 3.0 LAN; conforms to the IEEE 802.4 token-bus architecture; this adapter uses 2 optional ports in the 3172	10M bps
PC Network Baseband Adapter/A	Provides connection to a baseband IBM PC Network	1M bps
PC Network Adapters II/A, II/A Frequency 2, and II/A Frequency 3	Provide connections to broadband IBM PC Networks at different frequencies	2M bps
Token-Ring 16/4 Adapter	Supports a connection to either a 16M or 4M bps token-ring network; conforms to the IEEE 802.5 architecture	16M bps

Configuration

Sample Configuration for a 3172 Model 1 LAN Gateway

Component	Number Installed
System/370 Channel Adapter	1
ESCON Adapter	1
Token-Ring 16/4 Adapter	1
Ethernet Adapter	2
MAP 3.0 Broadband Adapter	1
PS/2 Network Management Workstation	1

Physical Environment

Product	3172 Model 1	3172 Model 2
Physical Dimensions (H x W x D, inches)	10.0 x 19.0 x 18.0	12.25 x 19.0 x 26.0
Weight (lb.)	31	86
Electrical Requirements	200-240 V AC, 2.8 Amp, 50-60 Hz	200-240 V AC, 2.8 Amp, 50-60 Hz
Operating Temperature (°F)	50-105	50-105

Pricing

Equipment Prices

		Purchase Price ($)	Annual On-Site Maint. ($)
3172 Interconnect Controller			
	Model 1	16,220	832
	Model 2	50,920	3,095
2500	Optional rackmount assembly	224	—
Optional Adapters			
2001	System/370 Channel Adapter	8,430	184
2002	ESCON (System/390 fiber optic) Channel Adapter	12,070	665
2260	TP Adapter Type T1	3,205	—
2220	Ethernet Adapter	786	73
2250	FDDI A Station Adapter (for Model 2 only) *(1)*	26,250	4,284
2270	IBM PC Network Baseband Adapter	330	—
2271	IBM PC Network Adapter II/A	669	—
2272	IBM PC Network Adapter II/A Frequency 2	669	—
2273	IBM PC Network Adapter II/A Frequency 3	669	—
2230	MAP 3.0 Broadband Adapter	2,795	182
2210	Token-Ring 16/4 Adapter	895	25

(1) Available in March 1992.

Software Prices

		Purchase Price ($)
3172 Interconnect Controller Program		
0150	Version 2.0 (Supports LAN Gateway functionality)	5,500
0152	Version 2.1 (Supports Remote Channel-to-Channel Feature)	20,000

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IBM 3172 Interconnect Controller

In this report:

Product Summary

Editor's Note

In 1989, IBM introduced the 3172 Interconnect Controller Model 1, to link local area networks to IBM mainframes. In its September 5, 1990 product announcements and enhancements, IBM released Model 2 of the 3172. The availability date for Model 2 is December 27, 1991.

Description

The 3172 Interconnect Controller is a microprocessor-based device that attaches LANs to the company's mainframes. Model 1 attaches to the System /370, and the as yet unreleased Model 2 will connect to the System/370 and the newly announced System/390. To accommodate IBM's new Enterprise Systems Connection (ESCON) architecture, the company currently offers an ESCON adapter for the Model 1 and plans to incorporate ESCON support into the Model 2.

Strengths

The Model 1 is already equipped with ESCON capabilities through the ESCON adapter.

Limitations

The Model 2, which supports LAN connections to the System /390, will not be available until December 27, 1991.

Competitors

IBM plug-compatible vendors.

Vendor

International Business Machines Corporation (IBM)
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Price

Model 1—$15,450; Model 2—$48,500 plus $25,000 for FDDI adapter.

—By Barbara Callahan
Associate Editor

Analysis

Product Strategy

On September 5, 1990, IBM bombarded the media with announcements that will affect the computer industry for years to come. Gearing up for a future in which speed, volume, and communications capabilities will dictate the creation of product lines and the marketing of them, the company introduced ESCON, an architecture that makes use of wideband, high-speed fiber optic channels. In effect, ESCON extends the walls of the data center by allowing equipment to be located more than five miles away.

Thrust into the limelight of the announcements, the 3172 Interconnect Controller is assuming more responsibility in networks based on Systems Network Architecture (SNA) and expanding into fiber networks via the new Model 2. Equipped with an Intel 80486 microprocessor, the 3172 Model 2 can attach an FDDI LAN to an IBM System/370 or System/390 parallel channel.

IBM's new Remote Channel-to-Channel Feature software allows a Model 1 to support channel-to-channel communications via T1 links between remote hosts. The software enables users to configure up to four T1s as a unified transmission group. Plans for incorporating T3 and OSI support into the 3172 are under way.

Competitive Position

In the LAN market, in which the 3172 competes, IBM faces a long list of competitors. Although late in entering the heterogeneous communications market, IBM made up for lost time by developing the 8209 LAN bridge that supports token-ring and Ethernet. That approach continues and expands in the 3172, which supports token-ring, Ethernet, and MAP 3.0.

Competitors who had hoped that IBM's years of dominance were waning must have experienced an early frost from the September announcements. The giant had not been sleeping, but had been merely honing its tools to capture more of the networking market. IBM has issued statements of direction for the 3172, thereby validating its importance as a tool in its LAN strategy.

Decision Points

Users can be sure that IBM will maintain its position as a LAN leader and a LAN trendsetter. If IBM believes in fiber and sets the stage for its widespread use through ESCON, users can bet that other vendors will follow. IBM will continue to support 3172, enhancing it for frontline service in the company's march toward T3, FDDI, and OSI. IBM plans to make its products talk to whatever is out there now and whatever will come along in the future.

Characteristics

Overview

The IBM 3172 Interconnect Controller Model 1 is a Micro Channel/80386-based intelligent device that supports channel attachment of local area networks to IBM System/370 host processors. Model 2, released in September 1990, is based on an Intel 80486 microprocessor. Model 2 can attach an FDDI LAN to an IBM System/370 or System/390 parallel channel. In multiple LAN attachments, the 3172 provides data transfer services and connections between LANs and host processors in Transmission Control Protocol/Internet Protocol (TCP/IP) and Manufacturing Automation Protocol (MAP) networks.

Configuration

The base unit of the 3172 consists of a cabinet with operations panel, system board with RAM and processor, diskette drive, hard disk, one channel adapter, and power supply.

LAN Support

The 3172 supports IEEE 802.5 (IBM Token-Ring) and IEEE 802.3 (CSMA/CD), which includes Ethernet via ▶

Company Profile
IBM Corporation

Corporate Headquarters
Old Orchard Road
Armonk, NY 10504

In Canada
IBM Canada Ltd.,
Markham
3500 Steeles Avenue E.
Markham, ON L3R 2Z1
(416) 474-2111

Offices located in other cities throughout Canada.

Officers
Chairman/CEO: John Akers
Vice Chairman: Jack D. Kuehler
Sr. VP/Gen. Mgr.: Terry Lautenbach

Company Background
Year Founded: 1914
No. Employees: 400,000 worldwide

IBM is one of the oldest manufacturers of computing equipment in the world. It started out in Poughkeepsie, NY as a small company manufacturing clocks for industrial use and later introduced punched card equipment for business accounting functions. According to *Business Week* and *Fortune*, IBM is among the top five industrial corporations by sales volume. It has dominated the mainframe market for over 30 years and has a strong hold on other industry sectors.

Business Overview
IBM designs, manufactures, markets, and services mainframe computer systems and associated peripherals; minicomputer systems and peripherals; microcomputer/personal computer systems; computer system software; data communications controllers and terminals; other communications products such as modems, voice response systems, and voice messaging systems; local area network communications products; and office equipment. In addition, IBM provides specialized products and services such as communications carrier and limited time-sharing services; the IBM Information Network, a communications facility with remote storage and computing services; OEM manufacturing of terminals, disk drives, and other products; maintenance service and system supplies; and financial services through its IBM Credit Corporation subsidiary.

Since it introduced its PC line of microcomputers, IBM has had several earning periods where the growth of the company was much less than anticipated. This reflects the competitive nature of the small systems market. To compete more effectively in this market, IBM has greatly expanded its software, as well as hardware, efforts and has entered into agreements with several independent software suppliers to provide tools for its entire line of computer products.

In September 1990, IBM sent shock waves through the industry, which are still being absorbed, by releasing a barrage of products in the mainframe and communications arenas that will shape the industry for many years. IBM introduced a new mainframe, the System/390, which, according to many analysts, represents the company's most significant announcement in 25 years. The System/390 is based on a comprehensive set of products, features, and functions that includes at its center the IBM Enterprise System/9000 family of processors—the most powerful ever offered by IBM. The company also introduced the Enterprise Systems Connection (ESCON) architecture, NetView Version 2, and a vast array of software. In addition, IBM enhanced many products, such as the 3172 and 3745 controllers.

Financial Profile
Operations results for 1989 showed that net profits fell 35 percent to $3.76 billion, or $6.47 per share. Revenues, however, increased 5.1 percent to $62.7 billion over 1988. Fourth-quarter earnings fell 75 percent to $591 million, or $1.04 per share, due to the $2.3 billion restructuring charge.

Management Statement
Moving more resources close to customers is a cornerstone of IBM's transformation in the computer industry. To that end, in 1988 IBM undertook the most significant restructuring of its business in more than 30 years, establishing seven lines of business and a new organization—IBM United States. This restructuring continued through 1989 and will continue to be dynamic in order to consistently meet the needs of its customers.

IBM notes that it is managing for the long term and, with the steps it has taken and continues to take, it remains confident about the future of its business.

To help its customers stay competitive, IBM announced its Computer-Integrated Manufacturing (CIM) Architecture. IBM claims its CIM Architecture gives customers a comprehensive strategy to help them integrate information in a consistent manner across the entire enterprise. It addresses the integration challenge in an environment characterized by a variety of computer system technologies, operating systems, and applications. The CIM Architecture focuses on the storage of shared information, its delivery throughout networks, and its presentation to a variety of devices and users. IBM says CIM functions will be implemented for its Systems Application Architecture operating environments and its Advanced Interactive Executive operating environments.

▶ *(Characteristics continued)*

TCP/IP, and MAP Version 3.0. The datastream is transparent to the 3172, which supports up to four LAN attachments and two channel attachments. Since MAP 3.0 adapters require two feature slots, the maximum of four LAN adapters is reduced by one for each MAP 3.0 installed by the user. Each 3172 includes one channel adapter as a standard feature and four feature slots for the connection of a variety of LAN adapters as optional features. The controller supports a second channel adapter as an option.

Components

System/370 Channel Adapter: This feature, which supports speeds up to 4.5M bps, interfaces with the System/370 block multiplexer channel as if it were a System 3088.

Interconnect Controller Token-Ring 16/4 Adapter: This device attaches to a 16M or 4M bps Token-Ring Network that conforms to the architecture specified by IEEE 802.5.

Interconnect Controller Ethernet Adapter: This feature provides attachment capabilities to IEEE 802.3 thick or thin Ethernet LANs.

Interconnect Controller MAP 3.0 Broadband Adapter: This adapter implements the connection to MAP Version 3.0 LANs and conforms to IEEE 802.4 10M bps Token-Bus architecture. An adapter controller and broadband modem come with the product.

Interconnect Controller MAP 3.0 Carrierband Adapter: This device implements the connection to MAP Version 3.0 LANs and conforms to IEEE 802.4 5M bps Token-Bus architecture. An adapter controller and carrierband modem come with the product.

ESCON Adapter: IBM enhanced the capabilities of the Model 1 with the ESCON adapter, which supports remote channel-to-channel attachment over wideband digital transmission links. The Model 2 will support ESCON in the future.

Workstation Support

Each IBM Personal Computer or PS/2 workstation communicating with the host via the 3172 can use one of the following:

- IBM TCP/IP for the Personal System/2
- IBM AIX Personal System/2 TCP/IP
- IBM AIX Access for DOS users
- IBM X Windows for IBM DOS
- IBM AIX/RT Version 2.2
- IBM OSI/Manufacturing Message Services for OS/2
- AS/400 TCP/IP Connectivity Utilities

Interconnect Controller Program

The IBM Interconnect Controller Program (5601-400) or equivalent controls the data flow from a LAN adapter to a channel adapter (subchannel) and/or from a channel adapter to a LAN adapter. Users can connect multiple LANs to a single subchannel or multiple subchannels. At IPL, a logical, permanent connection occurs between a LAN and a subchannel.

IBM includes a standalone configuration utility with each Interconnect Control Program. This configuration aid functions offline in any PS/2 or equivalent with space for a 3.5-inch, 1.44M-byte diskette drive and a 5M-byte hard drive disk. The utility operates with PC-DOS Version 3.3 or 4.0 or the DOS partition in the OS/2 operating system. The utility prepares a configuration file on the diskette that is shipped with the Interconnect Controller Program. When the configuration is complete, the user loads the diskette into the 3172.

Remote Channel-to-Channel Feature

This software enables a Model 1 to support channel-to-channel communications between remote hosts via T1 links. Users can configure up to four T1s as a single transmission group. IBM announced the same capability as a statement of direction for Model 2.

Pricing

The 3172 Model 1 costs $15,450, with an annual maintenance charge of $832. The 3172 Model 2, scheduled for availability December 27, 1991, costs $48,500. An FDDI adapter for the Model 2 costs $25,000. ■

IBM 3745 Communication Controller

In this report:

Note: IBM has extended the capacity and processing power of 3745 Models 210, 310, 410, and 610 through the 3746 Expansion Unit Model 900. Upgraded with support for additional memory, an enhanced maintenance subsystem, and an interface to the expansion unit, 3745 Models 210, 310, 410, and 610 have been renamed Models 21A, 31A, 41A, and 61A, respectively.

Datapro Summary

The IBM 3745 Communication Controller, whether used as a front-end processor or a remote processor, helps to isolate the host computer from the complexities of data networking, enabling the host to perform its primary function: processing data. Some of the many functions performed by the 3745 are host channel management, line concentration, message queuing, LAN gateway services, intelligent switching, protocol conversion, device polling, and alarm and event data collection. The 3745 is available in seven different models, supporting anywhere from 32 to 896 communications lines.

Strengths

- The 3745 supports T1/E1 data rates for wide area networks and connections to the ES/9000 fiber optic I/O channel via the IBM ESCON converter.
- The 3745 provides connectivity to non-SNA environments such as X.25, frame-relay, and TCP/IP networks.
- Redundant components and support for backup data paths ensure network reliability. The user can install, replace, or move communications line interfaces while the 3745 is operating. 3745 Models 41A and 61A offer dual, independent central control units (CCUs) for added fault tolerance.
- Remote 3745 operations can be controlled from a central site.

Limitations

- Users are migrating away from hierarchical host-to-terminal processing, for which the communications processor was originally developed, in favor of LAN internetworking. For intelligent switching of LAN traffic, LAN routers are destined to play a stronger role than the communications processor.

Competition

NCR, Amdahl, and Unisys.

Vendor

IBM
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Price

IBM 3745 prices range from $23,160 to $303,350. **GSA Schedule**: Yes.

—By Martin Dintzis
Assistant Analyst

Product Analysis

The IBM 3745 Communication Controller, available in seven models, is used in Systems Network Architecture (SNA) networks as a front-end processor to an IBM host, a remote concentrator, or an intelligent switch. The 3745 supports data communications between directly attached or remotely located devices (other 3745s, IBM 3174 terminal controllers, token-ring LAN and Ethernet LAN workstations, and display terminals); between these devices and IBM host computers; and between the host computers themselves.

In June 1993 IBM upgraded 3745 Models 210, 310, 410, and 610, renaming them Models 21A, 31A, 41A, and 61A, respectively. These new versions feature support for up to 16MB of internal memory, an enhanced maintenance subsystem, and an interface to the *3746 Expansion Unit Model 900*. Mounted to the right side of the 3745 (but powered separately), the 3746 connects to the 3745's internal bus and runs under 3745-resident ACF/NCP. Accommodating up to nine token-ring LAN or four ESCON interfaces, this expansion unit can be used to increase the capacity of the communications processor. The 3746 Model 900 can also off-load all channel and/or token-ring LAN management functions from the 3745, improving performance in frame relay and other wide area networking applications.

Target Applications

As a front end, the 3745 relieves the IBM host of the overhead incurred in message handling and network control. As a remote concentrator for IBM computing environments, the 3745 controls a community of terminals, terminal clusters, or distributed application processors; it gathers, queues, and multiplexes all transmissions onto one or more high-speed communications links. When used for intelligent switching applications, it routes messages between LANs and among the network's various end points. In addition to these functions, the 3745 performs protocol conversion, device polling, and alarm and event data collection.

The IBM 3745 Communication Controller is not targeted toward a particular industry. It is used to integrate multiple IBM and non-IBM computing facilities into a single local area and/or wide area network.

Strengths

Although IBM originally developed the 3745 for SNA communications, the vendor is progressively adding connectivity options allowing integration of both SNA and non-SNA environments. The 3745 now provides access to frame-relay transport facilities and Ethernet LANs, as well as X.25 packet switched, token-ring LAN, and TCP/IP networks.

With a single high-speed line to a public frame-relay network, users can access multiple remote 3745s. Reducing the number of lines cuts communications costs for IBM customers.

The 3745 supports T1/E1 data rates for wide area connectivity as well as ESCON (fiber optic) connections to an IBM ES/9000 host. The vendor has also announced future support for DS3, Asynchronous Transfer Mode (ATM), and Switched Multi-megabit Digital Service (SMDS) interfaces.

Redundant components and transmission lines with automatic switchover ensure reliable network operation. Hot pluggable Line Interface Couplers (LICs) allow the user to install, replace, or move communications line interfaces while the 3745 is operating. For additional fault tolerance, Models 41A and 61A support dual, independent central control units.

Multiple 3745s can be reconfigured, monitored, and managed from a central NetView console or from an IBM support center.

Limitations

As a front end to a host, the 3745 will continue to occupy an important place in IBM's networking strategy. As an intelligent switch, however, the 3745 must compete with a newer breed of devices: multiprotocol LAN routers. Users are migrating away from the hierarchical host-to-terminal type of processing, for which the communications processor was originally developed, in favor of peer-to-peer communications between intelligent workstations. In this environment, multiprotocol routers can provide higher throughput, greater efficiency, and more flexibility than the communications processor—for a lower price.

Competitive Analysis

The 3745 is one of IBM's chief solutions for integrating multiple SNA and non-SNA computing environments over local area and wide area networks. IBM continues to enhance the product line with host, LAN, and WAN connectivity options. Realizing, however, that its venerable communications processor cannot provide all of the features LAN users are looking for, IBM offers other solutions such as the 3172 Interconnect Controller and the 6611

Overview

3745 Model	Design	Date Announced	Date Released	Base Price ($)
130	Floorstanding	May 1989	May 1989	23,160
150	Floorstanding	May 1989	May 1989	34,150
170	Floorstanding	May 1989	May 1989	28,950
21A	Floorstanding	September 1992	June 1993	151,950
31A	Floorstanding	September 1992	June 1993	195,200
41A	Floorstanding	September 1992	June 1993	228,600
61A	Floorstanding	September 1992	June 1993	303,350
3746 Expansion Unit Model 900	Floorstanding	September 1992	June 1993	37,400

Decision Points

Models	Requirements	Comments
3745 Communication Controller	High Throughput	Supports T1/E1 speeds for wide area networks; accommodates 10M bps Ethernet LANs and 16M bps token-ring LANs; provides ESCON (fiber optic) connections to IBM ES/9000 hosts.
	Multivendor Networking Capability	Although the 3745 is designed primarily for IBM SNA/SDLC and 3270 BSC environments, it provides connectivity to non-SNA environments such as async ASCII, X.25, frame relay, and TCP/IP Ethernet networks.
	Reliability	Models 41A and 61A support dual, independent CPUs. Backup data paths provide access to redundant network lines and processor nodes.
	Upgradability	A modular architecture makes system expansion and performance upgrades straightforward.

LAN Router, which give users less expensive and simpler alternatives for interconnecting computing environments.

Vendor Analysis

Marketing Strategy

IBM is the leading vendor in the communications processor market. All major competitors, including NCR, Amdahl, and Unisys, offer compatibility with IBM's SNA and the 3745. To remain competitive with the multivendor networking capabilities in the communications processors of its competitors, IBM continues to add connectivity options to the 3745. Three of the more recent enhancements—Ethernet LAN, TCP/IP, and frame-relay networking support—represent IBM's increasing commitment to providing solutions for linking multiple, incompatible computing environments.

Target Markets

Supporting communications between an SNA environment and one or more SNA or non-SNA facilities, the 3745 is used by private and public corporations, financial institutions, governmental bodies, and universities around the world.

Market Position

Communications processors do not generate bold headlines but still find their niche in the industry. The technology is mature, but strong competition still exists among the major vendors. IBM is the leading supplier of communications processors.

Major Competitors

NCR is second to IBM in the sale of communications processors. Amdahl and Unisys follow in that order.

Sales and Distribution Strategy

Sales

IBM offers both purchase and leasing agreements for its communications processors.

Distribution

The 3745 is distributed worldwide through IBM's direct sales force.

Support

Policies and Programs

Warranty

IBM offers a one-year warranty with IBM On-Site Repair (IOR).

Support Services

IBM has consolidated all services under a simplified contract called the IBM Service Plan. Customers now have the ability to order any or all of a broad range of IBM services using a single-page document. IBM's network services are available for data, voice, and T1 networks with customized support options to suit a variety of needs. Network services include network evaluation, design, implementation, management, and operations.

IBM provides two broad categories of hardware maintenance: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services (MVS) covers maintenance and repair coordination of co-located non-IBM equipment.

IBM Maintenance Services

Under this agreement, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

Interoperability Matrix

Product	3745 Communication Controller
Product Classification	Proprietary network router/gateway device.
Relationship With Higher-Level Elements	
Position in Network Architecture	Appears to the IBM host as an SNA physical unit (PU) Type 4 device.
Host Software Required:	
Operating Systems	MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP.
Access Method	VTAM
Communications Processor Software Load	From the host, the processor's diskette, the processor's hard disk, or a remote IBM support center.
Host Access	Direct connection via a System/370 block/byte multiplexer channel or fiber optic channel, remote access via a dial-up or leased line, or indirect host access via a token-ring or Ethernet LAN.
Network Management Support	Relies upon IBM NetView; also supports remote diagnostics from an IBM support center.
Relationship With Peer-Level Elements	
Compatible Communications Processors	Plug compatible with the Amdahl 4745 communications processor. Also compatible with the NCR Comten 5600, Unisys DCP Series, and Unisys CAP processor lines.
Transport Architectures Supported	Async, frame relay, IBM SNA/SDLC, IBM 3270 BSC, TCP/IP, and X.25.
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to T1/E1 facilities via a V.35 interface.
Packet Switched Network Support	Supports access to an X.25 packet switched network using an X.21 or X.21bis interface.
LAN Attachment Support	Supports both Ethernet and token-ring LAN connections concurrently.

- National geographic coverage.
- Twenty-four-hour access to IBM parts inventory.
- A Customer Engineer (CE) assigned to each account.
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs.
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance.
- An on-line service database.
- Engineering changes management.

Multiple Vendor Services (MVS)

MVS is tailored to meet the customer's hardware maintenance requirements in a mixed-vendor environment. IBM provides these services in three modular offerings:

- *Repair Coordination.* IBM provides a single phone number (800/IBM-SERV) for all service requests, dispatches service vendors for non-IBM product repair, coordinates maintenance activities, and tracks the status of each problem.
- *Maintenance Coordination.* IBM takes a leadership role in scheduling and coordinating hardware maintenance activities to minimize network outages.
- *Service Management.* IBM identifies expert maintenance vendors, negotiates and administers service contracts, and reconciles invoices, relieving the customer of the burden of these management activities.

Service Hours

IBM Service can be obtained 24 hours per day, 7 days per week by calling (800) IBM-SERV (800/426-7378).

Specifications

Enhancements

Date	Enhancement
September 1992	Began shipping the 3745 Ethernet Local Area Network (LAN) Adapter, supporting Internet Protocol (IP) traffic routing on an existing SNA network.
September 1992	Released *Advanced Communications Function/Network Control Program (ACF/NCP) Version 6*, which supports the Ethernet LAN Adapter and uses the Internet Protocol. Additionally, ACF/NCP Version 6 allows the 3745 to access a frame-relay network as a DTE. The software monitors network congestion and provides alerts to NetView.
December 1992	Introduced support for Advanced Peer-to-Peer Networking on the 3745. This feature enables multiple 3745s to communicate as peers, dynamically routing network traffic between each other.
June 1993	Extended the power and capacity of the high-end 3745 models (210 through 610) through the 3746 Expansion Unit Model 900, off-loading LAN gateway and ESCON channel processing functions from the 3745.
	Upgraded 3745 Models 210, 310, 410, and 610 with support for up to 16MB of memory, an enhanced maintenance subsystem, and an interface to the 3746 Model 900. The upgraded versions are now referred to as Models 21A, 31A, 41A, and 61A, respectively.

Features/Functions

Models	130	150	170	21A
Hardware Features				
Max. No. of Central Control Units (CCUs)	1	1	1	1
Internal Memory Capacity (bytes)	8M	8M	8M	16M
Hard Drive Capacity (bytes)	67M	67M	67M	67M
Transmission Features				
Max. No. of Low-Speed Lines *(1)*	Does not apply; this model is designed for high-speed (local or remote) host links and LAN gateways.	32	112	896
Max. No. of T1/E1 Links	4	2	4	16
Max. No. of Host Channels	4	Does not apply; this model is designed for remote host links and LAN gateways.	4	16
Max. No. of Token-Ring LAN Connections	4	2	2	8
Max. No. of Ethernet LAN Connections	4	2	4	16
Physical Interfaces Supported	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), IEEE 802.5 (token-ring), System/370 (parallel channel), and ESCON (fiber optic channel).	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), and IEEE 802.5 (token-ring).	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), IEEE 802.5 (token-ring), System/370 (parallel channel), and ESCON (fiber optic channel).	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), IEEE 802.5 (token-ring), System/370 (parallel channel), and ESCON (fiber optic channel).

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Models	31A	41A	61A
Hardware Features			
Max. No. of Central Control Units (CCUs)	1	2	2
Internal Memory Capacity (bytes)	16M	16M	16M
Hard Drive Capacity (bytes)	67M	67M	67M

Features/Functions (Continued)

Models	31A	41A	61A
Transmission Features			
Max. No. of Low-Speed Lines *(1)*	896	896	896
Max. No. of T1/E1 Links	16	16	16
Max. No. of Host Channels	16	16	16
Max. No. of Token-Ring LAN Connections	8	8	8
Max. No. of Ethernet LAN Connections	16	16	16
Physical Interfaces Supported	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), IEEE 802.5 (token-ring), System/370 (parallel channel), and ESCON (fiber optic channel).	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), IEEE 802.5 (token-ring), System/370 (parallel channel), and ESCON (fiber optic channel).	V.24, V.25, V.35, X.21, X.21bis, IEEE 802.3 (Ethernet), IEEE 802.5 (token-ring), System/370 (parallel channel), and ESCON (fiber optic channel).

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Software Features (all models)

Multivendor Networking Capability	Supports both SNA and TCP/IP communications over a single wide area network. Provides gateways to both Ethernet and token-ring LANs.
Frame-Relay Networking	Can be configured as a DTE for communications with a frame-relay transport service.
X.25 Packet Switching	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.

Network Management Functions

Fault and Problem Management	Through an operator console, the user can access the *Maintenance and Operator Subsystem (MOSS)* of the 3745, which provides host-independent management capabilities. Functions supported include dump operations, on-line event recording, error notification, problem determination, and failure isolation through line and/or CCU switchover. An optional *Remote Support Facility (RSF)* enables a remote IBM support center to diagnose problems. IBM NetView permits the user to examine information related to the SNA network and to access problem determination information generated at network nodes.
Configuration Management	The *Maintenance and Operator Subsystem* provides controller initialization, program loading, line configuration and operating mode management, and access to hard disk functions. The user can also reconfigure the 3745 through NetView.
Performance and Accounting Management	NetView allows the user to control, record, and automate various operator tasks. The facility can also be used as an operator's interface to VTAM in a data communications network. The *NetView Performance Monitor (NPM)* provides performance management and problem determination. It measures line capacity and response time, generates reports, and provides accounting data.
Security Management	NetView supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF). RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Configuration

Components

Product	Description
Hardware:	
Central Control Unit (CCU)	The heart of the 3745, the CCU executes the machine instruction set, controls I/O functions, controls data communications to terminals, manages main memory, and sends error and status information to the MOSS. One or two CCUs can be installed, depending on the model.
Maintenance and Operator Subsystem (MOSS)	A microprocessor-based subsystem, MOSS communicates with the CCUs and controls the switching of the channel and line adapters from one CCU to the other. It also supports host-independent configuration and management functions such as program loading and initialization, event recording, error notification, and problem determination. MOSS supports links to an IBM remote support facility.
Main Storage	Provides from 4M to 16MB of RAM per CCU.
Channel Adapter (CA)	Provides logical and physical interface between the 3745 and an IBM 4341, 4361, 4381, 937X, 3090, or ES/9000 processor; attaches to a byte multiplexer, block multiplexer, or selector channel.
Buffer Chaining Channel Adapter (BCCA)	Provides the same capabilities as a regular channel adapter, but uses a buffer chaining process.

Configuration (Continued)

Components (Continued)

Product	Description
Hardware: (Continued)	
ESCON Converter Model 1	Attaches existing parallel channel devices, including the IBM 3745, to IBM's ESCON fiber optic channels. The ESCON Converter Model 1 supports data rates up to 17MB per second at extended distances.
Ethernet LAN Adapter	Provides two connections to 10M bps Ethernet Version 2 or IEEE 802.3 local area networks.
Token-Ring Adapter (TRA)	Provides two attachment ports to 4M or 16M bps IBM Token-Ring Networks using standard protocols.
Low-Speed Scanner (LSS)	A microprocessor-based device providing data link control for a set of telecommunications lines operating at speeds up to 256K bps.
High-Speed Scanner (HSS)	Provides scanner functions for attachment of a V.35, X.21, or X.21bis data link operating at speeds up to 2.048M bps.
Line Interface Coupler (LIC)	There are several types of LICs: Types 1, 3, 4A, 4B, 5, and 6. Types 1 through 4 provide internal clocking. Type 1 supports four 19.2K bps async, SDLC, or BSC lines. Type 3 supports one 256K bps SDLC or BSC line. Type 4A supports up to four 9.6K bps SDLC lines. Type 4B provides one variable speed (9.6K to 256K bps) SDLC line. Type 5 combines the functions of a line interface coupler and two 14.4K bps synchronous modems for multipoint configurations. Type 6 has a built-in 56K bps CSU/DSU.
Line Interface Coupler (LIC) Base	The LIC Base provides an enclosure housing up to eight LICs.
Two Processor Switch (TPS)	Provides a second channel interface to attach a Channel Adapter or a Buffer Chaining Adapter to a Multiprocessor System, or to two channels of the same or different processors.
Software:	
Advanced Communications Function for the Network Control Program	Residing in the 3745, ACF/NCP provides physical network management and supports IBM Systems Network Architecture requirements. ACF/NCP Version 6 supports the newer Ethernet LAN, TCP/IP, and frame-relay networking features.
Emulation Program (EP)/Partitioned Emulation Programming (PEP) Extension	EP allows the 3745 to emulate an IBM 270X communications controller to support non-SNA DTEs. PEP Extension enables both ACF/NCP and EP to coexist on the same 3745 processor.

Sample Configuration

Model	Description
170	One CCU with 8MB of memory and a power supply; dual host channel connections; one token-ring LAN connection; two active and two backup T1 transmission lines; twenty-four 9600 bps async lines, twelve 19.2K bps sync lines, and two 256K bps lines; and a remote connection to an IBM NetView management console.

Physical Environment

Models	130, 150, 170	210, 310 410, 610	3746 Model 900
Physical Specifications (H x W x D, in.)	39.5 x 29.5 x 25.5	70.0 x 47.5 x 29.5	70.0 x 31.0 x 29.5
Electrical Requirements	Single-phase AC, 200-240 V; 50/60 Hz	Three-phase AC, 208-240 V phase to phase; 50/60 Hz	Single-phase AC, 200-240 V or –48 V DC; 50/60 Hz *(1)*
Environmental Specifications	60°F to 100°F; 8 to 80% humidity	60°F to 100°F; 8 to 80% humidity	60°F to 100°F; 8 to 80% humidity

(1) The 3746 has its own power supply. It does not receive power from the 3745.

Options

Product	Description
Hardware	
3746 Expansion Unit Model 900	Extends the capacity and processing power of 3745 Models 21A, 31A, 41A, and 61A by off-loading ESCON channel and token-ring LAN gateway functions. Attached to the right side of the 3745, the expansion unit houses one factory-installed Token-Ring Coupler type 3 (TIC3, a token-ring LAN interface) and up to four processor modules, each providing either one ESCON connection or dual token-ring LAN connections. The 3746, therefore, supports up to nine token-ring or four ESCON interfaces. In addition to these intelligent adapters, the 3746 contains a connectivity switch, which provides interconnection between pairs of processor modules (via NCP in the 3745); a Controller Bus and Service Processor (CBSP), which provides an interface to the 3745's Service Processor; a Controller Bus Coupler, which provides a connection to the 3745's CCU; an AC power supply and cooling unit; and a control panel hidden by a sliding door.
Software	
X.25 NCP Packet Switching Interface (NPSI)	Provides a link to an X.25 packet switched network.

Pricing

IBM 3745 Communication Controller Products

Products	Description	Purchase Price ($)	Monthly Rental ($)
3745 Communication Controller			
Model 130	One CCU	23,160	2,310
Model 150	One CCU	34,150	3,405
Model 170	One CCU	28,950	2,885
Model 21A	One CCU	151,950	15,180
Model 31A	One CCU	195,200	19,520
Model 41A	Two independent CCUs	228,600	22,850
Model 61A	Two independent CCUs	303,350	30,340
3745 Options:			
1561	Channel Adapter for Models 21A, 31A, 41A, and 61A	12,150	1,215
1562	Channel Adapter with two processor switches	17,010	1,690
1563	Channel Adapter for Models 130, 150, and 170	7,520	750
1571	Buffer Chaining Channel Adapter (BCCA)	15,370	1,535
9034	ESCON Converter Model 1	15,450	750
4720	Low-Speed Scanner	17,010	1,690
4740	High-Speed Scanner	26,730	2,665
4770	Token-Ring Adapter Type 2	22,060	2,200
4900/4901	Line Interface Coupler (LIC) Unit	11,540	1,145
4902	LIC Base Type 1	4,855	485
4903	LIC Base Type 2	3,470	347
4911	LIC Type 1	3,155	314
4931	LIC Type 3	3,155	314
4941	LIC Type 4A	3,155	314
4942	LIC Type 4B	3,155	314
7865	LIC Type 5	5,435	542
7825	LIC Type 6	3,580	357
7100	Base Memory (4MB RAM)	12,150	1,215
7101	Memory Expansion to 8MB RAM	11,800	1,180
8320	Two Processor Switch	4,855	485

IBM 3745 Communication Controller Products (Continued)

Products	Description	Purchase Price ($)	Monthly Rental ($)
3746 Expansion Unit		37,400	3,740
3746 Options:			
5000	Dual Power Input (200/240 V AC)	8,800	880
5500	ESCON Processor	13,200	1,320
5501	ESCON Coupler	6,600	660
5600	Token-Ring Processor	13,200	1,320
5601	Token-Ring Coupler (TIC3)	3,300	330
5602	Controller Bus Coupler	6,600	660

		Purchase Price ($)	Monthly Rental ($)
Software Prices			
5688-231	ACF/NCP Version 6	9,880-29,930	212-623
5688-035	X.25 NPSI Version 3	2,820-15,150	57-315

■

IBM 3745 Communication Controller Models 310/610

New Product Announcement

Vendor
International Business Machines Corp. (IBM)
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Technology
The new IBM 3745 Communication Controllers, Models 310 (single CCU) and 610 (dual CCU), make use of a faster bipolar technology, with a larger high-speed buffer. The improved Central Control Unit (CCU) and Buffer Chaining Channel Adapters (BCCAs) of the Models 310 and 610 result in data throughput 2.5 times greater as compared to the Models 210 and 410.

Date Announced
June 1991.

Scheduled Delivery
Models 310 and 610, and upgrade kits for other 3745 models: October 25, 1991.
Timed IPL and Rename Load Module: March 1992.
Ethernet LAN Adapter: Third-quarter 1992.

—By Barbara Rinehart
Associate/Editor Analyst

Pricing
IBM 3745 Model 310: $18,960; IBM 3745 Model 610: $29,460; Ethernet LAN Adapter card: prices will range from $8,030 to $21,420, depending on the 3745 model to which it will be configured.

Relationship to Current Product Line
The IBM 3745 Communication Controller family now consists of seven models: 130, 150, 170, 210, 310, 410, and 610. The Models 130, 150, and 170 are for small- to medium-sized data centers, for specialized applications, or for remote network concentration. The Models 310 and 610 join the Models 210 and 410 as the medium to large environment controllers within the IBM 3745 Communication Controller family.

Market Position
The communications processor industry still exists, not as a shining star in the communications firmament, but as a reliable source of light. Major manufacturers of the communications processors, such as Amdahl, IBM, NCR, and Unisys, do not allow their products to become stagnant, but are continuously enhancing their products to meet today's needs.

IBM has fulfilled its promise about making announcements for the communications processor environment in 1991 by adding the two new 3745 models. The Ethernet LAN Adapter and the Timed IPL and Rename Load, however, will not be available until 1992. IBM also announced its intent to enhance the software on the 3745 to enable users to send Transmission Control Protocol/Internet Protocol (TCP/IP) data between users on geographically dispersed Ethernet networks, as well as between users and an IBM host computer running TCP/IP applications.

Description

The Model 310 operates with one central control unit (CCU), while the Model 610 operates with two independent CCUs. The CCU, driven by the Advanced Communications Function for Network Control Program (ACF/NCP) Version 5 in memory, controls all the attached lines, local area networks, and channel connections to hosts. The base IBM 3745 Models 310 and 610 can attach up to eight hosts (including IBM Enterprise System/9000, IBM Enterprise System/3090, IBM Enterprise System 4381, or IBM Enterprise System/9370), 128 lines, eight token-ring networks, 16 Ethernet networks, or various combinations of the aforementioned.

Components

The **Central Control Unit (CCU)** has its own storage (4 or 8 megabytes), runs its own ACF/NCP, and features three buses. The system performance improvement is mainly due to a reduced CCU base cycle and the use of a larger cache memory size.

The **Timed IPL** functions enable the controllers to automatically reload at a scheduled prescribed time under VTAM control commands. After the automatic reload, the network can be reactivated. This process is considerably faster than sequentially loading each controller. The systems management is enhanced by the IPL capabilities.

The **Rename Load Module** provides the capability for changing the name of the Communications Controller Load Module on the Maintenance Operating Subsystem (MOS) disk under VTAM control commands, saving the time required to download a new load module from the VTAM host through the IPL links.

The **Ethernet LAN Adapter (ELA)**, using Carrier Sense Multiple Access/Collision Detection (CSMA/CD), will attach 3745s to Ethernet Version 2 or IEEE 802.3 LANs. It will be attached to the DMA bus, improving data throughput, while reducing interference with CCU activity. When the Ethernet LAN Adapter becomes available, it can be installed in all seven models of the IBM 3745. The Ethernet LAN Adapter is not installable in 3746 expansion units. ■

IBM 3745 Communications Controller

Product Enhancement

Analysis

As part of its announcement blitz on September 5, 1990, IBM included enhancements to the 3745 controller.

Buffer Chaining Channel Adapter (BCCA)
This new feature for all 3745 channel-attached models offers users a 25 percent improvement in interactive processing and up to 100 percent improvement in batch processing. The performance improvements delivered by BCCA enable the 3745 to support a considerable improvement in data throughput, which translates into support for more stations and applications.

Support of NCP Load Modules
All 3745 modules can now support up to 6 megabytes of Network Control Program (NCP) Load Modules. These larger NCP load modules support the attachment of more stations per node, particularly in X.25 and LAN environments. The support of larger network configurations reduces the number of controllers required in a network, thereby simplifying network management and operations.

Memory Increase
Models 130, 150, and 170 support 8 megabytes of memory, which enables customers to use the larger NCP load modules and to run additional networking programs. The 3745 Model 150 can now support thirty-two 9600 bps lines, using the full scanner capacity.

ESCON Support
IBM offers integrated support for the new Enterprise Systems Connection Architecture (ESCON) I/O channel as part of the 3745 extensions. When users require ESCON I/O channel connectivity, they can use the IBM ESCON Converter Model 1 in conjunction with the 3745 parallel channel. ■

—By Barbara Callahan
Associate Editor

IBM 3745 Communication Controller

In this report:

Note: IBM has introduced an Ethernet LAN adapter for the 3745. A new version of ACF/NCP (Version 6) supports Ethernet LAN attachment and TCP/IP networking. Additional enhancements to ACF/NCP and the NetView Performance Monitor provide frame-relay network access and congestion control features for the 3745.

IBM's 3745 Communication Controller can function as a front end, a remote concentrator, or an intelligent switch in IBM SNA, token-ring LAN, Ethernet LAN, and TCP/IP networks. It supports anywhere from 32 to 896 communications lines.

Strengths

- The 3745 supports T1/E1 data rates for wide area networks and connections to the ES/9000 fiber optic I/O channel via the IBM ESCON converter.
- It provides connectivity to non-SNA environments such as X.25, frame-relay, and TCP/IP networks.
- Redundant components and support for backup data paths ensure network reliability. The user can install, replace, or move communications line interfaces while the 3745 is operating.
- Remote 3745 operations can be controlled from a central site.

Limitations

- Users are migrating away from hierarchical host-to-terminal processing, for which the communications processor was originally developed, in favor of LAN internetworking. For intelligent switching of LAN traffic, LAN routers are destined to play a stronger role than the communications processor.
- Redundant, independent central control units (CCUs) in Models 410 and 610 guard against a complete network crash in the event that one CCU fails. In a configuration in which both CCUs are fully configured and running simultaneously, however, the failure of one may result in poor performance.

Competition

NCR's Comten 5600 Series, the Amdahl 4745 Series, and the Unisys DCP Series.

Vendor

IBM
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Price

IBM 3745 prices range from $22,490 to $294,550. **GSA Schedule**: Yes.

—By Martin Dintzis
Assistant Editor/Analyst

Product Analysis

The IBM 3745 Communication Controller is available in seven models: 130, 150, 170, 210, 310, 410, and 610. It is used in SNA networks as a front end to an IBM host, a remote concentrator, or an intelligent switch. It supports data communications between directly attached or remote devices (other 3745s, IBM 3174 terminal controllers, token-ring LAN and Ethernet LAN workstations, and display terminals); between local/remote devices and one or more local/remote IBM 4300, 937X, 3033, 308X, 3090, or ES/9000 host processors; and between the host processors themselves.

Models 310 and 610 are the most recent additions to the IBM 3745 line. Models 130 and 150 are field upgradable to the Model 170. The Model 210 is field upgradable to Models 310, 410, or 610. The Model 310 and 410 are upgradable to the 610.

Target Applications

As a front end, the 3745 relieves the IBM host of the overhead incurred in message handling and network control. As a concentrator, the 3745 controls a community of terminals, terminal clusters, or distributed application processors, gathering, queuing, and multiplexing their transmissions onto one or more high-speed lines. When used for switching applications, it routes messages between LANs and among the network's various end points.

The IBM 3745 Communication Controller is not targeted toward a particular industry. It is used to integrate multiple IBM and non-IBM computing facilities into a single local area and/or wide area network.

Strengths

Although IBM originally developed the 3745 for SNA communications, the vendor has progressively added connectivity options allowing integration of both SNA and non-SNA environments. The 3745 now provides access to frame-relay transport facilities and Ethernet LANs, as well as X.25 packet switched, token-ring LAN, and TCP/IP networks.

With a single high-speed line to a public frame-relay network, users can access multiple remote 3745s. Reducing the number of lines will cut communications costs for IBM customers.

The 3745 supports T1/E1 data rates for wide area networks as well as ESCON (fiber optic) connections to an IBM ES/9000 host. The vendor has also announced future support for DS3 and Switched Multi-megabit Digital Service (SMDS) interfaces.

Redundant components and transmission lines with automatic switchover ensure reliable network operation. Hot Pluggability Line Interface Couplers (LICs) allow the user to install, replace, or move communications line interfaces while the 3745 is operational.

Multiple 3745s can be configured, monitored, and controlled from a central NetView console or from an IBM support center.

Limitations

As a front end to a host, the 3745 will continue to occupy an important place in IBM's networking strategy. As an intelligent switch, however, the 3745 must compete with a newer breed of devices: multiprotocol LAN routers. Users are migrating away from the hierarchical host-to-terminal type of processing, for which the communications processor was originally developed, in favor of peer-to-peer communications between intelligent LAN workstations. Multiprotocol routers can provide higher throughput, greater efficiency, and more flexibility than the communications processor—for a lower price. Aware of the changing needs of LAN users, IBM has recently introduced its 6611 LAN Router.

Questions arise about the efficiency of the dual central control unit (CCU) implementation supported by Models 410 and 610. If both CCUs are fully configured and running simultaneously, and one suddenly goes down, the remaining CCU may not have the capacity to handle all the applications of the downed CCU.

Competitive Analysis

The 3745 is one of IBM's chief solutions for integrating multiple SNA and non-SNA computing environments over local area and wide area networks. IBM continues to enhance the product line with host, LAN, and WAN connectivity options. Realizing, however, that its venerable communications processor cannot provide all of the features LAN users are looking for, the vendor has begun to offer intelligent switching capabilities through its new 6611 LAN router.

Overview

3745 Model	Design	Date Announced	Date Released	Base Price ($)
130	Floorstanding	May 1989	May 1989	22,490
150	Floorstanding	May 1989	May 1989	33,160
170	Floorstanding	May 1989	May 1989	28,110
210	Floorstanding	March 1988	March 1988	147,550
310	Floorstanding	July 1991	October 1991	189,550
410	Floorstanding	March 1988	September 1988	221,950
610	Floorstanding	July 1991	October 1991	294,550

Decision Points

Models	Requirements	Comments
3745 Processor Family	High Throughput	Supports T1/E1 speeds for wide area networks; accommodates 10M bps Ethernet LANs and 16M bps token-ring LANs; provides ESCON (fiber optic) connections to IBM ES/9000 hosts.
	Multivendor Networking Capability	Although the 3745 is designed primarily for IBM SNA/SDLC and 3270 BSC environments, it provides connectivity to non-SNA environments such as token-ring and Ethernet LANs, X.25 and TCP/IP networks, and frame-relay WANs.
	Reliability	Models 410 and 610 support dual, independent CPUs. Backup data paths provide access to redundant network lines and processor nodes.
	Upgradability	A modular architecture makes system expansion and performance upgrades straightforward.

Vendor Analysis

Marketing Strategy

IBM is the leading vendor in the communications processor market. All major competitors, including NCR, Amdahl, and Unisys, offer compatibility with IBM's Systems Network Architecture (SNA) and the 3745. To remain competitive with the multivendor networking capabilities in the communications processors of its competitors, IBM continues to add connectivity options to the 3745. The three most recent enhancements—Ethernet LAN, TCP/IP, and frame-relay networking support—represent IBM's increasing commitment to providing solutions for linking multiple, incompatible computing environments. IBM has also pledged future support for DS3 and Switched Multimegabit Digital Service (SMDS) on the 3745.

The 3745 Communication Controllers replaced the 3725 product line. The 3745 offers capabilities not previously featured on the 3725: support for T1 and other high-speed digital network facilities, "hot pluggable" line interface couplers, dual central control units (CCUs), and increased storage facilities.

Target Markets

A general-purpose product supporting communications between an SNA environment and one or more SNA or non-SNA facilities, the 3745 is used by private and public corporations, financial institutions, governmental bodies, and universities around the world.

Market Position

Communications processors do not generate bold headlines but still find their niche in the industry. The technology is mature, but the strong competition among IBM, NCR, Amdahl, and Unisys is evident. NCR is second to IBM in the sale of communications processors. Amdahl and Unisys follow in that order.

Major Competitors

NCR Comten's 5600 communications processor line includes five models: 5630, 5645-B, 5655-B, 5665-B, and 5675-B. The Comten 5675-B, the largest unit, supports up to 1,024 low- or medium-speed lines, 24 T1/E1 links, 16 IBM hosts, sixty-four 16M bps token-ring LAN connections, and 48 Ethernet LAN connections. The Comten 5600 processors can run TCP/IP software for internetworking, and they can be managed by NetView or Systems Center's Net/Master. NCR has announced future support for both frame-relay and SMDS transmission services.

The Comten 5600 processor line is just one component of NCR's *Open Networking Environment (ONE)* strategy. ONE includes a suite of open networking hardware and software products based on TCP/IP, OSI, and SNA.

Amdahl's 4745 Communications Processor Models 110 and 210 run IBM software without any modification. Designed as an alternative to the IBM 3745-210, the 4745-210 supports up to eight IBM hosts, 256 communications lines, and eight 4M bps token-ring LANs. The 4745 supports IBM ESCON connections, and by the end of this year, will also support 16M bps token-ring LANs.

Amdahl, unlike NCR, offers an IBM plug-compatible product, one that preserves the user's software investment. Although the 4745 does not offer the capacity and processing power of the larger IBM 3475 models, it is very competitive in price/performance, reliability, and ease of use.

Unisys markets the Distributed Communications Processor (DCP) Series, which includes six models: DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55. They range in size from the entry-level DCP/5, supporting up to 11 communications lines, to the top-of-the-line DCP/55, supporting over 1,500 communications lines.

DCPs are designed for users of Unisys 1100/2200 Series mainframes who also need access to some combination of IBM SNA, OSI, TCP/IP, Ethernet LAN, and X.25 environments. The most recent enhancement to the product line, IBM PU 2.1 node emulation, enables DCPs to route messages to and from other PU 2.1 devices, such as IBM FEPs, without IBM host assistance.

Interoperability Matrix

Products	3745 Processor
Product Classification	Proprietary network router/gateway device
Relationship With Higher-Level Elements	
Position in Network Architecture	Appears to the IBM host as an SNA physical unit (PU) Type 4 device
Host Software Required:	
Operating Systems	MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP
Access Methods	VTAM, BTAM, BTAM-ES, or RTAM
Communications Processor Software Load	From the host, the processor's diskette, the processor's hard disk, or a remote IBM support center
Host Access	Direct connection via a System/370 block/byte multiplexer channel or fiber optic channel, remote access via a dial-up or leased line, or indirect host access via a token-ring or Ethernet LAN
Network Management Support	Relies upon IBM NetView; also supports remote diagnostics from an IBM support center.
Relationship With Peer-Level Elements	
Compatible Communications Processors	Plug compatible with the Amdahl 4745 communications processor; also compatible with NCR's Comten 5600 processor line
Transport Architectures Supported	Async, frame relay, IBM SNA/SDLC, IBM 3270 BSC, TCP/IP, and X.25
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to T1/E1 facilities via a V.35 interface
Packet Switched Network Support	Supports access to an X.25 packet switched network using an X.21 or X.21bis interface
LAN Attachment Support	Supports both Ethernet and token-ring LAN connections concurrently

Sales and Distribution Strategy

The 3745 Communication Controller is sold worldwide through IBM's direct sales force.

Support

In 1991 IBM transformed its Systems Services Div. (SSD) into a wholly owned subsidiary called Integrated Systems Solutions Corp. (ISSC), addressing its customers' growing demand for outsourcing in systems operations, business applications, and data services. IBM offers a variety of support and services.

Policies and Programs

Warranty

IBM offers a one-year warranty with IBM On-Site Repair (IOR).

Support Services

Hardware Support

IBM provides two kinds of hardware support: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services covers maintenance and repair coordination of non-IBM equipment.

IBM Maintenance Services

Under Maintenance Services, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

- National geographic coverage
- Twenty-four hour access to IBM parts inventory
- A Customer Engineer (CE) assigned to each account
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance
- An online service database
- Engineering changes management

Network Custom Services

IBM's network services are available for data, voice, and T1 networks with customized support options to suit a variety of needs. Network services include network evaluation, design, implementation, management, and operations.

Service Hours

The IBM Service can be obtained 24 hours per day, 7 days per week by calling (800) IBM-SERV (800/426-7378).

Competitors' Programs

Support offered by NCR, Amdahl, and Unisys is closely patterned after IBM support services. No vendor seeking to compete in the market for SNA-compatible networking products could succeed otherwise. Support includes installation, round-the-clock maintenance and hot line support, remote diagnostics, education, and other services.

Specifications

Enhancements

Date	Enhancement
June 1992	IBM released the NetView Performance Monitor (NPM) Version 1 Release 5.1, which extends NPM performance support to collecting data about the 3745's frame-relay (DTE) interface (see the September 1992 enhancement to ACF/NCP).
September 1992	IBM began shipping the 3745 Ethernet Local Area Network (LAN) Adapter, which supports Internet protocol (IP) traffic routing on an existing SNA network.
September 1992	IBM released *Advanced Communications Function/Network Cotnrol Program (ACF/NCP) Version 6,* which supports the Ethernet LAN Adapter and uses the Internet Protocol. Additionally, ACF/NCP Version 6 allows the 3745 to access a frame-relay network as a DTE. The software monitors network congestion and provides alerts to NetView.
September 1992	IBM released *X.25 Network Control Program Packet Switching Interface (NPSI) Version 3 Release 5.* With support for the *High Performance Transmission Subsystem (HPTSS),* the new software supports data rates up to 2.048M bps. It enhances throughput further by blocking multiple X.25 packets into single SNA Path Information Units (PIUs) and reducing the number of preestablished LU-to-LU sessions required. The new software release is also compatible with ACF/NCP Version 6 enhancements.
Fourth-Quarter 1992 or First-Quarter 1993	IBM plans to introduce support for Advanced Peer-to-Peer Networking on the 3745. This feature will enable multiple 3745s to communicate as peers, dynamically routing network traffic between each other.

Features/Functions

Models	130	150	170	210
Hardware Features				
Max. No. of Central Control Units (CCUs)	1	1	1	1
Internal Memory Capacity (bytes)	8M	8M	8M	8M
Hard Drive Capacity (bytes)	67M	67M	67M	67M
Transmission Features				
Max. No. of Low-Speed Lines *(1)*	Does not apply; this model is designed for high-speed (local or remote) host links and LAN gateways.	32	112	896
Max. No. of T1/E1 Links	4	2	4	16
Max. No. of Host Channels	4	Does not apply; this model is designed for remote host links and LAN gateways.	4	16
Max. No. of Token-Ring LAN Connections	4	2	2	8
Max. No. of Ethernet LAN Connections	4	2	4	16
Physical Interfaces Supported	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)

Features/Functions (Continued)

Models	130	150	170	210
Software Features				
Multivendor Networking Capability	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs
Frame-Relay Networking	Can be configured as a DTE for communications with a frame-relay transport service	Can be configured as a DTE for communications with a frame-relay transport service	Can be configured as a DTE for communications with a frame-relay transport service	Can be configured as a DTE for communications with a frame-relay transport service
X.25 Packet Switching	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Models	310	410	610
Hardware Features			
Max. No. of Central Control Units (CCUs)	1	2	2
Internal Memory Capacity (bytes)	8M	16M	16M
Hard Drive Capacity (bytes)	67M	67M	67M
Transmission Features			
Max. No. of Low-Speed Lines *(1)*	896	896	896
Max. No. of T1/E1 Links	16	16	16
Max. No. of Host Channels	16	16	16
Max. No. of Token-Ring LAN Connections	8	8	8
Max. No. of Ethernet LAN Connections	16	16	16
Physical Interfaces Supported	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)	V.24, V.25, V.35, X.21, X.21bis, ESCON (fiber optic)
Software Features			
Multivendor Networking Capability	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs	Supports both SNA and TCP/IP communications over a single wide area network; provides gateways to both Ethernet and token-ring LANs
Frame-Relay Networking	Can be configured as a DTE for communications with a frame-relay transport service	Can be configured as a DTE for communications with a frame-relay transport service	Can be configured as a DTE for communications with a frame-relay transport service
X.25 Packet Switching	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.	Users can connect the 3745 to a wide area network supporting the X.25 transmission protocol.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Network Management Functions

Fault and Problem Management

Through an operator console, the user can access the *Maintenance and Operator Subsystem (MOSS)* of the 3745, which provides host-independent management capabilities. Functions supported include dump operations, online event recording, error notification, problem determination, and failure isolation through line and/or CCU switchover. An optional *Remote Support Facility (RSF)* enables a remote IBM support center to diagnose problems. IBM NetView permits the user to examine information related to the SNA network and to access problem determination information generated at network nodes.

Network Management Functions (Continued)

Configuration Management	The *Maintenance and Operator Subsystem (MOSS)* provides controller initialization, program loading, line configuration and operating mode management, and access to hard disk functions. The user can also reconfigure the 3745 through NetView.
Performance and Accounting Management	NetView allows the user to control, record, and automate various operator tasks. The facility can also be used as an operator's interface to VTAM in a data communications network. The *NetView Performance Monitor (NPM)* provides performance management and problem determination. It measures line capacity and response time, generates reports, and provides accounting data.
Security Management	NetView supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF). RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Configuration

Components

Product	Description
Hardware:	
Central Control Unit (CCU)	The heart of the 3745, the CCU executes the machine instruction set, controls I/O functions, controls data communications to terminals, manages main memory, and sends error and status information to the Maintenance and Operator Subsystem (MOSS). One or two CCUs can be installed, depending on the model.
Maintenance and Operator Subsystem (MOSS)	A microprocessor-based subsystem, MOSS communicates with the CCUs and controls the switching of the channel and line adapters from one CCU to the other. It also supports host-independent configuration and management functions such as program loading and initialization, event recording, error notification, and problem determination. MOSS supports links to an IBM remote support facility.
Main Storage	Provides from 4M to 8M bytes of RAM per CCU.
Channel Adapter (CA)	Provides logical and physical interface between the 3745 and an IBM 4341, 4361, 4381, 937X, 3090, or ES/9000 processor; attaches to a byte multiplexer, block multiplexer, or selector channel.
Buffer Chaining Channel Adapter (BCCA)	Provides the same capabilities as a regular channel adapter, but uses a buffer chaining process.
ESCON Converter Model 1	Attaches existing parallel channel devices, including the IBM 3745, to IBM's ESCON fiber optic channels. The ESCON Converter Model 1 supports data rates up to 4.5M bps at extended distances.
Ethernet LAN Adapter	Provides two connections to 10M bps Ethernet Version 2 or IEEE 802.3 local area networks.
Token-Ring Adapter (TRA)	Provides two attachment ports to 4M or 16M bps IBM Token-Ring Networks using standard protocols.
Low-Speed Scanner (LSS)	A microprocessor-based device providing data link control for a set of telecommunications lines operating at speeds up to 256K bps.
High-Speed Scanner (HSS)	Provides scanner functions for attachment of a V.35, X.21, or X.21bis data link operating at speeds up to 2.048M bps.
Line Interface Coupler (LIC)	There are several types of LICs: Types 1, 3, 4A, 4B, 5, and 6. Types 1 through 4 provide internal clocking. Type 1 supports four 19.2K bps async, SDLC, or BSC lines. Type 3 supports one 256K bps SDLC or BSC line. Type 4A supports up to four 9.6K bps SDLC lines. Type 4B provides one variable speed (9.6K to 256K bps) SDLC line. Type 5 combines the functions of a line interface coupler and two 14.4K bps synchronous modems for multipoint configurations. Type 6 has a built-in 56K bps CSU/DSU.
Line Interface Coupler (LIC) Base	The LIC Base provides an enclosure housing up to eight LICs.
Two Processor Switch (TPS)	Provides a second channel interface to attach a Channel Adapter or a Buffer Chaining Adapter to a Multiprocessor System, or to two channels of the same or different processors.
3746 Expansion Unit	The 3746 supplies the 3745 Communication Controller with additional channel adapters, low-speed scanners, and line interface couplers.
Software:	
Advanced Communications Function for the Network Control Program (ACF/NCP)	Residing in the 3745, ACF/NCP provides physical network management and supports IBM Systems Network Architecture requirements. ACF/NCP Version 6 supports the newer Ethernet LAN, TCP/IP, and frame-relay networking features.
Emulation Program (EP)/Partitioned Emulation Programming (PEP) Extension	EP allows the 3745 to emulate an IBM 270X communications controller to support non-SNA DTEs. PEP Extension enables both ACF/NCP and EP to coexist on the same 3745 processor.
X.25 NCP Packet Switching Interface (NPSI)	Provides a link to an X.25 packet switched network.

Sample Configuration

Model	Description
170	One CCU with 8M bytes of memory and a power supply; dual host channel connections; one token-ring LAN connection; two active and two backup T1 transmission lines; twenty-four 9600 bps async lines, twelve 19.2K bps sync lines, and two 256K bps lines; and a remote connection to an IBM NetView management console.

Physical Environment

Models	130, 150, 170	210, 310 410, 610
Physical Specifications (H x W x D, in.)	39.5 x 29.5 x 25.5	70.0 x 47.5 x 29.5
Electrical Requirements	Single-phase AC, 200-240 V; 50/60 Hz	Three-phase AC, 208-240 V phase to phase; 50/60 Hz
Environmental Specifications	60°F to 100°F; 8 to 80% humidity	60°F to 100°F; 8 to 80% humidity

Pricing

		Purchase Price ($)	Monthly Rental ($)
Equipment Prices			
3745 Communication Controller			
Model 130	One CCU	22,490	2,245
Model 150	One CCU	33,160	3,310
Model 170	One CCU	28,110	2,805
Model 210	One CCU	147,550	14,740
Model 310	One CCU	189,550	18,960
Model 410	Two independent CCUs	221,950	22,190
Model 610	Two independent CCUs	294,550	29,460
Features			
1561	Channel Adapter for Models 210, 310, 410, and 610	11,800	1,180
1562	Channel Adapter with two processor switches	16,520	1,645
1563	Channel Adapter for Models 130, 150, and 170	7,305	729
1571	Buffer Chaining Channel Adapter (BCCA)	14,930	1,495
9034	ESCON Converter Model 1	9,410-28,510	196-594
4720	Low-Speed Scanner	16,520	1,645
4740	High-Speed Scanner	25,960	2,590
4770	Token-Ring Adapter Type 2	21,420	2,140
4900/4901	Line Interface Coupler (LIC) Unit	11,210	1,115
4902	LIC Base Type 1	4,715	471
4903	LIC Base Type 2	3,370	337
4911	LIC Type 1	3,065	305
4931	LIC Type 3	3,065	305
4941	LIC Type 4A	3,065	305
4942	LIC Type 4B	3,065	305
7865	LIC Type 5	5,280	527
7825	LIC Type 6	3,480	347
7100	Base Memory (4M bytes RAM)	11,800	1,180
7101	Memory Expansion to 8M bytes RAM	11,800	1,180
8320	Two Processor Switch	4,715	471
3746 Expansion Unit			
A11	Expansion Unit	21,070	2,105

		Purchase Price ($)	Monthly Rental ($)
Software Prices			
5688-231	ACF/NCP Version 6	9,410-28,510	196-594
5688-738	ACF/NCP Version 5	8,660-25,990	178-540
5688-035	X.25 NPSI Version 3 Release 5	2,690-14,430	89-4,525

■

IBM 3745 Communication Controller

In this report:

Note: Since our last report, IBM has added two models to the 3745 product line: the 310 and the 610. IBM also announced an Ethernet LAN Adapter card (available 1992). Prices for all 3745 models and options have also increased.

IBM's Communication Controllers are intelligent and multifunction systems that serve as network nodes. All 3745 models operate under the control of the Advanced Communications Function for Network Control Program (ACF/NCP) Version 5. The 3745s consists of three main components: the Control Subsystem, the Communication Subsystem, and the Maintenance and Operator Subsystem (MOSS).

Strengths

- Remote 3745 operations can be controlled from a central site.
- Hot Pluggability Line Interface Couplers (LICs) allow the user to install, replace, or move communications line interfaces while the 3745 is operational.
- Each 3745 component includes a dedicated power supply.

Limitations

- The processor memory is needed to handle machine functions, further reducing the amount of memory available for T1 lines.

Competition

NCR 5600 Series, Amdahl 4745 Series, Unisys DCP Series.

Vendor

IBM Corp.
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Price

IBM 3745 prices range from $21,420 to $294,550.

GSA Schedule

Yes.

—By Barbara Rinehart
Associate Editor/Analyst

Product Analysis

This report focuses on the IBM 3745 Communication Controller, Models 130, 150, 170, 210, 310, 410, and 610. The 3745 supports data communications between terminal devices directly linked, linked by modem, or attached to an IBM Token-Ring Network; between terminal devices and one or more directly connected or remotely connected 4300, 937X, 3033, 308X, or 3090 host processors; or between host processors. Models 310 and 610 are recent additions to the IBM 3745 line. Models 130 and 150 are field upgradable to the Model 170. The Model 210 is field upgradable to Models 310, 410, or 610. The Model 310 and 410 are upgradable to the 610.

Target Applications

The IBM 3745 Communication Controllers are not targeted toward a particular industry. Target applications for Models 130, 150, and 170 are geared toward companies with one main host on-site, possibly two. Models 210, 310, 410, and 610 are geared toward the larger organizations.

Strengths

IBM 3745 Communication Controllers can be configured with one or two central control units (CCUs), depending on the model. Each of these CCUs operates independently, running separate and distinct copies of the Network Control Program (NCP).

A user-provided control terminal, attached to each 3745 via a modem and a switched communications line, can act as a remote operator console, managing a single 3745 or multiple 3745s.

The "hot pluggability" of the line interface couples (LICs) improves operation by allowing users to reconfigure the 3745 while it is running. New LICs can be installed, existing LICs can be reconfigured, and failing LICs can be replaced without disturbing the traffic on the other interfaces. Modification to the LIC configuration can take place as long there is no need for a prerequisite feature installation.

IBM has incorporated dedicated power supplies into each component of the 3745. A problem in any of the following devices will impact only its functionality: CCU, LIC unit, Channel Adapter with Two-Processor Switch (CATPS), Maintenance and Operator Subsystem (MOSS), and every pair of adapters.

The number of lines supported by the 3745 can be up to four times that of its predecessor, the 3725. Also, performance improvements of Models 310 and 610 over Models 210 and 410 can be attributed to a reduced CCU base cycle and the use of a larger cache memory size.

Models 210, 310, 410, and 610 can operate in four different modes: single mode, twin-standby mode, twin-backup mode, and twin-dual mode. The twin-dual mode allows the two CCUs to run independently as two separate subareas, each one

Overview

Models	130	150	170
Product History			
Date Announced	May 1989	May 1989	May 1989
Date Installed	May 1989	May 1989	May 1989
Marketing Status	Current	Current	Current

Models	210	310	410	610
Product History				
Date Announced	March 1988	July 1991	March 1988	July 1991
Date Installed	March 1988	October 1991	September 1988	October 1991
Marketing Status	Current	Current	Current	Current

Decision Points

Model	Requirements	Comments
IBM 3745 Family		
	Direct attachment to host	Yes
	Operates at T1 speed	Operates up to T1 requirements (1.544M bps.)
	Provides sufficient number of host attachments to FEP	Supports up to 16 host attachments
	Allows multiprotocol connectivity to SNA	Several licensed programs and networking hardware are available to allow non-SNA traffic to travel over existing SNA backbone.

with its own active NCP. This mode applies only to the 410 and 610.

The Timed IPL and Rename Load Module is planned for March 1992 and will enable the 3745 to automatically reload at a scheduled time without operator action and provide the capability for changing the external name of the NCP Load Module on the 3745 disk.

The IBM 3745 also supports connectivity to the ESCON I/O channel via the IBM 9034 ESCON converter.

Limitations

Questions arise about the efficiency of the dual backup method. If both CCUs are fully configured and running simultaneously, and one suddenly goes down, the remaining CCU does not have the capacity to handle all the applications of the downed CCU.

Vendor Analysis

The 3745 communications Controllers replaced the 3725 product line. The 3745 offers capabilities not previously featured on the 3725: support for T1 and other high-speed digital network facilities, "hot pluggable" line interface couplers, dual central control units (CCUs), and increased storage facilities.

In January 1988, IBM introduced the 3745 Communication Controller Models 210 and 410. Models 130, 150, and 160 were introduced in May 1989, at the International Communications Associations' Conference and Exposition in Dallas. In April 1991, IBM announced the 310 and 610.

Market Position

Communications controllers do not generate bold headlines but still find their niche in the industry.

Competitive Analysis

Variables	IBM	Amdahl	NCR	Unisys
Max. Number of Produt Line Models	7	2	5	8
Ability to Support Token-Ring/Ethernet	Yes/No	Yes/No	Yes/Yes	No/Yes
Max. Transmission Speed	T1	T1	T1	T1
Max. Hosts Attachable to FEP	16	8	16	56
Price Range ($) (approx.)	21.4K to 294.5K	1.6K to 132K	Not Available	18.8K to 396K

Standards Compliance

Product Classification	Communications Processors
Position in Architecture Hierarchy	Offers access to Transport and Network Architecture (SNA).
OSI Layers and Protocols Supported	Supports up to Layer 5 Session
Interface/Protocols	BSC, SDLC
Transport Interfaces	EIA 232D/CCITT V.24, EIA RS-366/CCITT V.25, CCITT X.21bis, CCITT V.35, CCITT V.21, CCITT X.21/X.24,V.25bis
Management Capability	IBM NetView, IBM Communication Network Management (CNM)

The technology is mature, but the strong competition among IBM, NCR, Amdahl, and Unisys is evident. According to the North American Telecommunications Association (NATA), the front-end processor market has had a compound annual revenue growth rate of 5.1% from 1984 to 1989. A projected compound annual revenue growth rate of 5% is expected for the period from 1990 to 1995.

Sales and Distribution Strategy

Currently the 3745 Communication Controllers, are sold through IBM's direct sales force.

Support

In May 1991, IBM transformed its Systems Services Division (SSD) into a wholly owned subsidiary called Integrated Systems Solutions Corp. (ISSC), addressing its customers' growing demand for out-sourcing in systems operations, business applications, and data services. IBM offers a variety of support and services.

Policies and Programs

Warranty Period

IBM offers a one-year warranty service. The warranty service is for IBM On-Site Repair (IOR).

Support Services

Hardware Support

IBM provides two kinds of hardware support: IBM Maintenance Services covers IBM equipment only; IBM Multiple Vendor Services covers maintenance and repair coordination of non-IBM equipment.

IBM Maintenance Services

Under Maintenance Services, IBM assumes service management responsibility for all IBM equipment. This includes the following services:

- Coverage hours: 24 hours per day, 7 days per week.
- Geographic coverage: national.
- Parts availability: 24-hour access to IBM parts inventory.
- Customer Engineer (CE): assigned to each account.
- Computer-assisted dispatch with multiple dispatch centers and direct digital radio links to CEs.
- Customer assistance groups (CAGs) to provide telephone support for immediate assistance.
- An online service database.
- Engineering changes management.

Network Custom Services

IBM's network services are available for data, voice, and T1 networks with customized support options to suit a variety of needs. Network services include network evaluation, design, implementation, management, and operations.

Service Hours

The IBM Warranty Service, Maintenance Service, or Hourly Service can be obtained by calling 1-800-IBM-SERV (1-800-426-7378). IBM Hourly Service is available at the applicable rate and terms, including an element exchange price if applicable.

Specifications

Enhancements

- 6/18/91 Launched enhancement to NetView and stated that it will support Frame Relay.
- 6/18/91 Introduced Models 310 and 610
- 6/18/91 Announced the X.25 SNA Interconnection (XI) Version 2 Release 3.
- 6/18/91 Announced Ethernet LAN Adapter, available third-quarter 1992.
- 6/18/91 Announced Timed IPL and Rename Load Module, available March 27, 1992.
- 3/7/91 Plans to enhance the IBM 3745 with DS-3, FDDI, and ESCON networking support.

Features/Functions

Hardware Features

Models	130	150	170
Processor Type	Proprietary	Proprietary	Proprietary
Main Memory Storage Capacity (MB)	8	8	8
Hard Disk Capacity (Mbytes) (formatted)	67	67	67
Technology Used in the CCU	TCM	TCM	TCM
Operator Console Required	Yes	Yes	Yes

Models	210	310	410	610
Processor Type	Proprietary	Proprietary	Proprietary	Proprietary
Main Memory Storage Capacity(MB)	8	8	16	16
Hard Disk Capacity (Mbytes) (formatted)	67	67	67	67
Technology Used in the CCU	TCM	ATX-1 bipolar	TCM	ATX-1 bipolar
Operator Console Required	Yes	Yes	Yes	Yes

Hardware Features

Subsystem	Description
Control Subsystem	Consists of the central control units and the channel adapters, two bus groups, bus switch, power supply per CCU, two types of channel attachment.
Communication Subsystem	Provides three types of attachment to the telecommunications network: Line Interface Couplers (LICs), High-Speed Scanners (HSSs), and Token-Ring Adapters (TRAs).
Maintenance and Operator Subsystem (MOSS)	Is functionally separate from the CCU and contains its own power supply. It operates the hard disk drive, the diskette drive, and the control panel of the 3745. It offers system procedures for notification of failures and provides the operator with tools for problem determination.

Software Features

Subsystem	Description
ACF/NCP Version 5	The IBM 3745 operates under the control of the Advanced Communications Function for Network Control Program (ACF/NCP) Version 5. ACP/NCP resides in the 3745 and provides physical management of the network. Three versions of the ACF/NCP are available.
X.25 NCP Packet Switching Interface (NPSI) Licensed Program	Users can attach the 3745 to data transmission networks supporting X.25 interfaces.
Emulation Program (EP)/Partitioned Emulation Program (PEP)	EP allows the 3745 to emulate the 270X communications controller. ACF/NCP and EP can be resident concurrently using the PEP extension, allowing the 3745 to appear to the host as a 270X or itself depending on the function required.

Transmission Features

Models	130	150	170
Maximum Number of T1 Lines Attached	4	2	4
Maximum Number of T1 Lines Concurrently Active	2	1	2
Maximum Input Rate	1.544M bps, CEPT	1.544M bps, CEPT	1.544M bps, CEPT
Maximum Number of Half-Duplex Lines	Not applicable	32	112

Models	210	310	410	610
Maximum Number of T1 lines Attached	16	16	16	16
Maximum Number of T1 lines Concurrently Active	8	8	8	8
Maximum Input Rate	1.544M bps, CEPT	1.544M bps, CEPT	1.544M bps, CEPT	1.5444M bps
Maximum Number of Half-Duplex Lines	896	896	896	896

Communications Features

Models	130	150	170
Number of Line Interface Couplers	6	6	6
Internal Clocking a Standard Feature	Not Available	Yes	Yes
Availability of Low Speed Scanners	Not Available	Not Available	Yes
Availability of High-Speed Scanner	Yes	Yes	Yes
Type of LAN Attachment	Token-Ring	Token-Ring	Token-Ring
Maximum number of Token-Rings Attached	4	2	2
Maximum number of Channel Adapters	4	0	4

Models	210	310	410	610
Number of Types of Line Interface Couplers (LIC)	6	6	6	6
Internal Clocking a Standard Feature	Yes	Yes	Yes	Yes
Availability of Low Speed Scanners	Yes	Yes	Yes	Yes
Availability of High-Speed Scanners	Yes	Yes	Yes	Yes
Type of LAN Attachment	Token-Ring	Token-Ring	Token-Ring	Token-Ring
Maximum number of Token-Rings Attached	8	8	8	8
Maximum number of Channel Adapters	16	16	16	16

Options

Option	Description
Channel Adapters (CA)	Provides logical and physical interface between the 3745 and an IBM 4341, 4361, 4381, 937X, 3090, or ES/9000 processor; attaches to byte multiplexer, block multiplexer, or selector channel.
Buffer Chaining Channel Adapter (BCCA)	Provides same capabilities as regular channel adapters except operates with buffer chaining process.
Low-Speed Scanner (LSS)	A microprocessor-based device that controls the data and performs the data link control of a set of telecommunications lines operating at speeds up to 256K bps.
High-Speed Scanner (HSS)	Provides scanner functions for attachment of a V.35 or X.21 SDLC nonswitched data link operating at speeds up to 1.544M bps.
Token-Ring Adapters (TRA)	A microprocessor-based device that provides two attachment ports to the 4M bps or 16M bps IBM Token-Ring Network using standard protocols.
Line Interface Couplers (LIC) Base	The LIC Base provides an enclosure housing up to eight LICs.
Line Interface Couplers (LIC) Unit	Provides an enclosure with 16 slots to plug up to 16 LICs.
Line Interface Couplers (LIC)	There are two categories of LICs on the 3745. One category supports data circuit-terminating equipment, modems, and digital service units, external to the communication controllers. The other provides support to data circuit-terminating equipment integrated within the communications controller.
Storage Increment	Provides main storage increments of 4MB per CCU allowing up to 8MB of memory per CCU.
Two Processor Switch (TPS)	Provides a second channel interface to attach a Channel Adapter or a Buffer Chaining Adapter to a Multiprocessor System or to two channels of the same or different processors.
3746 Expansion Unit	The 3746 supplies the 3745 Communication Controller with additional channel adapters, low-speed scanners, and line interface couplers. Machine type 3746 designates expansion frames and has five models.

Compatibility

Support	Description
Modems Supported	3834; 3864 Model 2; 3865 Models 1, 2; 3868 Models 3, 4; 3872; 5811 Model 20; 5812 Model 10; 5865 Models 2, 3; 5868 Model 52; 5866 Models 2, 3; 5868 Model 62; 5842; 5853; 7861, and 7868. Supports other modems with an interface compatible with the 3745 LICs.
DSU/CSUs Supported	5822 Model 10 and 5821 Model 10.
Communication Facilities Supported	Operates over common carrier-provided or equivalent customer-owned communications facilities.
Non-IBM Data Circuit-Terminating Equipment (DCE)	Non-IBM DCEs complying with EIA, RS-232C, CCITT Recommendation V.24, V.28, and ISO Standard 2110, or CCITT Recommendation V.35 and ISO Standard 2593 may be attached under the provisions of the IBM Multiple Supplier Systems Policy.

Configuration

Model	Configuration
Basic 3745	Provides a minimum configuration comprising 4MB storage per CCU, two low-speed scanners, one LIC unit type 1, and eight LICs.
IBM 3745-130	Supports two T1 lines, four host channel links, and four 4M bps or 16M bps Token-Ring Interfaces.
IBM 3745-150	Supports 16 ports at data rates up to 256K bps, two 4M bps or 16M bps IBM Token-Ring interfaces, and one T1 line.
IBM 3745-170	Supports 112 communications lines, two Token-Ring Networks at 4 or 16M bps, two high-speed lines (T1), and four LIC Bases.
IBM 3745-210/310	Consists of a single CCU with its power supply, 4M bytes of main storage with direct memory access, 16K bytes of cache storage, two bus groups and a bus switch, two low-speed scanners, eight LICs, one LIC unit type 1, and the MOSS.
IBM 3745-410/610	Includes the same elements as Models 210 and 310, but also houses a second CCU and 4M bytes of main storage, with one optional storage increment of 4M bytes, direct memory access (DMA), cache storage, power supply, and MOSS.

Network Management

Model	Description
NetView	The 3745 supports IBM's Communication Network Management (CNM) by sending information about errors to the NetView program in a host processor, which displays the alerts on the network control terminal. NetView provides alert support for the IBM Token-Ring Network. If NetView is not installed, IBM recommends the installation of a 3745 console near the VTAM console to assist users in determining and resolving problems.

Operating Requirements

Machine Requirements

Components	Description
Local Console	Requires an operator console such as IBM 3151, 3161, 3163, 3727; PS/2 Model 50, 60, 70, or 80, or an equivalent terminal.
IBM 5869 Portable Keypad Display (PAD)	Required for initial parameter setting and maintenance operations of the integrated modems and DSU/CSU-LDM of the IBM 3745 Model 150 and 170.
Remote Support Facility (RSF)	The RSF port operation in BSC protocol at a speed of 2400 bps on an analog telephone line.
Network Communication Terminal Equipment (NCTE)	NCTE, such as AVANTI ONC-10 or equivalent, must be provided by the user and is required for attachment to the fractional T1 service.

Programming Requirements

Program	Description
Advanced Communications Function for Network Control Program (ACF/NCP)	Supports the various 3745 functions and features. One of the following releases of ACF/NCP Version 5 licensed programs is required: ACF/NCP V5R2.1, ACF/NCP V5R3, ACF/NCP V5R3.1, ACF/NCP V5R4

Physical Environment

Models	210/310/410/610
Physical Specifications (H × W × D; weight)	70.0 × 47.5 × 29.5 (in.); 1,500 (lb.)
Electrical Requirements	AC 3-phase, 208-240 volts phase to phase; 50/60 HZ
Environmental Specifications	16 to 38C (60 to 100F); 8 to 80% humidity

Physical Specifications

Models	130/150/170
Physical Specifications (H × W × D; weight)	39.5 × 29.5 × 25.5 (in.); 507 (lb.)
Electrical Requirements	AC 1-phase, 200-240 volts; 50/60 Hz
Environmental Specifications	16 to 38 °C (60 to 100 °F); 8 to 80% humidity

Equipment Prices

		Purchase Price ($)	Monthly Rental ($)
3745 Communication Controller			
Model 130	One CCU	21,420	2,140
Model 150	One CCU	31,590	3,155
Model 170	One CCU	26,780	2,675
Model 210	One CCU	147,550	14,740
Model 310	One CCU	189,500	18,960
Model 410	Two independent CCUs	221,950	22,190
Model 610	Two independent CCUs	294,550	29,460
Features			
1561	Channel Adapter for Models 210, 310, 410, and 610	11,800	1,180
1562	Channel Adapter with two processor switches	16,520	1,645
1563	Channel Adapter	6,960	695
1571	Buffer Chaining Channel Adapter (BCCA)	14,930	1,495
1573	BCCA	10,090	1,010
1581	BCCA with TPS	19,650	1,965
4720	Low-Speed Scanner	16,520	1,645
4721	Low-Speed Scanner	14,990	1,490
4740	High-Speed Scanner	25,960	2,590
4760	Token-Ring Adapter Type 1	20,670	2,005
4770	Token-Ring Adapter Type 2	21,420	2,140
4900	Line Interface Coupler (LIC) Unit Type 1	11,210	1,115
4901	LIC Unit Type 2	11,210	1,115
4902	LIC Base Type 1	4,495	449
4903	LIC Base Type 2	3,210	321
4911	LIC Type 1	3,065	305
4931	LIC Type 3	3,065	305
4941	LIC Type 4A	3,065	305
4942	LIC Type 4B	3,065	305
7865	LIC Type 5	5,280	527
7100	Storage Increment (4MB)	11,800	1,180
7101	Memory Expansion	11,800	1,180
7825	LIC Type 6	3,480	347
8320	Two Processor Switches	4,495	449
3746 Expansion Unit			
A 11	Expansion Unit	20,070	2,005
A 12	Expansion Unit	20,070	2,005
L 13	Expansion Unit	20,070	2,005
L 14	Expansion Unit	20,070	2,005
L 15	Expansion Unit	20,070	2,005
Model Conversion Purchase Price			
From Model 210	To Model 310	42,000	—
From Model 210	To Model 610	147,000	—
From Model 410	To Model 610	72,600	—
From Model 310	To Model 610	105,000	—

IBM 3745 Communication Controller

In this report:

Product Summary

Editor's Note

The 3745 has remained stable during the year. IBM has not added any new models to the family. Price increases are reflected in the Equipment Prices section of the report.

Description

The 3745 line of communications controllers consists of the Models 210 and 410, the original models in the series, and the Models 130, 150, and 170, released in 1989. To keep up with industry demands, IBM incorporated T1 capabilities into the devices. The minimum configuration for a 3745 unit includes 4 megabytes of storage per Central Control Unit (CCU), two low-speed scanners, eight line interface couplers, and one Type 1 line interface coupler unit.

Users can attach the 3745 to a byte multiplexer, block multiplexer, or selector channel. When attached to a block multiplexer channel of a 937X or 3090, the 3745 supports datastreaming mode. Remote communications occur via common carrier or private communication facilities. The 3745 supports data communications between terminal devices directly linked, linked by modem, or attached to an IBM Token-Ring network; between terminal devices and one or more directly connected or remotely connected 4300, 937X, 3033, 308X, or 3090 host processors; or between host processors.

Strengths

Users can control remote 3745 operations from a central site. When connected to a 3745 via a modem and switched communication line, a user-provided control terminal can manage single or multiple 3745s.

Limitations

At this time, the 3745 does not support T3.

Competition

NCR Comten, Amdahl.

Vendor

International Business Machines Corp. (IBM)
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

Price

$20,600 to $213,450.

Analysis

In January 1988, IBM introduced the 3745 Communication Controller. A medium- to high-end member of the IBM Communication Controller family, the 3745 originally came in two versions: Model 210 and Model 410. The Model 210 has a single Central Control Unit (CCU) and is field upgradable to the Model 410. The Model 410 has two independent CCUs, each capable of running a separate Network Control Program (NCP). The Model 410 supports three modes of operation: twin dual, twin standby, and twin backup. The Model 410 offers twice the processing power of the Model 210. In 1989, IBM added the 3745 Models 130, 150, and 170, which support fractional T1 services leased in increments of 64K bits per second.

The 3745 supports IBM Communications Network Management (CNM), NetView, IBM Modems Link Problem Determination Aids (LPDAs) enhancements, IBM/Communications Systems, and the X.25 interface. In conjunction with up to five 3746 Expansion Units, the 3745 features modular growth capabilities that accommodate support for up to 16 host attachments, 512 line attachments, 8 high-speed line attachments to T1 and CEPT channels, and 8 IBM Token-Ring attachments.

In May 1989, at the International Communications Association's Conference and Exposition in Dallas, IBM announced low-end and midrange models for the 3745, as well as enhancements to the existing models. The enhanced models accommodate fractional T1 services and can now support up to 896 low-speed lines.

Competitive Position

Before its introduction, analysts predicted that the IBM 3745's capabilities would match those of the NCR Comten 5660, which supports 1,056 ports and T1 and has 16M bytes of internal storage. The 3745 supports only 512 lines, however, and 8M bytes of internal storage. Analysts have also questioned whether the 3745 can actually run eight T1 lines. The processor memory is also needed to handle machine functions, further reducing the amount of memory available for T1 lines. The general belief is that, with its present capabilities, the 3745 will be capable of running two or three T1 lines efficiently.

NCR has fortified its position in the communication processor market by introducing the 5655, 5665, and 5675 processors, which also compete against the IBM 3745 Models 210 and 410. The 5655 and 5665 can support 16 T1 lines and 64 token-ring LANs. The top-of-the-line model, the 5675, can support 24 T1 lines, as well as 1,024 full-duplex lines. The 5665 also supports 1,024 full-duplex lines. In the third quarter of 1989, NCR increased the 5675's support from 8 to 16 mainframes. IBM's claim that the 3745 is the only IBM or IBM-compatible communications controller that is offered with an option of two engines or internal central control units is not all that unique, according to the competition. While NCR Comten does not offer dual control units, it offers backup (redundancy) by attaching two processors through its Modem Interface Modules (MIMs). Both units run NCP and can be used if problems occur on the main processor.

Questions also arise about the efficiency of this dual backup method. If both CCUs are fully configured and running simultaneously, and one suddenly goes down, the remaining CCU does not have the capacity to handle all the applications of the downed CCU. A choice must be made as to the most critical applications to be run from each.

The 3745 will take an active role in IBM's plans to open its network architecture to other vendors without losing network control. The 3745 performs numerous routing functions in an SNA network, which will be of increasing importance as IBM migrates SNA from a hierarchical to a peer-to-peer network.

The use of ASIC chip technology, compatibility with NetView, and the ability to configure the IBM 3745 as a PU 2.1 device within an SNA network all indicate that IBM is building its communications controllers for the future.

Decision Points

The IBM 3745 rounds out the 37XX Communication Controller family. Unlike the older technology of the 3720 and the 3725, the 3745 is based on

Company Profile IBM Corporation

Corporate Headquarters
Old Orchard Road
Armonk, NY 10504

In Canada
IBM Canada Ltd.,
Markham
3500 Steeles Avenue E.
Markham, ON L3R 2Z1
(416) 474-2111

Offices located in other cities throughout Canada

Officers
Chairman/CEO: John Akers
Vice Chairman: Jack D. Kuehler
Sr. VP/Gen. Mgr.: Terry Lautenbach

Company Background
Year Founded: 1914
No. Employees: 400,000 worldwide

IBM is one of the oldest manufacturers of computing equipment in the world. It started out in Poughkeepsie, NY as a small company manufacturing clocks for industrial use and later introduced punched card equipment for business accounting functions. According to *Business Week* and *Fortune*, IBM is among the top five industrial corporations by sales volume. It has dominated the mainframe market for over 30 years and has a strong hold on other industry sectors.

Business Overview
IBM designs, manufactures, markets, and services mainframe computer systems and associated peripherals; minicomputer systems and peripherals, microcomputer/personal computer systems; computer system software; data communication controllers and terminals; other communication products such as modems, voice response systems, and voice messaging systems; and local area network communications products. In addition, IBM provides specialized products and services such as communications carrier and limited timesharing services; the IBM Information Network, a communications facility with remote storage and computing services; OEM manufacturing of terminals, disk drives, and other products; maintenance service and system supplies; and financial services through its IBM Credit Corp. subsidiary.

Since it introduced its PC line of microcomputers, IBM has had several earning periods when company growth was much less than anticipated. To compete more effectively in the small systems market, IBM has greatly expanded its software efforts and has entered into agreements with several independent software suppliers to provide tools for its entire line of computer products.

Financial Profile
Operations results for 1989 showed that net profits fell 35 percent to $3.76 billion, or $6.47 per share. Revenues, however, increased 5.1 percent to $62.7 billion over 1988. Fourth-quarter earnings fell 75 percent to $591 million, or $1.04 per share, due to a $2.3 billion restructuring charge.

In July 1990, IBM reported earnings were up 5.2 percent to approximately $1.41 billion or about $2.45 per share for the second quarter. Revenues were up 8.4 percent to $16.5 billion from $15.21 billion for the same quarter a year earlier.

Management Statement
Moving more resources close to customers is a cornerstone of IBM's transformation in the computer industry. To that end, in 1988 IBM undertook the most significant restructuring of its business in more than 30 years, establishing seven lines of business and a new organization—IBM United States. This restructuring continued through 1989 and will continue to be dynamic in order to consistently meet the needs of its customers.

IBM notes that it is managing for the long term and, with the steps it has taken and continues to take, it remains confident about the future of its business.

IBM's new line of Application Specific Integrated Circuit (ASIC) chips, which hold up to 40,000 circuits each, almost three times the capacity of previous IBM ASIC logic chips. Although the Model 410 offers performance up to four times that of the 3725 and supports twice the connectivity of the 3725, the 3745 is not intended to replace the 3725, but to serve as a high-end model in the communications controller product line. The 3725 is the medium- to high-end model.

The 3745 offers features that were not incorporated into the 3725, such as support for T1 and other high-speed digital network facilities; hot-pluggable Line Interface Couplers (LICs) that allow

LICs to be placed anywhere within the 3745 while the machine is running; dual Central Control Units (CCUs); and increased storage facilities.

The Model 210 supports about 1.6 to 4.0 times as many lines as the 3725. In 9600 bps full-duplex, multipoint SDLC lines with interactive traffic, Model 210 can support about 1.6 times as many lines; in 56K bps, full-duplex, point-to-point SDLC lines with batch traffic to the host, the Model 210 can support about 2.4 times as many; in 256K bps, full-duplex, point-to-point SDLC lines with batch traffic between NCP nodes, the Model 210 can support about 4.0 times as many lines. For batch traffic between Network Control Program (NCP) nodes on full-duplex, point-to-point SDLC lines, the Model 210 can process up to six times the data traffic of the 3725.

In terms of performance, the Model 410 offers twice the transaction processing power of the Model 210.

The newest models in the 3745 family, Models 130, 150, and 170, support fractional T1 services that are leased in increments of 64K bits per second. Each of the three models offers 4M bytes of main storage.

Users can benefit from the manner in which IBM has incorporated dedicated power supplies into each component of the 3745. A problem in any of the following devices will impact only its own functionality: CCU, LIC unit, Channel Adapter with Two Processor Switch (CATPS), Maintenance and Operator Subsystem (MOSS), and every pair of adapters.

Within the 3745, IBM has incorporated improved maintenance capabilities over those of the 3725, having added new facilities to MOSS. The MOSS subsystem performs an automatic analysis of Box Event Records (BERs). It also allows users to tap into the Remote Support Facility (RSF), which enables IBM product specialists at a centrally located support station to make contact with the 3745. After remotely monitoring the machine's operation, examining the BERs, and running diagnostic programs, the product specialists can make corrections and adjustments.

The "hot" pluggability of the LICs improves operation by allowing customers to place LICs anywhere within the 3745 while the machine is running. Users can reconfigure LICs or remove failing ones without disrupting traffic on other interfaces.

Another improvement over the 3725, the Automatic Scanner re-Initial Microcode Load (re-IML) enhances the availability of the scanner in the machine. If a scanner fails, the MOSS subsystem performs a dump of the scanner memory and IMLs without operator intervention. After completion of these routines, MOSS notifies the host of the outcome. If successful, the host reactivates the lines; if unsuccessful, manual intervention must occur. In the 3725, every installed LIC undergoes scanning; in the 3745, a selective scanning process takes place in which the scanner ignores LICs with no lines activated.

When using the 3745, customers can take advantage of an access area that enables them to install or change LICs. This arrangement enables customers to perform configuration upgrades or to replace faulty LICs without the assistance of a service person. In addition, customers can connect or disconnect all external cables of the 3745, except those for channel adapters.

IBM has included internal clocks as standard features in the 3745, and any LIC port can provide internal clocking when necessary. The customer no longer has to rely on IBM service personnel to set the clocks for directly attached terminals. In addition, the clocks can be assigned on a line-by-line basis, rather than through the method required by the 3725—the LIC basis. The control program now specifies the clock values for all types of attachments that require internal clocking.

Operating procedures allow users to remotely control 3745 operations from a central site. A user-provided control terminal, when attached to each 3745 via a modem and switched communication line, can serve as a remote operator console to manage single or multiple 3745s.

Characteristics

Models: Model 210 and 410; Models 130, 150, and 170.

Date of Announcement: Models 210 and 410—January 1988; Models 130, 150, and 170—May 1989.

Date of First Delivery: Model 210—March 1988; Model 410—September 1988; Models 130, 150, and 170—May 1989.

Number Installed: Information not available.

Configuration

The minimum configuration for a basic 3745 consists of 4 megabytes of storage per Central Control Unit (CCU), two low-speed scanners, eight line interface couplers, and one Type 1 line interface coupler unit.

IBM has equipped the models 210 and 410 with two sets of buses—Bus Group 1 and Bus Group 2—both of which link the channel adapters and communication line adapters to the CCUs.

IBM's newest models, the 130, 150, and 170, all run the same releases of the Network Control Programs (NCPs) as the Models 210 and 410. Users can upgrade the new models from one to another, but they cannot upgrade these models to the existing 210 and 410.

The Maintenance and Operator Subsystem (MOSS), the 3745's service processor, performs an automatic analysis of Box Event Records (BERs). If a failure occurs, the MOSS supplies a reference code for use by the customer and IBM's service organization to determine the cause. In addition, IBM offers the Remote Support Facility (RSF), which allows IBM product specialists at central support locations to establish a connection with the 3745. The port of the RSF modem supplied with the 3745 operates in BSC protocol at 2400 bps.

A customer-provided terminal serves as a local operator and service console. This terminal can be a directly attached 3151 (without modem) in native mode; or a 3151 Model 310/360 or 410/460 running in 3101 Model 23 emulation mode; or a 3161 Model 11/21 or 12/22 or 3163 Model 11/21 or 12/22 running in 3101 Model 23 emulation mode; or a 3727; or an equivalent terminal running in 3101 Model 23 mode at 2400 bps.

Users attach consoles to the 3745 via two MOSS communication ports. Only one console can be active at a time. The local console, acting as an operator and service unit, must be directly attached without a modem.

The alternate console is an optional, directly attached unit that cannot be used with the remote console. The remote console is an optional, modem-attached unit that manages one or multiple 3745s when attached to each 3745 via modems and a switched telecommunication line.

IBM modems suitable for use with the 3745 are listed in a table later in the report. Other IBM modems with an interface compatible with 3745 Line Interface Couplers (LICs) can also be used.

Models

Model 210: The basic Model 210 consists of a single CCU with its power supply, 4 megabytes of main storage with direct memory access (DMA) and 16K bytes of cache storage, two bus groups and bus switch, two low-speed scanners, eight LICs, one LIC Unit Type 1, and a Maintenance and Operator Subsystem (MOSS). Optional expansion features include one 4M-byte storage increment; up to eight channel adapters (CAs) or up to four channel adapters with two processor switch (CATPS), or a combination of CAs and CATPSs; one LIC Unit Type 1 or LIC Unit Type 2; and up to 24 optional LICs.

Model 410: The Model 410 includes the same elements as the Model 210, but IBM has equipped the Model 410 with two independent CCUs (CCU A and CCU B), each capable of running its own NCP. It offers twice the 210's transaction processing power.

Users can operate the Model 410 in dual, twin standby, and twin backup modes.

Twin-dual mode: The two CCUs of the Model 410 run independently, functioning as two separate subareas, each with its own active NCP. In this mode, Bus Group 1 connects to CCU A, and Bus Group 2 to CCU B. If one CCU stops, only its subarea is interrupted, and no bus switching occurs.

Twin-standby mode: In this mode, the active CCU controls the whole configuration, and Bus Group 1 and Bus Group 2 connect to the active CCU. The second CCU—the hot standby CCU—takes control if the first CCU cannot perform. The second CCU assumes control automatically if a hardware failure occurs or on command from the 3475 operator console.

Twin-backup mode: Under normal operating conditions, this method functions like the twin-dual mode. However, if one CCU stops, the other CCU takes control of its adapters. The active CCU may recover all or part of the traffic, depending on customer requirements. The switching between CCUs disrupts operation only for the sessions previously established on the stopped CCU. During backup status, Bus Group 1 and Bus Group 2 connect to the active CCU. When the other CCU is ready to resume processing, the appropriate Bus Group can revert to normal status via an operator command at the 3745 console.

Model 130: This model supports two T1 lines, four host channel links, and four 4M bps or 16M bps IBM Token-Ring interfaces.

Model 150: This model supports 16 ports at data rates up to 256K bps, two 4M bps or 16M bps IBM Token-Ring interfaces, and one T1 line.

Model 170: The Model 170, the largest of the three most recent processors, supports up to 112 lines at data rates up to 256K bps. The machine also supports two 4M or 16M bps IBM Token-Ring interfaces and two T1 lines.

The following table presents an overview of 3745 features.

Specifications	IBM 3745
Number of CCUs	One or two
Storage (bytes)	4M or 8M per CCU
Max. Duplex Line Attachment	528
Max. Line Speed (bps)	1.544M (T1)
Host Attachments	16
Token-Ring Adapters	8
Line Interfaces	EIA RS-232-C, RS-366, V.24, V.25, V.35, X.21, wideband, direct attach
Console Requirements	3151, 3161, 3727 (local), or PC emulating 3101 (remote)
Dimensions (in.)	Base: 69.9 high, 47.5 wide, 29.5 deep
Weight (lb.)	Base: less than 1,411
Power Requirements	208-240 V AC, 3 phase
Operating Environment	60° F; 8% to 80% relative humidity
Heat Output	Base: 3kW (10K Btus/hr.)

Subsystems

The 3745 consists of the Control Subsystem, Communication Subsystem, and Maintenance and Operating Subsystem.

Control Subsystem: This area consists of one or two CCUs with 4 megabytes of basic storage and an optional storage increment of 4 megabytes with direct memory access (DMA) and 16K bytes of cache storage. The Control Subsystem has two bus groups, each consisting of two Input/Output Control (IOC) buses and one DMA switch. This subsystem also has a bus switch and features a power supply per CCU. In addition, the Control Subsystem incorporates a combination of channel adapters (CAs) and/or channel adapters with two processor switches (CATPS). Each CATPS takes the place of two CAs. One power supply for each pair of adapters sustains the host connections.

Communication Subsystem: This subsystem provides three types of attachment to the telecommunications network: Line Interface Couplers, High-Speed Scanners, and Token-Ring Adapters.

Line Interface Couplers (LICs) support asynchronous or synchronous transmission at speeds up to 256K bps and direct or modem-attached data terminal equipment (DTE) under start/stop, BSC, or SDLC protocols via a Low-Speed Scanner. LIC Types 5 and 6 provide integrated modem and DSU/CSU functions. LIC units are modular enclosures that house up to 16 LICs with their own power supplies.

IBM offers the following Line Interface Couplers:

- LIC Type 1—four ports, up to 19.2K bps; supports EIA RS-232-D/CCITT V.24, EIA RS-366/CCITT V.25, and CCITT X.21 bis.
- LIC Type 3—one port, up to 256K bps; supports CCITT V.35 interface.
- LIC Type 4A—four ports, up to 9.6K bps; supports CCITT X.21 interface.
- LIC Type 4B—one port, above 9.6K bps to 256K bps; supports CCITT X.21/X.24 interfaces.
- LIC Type 5—two integrated modem ports at 4.8K bps, 9.6K bps, or 14.4K bps; attachment to analog lines.
- LIC Type 6—one integrated DSU/CSU or LDM port DSU/CSU attachment to DDS at 9.6K bps, 19.2K bps, or 56K bps, LDM attachment to baseband line at 9.6K bps, 19.2K bps, or 56K bps.

The following IBM modems can be used with the 3745.

Model	Characteristics
3834	4800 bps, sync
3864, Model 2	4800/2400 bps, switched, sync
3865, Models 1, 2	9600/4800 bps, sync
3868, Models 3, 4	9600/4800, bps, sync
3872	2400/1200 bps, sync
5811, Model 20	2400-19,200 bps, sync; 45.5-19,200 bps, async
5812, Model 10	2400-19,200 bps, sync; 45.5-19,200 bps, async
DSU/CSU Model 10	2.4K-56K bps sync
5865, Models 2, 3	9600/7200/4800 bps, sync
5868, Model 52	9600/7200/4800 bps, sync
5866, Models 2, 3	14,400/9600 bps, sync
5868, Model 62	14,400/9600 bps, sync
DSU/CSU 5821, Model 10	2400 to 56,000 bps, sync
5842	1200/2400 bps, sync; 45.5-2400 bps, async
5853	1200/2400 bps switched, sync
7861 and 7868	4800/9600/14,400/19,200 bps, sync
7855 V.32	To 1200 bps, sync/to 19.2K bps, async

Each *High-Speed Scanner* supports the attachment of two (one active at a time) V.35 or X.21 nonswitched SDLC data lines operating at speeds from 56K bps to 2.048M bps.

The *Token-Ring Adapters* (Type 1 and Type 2) each support attachment of two IBM Token-Ring Networks under standard protocols. Type 1 and Type 2 attach to 4M bps token-rings via the IBM Cabling System or telephone twisted-pair wiring. Type 2 also attaches to 16M bps token-rings via the IBM Cabling System.

Maintenance and Operator Subsystem (MOSS): The MOSS is functionally separate from the CCU and contains its own power supply. The MOSS operates the 45M-byte disk, the diskette drive, and the control panel of the 3745. Two communication ports support the attachment of 3745 operator consoles. The Remote Service Facility (RSF) port enables the 3745 to be connected to IBM Hardware Central Service. IBM supplies the RSF modem with the 3745.

The MOSS performs IPL functions and machine initialization and also controls the bus switching. It offers system procedures for notification of failures and furnishes the operator with tools to determine problems.

Storage

Disk Storage: In conjunction with the MOSS microcode and 3745 communication programming support, the 45-megabyte disk and disk adapter of the 3745 accommodate up to two NCP load modules, as well as any other communication controller resident programs, and one NCP dump per CCU. One or two NCP load modules per CCU can transfer from the host to the 3745 (local or remote) and be stored on the disk. From the network console, the operator can specify which NCP load module is selected for loading. The NCP transfer does not disrupt 3745 operations. If a CCU/storage-related failure occurs, a dump of the NCP storage is automatically saved on the 3745 disk before the start of the NCP automatic reload sequence. The network operator can request the online transfer of a full or partial dump.

3746 Expansion Unit

The 3746 supplies the 3745 Communication Controller with additional channel adapters, Low-Speed Scanners, and Line Interface Couplers. There are three models.

- **Model A11**—provides up to eight additional channel adapters, or up to four additional channel adapters with two processor switch, and up to 16 additional Low-Speed Scanners.
- **Model A12**—provides up to eight additional Low-Speed Scanners.
- **Models L13, L14, L15**—provide up to 256 additional line attachments provided by each model, with or without integrated modems.

The maximum attachment capacity of the 3745 and its associated expansion units is limited to 512 lines.

Software

ACF/NCP Version 5: The 3745 Communication Controller requires one of the following releases of the ACF/NCP Version 5 licensed program:

- ACF/NCP Version 5, Release 1, which is generated via ACF/SSP V3R3 for MVS/370 and MVS/XA;
- ACF/NCP Version 5, Release 2, which is generated via ACF/SSP V3R4 for MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/Advanced Function, or VSE/SP; or
- ACF/NCP Version 5, Release 2.1, which is generated via ACF/SSP V3R4.1 for MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/Advanced Function, or VSE/SP.

Network Management: The 3745 supports IBM's Communication Network Management (CNM) by sending information about errors to the NetView program in a host processor, which displays the alerts on the network control terminal. NetView provides alert support for the IBM Token-Ring Network. If NetView is not installed, IBM recommends the installation of a 3745 console near the VTAM console to assist customers in determining and resolving problems.

Support of CCITT X.25 for IBM and non-IBM DTEs: With the *X.25 NCP Packet Switching Interface (NPSI) Licensed Program*, users can attach the 3745 to data transmission networks supporting X.25 interfaces. With the *X.25 SNA Interconnection (XI) Licensed Program*, users can use the SNA backbone network and the SNA transport facilities to move X.25 traffic between compatible X.25 DTEs.

Equipment Prices

		Purchase Price ($)	Monthly Rental ($)
3745 Communication Controller			
Model 210	Single CCU	141,900	14,180
Model 410	Base dual CCU	213,450	21,340
Model 130	—	20,600	2,060
Model 150	—	30,380	3,035
Model 170	—	25,750	2,575

■

McDATA LinkMaster Interoperability Products

New Product Announcement

Analysis

Vendor
McDATA Corp.
310 Interlocken Parkway
Broomfield, CO 80021
(303) 460-9200

Technology
The LinkMaster 6100E is a network processor that attaches to an IBM mainframe and an Ethernet LAN; LinkMaster 4174 is an establishment controller that supports a 16M bps token-ring LAN.

Date Announced
6100E tn3270 server and 4174 Token-Ring feature—January 29, 1991.

Scheduled Delivery
Both products are available second-quarter 1991.

Pricing
4174 Token-Ring feature—$3,500 or $4,900, depending on the controller model; 6100E tn3270 software—no charge.

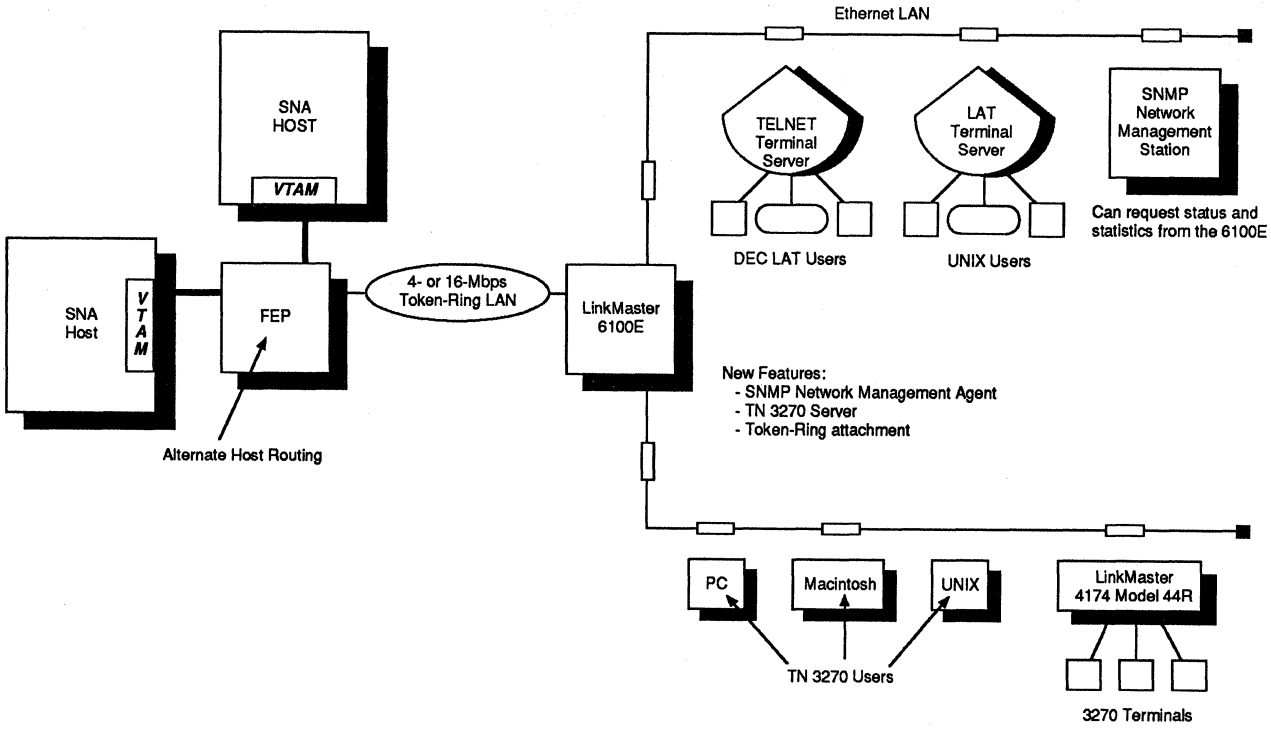
—By Barbara Callahan
Associate Editor

Company Background
McDATA Corp. designs, manufactures, and markets network communications systems. Major product families include wide area and local area channel extenders, host-to-host and host-to-Ethernet network processors, and a family of 3270-compatible establishment controllers and multiplexers. The company also markets custom solutions for manufacturers, systems integrators, and end users to unify multivendor environments.

Founded in 1982, McDATA now employs more than 300 people worldwide. Headquartered in Broomfield, CO, 15 miles northwest of Denver, the company also supports international sales offices in London, Munich, Calgary, Montreal, and Vancouver. U.S. offices are located in Atlanta; Boston; Chicago; Dallas; Los Angeles; Orlando; Pittsburgh; San Francisco; St. Louis; New York; Seattle; and Washington, DC.

Relationship to Current Product Line
The LinkMaster 6100E supports communications between SNA, TCP/IP, and Digital Equipment environments. By adding the capability of acting as a tn3270 server to the

Figure 1.
Software for LinkMaster 6100E



McDATA announced software features for the LinkMaster 6100E that increase its interoperability set.

6100E, McDATA expands the product's interoperability set to include Macintosh, UNIX, and PC workstations in the list of devices for which it provides SNA host access.

The LinkMaster 4174 series includes 15 models that offer local and remote data communications for small, medium, and large device clusters. The series includes IBM-compatible token-ring local area network gateway and downstream controller models. The Model 44R, introduced in 1990, attaches to an Ethernet LAN. With the addition of the new feature for the 4174, McDATA expands the controller's capabilities to support of 16M bps token-ring LANs.

Market Position

McDATA ranks second to IBM in the communications controller market. In the interoperability market, the vendor has carved out a unique niche with its expertise in IBM channel communications. Its products also access IBM's NetView applications.

Characteristics

LinkMaster 6100E tn3270 server—The LinkMaster 6100E network processor links different systems by connecting Digital Equipment Corporation and UNIX devices on Ethernet LANs to additional resources located on an IBM mainframe. The 6100E attaches to the IBM channel and the Ethernet network cable. The product supplies Ethernet connectivity for host-based applications and also functions as a channel application server to support terminal emulation and file transfers. When acting as a tn3270 server, the 6100E provides SNA host access to Macintosh, UNIX, and PC workstations running tn3270.

LinkMaster 4174 Establishment Controller 16M bps Token-Ring Feature—LinkMaster 4174s are modularly constructed and offer industry-standard interfaces that are IBM 3174 compatible at network and device levels. LinkMaster 4174 controllers support Category A coax devices from a variety of vendors. The Token-Ring feature for the 4174 consists of new software and a switchable 4/16M bps LAN interface card based on Texas Instruments' new chipset. McDATA plans to incorporate Remote Group Polling into the 4174 in the third quarter of 1991. ■

McDATA LinkMaster 6200 Network Gateway: First Look

In this report:

Note: Significant product announcements are previewed using the Datapro *First Look.* Interpretation and analysis of announcements is based on information available at press time. A full report will be issued when complete details are available.

McDATA has introduced a solution for integrating multiple, dissimilar LANs into host applications. Compatible with the IBM 3172 Interconnect Controller, McDATA's LinkMaster 6200 Network Gateway provides shared access to 3270 host environments for combinations of token-ring, Ethernet, and FDDI LAN workstations.

Date Announced
October 1992.

Scheduled Delivery
November 1992.

Competition
IBM's 3172 Interconnect Controller.

Vendor
McDATA Corp.
310 Interlocken Parkway
Broomfield, CO 80021
(303) 460-9200
In Canada:
Contact U.S. office.

Price
$21,000 to $42,000 for base configurations.
GSA Schedule: No.

—By Martin Dintzis
Assistant Analyst

Analysis

The LinkMaster 6200 Network Gateway enables users to consolidate multiple, otherwise incompatible local area networks. Through protocol conversion, concentration, and gateway services, it provides shared access to IBM host channels and 3270 applications.

Containing six slots for interface modules, the LinkMaster 6200 can accommodate up to four bus and tag host connections (one per slot), ten Ethernet LAN connections (two per slot), five token-ring LAN connections (one per slot), and two FDDI LAN connections. Through these modules, the LinkMaster 6200 supports multiple protocols concurrently, including SNA, TCP/IP, OSI, and DECnet, for interoperability between different LAN types.

Marketing Strategy

In addition to host-to-LAN gateways, McDATA designs, manufactures, and markets wide and local area channel extenders, multiplexers, and a family of IBM-compatible network controllers. The vendor also provides custom multivendor networking solutions to end users, manufacturers, and systems integrators. Its key strategy is to maximize investments in and productivity of enterprise networks based on IBM's Systems Network Architecture (SNA) and 3270 Information Display System.

Competition

The LinkMaster 6200 competes with the IBM 3172 Interconnect Controller, IBM's platform for LAN consolidation.

Decision Points

Strengths

- The LinkMaster 6200 supports up to four bus and tag connections; IBM's 3172, in contrast, supports a maximum of two.
- The LinkMaster 6200 can off-load up to 50% of the CPU's TCP/IP protocol processing overhead using Interlink Computer Sciences' *SNS/TCPaccess Network Integration* TCP/IP host software for MVS. McDATA claims that this combination exceeds the performance of the IBM 3172—even with IBM's newer off-load technology.
- It supports the most recent version of IBM VTAM, Version 3 Release 4, which simplifies host access and system administration over previous VTAM releases.
- The product's modular architecture enables users to migrate to a different LAN implementation (or a different media type) with simple board-level replacement.
- A UNIX-based platform, the LinkMaster utilizes an industry-standard operating system and bus architecture that can incorporate new technology (such as more powerful microprocessors) as it becomes available.
- System administrators can perform remote maintenance using UNIX's built-in diagnostic facilities, minimizing the need for on-site support.

Limitations

- The LinkMaster 6200 does not support T1 links between remote IBM hosts, as the IBM 3172 does.
- Support for IBM ESCON is a future offering.

Overview

Model	Design	Date Announced	Date Delivered	Purchase Price ($)
LinkMaster 6200	Floorstanding Unit	October 1992	November 1992	21,000 to 42,000 for base configurations

Decision Points

Model	Requirements	Comments
LinkMaster 6200		
	High Throughput	Supports 10M bps to 100M bps local area network connections and 4.5MB/sec. IBM bus and tag connections.
	Multivendor Networking	Consolidates combinations of dissimilar LANs, allowing shared access to host-based applications and resources. Utilizes the open networking features of UNIX, such as remote diagnostics capability.
	Host Independent Networking	Off-loads TCP/IP protocol processing from the host by as much as 50% when used with special mainframe software from Interlink Computer Sciences.

Specifications

Features/Functions

Model	LinkMaster 6200
Hardware Features	
Internal Microprocessor	80486
Bus Architecture	Extended Industry Standard Architecture (EISA)
Internal Memory Capacity (bytes RAM)	8M
Diskette Drive Capacity (bytes)	1.4M
Hard Disk Capacity (bytes)	120M
Tape Drive Capacity (bytes)	120M
Transmission Features	
Maximum Number and Types of Communications Interfaces Supported	Contains six internal slots for interface modules. These slots can accommodate as many as four 4.5MB/sec. bus and tag host connections (one per slot), ten 10M bps Ethernet (10BASE5 or 10BASE2) LAN connections (two per slot), five 16M/4M bps token-ring LAN connections (one per slot), and two 100M bps FDDI LAN connections. ESCON channels will be supported in future enhancements.
Software Features	
Multivendor Networking Capability	The LAN adapters support multiple protocols, including IBM SNA, TCP/IP, DECnet, and OSI. Different LAN platforms have shared access to 3270 host applications. Using Interlink Computer Sciences' DECnet software for IBM hosts, the LinkMaster 6200 can establish the IBM mainframe as a peer in the Digital VAX network.
Host TCP/IP Processing Offload	Working with Interlink's *SNS/TCPaccess Network Integration* TCP/IP host software for MVS environments, the LinkMaster 6200 can off-load up to 50% of host CPU protocol processing cycles.
Network Management Features	
Fault/Problem Management	The LinkMaster 6200 provides generic alerts to IBM NetView. It can be monitored and configured from a NetView console with NetView command processor software installed on the IBM host. The LinkMaster 6200 is also interoperable with SNMP-based systems.
Configuration Management	A network administrator can configure and manage the LinkMaster 6200 from LAN-attached workstations using the TELNET protocol; from a NetView console; or from a local/remote ASCII terminal. Software downloading from one of McDATA's support centers is possible.

Physical Specifications

Model	LinkMaster 6200
Physical Dimensions (H x W x D, inches)	6.9 x 19.0 x 19.0
Weight (lb.)	40, fully configured
Electrical Requirements	120/208/220 V AC, 3-5 Amp, 50-60 Hz
Environmental Specifications:	
Operating Temperature (°F)	40-105
Humidity (%)	10-80 (noncondensing)

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NCR Comten 5645 Communications Processor

New Product Announcement

Analysis

Vendor
NCR Comten
2700 Snelling Avenue N.
St. Paul, MN 55113
(612) 638-7777

Technology
Communications processor.

Date Announced
September 3, 1990.

Scheduled Delivery
Immediate.

Pricing
$59,000 base price.

Company Background
NCR Comten, a subsidiary of NCR Corporation since 1979, designs, maufactures, services, and markets a variety of data communications equipment, including data communications processors. The company has specialized in data communications systems since 1968.

In February 1989, NCR extended an agreement with Alcatel Business Systems Ltd., U.K., in which Alcatel continues to receive the rights to market NCR Comten data communications systems. The agreement, entered into in 1977 and extending until 1994, authorizes Alcatel to market, install, and service NCR Comten data communications systems and software in 14 European countries.

Relationship to Current Product Line
The Comten 5645 base system, a new member of the NCR Comten family of 5600 SNA communications processors, achieves the same performance level as the current Comten 5655 but features fewer host and line connections and, consequently, a lower price. The 5645 provides a cost-effective price/performance solution for networks that require fewer line and host connections than those offered by the other Comten 5600 processors but that need the performance range of those models. Users can upgrade the performance of the 5645 after installation in less than four hours to achieve 1.5 times (comparable to the performance of a Comten 5665) or 2.25 times (comparable to a Comten 5675) the performance of the base system.

—By Barbara Callahan
Associate Editor

Table 1. Processor Comparison Chart

	Comten 5620XP	Comten 5645	Comten 5655	Comten 5665	Comten 5675
Channel-Connected Hosts*	Up to 2	Up to 4	Up to 8	Up to 8	Up to 16
Lines*	Up to 64	Up to 128	Up to 512	Up to 1,024	Up to 1,024
T1 Links*	NA	Up to 4	Up to 16	Up to 16	Up to 24
Token-Ring LANs*	Up to 2	Up to 16	Up to 64	Up to 64	Up to 64
TCP/IP Ethernet LANs*	One maximum	Up to 12	Up to 48	Up to 48	Up to 48
Main Storage, bytes (min./max.)	1M to 4M	4M to 16M	4M to 16M	4M to 16M	8M or 16M
Fixed Disk Capacity, bytes	20M	80M	80M	80M	80M
System Console	Optional	Optional	Optional	Intelligent	Intelligent
Relative Performance**	0.25	Scalable (1.0, 1.5, or 2.25)	Scalable (1.0, 1.5, or 2.25)	1.5	2.25

**Note that all of the line, LAN, and host connectivity maximums listed cannot be achieved simultaneously. Actual connectivity is determined by modeling the unique traffic patterns of your network.*
***These figures compare the capability of NCR communications processors to handle real interactive work loads, not an artificial test environment. The minimum performance level of a Comten 5645 is defined as 1.0*
NA—Not applicable.

Market Position

Second to IBM in the market, NCR Comten is the leading vendor of communications processors for the IBM environment. In recent years, however, NCR Comten has focused on support for multivendor communications and evolving standards. To remain competitive, the company has looked beyond IBM and begun to produce products such as the 5600 communications processors that interconnect to OSI and ISDN systems.

Characteristics

Overview

The Comten 5645 can operate as a front-end processor, as a remote concentrator processor, or simultaneously as a front-end processor for local hosts and as a remote processor for hosts elsewhere in the network, providing SNA networking or linking SNA network applications with TCP/IP and OSI environments. Users can upgrade its memory on-site from 4 megabytes to 8 or 16 megabytes. Users can also install, on-site, attachments for token-ring and Ethernet LANs, T1 lines, and other NCR Comten communications line termination equipment, up to the system's main capacity.

For an overview of the characteristics of all processors in the 5600 family, see Table 1. ■

NCR Comten 5600 Communications Processors

In this report:

Note: In addition to supporting token-ring network gateway functionality, the Comten 5600's *Multiple Communications Adapter Module (MCAM)* now supports TCP/IP Ethernet LANs and European ISDN basic rate network connections.

NCR's Comten processors, designed to replace the IBM 3745, can function as front ends, remote concentrators, or intelligent switches in IBM and NCR host systems. They support anywhere between 32 and 1,024 communications lines and from 2 to 64 LANs, depending on the model.

Strengths

- Comten 5600 processor models are easily integrated into IBM environments; multiple units can be monitored and managed from a NetView, Net/Master, or NCR-provided administration console.
- Part of NCR's Open Networking Environment (ONE) strategy, NCR's processors link multiple, incompatible host and LAN environments, thereby providing a migration path from SNA to multivendor networking.
- They provide flexible configuration capability and can easily be upgraded without software modification.
- Support for redundant processors enables users to create backup facilities and to distribute the work load among multiple interconnected units.

Limitations

Comten 5600 processors are limited only by the constraints of the technology employed (e.g., IBM SNA/SDLC or 3270 BSC).

Competition

IBM and Amdahl.

Vendor

NCR Corp.
Network Products Group
2700 Snelling Avenue North
St. Paul, MN 55113
(612) 638-7777
In Canada:
NCR Canada Ltd.
6865 Century Avenue
Mississauga, ON L5N 2E2
(416) 826-9000

Price

A base configuration can cost from $36,880 to $254,000, depending on the model. **GSA Schedule:** Yes.

—By Martin Dintzis
Assistant Editor/Analyst

Product Analysis

Communications processor technology dates back to the early '70s. NCR, however, continues to streamline its Comten 5600 product line and to add additional multivendor networking features.

The modularly designed machines in the Comten 5600 family include the 5630, the 5645-B, the 5655-B, the 5665-B, and the 5675-B. Hardware and software compatibility runs through this family, as well as to the 5660 and 369X series products, which are no longer actively marketed.

Together, the five processor models provide the capability to link multiple local and remote IBM SNA/SDLC or 3270 BSC hosts to async, token-ring LAN, TCP/IP Ethernet LAN, and X.25 packet switched environments. The 5675-B can support as many as 16 IBM host connections and up to 64 token-ring or 48 Ethernet LANs.

In 1992 NCR added support for TCP/IP Ethernet LAN connections and European ISDN basic rate network connections on the Comten 5600's Micro Channel-based *Multiple Communications Adapter Module (MCAM)*. Each MCAM supports up to four 4M/16M bps token-ring LAN, six Ethernet LAN, and eight ISDN BRI interfaces. An evolving product, MCAM will support ISDN primary rate network connections in the second quarter of 1993, and frame-relay and SMDS environments at an unannounced future time.

Target Applications

NCR's Comten 5600 models can be used as front-end processors, remote concentrators, gateways, and intelligent switches. Locally attached to one or more host computers, a front-end processor relieves the hosts of the overhead involved in message handling and network control. A concentrator controls a community of terminals, terminal clusters, or distributed application processors, gathering, queuing, and multiplexing their transmissions onto one or more high-speed lines. An intelligent switch routes messages among the network's various end points.

Strengths

NCR's processors can easily be integrated into an existing IBM SNA network. Multiple processor units can be managed from an NCR, NetView, or Net/Master console. Part of NCR's ONE strategy for linking multiple, incompatible host and LAN environments, the processors go far beyond the bounds of SNA.

The modular design of the Comten 5600 processors offers configuration flexibility. Users can adjust to network growth requirements through on-site upgrades and on-site attachments expansion. Modularity allows users to add line, channel, and LAN connections as needed.

System upgrades usually require less than four hours for completion. In addition, upgrades do not necessitate modifications in network software or configurations, nor do they require the addition of a second CPU. Instead, the performance of the existing CPU is upgraded—an approach that eliminates the lengthy process of reconfiguring the network to decide which CPU will support which lines, LANs, and interfaces.

The number of components in Comten 5600 processors is 40% less than that of previous models. The technology incorporated into their design is based on application-specific integrated circuitry, which reduces floor space, power, and cooling requirements.

NCR's *Rack Mounted Universal Communications Adapter (RMUCA)*, one of the processor components, eliminates many network headaches. RMUCA creates up to two active and two backup data paths from one communications processor to other processor nodes. Through the RMUCA, users can back up all segments of their processors and the attached lines, or switch among multiple communications processors to evenly distribute the computing load.

NCR Comten Overview software, running on a personal computer, acts as an automated control facility for multiple network processors. It enables network operators to create and store often-used command sequences, which will be automatically activated in response to predefined conditions. Automating commands reduces the possibility of operator errors.

Limitations

Users are gradually migrating away from the hierarchical (host-to-terminal) type of processing, for which the IBM communications processor was originally developed, in favor of distributed processing and peer-to-peer communications using LAN PCs. The communications processor is a transition product, one that is allowing users to link an existing host processing system to an evolving LAN/WAN environment that is destined to eventually replace the host platform.

Competitive Analysis

NCR's Comten 5600 processor family provides full IBM compatibility, easy expansion, and a migration path to open networking environments of the future. The vendor's engineering, educational, and support services are available to help make this transition as smooth as possible for the user.

NCR's Comten processors are fully interoperable with IBM SNA environments, although they run NCR's own software. Amdahl's products, in contrast, are IBM plug-compatible: they run

Overview

Models	Design	Date Announced	Date Delivered	Base Price ($)
5630	Floorstanding unit	September 1991	September 1991	36,880
5645-B	Floorstanding unit	September 1990	September 1990	58,700
5655-B	Floorstanding unit	September 1990	September 1990	122,100
5665-B	Floorstanding unit	March 1991	March 1991	187,000
5675-B	Floorstanding unit	March 1991	March 1991	254,000

IBM's ACF/NCP software for the 3745 without modification. With this approach, Amdahl preserves the user's investment in software while offering superior price/performance, reliability, and ease of use on its own controllers. Plug compatibility, however, limits the number of unique features that a competing product can support.

Vendor Analysis

Marketing Strategy

For 20 years, NCR has been developing, manufacturing, marketing, and servicing data communications systems and networking software. For many years, NCR based its marketing strategy on the concept of making it easy for an IBM user to install an NCR communications processor in an SNA network. To remain competitive, however, the vendor is now looking beyond IBM, focusing on supporting multivendor communications and evolving standards, such as TCP/IP, frame relay, ISDN, and SMDS.

NCR is accomplishing this goal through the Comten 5600 processor family and its ONE strategy. ONE includes a suite of open networking hardware and software products based on TCP/IP and OSI; SNA software that ensures coexistence between existing networks and OSI networks; and transition products that provide a smooth migration to open networking.

Having merged with AT&T in September 1991, NCR is in a stronger position to offer multivendor wide area networking solutions to its customers. NCR has integrated AT&T's StarLAN family of network adapters and intelligent hubs, StarWAN line of bridges and routers, StarGROUP client/server software, and StarSENTRY network management software into ONE.

Target Markets

NCR's communications processors are designed for corporations with large SNA networks—especially those desiring a migration path to LAN processing or multivendor wide area networking.

Market Position

NCR is second only to IBM in the sale of communications processors for IBM host environments. NCR is best known, however, for its retail, banking, and financial computer systems. Its product line includes the following:

- Industry-specific workstations for retail, financial, manufacturing, and other markets;
- General-purpose workstations, such as personal computers and display terminals;
- Multiuser computer systems for interactive and batch processing; and
- Large computer systems for on-line transaction processing.

NCR is the fifth largest competitor in overall computer system sales, trailing IBM, Digital Equipment, Unisys, and Hewlett-Packard.

Major Competitors

In addition to IBM, Amdahl competes with NCR in the communications processor market.

Decision Points

Models	Requirements	Comments
Comten 5600 Communications Processor	High Throughput	Supports 16M bps token-ring LANs, and T1/E1 speeds for remote host connections. Support for frame relay, ISDN PRI, and SMDS is planned.
	Flexibility	A modular architecture makes system expansion and performance upgrades straightforward. Enhancements do not require software modifications or CPU replacement.
	Multivendor Networking	Supports async, IBM SNA/SDLC, IBM 3270 BSC, TCP/IP, and X.25 data flows concurrently. Accommodates both token-ring and Ethernet LANs.
	Reliability	Backup data paths provide access to redundant network paths and processor nodes.
	Network Management	Comten 5600 processors can be managed from an NCR, IBM NetView, or Systems Center Net/Master console. Realtime status information from multiple processors can be viewed simultaneously in varying levels of detail. User-defined alerts and automated operations are supported.

Interoperability Matrix

Product	Comten 5600 Communications Processor
Product Classification	Proprietary network router/gateway device.
Relationship With Higher-Level Elements	
Position in Network Architecture	Appears to the IBM host as an SNA physical unit (PU) type 4 device.
Compatibility	Designed to replace the IBM 3745 channel-attached or remote processor.
Host Software Required:	
Operating Systems	MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP
Access Methods	VTAM, BTAM, BTAM-ES, or RTAM
Communications Processor Software Load	From a local/remote personal computer or host, or from the processor's hard disk.
Host Access	Direct connection via a System/370 block multiplexer channel or data streaming channel, remote access via a dial-up or leased line, or indirect host access via an Ethernet or token-ring LAN.
Network Management Support	Can be configured, monitored, and managed via IBM NetView or Systems Center Net/Master.
Relationship With Peer-Level Elements	
Compatible Communications Processors	Fully interoperable with any IBM 3745 FEP or remote processor.
Transport Architectures Supported	Async, IBM SNA/SDLC, IBM 3270 BSC, TCP/IP, ISDN basic rate, and X.25 dataflows.
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to fractional or full T1/E1 lines via a T1, E1, or V.35 interface.
Packet Network Support	Supports access to an X.25 packet switched network using an RS-232-C or X.21 interface.
LAN Attachment Support	Ethernet (IEEE 802.3 10BASE5) and 4M/16M bps token-ring (IEEE 802.5) environments are supported concurrently.

Sales and Distribution Strategy

Sales

NCR has 7 main sales offices and more than 300 district offices throughout the U.S., as well as 1,300 sales offices in 120 countries worldwide.

Distribution

NCR distributes its products through a combination of direct and indirect channels, including OEMs, VARs, and dealers.

Support

NCR sells and leases Comten 5600 processors. Through its worldwide support organization, the vendor provides remote diagnostics; on-site service; consulting and engineering services for complex networks; multivendor solutions; and customer education and training.

Policies and Programs

Warranty

NCR guarantees all Comten 5600 processor components for one year and will provide on-site repair or replacement at no charge to the user.

Support Services

A 24-hour, 7-day-a-week hot line is available to all NCR customers with service contracts. Once a problem has been described to the support center phone crew, it is entered into a database, which forwards the problem to service personnel closest to the customer. On-site support is available as needed, whether over a weekend or during the week. The support hot line number is (800) 262-7782.

NCR offers a *Remote Support Program*, which also entitles the user to on-site maintenance if a problem cannot be resolved remotely. Remote diagnostics allow NCR support centers to use telephone connections to assist in diagnosing hardware and software problems, or maintaining microcode. It also enables periodic monitoring of a system and its peripherals, such as disk units, printers, and terminals.

Customers who elect not to participate in the Remote Support Program can obtain a conventional on-site hardware maintenance agreement, which is offered at an additional charge of 25% above remote support rates.

Service Divisions

NCR's worldwide customer service divisions are organized into Centers of Expertise. U.S. centers include the following:

Account Support Center: The main source of NCR customer services, this center is responsible for coordinating the delivery of services from other Centers of Expertise. It provides planning, consulting, and implementation services.

Systems Integration Center: Provides in-depth, technical support services for complex and leading-edge technology products. It also assists customers in the integration of NCR products into multivendor environments by subcontracting NCR third-party resources for each customer project.

Customer Support Center: Provides on-site and remote hardware and software service. Several of these centers may work as a team.

Software Engineering and Network Support Center: Guides customers in the use of NCR architecture, methodology, and tools for developing applications.

Service Hours

The support hot line, (800) 262-7782, is in service 24 hours a day, 7 days a week. Field service personnel are dispatched as needed, according to reports transmitted from the hot line center.

Training/Education

NCR's main education headquarters, located in California, Georgia, and Ohio, provide a full range or courses for customers. The vendor also maintains 12 regional education centers throughout the U.S. On-site training is available at a facility of the customer's choice, as are a variety of self-instruction courses. Customers selecting self-instruction courses also receive telephone assistance from an instructor. Subjects covered include data communications systems concepts, local area networks, enterprisewide networks, TCP/IP, SNA advanced program-to-program communications (APPC), problem determination for SNA, communications processor systems, and ACF/NCP generation.

Specifications

Enhancements

Date	Event
1991	NCR introduced the Model 5630, a low-end communications processor supporting both channel-attached and remote concentrator configurations.
	Introduced the *Multiple Communications Adapter Module (MCAM),* which initially supported multiple token-ring LAN interfaces.
	NCR announced that it had expanded its Open Networking Environment (ONE) product line and has integrated AT&T Network Systems' LAN internetworking products into ONE, creating an even more comprehensive solution
1992	NCR added support for TCP/IP Ethernet and European ISDN basic rate network connections on MCAM.
Second quarter of 1993	The vendor will add support for ISDN primary rate network connections on MCAM.

Features/Functions

Models	5630	5645-B	5655-B
Hardware Features			
Design	Floorstanding unit	Floorstanding unit	Floorstanding unit
Internal Memory Capacity (bytes RAM)	4M-16M	4M-16M	4M-16M
Hard Drive Capacity (bytes)	120M	120M	120M
Transmission Features			
Max. Number of Lines *(1)*	32	128	512
Max. Number of T1/E1 Links	2	4	16
Max. Number of Host Connections	2	4	8
Max. Number of Token-Ring LAN Connections	16	16	64
Max. Number of Ethernet LAN Connections	12	12	48
Physical Interfaces Supported	RS-232-C, RS-366 (auto call), T1, E1, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)	RS-232-C, RS-366 (auto call), T1, E1, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)	RS-232-C, RS-366 (auto call), T1, E1, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)

Features/Functions (Continued)

Software Features			
Multivendor Networking Capability	Supported through NCR's TCP/IP software.	Supported through NCR's TCP/IP software.	Supported through NCR's TCP/IP software.
Peer-to-Peer SNA Networking Capability	NCR's ACF/NCP Version 5.3 allows NT 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs.	NCR's ACF/NCP Version 5.3 allows NT 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs.	NCR's ACF/NCP Version 5.3 allows NT 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs.
Protocol Conversion Capability	Async to SDLC, async to X.25, and SDLC to X.25 conversions.	Async to SDLC, async to X.25, and SDLC to X.25 conversions.	Async to SDLC, async to X.25, and SDLC to X.25 conversions.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Models	**5665-B**	**5675-B**
Hardware Features		
Design	Floorstanding unit	Floorstanding unit
Internal Memory Capacity (bytes RAM)	4M-16M	4M-16M
Hard Drive Capacity (bytes)	120M	120M
Transmission Features		
Max. Number of Lines *(1)*	1,024	1,024
Max. Number of T1/E1 Links	16	24
Max. Number of Host Connections	8	16
Max. Number of Token-Ring LAN Connections	64	64
Max. Number of Ethernet LAN Connections	48	48
Physical Interfaces Supported	RS-232-C, RS-366 (auto call), T1, E1, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)	RS-232-C, RS-366 (auto call), T1, E1, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)
Software Features		
Multivendor Networking Capability	Supported through NCR's TCP/IP software.	Supported through NCR's TCP/IP software.
Peer-to-Peer SNA Networking Capability	NCR's ACF/NCP Version 5.3 allows NT 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs.	NCR's ACF/NCP Version 5.3 allows NT 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs.
Protocol Conversion Capability	Async to SDLC, async to X.25, and SDLC to X.25 conversions.	Async to SDLC, async to X.25, and SDLC to X.25 conversions.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Network Management Functions

Fault and Problem Management	**NCR Comten Communications Alerting Facility (CAF)**, software that runs on the communications processor, provides realtime status information via an NCR CAF console. It supports user-definable alerts and provides multiple report formats for displaying information in different levels of detail.
	NCR Comten Overview, software that operates on an NCR personal computer, permits a network operator to use a single console to view information about as many as 8 local and 12 remote communications processors. Comten Overview further enhances CAF by providing support for script files, windowing capability, a menu-driven interface, context-sensitive help screens, a system log, and access security.
Configuration Management	Configuration information is downline loadable to the Comten Communications Operating System Release 2 (COS 2) from an NCR console, an asynchronous terminal, a remote IBM host, or another remote communications processor.
	NCR Comten Support Facility, software that resides in multiple communications processors, allows a network operator to manage all the processors from an IBM NetView or Systems Center Net/Master console.
Accounting and Performance Management	NCR's ACF/NCP software produces host-independent network statistics not available through the IBM communications processor. Users can initiate and collect these statistics from an NCR console or through NetView or Net/Master.

Network Management Functions (Continued)

Security Management

Comten Overview software provides a multilevel sign-on procedure, securing access to the network management system. Other security features are available through NetView and Net/Master. NetView, for example, supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF). RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs.

Configuration

Components

Product	Description
Communications Base (CB) Module	Supports up to 16 communications lines concurrently, with data rates up to 56K/64K bps per line.
Multiple Communications Adapter Module (MCAM)	A Micro Channel-based unit supporting up to four 4M/16M bps token-ring LAN, six Ethernet LAN, or eight ISDN BRI interfaces *(1)*. Combinations of both types, up to a maximum of six LANs, are possible.
Rack Mount Network Interface Adapter (NIA)	Supports up to four LANs (up to three Ethernet or four token-ring). Combinations of both Ethernet and token-ring are possible.
Rack Mount Universal Communications Adapter (RMUCA)	Provides up to two active and two alternate data paths between a communications processor and other local or remote processors. With RMUCA, the user can establish redundant communications facilities, or distribute the work load among multiple communications processors.
T1/E1 Interface Module	Provides access to a fractional or full T1/E1 transport services, supporting data rates up to 2.048M bps.

(1) Future enhancements will add support for frame relay, ISDN PRI, and SMDS on this module.

Configuration Rules

Models	5630	5645-B	5655-B
Max. Number of CB Modules	2	8	32
Max. Number of MCAMs	2	4	4
Max. Number of NIAs	Not used in this model. MCAM provides LAN connectivity.	4	16
Max. Number of RMUCAs	Not used in this model. CB module provides direct connections to other processors.	Not used in this model. CB module provides direct connections to other processors.	4
Max. Number of T1/E1 Modules	2	4	16

Models	5665-B	5675-B
Max. Number of CB Modules	64	64
Max. Number of MCAMs	16	16
Max. Number of NIAs	16	16
Max. Number of RMUCAs	8	8
Max. Number of T1/E1 Modules	16	24

Physical Environment

Models	5630	5645-B, 5655-B, 5665-B, 5675-B
Physical Specifications (H x W x D, In.)	39 x 24 x 28	67 x 24 x 28
Electrical Specifications	200 V-240 V AC, 8 Amp (max.)	200 V-240 V AC, 16 Amp (max.)
Environmental Specifications	Operating temp.: 60-90°F; humidity: 35%-60% noncondensing	Operating temp.: 60-90°F; humidity: 35%-60% noncondensing

Optional Software

Comten TCP/IP Release 1	Fosters interoperability among devices in async, SNA, and Ethernet LAN networking environments, allowing users to share resources and software applications. Supports File Transfer Protocol (FTP) for host-to-host file transfer; Simple Mail Transfer Protocol (SMTP), which allows message transfer between TCP/IP resources and SNA hosts; and SNMP enables network-based X Windows server systems and clients to access IBM host applications. Provides multiple APIs: Berkeley Software Distribution Socket Interface, AT&T Transport Layer Interface, NCR's TCP/RPI, and Sun Microsystems' RPC/XDR.
Comten X.25 Version 2 Release 2	Provides the flexibility to use an X.25 packet switched network as the primary data communications network, or to integrate an X.25 network into an existing SNA or NCR network. Performs packet assembly/disassembly and protocol conversion for async, IBM 3270 BSC, and SDLC devices, and incorporates IBM NCP Packet-Switching Interface (NPSI) functionality.

Pricing

Equipment Prices

Processor Model	Description	Base Purchase Price ($)
5630	Includes 4MB of internal memory, an integrated CB Module, and eight communications line interfaces	36,880
5645-B	Includes 4MB of internal memory, one RMUCA module, one CB module, and 16 communications line interfaces	58,700
5655-B	Includes 4MB of internal memory, one RMUCA module, two CB modules, and 32 communications line interfaces	122,100
5665-B	Includes 8MB of internal memory, one RMUCA module, two CB modules, and 32 communications line interfaces	187,000
5675-B	Includes 8MB of internal memory, one RMUCA module, and 32 communications line interfaces	254,000

Software Prices

Product	Description	Annual License Fee ($)
NCR Comten Operating System Release 2 (COS 2)	Required for each communications processor	None
ACF/NCP Version 5.3	Required for SNA peer-to-peer networking	5,162-20,582
NCR Comten Communications Alert Facility (CAF)	Network management software for each Comten processor; provides realtime status information, alerts, and reports	1,071-4,287
NCR Comten Overview	Optional personal computer network management software permitting a network operator to monitor the status of multiple local/remote Comten processors	2,614-3,326
NCR Comten Support Facility (CSF)	Optional processor software permitting an operator to manage Comten processors from a NetView or Net/Master console	3,920-5,108
NCR Comten X.25 Version 2 Release 2	Optional processor software providing X.25 packet assembly/disassembly (PAD) and protocol conversion	2,247-8,990
TCP/IP Release 1	Supports communications with hosts and Ethernet LANs using TCP/IP protocols	1,829-3,659

■

NCR Comten 5600 Communications Processors

In this report:

Note: Now allied with AT&T, NCR is positioned to support an even greater selection of LAN networking options for its Comten 5600 communications processor family. NCR has released a new low-end processor model, the 5630, which supports both channel-attached and remote IBM hosts. The vendor has also introduced the *Multiple Communications Adapter Module (MCAM)*, which supports token-ring network gateway functionality now, and will eventually support TCP/IP Ethernet LANs, frame relay, ISDN, and SMDS.

NCR's Comten processors, designed to replace the IBM 3745, can function as front ends, remote concentrators, or intelligent switches in IBM and NCR host systems. They support anywhere between 32 and 1,024 communications lines and from 2 to 64 LANs, depending on the model.

Strengths

- Comten 5600 processor models are easily integrated into IBM environments; multiple units can be monitored and managed from a NetView, Net/Master, or NCR-provided administration console.
- Part of NCR's Open Networking Environment (ONE) strategy, NCR's processors link multiple, incompatible host and LAN environments, thereby providing a migration path from SNA to multivendor networking.
- They provide flexible configuration capability and can easily be upgraded without software modification.
- Support for redundant processors enables users to create backup facilities and to distribute the work load among multiple interconnected units.

Limitations

Comten 5600 processors are limited only by the constraints of the technology employed (e.g., IBM SNA/SDLC or 3270 BSC).

Competition

IBM and Amdahl.

Vendor

NCR Corp.
Network Products Group
2700 Snelling Avenue N.
St. Paul, MN 55113
(612) 638-7777
In Canada:
NCR Canada Ltd.
6865 Century Avenue
Mississauga, ON L5N 2E2
(416) 826-9000

Price

A base configuration can cost from $32,400 to $254,000, depending on the model. **GSA Schedule:** Yes.

—By Martin Dintzis
Assistant Editor

Product Analysis

Communications processor technology dates back to the early '70s. NCR, however, continues to streamline its Comten 5600 product line and to add additional multivendor networking features.

The modularly designed machines in the Comten 5600 family include the 5630, the 5645-B, the 5655-B, the 5665-B, and the 5675-B. Hardware and software compatibility runs through this family, as well as to the 5660 and 369X series products, which are no longer actively marketed.

Together, the five processor models provide the capability to link multiple local and remote IBM SNA/SDLC or 3270 BSC hosts to async, token-ring LAN, TCP/IP Ethernet LAN, and X.25 packet switched environments. The 5675-B can support as many as 16 IBM host connections and up to 64 token-ring or 48 Ethernet LANs.

New options introduced late in 1991 include the release of the 5630, an entry-level model, and the introduction of the Micro Channel-based *Multiple Communications Adapter Module (MCAM)*. An evolving product option, MCAM presently supports up to sixteen 4M/16M bps token-ring LAN attachments, and will eventually support Ethernet LAN, frame relay, ISDN, and SMDS environments as well.

Target Applications

NCR's Comten 5600 models can be used as front-end processors, remote concentrators, gateways, and intelligent switches. Locally attached to one or more host computers, a front-end processor relieves the hosts of the overhead involved in message handling and network control. A concentrator controls a community of terminals, terminal clusters, or distributed application processors, gathering, queuing, and multiplexing their transmissions onto one or more high-speed lines. An intelligent switch routes messages among the network's various end points.

Strengths

NCR's processors can easily be integrated into an existing IBM SNA network. Multiple processor units can be managed from an NCR, NetView, or Net/Master console. Part of NCR's Open Networking Environment (ONE) strategy for linking multiple, incompatible host and LAN environments, the processors go far beyond the bounds of SNA.

The modular design of the Comten 5600 processors offers configuration flexibility. Users can adjust to network growth requirements through on-site upgrades and on-site attachments expansion. Modularity allows users to add line, channel, and LAN connections as needed.

System upgrades usually require less than four hours for completion. In addition, upgrades do not necessitate modifications in network software or configurations, nor do they require the addition of a second CPU. Instead, the performance of the existing CPU is upgraded—an approach that eliminates the lengthy process of reconfiguring the network to decide which CPU will support which lines, LANs, and interfaces.

The number of components in Comten 5600 processors is 40% less than that of previous models. The technology incorporated into their design is based on application-specific integrated circuitry, which reduces floor space, power, and cooling requirements.

NCR's *Rack Mounted Universal Communications Adapter (RMUCA)*, one of the processor components, eliminates many network headaches. RMUCA creates up to two active and two backup data paths from one communications processor to other processor nodes. Through the RMUCA, users can back up all segments of their processors and the attached lines, or switch among multiple communications processors to evenly distribute the computing load.

NCR Comten Overview software, running on a personal computer, acts as an automated control facility for multiple network processors. It enables network operators to create and store often-used command sequences, which will be automatically activated in response to predefined conditions. Automating commands reduces the possibility of operator errors.

Limitations

Users are gradually migrating away from the hierarchical (host-to-terminal) type of processing, for which the IBM communications processor was originally developed, in favor of distributed processing and peer-to-peer communications using LAN PCs. The communications processor is a transition product, one that is allowing users to link an existing host processing system to an evolving LAN/WAN environment that is destined to eventually hierarchical networking.

Competitive Analysis

NCR's Comten 5600 processor family provides full IBM compatibility, easy expansion, and a migration path to open networking environments of the future. The vendor's

Overview

Models	Design	Date Announced	Date Delivered	Base Price ($)
5630	Floorstanding unit	September 1991	September 1991	32,400
5645-B	Floorstanding unit	September 1990	September 1990	59,000
5655-B	Floorstanding unit	September 1990	September 1990	12,100
5665-B	Floorstanding unit	March 1991	March 1991	187,000
5675-B	Floorstanding unit	March 1991	March 1991	254,000

Decision Points

Models	Requirements	Comments
Comten 5600 Communications Processor Family	High Throughput	Supports 16M bps token-ring LANs, and T1/E1 speeds for remote host connections; support for frame relay, ISDN, and SMDS is planned
	Flexibility	A modular architecture makes system expansion and performance upgrades straightforward; enhancements do not require software modifications or CPU replacement
	Multivendor Networking	Supports async, IBM SNA/SDLC, IBM 3270 BSC, TCP/IP, and X.25 data flows concurrently; accommodates both token-ring and Ethernet LANs
	Reliability	Backup data paths provide access to redundant network paths and processor nodes
	Network Management	Comten 5600 processors can be managed from an NCR, IBM NetView, or Systems Center Net/Master console; realtime status information from multiple processors can be viewed simultaneously in varying levels of detail; user-defined alerts and automated operations are supported

engineering, educational, and support services are available to help make this transition as smooth as possible for the user.

Vendor Analysis

Marketing Strategy

For 19 years, NCR has been developing, manufacturing, marketing, and servicing data communications systems and networking software. For many years, NCR based its marketing strategy on the concept of making it easy for an IBM user to install an NCR communications processor in an SNA network. To remain competitive, however, the vendor is now looking beyond IBM, focusing on supporting multivendor communications and evolving standards, such as TCP/IP, frame relay, ISDN, and SMDS.

NCR is accomplishing this goal through the Comten 5600 processor family and its *Open Networking Environment (ONE)* strategy. ONE includes a suite of open networking hardware and software products based on TCP/IP and OSI; SNA software that ensures coexistence between existing networks and OSI networks; and transition products that provide a smooth migration to open networking.

After having merged with AT&T in September 1991, NCR is in an even stronger position to offer multivendor wide area networking solutions to its customers. NCR has integrated AT&T's Starlan family of network adapters and intelligent hubs, StarWAN line of bridges and routers, StarGROUP client/server software, and StarSENTRY network management software into ONE.

In the fourth quarter of 1991, NCR also introduced *NCR SNA/Open Gateway*, a combination of hardware and software enabling SNA users to access IBM 3270-based applications residing on a UNIX computer. The vendor also added network management for *NCR WaveLAN* wireless local area networks using *NCR LAN Manager for UNIX.*

Target Markets

NCR's communications processors are designed for corporations with large SNA networks—especially those desiring a migration path to LAN processing or multivendor wide area networking.

Market Position

NCR is second only to IBM in the sale of communications processors for IBM host environments. NCR is best known, however, for its retail, banking, and financial computer systems. Its product line includes:

- Industry-specific workstations for retail, financial, manufacturing, and other markets;
- General-purpose workstations, such as personal computers and display terminals;
- Multiuser computer systems for interactive and batch processing; and
- Large computer systems for online transaction processing.

NCR is the fifth largest competitor in overall computer system sales, trailing IBM, Digital Equipment, Unisys, and Hewlett-Packard.

Major Competitors

IBM's 3745 processor family includes the low-end Models 130, 150, and 170, and the larger processor Models 210, 310, and 410. The most powerful model, the 3745-410,

Interoperability Matrix

Product	Comten 5600 Communications Processor Family
Product Classification	Proprietary network router/gateway device
Relationship With Higher Level Elements	
Position in Network Architecture	Appears to the IBM host an SNA physical unit (PU) type 4 device
Compatibility	Designed to replace the IBM 3745 channel-attached or remote processor
Host Software Required:	
Operating Systems	MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP
Access Methods	VTAM, BTAM, BTAM-ES, or RTAM
Communications Processor Software Load	From a local/remote personal computer or host, or from the processor's hard disk
Host Access	Direct connection via a System/370 block multiplexer channel, remote access via a dial-up or leased line, or indirect host access via an Ethernet or token-ring LAN
Network Management Support	Can be configured, monitored, and managed via IBM NetView or Systems Center Net/Master
Relationship With Peer Level Elements	
Compatible Communications Processors	Fully interoperable with any IBM 3745 FEP or remote processor
Transport Architectures Supported	Async, IBM SNA/SDLC, IBM 3270 BSC, TCP/IP, and X.25 dataflows
Relationship With Lower Level Elements	
Leased Line Support	Provides access to fractional or full T1/E1 lines via a T1, E1, or V.35 interface
Packet Network Support	Supports access to an X.25 packet switched network using an RS-232-C, V.24, or X.21 interface
LAN Attachment Support	Ethernet (IEEE 802.3 10BASE5) and 4M/16M bps token-ring (IEEE 802.5) environments are supported concurrently

supports up to 16 IBM hosts, 896 medium- and high-speed lines, and eight 16M bps token-ring networks. Model 410 has two independent central control units (CCUs), each capable of running a separate Network Control Program (NCP).

In addition to IBM, Amdahl competes with NCR in the communications processor market. Amdahl markets IBM 3745-compatible processor Models 4745-110 and 4745-210, which run IBM software without any modification. Designed as an alternative to the IBM 3745-210, Amdahl's 4745-210 supports up to eight IBM hosts, 256 communications lines, and eight 4M bps token-ring networks.

By offering an IBM plug-compatible product, Amdahl seeks to preserve the user's investment in software while providing superior price/performance, configuration flexibility, ease of expansion and upgradability, and high reliability. This approach, however, limits the range of unique features that the 4745 can support, particularly in the area of multivendor connectivity.

Sales and Distribution Strategy

NCR distributes its products through a combination of direct and indirect channels, including OEMs, VARs, and dealers. The vendor has seven main sales offices and more than 300 district offices throughout the U.S. NCR also has 1,300 sales offices in 120 countries worldwide.

Support

NCR sells and leases Comten 5600 processors. Through its worldwide support organization, the vendor provides remote diagnostics; on-site service; consulting and engineering services for complex networks; multivendor solutions; and customer education and training.

Policies and Programs

Warranty

NCR guarantees all Comten 5600 processor components for one year, and will provide on-site repair or replacement at no charge to the user.

Support Services

A 24-hour, 7-day-a-week hot line is available to all NCR customers with service contracts. Once a problem has been described to the support center phone crew, it is entered into a database, which forwards the problem to service personnel closest to the customer. On-site support is available as needed, whether over a weekend or during the week. The support hot line number is (800) 262-7782.

NCR offers a *Remote Support Program*, which also entitles the user to on-site maintenance if a problem cannot be resolved remotely. Remote diagnostics allow NCR support centers to use telephone connections to assist in diagnosing hardware and software problems, or maintaining

microcode. It also enables periodic monitoring of a system and its peripherals, such as disk units, printers, and terminals.

Customers who elect not to participate in the Remote Support Program can obtain a conventional on-site hardware maintenance agreement, which is offered at an additional charge of 25% above remote support rates.

Service Divisions

NCR's worldwide customer service divisions are organized into Centers of Expertise. U.S. centers include the following:

Account Support Center: The main source of NCR customer services, this center is responsible for coordinating the delivery of services from other Centers of Expertise. It provides planning, consulting, and implementation services.

Systems Integration Center: Provides in-depth, technical support services for complex and leading-edge technology products. It also assists customers in the integration of NCR products into multivendor environments by subcontracting NCR third-party resources for each customer project.

Customer Support Center: Provides on-site and remote hardware and software service. Several of these centers may work as a team.

Software Engineering and Network Support Center: Guides customers in the use of NCR architecture, methodology, and tools for developing applications.

Service Hours

The support hot line, (800) 262-7782, is in service 24 hours a day, 7 days a week. Field service personnel are dispatched as needed, according to reports transmitted from the hot line center.

Training/Education

NCR's main education headquarters, located in California, Georgia, and Ohio, provide a full range or courses for customers. The vendor also maintains 12 regional education centers throughout the U.S. On-site training is available at a facility of the customer's choice, as are a variety of self-instruction courses. Customers selecting self-instruction courses also receive telephone assistance from an instructor. Subjects covered include data communications systems concepts, local area networks, enterprise-wide networks, TCP/IP, SNA advanced program-to-program communications (APPC), problem determination for SNA, communications processor systems, and ACF/NCP generation.

Competitors' Programs

Amdahl Customer Services offers both installation services and ongoing product support. Several support programs are available for the 4745, including on-site maintenance, remote diagnostics through the *Amdahl Diagnostic Assistance Center (AMDAC)*, and software updates by remote transmission.

Amdahl also offers a complimentary analysis that compares a customer's current computing configuration with projected capacity needs. This analysis can result in improved network efficiency and provide key information for future network planning.

IBM's service plan allows users to order any or all IBM services through a single document that includes maintenance, invoicing, end-user support, site-planning, installation, and network services. Round-the-clock maintenance is provided by calling (800) IBM-SERV for customer engineers (CEs), customer assistance groups (CAGs), remote diagnostics, and technical support. In addition, IBM offers Technical Services Management (TSM), which provides maintenance for customers in a mixed-vendor environment.

User Groups

The Comten Users' Exchange, Inc. (CUE), established as an informal group in 1973, is now a nonprofit corporation with a membership of over 200 NCR Network Products Group customers worldwide. CUE provides a forum for the dissemination and discussion of the latest concepts and technical developments in the field of data communications. Particular emphasis is placed on information allowing users to enhance utilization of NCR's communications processors.

Specifications

Enhancements

Date	Event
October 1991	NCR introduced the Model 5630, a low-end communications processor supporting both channel-attached and remote concentrator configurations; the vendor also introduced the Multiple Communications Adapter Module (MCAM), which provides multiple token-ring LAN connections; through future enhancements, MCAM will support Ethernet LAN connections and emerging technologies such as ISDN, frame relay, and SMDS
October 1991	NCR announced that it had expanded its Open Networking Environment (ONE) product line and has integrated AT&T Network Systems' LAN internetworking products into ONE, creating an even more comprehensive solution

Features/Functions

Models	5630	5645-B	5655-B
Hardware Features			
Design	Floorstanding unit	Floorstanding unit	Floorstanding unit
Internal Memory Capacity (bytes RAM)	4M-16M	4M-16M	4M-16M
Hard Drive Capacity (bytes)	48M-112M	80M	80M
Transmission Features			
Max. No. of Lines *(1)*	32	128	512
Max. No. of T1/E1 Links	2	4	16
Max No. of Host Connections	2	4	8
Max. No. of Token-Ring LAN Connections	8	16	64
Max. No. of Ethernet LAN Connections	16	12	48
Physical Interfaces Supported	RS-232-C, RS-366 (auto call), T1, E1, V.24, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)	RS-232-C, RS-366 (auto call), T1, E1, V.24, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)	RS-232-C, RS-366 (auto call), T1, E1, V.24, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)
Software Features			
Multivendor Networking Capability	Supported through NCR's TCP/IP software	Supported through NCR's TCP/IP software	Supported through NCR's TCP/IP software
Peer-to-Peer SNA Networking Capability	NCR's Advanced Communications Function/Network Control Program (ACF/NCP) Version 5.2 allows node type (NT) 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs	NCR's Advanced Communications Function/Network Control Program (ACF/NCP) Version 5.2 allows node type (NT) 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs	NCR's Advanced Communications Function/Network Control Program (ACF/NCP) Version 5.2 allows node type (NT) 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs
Protocol Conversion Capability	Async to SDLC, async to 3270 BSC, async to X.25, and SDLC to X.25 conversions	Async to SDLC, async to 3270 BSC, async to X.25, and SDLC to X.25 conversions	Async to SDLC, async to 3270 BSC, async to X.25, and SDLC to X.25 conversions

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Models	5665-B	5675-B
Hardware Features		
Design	Floorstanding unit	Floorstanding unit
Internal Memory Capacity (bytes RAM)	4M-16M	4M-16M
Hard Drive Capacity (bytes)	80M	80M
Transmission Features		
Max. No. of Lines *(1)*	1,024	1,024
Max. No. of T1/E1 Links	16	24
Max. No. of Host Connections	8	16
Max. No. of Token-Ring LAN Connections	64	64
Max. No. of Ethernet LAN Connections	48	48
Physical Interfaces Supported	RS-232-C, RS-366 (auto call), T1, E1, V.24, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)	RS-232-C, RS-366 (auto call), T1, E1, V.24, V.35, V.36, X.21, NCR/DLC, MIL-188, IEEE 802.5 (4M/16M bps token-ring), and IEEE 802.3 10BASE5 (Ethernet)
Software Features		
Multivendor Networking Capability	Supported through NCR's TCP/IP software	Supported through NCR's TCP/IP software
Peer-to-Peer SNA Networking Capability	NCR's Advanced Communications Function/Network Control Program (ACF/NCP) Version 5.2 allows node type (NT) 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs	NCR's Advanced Communications Function/Network Control Program (ACF/NCP) Version 5.2 allows node type (NT) 2.1 devices to use the LU6.2 protocol, for peer-to-peer sessions over SNA WANs
Protocol Conversion Capability	Async to SDLC, async to 3270 BSC, async to X.25, and SDLC to X.25 conversions	Async to SDLC, async to 3270 BSC, async to X.25, and SDLC to X.25 conversions

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Network Management Functions

Fault and Problem Management	**NCR Comten Communications Alerting Facility (CAF)**, software that runs on the communications processor, provides realtime status information via an NCR CAF console; it supports user-definable alerts and provides multiple report formats for displaying information in different levels of detail **NCR Comten Overview**, software that operates on an NCR personal computer, permits a network operator to use a single console to view information about as many as 8 local and 12 remote communications processors; Comten Overview further enhances CAF by providing support for script files, windowing capability, a menu-driven interface, context-sensitive help screens, a system log, and access security
Configuration Management	Configuration information is downline loadable to the Comten Communications Operating System Release 2 (COS 2) from an NCR console, an asynchronous terminal, a remote IBM host, or another remote communications processor **NCR Comten Support Facility**, software that resides in multiple communications processors, allows a network operator to manage all the processors from an IBM NetView or Systems Center Net/Master console
Accounting and Performance Management	NCR's ACF/NCP software produces host-independent network statistics not available through the IBM communications processor; users can initiate and collect these statistics from an NCR console or through NetView or Net/Master
Security Management	Comten Overview software provides a multilevel sign-on procedure, securing access to the network management system; other security features are available through NetView and Net/Master; NetView, for example, supports security management by restricting access to NetView, and by providing an interface to IBM's Resource Access Control Facility (RACF); RACF provides security features such as user profile control, multilevel automated logon to specified applications, automated logoff, and time-outs

Configuration

Components

Product	Description
Communications Base (CB) Module	Supports up to 16 communications lines concurrently, with data rates up to 56K/64K bps per line
Multiple Communications Adapter Module (MCAM)	A Micro Channel-based unit supporting up to eight 4M/16M bps token-ring LANs *(1)*
Rack Mount Network Interface Adapter (NIA)	Supports up to four LANs (up to three Ethernet or four token-ring); combinations of both Ethernet and token-ring are possible
Rack Mount Universal Communications Adapter (RMUCA)	Provides up to two active and two alternate data paths between a communications processor and other local or remote processors; with RMUCA, the user can establish redundant communications facilities, or distribute the work load among multiple communications processors
T1/E1 Interface Module	Provides access to a fractional or full T1/E1 transport services, supporting data rates up to 2.048M bps

(1) Future enhancements will add support for Ethernet LANs, frame relay, ISDN, and SMDS on this module.

Configuration Rules

Models	5630	5645-B	5655-B
Max. No. of CB Modules	2	8	32
Max. No. of MCAMs	2	2	4
Max. No. of NIAs	Not used in this model; MCAM provides LAN connectivity	4	16
Max. No. of RMUCAs	Not used in this model; CB module provides direct connections to other processors	Not used in this model; CB module provides direct connections to other processors	4
Max. No. of T1/E1 Modules	2	4	16

Models	5665-B	5675-B
Max. No. of CB Modules	8	8
Max. No. of MCAMs	8	8
Max. No. of NIAs	16	16
Max. No. of RMUCAs	8	8
Max. No. of T1/E1 Modules	16	24

Physical Environment

Models	5630	5645-B, 5655-B, 5665-B, 5675-B
Physical Specifications (H x W x D, in.)	39 x 24 x 28	67 x 24 x 28
Electrical Specifications	200V-240 V AC, 8 Amp (max.)	200V-240 V AC, 16 Amp (max.)
Environmental Specifications	Operating temp.: 60-90°F; humidity: 35%-60% noncondensing	Operating temp.: 60-90°F; humidity: 35%-60% noncondensing

Optional Software

Comten TCP/IP Release 2	Fosters interoperability among devices in async, SNA, and Ethernet LAN networking environments, allowing users to share resources and software applications Supports File Transfer Protocol (FTP) for host-to-host file transfer; Simple Mail Transfer Protocol (SMTP), which allows message transfer between TCP/IP resources and SNA hosts; and Simple Network Management Control Protocol (SNMP); enables network-based X Windows server systems and clients to access IBM host applications Provides multiple application programming interfaces (APIs): Berkeley Software Distribution Socket Interface, AT&T Transport Layer Interface, NCR's TCP/RPI, and Sun Microsystems' RPC/XDR
Comten X.25 Version 2 Release 2	Provides the flexibility to use an X.25 packet switched network as the primary data communications network, or to integrate an X.25 network into an existing SNA or NCR network; performs packet assembly/disassembly and protocol conversion for async, IBM 3270 BSC, and SDLC devices, and incorporates IBM NCP Packet-Switching Interface (NPSI) functionality

Pricing

Equipment Prices

Processor Model	Description	Base Purch. Price ($)
5630	Includes 4M bytes of internal memory, an integrated CB Module, and eight communications line interfaces	32,400
5645-B	Includes 4M bytes of internal memory, one RMUCA module, one CB module, and 16 communications line interfaces	59,000
5655-B	Includes 4M bytes of internal memory, one RMUCA module, two CB modules, and 32 communications line interfaces	122,100
5665-B	Includes 8M bytes of internal memory, one RMUCA module, two CB modules, and 32 communications line interfaces	187,000
5675-B	Includes 8M bytes of internal memory, one RMUCA module, and 32 communications line interfaces	254,000

Software Prices

Product	Description	Charge ($)
NCR Comten Operating System Release 2 (COS 2)	Required for each communications processor	None
ACF/NCP Version 5.2	Required for SNA peer-to-peer networking	Annual license fee: 426-1,701
NCR Comten Communications Alert Facility (CAF)	Network management software for each Comten processor; provides realtime status information, alerts, and reports	Annual license fee: 974-3,897
NCR Comten Overview	Optional personal computer network management software permitting a network operator to monitor the status of multiple local/remote Comten processors	Annual license fee: 2,200-3,024
NCR Comten Support Facility (CSF)	Optional processor software permitting an operator to manage Comten processors from a NetView or Net/Master console	Annual license fee: 3,564-4,600
NCR Comten X.25 Version 2 Release 2	Optional processor software providing X.25 packet assembly/disassembly (PAD) and protocol conversion	Annual license fee: 2,043-8,173
TCP/IP Release 2	Supports communications with hosts and Ethernet LANs using TCP/IP protocols	Purchase price: 10,000

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In this report:

Product Summary

Editor's Note

NCR Comten is no longer actively marketing the 3695 and 5660 Communications Processors. The company is now focusing on the 5600 family, which offers a wide range of performance levels.

Description

The 5600 family includes the entry-level 5620XP, which supports up to 2 hosts and 64 lines; the 5655 midrange, which supports up to 8 hosts and 512 lines; the 5665, which supports up to 8 hosts and 1,024 lines; and the 5675, which supports up to 16 hosts and 1,024 lines.

The 5675, the highest performance SNA-compatible processor in the industry, offers eight to nine times the performance power of the 5620XP. The main storage capacity of the 5665 is 4 to 8 megabytes; of the 5665, 4 to 16 megabytes; and of the 5675, 8 to 16 megabytes.

The 5600 processors support SNA and multivendor environments. Connectivity options support the direct termination of up to 24 T1 lines. The Comten Overview, an intelligent network console facility, centrally controls multiple NCR Comten processors. SNA compatibility enables the processors to send information to the host-based NetView console.

Strengths

The processors accommodate flexible configurations for redundancy and backup. Hardware and software compatibility preserves users' investments. The machines can support up to 64 token-ring LANs.

Limitations

The 5600 family is limited only by the constraints of the technology employed.

Competition

Amdahl 4745, IBM 3745.

Vendor

NCR Comten
2700 Snelling Avenue N.
St. Paul, MN 55113
(612) 638-7777

Price

$122,100 to $254,000.

Analysis

Product Strategy

NCR Comten has streamlined its communications processor line into the 5600 family. The modularly designed machines include the 5620XP entry-level, 5655 midrange, 5665 high-end, and 5675 high-end, high-volume models. NCR based these processors on the architecture of the popular Comten 5660. Hardware and software compatibility runs through the family, as well as to the 5660 and 369X, which are no longer actively marketed.

Although communications processor technology dates back to the early '70s, NCR Comten has endowed its 5600 machines with features of the '90s. The 5675 can support up to 24 T1 interfaces and up to 64 token-ring LANs. Protocols supported include SDLC/SNA, LU6.2, BSC, X.25, and X.21.

Decision Points

The Comten 5600 processors enhance network reliability through a variety of features that support redundancy and backup. The company offers options of one standby processor for each active processor, a method that delivers 100 percent redundancy. For greater cost-effectiveness, one standby processor can backup many active processors. This method allows the backup processor to shoulder the load of one of the processors it backs up.

The modular design of the 5600 processors offers many advantages. Users can adjust to network growth requirements by initiating on-site upgrades and on-site attachments expansion. Modularity allows users to add line, channel, T1, or token-ring connections when needed. The bottom line of modular design is the freedom it conveys to users to invest in equipment only when necessary.

System upgrades, performed at the customer's site, usually require less than four hours for completion. In addition, upgrades do not necessitate modifications in network software or configurations. Upgrading a machine does not require the addition of a second CPU. In Comten 5600 processors, the performance of the CPU is upgraded. This method eliminates the lengthy process of reconfiguring the network to decide which CPU will support lines, LANs, or interfaces.

The Comten Universal Communications Adapter (UCA) eliminates many network headaches. UCA creates up to two active and two backup data paths between the processor and the communications modules. Users can determine the degree of backup or availability required by each network node. Through the UCA, users can back up all segments of their processors and the attached lines. The device enables users to switch among multiple communications processors.

Acting as an automated control facility for NCR Comten processors in a network, the Comten Overview operates in the PC-based system console. Comten Overview operators can create and store often-used command sequences in the system to be automatically activated in response to predefined conditions. Automating commands reduces the possibility of operator errors.

The number of components in the 56X5 family is 40 percent less than previous models. The technology incorporated into the design of the processors is based on application-specific integrated circuitry, which reduces floor space, power, and cooling requirements.

Each Comten 56X5 processor supports up to 64 token-ring interfaces. Support for this large amount of token-ring traffic occurs in an efficient manner because NCR Comten has incorporated intelligence into the processors' token-ring interface modules.

Competitive Position

For 18 years, NCR Comten has been developing, manufacturing, marketing, and servicing data communications systems and networking software. Second to IBM in the market, NCR Comten is the leading vendor of communications processors for the IBM environment. For many years, NCR based its marketing strategy on the concept of making it easy for an IBM user to install an NCR Comten communications processor in an SNA network.

Company Profile NCR Comten

Corporate Headquarters
2700 Snelling Avenue N.
St. Paul, MN 55113
(612) 638-7777

In Canada
NCR Comten
515 Consumers Road,
Suite 100
Willowdale, ON M2J 4Z2
(416) 496-1300

Officers
President: A. Daniel Pigott

Company Background
NCR Comten, a subsidiary of NCR Corporation since 1979, designs, manufactures, services, and markets a variety of data communications equipment, including data communications processors and networking software. The company has specialized in data communications systems since 1968 and ranks second to IBM in offering communications processors for the IBM mainframe environment. In 1972, the company delivered its first IBM-compatible communications processor.

In July 1989, NCR Corporation structured NCR Comten as the Network Products Division within its newly formed General Purpose Products Group (GPPG) and appointed NCR Comten president, A. Daniel Pigott, to head the new division. Primarily, GPPG develops and produces platform products for the corporation.

Acting as the Network Products Division, NCR Comten's charter calls for it to serve as NCR's principal source of goods and services in domestic and international markets for computer networks. In essence, the charter assigns NCR Comten responsibility for the intercommunication of all NCR products, such as LANs, workstations, mainframes, terminals, or geographically dispersed networks.

NCR Comten's responsibilities include developing overall networking strategies and architectures for the NCR Corporation; publishing and formulating network interconnect standards; developing and producing products for chartered offerings; providing network design, integration, and implementation services; providing direct sales and support; and establishing strategic alliances.

In October 1989, the company entered a new area of communications by introducing the NCR 5480 series of packet-switching processors. The NCR 5480 allow users to establish X.25 standards-based wide area networks to attain multivendor connectivity while preserving their SNA investments. NCR Comten's direct sales force markets the 5480.

This year, NCR Comten announced the Bridgeport series of token-ring bridges and related peripherals. Available in three models, the bridges are the 7404, 7604, and 7412. The Bridgeport family enables users to integrate token-ring LANs into wide area networks.

In February 1989, NCR Comten extended an agreement with Alcatel Business Systems Limited, U.K., in which Alcatel continues to receive the rights to market NCR Comten data communications systems. The agreement, entered into in 1977 and extending until 1994, authorizes Alcatel to market, install, and service NCR Comten data communications systems and software in 14 Western European countries.

In recent years, however, NCR has focused on support for multivendor communications and evolving standards. To remain competitive, the company has looked beyond IBM and begun to produce products that interconnect to OSI and ISDN systems. NCR Comten accomplished this goal through the 5600 Communications Processors. In October 1989, NCR Comten announced Comten TCP/IP, which provides multivendor interoperability among devices in SNA and TCP/IP networks.

When configured as a front-end processor, the 5620XP competes against the IBM 3720 processor. When configured as a remote concentrator, however, the 5620XP competes against sophisticated high-end statistical multiplexers from AT&T, Codex, DCA, Infotron, and Timeplex. The 5655, 5665, and 5675 go up against IBM's 3725 and 3745 processors. According to NCR Comten, the high-end 5675 offers up to 2½ times the performance of an IBM 3745.

Characteristics

Overview

The 5600 family includes the entry-level 5620XP, which supports up to 2 hosts and 64 lines; the 5655 midrange, which supports up to 8 hosts and 512 lines; the 5665, which supports up to 8 hosts and 1,024 lines; and the 5675, which supports up to 16 hosts and 1,024 lines.

The processors offer a range of redundancy options, including one standby processor for each active processor to provide 100 percent redundancy. In addition, one standby processor backs up multiple active processors for greater cost-effectiveness. The machines are compatible with SNA architectures, and they can access multivendor equipment. A common software set runs on all 5600 Comten processors.

Universal Communications Adapter (UCA)

The Comten Universal Communications Adapter (UCA) provides up to two active and two back-up data paths between the processor and the communications modules. Through the UCA, users have as an option the capability of backing up all portions of their communications processors and their attached communications lines. The UCA allows users to switch among multiple communications processors, thereby attaining full use of all their processors. When backup occurs, users can switch network traffic off the designated system to other active systems.

The UCA operates by concentrating data from NCR Comten communications line terminal equipment and routing it through the input/output channels of one or more attached NCR Comten processors. For maximum network availability, each Comten UCA implements data routing through two online and two backup channel connections, increasing users' options for data routing during routine or emergency maintenance and for load balancing during peak traffic periods. UCA provides an aggregate throughput of 512K characters per second.

5620XP Processor

The Comten 5620XP supports up to two host processors and can support up to 64 full-duplex or half-duplex lines in any of three configurations: as a front-end processor, as a remote concentrator, or as a front-end processor and remote concentrator.

The NCR Comten 5620XP Communications Processor is hardware/software compatible with IBM host processors and with the Comten 3600 Series. The 5620XP functions as a direct replacement for an IBM 370X or 270X Communications Controller. It uses IBM Virtual Telecommunications Access Method (VTAM), Telecommunications Access Method (TCAM), Advanced Communication Function/Telecommunications Access Method (ACF/TCAM), and ACF/VTAM and provides an IBM 270X/370X-compatible interface through a channel interface adapter.

The 5620XP can handle switching, polling, routing, error recovery, automated dialing, multiplexing, and data concentration. Since the 5620XP does not require special computer room conditions, users can install the unit in an office environment. The system runs all of NCR Comten's networking products and supports various terminals and protocols.

Configuration

A fully configured 5620XP has a CPU, four communications subsystems, a fixed disk drive, and a channel interface adapter for host connections. Each communications subsystem handles up to 16 communications lines. With four communications subsystems, the 5620XP can support up to 64 full- or half-duplex lines and one or two host computers. The Comten 5620XP channel interface adapter unit supports IBM, IBM-compatible, or NCR hosts and asynchronous, bisynchronous, SDLC, and X.25 line protocols. The fixed disk drive supports rapid restart and recovery capabilities and allows virtually unattended remote operation.

The 5620XP's modular architecture employs very large-scale integration (VLSI) technology that provides greater reliability, lowers power consumption, and requires less space (smaller footprint).

Users can replace one or two of the 5620XP's four subsystems with a Comten Integrated Protocol Converter (IPC), which converts asynchronous protocol to bisynchronous protocol for accessing IBM 3270 applications from an asynchronous terminal. Comten IPCs also pass through data from asynchronous terminals without protocol conversion so that the terminals can access both bisynchronous and asynchronous applications without additional hardware or software changes. On the older 5620, the IPC option provided 32 additional lines, allowing the system to support up to 64 lines. On the 5620XP, the addition of IPCs increases maximum system capacity to 96 lines.

56X5 Processors

Based on the architecture of the Comten 5660, the 56X5 processors, which include the 5655, 5665, and 5675 models, can function as channel-attached or remote processors, or perform both functions simultaneously. The processors feature 64K bytes of cache memory and an 80-megabyte hard disk. Separate line termination modules increase network availability through flexible line switching and backup options. To facilitate servicing, each communications base module, connecting up to 16 lines, can be serviced individually without disrupting the remaining active lines.

Table 1. Processor Comparison Chart

	Comten 5620XP	Comten 5655	Comten 5665	Comten 5675
Relative Performance*	0.25	1.0	1.5	2.25
Channel-Connected Hosts	Up to 2	Up to 8	Up to 8	Up to 16
Lines	Up to 64	Up to 512	Up to 1.024	Up to 1,024
T1 Links	NA	Up to 16	Up to 16	Up to 24
Token-Ring LANs	Up to 2	Up to 64	Up to 64	Up to 64
Main Storage (min./max.) (M bytes)	1/4	4/8	4/16	8/16
Fixed Disk Capacity (M bytes)	20	80	80	80
System Console	Yes (optional)	Intelligent	Intelligent	Intelligent

**These figures compare the ability of NCR Comten processors to handle real interactive data communications, not an artificial test environment. The Comten 5655 is used as the baseline for this comparison.*
NA—Not applicable.

Standard with the 56X5 family, the NCR Comten intelligent system console, equipped with Comten Overview, supplies automated responses to user-defined network events. Overview provides help screens and menu interfaces to assist personnel.

Comten 56X5 processors promote token-ring connectivity. They handle token-ring traffic via the intelligence in the processor's token-ring interface module. Each Comten 56X5 processor supports up to 64 token-ring interfaces.

Users can network Comten 56X5 processors with Comten 369X and 56X0 processors, as well as with IBM 3745 and 372X systems. Comten Communications Operating System 2 (COS2) Release 4 runs on the 56X5 processors and on the 369X and 56X0 machines. The 5600 processors offer SNA compatibility and enable SNA networks to communicate with multivendor environments without requiring SNA network changes. As a result of their SNA compatibility, processors can also send information to the host-based NetView console.

The 56X5 processors share line termination equipment with the 369X and 5660 processors, such as 16-Line Communications Bases (CBs), Data Link Control-Modem Interface Modules (DLC-MIMS), High-Speed Link Control (HLC) MIMs, and Integrated Protocol Converters (IPCs).

Configuration

See Table 1.

Transmission Specifications

For line speeds up to 56K/64K bps, Comten Communications Bases effect termination for up to eight lines. For speeds up to 256K bps, the Comten HLC-MIM supplies termination for up to four lines. For speeds up to 1.544M/2.048M bps (T1/E1), Comten T1 Interface Modules provide the termination. The communications processors support up to 24 T1 interfaces.

Software

Comten Advanced Communications Function/Network Control Program (ACF/NCP) Version 5 supports distributed peer-to-peer sessions over wide area SNA networks with minimal host intervention. The program allows Node Type (NT) 2.1 devices to use the Logical Unit (LU) 6.2 protocol to conduct peer-to-peer sessions over wide area SNA networks. This version produces host-independent network statistics not available through the IBM communications processor. Users can initiate and collect these statistics through the NCR Comten console, the Comten Support Facility, or NetView.

ACF/NCP Version 5 resides in a Comten 5620 or in the Comten 56X5 family of communications processors. It is compatible with earlier processor models. Version 5 is functionally compatible with, and provides features found in, IBM's ACF/NCP Version 5 Releases 1 and 2. Capabilities provided by NCR's ACF/NCP Version 5 not found in IBM's version include usage statistics for network tuning, multiple ACF/NCP environments in a single Comten communications processor, and a feature that allows switched-line bisynchronous devices, such as PCs, to access applications in SNA mainframes.

Comten TCP/IP and Comten Ethernet LAN Interface foster interoperability among devices in SNA and TCP/IP networks, allowing users to share resources such as communications lines and to interoperate among various software applications in the network. These products assist users with SNA networks and Ethernet LANs running TCP/IP at local SNA mainframe sites and remote sites.

The TCP/IP/SNA network opens up two-way interoperability among Ethernet LANs using TCP/IP and SNA devices. Devices in the SNA network can interoperate with SNA applications and applications on Ethernet LANs. Similarly, Ethernet LAN devices using TCP/IP

can interoperate with SNA applications, such as file transfer, electronic mail, and remote terminal logon.

In addition, the products enable Ethernet LAN users to interoperate with other local Ethernet devices and remote Ethernet devices without taxing the mainframe. NCR Comten processors can connect up to 48 Ethernet LANs running TCP/IP. Comten TCP/IP can coexist with Simple Network Management Protocol (SNMP) operating in a TCP/IP network. For users who create a centralized system, TCP/IP is included among the products for which NCR Comten offers NetView support. Through the Comten Support Facility (CSF), the NetView operator can issue commands and receive responses to manage NCR Comten products. The operator can also gather statistics on network usage and performance.

Comten OSI/CP. Comten Open Systems Interconnection/Communications Processor (OSI/CP), running in an NCR Comten communications processor, lets OSI end systems interoperate over a single multipurpose wide area network, independent of the mainframe. This direct data path allows end systems to exchange files or electronic mail while freeing applications processing cycles that would otherwise be used for data routing.

The system provides interoperability among OSI end systems located on Ethernet LANs or X.25 networks. In addition, Comten OSI/CP allows these users to access OSI applications on the mainframe. As a network-based solution for integrating OSI, TCP/IP, and SNA networking environments, Comten OSI/CP allows the wide area network infrastructure to be shared by multiple environments.

The host prerequisites for Comten OSI/CP are an IBM or IBM-compatible host processor operating in the OS/MVS, DOS/VSE, or VM environments and running VTAM Version 3 Release 2 or higher. The NCR Comten prerequisites for running OSI/CP are Comten 369X or 5600 communications processors; Comten Communications Operating System (COS2) Release 5 or higher; ACF/NCP Version 4.2 or higher, Comten Network Support Services (NSS2) Release 2 or higher; Comten Language Support System (CLSS1) Release 4 or higher; and Comten Enhanced Generation (EGEN) Release 3 or higher.

In addition, the following products support specific features and capabilities as noted:

- Comten Network Interface Adapter (NIA) with appropriate Ethernet features for the direct attachment of Ethernet LANs to the communications processor, and
- Comten X.25 Version 2 Release 2, including these separately licensed features: NCP Packet Switching Interface (NPSI), Comten Networking System 3 (CNS3) Release 3E or higher, Comten Support Facility Release 1 or higher for NetView support, and Comten TCP/IP Release 1 or higher for TCP/IP support and host applications.

Pricing and Support

The base configuration for the Comten 5655 is $122,100; for the Comten 5665, $187,000; for the Comten 5675, $254,000.

Equipment Prices

		Purchase Price ($)
Comten 5655	Processor, 80MB hard disk, 4MB main storage, remote expansion cabinet, UCA, two 16-Line Communications Bases, 8 RS-232-C Line Interface Features	122,100
Comten 5665	Processor, 80MB hard disk, 4MB main storage, remote expansion cabinet, UCA, two 16-Line Communications Bases, 8 RS-232-C Line Interface Features	187,000
Comten 5675	Processor, 80MB hard disk, 8MB main storage, remote expansion cabinet, UCA, two 16-Line Communications Bases, 8 RS-232-C Line Interface Features	254,000

Software Prices

		Monthly License Fee ($)	Annual License Fee ($)
ACF/NCP V 5	Comten 5620	395	4,345
ACF/NCP V 5	Comten 5655	895	9,845
ACF/NCP V 5	Comten 5665	1,365	15,015
ACF/NCP V 5	Comten 5675	1,575	17,325

Ethernet LAN Interface

		Purchase Price ($)	Monthly Maint.
Ethernet	Interface	8,000	83
Ethernet	Additional interfaces	3,000	50

TC/IP Software

		Initial License Fee ($)	Monthly License Fee ($)	Yearly License Fee ($)
Basic	Communications processor TCP/IP software	10,000	200	2,200
SNA mainframe	Support for file transfer and electronic mail applications (SNA mainframe resident)	12,000	300	3,300
Telnet Client	Communications processor-resident TCP/IP to SNA software	4,000	100	1,100

Unisys Communications Access Processor (CAP)

In this report:

Datapro Summary

Unisys offers a solution for integrating IBM SNA and UNIX-based LAN environments, providing shared access to applications and resources in both worlds. The Communications Access Processor (CAP), available in two models, supports direct attachment of UNIX-based LAN servers and IBM 3270 SNA terminals, controllers, and other devices. CAP maps between IBM and UNIX applications, enabling any device to establish application sessions and access resources on either processing platform.

Strengths

- CAP establishes and manages SNA sessions independently of the IBM host.
- It provides PU Type 5 functionality rather than emulating 3270 PU Type 2 devices; therefore, it does not require configuration of CAP-attached devices within ACF/VTAM and ACF/NCP. CAP reduces, rather than increases, host and controller processing overhead in an SNA network.
- CAP provides LAN routing, peer-to-peer networking, and SNA-to-Ethernet LAN gateway functionality.
- In addition to SNA, CAP supports TCP/IP and X.25 protocols, allowing a gradual migration to open networking.

Limitations

- CAP does not support IBM host channel connections directly. It connects to IBM's 3745 and 3174 communications controllers via transmission groups. This, however, is an important safety feature rather than a disadvantage; CAP does not alter the existing SNA network or host processing platform in any way.
- Data rates for wide area networking trunks are limited to 64K bps.

Competition

IBM, McDATA Corp., and Apertus Technologies.

Corporate Headquarters

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424, U.S.A.
Tel: +1 215 542 4011
Fax: +1 215 986 4386

Prices

CAP/200 and CAP/250 base pricing starts at $70,685 and $94,362, respectively (U.S.).

—By Martin Dintzis
Assistant Analyst

Product Analysis

The Communications Access Processor (CAP) family, comprising the CAP/200 and CAP/250 models, integrates SNA networks and UNIX LAN environments. CAP implements a subset of the IBM mainframe's System Services Control Point (SSCP). Appearing as both a Physical Unit Type 4 and 5, CAP establishes and manages SNA sessions for both IBM and UNIX-based devices independently of the IBM host computer.

CAP supports direct attachment of IBM SNA controllers and terminal devices as well as UNIX-based LAN servers. It is interoperable with both Unisys and non-Unisys UNIX workstation environments. The CAP-attached workstation or LAN server, however, must be a Unisys U 6000 model. CAP establishes links to IBM host facilities and other CAP processors over 64K bps wide area SNA/SDLC or X.25 trunks or the Ethernet LANs.

Special software running on a UNIX server provides mapping between SNA and UNIX applications, allowing any device to access any application. Tying into a UNIX application, for example, a 3270 terminal user can take advantage of UNIX's pull-down menus, context-sensitive help, and other tools and features while preserving the 3270 terminal interface.

CAP/200, a 30-inch-high office environment processor, supports up to twenty-eight ports and/or trunks, including as many as twenty-eight 9600 bps RS-232-C, fourteen 19.2K bps RS-232-C, two 64K bps V.35, and two 10M bps Ethernet LAN connections.

CAP/250 is a 64-inch-high, triple-rack, computer room processor. In a single-rack configuration, CAP/250 provides the same capacity as the CAP/200. The CAP/250's other two racks increase its capacity to one hundred fifty-six 9600 bps or seventy-eight 19.2K bps trunks and/or ports, six 64K bps V.35 trunks, and six Ethernet LAN connections.

Target Markets

A multifunction product, CAP provides the features of an intelligent switch, a concentrator, a protocol converter, a LAN bridge, and a LAN router. All of these capabilities enable it to effectively integrate host and LAN processing platforms. Users of Communications Access Processors include engineering and manufacturing firms, airlines, financial service organizations, and research and educational institutions.

Strengths

CAP preserves user investment in SNA technology while allowing smooth migration to LAN-based processing. It accomplishes this without addition or modification to host software.

CAP reduces, rather than increases, host and controller processing overhead in an SNA network. It establishes and manages SNA sessions independently of the IBM host. Since it provides Physical Unit Type 5 functionality rather than emulating a 3270 Physical Unit Type 2 device, CAP-attached workstations and terminal devices require no configuration within ACF/VTAM and ACF/NCP.

CAP offers full network routing capability for attached terminal and controllers. It also provides LAN routing, Physical Unit Type 2.1 Low Entry Networking (LEN) capability for peer-to-peer networking, and SNA-to-Ethernet LAN gateway functionality for UNIX processors.

In addition to SNA, CAP supports TCP/IP and X.25 protocols, allowing the user to gradually migrate to an open networking environment.

Limitations

CAP does not support direct IBM host channel attachment. It accesses hosts indirectly through IBM 3745 and 3174 communications controllers. This is an advantage rather than a disadvantage, however. CAP does not alter the existing SNA network or host processing platform in any way, making it a safe networking solution.

CAP does not support fractional or full T1 data rates for wide area trunks; data rates up to 64K bps are supported via a V.35 interface.

Competitive Analysis

Unisys CAP competes with communications processors from IBM, McDATA Corp., and Apertus Technologies. In LAN-to-host communications, CAP complements the IBM 3745, which provides direct host channel attachment. In LAN/WAN communications, CAP can replace the 3745. Although the 3745 now supports an Ethernet TCP/IP LAN gateway, participating LAN workstations must run 3270 terminal emulation software.

Apertus Technologies' *Datastar 3270 Access Hub* and *Datastar 6800 TCP/IP LAN-to-Host Gateway* are communications processors offering bidirectional interoperability between IBM 3270 or Digital VT100/220 terminals and Ethernet or token-ring LAN environments. They accomplish this by performing terminal emulation for LAN workstations and TELNET emulation for dumb terminals. The Datastar 6800 supports FTP access to IBM host resources without TCP/IP or FTP software on the host computer.

McDATA's LinkMaster 7100 Network Controller, an IBM 3174-compatible product, offers TELNET Client support, enabling both 3270 coax and ASCII displays attached to the LinkMaster 7100 to interact with a remote Ethernet- or token-ring-based UNIX host. The LinkMaster 7100 also provides 3270 emulation for UNIX workstations and PCs.

Overview

Models	Design	Date First Released	Base Purch. Price (US$)
CAP/200	Rackmount	September 1992	70,685
CAP/250	Rackmount	September 1992	94,362

Vendor Analysis

Regional Addresses

United States

Central Group
One Unisys Center
Suite 901
Lombard, Illinois 60148
Tel: +1 708 810 8000

Eastern Group
Two Oak Way
Berkeley Heights, New Jersey 07922
Tel: +1 908 771 5307

Southern Group
4151 Ashford Dunwoody Road, NE
Suite 600E
Atlanta, Georgia 30319
Tel: +1 404 851 3000

Western Group
5 Hutton Center Drive
Suite 1200
Santa Ana, CA 92707
Tel: +1 714 755 4700

Europe

Unisys Europe Africa, Ltd.
Bakers Court, Bakers Road
Uxbridge
Middlesex, UB8 1RG, England
Tel: +44 895 237137

Asia

Unisys Pacific Asia Americas Div.
P.O. Box 500
Blue Bell, Pennsylvania 19424-0001
Tel: +1 215 986 7007
Unisys markets a full line of products, including display terminals, personal computers, high-performance multitasking/multiuser workstations, UNIX-based minicomputers, and mainframe systems. All these products interoperate with each other and with other vendors' systems in an open computing environment.

Marketing Strategy

The vendor's strategy is to place open standards at the base of its information networks while allowing customers to continue using proprietary systems providing greater functionality than newer open systems. CAP, for example, is designed to enable users to migrate gradually from a hierarchical SNA environment to an Ethernet LAN/WAN implementation.

Market Position

Unisys is a leader in open networking solutions featuring IBM SNA connectivity.

Interoperability Matrix

Product Family	Communications Access Processor (CAP)
Relationship With Higher-Level Elements	
Position in Network Architecture	Supports IBM 3270 SNA mainframe and UNIX-based Ethernet LAN environments. Appears to the IBM host as both an SNA Physical Unit Type 4 and 5. Supports Physical Unit Type 2, 2.1, 4, and 5 devices.
Host Software Required:	
Operating System	Requires no host software installation or modification. Works with MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, and VSE/SP.
Access Method	VTAM
Network Management Support	Works with IBM NetView; can also be configured and managed from a local or remote display terminal.
Relationship With Peer-Level Elements	
Compatible Communications Controllers	IBM 3745 and 3174.
Transport Architectures Supported	IBM 3270 SNA, TCP/IP, and X.25.
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to 64K bps private lines using a V.35 interface.
Packet Switched Network Support	Supports access to an X.25 packet switched network using a V.35 or RS-232-C interface.
LAN Attachment Support	Supports UNIX applications running on Ethernet IEEE 802.3 LANs and standalone workstations.

Sales and Distribution Strategy

Unisys offers CAP for purchase only. Distribution channels consist of both direct and indirect sales. Direct sales are made through marketing and service offices in over 50 countries worldwide. The vendor offers a Government Services Administration (GSA) schedule.

Unisys distributes its products through a direct sales force in over 50 countries worldwide and a network of third-party distributors, value-added resellers, and original equipment manufacturers across about 100 countries worldwide. The vendor's commercial market is divided into three geographical areas. The United States Information Systems (USIS) is based in Blue Bell, Pennsylvania, U.S.A.; the Europe-Africa Div. (EAD) is based in Uxbridge, England; and the Pacific Asia-America Div. (PAAD) is also based in Blue Bell, Pennsylvania. In addition, the Unisys Defense units are based in McLean, Virginia, U.S.A.

Support

Warranty

Unisys warrants that its equipment will be free from defects in material and workmanship for a period of 12 months from its installation date.

Support Services

Unisys offers a wide range of services from support centers across the United States and around the world. These services include network planning, implementation, testing, systems integration, customer training, outsourcing, hotline support, remote diagnostics, and onsite maintenance.

In the U.S., Unisys provides on-site service through several regional branches. Remote diagnostics is made possible through CAP's *Maintenance and Control Feature*, which provides a means of monitoring and displaying various CAP status and control signals, both locally and from a remote location.

Service Providers

Unisys provides direct support and service in the U.S. and in other more than 50 other countries.

Service Locations

Unisys has 90 service locations in the United States. Users can access the main support center in Roseville, Minnesota, through (800) 422-8466 for hardware difficulties or (800) 422-0440 for software difficulties. All support centers have access to a historical database of reported problems and their resolutions. Around the world, each regional Unisys sales center provides direct customer support. The major support center for Europe and Africa is located in Middlesex, England.

Service Hours

Support is available 24 hours a day, 365 days a year in each supported region worldwide.

Training/Education

Through educational courses, Unisys provides its customers with the skills to design, configure, manage, and operate a CAP-based network. In the U.S., these courses are conducted at any of five major education centers in Atlanta; Washington, DC; Philadelphia; Chicago; or southern California. The vendor also has an education and training facility in Milton Keynes, England.

Unisys also provides a number of self-study courses. Areas of instruction offered by the vendor include the following:

- Data Communications Concepts
- Introduction to TCP/IP
- Open Systems Interconnection (OSI) Concepts
- Client/Server Distributed Databases and Networks
- Enterprise Network Management

Specifications

Features/Functions

Models	CAP/200	CAP/250
Hardware Features		
Number of CPUs	1	1
Internal Memory Capacity (bytes of RAM)	4M standard; 8M optional.	4M standard; 8M optional.
Hard Drive Capacity	80M	80M
Diskette Drive Capacity	1.44M, 3.5 inch	1.44M, 3.5 inch
Transmission Features		
Maximum Number of Communications Interfaces (ports and/or trunks)	28	156
Maximum Number of Low-Speed Connections (bps)	Twenty-eight 9600 RS-232-C interfaces.	One hundred fifty-six 9600 RS-232-C interfaces.

Features/Functions (Continued)

Models	CAP/200	CAP/250
Transmission Features (Continued)		
Maximum Number of Medium-Speed Connections (bps)	Fourteen 19.2K RS-232-C interfaces.	Seventy-eight 19.2K RS-232-C interfaces.
Maximum Number of High-Speed Connections (bps)	Two 64K V.35 interfaces.	Six 64K V.35 interfaces.
Maximum Number of Ethernet LAN Connections (bps)	Two 10M Ethernet LAN interfaces.	Six 10M Ethernet LAN interfaces.
Software Features		
Host Independence	Requires no software modification or addition on the IBM mainframe. Implements a subset of the mainframe SNA System Services Control Point (SSCP), allowing CAP to establish and manage SNA sessions independently of the host.	Requires no software modification or addition on the IBM mainframe. Implements a subset of the mainframe SNA System Services Control Point (SSCP), allowing CAP to establish and manage SNA sessions independently of the host.
	Since CAP provides PU Type 5 functionality, it does not require configuration of CAP-attached terminals within ACF/VTAM, and it does not increase mainframe processing due to device contention.	Since CAP provides PU Type 5 functionality, it does not require configuration of CAP-attached terminals within ACF/VTAM, and it does not increase mainframe processing due to device contention.
Multivendor Networking	Supports the direct connection of 3270 SNA terminal devices for access to both IBM mainframe and UNIX application environments. The UNIX LAN server defines and implements a presentation interface between IBM 3270 terminals and UNIX applications. This definition includes three levels of screen and application mapping.	Supports the direct connection of 3270 SNA terminal devices for access to both IBM mainframe and UNIX application environments. The UNIX LAN server defines and implements a presentation interface between IBM 3270 terminals and UNIX applications. This definition includes three levels of screen and application mapping.
	Also provides SNA session management for non-SNA devices. Supports TCP/IP and X.25 architectures along with SNA.	Also provides SNA session management for non-SNA devices. Supports TCP/IP and X.25 architectures along with SNA.
Intelligent Routing	Offers full SNA network and LAN routing capability for all attached terminals and workstations. Provides automatic rerouting around failed network hosts and components.	Offers full SNA network and LAN routing capability for all attached terminals and workstations. Provides automatic rerouting around failed network hosts and components.

Network Management Functions

Fault/Problem Management	During power-up, CAP performs diagnostic tests and reports any problems to the user. CAP can be monitored locally, through an attached display terminal, or remotely, through IBM NetView. NetView permits the user to examine information related to the SNA network and to access problem determination information generated at network nodes.
Configuration Management	CAP reinitializes from local disk storage, which can contain multiple copies of both system software and network configuration.
Performanace/Accounting Management	Network events and statistical records are generated by CAP and optionally recorded to disk. These events can also be forwarded to NetView for host processing.
Security Management	CAP restricts access to its network control facility through password security.

Configuration

Components

Products	Description
Enclosure	CAP/200 components are housed in a 30-inch-high cabinet. CAP/250 components are enclosed in a triple-rack unit 64 inches in height.
Input/Output Module (IOM)	The IOM in CAP/200 contains a total of 16 slots. Four of these slots house the 32-bit custom-designed CPU, main memory, an 80MB hard disk, and dual power supplies. The remaining 12 slots accommodate various combinations of the Line Modules (LMs) (described below). CAP/250 contains this same IOM, while optionally supporting up to two additional IOMs. Optional IOMs can control up to 16 LMs each; they include dual power supplies but no CPU, main memory, or hard disk.
802.3 Line Module	Provides one 10M bps Ethernet LAN Interface; occupies one slot in the CAP processor. Up to two of these LMs can be installed in an IOM.
4X1 Synchronous Line Module	Provides four 9600 bps or two 19.2K bps RS-232-C interfaces. Any number can be installed in an IOM, each LM occupying one slot.

Configuration (Continued)

Components (Continued)

Products	Description
RS-232-C Medium Speed Line Module	Provides one 19.2K bps RS-232-C interface. Any number can be installed in an IOM, each LM occupying one slot.
V.35 High Speed Line Module	Provides one 64K bps V.35 interface. Up to two can be installed in an IOM, each LM occupying two slots.
Power Control Module	Regulates and monitors AC/DC power and fan operation. Also provides two RS-232-C interfaces, which can be used for network management console attachment and remote diagnostics. Each unit includes one of these.

Configuration Rules

Models	Description
CAP/200	A base configuration includes one Input Output Module (IOM) containing the CPU, 4MB of main memory, an 80MB hard disk, dual power supplies, dual RS-232-C Medium Speed Line Modules, one V.35 High Speed Line Module, and one 802.3 LAN Line Module. Seven unused IOM slots can accommodate additional Line Modules with a maximum of one additional V.35 High Speed and one additional 802.3 LAN LM (see previous table). Expansion to 8MB of memory is optional.
CAP/250	CAP/250 is a triple-rack product. At present, however, a single-rack configuration providing the same modular components is available. In the future, users can fill each of the two extra racks with optional IOMs, each supporting up to 16 LMs (with a maximum of two V.35 High Speed and two 802.3 LAN LMs per IOM).

Physical Environment

Models	CAP/200	CAP/250
Physical Specifications:		
(H x W x D, in.)	30.4 x 24.0 x 30.0	64 x 24 x 30
(H x W x D, mm.)	772 x 610 x 762	1,536.0 x 609.6 x 762.0
Electrical Specifications	110/220 V AC, 50-60 Hz	110/220 V AC, 50-60 Hz
Environmental Specifications:		
Operating Temperature (°F)	50-93	50-93
Operating Temperature (°C)	10-34	10-34
Humidity (noncondensing)	20%-80%	20%-80%

Pricing

Unisys Communications Access Processor (CAP)

Models	Description	Price (US$)
CAP/200	Includes dual RS-232-C Medium Speed Line Modules, one V.35 High Speed Line Module, one 802.3 LAN Line Module, and a network management console.	70,685
CAP/250	Includes dual RS-232-C Medium Speed Line Modules, one V.35 High Speed Line Module, one 802.3 LAN Line Module, and a network management console. Expansion to two or three racks will be available in the future.	94,362

Software Prices

Product	Description	Price (US$)
IS-6000	Software for a Unisys U 6000 LAN server providing UNIX-to-3270 conversion capabilities.	2,200 to 8,250

■

Unisys Communications Access Processor (CAP)

In this report:

Note: Unisys has introduced a new solution for integrating IBM SNA and UNIX-based LAN environments, providing shared access to applications and resources in both worlds.

Communications Access Processor, available in two models, supports direct attachment of UNIX-based LAN servers; and IBM 3270 SNA terminals, controllers, and other devices. CAP maps between IBM and UNIX applications, enabling any device to establish application sessions and access resources on either processing platform.

Strengths

- CAP establishes and manages SNA sessions independently of the IBM host.
- It provides PU Type 5 functionality rather than emulating 3270 PU Type 2 devices; therefore, it does not require configuration of CAP-attached devices within ACF/VTAM and ACF/NCP. CAP reduces, rather than increases, host and controller processing overhead in an SNA network.
- CAP provides LAN routing, peer-to-peer networking, and SNA-to-Ethernet LAN gateway functionality.
- In addition to SNA, CAP supports TCP/IP and OSI protocols, allowing a gradual migration to open networking.

Limitations

- CAP does not support IBM host channel connections directly. It connects to IBM's 3745 and 3174 communications controllers via transmission groups. This, however, is an important safety feature rather than a disadvantage; CAP does not alter the existing SNA network or host processing platform in any way.
- Data rates for wide area networking trunks are limited to 64K bps.

Competition

In LAN-to-host communications, CAP complements the IBM 3745, 3174, and compatibles. In LAN/WAN communications, however, it can replace these products.

Vendor

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424
(215) 542-4011
In Canada:
2001 Sheppard Avenue East
North York, ON M2J 4Z7
(416) 495-0515

Prices

CAP/200 and CAP/250 base pricing starts at $70,685 and $94,362, respectively. **GSA Schedule:** Yes.

—By Martin Dintzis
Assistant Analyst

Product Analysis

The Communications Access Processor (CAP) family, comprising the CAP/200 and CAP/250 models, integrates SNA networks and UNIX LAN environments. CAP implements a subset of the IBM mainframe's System Services Control Point (SSCP). Appearing as both a Physical Unit Type 4 and 5, CAP establishes and manages SNA sessions for both IBM and UNIX-based devices independently of the IBM host computer.

CAP supports direct attachment of both IBM SNA terminals, controllers, and UNIX-based LAN servers. CAP supports both Unisys and non-Unisys UNIX workstation environments. The CAP-attached workstation or LAN server, however, must be a Unisys U 6000 model. CAP establishes links to IBM host facilities and other CAP processors over either 64K bps SNA/SDLC or X.25 wide area trunks or the Ethernet LANs.

Special software running on a UNIX server provides mapping between SNA and UNIX applications, allowing any device to access any application. Tying into a UNIX application, for example, a 3270 terminal user can take advantage of UNIX's pull-down menus, context-sensitive help, and other tools and features while preserving the 3270 terminal interface.

CAP/200, a 30-inch-high office environment processor, supports up to twenty-eight ports and/or trunks, including as many as twenty-eight 9600 bps RS-232-C, fourteen 19.2K bps RS-232-C, two 64K bps V.35, and two 10M bps Ethernet LAN connections.

CAP/250 is a 64-inch-high, triple-rack, computer room processor. In its initial release, however, it supports a single-rack configuration providing the same capacity as the CAP/200. In June 1993 Unisys will introduce expansion options for the other two CAP/200 racks, increasing its capacity to one-hundred-fifty-six 9600 bps or seventy-eight 19.2K bps trunks and/or ports, six 64K bps V.35 trunks, and six Ethernet LAN connections.

Target Applications

A multifunction product, CAP provides the features of an intelligent switch, a concentrator, a protocol converter, a LAN bridge, and a LAN router. All of these capabilities enable it to effectively integrate host and LAN processing platforms.

Strengths

CAP preserves user investment in SNA technology, while allowing smooth migration to LAN-based processing. It accomplishes this without addition or modification to host software.

CAP reduces, rather than increases, host and controller processing overhead in an SNA network. It establishes and manages SNA sessions independently of the IBM host. Since it provides Physical Unit Type 5 functionality rather than emulating a 3270 Physical Unit Type 2 device, CAP-attached workstations and terminal devices require no configuration within ACF/VTAM and ACF/NCP.

CAP offers full network routing capability for attached terminal and controllers. It also provides LAN routing, Physical Unit Type 2.1 Low Entry Networking (LEN) capability for peer-to-peer networking, and SNA-to-Ethernet LAN gateway functionality for UNIX processors.

In addition to SNA, CAP supports TCP/IP and OSI protocols, allowing the user to gradually migrate to an open networking environment.

Limitations

CAP does not support direct IBM host channel attachment. It accesses hosts indirectly through IBM 3745 and 3174 communications controllers. This is an advantage rather than a disadvantage. CAP does not alter the existing SNA network or host processing platform in any way, making it a very safe networking solution.

CAP does not support fractional or full T1 data rates for wide area trunks; data rates up to 64K bps are supported via a V.35 interface.

Competitive Analysis

No other existing product provides a seamless link between SNA and UNIX-based Ethernet LANs. Although the IBM 3745 now supports an Ethernet TCP/IP LAN gateway, participating LAN workstations must run 3270 terminal emulation software.

Overview

Models	CAP/200	CAP/250
Product Type	A multifunction communications controller providing intelligent switching, concentration, protocol conversion, and LAN routing.	A multifunction communications controller providing intelligent switching, concentration, protocol conversion, and LAN routing.
Design	Rack mount	Rack mount
Date First Released	September 1992	September 1992
Base Price ($)	70,685	94,362

Decision Points

Product Family	Requirements	Comments
Communications Access Processor (CAP)	High Throughput	Supports connections to 10M bps Ethernet LANs and 64K bps wide area network links.
	Multivendor Connectivity	Supports direct attachment of 3270 SNA and UNIX LAN servers. Provides shared access to both IBM SNA and UNIX applications and network resources for all CAP-attached devices.
	Host-Independent Networking	Implements a subset of the mainframe SNA System Services Control Point (SSCP), allowing CAP to manage SNA sessions independently of the host. Does not require configuration of CAP- or network-attached devices within ACF/VTAM or ACF/NCP.
	Network Management	NetView access provided.

Vendor Analysis

Marketing Strategy

Unisys markets a full line of products, including display terminals, personal computers, high-performance multitasking/multiuser workstations, UNIX-based minicomputers, and mainframe systems. All these products interoperate with each other and with other vendors' systems in an open computing environment.

The vendor's strategy is to place open standards at the base of its information networks while allowing customers to continue using proprietary systems providing greater functionality than newer open systems.

Target Markets

Users of Communications Access Processors include engineering and manufacturing firms, airlines, financial service organizations, and research and educational institutions.

Market Position

Unisys is a leader in open networking solutions featuring IBM SNA connectivity.

Major Competitors

The communications processor market includes few major competitors. IBM dominates the scene, followed by NCR and Amdahl which market 3745-compatible controllers.

In LAN-to-host communications, CAP complements the IBM 3745, which provides direct host channel attachment. In LAN/WAN communications, CAP can replace the 3745.

Sales and Distribution Strategy

Sales

Unisys and its resellers offer CAP for purchase only.

Distribution

With operations in about 100 countries, Unisys distributes its products through its own sales force, third-party distributors, and value-added resellers. The vendor's commercial market is divided into three geographical areas. The United States Information Systems (USIS) is based in Blue Bell, PA; the Europe-Africa Div. (EAD) is based in Uxbridge, England; and the Pacific Asia-America Div. (PAAD) is also based in Blue Bell. In addition, the Unisys Defense units are based in McLean, VA.

Support

Policies and Programs

Warranty

Unisys warrants that its equipment will be free from defects in material and workmanship for a period of 12 months from its installation date.

Support Services

Unisys offers a wide range of services from support centers across the United States and around the world. These services include network planning, implementation, testing, systems integration, customer training, outsourcing, hot line support, remote diagnostics, and on-site maintenance.

In the U.S., Unisys provides on-site service through several regional branches. Remote diagnostics is made possible through CAP's *Maintenance and Control Feature*, which provides a means of monitoring and displaying various CAP status and control signals, both locally and from a remote location.

Interoperability Matrix

Product Family	Communications Access Processor (CAP)
Relationship With Higher-Level Elements	
Position in Network Architecture	Supports IBM 3270 SNA mainframe and UNIX-based Ethernet LAN environments. Appears to the IBM host as both an SNA Physical Unit Type 4 and 5; supports Physical Unit Type 2, 2.1, 4, and 5 devices.
Host Software Required:	
Operating System	Requires no host software installation or modification. Works with MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, and VSE/SP.
Access Method	VTAM
Network Management Support	Works with IBM NetView; can also be configured and managed from a local or remote display terminal.
Relationship With Peer-Level Elements	
Compatible Communications Controllers	IBM 3745 and 3174
Transport Architectures Supported	IBM 3270 SNA, TCP/IP, X.25, and OSI
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to 64K bps private lines using a V.35 interface.
Packet Switched Network Support	Supports access to an X.25 packet switched network using a V.35 or RS-232-C interface.
LAN Attachment Support	Supports UNIX applications running on Ethernet IEEE 802.3 LANs and standalone workstations.

Service Providers
Domestically, Unisys provides direct support and service.

Service Locations
Unisys has 90 sales/service locations in the United States. Users can access the main support center in Roseville, MN, through (800) 422-8466 for hardware difficulties or (800) 422-0440 for software difficulties. All support centers have access to a historical database of reported problems and their resolutions.

Service Hours
Support is available 24 hours a day, 365 days a year.

Training/Education
Through educational courses, Unisys provides its customers with the skills to design, configure, manage, and operate a CAP-based network. These courses are normally conducted in the U.S. at any of five major education centers in Atlanta; Washington, DC; Philadelphia; Chicago; or southern California. Unisys also provides a number of self-study courses. Areas of instruction offered by the vendor include the following:

- Data Communications Concepts
- Introduction to TCP/IP
- Open Systems Interconnection (OSI) Concepts
- Client/Server Distributed Databases and Networks
- Enterprise Network Management

Competitors' Programs
Support offered by NCR, Amdahl, and Unisys is closely patterned after IBM support services. No vendor seeking to compete in the market for SNA-compatible networking products could succeed otherwise. Services offered by IBM, NCR, and Amdahl include installation, round-the-clock maintenance and hot line support, remote diagnostics, and education.

Specifications

Features/Functions

Models	CAP/200	CAP/250
Hardware Features		
Number of CPUs	1	1
Internal Memory Capacity (bytes of RAM)	4M standard; 8M optional	4M standard; 8M optional
Hard Drive Capacity	80M	80M
Diskette Drive Capacity	1.44M, 3.5 inch	1.44M, 3.5 inch
Transmission Features		
Maximum Number of Communications Interfaces (ports and/or trunks)	28	156 *(1)*
Maximum Number of Low-Speed Connections	Twenty-eight 9600 bps RS-232-C interfaces	One hundred fifty-six 9600 bps RS-232-C interfaces *(1)*
Maximum Number of Medium-Speed Connections	Fourteen 19.2K bps RS-232-C interfaces	Seventy-eight 19.2K bps RS-232-C interfaces *(1)*
Maximum Number of High-Speed Connections	Two 64K bps V.35 interfaces	Six 64K bps V.35 interfaces *(1)*
Maximum Number of Ethernet LAN Connections	Two 10M bps Ethernet LAN interfaces	Six 10M bps Ethernet LAN interfaces *(1)*
Software Features		
Host Independence	Requires no software modification or addition on the IBM mainframe. Implements a subset of the mainframe SNA System Services Control Point (SSCP), allowing CAP to establish and manage SNA sessions independently of the host.	Requires no software modification or addition on the IBM mainframe. Implements a subset of the mainframe SNA System Services Control Point (SSCP), allowing CAP to establish and manage SNA sessions independently of the host.
	Since CAP provides PU Type 5 functionality, it does not require configuration of CAP-attached terminals within ACF/VTAM, and it does not increase mainframe processing due to device contention.	Since CAP provides PU Type 5 functionality, it does not require configuration of CAP-attached terminals within ACF/VTAM, and it does not increase mainframe processing due to device contention.
Multivendor Networking	Supports the direct connection of 3270 SNA terminal devices for access to both IBM mainframe and UNIX application environments. The UNIX LAN server defines and implements a presentation interface between IBM 3270 terminals and UNIX applications. This definition includes three levels of screen and application mapping.	Supports the direct connection of 3270 SNA terminal devices for access to both IBM mainframe and UNIX application environments. The UNIX LAN server defines and implements a presentation interface between IBM 3270 terminals and UNIX applications. This definition includes three levels of screen and application mapping.
	Also provides SNA session management for non-SNA devices. Supports TCP/IP and X.25 architectures along with SNA.	Also provides SNA session management for non-SNA devices. Supports TCP/IP and X.25 architectures along with SNA.
Intelligent Routing	Offers full SNA network and LAN routing capability for all attached terminals and workstations. Provides automatic rerouting around failed network hosts and components.	Offers full SNA network and LAN routing capability for all attached terminals and workstations. Provides automatic rerouting around failed network hosts and components.

(1) Although CAP/250 enclosure supports three racks, the initial release of the product supports a single rack providing the same capacity as CAP/200. In June 1993 Unisys will introduce an expansion module for each of the two extra shelves, increasing the maximum capacity to the values listed here.

Network Management Functions

Fault/Problem Management	During power-up, CAP performs diagnostic tests and reports any problems to the user. CAP can be monitored locally, through an attached display terminal, or remotely, through IBM NetView. NetView permits the user to examine information related to the SNA network and to access problem determination information generated at network nodes.
Configuration Management	CAP reinitializes from local disk storage, which can contain multiple copies of both system software and network configuration.
Performance/Accounting Management	Network events and statistical records are generated by CAP and optionally recorded to disk. These events can also be forwarded to NetView for host processing.
Security Management	CAP restricts access to its network control facility through password security.

Configuration

Components

Products	Description
Enclosure	CAP/200 components are housed in a 30-inch-high cabinet. CAP/250 components are enclosed in a triple-rack unit 64 inches in height.
Input/Output Module (IOM)	The IOM in CAP/200 contains a total of 16 slots. Four of these slots house the 32-bit custom-designed CPU, main memory, an 80MB hard disk, and dual power supplies. The remaining 12 slots accommodate various combinations of the Line Modules (LMs) (described below). CAP/250 contains this same IOM, while optionally supporting up to two additional IOMs. Optional IOMs can control up to 16 line modules each; they include dual power supplies but no CPU, main memory, or hard disk.
802.3 LAN Line Module	Provides one 10M bps Ethernet LAN Interface; occupies one slot in the CAP processor. Up to two of these Line Modules (LMs) can be installed in an IOM.
4X1 Synchronous Line Module	Provides four 9600 bps or two 19.2K bps RS-232-C interfaces. Any number can be installed in an IOM, each LM occupying one slot.
RS-232-C Medium Speed Line Module	Provides one 19.2K bps RS-232-C interface. Any number can be installed in an IOM, each LM occupying one slot.
V.35 High Speed Line Module	Provides one 64K bps V.35 interface. Up to two can be installed in an IOM, each LM occupying two slots.
Power Control Module	Regulates and monitors AC/DC power and fan operation. Also provides two RS-232-C interfaces, which can be used for network management console attachment and remote diagnostics. Each unit includes one of these.

Configuration Rules

Models	Description
CAP/200	A base configuration includes one Input Output Module (IOM) containing the CPU, 4MB of main memory, an 80MB hard disk, dual power supplies, dual RS-232-C Medium Speed Line Modules, one V.35 High Speed Line Module, and one 802.3 LAN Line Module. Seven unused IOM slots can accommodate additional Line Modules with a maximum of one additional V.35 High Speed and one additional 802.3 LAN LM (see previous table). Expansion to 8MB of memory is optional.
CAP/250	CAP/250 is a triple-rack product. At present, however, a single-rack configuration providing the same modular components is available. In the future, users can fill each of the two extra racks with optional IOMs, each supporting up to 16 LMs (with a maximum of two V.35 High Speed and two 802.3 LAN LMs per IOM).

Physical Environment

Models	CAP/200	CAP/250
Physical Specifications (H x W x D, in.)	30.4 x 24.0 x 30.0	64 x 24 x 30
Electrical Specifications	110/220 V AC, 50-60 Hz	110/220 V AC, 50-60 Hz
Environmental Specifications:		
Operating Temperature (°F)	50-93	50-93
Humidity (noncondensing)	20%-80%	20%-80%

Pricing

Equipment Prices

Models	Description	Purchase Price ($)
CAP/200	Includes dual RS-232-C Medium Speed Line Modules, one V.35 High Speed Line Module, one 802.3 LAN Line Module, and a network management console.	70,685
CAP/250	Includes dual RS-232-C Medium Speed Line Modules, one V.35 High Speed Line Module, one 802.3 LAN Line Module, and a network management console. Expansion to two or three racks will be available in the future.	94,362

Software Prices

Product	Description	Purchase Price ($)
IS-6000	Software for a Unisys U 6000 LAN server providing UNIX-to-3270 conversion capabilities.	2,200 to 8,250

Unisys DCP Series Communications Processors

In this report:

Note: Unisys has released the DCP/600 Series of fault-tolerant processor models. Designed primarily for LAN internetworking, these models offer a distributed internal processing architecture, component redundancy, and dual-partition configuration options. Unisys has released FDDI LAN support and has announced future token-ring LAN support.

Datapro Summary

The DCP family consists of the DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, DCP/55, DCP/614, DCP/624, and DCP/628 models. They support from 11 to over 1,800 communications lines, depending on the model. Distributed Communications Processor (DCP) processors can function as front-end processors, intelligent switches and routers, LAN-to-host gateways, remote concentrators, or a mixture of these. Telcon and SNA/net software provide the capability to integrate DCPs and their Unisys 1100/2200 hosts into many environments, including IBM SNA and BSC, OSI, and TCP/IP networks.

Strengths

The DCP Series provides extensive multiprotocol support, letting users establish links between different host computers and local area networks.

- An NT 2.1 feature, part of the DCP's SNA/net software, provides IBM LU6.2 functionality for peer-to-peer networking.
- The DCP's modular architecture facilitates configuration and maintenance. Users can add or remove hardware and software, reconfigure portions of the system, and activate memory dumps without interrupting system performance.
- DCPs offer redundant power supplies, power controls, processing modules, and processor partitions, with automatic switchover to the backup modules or systems.

Limitations

- Communications processors such as the DCP Series must compete with a new breed of devices, multiprotocol routers, which offer a streamlined approach to LAN internetworking.
- DCPs do not support IBM's ESCON fiber optic channel.

—By Martin Dintzis
Assistant Analyst

Vendor

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19422
(215) 542-4011
In Canada:
2001 Sheppard Avenue East
North York, ON M2J 4Z7
(416) 495-0515

Competition

IBM, NCR, and Amdahl.

Price

Base prices (including hardware and software) include $9,800 for the DCP/5 and $250,000 for the DCP/628. **GSA Schedule:** Yes.

Product Analysis

Unisys introduced the DCP Series in 1979. Since that time, the company has added and withdrawn models from this product family. The series now consists of the DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, DCP/55, DCP/614, DCP/624, and the DCP/628. They range in size from the entry-level DCP/5, which supports up to 11 communications lines, to the top-of-the-line DCP/628, which supports over 1,800 communications lines.

DCPs support communications between Unisys 1100 and 2200 Series host computers. Part of Unisys's Distributed Communications Architecture (DCA), which is based on the Open Systems Interconnection (OSI) model, DCPs also support interoperability with asynchronous, IBM mainframe, and IBM midrange hosts; Ethernet and FDDI LAN; and X.25 packet switched, TCP/IP, and OSI environments.

All DCPs (except the entry-level DCP/5 model) are based on a common machine architecture containing the same basic components: Communications Processor (CP) Modules, Input/Output (I/O) Modules, and Line Modules. The CP is a microprogrammed processor supplying the bus structure, timing, micromemory, arithmetic logic units, and error control to execute the DCP instruction repertoire. I/O Modules function as the interfaces from the CPs to mass storage, host computer channels, and various Line Modules. A Line Module serves as the connection point for terminals, channels, and networks to the DCP system.

Users manage the DCP processors and their networks through the DCP/OS operating system and Telcon networking software. DCP/OS handles basic operations, including memory management, file control, and service utilities; Telcon supplies the distributed networking intelligence. Telcon includes the following software components:

- *SNA/net* software provides interoperability with IBM SNA/SDLC, 3270 BSC, 2780/3780 BSC RJE, and X.25 packet switched environments.
- *TCP-IP Stack* program implements TCP/IP protocols and provides Telnet terminal protocols for communications with the TCP/IP Defense Data Network (DDN).
- *OSI Transport Services (OSITS)* supports OSI Class 0, 2, and 4 transport services.

This year, Unisys announced the DCP/600 Series of fault-tolerant communications processors. The DCP/614 and DCP/624 are available now; the DCP/628 will be available in December 1993.

The DCP/600 Series models offer several reliability features making them ideal for LAN internetworking applications. Each I/O Module contains dual power supplies and each cabinet contains dual power controls. The DCP/624 and DCP/628 support dual-partition configurations, permitting load sharing between two active systems or defining one active and one hot standby system.

A new family of dual-bus line modules for the DCP/600 Series provides automatic switchover to the hot standby system in dual-partition machines. In single- or dual-partition configurations, these intelligent line modules off-load connection-, I/O-, and protocol-conversion-related functions from the DCP's central processing units, enhancing overall system performance. Additionally, they are power-on-replaceable. The new line modules can be used in older DCP models (single-partition operation only). At the same time, DCP/600 Series processors can use the previous generation of DCP line modules.

Unisys has released an FDDI LAN module as part of this new offering. In the fourth quarter of 1993, the vendor will introduce a 4M/16M bps token-ring LAN module.

Target Applications

DCP processors can function as front-end processors, intelligent switches, and remote concentrators for Unisys 1100 Series, 2200 Series, and System 80 host computers that support on-line transaction processing, timesharing services, and management of large databases. DCPs meet the open computing needs of users requiring access to both Unisys and non-Unisys facilities. With the latest product introductions and enhancements, DCPs are positioned even more strongly to provide multiprotocol LAN routing and LAN-to-host gateway services.

Strengths

Based on the OSI model for open networking, the DCP isolates the host computer from the communications facility, allowing both environments to evolve independently. Programmers are free to concentrate on applications development without being concerned about network enhancements. The DCP provides extensive multiprotocol support, including gateways to IBM SNA and BSC environments.

Overview

Models	Design	Release Date	Base Price ($) *(1)*
DCP/5	Desktop personal computer-based product	June 1990	9,800
DCP/25	Floorstanding unit	October 1990	26,000
DCP/30	Floorstanding unit	October 1988	55,000
DCP/35	Floorstanding unit	December 1990	125,000
DCP/50	Floorstanding unit	August 1991	275,000
DCP/55	Floorstanding unit	December 1987	396,000
DCP/614	Floorstanding unit	April 1993	175,000
DCP/624	Floorstanding unit	April 1993	200,000
DCP/628	Floorstanding unit	December 1993	250,000

(1) Price includes hardware and software.

Decision Points

Models	Requirements	Comments
DCP Processor Family	High throughput	Supports 100M bps local area and T1/E1 wide area network data rates.
		The dual-bus Intelligent Line Modules offload connection- and I/O-related functions from the DCP's central processing units, enhancing overall performance.
	Flexibility	A modular architecture makes system expansion straightforward.
	Multivendor networking	Supports async, IBM SNA/SDLC, IBM 3270 BSC, Ethernet LAN, FDDI LAN, TCP/IP, X.25 packet switching, and OSI environments concurrently. Token-ring LAN support will be introduced in the fourth quarter of 1993.
	Fault Tolerance	DCP/624 and DCP/628 support dual-partition configurations, in which load sharing between two active systems or establishment of one active and one hot standby systems is possible. Dual-bus line modules provide automatic switchover to the hot standby system.
		Other DCP reliability features include redundant power supplies, dual power controls, power-on-replaceable line modules, and automatic switchover to individual backup processor modules.
	Network Management	Unisys's Network Management Services (NMS) software provides complete configuration, monitoring, and diagnostics capability for DCPs. SNA/net software supports integration with IBM SNA networks and the NetView network management system.

An NT 2.1 feature, part of the DCP's SNA/net software, provides IBM LU6.2 functionality for peer-to-peer networking. With this feature, network nodes can perform dynamic message routing without IBM host involvement for session control. The software also includes a Terminal Operator Menu Facility (TOMF), for accessing both Unisys and IBM SNA destinations from a terminal, and a printer sharing feature that emulates the IBM printer-sharing process for outbound open requests from Unisys systems. This feature provides automatic queuing of print requests.

The modular DCP Series hardware and software architecture facilitates configuration and maintenance. All models run the same software, and with the exception of the DCP/5, share the same hardware design. Users can perform upgrades through conversion kits. Without interrupting the system's performance, users can also add or remove hardware and software, reconfigure portions of the system, and activate memory dumps.

DCPs offer redundant power supplies, power controls, processing modules, and processor partitions, with automatic switchover to the backup modules or systems.

The innovative design of the DCP/5, a cost-effective entry into the communications processor arena, should appeal to many users who will respond to the concept of acquiring a fully functioning communications processor that can be installed as easily as a PC.

Limitations

Although the communications processor has been widely used to link multiple computing environments for years, it is now viewed as a transition product that enables users to link an existing host processing system to an evolving host-independent LAN/WAN environment. Users are migrating away from the hierarchical host-to-terminal type of processing, for which the communications processor was originally developed, in favor of multiprotocol routers, which can perform intelligent switching more efficiently for LAN-attached PCs communicating on a peer basis. Vendors offering routers that support IBM's SNA and other protocols (in addition to IBM itself) include Cisco Systems, Vitalink Communications, Proteon, and Wellfleet Communications.

Unlike IBM's 3745 Communications Controller, DCPs do not support ESCON fiber optic channels.

Competitive Analysis

DCP processors are versatile. They can perform front-end processing, intelligent switching and routing, remote concentration, and gateway functions. Designed for multivendor networks, they provide compatibility with existing proprietary systems while leaving a migration path to future open networks.

Interoperability Matrix

Product	Unisys DCP Series Processors (all models)
Product Classification	Proprietary network router/gateway device.
Relationship With Higher-Level Elements	
Position in Network Architecture	Can appear to the IBM host as an SNA physical unit (PU) Type 2, 2.1, 4, 5, or some combination of these. In Unisys DCA, OSI, and TCP/IP environments, the DCP links multiple environments transparently. All communications functions are isolated from host processing applications.
Compatibility	Capable of replacing the IBM 3745 channel-attached or remote processor in multivendor networks consisting of both Unisys and non-Unisys host computers. DCP processors are fully interoperable, but not plug compatible, with IBM 3745 models.
Host Software Required	
Operating Systems	Unisys's 1100 and 2200 Series hosts run the OS/1100 operating system. IBM hosts run the MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP operating system with the VTAM access method.
Communications Processor Software Load	From a Unisys host or from the processor's hard drive.
Host Access	Direct connection via a block multiplexer channel, or a host word channel; remote access via a dial-up or leased line; or indirect host access via an Ethernet or FDDI LAN.
Network Management Support	Configured and managed via Unisys's *Network Management Services (NMS) software*, which runs on the DCP. Can also be managed by Unisys's *Common Network Management System.*
Relationship With Peer-Level Elements	
Compatible Communications Processors	Fully interoperable with any IBM 3745 or compatible processor.
Transport Architectures Supported	Async, IBM SNA/SDLC, IBM 3270 BSC, Unisys DCA/UDLC, TCP/IP, X.25 packet switched, and OSI data flows.
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to fractional or full T1/E1 lines via a T1, an E1, or a V.35 interface.
Packet Network Support	Supports access to an X.25 packet switched network using an RS-232-C, an RS-232-D, a V.35, a T1, an E1, or an X.21 interface.
LAN Attachment	Supports 10M bps Ethernet (IEEE 802.3) and 100M bps FDDI LAN environments. Will support 4M/16M token-ring (IEEE 802.5) LAN environments by the fourth quarter of 1993.

Vendor Analysis

Marketing Strategy

Unisys markets a full line of products, including display terminals, personal computers, high-performance multitasking/multiuser workstations, UNIX-based minicomputers, and mainframe systems. All these products interoperate with each other and with other vendors' systems in an open computing environment.

The vendor's strategy is to place open standards at the base of its information networks while allowing customers to continue using proprietary systems that provide greater functionality than newer open systems.

Target Markets

Users of DCP processors include engineering and manufacturing firms, airlines, telecommunications service providers, financial service organizations, and research and educational institutions.

Market Position

The communications processor market includes few major competitors. Although Unisys is not a leading vendor of communications processors, the company has built steadily upon the capabilities of the DCP Series, investing in its development, refining its features, and expanding its communications options. Its position in Unisys's open networking architecture makes the DCP Series a significant product line.

Major Competitors

IBM dominates the communications processor market, followed by NCR, Amdahl, Unisys, and others.

Sales and Distribution Strategy

Sales

Unisys offers both purchase and leasing arrangements to its customers.

Distribution

With operations in about 100 countries, Unisys distributes its products through its own sales force, third-party distributors, and value-added resellers. The vendor's commercial market is divided into three geographical areas. The United States Information Systems (USIS) is based in Blue Bell, PA; the Europe-Africa

Div. (EAD) is based in Uxbridge, England; and the Pacific Asia-America Div. (PAAD) is also based in Blue Bell. In addition, the Unisys Government and Defense units are based in McLean, VA.

Support

Policies and Programs

Warranty

Unisys warrants that its equipment will be free from defects in material and workmanship for a period of 12 months from its installation date.

Support Services

Unisys offers a wide range of services from support centers across the United States and around the world. These services include installation, hot line support, remote diagnostics, and on-site maintenance.

In the U.S., Unisys provides on-site service through several regional branches. Remote diagnostics is made possible through DCP's *Maintenance and Control Feature*, which provides a means of monitoring and displaying various DCP status and control signals, both locally and from a remote location.

Service Providers

Domestically, Unisys provides direct support and service.

Service Locations

Unisys has 90 sales/service locations in the United States. Users can access the main support center in Roseville, MN, through (800) 422-8466 for hardware difficulties or (800) 422-0440 for software difficulties. All support centers have access to a historical database of reported problems and their resolutions.

Service Hours

Support is available 24 hours a day, 365 days a year.

Training/Education

Through educational courses, Unisys provides its customers with the skills to design, configure, manage, and operate a DCP-based network. These courses are normally conducted in the U.S. at any of five major education centers in Atlanta; Washington, DC; Philadelphia; Chicago; or southern California. Unisys also provides a number of self-study courses. Areas of instruction offered by the vendor include the following:

- Data Communications Concepts
- DCP/Telcon Operations
- Introduction to TCP/IP
- Open Systems Interconnection (OSI) Concepts
- Client/Server Distributed Databases and Networks
- Enterprise Network Management

Specifications

Enhancements

Date	
February 1992	Introduced SNA/net 4R1, a new release of its SNA network connectivity software providing IBM host interoperability with Unisys DCP processors and 1100/2200 Series hosts. The new software now provides the functions and protocols of IBM Physical Unit Types 2, 2.1, 4, and 5. A new *NT 2.1* feature allows users to participate in peer-to-peer communications without IBM host involvement for session control. *Configured Routing*, another feature, enables DCPs to route message flows among PU Type 2.1 devices connected to it. The new software also provides automatic queuing of print requests sent to IBM printers and an easy-to-use menu for accessing both Unisys and IBM SNA hosts.
April 1993	Introduced, along with the new DCP/600 Series of fault-tolerant processor models, an FDDI LAN connection module. This module can be used in DCP Models 25 through 55 as well as in the 600 Series Models.
Fourth-Quarter 1993	Will introduce a 4M/16M bps token-ring LAN module for DCP Models 25 through 628.

Features/Functions

Models	DCP/5	DCP/25	DCP/30	DCP/35
Hardware Features				
Design	Desktop personal computer	Floorstanding	Floorstanding	Floorstanding
Number of Partitions	1	1	1	1

Features/Functions (Continued)

Models	DCP/5	DCP/25	DCP/30	DCP/35
Hardware Features (Continued)				
Number of CP Processors	1	1	1	2
Internal Memory Capacity (bytes)	2M	4M to 8M	4M to 8M	8M
Transmission Features				
Max. Number of Lines *(1)*	15	184	680	672
Max. Number of T1/E1 Links *(1)*	Not supported	2	3	3
Max. Number and Types of Host Connections	One remote host connection	6 local, unlimited remote	21 local, unlimited remote	21 local, unlimited remote
Max. Number of 10M Ethernet LAN Connections	4	9	33	32
Max. Number of 4M/16M Token-Ring LAN Connections *(2)*	Not supported	9	33	32
Max. Number of FDDI LAN Connections	Not supported	9	33	32
Max. Line Speeds (bps)	64K WAN; 10M LAN	1.544M/2.048M WAN; 100M LAN	1.544M/2.048M WAN; 100M LAN	1.544M/2.048M WAN; 100M LAN
Software Features				
IBM Compatibility	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/net also supports LU6.2 functionality and peer-to-peer networking capability.
Multivendor Networking Capabilities:				
TCP/IP Networking	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
OSI Networking	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.

Features/Functions (Continued)

Models	DCP/5	DCP/25	DCP/30	DCP/35
Software Features (Continued)				
Protocol Conversion Capability	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.
(2) Token-ring LAN module will be available in the fourth quarter of 1993.

Models	DCP/50	DCP/55	DCP/614	DCP/624
Hardware Features				
Design	Floorstanding	Floorstanding	Floorstanding	Floorstanding
Number of Partitions	1	1	1	2
Number of CP Processors	1	2	4	4 per partition
Internal Memory Capacity (bytes)	4M to 8M	8M	16M	16M per partition
Transmission Features				
Max. Number of Lines *(1)*	1,912	1,536	1,800+	1,800+
Max. Number of T1/E1 Links *(1)*	12	12	12	12
Max. Number and Types of Host Connections	56 local, unlimited remote	44 local, unlimited remote	52 local, unlimited remote	52 local, unlimited remote
Max. Number of 10M Ethernet LAN Connections	91	74	180	180
Max. Number of 4M/16M Token-Ring LAN Connections *(2)*	91	74	180	180
Max. Number of FDDI LAN Connections	91	74	180	180
Max. Line Speeds (bps)	1.544M/2.048M WAN; 100M LAN	1.544M/2.048M WAN; 100M LAN	1.544M/2.048M WAN; 100M LAN	1.544M/2.048M WAN; 100M LAN
Software Features				
IBM Compatibility	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.
Multivendor Networking Capabilities:				
TCP/IP Networking	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.

Features/Functions (Continued)

Models	DCP/50	DCP/55	DCP/614	DCP/624
Software Features (Continued)				
OSI Networking	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
Protocol Conversion Capability	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.
(2) Token-ring LAN module will be available in the fourth quarter of 1993.

Models	DCP/628
Hardware Features	
Design	Floorstanding
Number of Partitions	2
Number of CP Processors	8 per partition
Internal Memory Capacity (bytes)	16M per partition
Transmission Features	
Max. Number of Lines *(1)*	1,800+
Max. No. of T1/E1 Links *(1)*	12
Max. Number and Types of Host Connections	56 local, unlimited remote
Max. Number of 10M Ethernet LAN Connections	180
Max. Number of 4M/16M Token-Ring LAN Connections *(2)*	180
Max. Number of 100M FDDI LAN Connections	180
Max. Line Speeds (bps)	1.544M/2.048M WAN; 100M LAN
Software Features	
IBM Compatibility	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.
Multivendor Networking Capabilities:	
TCP/IP Networking	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network. It also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.

Features/Functions (Continued)

Models	DCP/628
Software Features (Continued)	
OSI Networking	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
Protocol Conversion Capability	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions.

Network Management Functions

Fault and Problem Management	**Network Management Services (NMS)** software provides an administrative interface to the network for DCP monitoring, event reporting, statistical data collection, and diagnostics. It also provides integration with IBM NetView, allowing management and control of both networks from a single administrative console.
Configuration Management	**DCP Operating System (DCP/OS),** a multiprogramming operating system, controls all DCP hardware operations and provides software installation and booting capabilities.
	Telcon, the core communications software product, enables multiple DCPs to be interconnected to form the backbone of a DCA network. With Telcon, users define the characteristics and connections of all devices in the network that communicate through a particular DCP.
Performance and Accounting Management	Statistical data collection and reporting capabilities are provided by **Network Management Services** software.
Security Management	Telcon software secures access to hosts and their applications by user and by terminal.

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.
(2) Token-ring LAN module will be available in the fourth quarter of 1993.

Configuration

Components

Product	Description
Parallel Line Modules:	
Block MUX Channel Module	Provides one block multiplexer channel interface to a Unisys host computer.
Host Word Channel Module	Provides one word channel interface to a Unisys host computer.
SCSI Line Module	Provides one interface to an integrated mass storage.
Single-Bus Line Modules:	
Auto Dial Line Module	Provides one RS-366 interface for automatic dialing.
Direct Connect Line Module	Provides one coax interface capable of supporting up to 16 multidrop terminals.
High-Speed Line Module	Provides one AT&T 303 or V.35 interface for synchronous data rates up to 64K bps.
Medium-Speed Line Module	Provides one interface (RS-232-C, RS-232-D, RS-449, or X.21) for synchronous data rates up to 19.2K bps.
Multiline Module	Provides four or eight interfaces (RS-232-C and RS-232-D) for sync or async devices. Supports data rates up to 19.2K bps per line.
Twisted-Pair Line Module	Provides one twisted-pair wire interface supporting data rates up to 64K bps.
High-Speed Intelligent Line Module (ILM20)	Provides four interfaces (V.35, EIA-530, X.21, RS-232-C, or RS-232-D). Each line can be configured for any data rate as long as the aggregate speed of all four does not exceed 2.048M bps. An on-board co-processor supports the X.25 LAPB protocol.
IEEE 802.3 LAN Line Module	Provides one IEEE 802.3 (Ethernet) LAN interface. Supports data rates up to 10M bps.
Dual-Bus Line Modules:	
IEEE 802.5 Token Ring Intelligent LAN Line Module	Provides one 4M/16M token-ring LAN interface. Supports both shielded and unshielded twisted-pair wire.
FDDI Intelligent LAN Line Module	Provides one Fiber Distributed Data Interface (FDDI) LAN interface. Supports 100M bps LAN data rates.
Dual-Bus Multiline Line Module	Provides dual bus access to four RS-232 interfaces. Supports sync and async data rates up to 19.2K bps.
Dual-Bus High Speed Line Module	Provides one V.35 interface for sync data rates up to 64K bps.
Dual-Bus X.21 Line Module	Provides one X.21 interface for sync devices. Supports data rates up to 19.2K bps.

Configuration (Continued)

Components (Continued)

Product	Description
Input/Output (I/O) Module	Routes data between the DCP processor and line modules, host channels, and SCSI Line Modules. Supports up to 16 Line Modules.

Configuration Rules

Models	Description
DCP/5	Contains one system board that implements the functions of the Communications Processor, I/O Module, and SCSI storage controller modules. The system board includes a Medium-Speed Line Module supporting five 19.2K bps RS-232-C or X.21 attachment ports, and it allows attachment of four additional line modules. The DCP/5 includes a monochrome monitor, keyboard, 20MB hard drive, and 1.2MB diskette drive. *DCP/5 components are not interchangeable with those of other DCP Series models.*
DCP/25	Supports one cabinet with one CP Processor, up to 2 I/O Modules, and a total of 31 Line Modules. Comes with one 655KB diskette and up to two 20MB hard drives per I/O Module.
DCP/30	Expandable to two cabinets with a total of 6 I/O Modules and 93 Line Modules. Comes with one 655KB diskette and up to two 20MB hard drives per I/O Module.
DCP/35	Expandable to two cabinets with a total of 6 I/O Modules and 92 Line Modules. Comes with one 655KB diskette and up to two 20MB hard drives per I/O Module.
DCP/50	Expandable to six cabinets with a total of 11 I/O Modules and 247 Line Modules. Comes with one 655KB diskette and up to two 20MB hard drives per I/O Module.
DCP/55	Expandable to six cabinets with a total of 13 I/O Modules and 200 Line Modules. Comes with one 655KB diskette and up to two 20MB hard drives per I/O Module.
DCP/614	Expandable to six cabinets with a total of 16 I/O Modules and 232 Line Modules. Comes with one 1.4MB diskette drive and an 80MB hard drive. Expandable to two disk subsystems per I/O Module.
DCP/624	Expandable to six cabinets with a total of 16 I/O Modules and 232 Line Modules. Comes with one 1.4MB diskette drive and an 80MB hard drive. Expandable to two disk subsystems per I/O Module.
DCP/628	Expandable to six cabinets with a total of 16 I/O Modules and 232 Line Modules. Comes with one 1.4MB diskette drive and an 80MB hard drive. Expandable to two disk subsystems per I/O Module.

Physical Environment

Models	CP/5	DCP/25	DCP/30	DCP/35
Physical Specifications (H x W x D, in.)	11.6 x 13.0 x 15.3	64 x 24 x 30	64 x 24 x 30 *(1)*	64 x 24 x 30 *(1)*
Electrical Specifications	115/240 V AC, 135 watts	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*
Environmental Specifications:				
Operating Temperature (°F)	50 to 93	50 to 93	50 to 93	50 to 93
Relative Humidity (%)	10 to 80	10 to 80	10 to 80	10 to 80

(1) Each base or expansion cabinet.

Models	DCP/50	DCP/55	DCP/614	DCP/624
Physical Specifications (H x W x D, in.)	64 x 24 x 30 *(1)*	64 x 24 x 30 *(1)*	69.7 x 22.0 x 36.3 *(1)*	69.7 x 22.0 x 36.3 *(1)*
Electrical Specifications	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*
Environmental Specifications:				
Operating Temperature (°F)	50 to 93	50 to 93	55 to 95	55 to 95
Relative Humidity (%)	10 to 80	10 to 80	10 to 80	10 to 80

(1) Each base or expansion cabinet.

Models	DCP/628
Physical Specifications (H x W x D, in.)	69.7 x 22.0 x 36.3 *(1)*
Electrical Specifications	200/240 V AC, 1.6kVA *(1)*

Physical Environment (Continued)

Models	DCP/628
Environmental Specifications:	
Operating Temperature (°F)	55 to 95
Relative Humidity (%)	10 to 80

(1) Each base or expansion cabinet.

Software Options

Product	Description
SNA/net Software:	
SNA/net Base	The foundation SNA/net product, SNA/net Base provides the terminal protocol conversion code used by other SNA/net software components. It is a prerequisite, therefore, for all other SNA/net features.
SNA/net Terminal Connect	This feature connects SNA PU Type 2.0 devices, such as IBM 3174 Controllers and 3270 display terminals, to a DCP Series Processor.
SNA/net PU Type 2.0 Inverted Boundary Function (PUT 2.0 IBF)	SNA/net PUT 2.0 IBF enables the DCP to emulate an IBM SNA PU Type 2.0 device. With this feature, an IBM 37XX Communications Controller and its IBM host view the DCP as an IBM 3174 cluster controller device. The DCP, therefore, is considered to be in the Domain of the IBM host.
SNA/net NT 2.1	This feature enables the DCP to emulate an IBM PU Type 2.1 device (such as an IBM AS/400) for communications with PU Type 2.1 devices. SNA/net NT 2.1 provides routing of messages among DCP-attached NT 2.1 devices as well as LU6.2 functions supporting IBM's SNA Distribution Services (SNADS) and Document Interchange Architecture (DIA).
SNA/net Cross Domain Resource Manager (CDRM)	SNA/net CDRM enables the DCP to act as a peer to an SNA domain. All devices connected to the DCP which access SNA are "owned" and controlled by the SSCP located in the DCP.
SNA/net RBFTE	This feature is required in the DCP, along with either the SNA/net CDRM or SNA/net PUT 2.0 IBF feature, to support interoperation with an IBM host using JES2 or JES3.
SNA/net NPSI and X.25 Packet Switched Communications Software (PSCS)	These products are used to interconnect IBM 3745 communications controllers and/or PU Type 2.0 devices with DCPs via X.25 packet switched networks.

Pricing

Unisys DCP Series Communications Processors

Equipment Prices Processor Model	Base Purchase Price ($)
DCP/5	9,800
DCP/25	26,000
DCP/30	55,000
DCP/35	125,500
DCP/50	275,000
DCP/55	396,000
DCP/614	175,000
DCP/624	200,000
DCP/628	250,000

Unisys DCP Series Communications Processors (Continued)

Software Prices

Product	Purchase Price ($)
DCP OS Group: *(1)*	
For the DCP/5	2,100
For the DCP/25	25,321
For the DCP/30	44,463
For the DCP/35	54,075
For the DCP/50	73,380
For the DCP/55	91,228
For the DCP/614	73,380
For the DCP/624	73,380
For the DCP/628	91,928
SNA/net Software:	
SNA/net Base	*(2)* 3,595-10,273
SNA/net Terminal Connect	*(2)* 4,645-13,276
SNA/net PU Type 2.0 Inverted Boundary Function	2,966-8,474
SNA/net NT 2.1	5,145-14,700
SNA/net CDRM	16,428-46,937
SNA/net RBFTE	2,737-7,509
SNA/net NPSI	4,164-11,897
X.25 Packet Switched Communications Software	*(2)* 4,145-11,385

(1) DCP/OS Group is a package that includes the following software: DCP/OS Operating System, Network Management Services (NMS), Telcon, TCP-IP Stack program, and OSI Transport Services.
(2) Prices vary with the DCP model. ■

Unisys DCP Series Communications Processors

In this report:

Note: Unisys introduced a new release of its SNA/net software supporting IBM LU6.2 functionality for peer-to-peer networking. With this feature, network nodes can perform dynamic message routing without IBM host involvement for session control.

The DCP family consists of the DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55 models. They support from 11 to over 1,500 communications lines, depending on the model. DCP processors can function as front-end processors, intelligent switches, remote concentrators, or as a mixture of these.

Telcon and SNA/net software provide the capability to integrate DCPs and their Unisys 1100/2200 hosts into a variety of other environments, including IBM SNA and BSC, OSI, and TCP/IP networks.

Strengths

- The DCP's modular architecture facilitates configuration and maintenance. Without interrupting system performance, users can add or remove hardware and software, reconfigure portions of the system, and activate memory dumps.
- DCPs provide redundant power supplies and automatic switchover to backup facilities.
- Based on the OSI model for open networking, the DCP processor isolates applications programmers from the complexities of the communications environment. The DCP Series also provides extensive multiprotocol support.

Limitations

- Although DCPs support Ethernet LAN connections, they do not operate with token-ring LANs.
- For intelligent switching over wide area networks, communications processors such as the DCP Series must compete with a newer breed of devices—multiprotocol routers—which can provide more efficient data transport for LAN devices.

Vendor

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19422
(215) 542-4011
In Canada:
2001 Sheppard Avenue East
North York, ON M2J 4Z7
(416) 495-0515

Competition

IBM, NCR, and Amdahl.

Price

Base prices (including hardware and software) range from $11,900 for the DCP/5 to $487,228 for the DCP/55. **GSA Schedule:** Yes.

—By Martin Dintzis
Assistant Editor

Product Analysis

Unisys introduced the Distributed Communications Processor (DCP) Series in 1979. Since that time, the company has added and withdrawn products from this line. The series now consists of the DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55. They range in size from the entry-level DCP/5, which supports up to 11 communications lines, to the top-of-the-line DCP/55, which supports over 1,500 communications lines.

DCPs support communications between Unisys 1100 and 2200 Series host computers. Part of Unisys's Distributed Communications Architecture (DCA), which is based on the Open Systems Interconnection (OSI) model, DCPs also support interoperability with asynchronous, IBM mainframe, and IBM midrange hosts; and Ethernet LAN, X.25 packet switched, TCP/IP, and OSI environments.

All DCPs (except the entry-level DCP/5 model) are based on a common machine architecture and contain the same components: Communications Processor (CP) Modules, Input/Output Processor (IOP) Modules, and Line Modules. The CP is a microprogrammed controller that supplies the bus structure, timing, micromemory, arithmetic logic units, and error control to execute the DCP instruction repertoire. Input/Output Processor (IOP) modules function as the interfaces from the CPs to mass storage, host computer channels, and various Line Modules. A Line Module serves as the connection point for terminals, channels, and networks to the DCP system.

Users manage the DCP processors and their networks through the DCP/OS operating system and Telcon networking software. DCP/OS handles basic operations, including memory management, file control, and service utilities; Telcon supplies the distributed networking intelligence. Telcon includes the following software components:

- *SNA/net* software provides intility with IBM SNA/SDLC, 3270 BSC, 2780/3780 BSC RJE, and X.25 packet switched environments.
- *TCP-IP Stack* program implements TCP/IP protocols and provides TELNET terminal protocols for communications with the TCP/IP Defense Data Network (DDN).
- *OSI Transport Services (OSITS)* supports OSI Class 0, 2, and 4 transport services.

This year, Unisys introduced a new release of its SNA/net software. A new NT 2.1 feature, now part of SNA/net, provides IBM LU6.2 functionality for peer-to-peer networking. With this feature, network nodes can perform dynamic message routing without IBM host involvement for session control. The new release also includes a Terminal Operator Menu Facility (TOMF), a menu for accessing both Unisys and IBM SNA destinations from a terminal. A new printer-sharing feature emulates the IBM printer-sharing process for outbound open requests from Unisys systems. This feature provides automatic queuing of print requests.

Target Applications

DCP systems function as front-end processors (FEPs), intelligent switches, and remote concentrators (RCs) for Unisys 1100 Series, 2200 Series, and System 80 host computers that support online transaction processing, time-sharing services, and management of large databases. DCPs also meet the open computing needs of users requiring access to both Unisys and non-Unisys facilities.

Strengths

The modular DCP Series hardware and software architecture facilitates configuration and maintenance. All models run the same software, and with the exception of the DCP/5, share the same hardware design. Users can perform upgrades through conversion kits. Without interrupting the system's performance, users can also add or remove hardware and software, reconfigure portions of the system, and activate memory dumps.

Redundancy is built into DCPs. Each Input/Output Processor Module contains dual power supplies for added protection. A *Hot Standby* feature, standard with Telcon software, provides automatic switching to a backup communications facility or a backup DCP processor in the event of a communications problem.

Based on the OSI model for open networking, the DCP isolates the host computer from the communications facility, allowing both environments to evolve independently. Programmers are free to concentrate on applications development without being concerned about network enhancements. The DCP provides extensive multiprotocol support, including gateways to IBM SNA and BSC environments.

Overview

Models	Design	Date Released	Base Price ($) *(1)*
DCP/5	Desktop personal computer-based product	June 1990	11,900
DCP/25	Floorstanding unit	October 1990	51,321
DCP/30	Floorstanding unit	October 1988	99,463
DCP/35	Floorstanding unit	December 1990	179,575
DCP/50	Floorstanding unit	August 1991	348,380
DCP/55	Floorstanding unit	December 1987	487,228

(1) Price includes hardware and software.

Decision Points

Models	Requirements	Comments
DCP Processor Family	High throughput	Supports 10M bps Ethernet LANs and T1/E1 speeds for remote host connections.
	Flexibility	A modular architecture makes system expansion straightforward.
	Multivendor networking	Supports async, IBM SNA/SDLC, IBM 3270 BSC, Ethernet LAN, TCP/IP, X.25 packet switching, and OSI environments concurrently; does not support token-ring LANs.
	Reliability	Redundant power supplies and automatic switchover to backup processing modules and communications facilities maintain system reliability.
	Network Management	Unisys's Network Management Services (NMS) software provides complete configuration, monitoring, and diagnostics capability for DCPs. SNA/net software supports integration with IBM SNA networks and the NetView network management system.

The innovative design of the DCP/5, a cost-effective entry into the communications processor arena, should appeal to many users who will respond to the concept of acquiring a fully functioning communications processor that can be installed as easily as a PC.

Limitations

Unlike IBM's 3745 Communications Controller, DCPs do not support communications with token-ring LANs. They do provide provide Ethernet LAN connectivity, however.

Although the communications processor has been widely used to link multiple computing environments for years, it is now viewed as a transition product that enables users to link an existing host processing system to an evolving host-independent LAN/WAN environment. Users are migrating away from the hierarchical host-to-terminal type of processing, for which the communications processor was originally developed, in favor of multiprotocol routers, which can perform intelligent switching more efficiently for LAN-attached PCs communicating on a peer basis. Vendors offering routers that support IBM's SNA and other protocols (in addition to IBM itself) include Cisco Systems, Vitalink Communications, Proteon, and Wellfleet Communications.

Competitive Analysis

DCP processors are versatile. They can perform front-end processing, intelligent switching, remote concentration, and gateway functions. Designed for multivendor networks, they provide compatibility with existing proprietary systems while leaving a migration path to future open networks.

Vendor Analysis

Marketing Strategy

Unisys markets a full line of products, including display terminals, personal computers, high-performance multitasking/multiuser workstations, UNIX-based minicomputers, and mainframe systems. All these products interoperate with each other and with other vendors' systems in an open computing environment.

The vendor's strategy is to place open standards at the base of its information networks while allowing customers to continue using proprietary systems that provide greater functionality than newer open systems.

Target Markets

Users of DCP processors include engineering and manufacturing firms, airlines, telecommunications service providers such as the Bell Operating Companies (BOCs), financial service organizations, and research and educational institutions.

Market Position

The communications processor market includes few major competitors. IBM dominates the scene, followed by NCR and Amdahl. Although Unisys does not rank among the leaders, the company has built steadily upon the capabilities of the DCP Series, investing in its development, refining its features, and expanding its communications options. Its position in Unisys's open networking architecture makes the DCP Series a significant product line.

Major Competitors

IBM's 3745 processor family includes the low-end Models 130, 150, and 170, and the larger processor Models 210, 310, 410, and 610. The most powerful model, the 3745-610, supports up to 16 IBM hosts, 896 medium- and high-speed lines, and eight 16M bps token-ring LANs. Models 210, 310, 410, and 610 can be configured with two independent central control units (CCUs), each running a separate Network Control Program (NCP).

NCR's Comten 5600 communications processor line consists of five models: 5630, 5645-B, 5655-B, 5665-B, and 5675-B. The Comten 5675-B, the largest unit, supports up to 1,024 low- or medium-speed lines, 24 T1/E1 links, 16 IBM hosts, sixty-four 16M bps token-ring LAN connections, and forty-eight Ethernet LAN connections.

For years, NCR based its strategy on providing a product that was easy to configure, upgrade, and install in an IBM network. NCR, like Unisys, now looks beyond IBM, offering support for multivendor communications and evolving standards. NCR Comten 5600 processors run TCP/IP software for internetworking. They can be managed by Systems Center's Net/Master as well as IBM's NetView network management systems.

Amdahl markets the IBM 3745-compatible processor Models 4745-110 and 4745-210, which run IBM software without any modification. Amdahl's 4745-210 supports up to eight IBM hosts, 256 communications lines, and eight 4M bps token-ring LANs.

By offering an IBM plug-compatible product, Amdahl seeks to preserve the user's investment in software while providing superior price/performance, configuration flexibility, ease of expansion and upgradability, and high reliability. This approach, however, limits the range of unique features that the 4745 can support—particularly in the area of multivendor connectivity.

Sales and Distribution Strategy

With operations in about 100 countries, Unisys distributes its products through its own sales force, third-party distributors, and value-added resellers. The vendor's commercial market is divided into three geographical areas. The United States Information Systems (USIS) is based in Blue Bell, PA; the Europe-Africa Division (EAD) is based in Uxbridge, England; and the Pacific Asia-America Division (PAAD) is also based in Blue Bell. In addition, the Unisys Defense units are based in McLean, VA.

Interoperability Matrix

Product	Unisys DCP Series Processors (all models)
Product Classification	Proprietary network router/gateway device
Relationship With Higher-Level Elements	
Position in Network Architecture	Can appear to the IBM host as an SNA physical unit (PU) Type 2, 2.1, 4, 5, or some combination of these; in Unisys DCA, OSI, and TCP/IP environments, the DCP links multiple environments transparently; all communications functions are isolated from host processing applications
Compatibility	Capable of replacing the IBM 3745 channel-attached or remote processor in multivendor networks consisting of both Unisys and non-Unisys host computers; DCP processors are fully interoperable, but not plug compatible, with IBM 3745 models
Host Software Required	
Operating Systems	Unisys's 1100 and 2200 Series hosts run the OS/1100 operating system; IBM hosts run the MVS/370, MVS/ESA, MVS/XA, VM/SP, VM/SP HPO, VM/XA, VSE/AF, or VSE/SP operating system with the VTAM, BTAM, or RTAM access method
Communications Processor Software Load	From a Unisys host or from the processor's hard disk
Host Access	Direct connection via a block multiplexer channel, or a host word channel; remote access via a dial-up or leased line; or indirect host access via an Ethernet LAN
Network Management Support	Configured and managed via Unisys's Network Management Services (NMS) software, which runs on the DCP
Relationship With Peer-Level Elements	
Compatible Communications Processors	Fully interoperable with any IBM 3745 or compatible processor
Transport Architectures Supported	Async, IBM SNA/SDLC, IBM 3270 BSC, Unisys DCA/UDLC, TCP/IP, X.25 packet switched, and OSI dataflows
Relationship With Lower-Level Elements	
Leased Line Support	Provides access to fractional or full T1/E1 lines via a T1, E1, or V.35 interface
Packet Network Support	Supports access to an X.25 packet switched network using an RS-232-C, RS-232-D, V.35, T1, E1, or X.21 interface
LAN Attachment	Supports Ethernet (IEEE 802.3) environments

Support

Policies and Programs

Warranty
Unisys warrants that its equipment will be free from defects in material and workmanship for a period of 12 months from its installation date.

Support Services
Unisys offers a wide range of services from support centers across the United States and around the world. These services include installation, hot line support, remote diagnostics, and on-site maintenance.

In the U.S., Unisys provides on-site service through several regional branches. Remote diagnostics is made possible through DCP's *Maintenance and Control Feature*, which provides a means of monitoring and displaying various DCP status and control signals, both locally and from a remote location.

Service Providers
Domestically, Unisys provides direct support and service.

Service Locations
Unisys has 90 sales/service locations in the United States. Users can access the main support center in Roseville, MN, through (800) 422-8466 for hardware difficulties or (800) 422-0440 for software difficulties. All support centers have access to a historical database of reported problems and their resolutions.

Service Hours
Support is available 24 hours a day, 365 days a year.

Training/Education
Through educational courses, Unisys provides its customers with the skills to design, configure, manage, and operate a DCP-based network. These courses are normally conducted in the U.S. at any of five major education centers in Atlanta; Washington, DC; Philadelphia; Chicago; or southern California. Unisys also provides a number of self-study courses. Areas of instruction offered by the vendor include the following:

- Data Communications Concepts
- DCP/Telcon Operations
- Introduction to TCP/IP
- Open Systems Interconnection (OSI) Concepts
- Client/Server Distributed Databases and Networks
- Enterprise Network Management

Competitors' Programs

Support offered by Amdahl, NCR, and Unisys is closely patterned after IBM support services. No vendor seeking to compete in the market for SNA-compatible networking products could succeed otherwise. Support includes installation, round-the-clock maintenance and hot line support, remote diagnostics, education, and other services.

Specifications

Enhancements

Date	Event
February 1992	Introduced SNA/net 4R1, a new release of its SNA network connectivity software providing IBM host interoperability with Unisys DCP processors and 1100/2200 Series hosts. The new software now provides the functions and protocols of IBM Physical Unit Types 2, 2.1, 4, and 5. A new *NT 2.1* feature allows users to participate in peer-to-peer communications without IBM host involvement for session control. *Configured Routing*, another feature, enables DCPs to route message flows among PU Type 2.1 devices connected to it. The new software also provides automatic queuing of print requests sent to IBM printers and an easy-to-use menu for accessing both Unisys and IBM SNA hosts.

Features/Functions

Models	DCP/5	DCP/25	DCP/30	DCP/35
Hardware Features				
Design	Desktop personal computer	Floorstanding	Floorstanding	Floorstanding
No. of CP Processors	1	1	1	2
Internal Memory Capacity (bytes)	2M	4M to 8M	4M to 8M	8M
Transmission Features				
Max. No. of Lines *(1)*	15	184	680	672

Features/Functions (Continued)

Models	DCP/5	DCP/25	DCP/30	DCP/35
Max. No. of T1/E1 Links *(1)*	Not supported	2	3	3
Max. No. and Types of Host Connections	One remote host connection	6 local, unlimited remote	21 local, unlimited remote	21 local, unlimited remote
Max. No. of Ethernet LAN Connections	4	9	33	32
Max. Line Speeds (bps)	64K	1.544M/2.048M WAN, 10M LAN	1.544M/2.048M WAN, 10M LAN	1.544M/2.048M WAN, 10M LAN
Software Features				
IBM Compatibility	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/net also supports LU6.2 functionality and peer-to-peer networking capability.
Multivendor Networking Capabilities:				
TCP/IP Networking	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network; it also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network; it also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network; it also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network; it also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
OSI Networking	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
Protocol Conversion Capability	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Features/Functions (Continued)

Models	DCP/50	DCP/55
Hardware Features		
Design	Floorstanding	Floorstanding
No. of CP Processors	1	2
Internal Memory Capacity (bytes)	4M to 8M	8M
Transmission Features		
Max. No. of Lines *(1)*	1,912	1,536
Max. No. of T1/E1 Links *(1)*	12	12
Max. No. and Types of Host Connections	56 local, unlimited remote	44 local, unlimited remote
Max. No. of Ethernet LAN Connections	91	74
Max. Line Speeds (bps)	1.544M/2.048M WAN, 10M LAN	1.544M/2.048M WAN, 10M LAN
Software Features		
IBM Compatibility	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.	SNA/net software allows the DCP to interoperate with IBM hosts, 3745 FEPs, and 3270-type terminals. SNA/Net also supports LU6.2 functionality and peer-to-peer networking capability.
Multivendor Networking Capabilities:		
TCP/IP Networking	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network; it also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**TCP-IP Stack** program implements TCP/IP protocols within a DCA network; it also provides TELNET terminal protocols specifically for the TCP/IP DDN environment. With this feature, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
OSI Networking	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.	**OSI Transport Services (OSITS)** program implements OSI protocols within a DCA network, supporting OSI Class 0, 2, and 4 transport services. OSITS also includes a protocol conversion interface between the Unisys DCA Transport Protocol (DTP) and OSI transport layer protocols. With OSITS, DCPs can communicate across an Ethernet LAN or an X.25 packet switched WAN.
Protocol Conversion Capability	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions	Performs bidirectional async-to-Unisys Uniscope, async-to-X.25, SDLC-to-X.25, Unisys Uniscope-to-3270 BSC, and Unisys Uniscope-to-3270 SNA conversions

(1) Not all of the line, LAN, and host connection maximums can be achieved simultaneously.

Network Management Functions

Fault and Problem Management	**Network Management Services (NMS)** software provides an administrative interface to the network for DCP monitoring, event reporting, statistical data collection, and diagnostics; it also provides integration with IBM NetView, allowing management and control of both networks from a single administrative console.
Configuration Management	**DCP Operating System (DCP/OS)**, a multiprogramming operating system, controls all DCP hardware operations and provides software installation and booting capabilities. **Telcon**, the core communications software product, enables multiple DCPs to be interconnected to form the backbone of a DCA network. With Telcon, users define the characteristics and connections of all devices in the network that communicate through a particular DCP.
Performance and Accounting Management	Statistical data collection and reporting capabilities are provided by **Network Management Services** software.
Security Management	Telcon software secures access to hosts and their applications by user and by terminal.

Configuration

Components

Product	Description
Parallel Line Modules:	
Block MUX Channel Module	Provides one block multiplexer channel interface to a Unisys host computer
Host Word Channel Module	Provides one word channel interface to a Unisys host computer
SCSI Line Module	Provides one interface to an integrated mass storage

Configuration (Continued)

Components

Product	Description
DCP Line Modules:	
Auto Dial Line Module	Provides one RS-366 interface for automatic dialing
Direct Connect Line Module	Provides one coax interface capable of supporting up to 16 multidrop terminals
High-Speed Line Module	Provides one AT&T 303 or V.35 interface for synchronous data rates up to 64K bps
Medium-Speed Line Module	Provides one interface (RS-232-C, RS-232-D, RS-449, or X.21) for synchronous data rates up to 19.2K bps
Multiline Module	Provides four or eight interfaces (RS-232-C and RS-232-D) for sync or async devices; supports data rates up to 19.2K bps per line
Twisted-Pair Line Module	Provides one twisted-pair wire interface supporting data rates up to 64K bps
High-Speed Intelligent Line Module (ILM20)	Provides four interfaces (V.35, EIA-530, X.21, RS-232-C, or RS-232-D); each line can be configured for any data rate as long as the aggregate speed of all four does not exceed 2.048M bps; an onboard co-processor supports the X.25 LAPB protocol
IEEE 802.3 LAN Line Module	Provides one IEEE 802.3 (Ethernet) LAN interface; supports data rates up to 10M bps
Input/Output Processor (IOP) Module	Routes data between the DCP processor and line modules, host channels, and SCSI Line Modules; the IOP Module supports up to 16 Line Modules

Configuration Rules

Models	
DCP/5	Contains one system board that implements the functions of the Communications Processor, Input/Output Processor (IOP), SCSI storage controller modules; the system board includes a Medium-Speed Line Module supporting five 19.2K bps RS-232-C or X.21 attachment ports, and it allows attachment of four additional line modules; the DCP/5 includes a monochrome monitor, keyboard, 20M-byte hard drive, and 1.2M-byte diskette drive; *DCP/5 components are not interchangeable with those of other DCP Series models.*
DCP/25	Supports one cabinet with one CP Processor, up to 2 IOP Modules, and a total of 31 Line Modules; comes with one 655K-byte diskette and up to two 20M-byte hard drives per IOP Module.
DCP/30	Expandable to two cabinets with a total of 6 IOP Modules and 93 Line Modules; comes with one 655K-byte diskette and up to two 20M-byte hard drives per IOP Module.
DCP/35	Expandable to two cabinets with a total of 6 IOP Modules and 92 Line Modules; comes with one 655K-byte diskette and up to two 20M-byte hard drives per IOP Module.
DCP/50	Expandable to six cabinets with a total of 11 IOP Modules and 247 Line Modules; comes with one 655K-byte diskette and up to two 20M-byte hard drives per IOP Module.
DCP/55	Expandable to six cabinets with a total of 13 IOP Modules and 200 Line Modules; comes with one 655K-byte diskette and up to two 20M-byte hard drives per IOP Module.

Physical Environment

Models	DCP/5	DCP/25	DCP/30	DCP/35
Physical Specifications (H x W x D, in.)	11.6 x 13.0 x 15.3	64 x 24 x 30	64 x 24 x 30 *(1)*	64 x 24 x 30 *(1)*
Electrical Specifications	115/240 V AC, 135 watts	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*
Environmental Specifications	50°F to 93°F	50°F to 93°F	50°F to 93°F	50°F to 93°F

(1) Each base or expansion cabinet.

Models	DCP/50	DCP/55
Physical Specifications (H x W x D, in.)	64 x 24 x 30 *(1)*	64 x 24 x 30 *(1)*
Electrical Specifications	200/240 V AC, 1.6kVA *(1)*	200/240 V AC, 1.6kVA *(1)*
Environmental Specifications	50°F to 93°F	50°F to 93°F

(1) Each base or expansion cabinet.

Software Options

Product	Description
SNA/net Software:	
SNA/net Base	The foundation SNA/net product, SNA/net Base provides the terminal protocol conversion code used by other SNA/net software components. It is a prerequisite, therefore, for all other SNA/net features.
SNA/net Terminal Connect	This feature connects SNA PU Type 2.0 devices, such as IBM 3174 Controllers and 3270 display terminals, to a DCP Series Processor.
SNA/net PU Type 2.0 Inverted Boundary Function (PUT 2.0 IBF)	SNA/net PUT 2.0 IBF enables the DCP to emulate an IBM SNA PU Type 2.0 device. With this feature, an IBM 37XX Communications Controller and its IBM host view the DCP as an IBM 3174 cluster controller device. The DCP, therefore, is considered to be in the Domain of the IBM host.
SNA/net NT 2.1	This feature enables the DCP to emulate an IBM PU Type 2.1 device (such as an IBM AS/400) for communications with PU Type 2.1 devices. SNA/net NT 2.1 provides routing of messages among DCP-attached NT 2.1 devices as well as LU6.2 functions supporting IBM's SNA Distribution Services (SNADS) and Document Interchange Architecture (DIA).
SNA/net Cross Domain Resource Manager (CDRM)	SNA/net CDRM enables the DCP to act as a peer to an SNA domain; all devices connected to the DCP which access SNA are "owned" and controlled by the SSCP located in the DCP.
SNA/net RBFTE	This feature is required in the DCP, along with either the SNA/net CDRM or SNA/net PUT 2.0 IBF feature, to support interoperation with an IBM host using JES2 or JES3.
SNA/net NPSI and X.25 Packet Switched Communications Software (PSCS)	These products are used to interconnect IBM 3745 communications controllers and/or PU Type 2.0 devices with DCPs via X.25 packet switched networks.

Pricing

Equipment Prices

Processor Model	Base Purchase Price ($)
DCP/5	9,800
DCP/25	26,000
DCP/30	55,000
DCP/35	125,500
DCP/50	275,000
DCP/55	396,000

Software Prices

Product	Purchase Price ($)
DCP OS Group: *(1)*	
For the DCP/5	2,100
For the DCP/25	25,321
For the DCP/30	44,463
For the DCP/35	54,075
For the DCP/50	73,380
For the DCP/55	91,228
SNA/net Software:	
SNA/net Base	*(2)* 3,595-10,273
SNA/net Terminal Connect	*(2)* 4,645-13,276
SNA/net PU Type 2.0 Inverted Boundary Function	2,966-8,474
SNA/net NT 2.1	5,145-14,700
SNA/net CDRM	16,428-46,937
SNA/net RBFTE	2,558-7,018
SNA/net NPSI	3,785-10,850
X.25 Packet Switched Communications Software	*(2)* 3,948-11,954

(1) DCP/OS Group is a package that includes the following software: DCP/OS Operating System, Network Management Services (NMS), Telcon, TCP-IP Stack program, and OSI Transport Services.
(2) Prices vary with the DCP model. ■

Unisys DCP Series Communications Processors

In this report:

Product Summary

Editor's Note

Since our last report on the Distributed Communications Processor (DCP) Series, Unisys has withdrawn Models DCP/15 and DCP/40, retained Models DCP/5, DCP/30, and DCP/50, and added Models DCP/25, DCP/35, and DCP/55. Recent enhancements include support for power-on-pluggable line modules, redundant input/output module power supplies, a redesigned maintenance control feature (MCF), an improved power control feature, and a high-performance input/output module capability.

Description

The DCP family now consists of the DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55 systems. They range in size from the DCP/5, which serves as a remote concentrator for up to 11 communications lines, to the top-of-the-line DCP/55, which is a dual processor that can support over 1,500 communications lines.

The models can function as front-end processors (FEPs), nodal processors (NPs), remote concentrators (RCs), or as a mixture of these functions. The DCP/5, however, functions primarily as a remote concentrator and/or as a nodal processor. Telcon and DCP/OS serve as the software for the DCP family. DCP/OS handles basic operations, including memory management, file control, and service utilities; Telcon provides networking intelligence.

—By Barbara Callahan
Associate Editor

Strengths

The DCP family displays a high level of versatility. The products can perform front-end processing, nodal processing, remote concentration, communications functions, and networking functions.

Limitations

When the DCP/5 is functioning in its networking capacity, the personal workstation supports only communications tasks and does not perform personal computing functions.

Competition

Amdahl, IBM, NCR Comten.

Vendor

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19422
(215) 542-4011

Price

From $9,800 (DCP/5) to $396,000 (DCP/55).

Analysis

Product Strategy

Unisys introduced the Distributed Communications Processor (DCP) Series in 1979. Since that time, the company has added and withdrawn products from this line. The series now consists of the DCP/5, DCP/25, DCP/30, DCP/35, DCP/50, and DCP/55. They range in size from the entry-level DCP/5, which supports up to 11 communications lines, to the top-of-the-line DCP/55, which supports over 1,500 communications lines. DCP systems can function as front-end processors (FEPs), nodal processors (NPs), or remote concentrators (RCs) in a Unisys or multivendor network. The DCP/5, however, operates mostly as a remote concentrator and/or a nodal processor.

Although varied in the applications they support, the models in the DCP series are based on a common machine architecture. All DCPs have a communications processor (CP), which is a microprogrammed controller that supplies the bus structure, timing, micromemory, arithmetic logic units, and error control required to execute the CP instruction repertoire. Local storage serves the CP and each input/output processor (IOP) and CP control. The IOPs function as the external interfaces from the DCPs to mass storage, host computer channels, and various line modules. A line module serves as the connection point for terminals, channels, and networks to the DCP system. The line module operating with the IOP forms a port processor (PP). Depending on system type and configuration, up to 16 PPs can function under the control of a single IOP.

Users manage the DCP processors and their networks through the DCP/OS operating system and Telcon communications and networking software. DCP/OS handles basic operations, including memory management, file control, and service utilities; Telcon supplies the networking intelligence. Telcon provides gateways to non-DCA networks, such as IBM's SNA and many public data networks. Without interrupting the performance of the system, users can add or remove programs, reconfigure portions of the system, and activate memory dumps.

Decision Points

Unisys designed the DCP series to satisfy a variety of needs. Users can select from six models. Unisys positions the DCP/5 as the low end of the DCP series and targets the machine to small sites. In remote environments, the DCP/5 can function in an unattended mode. The product can act as a remote concentrator and LAN-to-WAN gateway at small sites, supporting up to 11 lines. Although housed in a Unisys Personal Workstation, the DCP/5 is dedicated to communications tasks; the workstation will not perform any personal computing applications when the DCP/5 is activated. The keyboard and monitor serve as operator and maintenance console devices.

The DCP/25 concentrates a large number of lines at remote locations; it can also act as a front-end processor. The DCP/30 midrange model is compatible with all the other models of the DCP family. The DCP/30 can perform front-end processing, nodal processing, remote concentration, communications, and networking functions. The model is appropriate for medium-sized networks.

The DCP/35, compatible with the other members of the DCP family, incorporates two processors. DCP/35 performs front-end processing, nodal processing, remote concentration, communications, and networking functions.

Users with large networks can take advantage of the power of the DCP/50, which supports a wide variety of applications in larger sized networks. Based on Unisys Communications Processor Architecture (CPA) and Telcon communications software, the DCP/50 can function in the same networks as other DCP products.

The DCP/55 is the top-of-the-line product in the family. It also supports intelligent communications for a wide variety of applications in larger networks. The DCP/55 increases the power of the DCP products through its dual processors. It has a processor cycle time of approximately 26 nanoseconds and a storage cycle time of approximately 105 nanoseconds. It is 1.7 times more powerful than the DCP/50.

Company Profile
Unisys Corp.

Corporate Headquarters
P.O Box 500
Blue Bell, PA 19422
(215) 542-4011

In Canada
Unisys Corp.
2001 Sheppard Avenue E.
North York, ON M2J 4Z7
(416) 495-0515

Officers
CEO: James A. Unruh
Executive Vice Presidents: Cyril Yansouni, Reto Braun
Vice President Information Services: Howard A. Downey

Company Background
Unisys was formed in 1986 from the merger of Burroughs Corp. and Sperry Corp. The company is a manufacturer of commercial information systems, defense systems, and related services. It serves more than 60,000 customers in over 100 countries. Long a supplier of large-scale mainframe computers, Unisys has built a $2 million business based on workstations and UNIX-based departmental systems. In January 1990, Unisys formed the Systems Management Group to provide systems integration and professional services in government and commercial markets.

In July 1990, Unisys reported that earnings fell 78 percent for the second quarter, to $11.8 million, for a loss of 9 cents per share after preferred dividend payments. Revenue fell 4 percent to $2.47 billion from $2.57 billion for the same quarter in 1989. In October 1990, Unisys reported a loss of approximately $356.8 million for the third quarter, compared to a loss of about $648.2 million a year earlier. Revenues increased 2.1 percent to approximately $2.4 billion from about $2.35 billion for the third quarter in 1989.

In October 1990, Unisys announced plans to reduce staff by 5,000 due to the nearly $357 million loss incurred in the third quarter and the possibility of additional losses in the fourth quarter. The company attributes problems to a soft demand for computers internationally.

Alliances
January 1990—Announced a joint development agreement with KPMG Peat Marwick for a systems integration program to support EDI applications. Unisys provides the software and hardware, and Peat Marwick provides consulting services to users.

January 1990—Announced an agreement with VISsystems, Inc. in which VISsystems became a Marketing Associate through the Unisys Value-Added Marketing Division.

March 1990—Signed an agreement with Sigma Imaging Systems for Sigma to develop a special version of its OMNIDESK imaging software to run on Unisys PW2 personal computers and integrate with FileNet's Image Access Facility.

April 1990—Announced an agreement with Oracle Corp. under which the Oracle relational database management system and associated tools are ported to the Unisys 2200 mainframe line.

April 1990—Announced a joint marketing agreement with Unidata, under which the Value-Added Marketing Division of Unisys makes Unidata's SQL-based RDBMS available on the Unisys U 6000 Series.

April 1990—Signed an agreement with Formula Consultants under which Formula Consultants modifies its System for Tape Administration and Reporting (STAR-1100) to operate on Unisys 1100/90 and 2200 Series mainframes.

May 1990—Entered into an agreement with Intercim under which Intercim's Factory Data Manager software is available to users of Unisys U Series UNIX OS-based computers.

May 1990—Announced a four-year OEM agreement with Solbourne Computer Inc. to resell Solbourne workstations and servers.

June 1990—Signed an agreement with Novell, which certified Unisys as an authorized NetWare Support Organization and as a Novell Authorized Education Center.

June 1990—Entered into an agreement with Misui & Co. to provide for the private placement to Mitsui of $150 million of Unisys convertible preferred stock in two series and a $50 million five-year subordinated loan.

August 1990—Renewed a purchase agreement with Sun Microsystems in which Unisys purchases for internal development and resells Sun's SPARC-based workstations and servers.

November 1990—Announced an agreement with AT&T USL, in which the two companies will jointly market ALLY, a 4GL tool from Unisys that will be fully integrated with TUXEDO, AT&T's transaction processing system for its UNIX System V.

Market Position

The communications processor market includes very few players. IBM dominates the scene, followed by NCR Comten and Amdahl. When IBM introduced its 3745 processor in 1988, competition intensified among the Big Three. NCR Comten recently added the 5645 to its family of 5600 SNA communications processors. NCR Comten emphasizes that its 5660 products address the need for

coexistence of SNA and multivendor networks. Unisys has also geared its communications processors toward multivendor networks. This approach broadens the appeal of the machines and can attract more users. Amdahl can capitalize on its plug compatibility with IBM products.

Although Unisys does not rank among the leaders, the company has built steadily upon the capabilities of the DCP series, investing in its development, refining its features, and expanding its communications options. The innovative design of the DCP/5, a cost-effective entry into the communications processor arena, should appeal to many users who will respond to the concept of acquiring a fully functioning communications processor that can be installed as easily as a PC.

Characteristics

Processor Features

Unisys has equipped the DCP family with the following features.

Power-on-Pluggable Line Module. This feature exploits the capability of the I/O modules and backplane to suppress power transients and bus interface interruptions that occur with power-on removal or insertion of line modules.

Redundant Power Supply. Two power supplies are incorporated into the I/O modules. After a failure in power supply is detected by the power control and maintenance control feature, restoral takes place without system interruption.

Triple Input/Output Processor (DCP/50 and DCP/55 only). The provision of three input/output processors within a single input/output module increases the potential throughput of the input/output module by a factor of 3. This high-performance input/output module serves configurations that require high-demand I/O processing, such as host interfaces, LAN line modules, high-speed line modules, and multiline line modules. The input/output module has three I/O processors and one SPE/IO in a segmented back panel and 19-inch card rack with dual power supplies. Users can mount as many as 14 line modules in the remaining card slots.

Maintenance Control Feature (MCF). The new design of the MCF has increased the size of the read-only memory (ROM), incorporated random access memory (RAM), and incorporated a personal computer interface (PCI) with a 19.2K bps rate for remote control capabilities. The remote control interface has a dual-port capability. MCF collects the faults and abnormal condition information from the power control module.

Power Control Feature. Located in each cabinet, this feature provides a front-end access to assemblies within the module. Fault latch indicators indicate the status of the system power supplies and fans.

DCP Line Modules. Line modules interface with communications devices, peripherals, and host computers. Communications line modules link DCPs to modems, terminals, and other networks. Peripheral line modules support connections to integrated peripheral devices. Host interface line modules provide direct attachment to host computer channels.

The High-Speed ILM20 Line Module (DCP/25/30/35/50/55 systems). The ILM20 provides one to four HDLC line interfaces with a four-line aggregate data rate up to T1/C1 speeds of 1.544M/2.048M bps. It supports four V.35, EIA-530, or X.21 interfaces, operating at a 2.048M bps aggregate data rate, or an RS-232-C interface operating at speeds up to 19.2K bps on each line. An onboard coprocessor supports the X.25 LAPB protocol.

Line Module Configurations

Type	Method
Block MUX	Line module to attach to host block MUX channel
Word Channel	Line module to attach to host word channel
High Speed	Intelligent line modules supporting up to a 4-line aggregate data rate of 2.048M bps; V.35, EIA 530, X.21 interfaces supported
Multiline (8 & 4)	Synchronous and asynchronous line modules for data rates up to 9.6K bps; RS-232-C and D, V.24/V.28 interfaces supported
High Speed	Synchronous line modules for data rates up to 64K bps; AT&T 303 and V.35 interfaces supported
Medium Speed	Synchronous line modules for data rates up to 19.2K bps; RS-232-C and D, RS-449, and X.21 interfaces supported

Type	Method
Direct Connect	Line modules to support up to 16 multidropped, direct coax-connected, single stations at data rates up to 250K bps
Twisted Pair	Line modules to support Unisys telephone twisted-pair-connected terminals at data rates up to 64K bps
IEEE 802.3 LAN	Line modules to support connections to IEEE 802.3 (Ethernet) LANs at data rates up to 10M bps
Auto Dial	Line modules to interface with automatic calling units

Models

DCP/5

The compatibility of the DCP/5 with the communications processor architecture of the DCP family is implemented through its system board, line modules, DCP/OS operating system, and Telcon software. The DCP/5 is currently housed in the Unisys PW2 500 or PW2 800 Series personal computer.

The system board is a microprogrammable device that performs network processing tasks, including input/output. A hardware microprocessor (the Unisys COM chip) implements the functions of the communications processor, input/output processor, and storage controller. Two megabytes of error-correcting local storage are included on the system board. A single, medium-speed, loadable line module (MSLLM) is also included on the system board, providing full-duplex RS-232-C or X.21 attachment to a synchronous or asynchronous line at speeds up to 19.2K bps. Four types of DCP/5 line modules use four processor ports. Since the DCP/5 resides in a personal computer, DCP/5 line modules are not interchangeable with line modules used by other DCP systems.

DCP/25/30/35/50/55 Basic Systems

Users can configure these systems in various ways, but a Basic System (defined as an entry-level system plus a local storage selection) is required to provide DCP/Telcon operability. Users can augment the entry-level systems with additional components to attain the required functionality.

In a front-end processor configuration, a word channel or block mux (FIPS) line module is required. Unisys recommends a network console, which can be any supported protocol/terminal, to operate a DCP/Telcon network. The console can reside anywhere in the network and can operate in session with Network Management Services (NMS). The console can control network operation and gather performance statistics.

An integrated 655K-byte flexible and 20M-byte (optional 80M-byte) hard disk are part of every system. Users can add additional mass storage with more integrated units.

Configuration

DCP/5. The DCP/5 is housed in the Unisys PW2 500 or PW2 800 Series personal computer.

DCP/25. A maximum DCP/25 system includes a DCP/25 processor, 8M bytes of memory, a cabinet, two standard I/O modules, up to 31 line module slots, and up to 184 communications lines. The DCP/25 cabinet includes a power control module and active line indicators for three I/O modules. The third I/O module position is used for conversion to a DCP/30/35/50/55 system.

DCP/30. A maximum DCP/30 system includes a DCP/30 processor, 8M bytes of memory, two cabinets, six standard I/O modules, up to 93 line module slots, and up to 680 communications lines. The DCP/30 basic and expansion cabinet each include a power control module and active line indicators for three input/output modules. The DCP/30 processor/storage boards mount in reserved line module slots.

DCP/35. A maximum DCP/35 system includes two DCP/30 processor boards, 8M bytes of memory, two cabinets, six standard I/O modules, up to 92 line module slots, and up to 672 communications lines. The DCP/35 processor/storage boards mount in reserved line module slots.

DCP/50. A maximum DCP/50 system includes a DCP/50 processor, six cabinets (five expansions), 8M bytes of memory, 16 I/O modules, up to 247 line module slots, and up to 1,912 communications lines. The first cabinet provides the CP/Storage Module and two high-performance I/O modules. The CP/Storage Module houses the processor, two Storage Port Expansions (SPE/CPs), one 4M-byte storage bank, and space for an additional 4M-byte bank. The second cabinet and each expansion cabinet contains a standard I/O module in the top cabinet position and mounting capacity for two more I/O modules. Each DCP/50 Enhanced System Cabinet includes one power control module and active line indicators for three I/O modules.

Software

DCP Operating System (DCP/OS)

A multiprogramming operating system, DCP/OS supports the DCP architecture and controls all DCP hardware operations. It allows multitasking programs to be executed in demand (interactive) or batch mode. DCP/OS creates the environment for the development and operation of communications hardware and related utility programs.

Features and functions provided by DCP/OP include a file manager, CPA (access to CPA structures), RUN, process control, a port processor, a line module, a dictionary, interprogram messaging, record handling, and instrumentation. DCP/OS also provides facilities

that support DCP operations, including software installation and booting, DCP memory management, and console and peripheral device management.

Telcon

Telcon is the core communications software product for the DCPs, performing all communications processing on DCPs operating within a DCA network. Telcon enables multiple DCPs to be interconnected to form the backbone of a DCA network. DCPs within the network can perform communications processing independently of host processors, maintaining network communications paths and routing services, regardless of the operational status of individual hosts.

Users can define Telcon software to determine the characteristics and connections of all devices in the network that communicate through a particular DCP. Telcon executes as an application under DCP/OS, which manages all DCP internal processors, memory, and peripheral hardware. Telcon covers four categories: communications handlers and interface software, network management services, network software for establishing and maintaining communications between peer entities in a Telcon network, and support software for specialized capabilities.

Communications handlers and interface software include:

- Universal Data Link Control (UDLC) handler for intranetwork DCP-to-DCP trunk connections and connections between DCPs and remote DCA termination systems,
- Host Channel Handler (HCH) for word channel and byte channel connections between OS 1100 host processors and DCPs, and
- Communications Handlers supporting connection of a wide range of synchronous and asynchronous interactive and batch terminals to DCPs.

Network Management Services (NMS) software controls physical and logical facilities. NMS provides an administrative interface to a Telcon-based network for monitoring network activity and performance, collecting statistical data, performing online diagnostics, and controlling the operation of network facilities.

Network software for establishing and maintaining communications between peer entities in a Telcon network consists of a complex set of communications protocols, architecturally consistent with the seven-layer OSI model. Telcon includes protocol software that supports the information processing and data transport portions of a DCA network.

Support software handles specialized tasks, such as downloading software and configuration files to remote DCPs. Support software includes utilities that assist in configuring, generating, loading, and operating Telcon.

Telcon software also integrates software modules that support communications protocols required in other network environments. These additional software modules are called Telcon program products. Users install these program products as extensions to Telcon. The Telcon program products are LAN Platform, X.25 Packet Switched Communications Software (PSCS), TCP/IP Stack, and OSI Transport Services (OSITS).

Pricing

Purchase prices for the DCP family are DCP/5—$9,800; DCP/25—$31,000; DCP/30—$55,000; DCP/35—$125,500; DCP/50—$275,000; and DCP/55—$396,000. ■