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# Advanced Computer Communications Internetworking Products

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## Product Summary

### Editor's Note

Advanced Computer Communications is a well-established firm in the internetworking business—a market segment that is becoming increasingly crowded with new vendors' offerings.

### Description

ACC's ACS4400 is a good example of the modular chassis architecture to which many vendors are moving. The unit accepts various cards to perform internetworking functions—local bridging, remote bridging and routing, and token-ring attachment.

### Strengths

ACS4400 provides a modular chassis for various internetworking hardware options.

### Limitations

No significant limitations.

### Competition

Cisco Systems, Wellfleet, Vitalink, Proteon.

### Vendor

Advanced Computer Communications (ACC)  
720 Santa Barbara Street  
Santa Barbara, CA 93101  
(805) 963-9431

### Price

ACS4400 rack-mount chassis, empty—\$2,000.  
ACS4400 with four ACP4100 Ethernet remote/bridge router modules—\$20,000.  
ACS4400 with four ACP4100 token-ring remote/bridge router modules—\$24,000.

### GSA Schedule

No.

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—By *John Krick*  
Associate Editor

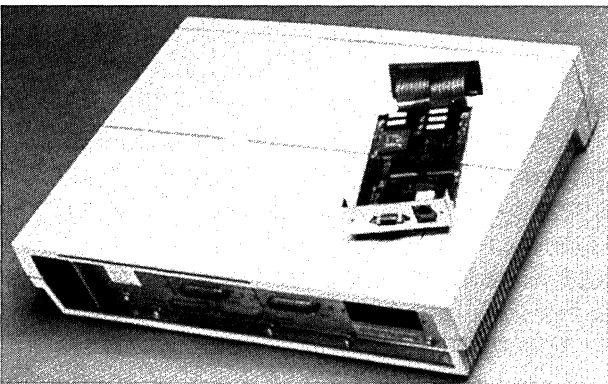
# Analysis

## Product Strategy

The internetworking market is an extremely dynamic one, with an increasing number of vendors, typically those already involved in another segment of the networking business, offering new bridge or router products.

ACC offers its internetworking products in two configurations—as standalone boxes, or as modular components for its ACS4400 chassis. In the 4400 product line, ACC is following a strategy that moves the company away from standalone, single-function boxes. The 4400 is a modular cabinet that accepts various types of internetworking modules, including cards that are functionally identical to the company's standalone devices.

ACC is a good example of a company that is well positioned at the juncture of two technologies that are rapidly converging. At the high end, both local area networking and wide area networking are converging on the modular chassis at the center of a star-based topology as an easily manageable, easily upgradable solution. Many companies that started in the wiring center business saw that they could easily add internetworking functionality to their products by building the needed cards. So far, most internetworking companies have produced



*The interchangeable interface architecture of the ACC Series 4000 products is clearly shown in this photo, which shows an IC41TR Token Ring Interface Card removed from the chassis.*

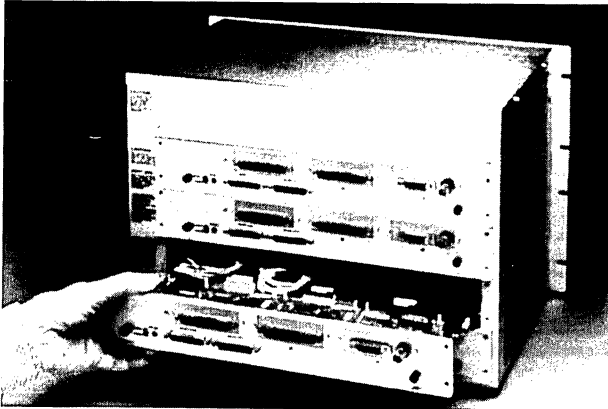
only small-scale, modular chassis—four- or five-slot boxes that are focused on what these companies know best—internetworking.

## Competitive Position

ACC competes against several vendors that have carved out comfortable niches for themselves in internetworking—Cisco, Wellfleet, and Vitalink; as well as several smaller companies that are new to the market but offer strong product lines. Now, the trend noted earlier—builders of network wiring centers adding bridging and routing functionality to their modular concentrator chassis—is bringing a whole new group of vendors to the expanding internetworking market.

The challenge of keeping a small company with a sharply focused line of products such as ACC's afloat in a rapidly changing market is one that could require that all the right moves be made at just the right times. It seems unlikely that a company like ACC could command the resources, on its own, to expand its product line to embrace general-purpose wiring centers. A codevelopment alliance with some firm looking to add internetworking functionality to its hub/concentrator line might be a key move for a company such as ACC. OEM agreements with companies that have large installed bases worldwide would also be important to such a company.

In fact, ACC has made these kinds of alliances over the past few years. ACC and enterprise networking pioneer Ungermann-Bass have joined to produce a multiprotocol bridge and router solution for U-B's Access/One intelligent wiring hub. Both companies are further linked by their respective OEM and development deals with telecommunications giant British Telecom (BT). Ungermann-Bass supplies BT with LAN equipment sold as its T-NET product line. The T-NET line also includes internetworking devices provided by ACC. In addition, ACC has been developing frame-relay technology for British Telecom's Tymnet subsidiary. Development work such as this can easily be plowed back into the company's own product line.



*The back panel of the ACS4400 modular chassis is shown here, illustrating how the separate modules are inserted. Modules include the ACP2100, ACP4100, and ACP4200 Ethernet bridge/router models, and the ACP4100 token-ring bridge/router.*

### Decision Points

ACC offers a product line that deserves strong consideration from users with a requirement to interconnect Ethernet or token-ring LANs. In this market, it is easy to spend more money than is strictly necessary—internetworking devices can cost in the tens of thousands of dollars. ACC's products are positioned at the low end of the internetworking market in price, but not in functionality. The most capable systems in their product line top out in price near the level where some of the competition's prices begin.

ACC seems to be moving quickly to add important functionality to its products—unshielded twisted-pair Ethernet and 16M bps token-ring network connections are among the newest additions to the capabilities of the ACC line. Until recently, ACC supported only Ethernet/802.3 networking. Its addition of token-ring and source routing support can only broaden the potential market for the company's products. ACC does not support FDDI or fiber optic Ethernet as yet.

### Company Profile

Advanced Computer Communications is a privately held company first formed in 1975 as Associated Computer Consultants to bring together several key participants in the Defense Department

ARPANET project. Subsequently, ACC became one of the largest suppliers of packet-switching interface hardware for ARPANET and ARPA-style networks. Today, the company manufactures internetworking equipment in a 39,000 square foot facility in Santa Barbara, CA and employs 80 people.

## Characteristics

**Model:** Local and remote bridges for Ethernet and token-ring connections to wide area networks.

**Date of Announcement:** ACS4100: September 1988.  
ACS4400: September 1989. ACS4200: January 1991.

**Date First Installed:** ACS4100: November 1988.  
ACS4400: October 1989; ACS4200: March 1991.

**Number Installed:** 2,693 remote bridge/router devices.

**Distribution:** Resellers and distributors.

### Architecture

Bridges and routers provide two solutions to the same problem—linking separate LANs, but at different levels of complexity. Bridges are simple devices that connect two networks. They have no "intelligence" beyond the capability to discriminate between packets destined for the far side of the bridge and those that stay on the near side. Routers, on the other hand, can choose among several paths to a network destination.

Lately, some vendors have been combining the functions of a bridge and router in one box. Since routers are protocol specific, these combination devices can usually route only one protocol, such as TCP/IP, while bridging all others.

The IEEE in its 802.2 Logical Link Control standard, has mandated the Spanning Tree Protocol (STP) for use in networks linked by multiple bridges. If redundant bridged connections exist, packets could wind up looping around the network and never reach their intended destination. The Spanning Tree algorithm works by deactivating redundant bridges unless a failure occurs.

IBM-compatible token-ring networks use a different sort of bridging protocol called source routing. In source routing, the transmitting workstation determines the path its packet will take through the internetwork topology. It discovers this path by reading address information that is delivered to it on a regular basis by internetwork devices such as bridges and routers.

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## Hardware

**ACS2100:** This is a local Ethernet bridge/router based on the Intel 80376. As a bridge, the ACS2100 is protocol independent and is a learning bridge, meaning that it automatically builds tables of workstation addresses by looking at the source addresses of arriving packets. The ACS2100 can be programmed to filter packets based on source or destination addresses, or based on protocol type. It can also function as an IP router, performing source and destination filtering and TCP/IP port number filtering.

The ACS2100 supports the Routing Information Protocol (RIP), a standard in TCP/IP internetworking. It also contains a Simple Network Management Protocol (SNMP) agent, so that it can deliver performance data and other statistics to a network management station. The ACS2100 is equipped with two Ethernet ports which can be thick or thin Ethernet connections. An RS-232 connector that can be supplied as a male DTE or female DCE connector is also included for attachment of a terminal console for programming filters and turning on the IP routing feature.

**ACS4100 Ethernet:** This is an Ethernet remote bridge that can connect a single local Ethernet to a variety of wide area networking resources. Used with ACC's Series 4000 Software Distribution, it can connect to remote Ethernet LANs via serial connections or public or private packet switched networks. It features two WAN ports that can be any combination of RS-232, RS-422/-449, V.35, or X.21 interfaces. The single Ethernet connection can be either a thick or thin coaxial connector. An RS-232 port, which can be supplied as either a male DTE or female DCE connector, is used to connect a terminal console for programming the ACS4100's bridging and routing filters as well as the SNMP agent provided. The ACS4100 contains an internal, 3½-inch diskette drive used to load and update the software.

**ACS4100 Token Ring:** The ACS4100 is a token-ring, remote bridge that can connect a single 802.5 token-ring network to wide area networks through two WAN ports. WAN ports can be any combination of RS-232, RS-422/-449, EIA530, V.35, or X.21 interfaces. Both an RJ-45 connector, for unshielded twisted pair, and a DB-9 connector, for shielded twisted pair, are included with the base unit. It supports the source routing scheme used in IBM-compatible token-ring networks, as well as IP datagram routing.

**ACS4200:** The ACS4200 is a high-performance, remote bridge/router based on a 25MHz Motorola 68030. It supports connection to T1 and European T1 (E1) transmission lines. It includes two serial ports that can be configured independently for different line speeds and types. The two ports can be connected to different remote sites or to the same site for redundancy or load leveling. Like the ACS4100 models described above, the ACS4200 can be modified in the field to use different types of connectors. It is equipped with an internal, 3½-inch diskette drive used to load and update the software.

**ACS4400:** This is a modular platform that can support up to four communications modules. Each communications module has one port for attachment to a local Ethernet and two ports for wide area network connection, for a maximum of four LAN ports and eight WAN ports. Modules can be ordered with connections for either thin or thick coaxial Ethernet; for token-ring; and with any combination of RS-232, RS-422, X.21, or V.35 interfaces, and interfaces can be modified in the field using ACC's interface cards. The ACS4400 features a 3½-inch diskette drive to load the Series 4000 software distribution for each module. Modules can be installed or replaced while the unit is operating, so that no network downtime is required for maintenance.

**ACP2100 Module:** This module provides functionality identical to that of the standalone ACS2100 local bridge, but is offered as a module for the ACS4400 chassis.

**ACP4100 Module:** This module provides functionality identical to that of the standalone ACS4100 remote bridge, but is offered as a module for the ACS4400 chassis. It features interchangeable LAN and WAN interface cards so that connections can be modified in the field.

**ACP4200 Module:** This module provides functionality identical to that of the standalone ACS4200 remote bridge, but is offered as a module for the ACS4400 chassis. It features interchangeable LAN and WAN interface cards so that connections can be modified in the field.

**Interface Cards and Adapters:** ACC's Series 4000 bridge/routers, including the ACS4400 modules, are based on a flexible interface design called the Standard Interface Convertor (STIC). It allows connectors for LAN and WAN attachment to be modified in the field using modules that are easily changed. Various modules are available for connection to thick and thin Ethernet and token-ring LANs, and for several WAN interface standards—V.35, RS-422/-449, RS-232, and X.21.

ACC refers to LAN and WAN connector cards for the ACS/ACP4100, and LAN interface cards for the ACS/ACP4200 as Interface Cards, and to the WAN interface cards for the ACS/ACP4200 as Interface Adapters. LAN Interface Cards are offered for the ACS/ACP4100 and ACS/ACP4200 to provide Ethernet

connections and for the ACS/ACP4100 for token-ring connections. Four WAN Interface Cards for the ACS/ACP4100, and four WAN Interface Adapters for the ACS/ACP4200, are offered, with 25-pin RS-232, 37-pin RS-422/-449, 15-pin X.21, or 34-pin V.35 connectors.

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## Software

**Series 4000 Software Distribution:** Included with the ACS4100 and the ACS4400, the Series 4000 Software Distribution allows these devices to be configured in several ways. Remote Ethernet bridging, TCP/IP, DECnet, XNS, and IPX routing are supported, and simultaneous bridging and multiprotocol routing can be specified at setup time. Configured as a remote Ethernet bridge, a Series 4000 platform features automatic address learning, continually updating its database of forwarding addresses. Moves, additions, and deletions of workstations are accomplished without manual modification of the bridge software.

Automatic filtering of packets insures that only those packets destined for remote locations are forwarded. Custom address filters can also be added so that the bridge will reject packets addressed to or sent from sensitive resources. Protocol precedence can also be established so that the bridge will forward packets of certain types on a priority basis. Frame compression allows the transmission of compressed packets for optimal utilization of low-speed serial lines. The bridge software implements the IEEE 802.1 Spanning Tree Protocol, which deactivates redundant links between networks unless a failure occurs.

TCP/IP routing can be performed using the Routing Information Protocol (RIP) or the more capable Open Shortest Path First (OSPF) protocol. Both protocols can be supported simultaneously, as well. Users can establish fixed paths between routers by customizing the routing tables, a technique referred to as static routing. To support Defense Data Network (DDN) applications, the Series 4000 software implements the Exterior Gateway Protocol (EGP). When attached to secure X.25 networks, the Blacker interfaces required on Department of Defense networks can be used.

DECnet Phase IV routing at level 1 and level 2 is supported, and simultaneous bridging of Local Area Transport (LAT) packets is also possible. A migration path to DECnet Phase V will be provided as Phase V becomes available. Series 4000 software transparently routes DECnet Network Information and Exchange (NICE) network management packets to DECnet nodes, while providing SNMP data to other network management stations at the same time.

Novell IPX routing is supported using RIP or the Novell Server Advertising Protocol (SAP). Xerox and

Ungermann-Bass XNS routing uses RIP, with optional RIP extensions. Error Protocol and Echo Protocol are supported to ease network troubleshooting in XNS environments.

**ACS4800:** ACS4800 network management software runs on a Sun Microsystems Sun-3 or Sun-4/SPARCstation. Based on the X Windows graphical user interface (GUI), the ACS4800 screen makes extensive use of symbols and color coding to indicate the locations and status of hosts, bridges, routers, and other network components. An embedded SQL database collects information about each device when the network map is created by the administrator and is continually updated as the ACS4800 performs its polling sequence. ACS4800 software uses the Simple Network Management Protocol (SNMP) to monitor the network and collect statistics. Widely used in the TCP/IP community, SNMP has become a de facto standard for network management.

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## Support

### **Installation**

ACC offers installation support by factory-trained technicians. Contact ACC Customer Service for prices and to schedule installation at the time the equipment order is placed.

### **Training**

ACC offers a number of training course on its products' functions and use, repair, and networking concepts. Custom course development is also offered. Contact ACC Customer Service for details and prices.

### **Warranty**

ACC provides a one-year warranty on all of its equipment.

### **Maintenance/Support**

ACC provides a yearly On-Site Service maintenance plan that includes toll-free telephone technical support, on-site repair of hardware products, and a Software Support program subscription. On-site service is available 24 hours a day, 7 days a week. Repair service is also offered on a time-and-materials basis. Another service plan called Service One provides all of the above plus 24-hour replacement of malfunctioning hardware.

### **Software Support**

ACC's Software Support is a yearly plan that provides toll-free telephone technical assistance and software updates.

## Equipment Prices

		<b>Purchase Price (\$)</b>			<b>Purchase Price (\$)</b>
S2100	ACS2100 Two-port local Ethernet bridge/router	3,250	M4200-E	ACP4200 Module (for ACS4400 chassis)	7,375
S4100-E	ACS4100 Ethernet three-port remote bridge/router	5,500	IC232	RS-232 Interface Card for ACS/ACP4100	475
S4100-T	ACS4100 Token Ring three-port remote bridge/router	6,500	IC422	RS-422 Interface Card for ACS/ACP4100	475
S4200-E	ACS4200 high-performance Ethernet remote bridge/router	8,500	ICX21	X.21 Interface Card for ACS/ACP4100	475
S4400	ACS4400 Modular multiport bridge/router hardware platform (chassis only)	2,000	ICV35	V.35 Interface Card for ACS/ACP4100	475
M2100	ACP2100 Module (for ACS4400 chassis)	3,250	IC41TR	802.5 Token Ring Interface Card	1,000
M4100-E	ACP4100 Ethernet Module (for ACS4400 chassis)	4,500	IC41ET	Ethernet Interface Card for ACS/ACP4100	600
M4100-T	ACP4100 Token Ring Module (for ACS4400 chassis)	5,500	IC42ET	Ethernet Interface Card for ACS/ACP4200	950
			IA232	RS-232 Interface Adapter Kit	275
			IA422	RS-422 Interface Adapter Kit	275
			IAV35	V.35 Interface Adapter Kit	275
			IAX21	X.21 Interface Adapter Kit	275
			SW4800	ACS4800 Network management software	12,500



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# Apple Computer AppleTalk Network System

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**Product Summary****Editor's Note**

The introduction of new low-cost models of the Macintosh and a "plug-and-play" Ethernet system are the major highlights of much recent activity at Apple headquarters.

**Description**

A network operating system, AppleTalk, together with supporting hardware and software based on the OSI protocols, designed for use with the Apple Macintosh microcomputer product line.

**Strengths**

- "Plug-and-play" installation at low end.
- Development tools for access to mainframe applications using Macintosh GUI.

**Limitations**

- High list prices for adapter cards and other hardware.
- Not enough end-user software products—developer tools predominate.

**Competition**

IBM PC networks running on Novell, IBM, and Microsoft network operating systems; Macintosh networking products from many third-party suppliers including Farallon, Shiva, TriData, and Avatar.

**Vendor**

Apple Computer, Inc.  
20525 Mariani Avenue  
Cupertino, CA 95014  
(408) 996-1010

**Price**

Prices vary depending on product and configuration.

**GSA Schedule**

Yes.

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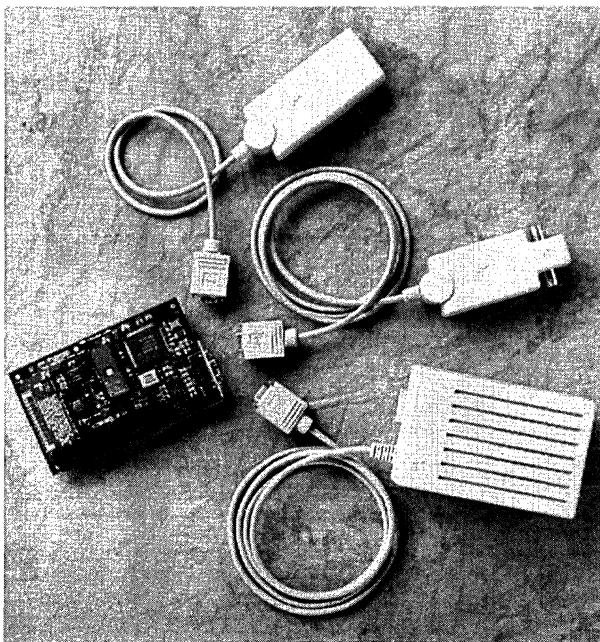
—By *John Krick*  
Associate Editor

# Analysis

## Product Strategy

Apple's strategy in any of the several markets it competes in is problematic. Compared with the options available from any of the several hundred makers of IBM PC clones—and the thousands of suppliers of aftermarket products for them—Apple's pricing policies, the product mix it offers, and its refusal to allow third-party firms to build Macintosh compatibles, seem at odds with its stated desire to overtake IBM in the microcomputer market.

The new models of the Macintosh—the Macintosh Classic, the Macintosh LC, and the Macintosh IIsi, are cases in point. They seem to offer little to attract the corporate user who is not already a Macintosh devotee. The Macintosh Classic, which replaces the Plus and the SE, has no



Apple's new "plug-and-play" Ethernet products include the Ethernet LC card, at left, and, from top to bottom, the Ethernet Twisted Pair Transceiver, the Ethernet Thin Coax Transceiver, and the Ethernet AUI Adapter.

expansion slots, a monochrome display, and is based on an 8MHz 68000. It is basically the same old Macintosh, except that it has a price under \$1,000. The Macintosh LC is the most radical departure from existing products. It features a 68020 and RGB color but has only a single expansion slot, and that slot is of a design different from any other in the Macintosh line. The Macintosh IIsi is the new low-end machine in the Mac II family and is based on the 68030 processor. It, too, has only one expansion slot.

## A New Ethernet Connection

Apple's new Ethernet scheme includes adapter cards for the new Macintosh LC "processor-direct" bus slot and for the NuBus used in the Macintosh II product line. The system uses a new proprietary connector that Apple says was necessary because the industry-standard AUI interface draws too much power. Many third-party suppliers of Macintosh connectivity hardware have already promised to bring to market products that support the Apple Ethernet Interface, as the new connection system is called. The new cabling system will be self-terminating, which means that adding or removing a Mac from the network will have less of an effect on network operation. When a machine is removed from the network, the self-terminating cables loop internally, forming two subnets. The adapter card for the LC was the first product to be introduced, while the NuBus card is expected to be released in the second quarter of 1991. The NuBus card will reportedly be based on the Macintosh Coprocessor Platform, which means the card will have a 68000 and at least 512K bytes of RAM on-board to handle all of the processing necessary to interface to the Ethernet network.

## A New Operating System

The long-awaited System 7.0 operating system, scheduled for release on May 13, 1991, promises many features of interest to network users, including a new distributed network system, Apple FileShare; new Interapplication Communications (IAC) capabilities; and new E-Mail software called AppleMail.

Apple FileShare is a distributed network operating system built into System 7.0, which means that it does not require dedicated file server machines. Any user can elect to share his or her hard disk or certain folders with all or selected users on



## Company Profile Apple Computer, Inc.

### **Corporate Headquarters**

20525 Mariani Avenue  
Cupertino, CA 95014  
(408) 996-1010

### **Officers**

*Chairman, and CEO:*  
John Sculley  
*President and COO:*  
Michael Spindler  
*Exec. VP and CFO*  
Joseph A. Graziano  
*President, Apple USA:*  
Robert Puette  
*Senior VP, President  
Apple Pacific:*  
Ian Diery

### **Company Background**

*Year Founded:* 1977  
*No. Employees:* 12,000  
worldwide

Apple develops, produces, and markets personal computers, peripherals, systems software, and communications products for the business, education, engineering, government, and scientific markets. Founded by Steve Wozniak and Steve Jobs in Santa Clara Valley, CA, Apple's original goal was to make computers accessible for every type of user, from novices to experienced users.

### **Business Overview**

Apple's first computer, the Apple II, was introduced in 1977. It became immediately popular in the education, small business, and personal productivity markets. The Macintosh computer was introduced in 1984, and it expanded the scope of business computing. More than 12,000 software programs have been written by third-party vendors for the Apple II, and more than 4,000 for the Macintosh. In 1988, Apple joined the UNIX market with the introduction of A/UX. In 1990, Apple joined both UNIX International and the Open Software Foundation.

Due to a slight loss of its share in the PC market, Apple recently revamped its Macintosh line and cut prices on all models.

### **Financial Profile**

Apple has evolved from a two-person shop into a multibillion dollar, *Fortune* 200 company. Apple posted revenues of \$5.28 billion in 1989 and \$5.56 billion for fiscal 1990, which ended on September 28. Net income for the full year was \$474.9 million, a 5 percent increase from 1989. International sales accounted for 42 percent of total revenues in 1990, compared to 36 percent in 1989.

Apple maintains one of the highest revenue-per-employee rankings in the personal computer business, with an excess of \$400,000 per employee.

the network. A User Setup Control Panel allows each machine's owner to specify which other users or groups of users can access his or her files, define group members, and set passwords. All of these functions are implemented in the familiar Macintosh style, with users and groups represented by icons. Apple FileShare should fill the needs of small workgroups quite well. Users with larger networks will need to stay with the dedicated server AppleShare system, since the practical limit on the number of users with FileShare is about 50. Interapplication Communications (IAC) is a system through which programs can communicate with each other. It includes Publish and Subscribe, also referred to as "live" cut and paste, meaning that if changes are made to a document that is shared by several users in a workgroup, the changes are reflected in all copies of the document. Also included in IAC is AppleEvents, a low-level protocol set used by applications and IAC features like Publish and Subscribe to communicate between themselves. Developers will need to design new applications and update old ones, so that they can

take full advantage of AppleEvents and the other features of IAC. IAC should spur the growth of both the peer-to-peer and client/server computing models in the Macintosh world.

### **Data Access Language**

Apple's Data Access Language (DAL), formerly known as CL/1, shipped in March. This "generic" front end for Structured Query Language (SQL) databases can provide an easy to use interface to SQL. It can also provide users with consistency of operation where more than one SQL database is employed, perhaps on different hardware platforms. Once a DAL front end has been developed, it can be easily ported to new SQL applications. DAL is a client/server application, with components that run on both the host and the Macintosh workstations.

### **AppleTalk Licensing Program**

Since June 1990, Apple has been pursuing an aggressive licensing strategy with DAL and with the AppleTalk protocol set and has recently added net-

work giant Novell and AT&T to its list of licensees. Novell will be using the AppleTalk source code to build NetWare for Macintosh v3.0, a set of NetWare Loadable Modules (NLMs) for NetWare v3.11. Apple and AT&T agreed on a specification for access to the AppleTalk protocol set from UNIX System V Release 4. AT&T has already incorporated the APIs described in this specification into its UNIX-based StarGROUP LAN Manager system. Mainframe manufacturer Tandem, considered a major force in online transaction processing systems, will be releasing the Tandem DAL Server, which provides access to Tandem's NonStop SQL databases.

Other recent DAL licensee's include Data General, for its Avion line of UNIX workstations, and Pacer Software which has licensed DAL to develop UNIX server packages for Hewlett-Packard, Sun Microsystems, Digital Equipment Corporation, and the IBM RS6000 UNIX platforms. Blyth Software has signed on to develop versions for MS-DOS, Microsoft Windows 3.0, and OS/2, and a client version for UNIX.

Another important licensing agreement was forged with Farallon, one of the most significant third-party Macintosh connectivity vendors, to allow development and marketing of the AppleShare PC product. Farallon will also develop a new AppleTalk implementation for the Microsoft Windows environment.

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## Competitive Position

It is important to recognize that the Macintosh fostered a new vision of the possibilities of truly user-friendly computing based around a consistent graphical user interface (GUI). In fact, the Macintosh's once unique Desktop has been the primary reason for the success and longevity of the Macintosh in a market where the dominance of the IBM PC standard is taken for granted. It is truly ironic that many in the business world are only now beginning to take the icon- and mouse-oriented GUI seriously since the advent of Microsoft Windows. Even given the advances achieved with Windows 3.0, Microsoft has a long way to go before it achieves the kind of consistency of operation across widely divergent types of applications that the Mac has always had. Providing a user interface for sophisticated client/server applications like SQL databases is where the Macintosh

really shines. It takes the experience of actually seeing and working with a Macintosh that has been properly configured with DAL or MacWorkStation and wired into a mainframe database to convince users that the Macintosh offers the most well-developed platform available today for client/server computing.

While Apple represents the only real alternative to the often arcane world of the IBM PC and its predominant networking schemes, until relatively recently Apple has done little to advance the cause of real-world connectivity for its machines. Apple's much heralded June 1989 AppleTalk Phase 2 announcements appeared to be intended to position the company as the central focus of a burgeoning market of Macintosh connectivity products, but that promise has been left largely unfulfilled. Many of the products Apple announced have only recently been delivered, while others are chiefly developer's tools and not the end-user products that customers might have hoped for.

The center of Macintosh connectivity is diffuse, spread among many vendors that each provide a piece of the puzzle. While sophisticated links between PC LANs, wide area networks, and mainframe computers can be forged, the lack of any large organization on the order of a Novell or a 3Com, that is devoted to Macintosh connectivity in the same way that those companies are devoted to PC networking, makes the task daunting at best. Apple has yet to show itself capable of being such an organization. A high degree of interoperability is possible today between the Macintosh, PC networks, and large-scale computing resources, but network builders must assemble pieces from many different manufacturers—sometimes with little regard for Apple's own offerings—to achieve it.

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## Decision Points

Networks of Macintoshes seem to fall primarily into two categories—small all-Macintosh networks and large networks of Macintoshes that are attached to larger networks of PCs and mainframes. Few users have built large networks based on industry connectivity standards such as Ethernet or token-ring that are chiefly composed of Macintoshes.

For the small network user, Apple can provide low-cost connectivity either through the venerable but slow LocalTalk hardware included with

every Mac, or through its newer Ethernet options. Apple's list prices for such items as its EtherTalk card have always been steep. The EtherTalk NB card is now being phased out in favor of the new "plug-and-play" Ethernet adapters, which will carry a lower price tag but require the purchase of a transceiver that nearly doubles the list price. Users with a requirement to connect Macintoshes to Ethernet should shop diligently among the many companies now offering such connections, including the several makers of LocalTalk-to-Ethernet gateways. Token-ring connectivity presents fewer choices since relatively few companies offer such hardware. Token-ring hardware is generally quite expensive; Apple's TokenTalk NB card is very expensive.

Apple's offerings in the Mac-to-mainframe segment are also high priced, and several well-regarded firms such as Avatar and DCA offer alternatives.

In the area of front-end software for client/server applications, Apple's Data Access Language and MacWorkstation deserve strong consideration and could form the crux of a decision to go with the Macintosh as a client machine.



## Characteristics

**Model:** AppleTalk network operating system and supporting hardware and software.

**Date of Announcement:** AppleTalk Phase 1—January 1985; AppleTalk Phase 2—June 1989.

**Date First Installed:** AppleTalk Phase 1—March 1985; AppleTalk Phase 2—July 1989.

**Number Installed:** 2.4 million nodes worldwide.

**Distribution:** Dealers and VARs.

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## Architecture

Devices in an AppleTalk network use the AppleTalk protocol set for communications. Some confusion invariably seems to exist among users between the AppleTalk protocol set and Apple's LocalTalk network hardware system discussed later. The term AppleTalk refers only to Apple's network software. Currently, Apple supports three types of AppleTalk networks—LocalTalk, EtherTalk, and TokenTalk. Some third-party vendors support AppleTalk on Arcnet.

AppleTalk was designed to comply with the International Organization for Standardization's (ISO's) OSI Reference Model. The protocol set includes modules that address each of the seven layers of the OSI model. AppleTalk also supports Dynamic Node Addressing, which automatically assigns network devices node addresses at start-up so that the addressing is transparent to the user. Another feature of the protocol, Distributed Name Service, lets users read and access resources on the network by name instead of by network address.

Apple announced AppleTalk Phase 2 in June 1989. Phase 2 greatly extended the capabilities of AppleTalk through extended addressing. AppleTalk Phase 1 could only address a maximum of 256 network nodes. AppleTalk Phase 2 can support up to 16 million nodes through internetwork connections.

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## Hardware

Since 1984, all Macintoshes have included a physical data link called LocalTalk that features a speed of 230.4K bits per second and uses shielded twisted-pair wiring arranged in a daisychain topology. While LocalTalk is adequate for small networks, Apple's networking strategy in recent years has emphasized integration of the Macintosh into industry-standard networks for enterprise-wide connectivity.

While EtherTalk and TokenTalk let Apple Macintoshes use standard networks, LocalTalk can also be used to allow MS-DOS-based machines to access Apple's network servers and Apple LaserWriter printers. EtherTalk (Version 2.0) brings AppleTalk Phase 2 support to Ethernet network environments.

### Network Interface Cards

**Ethernet LC Card:** Designed for the Macintosh LC's 68020 "processor-direct" expansion slot, the LC card uses the new Apple Ethernet Cabling system, which draws less power and occupies less space than the traditional Ethernet AUI connector. A line of transceivers, described elsewhere, is offered to facilitate connection to standard Ethernet cabling.

**Ethernet NB Card:** Like the LC Card described previously, this NuBus card features the ease of installation

of the new Apple Ethernet Cabling system. It is an intelligent card based on the Macintosh Coprocessor System, in which an on-board 68000 processor and 512K bytes of memory are dedicated to Ethernet processing tasks.

**EtherTalk NB Card:** This card allows Macintosh II computers to connect to 10M bps 802.3 Ethernet networks. Apple OEMs the EtherTalk NB card from 3Com, and it is due to be phased out as the new Apple Ethernet Interface cards, described before, become available. Included with the card is EtherTalk software. EtherTalk NB works with the AppleTalk protocol, TCP/IP, and a number of protocols provided by third-party developers. When the board is installed in a personal computer using Apple's A/UX operating system, it allows the computer to connect to UNIX-based LANs, including TCP/IP and the Sun Network File System (NFS). A transceiver and a BNC connector for thin Ethernet coaxial cabling are provided on the board; a 15-pin AUI connector for thick Ethernet coaxial cable is also provided through an external transceiver. The EtherTalk NB Card can be installed in the NuBus slot of any Macintosh II personal computer.

**TokenTalk NB Card:** The TokenTalk NB card allows Macintosh II family personal computers to communicate with IBM and compatible 4M bps token-ring networks. The card is compatible with IEEE 802.5 Media Access Control (MAC) and 802.2 Logical Link Control (LLC) standards. TokenTalk NB has its own 68000 microprocessor, memory, and realtime operating system. The card uses the Texas Instruments TMS 380 chip set to perform all token-ring access functions.

Included with the TokenTalk NB Card is TokenTalk software and the Server Message Block (SMB) File Transfer Utility. TokenTalk software supports AppleTalk Phase 2 protocols running over 802.5 token-ring networks. It allows Macintosh users on a token-ring network to access AppleTalk services. The SMB File Transfer Utility allows Macintosh and IBM PC users to transfer files within a workgroup. The SMB utility includes an Apple File Exchange application program that transfers and translates files between Macintosh and DOS formats.

Using TokenTalk NB requires a Macintosh II family computer and any one of the following application packages: TokenTalk software, SMB File Transfer Utility, MacDFT software (performs 3270 emulation in a token-ring environment), or MacAPPC Software (provides APPC support in a token-ring environment). The TokenTalk NB card includes a DB-9 connector for attachment to IBM cabling. External adapters can also be added to the board for attachment to Type 3 cables.

**Serial NB Card:** This card connects Macintosh II computers to remote systems. The board has four serial ports that support RS-232, RS-422, X.21, or V.35 communications. Two ports can be configured for high-speed communications at rates up to 64K bps full duplex or 230.4K bps half duplex. Low-speed ports

transfer data at rates up to 19.2K bps. The card has its own on-board 68000 microprocessor, memory, and multitasking operating system. When used with MacAPPC software, the board establishes an SDLC link with an IBM SNA network.

The Serial NB card can be installed in any Macintosh II family computer. Macintosh System Software Version 6.0.3 or later is required. The card has an on-board DB-62, multiple-port connector.

**Coax/Twinax Card:** The Coax/Twinax card allows the Macintosh II family of personal computers to access an IBM SNA network via coaxial cabling. The card enables the Macintosh to emulate a 3270 terminal while maintaining local Macintosh functionality. The board provides a BNC coax connector and a 15-pin D-style twinax connector. The latter paves the way for future support of 5250 emulation. The board includes memory, a 68000 microprocessor running at 10MHz, and a realtime operating system that off-loads all communications processing from the Macintosh.

When using MacDFT application software with the card, either single-session Control Unit Terminal (CUT) mode operation or up to five-session Distributed Function Terminal 3270 emulation is supported. Files are transferred between the personal computer and mainframes running VM/CMS or MVS/TSO using IBM's IND-\$FILE package.

Using Apple's Coax/Twinax Card requires a Macintosh II family computer, MacDFT application software, and System Software Version 6.0.3 or higher. The card also supports Apple's 3270 API, which allows programmers to develop customized 3270 applications.

### Other Hardware

**Thin Coax Transceiver:** This allows connection of the Apple Ethernet NB and Ethernet LC cards to thin coaxial Ethernet cabling with a BNC connector.

**Twisted-Pair Transceiver:** This transceiver connects the Ethernet NB and Ethernet LC cards to unshielded twisted-pair Ethernet cabling through an RJ45 connector.

**AUI Adapter:** This product provides a 15-pin Attachment Unit Interface (AUI), the standard connector for Ethernet attachment to thick coaxial transceivers and other devices.

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## Software

### Server Software

**AppleShare File Server Software Version 2.0:** This software turns a dedicated Macintosh with at least one hard disk into a file server on an AppleTalk network. Users connect to the AppleShare server by clicking on the AppleShare icon in the Chooser.

Users who store folders on the AppleShare server can define access rights to those folders, so that other users can only read documents and applications stored there, can read the contents of other folders within a folder, or can have full read and write access. They can make folders private, so that only the owner can access them, or shared, so that selected groups of users or everyone on the network can see them.

**AppleShare PC Version 2.0:** This is client software that allows users of MS-DOS-based PCs to access the AppleTalk network, sharing files and access to Apple LaserWriter and ImageWriter network printers. AppleShare PC also allows data files created under DOS applications to be mapped to Macintosh applications that have the same format, such as Microsoft Word and Excel.

AppleShare PC software is data-link independent; a PC running AppleShare PC can work with any network interface card that complies with the Multiple Link Interface Driver (MLI) specification. Apple's LocalTalk PC card can be used to connect a PC to a LocalTalk network.

AppleShare PC requires a DOS-based computer with at least 384K bytes of RAM and two diskette drives. The computer must be running MS-DOS Version 3.1 or later.

**AppleShare Print Server Version 2.0:** Version 2.0 runs on a dedicated Macintosh Plus or larger system and provides print spooling for networked Macintoshes. It can run concurrently with the AppleShare File Server so that the most efficient use of server resources can be achieved. It supports up to five LaserWriter or ImageWriter printers. Print-queue management functions are included to allow administrators to control queues from a centralized location.

### **Communications Software**

**AppleTalk Internet Router:** This router allows users to connect LocalTalk, EtherTalk, and TokenTalk networks to form an internet and provides transparent access to LocalTalk-connected LaserWriter and ImageWriter II printers from EtherTalk and TokenTalk networks. Using the router, an AppleTalk internet can support extended addressing of up to 16 million devices (nodes) distributed over as many as 1,024 interconnected networks. A single, large network can also support the maximum number of nodes. As many as eight networks can be connected through an internet router installed on a single Macintosh.

Internet router software is installed in a nondedicated Macintosh. That Macintosh manages the addressing information for routing data between each network while maintaining its local workstation capabilities. Local traffic is isolated from the internet traffic, and data is routed along the shortest path to its destination. All network connections can be displayed on the Macintosh serving as the router. The user enters a network

number range for each network that needs to be interconnected. A zone name can be assigned to each node, and directory services can be performed according to node. Users can use a redundant route topology to re-route internet traffic in the event of a network failure. A router desk accessory allows users to display statistics and activity windows. Users can display error information, view a routing table of the internet, change router setup information, and print setup and administrative display screens.

When working with EtherTalk and TokenTalk networks, a feature called zone multicast is used to send messages to members of a specific zone, instead of to all nodes on the internet.

The AppleTalk Internet Router can be installed on any Macintosh Plus or larger system running Macintosh System Software Version 6.0.3 or later. The appropriate network interface cards and software are also required for establishing network connections. AppleTalk Internet Router uses between 120K and 160K bytes of RAM, depending on the number of networks in the internet.

**MacDFT:** MacDFT is a program that allows a Macintosh to emulate an IBM 327X terminal in order to access information on an IBM host running VM/CMS or MVS/TSO. The program supports 3270 Model 2, 3, 4, and 5 screen formats and is designed to work with Apple's Coax/Twinax and TokenTalk NB Cards. Although named MacDFT, the program supports both DFT- and CUT-mode operation. Text, binary, and MacBinary files can be transferred using a method based on IBM's IND-\$FILE transfer method. Users can copy and paste information between the Macintosh and the mainframe. Features of the program include keyboard mapping and keystroke record and playback. MacDFT remains active in the background, functioning under MultiFinder, while the user works on other applications in the foreground. The program requires the use of System Software Version 6.0.3 or later.

**MacAPPC:** MacAPPC is a software tool and Application Programming Interface (API) that allows Macintosh computers to exchange information with other computers supporting IBM's Advanced Program-to-Program Communications (APPC) on a peer-to-peer basis. The product includes an implementation of the LU6.2 and PU2.1 protocols and interfaces that programmers can use to develop communications services between Macintoshes and SNA networks. APPC support guarantees that the software is hardware independent, and applications developed with MacAPPC can be used with tokenring, SDLC, X.25, or other types of connections. MacAPPC uses the familiar Macintosh user interface.

Developers can create customized applications using 68000 Assembler, C, Pascal, or HyperCard. In client/server configurations, the server code resides on a communications card that plugs into the NuBus expansion slot of a Macintosh II family computer. The client or toolbox side resides on the Macintosh as a set of device drivers. On the server side, the system requires a Macintosh II family computer and an intelligent NuBus

communications card that complies with the Macintosh Coprocessor Platform architecture. On the client side, a Macintosh Plus, Macintosh SE, Macintosh SE/30, or any Macintosh II family computer is required. Both the server and client components can reside on the same Macintosh.

**Apple 3270 API:** This is a high-level application programming interface based on IBM's 3270 PC HLLAPI. Developers and programmers can use the interface to design their own customized applications programs. The API allows terminal emulators, file transfer programs, and Macintosh applications and tools to use 3270 services without regard to the type of physical connection.

**MacTCP:** MacTCP provides a platform for development of TCP/IP communication applications. It includes a set of protocol drivers and programming libraries that developers can use to create Macintosh applications for TCP/IP environments. C and assembly language interfaces and object code libraries for TCP and User Datagram Protocol (UDP) and a name-to-address resolver are provided.

**MacX25:** This is server software that allows Macintoshes to connect to packet switched data networks (PSDNs) that support the CCITT X.25 Recommendation. The software is installed on a single Macintosh, which is the sole entry point to the X.25 network. Macintosh computers on an AppleTalk network then gain access to host computers and services based on the PSDN. Because access is server based, users can be added easily and fewer leased lines need to be set up. Part of the MacX25 package is MacPAD software. Working with the server software, it performs X.3, X.28, and X.29 packet assembly/disassembly (PAD) functions that provide connectivity to the PSDN. The Macintosh, acting as an asynchronous terminal, can access packet switched networks when using MacPAD. Using an RS-232-C connection, information is transferred at rates up to 19.2K bps. Using a V.35 interface, information is transferred at rates up to 64K bps.

Other features include an address book for selecting services by name instead of PAD commands, a graphics-based administrator application that administrators user access, and user passwords for security. The package also includes a MacX25 Programming Library toolkit, or collection of routines, that provides a high-level program interface for applications. The library includes such routines as establishing and terminating contact with the MacX25 server, establishing and closing a virtual circuit, and transferring data across a virtual circuit. C programming libraries are also included. MacX25 can be installed on a Macintosh II family personal computer with a fixed disk and 2M bytes of RAM. The system must be running Macintosh System Software Version 6.0.3 or later. Also necessary is an Apple Serial NB Card with an RS-232-C or V.35 cable and the appropriate AppleTalk network-compatible cable connectors. Using MacX25 on an Ethernet network requires

an Ethernet interface card. MacPAD can be installed on any Macintosh Plus or larger Macintosh system. The PAD also requires AppleTalk-compatible cable connectors and a terminal service application that uses the Macintosh Communications Toolbox. AppleTalk Data Stream Protocol (ADSP) software and the Macintosh Communications Toolbox are part of MacX25 server software.

MacX25 is certified for connection to the Telenet and GEIS networks. In the future, it will also be certified for Tymnet and DDN, as well as for several European services, Canada's Datapac, and Australia's Austrpac. The program does not support permanent virtual circuits or X.32 switched-circuit operation.

### **Additional Software**

**Data Access Language (DAL):** This language was formerly known as CL/1. DAL is a connectivity language that allows developers to provide Macintosh computers access to information on Structured Query Language (SQL) database systems. Although SQL is supposedly standardized, each database developer has added its own enhancements to SQL, so that users of one relational database cannot easily work with another type. DAL allows transparent access to many varieties of SQL databases through the familiar Macintosh user interface.

DAL is composed of client and server components. The DAL server portion can reside on an IBM mainframe for access to DB2 databases running under MVS/TSO or SQL/DS databases under VM/CMS. On a Digital Equipment Corp. VAX computer running under VMS, DAL can access data from a variety of databases including Oracle, Ingres, Informix, Sybase SQL Server, and VAX Rdb. The DAL client can be a Macintosh Plus or higher.

**MacWorkStation:** This is a developer's tool for programmers who are largely unfamiliar with the requirements of the Macintosh programming environment, but who need to create Macintosh-based user interfaces for mainframe applications. It gives programmers high-level access to the Macintosh Toolbox to access the standard components of the Macintosh user interface such as dialog boxes, pull-down menus, alerts, and windows.

**InterPoll:** This software is a network planning and analysis tool that can display lists of zones, connected sub-networks, and active devices; query nodes to report system software versions; and test paths and connection status to any specific device or part of the network. It can be used as a troubleshooting tool or to help plan optimum network design. A Network Map file can be created that shows floor plans, cable layout, and device locations. InterPoll can run on any Macintosh Plus or later model.

**MacX 1.1:** This is an X Window display server that runs under the Macintosh operating system. Three major enhancements have been included with Version 1.1—a

threefold increase in server performance, cut-and-paste of both text and color graphics between X and Macintosh applications, and complete conformance to the Version 11 Release 4 (X11R4) code base of the X Window system.

The X Window system, based on a client/server model, allows users to access X Window-based applications from their Macintoshes. It supports MultiFinder software, remaining active in the background while the user performs other applications in the foreground. The software works with AppleTalk, TCP/IP, and third-party DECnet protocols.

MacX includes a Window Manager that provides a user interface similar to that of the Macintosh. It supports the use of multiple video monitors to display a single application, such as CAD/CAM/CAE or color publishing, over several screens. The server supports a monochrome monitor or the simultaneous display of up to 256 colors from a palette of 16 million using an 8-bit video card. MacX also includes a tool to manipulate fonts.

MacX can be installed in a Macintosh Plus or larger computer. It requires at least two diskette drives and 1M byte of memory. A fixed disk and 2M bytes of RAM, however, are strongly recommended. MacX must run under Macintosh System Software Version 6.0.3 or later. An Ethernet or LocalTalk network connection is also necessary.

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## Support

### Installation

The LocalTalk and the new Apple Ethernet Interface networks are designed to be "plug-and-play" networks that users who are not technically proficient can install simply. The devices on the network have a peer-to-peer relationship, allowing each to retain its individual functionality while simultaneously functioning in a network environment. Setting up internets may require assistance.

### Training

Apple developed the Network Administrator's Course and LAN Literacy Course to teach users how to set up, configure, and maintain an AppleTalk network. The two-day course is offered by authorized Apple training providers.

### Warranty

Apple systems are warranted for one year, including parts and labor. Dealers provide carry-in maintenance during the warranty period. AppleCare extended service contracts are available for an annual fee.

### Maintenance/Support

Dealers provide maintenance. Apple has a toll-free support line called the Technical Coordinator Answerline

that registered users can subscribe to in order to obtain technical help over the phone. Technical Coordinator Answerline subscriptions are available on a yearly basis, allowing an unlimited number of support incidents, or on a 6-incident basis for those who have only an occasional need for technical support.

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## Equipment Prices

	<b>Purchase Price (\$)</b>
Ethernet LC Card	199
Ethernet NB Card	424
EtherTalk NB Card	599
TokenTalk NB Card	1,250
Coax/Twinax Card	1,250
Coax/Twinax Card (bundled with MacDFT software)	1,495
Serial NB Card	1,195
Ethernet Thin Coax Transceiver	175
Ethernet Twisted Pair Transceiver	175
Ethernet AUI Adapter	175
AppleShare File Server 2.0	799
AppleShare PC v2.0	149
AppleShare Print Server	299
AppleTalk Internet Router	399
InterPoll Network Administrator's Utility	129
MacDFT	245
MacAPPC	200
MacTCP	100
MacX25 Server Software Kit	800
MacX25 Server Software Kit bundled with Serial NB card	2,124
MacWorkstation	100
MacX 1.1	295
MacX 1.1 Update (from 1.0)	145
Data Access Language Server for Digital Equipment Corp. VAX/VMS (specify 9-track or TK50 format)	5,000
Data Access Language Server for IBM VM/CMS	15,000
Data Access Language Server for IBM MVS/TSO	20,000

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# Artisoft LANtastic Local Area Networks

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**Product Summary**

**Editor's Note**

Artisoft was founded in 1982 and began developing local area network (LAN) products in 1986. Its LANtastic network operating system (NOS) has won critical acclaim from several industry trade publications, including *Byte* magazine.

**Description**

LANtastic is a peer-to-peer LAN operating system; it requires no dedicated server. Versions of LANtastic are available that run on Artisoft's Ethernet and 2M bps adapters, as well as on other vendors' NETBIOS-compatible adapters. A fourth version, LANtastic Z, is a serial/parallel network that requires no adapters. Artisoft has recently introduced the LANtastic Voice Adapter, which provides voice messaging capability on a LANtastic network.

**Strengths**

LANtastic is a full-featured peer-to-peer LAN that supports NETBIOS-compatible networking. It requires no dedicated server and uses as little as 32K bytes of RAM base memory on a server station and as little as 11.5K bytes of RAM base memory on a node. LANtastic V3.0 allows a

maximum of 300 servers on a network and up to 300 users logged into each server.

**Limitations**

Artisoft's target market for LANtastic is the small- to medium-sized business or workgroup. LANtastic may not provide the performance levels required by larger companies.

**Competition**

Entry-level LANs from vendors such as D-Link Systems, DNA Networks, Digital Products, O'Neill Communications, and others.

**Vendor**

Artisoft, Inc.  
 Artisoft Plaza, 575 East River Road  
 Tucson, AZ 85704  
 (602) 293-6363

**Price**

The LANtastic Ethernet Starter Kit is priced at \$725; the LANtastic 2M bps Starter Kit sells for \$525.

**GSA Schedule**

Pending.

# Analysis

## Product Strategy

As the local area network (LAN) market begins to mature, many of the established vendors have staked out their turf. Novell, 3Com, IBM, Banyan, Ungermann-Bass, Proteon, and others have targeted the lucrative *Fortune* 1000 accounts. Many of these accounts started with small PC networks in various departments; their networks have since grown or been interconnected to form larger, enterprise-wide LANs. As the networks grow, the capabilities demanded by users grow—as do the sales and profits of the major LAN vendors.

As this portion of the LAN market has come to be dominated by the large LAN vendors, smaller competitors have sought out market niches in which they can compete successfully. The most promising of these niches is the market for small-to medium-sized businesses and workgroups. These offices are prime candidates for entry-level LANs—networks capable of linking anywhere from 2 to 20 PCs quickly, easily, and inexpensively.

This is the market that Artisoft has targeted for its LANtastic networking products. Artisoft currently has an installed base of more than

200,000 network adapters; more than half are installed in companies with fewer than 25 employees. The average LANtastic network has 5 nodes, while almost 90 percent of Artisoft's customers have 10 or fewer nodes.

Artisoft estimates that 80 percent of all U.S. businesses fall into the small- to medium-sized niche that the company is targeting (see Figure 1). According to Artisoft President and CEO C. John (Jack) Schoof, reaching this market is a matter of selling customers on the benefits of networking. "With a market segment that potentially includes a very large percentage of U.S. and foreign business, it's a matter of education," says Schoof. "Buyers within this group need to know that low-cost LANs can meet their needs."

## LANtastic NOS

The LANtastic Network Operating System (NOS) software is available in four versions: 10M bps IEEE 802.3 (10BASE5 and 10BASE2) Ethernet using Artisoft's AE-2 Ethernet Adapter; a proprietary version using Artisoft's 2M bps Adapter; and a version using other vendors' NETBIOS-compatible network adapters (Adapter Independent LANtastic NOS). The fourth version, called LANtastic Z, connects two PCs via their serial or parallel ports.

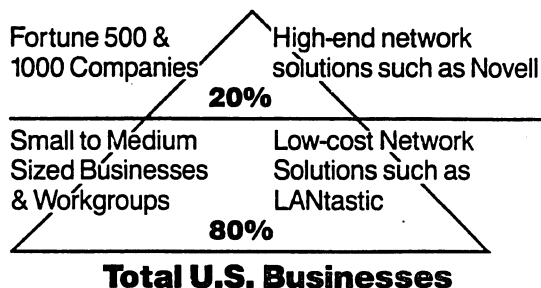
## LANtastic Adapters

In addition to the AE-2 Ethernet Adapter and the 2M bps Adapter, Artisoft markets the LANtastic Voice Adapter. When used with LANtastic NOS V3.0 or other supporting software, this adapter provides the LAN with voice messaging capability. Each Voice Adapter is equipped with a telephone-style handset.

## Other LANtastic Products

Artisoft markets a software program called The Network Eye, which allows users to monitor and/or control any computer on the network, or broadcast its screen to any computer on the network. Another program, the Voice Programmers Interface (VPI), provides a set of software commands that interface to the LANtastic Voice Adapter and allow programmers to add sound effects to software programs. A third program, AI-LANBIOS, is an adapter-independent version of NETBIOS that can be used with another vendor's network adapter if Artisoft or the vendor has developed an AI-LANBIOS driver for the adapter.

Figure 1.  
Artisoft's Target Market



According to Artisoft, 80 percent of all U.S. businesses fall into the market niche that the company is targeting.

Source: Artisoft, Inc.

Artisoft also sells an active hub, the LANTastic Hub, that helps a network manager connect multiple LANTastic networks in a star or tree configuration, or connect them into a telephone punchboard.

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## Competitive Position

Artisoft is not the only company that recognizes the entry-level LAN market's potential. A wide variety of low-cost, basic-function networks have been introduced over the past few years to address this market.

The simplest of these competitors are the zero-slot LANs, also known as sub-LANs. These networks require no adapter boards; they interconnect PCs through the computers' serial or parallel ports, like Artisoft's LANTastic Z. They usually include the basic network operating software and connection cables. The speed of sub-LANs is generally limited to 115.2K bps; they are, therefore, not suited for applications requiring the transfer of large files.

Digital Products' NetCommander is among the more popular sub-LANs, as is Avatar's Alliance. Travelling Software, Buffalo Products, Rose Electronics, 3X USA, SimpleNET Systems, Applied Knowledge, and The Software Link all manufacture products that fall into this category.

Another, more advanced type of network is the wireless LAN. These networks interconnect PCs using another method besides a physical, wire (twisted-pair, coaxial cable, or optical fiber) connection. O'Neill Communications' Local Area Wireless Network (LAWN) uses high frequency spread spectrum radio technology to link stations on the network. LAWN devices are modem-sized boxes that attach to the serial port of a PC or printer. Another company, Photonics, markets a network called Photolink that uses infrared technology.

Artisoft's most direct competitors market products similar to LANTastic; essentially, they are "LANs in a box." D-Link Systems' LANsmart and DNA Networks' MicroNet fall into this category. D-Link's LANsmart is a peer-to-peer network operating system compatible with Novell's IPX protocol. D-Link markets its LANsmart NOS with ARCnet, Ethernet, and twisted-pair adapters. LANsmart is priced at \$495, while D-Link's LANmagic starter kits range from \$1,245 to



*LANTastic Z is a two-node serial/parallel network that requires no interface cards.*

\$1,445. DNA's MicroNet operating system provides 2M bps, NETBIOS-compatible networking for two PCs at a cost of \$345.

Some large LAN vendors offer entry-level versions of their core operating system software. Waterloo Microsystems' PORT Lite connects up to 5 workstations and can be expanded to 25. PORT Lite Version 2.5 sells for \$695, while a two-node ARCnet PORT Lite Starter Kit is available for \$995.

Other vendors offering peer-to-peer LANs include DCA (10NET Plus) and TOPS (recently renamed Sitka).

Novell offers its Entry Level Solution (ELS) NetWare in two versions. ELS NetWare Level I v2.0a allows up to four users to share files and network resources; it sells for \$695. ELS NetWare includes many of the advanced features and functions of high-end NetWare versions; it also contains much of NetWare's inherent complexity and is not a good choice for users who require easy installation and network maintenance. ELS NetWare Level II v2.15 is a fully functional version of NetWare, albeit with limited internetworking capabilities. It sells for \$1,895; it would not be considered a competitor to LANTastic.

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## Decision Points

In its marketing material, Artisoft states that prospective LAN purchasers should evaluate eight criteria when choosing an entry-level, peer-to-peer network.

### **RAM Requirements**

Artisoft claims that LANtastic requires the smallest amount of RAM of any NOS on the market. It requires a minimum of 32K bytes on a server station, and a minimum of 11.5K bytes on a workstation.

### **Compatibility**

LANtastic supports the IEEE 802.3 Ethernet 10BASE5 (thick Ethernet) and 10BASE2 (thin Ethernet) standards. It also supports several vendors' NETBIOS-compatible network adapters. LANtastic is compatible with DOS 3.1 and above (though DOS 3.2 is not recommended) and supports DOS 3.1 file and record locking.

### **Flexibility**

LANtastic's peer-to-peer nature means that any station on the network can be a server, workstation, or both. The optional Voice Adapter provides voice messaging capability on a LANtastic network. The NOS also supports CD-ROM drives that use Microsoft CD-ROM extensions. The serial/parallel version of LANtastic, LANtastic Z, can be used to access a network via a modem, and to interconnect laptop PCs as well as desktop machines.

### **Expandability**

LANtastic can connect as few as two PCs, or can accommodate as many as 300 servers, each of which can have 300 users logged in.

### **Security**

LANtastic features Username with Password, preventing unauthorized entry into the network. Access Control Lists provide different levels of access privilege to users, including time-of-day logins. An Audit Trail monitors network use.

### **Ease of Installation/Use**

The LANtastic NOS comes with one diskette and one manual. Artisoft claims that with LANtastic's Install program, users can have the NOS installed and running within minutes. The network's DOS compatibility eliminates the need to reformat the server's hard drive during installation.

### **Support**

LANtastic's simplicity and ease of use contribute to its ease of support. An experienced network administrator is not needed. Artisoft's The Network

Eye software allows users to monitor and troubleshoot the network from a single station. Artisoft also provides unlimited free technical support to registered end users.

### **Price/Performance**

At entry-level prices, LANtastic provides an ample range of functionality and features.

Artisoft bills LANtastic as an entry-level LAN solution. Novell's NetWare, Microsoft's OS/2 LAN Manager (and its derivatives), and Banyan's VINES all offer more functionality—at corresponding prices and levels of complexity. It should be noted, however, that recent benchmark tests conducted by a major trade publication indicate that the performance gap between LANtastic and the larger NOSs may not be so wide.

Still, LANtastic is aimed at the entry-level market, and users requiring basic LAN functionality at entry-level costs should consider it seriously.

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### **Company Profile**

Artisoft is a privately held company of more than 100 employees based in Tucson, AZ. It was founded in 1982 through private investment and began developing networking products in 1986. Earlier products designed and marketed by Artisoft included telecommunications software and peripheral-sharing devices.

Sales for fiscal 1989 were \$7 million; 1990 sales projections are in the \$20 million range. Artisoft's CEO, president, and founder is C. John (Jack) Schoof II. Alex Karahalios is vice president of engineering, and William D. Baker is the CFO.

Artisoft products are sold through over 5,000 authorized resellers in the U.S., as well as through Ingram Micro D. The company sells its products internationally through exclusive distributors in 39 countries.

# Characteristics

**Models:** LANtastic Network Operating System (NOS) V3.0; Adapter Independent LANtastic NOS (NOS/AI); and LANtastic Z.

**Date Announced:** LANtastic NOS V3.0—June 1990; LANtastic NOS/AI—May 1988; LANtastic Z—November 1989.

**Date First Installed:** LANtastic NOS V3.0—June 1990; LANtastic NOS/AI—June 1988; LANtastic Z—November 1989.

**Number Installed:** Over 200,000 LANtastic adapters.

**Distribution:** Through authorized domestic resellers, a domestic distributor (Ingram Micro D), and international distributors.

## Architecture

LANtastic NOS V3.0 runs on Artisoft's AE-2 Ethernet Adapter or 2M bps Adapter. The Ethernet version is compatible with IEEE 802.3 10BASE5 and 10BASE2 standards, running over thick or thin Ethernet coaxial cable, respectively. It runs at a maximum throughput speed of 10M bps, and uses the carrier sense multiple access with collision detection (CSMA/CD) access method to regulate network traffic. It uses a linear bus topology. Maximum cable lengths per segment are 185 meters (607 feet) using thin Ethernet cable (increased to 300 meters using jumper option not in compliance with IEEE 802.3), and up to 500 meters (1,640 feet) with thick Ethernet cable.

The 2M bps Adapter provides proprietary networking. Throughput speed is 2M bps, and the CSMA/CD and CSMA/CA (carrier sense multiple access with collision avoidance) access methods are supported. A bus topology is standard; star and tree configurations can be obtained using the LANtastic Hub. Maximum cable lengths are 1,500 feet using shielded twisted-pair wire, and 300 feet using unshielded twisted-pair wire.

Adapter Independent LANtastic NOS (NOS/AI) assumes the transmission and configuration specifications of the network adapter used.

LANtastic Z is a zero-slot LAN that connects two PCs via the computers' serial or parallel ports. It supports both desktop and laptop PCs. Throughput speeds from 20K to 40K bps are possible through the parallel port; speeds from 8K to 10K bps can be achieved via

the serial port. LANtastic Z comes with the recommended 18-foot cable for connection to a parallel port, and a 25-foot cable for connection to a serial port.

## Hardware

### Servers

LANtastic is a peer-to-peer LAN and requires no dedicated server. Any PC on the network can act as a server, a workstation, or both.

### Workstations

Artisoft network adapters support the attachment of the IBM PC/XT/AT family and compatibles; IBM PS/2 Model 30, Model 30-286, and compatibles; and 386-based EISA-bus compatibles. The LANtastic Z serial/parallel network supports attachment of all the previously mentioned computers plus laptops.

### Network Interface Cards

**LANtastic AE-2 Ethernet Adapter** is an 8-/16-bit adapter that conforms to the IEEE 802.3 10BASE5 and 10BASE2 Ethernet standards. The AE-2 adapter features 16K of on-board buffer RAM, expandable to 64K. It auto-senses between 8- and 16-bit modes and can automatically switch modes; it can also run in 8-bit mode in a 16-bit slot. Diskless remote booting is optional. The AE-2 features selectable I/O base addresses and support for eight IRQs. It is downward-compatible with the Novell NE2000 Ethernet adapter.

**LANtastic 2M bps Adapter** is an 8-bit adapter with 32K of on-board buffer RAM. Features include a switch-selectable I/O port, software-selectable IRQ, and software-selectable RAMBASE address settings. NET-BIOS is loaded into and implemented on the adapter so it requires only 2.5K of the PC's RAM.

**LANtastic Boot ROM Daughter Board** plugs into the expansion bus on the LANtastic 2M bps Adapter, allowing diskless workstations to boot remotely off of the server. It requires 1.5K of the PC's memory and has 32K switch-selectable ROM addresses.

**LANtastic RAM Daughter Board** plugs into the expansion bus of the LANtastic 2M bps Adapter, lowering the RAM overhead on LANtastic to zero in a workstation and 32K in a server. The LANtastic NOS is loaded into memory on the board.

**LANtastic Voice Adapter** is an 8-bit adapter that supports voice messaging when used with LANtastic V3.0 or other programs that support voice. The Voice Adapter includes a telephone handset and a cord that connects it to the adapter.

## Hubs

**LANtastic Hub** is an active hub that allows users to create multiple LANtastic networks in a star or tree configuration, connect into a telephone punchboard, or boost network signals.

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## Software

### Network Operating System

**LANtastic Network Operating System (NOS) V3.0:** This peer-to-peer NOS for DOS-based networks runs on Artisoft's LANtastic AE-2 Ethernet Adapter and LANtastic 2M bps Adapter. The LANtastic NOS does not require a dedicated server—any station on the network can be configured as a server, a workstation, or both.

LANtastic is shipped on one diskette with one manual. The NOS Install program allows users to install the software easily and quickly. LANtastic also uses a small amount of a PC's RAM—less than 40K on a server and less than 12K on a workstation.

LANtastic's E-Mail/voice feature is a menu-driven program that allows text and voice messages to be sent and received on the LANtastic network. Recipients can store and save messages. LANtastic's Chat feature allows users to verbally chat in real time across the network, and to textually chat using the pop-up chat windows. A LANtastic Voice Adapter must be installed to take advantage of either of the voice features. LANtastic supports DOS 3.1 file and record locking; disk caching (data is temporarily stored in memory cache until it is written to the disk or flushed); simultaneous despooling to multiple printers; and up to 5,100 open files per server.

Since LANtastic is NETBIOS compatible, it can run application programs that are also NETBIOS compatible.

LANtastic provides built-in security. Username with Password prevents unauthorized entry to the network. Users can be given different privilege levels using the NOS' Access Control Lists. A user's access to the network can be limited to certain times of the day, and any combination of the following privileges can be granted: read, write, modify, create, and delete files; make, delete, and look up directories; execute programs; change file attributes.

An audit trail is also available to monitor access to subdirectories and printers. The audit trail monitors access, providing the identity of the user, time of use, and length of use. It also identifies users who attempt to access a "locked" file and reports the number of characters printed at a printer.

LANtastic supports CD-ROM drives that conform to Microsoft CD-ROM extensions. The extension software resides on the computer to which the CD-ROM drive is attached.

**Adapter Independent LANtastic NOS (NOS/AI):** This version runs with other vendors' NETBIOS-compatible network adapters. NOS/AI contains all of the features of LANtastic V3.0.

**LANtastic Z:** This serial/parallel network connects two PCs via the computers' serial or parallel ports. No adapter cards are required. LANtastic Z also allows a laptop computer to be connected to the serial or parallel port of a network server to print or use another peripheral, and to transfer files between the server and the laptop. In addition, it allows remote access to a network server via a modem. LANtastic Z includes a 25-foot serial cable and an 18-foot parallel cable.

### Utility Software

**The Network Eye:** This remote control program allows any user to monitor and/or control any PC on the network from the user's PC. A single user can monitor and/or control as many as 32 other computers, and conversely, many computers can monitor and/or control a single PC.

Using The Network Eye, each remote screen appears on the control station's screen within a pop-up window. Switching between windows requires a single keystroke. The user can change AUTOEXEC.BAT files, reboot, change server and printer connections, or perform other network management tasks on remote stations from the control station.

The Network Eye also provides for multiprocessing on idle PCs; remote teaching and training; the creation of a shared modem, fax, or plotter/server; and copying, cutting, and pasting from one station to another. The program uses less than 30K of memory on the control station and as little as 2K on the remote station being monitored or controlled. Passwords prevent unauthorized monitoring and control, and on-screen notification of remote monitoring is available. The Network Eye runs on networks using ARCnet, token-ring, and Ethernet adapters that have correctly implemented NETBIOS, in addition to Artisoft's LANtastic network adapters.

**Voice Programmers Interface (VPI):** This consists of software commands that interface to the LANtastic Voice Adapter to provide sound effects (speech and music) for software programs.

**AI-LANBIOS:** This is an adapter-independent version of NETBIOS. When used in conjunction with Artisoft's Adapter Independent LANtastic NOS (NOS/AI), it allows LANtastic to run on third-party network adapters that have an AI-LANBIOS driver.

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## Support

### Installation

LANTastic comes with an Install program for quick and easy installation.

### Training

Dealer training is provided through Ingram Micro D.

### Warranty

Artisoft provides a one-year warranty on hardware.

### Maintenance

Artisoft will repair out-of-warranty hardware at an hourly rate.

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## Pricing

Artisoft products are sold through Ingram Micro D, authorized resellers, and selected retail outlets, including CompuAdd and Inmac. The following prices are suggested retail.

## Product Prices

	<b>Purchase Price (\$)</b>
<b>Kits</b>	
LANTastic AE-2 Ethernet Starter Kit; includes LANTastic NOS V3.0, 2 LANTastic AE-2 Ethernet adapters, cable, and documentation	725
LANTastic 2M bps Starter Kit; includes LANTastic NOS V3.0, 2 LANTastic 2M bps adapters, cable, and documentation	525
LANTastic Z Two-Station Kit; includes LANTastic Z NOS, serial cable, and parallel cable	199
<b>Hardware</b>	
LANTastic AE-2 Ethernet Adapter	349
LANTastic 2M bps Adapter	249
LANTastic Boot ROM Daughter Board	99
LANTastic RAM Daughter Board	99
LANTastic Voice Adapter	149
LANTastic Hub	495
<b>Software</b>	
Adapter Independent LANTastic NOS (NOS/AI)	495
The Network Eye	295
Voice Programmers Interface (VPI)	195
AI-LANBIOS	295







# AST Research PC Communications Products



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**Product Summary**

**Editor's Note**

AST Research has been a top competitor in the PC-to-host marketplace almost since its inception.

Since our last report, however, the company has significantly reduced its product line in this area, decreasing its midrange offerings and eliminating its Digital connectivity products. This report examines AST's current line.

**Description**

AST's terminal emulation and file transfer products provide a connection between IBM PC/XT/AT, PS/2, and compatible microcomputers and IBM mainframe, System/3X, and AS/400 host systems.

**Strengths**

AST has earned a reputation for producing reliable and easy-to-use connectivity products, allowing potential users to feel comfortable about the quality they will receive.

**Limitations**

The recent shrinking of AST's communications product line, along with the company's increasing emphasis on its line of personal computers, may lead some users to move to vendors that focus more on connectivity products.

**Competition**

Digital Communications Associates (DCA); Novell; BlueLynx.

**Vendor**

AST Research, Inc.  
 16215 Alton Parkway, P.O. Box  
 19658  
 Irvine, CA 92718  
 (714) 727-4141  
 In Canada:  
 AST Canada  
 6549-A Mississauga Road  
 Mississauga, ON L5N 1A6  
 (416) 826-7514

**Price**

Prices for AST connectivity products range between \$800 and \$1,000.

**GSA Schedule**

Yes.

# Analysis

## Product Strategy

AST Research has traditionally been a strong competitor in the PC-to-host marketplace, offering products for connecting microcomputers to IBM mainframe and midrange computers. The company's biggest (and most recent) success, however, has come in the personal computer market. Sales of 286- and 386-based computer systems have put the company on strong financial ground. In addition to PCs and connectivity products, AST offers such products as display stations, memory boards, multifunction boards, and graphics adapters.

The connectivity product line includes two families that address connections to three types of "hosts": IBM System/3X and AS/400 minicomputers and IBM mainframes. The products provide file transfer and emulation capabilities and include standalone and gateway devices that establish local or remote connections. The 5250 and 3270 products were all developed by AST Research itself. The 5250 line comprises standalone and gateway products. These come in twinax versions for local attachment, or they can be attached through a modem for remote connection. In the 3270 market, AST offers CUT, DFT, SNA, gateway, and RJE emulation versions.

All AST PC connectivity products are designed to work in IBM PC/XT/AT computers and most compatibles. Micro Channel versions of some models in the 3270 and 5250 lines are available for installation in IBM PS/2 Models 50 through 80. Some products work with AST microcomputers as well.

The 3270 devices are targeted to users of IBM mainframes, generally medium-size to very large corporations while the 5250 products sell mostly to medium-size companies. Organizations using AST connectivity products include MCI, North Carolina National Bank, Telex, Mazda, AT&T, and the State of Oregon.

## Competitive Position

As mentioned, AST Research has traditionally enjoyed a spot as a top competitor in the PC-to-host marketplace, competing with such companies as Digital Communications Associates (DCA), Novell, BLUELYNX, and Attachmate. DCA, because of its large installed base and reputation for reliable products, has earned the title of market leader, with Novell and AST generally considered its strongest opposition.

Recently, however, AST has been enjoying great success in the microcomputer marketplace. In fact, the company has been channeling most of its resources into this area in an effort to become a serious competitor to IBM and Compaq. AST seems to have been successful in this effort and is now gaining recognition for its microcomputer systems. This has resulted, however, in a decreased emphasis on other areas, including the company's connectivity products. AST's line of 5250 products has recently been pared down, and its line of products to provide Digital VAX connectivity has been eliminated. While the company still maintains a strong line of connectivity products, it remains to be seen whether it will continue to keep pace with market leaders such as DCA and Novell.

AST is currently in a strong financial position and still offers a competitive array of communications products. Potential users can enjoy the security of a well-established, stable vendor backing their products. If the company is to remain on a par with PC-to-host market leaders, however, it must be prepared to expand and build on its current product line.

## Decision Points

### User Interface

AST's two product families are linked by a common user interface, which AST calls the Application Presentation Interface. This interface supports automatic sign-on, keyboard macros, a Windows manager, and security for the emulator and configurator. While many competitors, such as Novell, offer user interfaces within a product family, other major vendors have been slow in developing user interfaces that span both midrange and mainframe connectivity products. The advantage is a savings

## Company Profile

### AST Research, Inc.

#### Corporate Headquarters

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#### In Canada

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Mississauga, ON  
L5N 1A6  
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#### Officers

*President and CEO:* Safi U. Qureshey

*COO:* Thomas C. Yuen  
*Senior Vice President & CFO:* Bruce C. Edwards

*Senior Vice President:* James W. Ashbrook

*Vice Presidents:* Leo V. Beulieu, Kathleen M. Fisher, Dennis R. Leibel, John C. Olson, and Wai S. Szeto

#### Company Background

The story of AST Research is the story of three men who emigrated to the United States as teenagers to get an education. The three later crossed paths a few times, and fate had them all meet again in 1975. By that time, they were professionals working at Computer Automation, a minicomputer manufacturer. As the men began discussing their disillusionment and frustration

with working for a large corporation, they realized that forming their own company might be the solution. They tossed around ideas about technologies until they finally decided to design enhancement products for the IBM PC. The market appeared to be lucrative and the time seemed right, so the three mortgaged their houses to get capital. In 1981, they released their first product, a memory board, which they assembled themselves, and the company called AST Research was on its way.

Two of the company's original founders, Safi U. Qureshey and Thomas C. Yuen, continue to guide the company today. Good business skills and a sense of camaraderie have kept the men together, and they have now successfully moved the company away from being a board vendor and into the ranks of system vendors. This past fiscal year, AST reported \$412.7 million in sales. As a result of thoughtful analysis of the market, it has expanded its product line over the years to include microcomputers, display stations, memory boards,

	Fiscal 1989	Fiscal 1988	Fiscal 1987
Net sales	\$456.5 million	\$412.7 million	\$205.9 million
Net income (loss)	(\$7.4 million)	\$15 million	\$13 million
Operating income (loss)	(\$4 million)	\$22.9 million	\$19.1 million
Net income (loss) per share	(\$0.64)	\$1.28	\$1.13

multifunction boards, graphics adapters, and connectivity products.

Since its founding, AST has exhibited continual, sometimes dramatic growth in revenues. Though the company *did* report losses in fiscal 1989, as the popularity of its line of personal computers has continued to improve, the company has rebounded nicely—reporting net income of \$9.6 million for the third quarter of fiscal 1990, compared to a loss of \$1.3 million for the same period last year.

#### Management Statement (for fiscal 1989)

“AST Research's rapid expansion into the high-performance personal computer marketplace continued during fiscal 1989. With a full line of powerful 80386 and 80286 computers, we have positioned ourselves as a brand-name manufacturer of high-quality, high-performance personal computers.

“Our strategy of developing and introducing products in areas of new technology is lessening our dependence on revenue from products that

fall within the price-sensitive end of the marketplace. During the third and fourth quarters of fiscal 1989, we introduced and shipped several high-end 80386 personal computers.

“However, in the second quarter increasing price competitiveness in the 80286 marketplace and actions taken by management to reduce costs resulted in an after-tax loss of approximately 9 million dollars. These actions included product line consolidation, reorganization, and inventory cost adjustments.

“We believe our investments in technology and manufacturing capabilities, our comprehensive distribution strategy, and our increased presence in both the domestic and international markets will provide AST with the foundation for continued progress. With the support of our employees, customers, vendors, and shareholders, we look forward to making this foundation even stronger in fiscal year 1990.”

► *(Analysis continued)*

in cost and time spent on training users—a common interface allows users to move from one AST product to another without additional training.

In addition, AST's 5250 and 3270 products offer other features that make them easy to learn and use. Menus aid the user in configuration, and multisession windowing capabilities allow a PC user to work on several applications at once, instead of tying up their PC waiting for a file to finish downloading. Other useful features include bidirectional file transfer and user-defined keyboard mapping.

### Expandability

Expandability and an easy upgrade path can be a particularly important concern to entry-level users of connectivity products. In the past, AST has done an excellent job of providing a smooth transition for users as their communications needs expanded. AST users have found it a simple matter to move from standalone to cluster (no longer available) to gateway products. It remains to be seen, however, if the company's decreasing emphasis on connectivity products will have any affect on this area. Certainly, users can still feel confident of a simple transition between AST's current standalone and gateway products. Should the company fail to keep pace with other top connectivity vendors in bringing new products to the market, however, consumers might feel more comfortable dealing with vendors that specialize in communications.

### Mainframe Connectivity

Though AST has reduced the overall number of connectivity solutions it offers, it has left its strong line of PC-to-mainframe products relatively unchanged. The current line of AST mainframe connectivity products includes standalone and gateway options, providing both local (in both CUT and DFT modes) and remote (SNA/SDLC) access to IBM mainframes. The company also offers AST-3780, one of the few packages that supports remote job entry (RJE) using the point-to-point bisync protocol. This package allows users to transfer large amounts of data in batches and supports peer-to-peer communications, enabling users to share information.

## Characteristics

**Models:** Products for micro-to-midrange communications: AST-5251/11 Enhanced Plus, AST-5251/11A Enhanced Plus, AST-5251/12, AST-5251/12A, and AST-5250/Gateway Option. Products for PC-to-IBM mainframe communications: AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT, AST-3270/DFT Option, AST-3780, AST-3780A, AST-3270/SNA II, AST-3270/SNA IIA, and AST-3270/Gateway Option.

**Date Announced:** AST-5251/11 Enhanced Plus, AST-5251/11A Enhanced Plus—January 1984; AST-5251/12, AST-5251/12A—January 1984; AST-5250/Gateway Option—June 1987; AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT—September 1987; AST-3270/DFT Option—September 1987; AST-3780—January 1982; AST-3780A—November 1987; AST-3270/SNA II, AST-3270/SNA IIA—May 1988; AST-3270/Gateway Option—January 1986.

**Date First Installed:** AST-5251/11 Enhanced Plus, AST-5251/11A Enhanced Plus—February 1984; AST-5251/12, AST-5251/12A—February 1984; AST-5250/Gateway Option—July 1987; AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT—October 1987; AST-3270/DFT Option—October 1987; AST-3780—February 1982; AST-3780A—December 1987; AST-3270/SNA II, AST-3270/SNA IIA—June 1988; AST-3270/Gateway Option—February 1986.

**Number Installed:** Vendor did not specify.

**Distribution:** AST Research distributes its products through certified resellers, distributors, and major retail chains, such as ComputerLand.

### 5250 Communications Products

AST's 5250 products connect IBM PC/XT/AT and Personal System/2 computers and VT100-type terminals with IBM System 34/36/38 and AS/400 minicomputers. The product line encompasses models for local, remote, standalone, and gateway connections. Each model supports emulation and bidirectional file transfer capabilities. All support the use of IBM's API for integrating PC and host applications. The local products are connected via twinaxial cable, and remote connections are made via modems. AST's 5250 and 3270 product lines share a common user interface for ease of use. The products are menu driven and offer context-sensitive help

screens. A menu guides the user through the configuration and reconfiguration processes. All products support a hot-key function to toggle between DOS and a session or, in the case of products with multisession capabilities, from session to session.

**AST-5251/11 Enhanced Plus:** A hardware/software combination that connects a PC to an IBM System/3X or AS/400 minicomputer via twinaxial cable. The product emulates IBM 5251 Model 11, 5291, and 5292 Model 1 terminals, as well as IBM 5256, 5224, 5225, or 5219 printers. Features include support of up to seven simultaneous host sessions; a screen snapshot that saves screen images to virtual memory; redefinable keyboard mapping; and programmable printer and display attribute configurations. Attached printers can print in background mode while a DOS or emulation session is active in the foreground. A file transfer function allows users to manipulate data downloaded from the host to be used with PC applications software, such as Lotus 1-2-3, WordStar (ASCII files), and dBASE. A full-length IBM expansion slot is necessary for installing the product.

**AST-5251/11A Enhanced Plus:** A Micro Channel version of the AST-5251/11 Enhanced Plus. (The "A" at the end of any AST product name signifies the product is designed for IBM PS/2 Models 50/60/70.) Instead of having one Micro Channel version of the AST-5251/11 Enhanced Plus that supports one session and another that supports seven sessions, AST opted to offer only a seven-session model, which can be configured for one session only if needed.

**AST-5251/12:** Designed for remote emulation in an SNA/SDLC environment, it allows a PC to communicate with a System/3X minicomputer via a synchronous modem. The product emulates IBM 5251 Model 12 terminals and IBM 5256, 5224, or 5225 printers, operating over dial-up or leased, point-to-point or multipoint lines. Nine 5251/12 display sessions and up to five printer sessions can be supported simultaneously. Attached printers can print in background mode while a DOS or emulation session is active in the foreground. With the on-board modem eliminator, users can locally attach this model to System/3X minicomputers that are less than 50 feet from the PC. Like the 5251/11 products, AST-5251/12 allows users to redefine keyboard mapping and manipulate downloaded data for use in Lotus 1-2-3, WordStar (ASCII files), and dBASE. This product requires a single diskette drive, a color or monochrome display adapter and monitor, and a full-length IBM expansion slot.

**AST-5251/12A:** The Micro Channel version of the AST-5251/12.

**AST-5250/Gateway Option:** Provides 5250 terminal emulation. The AST-5250/Gateway Option is basically an AST-5251/11 Enhanced Plus or AST-5251/12 with gateway capabilities. The PC acting as a gateway can

be connected to an IBM System/3X or AS/400 either locally (via twinaxial cable) or remotely (via a modem). The gateway is compatible with any NETBIOS-compatible LAN. Printers emulated include IBM 5256, 5224, 5225, and 5219. Once the hardware/software is installed, each network PC has full access to host sessions, even while the gateway system operates in DOS. Printer and display attributes can be reconfigured.

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## Environment

**Emulation Modes:** Emulation modes are listed with the description of each model.

**Host Environments:** All the 5250 products support IBM's Application Program Interface, which allows the use of programs such as IBM's FSU, PC Support/36, PC Support/38, and AS/400 PC Support. Compatible host systems are IBM System/3X and AS/400 minicomputers. Both AST-5251/12 and AST-5251/12A support AST-5250 FT/A file transfer as well. These two models allow for nine 5251/12 display sessions and up to five 5219, 5224, 5225, or 5256 printer sessions.

**Protocol:** The AST-5251/12 and AST-5251/12A support SNA/SDLC.

**Local Area Network Support:** Gateway products support any NETBIOS-compatible LAN.

**Transmission Speed:** The AST-5251/12, AST-5251/12A, and AST-5250/Gateway Option operate at rates from 1200 to 9600 bps.

**Computers Supported:** Micro Channel versions of the 5250 products are compatible with IBM PS/2 Models 50 through 80. All remaining products can be used with IBM PC/XT/AT and most compatible computers. In addition, the AST-5251/12 can be used with IBM Portable computers, and the AST-5251/11 Enhanced Plus and AST-5251/12 can be used with any AST personal computer.

**Minimum Configuration:** With the exception of the gateway products, all models require at least 256K bytes of RAM. The gateway products require 384K bytes of RAM.

**Operating Systems:** With the exception of the AST-5250/Gateway Option, all products operate on systems running MS-/PC-DOS Version 2.0 or later. The two gateway products operate on systems running MS-/PC-DOS 3.1 and above.

## Hardware

**Communications Interface:** The 5250 products used in local configurations are attached directly through twinaxial cable. Remote products are attached via the RS-232-C interface on a synchronous modem.

**Addressable Ports/Interrupts:** All models support COM1 or COM2 ports.

**Adapter Cards:** The products installed in IBM PC/XT/AT/Portable or AST computers all require a full-length expansion slot. Those products designed for PS/2 computers require a full-length Micro Channel expansion slot.

## Software

**File Transfer:** The software component of each model in the 5250 family supports bidirectional transfer of text and binary files.

**Programmability:** The software in the AST 5250 product family is reconfigurable. The products support IBM's API Version 4.0, which allows users to write programs to interface with existing software.

**Security:** The AST-5251/11 Enhanced Plus, AST-5251/11A Enhanced Plus, AST-5251/12, and AST-5251/12A have password protection for emulation sessions, configuration program, and hot-key functions. The gateway products offer security through sign-on passwords. The other models do not offer security features.

## 3270 Communications Products

Products in AST's 3270 communications family allow PCs to communicate with mainframes. All the products share the same user interface, which is also the same user interface as the 5250 product family. Configuration is menu driven, and context-sensitive help screens aid the user. Keyboards can be customized by the user, or AST, IBM, or IRMA mapping can be selected. Users can also hot-key between 3270 and PC-DOS sessions. Listed below are the products in the 3270 family and a brief description of each. The general specifications of the entire 3270 product line are shown after these descriptions. Unless otherwise indicated, all the 3270 products share those specifications.

**AST-3270/Coax II-CUT:** Functions as the base product of the 3270 line. It allows PCs to communicate with a System/370 host via a coaxial (Type A) attachment to a 3X74 cluster controller in a local or remote SNA/SDLC or bisync environment. AST-3270/Coax II-CUT provides Control Unit Terminal (CUT) mode 3270 terminal emulation, which includes the following color and monochrome displays: 3278 Models 2, 3, 4, and 5; 3279

Models 2A, 2B, 3A, and 3B; 3178; and 3179. The product is both IBM and IRMA compatible and supports AST, IBM, or IRMA software.

**AST-3270/Coax IIA-CUT:** For use in Micro Channel computers, it is identical in function to the AST-3270/Coax II-CUT.

**AST-3270/DFT Option:** A software upgrade to the base product, the DFT Option provides Distributed Function Terminal (DFT) mode emulation, allowing up to five simultaneous 3270 display and printer sessions.

**AST-3780:** A hardware/software package for RJE workstation emulation and file transfer using the point-to-point bisync protocol. Workstations emulated include IBM 2770, 2780, and 3780 RJE stations, as well as the IBM 3741 data station. AST-3780 also emulates the IBM 3780 Bar Printer. The product can be configured for PC-to-host or peer-to-peer communications, allowing users to share data, text, or program files. The unit operates over dial-up or leased lines in local connections, using a modem eliminator. It can also be configured for remote operation through a synchronous modem, which is already integrated into the board. Features include interactive or batch transmission and ASCII-to-EBCDIC translation. AST-3780 requires a diskette drive and a monochrome or color display. An RS-232-C cable to a modem or a front-end mainframe is also required.

**AST-3780A:** The Micro Channel version of the AST-3780.

**AST-3270/SNA II:** A hardware/software product that provides remote communications in an SNA/SDLC environment. The AST-3270/SNA II emulates the 3274 and 3276 cluster control units. The product also emulates the following terminals: 3278 Models 2, 3, 4, and 5; 3279 Models 2A, 2B, 3A, and 3B; 3178; and 3179. A remote connection is established using a synchronous modem. A local connection using a modem eliminator is possible when the PC is 50 feet or less from the host. Communications can be established over dial-up lines in point-to-point or multipoint configurations. Up to five simultaneous sessions can be displayed on a screen using the Windows Manager program, which features a pull-down menu.

**AST-3270/SNA IIA:** The Micro Channel version of the AST-3270/SNA II.

**AST-3270/Gateway Option:** A hardware/software combination that connects a PC with a 3270 mainframe, allowing up to 16 IBM PC/XT/AT (and most compatible) computers on a LAN to simultaneously access IBM 4300, 303X, 308X, or System/370 hosts. The PC designated to serve as a gateway emulates an IBM 3274 or 3276 control unit, and up to 16 PCs attached to it emulate IBM 3278 or 3279 Model D display stations. The gateway PC maintains its personal computing capabilities while functioning as a gateway. More than 16 PCs

can be networked into the system, but logical units have to be assigned to those PCs that require guaranteed host access. Other PCs can access the host on a first-come, first-served basis. The product only works in LAN environments using the SNA/SDLC protocol. It is available in versions for up to 16 simultaneous sessions. This product requires at least two IBM PC/XT/AT/Portables, one diskette drive per PC, and a full-size expansion slot for the gateway PC.

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## Environment

**Emulation Modes:** Emulation modes are listed with the description of each product.

**Host Environments:** The AST-3780 and AST-3780A support IBM mainframe hosts, and System/34/38 and AS/400. Applications for those two products include VSE/POWER RJE, JES/2 and 3, CICS/VS, and BTAM. AST-3270/Gateway Option applications include CICS/VS, IMS, TSO, CMS, JES/2 and 3, VTAM, ICCF, and TCAM. All remaining products support IBM mainframes.

**Local Area Network Support:** The AST-3270/Gateway Option is compatible with all IBM NETBIOS-compatible LANs.

**Transmission Speed:** The AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT, and AST-3270/DFT Option are all coax connected and have a 2.36M bps transmission rate. AST-3780 and AST-3780A have support line speeds of 1200 to 9600 bps when connected to the host via a synchronous modem. When connected with a modem eliminator, the transfer rate can be as high as 19.2K bps. The remaining products—AST-3270/SNA II, AST-3270/SNA IIA, and AST-3270/Gateway Option—support line speeds of 1200 to 9600 bps.

**Computers Supported:** Each product with an A at the end of its name is a Micro Channel version designed for IBM PS/2 computers, Models 50 through 80. All remaining products can be used with IBM PC/XT/AT and most compatible computers.

**Minimum Configuration:** Models requiring at least 128K bytes of RAM are AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT, AST-3780, and AST-3780A. The AST-3270/SNA II, AST-3270/SNA IIA, and AST-3270/DFT Option require at least 384K bytes of RAM.

**Operating Systems:** AST-3270/SNA II, AST-3270/SNA IIA, and AST-3270/DFT Option run under MS-/PC-DOS Version 3.0 or higher. AST-3780 and AST-3780A run under MS-/PC-DOS Versions 1.1, 2.0, 2.1, or 3.0. AST-3270/Coax II-CUT and AST-3270/Coax IIA-CUT require PC-DOS 2.0 or later versions.

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## Hardware

**Communications Interface:** Descriptions of how hardware products are connected are listed in the individual product descriptions.

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## Software

**File Transfer:** Each model in the 3270 family supports bidirectional transfer of text and binary files. AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT, AST-3270/SNA II, and AST-3270/SNA IIA use AST's FTSII file transfer software, which allows users to initiate editor-based file transfers or IBM's Send/Receive-compatible file transfer. AST-3780 and AST-3780A allow automated file transfer for sending and receiving files at night, when phone line costs are lower. File transfer with those models can be set for transparent or nontransparent.

**Programmability:** All products support the IBM Applications Program Interface. AST-3270/Coax II-CUT, AST-3270/Coax IIA-CUT, AST-3270/SNA II, and AST-3270/SNA IIA and AST-3270/Gateway Option also support IBM's Presentation Space API, which supports Personal Services/PC (PS/PC) software. In addition, with the AST-3270/II Family Programmer's Toolkit, users can write programs to automate PC-to-mainframe communications. The toolkit is compatible with AST-3270/Coax II-CUT and AST-3270/Coax IIA-CUT and requires the use of AST's Entry Emulator High Level Language Application Programming Interface (EEHLLAPI).

**Security:** Password protection is available on all models for emulators.

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## Support

**Phone Support:** The AST Research Product Support Center can be reached between 7:30 a.m. and 3:00 p.m. Pacific time, Monday to Friday, at (714) 727-9630.

**Warranty:** All AST Research 3270 and 5250 products are warranted for two years.

**Maintenance:** Equipment maintenance contracts for AST products can be obtained from the vendor for shipment of defective parts to an AST repair center.

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## Pricing

Following are the list prices of all the products covered in this report. The products can be purchased from authorized resellers, distributors, or major chains.

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**Equipment Prices**

	<b>Purchase Price (\$)</b>
<hr/> <b>5250 Communications Products</b>	
AST-5251/11 Enhanced Plus	895
AST-5251/11A Enhanced Plus	895
AST-5251/12	790
AST-5251/12A	790
AST-5250/Gateway Option	995
<hr/> <b>3270 Communications Products</b>	
AST-3270/Coax II-CUT	895
AST-3270 Coax IIA-CUT	895
AST-3270/Coax II-DFT	195
AST-3780	895
AST-3780/A	895
AST-3270/SNA II	895
AST-3270/SNA IIA	895
AST-3270/Gateway Option	995
AST-3270/11 Toolkit	99

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# AT&T Starlan Network Products



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**Product Summary**

**Editor's Note**

Since our last report AT&T has introduced a new StarGROUP LAN operating system (StarGROUP Software LAN Manager Server) based on Microsoft's LAN Manager program, and has added support for OS/2 and Macintosh systems.

**Description**

The AT&T Starlan 10 and Starlan networks are designed to connect a variety of devices (PCs, minicomputers, etc.) in the UNIX System V and MS-DOS environments for communications and resource-sharing applications.

**Strengths**

The Starlan 10 and Starlan networks offer the capability for UNIX, MS-DOS, OS/2, and Macintosh workstations to communicate on the same network.

**Limitations**

NHUs in a Starlan 10 network support only 11 workstation connections, resulting in the potentially costly, continual addition of NHUs in larger networks.

**Competition**

IBM PC and Token-Ring Networks; Hewlett-Packard HP Starlan; Western Digital Starlan.

**Vendor**

AT&T  
 1 Speedwell Avenue  
 Morristown, NJ 07960  
 (800) 247-1212

In Canada:  
 AT&T Canada  
 3650 Victoria Park Avenue  
 Suite #800  
 Willowdale, ON M2H 3P7  
 (416) 499-9400

**Price**

Starlan NAU LAN adapters range in price from \$295 to \$995, Network Hub Units are priced between \$625 and \$2,395, and the StarGROUP Software LAN Manager Server costs from \$1,895 to \$3,495.

**GSA Schedule**

Information not available.

# Analysis

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## Product Strategy

The AT&T Starlan 10 network and Starlan network are designed to connect a variety of devices (PCs, minicomputers, terminals, etc.) operating under the UNIX System V, MS-DOS, OS/2, and Macintosh operating system environments, for local communications and resource sharing applications. Generally, file servers and minicomputer systems operating under UNIX provide file- and device-sharing services to PCs running MS-DOS. Remote communications options, including inter-networking bridges, routers, and gateways to host computers and public data networks (PDNs), are also available for these networks. Originally, the Starlan network was designed to connect AT&T's own computers, including the PC 6300 and UNIX PC, as well as the 3B2 minicomputer family; but ended up interconnecting more IBM and IBM-compatible PCs than it did AT&T computers.

This trend led to great initial popularity for the 1M bps Starlan network, which is now firmly entrenched as a leader in the low-end LAN marketplace. Following the success of its original LAN offering, AT&T introduced the 10M bps Starlan 10 network in an attempt to capture a spot in the high end of the market. Though not as quickly accepted as its predecessor, this product has also met with fair success.

The Starlan network's widespread initial acceptance can be attributed mainly to its use of unshielded, twisted-pair telephone wire as a transmission medium. Because most buildings are already equipped with twisted-pair wiring, Starlan offers a cost-effective alternative to networks requiring the purchase and installation of another medium, such as coaxial cable. In addition, the Starlan 10 and Starlan networks' adherence to the IEEE 802.3 10BASE-T and 1BASE5 standards, along with the recently announced support for the OS/2 and Macintosh operating systems, has helped keep them competitive in a volatile marketplace.

The Starlan families include a variety of Network Access Units (NAUs), interface cards that allow devices to access the network; Network Hub Units (NHUs), 12-port external hubs that link NAUs and detect/signal heavy network traffic and collisions; and a number of bridges, routers, and gateways. All network hardware is compatible with either the 1M bps or the 10M bps Starlan but is not interchangeable between the two.

Starlan users can also benefit from StarGROUP software options, including the StarGROUP Software LAN Manager Server, AT&T's LAN operating system; and the StarGROUP Software Network Manager, Computer Manager, and Router Manager, which provide network management capabilities.

With additional hardware and software, Starlan 10 offers flexible connectivity with Ethernet networks, X.25 networks, and IBM mainframes. Starlan networks can also be linked to one another through AT&T's Information Systems Network (ISN) or through the use of bridges and gateways. (For some typical Starlan 10 and Starlan network connectivity options in a variety of minicomputer and mainframe environments, see Figure 1.)

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## Competitive Position

The low cost of Starlan-type networks, which conform to the IEEE 802.3 1BASE5 standard, has ensured them of a significant share of the LAN market. AT&T has quickly established itself as a top player in this low-end market. The company introduced the Starlan network in March 1985, but it did not begin shipping the product until May 1986, over a year later. Moreover, shortly after AT&T began shipping Starlan, several vendors introduced Starlan-compatible products, and a number of other companies have since entered the market. (In fact, AT&T maintained at one time that more vendors had announced support of Starlan technology than had come out in support of token-ring technology). By 1987, officials at AT&T reported that their new LAN was selling as fast as it was being produced.

The almost instantaneous popularity of Starlan opened the industry floodgates, and several major vendors quickly introduced Starlan products of their own. As a result, AT&T soon found itself competing for a share of the Starlan market with vendors such as Western Digital, Hewlett-Packard,

## Company Profile AT&T

### **Corporate Headquarters**

295 N. Maple Avenue  
Basking Ridge, NJ 07920  
(201) 221-2000

### **Officers**

*CEO:* Robert E. Allen  
*CFO:* Morris Tanenbaum  
*Senior V.P. Business Sales  
Division:* J.A. Blanchard

### **Company Background**

*No. Employees:* 299,200

AT&T is the largest telecommunications manufacturer in the United States. AT&T reports that, financially, 1989 was its strongest year since divestiture. Profits, according to the company's 1989 annual report, were \$2.7 billion, or \$2.50 per share. This represents a 19 percent increase from the previous year (exclud-

ing the 1988 charge for network modernization).

In the 1989 Annual Report Chairman's Message, Robert Allen delineated AT&T's purpose for the 1990s: "As we move into 1990, I have set three priorities for myself and the rest of the company.

"First, we will step up our efforts to become a company that is totally committed to quality. I want AT&T quality to be the best in the world.

"Second, in managing the business, we will keep striving for an operating style and behavior that is characterized by a sharper focus on customer needs.

"And third, we will continue to develop into a

truly global corporation. It is not sufficient for AT&T to be a U.S. company with aspirations to serve international markets. The concept of globalization must become an ingrained part of the way our people think and view themselves and their work."

The chairman concluded by saying, "The AT&T of the 1990s will be a leading, customer-focused, marketing-savvy business with a strong technology base—a business that will be successful in an era of global information movement and management." It is interesting that Allen used the words "marketing-savvy business" because, although AT&T has long been known for technically excellent products and outstanding innovations, it has only recently begun serious marketing efforts. AT&T had long believed that "a good product will sell itself,"

and for many years this was true. But today, the company is faced with a number of upstart competitors who have honed and perfected the art of aggressive marketing, and finally AT&T is responding in kind.

Much of AT&T's success has been and will be dependent on Bell Laboratories, one of the premier technical research and development organizations in the world. Bell Labs engineers, for example, were responsible for merging the best features of the System 75 and 85 PBXs to create the Definity system. Among other studies, AT&T scientists are currently conducting research in optical processors, which process information with light rather than electricity. These efforts could lead the way to even faster, smarter telecommunications products.

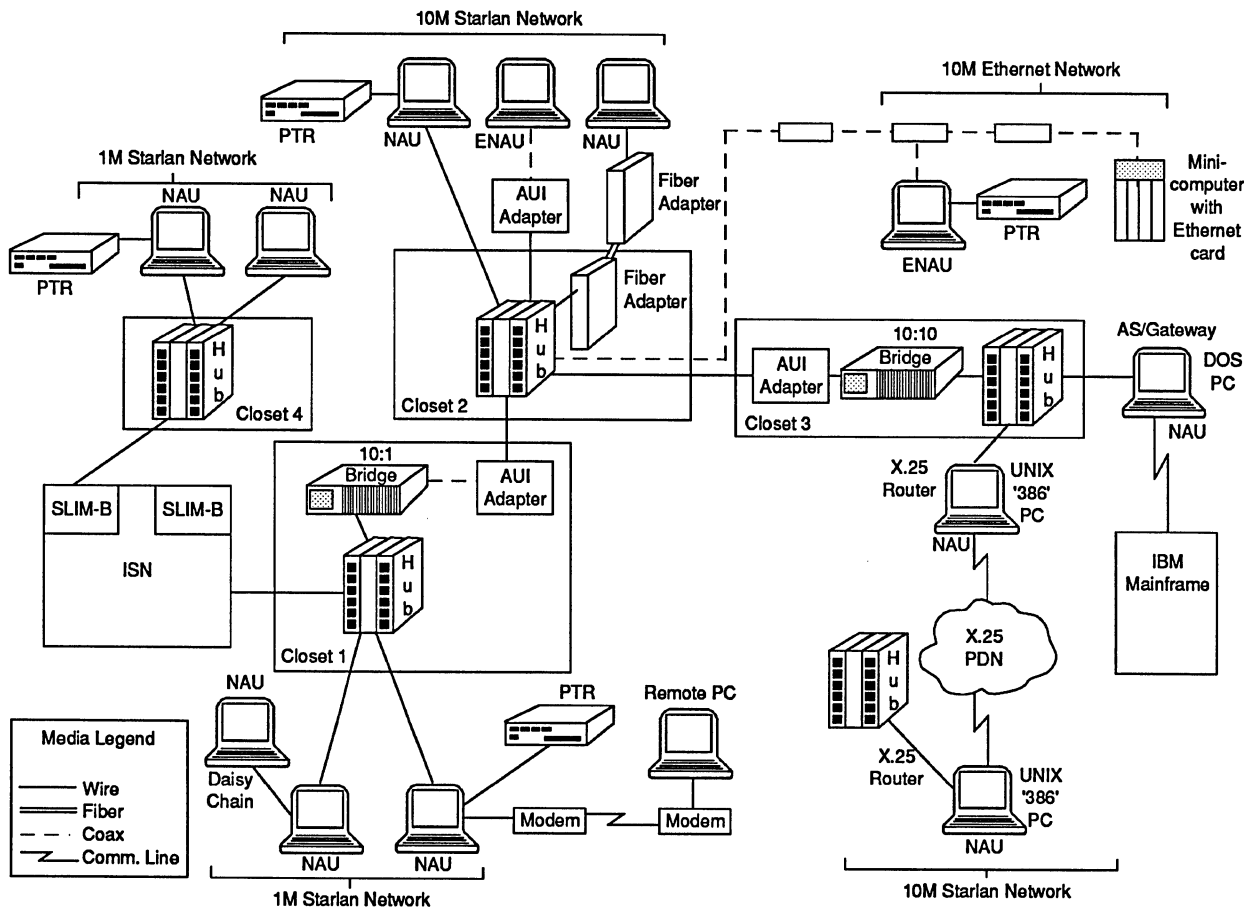
Xerox, and Excelan. There had been proprietary twisted-pair networks (such as 10NET Communications' 10NET Plus local area network system and Corvus' Omninet) before the introduction of Starlan, but AT&T was the first to combine the simplicity and inexpensiveness of twisted-pair wire with standard LAN specifications such as Ethernet.

In May 1988, AT&T announced Starlan 10, a 10M bps LAN targeted at the market's high end. Starlan 10, however, was not greeted with the same initial enthusiasm as its predecessor, largely because Ethernet and token-ring networks had already established themselves in the high end. It remains to be seen how far Starlan 10 can ride the popularity of twisted-pair wire, which is already enjoying considerable success in the Ethernet world. Its compliance with the IEEE 10BASE-T

standard, however, along with the StarGROUP Software's ability to connect UNIX, MS-DOS, OS/2, and Macintosh systems, should help Starlan 10 to garner a favorable position in the high end of the market.

In addition, the UNIX operating system—with its adherence to the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) reference model and multiuser, multitasking capabilities—has gained a good deal of acceptance in the corporate environment. As a result, the Starlan 10 and Starlan networks could benefit from their unique capability to link UNIX devices with systems in other operating environments (as mentioned above), particularly if UNIX can continue to make inroads outside of the scientific/engineering communities.

Figure 1.  
 Starlan Connectivity Options



Some typical Starlan 10 and Starlan network connectivity options include the AS/Gateway, X.25 Router, and network bridges, for a variety of minicomputer and mainframe environments.

## Decision Points

### Flexibility

When used in conjunction with AT&T's StarGROUP Software LAN Manager Server network operating system, Starlan 10 and Starlan networks provide the kind of broad support required in today's multivendor environment. StarGROUP-based networks allow UNIX, MS-DOS, OS/2, and Macintosh systems to share a single network. Although some other vendors support such interconnections, they are, for the most part, third-party vendors, not the network provider. This is a strong advantage for users of AT&T's UNIX-based 3B2 minicomputers, for example, who have MS-DOS, OS/2, or Macintosh workstations. There simply are not that many UNIX workstations installed in the field, other than in scientific/engineering sites, and,

as mentioned, the main application for Starlan has tended toward connecting MS-DOS machines in office environments.

In addition, users of the LAN Manager Server software can take advantage of support for non-AT&T LAN adapters. Aside from AT&T's own NAUs, the software also supports IBM's Token-Ring 16/4 adapters (4M bps only), IBM's Token-Ring adapters I and II, 3COM's EtherLink adapters I and II, and Racal InterLan NI5210.

AT&T has also adhered to industry standards in designing the hardware components for Starlan 10 and Starlan networks, which conform to the IEEE 802.3 10BASE-T and 1BASE5 standards, respectively. This could prove particularly advantageous for the Starlan 10 Network, as the demand for 10BASE-T-compliant products continues to increase. Additionally, Starlan 10 hardware is now

compatible with the Novell NetWare and Banyan Vines operating systems, allowing users of these systems to take advantage of the hardware's 10BASE-T compatibility while still protecting their current software investments.

### Ease of Expansion

Easy expansion is another positive characteristic of the Starlan networks. Under ideal circumstances, adding a workstation to a 1M bps Starlan network is as easy as inserting an NAU in a PC and just plugging into the network hub. In the 1M bps Starlan network, daisy-chained workstations can be connected through NHUs in a two-tiered network, allowing as many as 1,210 physical connections.

Despite Starlan 10's increased complexity as a high-end LAN, its use of the NHU keeps the addition of new workstations relatively simple. Although the network is initially configured and expanded with relative ease, it has some limitations in comparison to Ethernet. The most obvious is distance. The maximum distance allowed between any two devices on a 10M bps network operating over twisted-pair wire is about 100 meters. A network operating over thin coaxial cable, on the other hand, allows almost twice as much distance between workstations. And the fact that only 11 workstations can be connected to an NHU could present a problem with larger networks; aside from complicating network topology, continual addition of NHUs could quickly become costly. Users who want to take full advantage of Starlan 10's flexibility face more complications, including the addition of bridges, routers, gateways, and the like. Of course, most potential users are not likely to use every available Starlan 10 option, reducing the problem of complexity.

### Affordability

A key strength of the Starlan 10 and Starlan networks (and Starlan-type networks in general) is their capability to connect devices over inexpensive, unshielded twisted-pair wiring. The cost savings and ease of installation associated with this medium (already in place in most buildings) has enabled Starlan networks to establish themselves in the low end of the LAN marketplace. With the 10M bps Starlan 10, however, AT&T is attempting to use these same advantages to compete with the Ethernet networks for a share of the high end of the market. As previously mentioned, however, larger,

more complex Starlan 10 networks can become expensive, and with the advent of Ethernet over twisted-pair it may be more difficult for Starlan to get a foothold in this segment of the market.

## Characteristics

**Model:** AT&T Starlan and Starlan 10 networks.

**Date Announced:** Starlan—March 1985; Starlan 10—May 1988.

**Date First Installed:** Starlan—May 1986; Starlan 10—July 1988.

**Number Installed:** Information not available.

**Serviced by:** Dealer or AT&T.

### Architecture

The Starlan 10 and Starlan networks are designed to operate over twisted-pair wire in a daisy-chain (1M bps system only), star, or bus topology. The lower level protocols are compatible with the IEEE 802.3 10BASE-T and 1BASE5 standards for baseband, carrier sense multiple access with collision detection (CSMA/CD), 10M and 1M bps local area networking, respectively. The 10BASE-T standard specifies a 10M bps baseband network operating at distances up to 100 meters, and the 1BASE5 standard specifies a 1M bps baseband network operating over twisted-pair wire at distances up to 500 meters.

The upper level Starlan protocols are compatible with Microsoft networks and the IBM NETBIOS standard. Applications designed for these environments will operate on the Starlan network.

The Starlan wiring scheme (24-gauge twisted-pair telephone wiring) is based on the AT&T Premises Distribution System (PDS), which is the standard wiring scheme for all of AT&T's data networking products.

### Communications

**Transmission Technique:** Baseband.

**Topology:** Daisy-chain (1M bps system only), star, and bus.

**Access Method:** CSMA/CD.

**Maximum Data Rate:** Starlan 10—10M bps; Starlan—1M bps.

**Media Supported:** The Starlan 10 and Starlan networks operate over 24-gauge unshielded twisted-pair telephone wire compatible with the AT&T PDS standard for building wiring. Optical fiber can also be used as an optional backbone transport medium, with appropriate fiber adapters.

**End-User Devices Supported:** AT&T PC6300, 6300 Plus, 6310, 6300 WGS, 6286 WGS, 6312 WGS, 6386 WGS, processor-based workgroup systems, UNIX 3B2 minicomputer family; IBM PC/XT/AT, PS/2, and compatibles; and Compaq Deskpro 286/386 and compatibles.

**Maximum Transmission Distance:** Starlan 10 network—100 meters over twisted-pair wire; Starlan network—500 meters over twisted-pair wire.

**IEEE 802 Standards Supported:** 802.3 10BASE-T and 1BASE5 standards.

## Hardware

**Servers:** Starlan 10 and Starlan networks do not require a specific server; however, the StarGROUP software is certified for use only with AT&T servers. A PC or minicomputer supported by the network can act as a server when equipped with the appropriate software. In fact, a PC can function as a concurrent client/server in smaller networks that do not require a dedicated server.

Normally, 286- and 386-based computers are configured as network servers in typical LAN installations.

For Starlan network installations that require extensive storage, users can also employ one of AT&T's 3B2 minicomputers (Model 310, 400, 600, or 700) as a server. These computers allow up to 15.9G bytes of storage, when used in conjunction with an SCSI Host Adapter. In addition, AT&T has introduced two new UNIX-based servers: StarServer E and StarServer FT. The StarServer E is an EISA-based computer, featuring symmetric multiprocessing (SMP), disk mirroring, system management capabilities, and fixed disks offering up to 1G byte of storage. The StarServer FT is a fault-tolerant, UNIX System V-based RISC computer, and is recommended by AT&T for use with "mission-critical" applications. The system offers a storage capacity of up to 17.5G bytes for unmirrored disks and 8.75G bytes for mirrored disks.

**Workstations:** The Starlan 10 and Starlan networks are designed to interconnect AT&T 6300, 6300 Plus, 6310, 62XX/63XX Workgroup Systems (WGS), UNIX PC 3B1 (though AT&T no longer produces this model, it is still supported by the networks), and 3B2 minicomputers; IBM PC/XT/AT, PS/2 series, and compatibles; Apple Macintosh computers; and Compaq 286/386 and compatibles. In addition, Starlan 10 users can include any minicomputer with an Ethernet controller card running under UNIX System V (Version 3.0 or higher).

**Network Interface Boards:** Access to the Starlan 10 and Starlan networks is provided by a Network Access Unit (NAU), a printed circuit board that fits in an expansion slot in a workstation. In the 1M bps Starlan network, the NAU can connect workstations in a daisychain; in addition, the NAU can connect the daisychain to a star configuration through a centralized hub.

**Table 1. Typical AT&T 6XXX Work Group Systems and 3B2 Computer Configuration When Used as a Starlan Network Server**

	Recommended Maximum Simultaneous Clients (per Server)	Absolute Maximum Simultaneous Clients (per Server)	Maximum Simultaneous Links to Server	Maximum Attached Printers (P—Parallel) (S—Serial)	Maximum Factory Installed Hard Disk (bytes)
6300 WGS	8	32	80	2P and 1S	20M
6286 WGS	16	32	80	2P and 1S	40M
6312 WGS	16	32	80	2P and 1S	68M
6386 WGS DOS	32	32	80	2P and 1S	300M
UNIX(1)	64	64	1,000	2P and 1S	300M
382(1) Computers	100	100	1,000	Up to 11P and 45S or 88S	Up to 600M(2)

(1) Server software does not limit supported clients. These limitations are merely guidelines.

(2) Expandable to 15.9G bytes with external hard disk.

In the Starlan 10 network, however, each NAU must be directly connected to a hub. Several NAU types are available for the Starlan product line. These boards are not interchangeable. AT&T provides two NAUs to connect most supported workstations to the Starlan 10 and Starlan networks: the Starlan 10 network PC NAU and the AT&T 6300 PC NAU, respectively. There are also NAUs available for either network for use exclusively with the AT&T 3B2 minicomputer family. The Starlan NAU Plus and Starlan 10 NAU Plus, when used with AT&T's 6386 WGS or 6386E WGS, provide network management capabilities to their respective networks.

Two additional NAUs are available for the Starlan 10 network only: the EN100 NAU and MC200 NAU. The EN100 is an Ethernet circuit board for AT&T PCs and compatibles that accesses networks running on either thin or thick coax cable. The MC200 is an expansion board for IBM PS/2 Model 60 and higher computers. It enables a PS/2 using the Micro Channel bus interface to access a Starlan 10.

**Network Hubs:** The Starlan Network and Starlan 10 Network Hub Units (NHUs) provide a means of expansion. The Starlan and Starlan 10 NHUs connect not only workstations but other NHUs as well. Connecting multiple NHUs to one central NHU increases the number of workstations the network can support. The NHUs also act as signal concentrators, amplify and retime network signals, and detect and signal heavy traffic and collisions. Light-emitting diodes on the NHUs signal and help isolate transmission errors.

The Starlan NHU (for use with the 1M bps system) can connect up to 11 daisychain networks, each with as many as 10 workstations. In turn, up to 11 NHUs can be connected to 1 master NHU, forming a two-tiered network capable of supporting a maximum of 1,210 physical connections. Depending on the application, however, the 1M bps Starlan network can actually support from 2 to 200 active workstations.

The Starlan 10 NHU can connect up to 12 workstations over twisted-pair wiring. In addition, coaxial cable-based segments can be connected through an Attachment Unit Interface (AUI) port. Starlan 10 NHUs can be added to the network as required, with a maximum distance of 328 feet between any two devices. Starlan 10 networks operating over optical fiber medium must use the Starlan 10 Network Fiber Hub to interconnect devices. This hub has six fiber ports, one modular port, and one AUI port. The maximum distance between fiber hubs is 3,280 feet.

**Gateway/Bridge Products:** The StarWAN Network 1:10 and 10:10 Bridges are desktop standalone devices for the Starlan 10 that provide connectivity with other Starlan networks. The 1:10 Bridge allows a Starlan 10 to be connected to a 1M bps Starlan network. With the StarWAN Network 10:10 Bridge, two Starlan 10 networks can be connected, or a Starlan 10 can be connected to any IEEE 802.3 Ethernet 10M bps network. Starlan 10s

can also be connected through AT&T's Information Systems Network (ISN) using the Ethernet Bridge Interface Module (EBIM).

The Starlan Interface Module-Bridge (SLIM-B) and Starlan Interface Module-Connection (SLIM-C) provide an interface between AT&T's ISN and the 1M bps Starlan network. With SLIM-B, a transparent data link is provided between devices on different 1M bps Starlan networks. ISN devices not on a Starlan network cannot be accessed through SLIM-B. But SLIM-C allows workstations on 1M bps Starlan Networks to access any asynchronous endpoint on ISN.

The AT&T System 25 Starlan Network Access Feature allows Starlan network workstations to communicate with terminals and computers not on the network. Using System 25 as a bridge to a Starlan Network, local and remote PCs can run network applications and access files as if they were on the network. In addition, with System 25 no individual data connections or modems are needed; all data is switched by System 25. Starlan users can also place data and voice calls using the System 25 gateway mode. There are two types of software available with this setup: the Starlan Access Software and the Communications Access Manager. The former provides the basic interface functions, while the latter enables voice and data call management.

AT&T also offers a full-sized expansion board for DOS PCs as part of its AS/Gateway Single Board Solution (SBS), a hardware/software product that allows DOS PCs to share information with IBM mainframes.

**Additional Products:** The Network Repeater Unit (NRU) is used to extend the distances between devices and improve the quality of transmitted signals on the 1M bps Starlan Network. The NRU can be used to increase the diameter of the network by interconnecting multiple NHUs.

There are three Starlan 10 media adapters available: the Starlan 10 Network AUI Adapter, the Starlan 10 Network Fiber Adapter, and the Starlan 10 Network Coax Adapter. The AUI Adapter permits Ethernet devices, which normally run on coaxial cable, to operate over the twisted-pair wiring of the Starlan 10. The Fiber Adapter allows a workstation to connect to a hub (as far as one kilometer away from the workstation) over optical fiber. Two adapters—one at each end of the fiber cable—are required to make the connection. The Starlan 10 Network Coax Adapter is an IEEE 802.3-compliant two-port repeater, which allows users of thin coax-based networks to connect to a Starlan 10 Network Hub Unit over unshielded twisted-pair wire.

AT&T also offers the Starlan 100 Network Concentrator, a new product that allows users to attach high-speed workstations and hosts to an FDDI network. The product provides up to 15 connections and the ability to detect and isolate station failures. According to AT&T, "this is the industry's first FDDI concentrator that allows both single and dual attachments."

## Software

**Network Operating System:** AT&T's StarGROUP Software LAN Manager Server is a UNIX-based LAN operating system derived from Microsoft's LAN Manager technology. The software offers standard networking features such as file and printer sharing, remote administration, and support for distributed networked applications. In addition to Starlan and Starlan 10 hardware, the program offers compatibility with the IBM Token-Ring 16/4 adapter (4M bps only), IBM Token-Ring adapters I and II, 3Com EtherLink adapters I and II, and the Racal InterLan NI5210.

Most existing MS-DOS, OS/2, and Macintosh applications can access files resident on a StarGROUP server. Users can access multiple servers, and multiple users can share information located on a file server. Additional features of the StarGROUP Server programs for UNIX include queue query and administration services; security via restricted access to network resources; distributed processing; support for most LAN Manager APIs; support for Structured Query Language (SQL) applications and record and file locking.

AT&T also offers the StarGROUP Software OSI Network Program, which is for use in a UNIX environment when DOS workstations are not connected to a Starlan network. There are two versions of this software available, one for use with the AT&T 6386 WGS and one for AT&T'S 3B2 minicomputer family. Each version provides communications with other UNIX System V computers, permitting the sharing of such capabilities as remote file and printer sharing, file transfer, electronic mail, and remote login. Both versions are compatible with the X.25 router, and the UNIX System V/386 version can also be used with the Asynchronous Gateway Server and the Remote PC Gateway.

The StarGROUP DOS ISO NETBIOS Program is for independent vendors and resellers that are writing software programs for Starlan networks. This software complies with the OSI model and NETBIOS programming interface, and allows the writing of software that is not dependent on AT&T servers.

**Communications Software:** AT&T offers a variety of communications software for use with its Starlan networks. The StarGROUP software products discussed in the following paragraphs are all available for both Starlan and Starlan 10.

The AS/Gateway Single Board Solution is an expansion board and accompanying software product that allows DOS PCs to communicate with an IBM mainframe at 19.2K bps. The AS/Gateway emulates IBM's 3274 Type C cluster controller, with networked PCs emulating 3278/3279 terminals and 3287 printers. Multiple gateways are supported on a single network, with each gateway providing access for up to 32 simultaneous on-line sessions.

The StarGROUP Software Asynchronous Gateway allows workstations on the network to share asynchronous communications facilities (modems, AT&T's

ISN, RS-232-C lines, etc.) and connect with host computers not on the network. It supports Crosstalk/DCA's Crosstalk XVI terminal emulator and IBM's asynchronous communications protocol. With the Crosstalk (or compatible) software, users can establish host connections, perform terminal emulation, and upload/download files.

The StarGROUP Software Remote PC Gateway lets a remote PC access Starlan/Starlan 10 services, through either a dial-up or direct RS-232-C connection. Remote PC Gateway consists of a server program and a DOS client program that must be installed on all PCs that will be accessing the network.

The X.25 Router allows remote Starlan networks to communicate with one another via X.25 packet-switching networks, digital or analog private lines, or DDD networks. The software can be installed on either an AT&T 3B2 computer or an AT&T 6386 WGS. The X.25 Router lets most DOS functions operate transparently between connected networks.

TEWorks/LAN software allows a networked PC to communicate with hosts connected to AT&T's ISN by the Starlan Interface Module-Connector (SLIM-C). This software lets a PC emulate a standard Teletype terminal, an American National Standards Institute (ANSI) terminal, or a Digital Equipment Corp. terminal (VT100, VT102, VT220, or VT52). It can also be used to dial out to an asynchronous host or to log in to a UNIX operating system host.

AT&T's PC/TCP Program enables DOS PCs on a Starlan network to access host computer features on a Transmission Control Protocol/Internet Protocol (TCP/IP) network. The program allows networked PCs to make use of such TCP/IP services as File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), and Network Virtual Terminal Protocol (TELNET).

The StarGROUP Software TCP Access Program (TAP) lets workstations on ISO-based StarGROUP systems access remote host computers on TCP/IP networks through TELNET. The software allows the features of StarGROUP software and TCP/IP software to interact. TAP is available for both the AT&T 3B2 computer and the 6386 WGS.

The Starlan Access Program and Communications Access Manager (CAM) are software programs used with the System 25 Starlan Network Access Feature, a hardware/software product that allows network workstations to communicate with nonnetwork computers and terminals. Starlan Access Software is an MS-DOS program that lets nonnetwork PCs (either local or remote) use System 25 to access Starlan resources as if the PCs were physically connected to the network. The software is NETBIOS compatible, allowing execution of applications for industry-standard LANs. CAM is an MS-DOS package that supplies terminal emulation and a telephone manager for placing voice and data calls. This program includes a 200-entry directory, auto logon capability, password-protected access to PC files, support for electronic mail, and Xmodem protocol for file support.



The Virtual Circuit Switch Access Program (VAP) is gateway software, providing fiber-based connections between ISO-based devices running in a StarGROUP environment and devices on an AT&T StarWAN Information System Network (ISN). VAP allows users to take advantage of ISN Host services such as remote login, file transfer, and remote execution between the server and the ISN endpoints. In addition, since VAP provides a bi-directional connection, ISN endpoints can access asynchronous hosts residing on a StarGROUP-based LAN.

**Network Management Software:** Central administration for StarGROUP Software LANs is provided by the StarGROUP Software Network Manager program, which uses a three-tiered structure in providing the ability to manage up to 250 LANs and 23,000 nodes from a single location. Network Manager (operating in conjunction with the Network Manager Agent program) generates daily summary reports; monitors node and server status, alarm status, and network performance; and supports remote communications through X.25, SNA, and RS-232-C connections. The program is designed for use on an AT&T 6386 WGS running UNIX System V/386, release 3.2.2.

AT&T also offers StarGROUP Software Computer Manager, which provides management support for up to 1,000 3B2 or 6386 WGS computers running UNIX System V; and StarGROUP Software Router Manager, which works with the Network Manager software to provide the ability to manage StarGROUP Software X.25 Routers. In addition, StarGROUP Software Management Utilities are available for integrating the administration and support of the network, computer and router management applications through a multiwindow interface, running under the OPEN LOOK graphical user interface.

**Applications Software:** Most office and business applications available for Starlan users are those available off the shelf for the UNIX and DOS operating system environments. For DOS-based workstations linked by AT&T Starlan networks, there are thousands of business applications that run in standalone and networked environments.

Among the communications and file transfer applications that AT&T offers for use with its network products is the PMX/StarMail E-Mail optional package, a LAN version of its Mail Private Message Exchange. It provides Starlan users local and even worldwide (through the AT&T Mail service) electronic mail capabilities. PMX/StarMail is made up of user access and post office software. The user access software lets network users access the mail system, while the post office software lets a UNIX computer or MS-DOS PC (with at least a 10M-byte hard disk) act as a dedicated post office. A post office handles communications with other StarMail post offices, UNIX systems employing StarMail, and the AT&T Mail service.

## Support

**Installation:** Complete network installation, including building wiring, network software, and advanced applications installation, is available. Installation and maintenance training for larger distributors that install networks for their customers is also available. In addition, comprehensive documentation from design guides to technical reference manuals and application programmers reference manuals can be purchased from AT&T's Customer Information Center; call (800) 432-6600.

**Training:** AT&T provides comprehensive training options for customers. Training includes a Starlan network technical overview course and network administration course.

**Warranty:** Length and terms of warranty vary depending on the product. Contact AT&T for details. On-site coverage and mail-in/carry-in service are also offered.

**Maintenance:** AT&T provides comprehensive service options for customers. For more information, contact AT&T at (800) 247-1212.

## Pricing

AT&T Starlan network products are distributed through authorized dealers and value-added resellers, as well as direct from AT&T to large-account customers, on a purchase-only basis.

## Equipment Prices

	<b>Purch. Price (\$)</b>
<b>Starlan Network 1M bps Hardware</b>	
AT&T 6300 PC Network Access Unit (NAU)	295
AT&T 3B2 Computer NAU	995
AT&T Starlan NAU Plus	895
Network Hub Unit (NHU)	625
Network Repeater Unit (NRU)	495
Starlan Interface Module—Bridge (SLIM-B)	2,800
Starlan Interface Module—Connection (SLIM-C)	3,000
<b>Starlan Network 10M bps Hardware</b>	
Starlan 10 Network Hub Unit	1,895
Starlan 10 Network Fiber Hub	2,395
Starlan 10 Network Attachment Unit Interface (AUI) Adapter	175
Starlan 10 Network Fiber Adapter	500
Starlan 10 Network Coax Adapter	795
Starlan 10 Network PC NAU	295
Starlan 10 Network EN100 NAU	495
Starlan 10 Network MC200 NAU	445

	<b>Purch. Price (\$)</b>
<b>Starlan Network 10M bps Hardware (Continued)</b>	
Starlan 10 Network NAU Plus (NM)	895
Starlan 10 Network Fiber NAU	995
NAU 10M Interface for 3B2	1,500
IPC 802 System for AGS/386	1,195
Starlan Network 1:10 Bridge	4,500
Starlan Network 10:10 Bridge	5,950
GPSC-AT for X.25/386 Router	1,595
ISC for X.25/3B2 Router	1,475
Ethernet Bridge Interface Module (EBIM)	4,500
StarServer E (configuration 1)	27,500
StarServer E (configuration 2)	29,000
StarServer E (configuration 3)	39,900
StarServer FT	172,000

	<b>Purch. Price (\$)</b>
<b>StarGROUP Network Software (Continued)</b>	
StarGROUP Software OSI Network Program for use with 3B2 UNIX System V Rel. 3.2	995
StarGROUP Server for use with 3B2 UNIX System V Rel. 3.2 (Models 310/400)	2,995
StarGROUP Server for use with 3B2 UNIX System V Rel. 3.2 (Models 500, 600, 700)	3,995
StarGROUP Software Server Foundation Set for use with UNIX System V/386	4,995
Touchstone TEWorks LAN	149
StarGROUP Software Asynchronous Gateway for use with UNIX System V/386	1,275
StarGROUP Software Remote PC Gateway for use with UNIX System V/386	1,495
StarGROUP Software X.25 Router for use with UNIX System V/386	1,675
StarGROUP Software X.25 Router for use with 3B2 UNIX System V Rel. 3.2	1,975
AT&T Virtual Circuit Switch Access Program (VAP)	2,995
StarGROUP Software TCP Access Program for use with 3B2 UNIX System V Rel. 3.2	1,975
StarGROUP Software ISO-to-URP Gateway for use with UNIX System V/386	1,495
StarGROUP Software TCP Access Program for use with UNIX System V/386	1,475
StarGROUP Software 3B4000 OSI Network Program for use with 3B4000	4,000
StarGROUP Software AS/Gateway SBS MLU 8	2,595
StarGROUP Software AS/Gateway SBS MLU 8/16 Upgrade	1,700
StarGROUP Software AS/Gateway SBS MLU 16/32 Upgrade	1,000

## Software Prices

	<b>Purch. Price (\$)</b>
<b>StarGROUP Network Software</b>	
StarGROUP Software LAN Manager Server (eight users)	1,895
StarGROUP Software LAN Manager Server (unlimited users)	3,495
StarGROUP Software OSI Network Program (for use with UNIX System V/386)	795
StarGROUP Software 386 Server for use with UNIX System V/386; for up to 8 users	1,295
StarGROUP Software 386 Server (for use with UNIX System V/386; unlimited)	2,295
StarGROUP Software Network Manager	10,495
StarGROUP Software Computer Manager	10,495
StarGROUP Software Router Manager	1,995
StarGROUP Software Management Utilities	995

### Application Software Options

AT&T StarMAIL (8-user version)	395
AT&T StarMAIL (unlimited-user version)	1,295-1,900

# Attachmate EXTRA! PC-to-Host Products

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## Product Summary

### Editor's Note

In May, Attachmate released EXTRA! for Windows Release 3.2—a new EXTRA! for Windows version that provides additional features in the automation of PC-to-host transactions. In June, Attachmate released EXTRA! Extended for DOS Versions 2.2 and 2.3, 3270 Gateway Option Version 2.0, and Asynchronous SNA Adapter—all of which simplify remote SNA connectivity by using standard PC COM ports, provide compatibility with Novell's IPX transport protocol, and are optimized for use with Microsoft MS-DOS Version 5.

### Description

Attachmate's EXTRA! PC-to-host products provide IBM 3278/79 terminal emulation and file transfer capabilities to users of IBM PC/XT/AT, PS/2, and compatible computers.

### Strengths

EXTRA! software packages support multiple connection types, including coaxial, LAN gateways, and IBM's Token-Ring Interface Coupler. Users

retain a consistent user interface, regardless of connection type. Also, Attachmate maintains the compatibility of its products with almost every IBM hardware and software interface.

### Limitations

EXTRA! software is available for MS-DOS and Windows environments; however, it does not offer support for Macintosh and UNIX environments.

### Competition

IBM, Digital Communications Associates (DCA), Eicon Technology, Network Software Associates (NSA).

### Vendor

Attachmate Corp.  
13231 SE 36th Street  
Bellevue, WA 98006  
(206) 644-4010

In Canada:

Attachmate #1 First Canadian Place  
P.O. Box 24, Suite 5900  
Toronto, ON M5X 1R2  
(416) 366-2497

### Price

EXTRA! Extended for DOS and EXTRA! for Windows are both priced at \$425.

### GSA Schedule

Yes.

—By Donna Horsley  
Staff Writer

# Analysis

## Product Strategy

Since its inception nine years ago, Attachmate has profited from the proliferation and success of IBM in the computer industry. Attachmate provides true IBM-compatible PC-to-mainframe products that have strong features and enhancements for advanced functionality. In 1990, the company earned more than \$78 million in sales, and it has maintained a 100 percent dollar growth rate for more than two years.

Attachmate believes IBM will remain a standard computing tool in the computer industry. It is committed to maintaining the compatibility of its products with almost every IBM hardware and software interface and bases them on IBM's architecture and not its own.

Attachmate's emergence as a leader in the PC-to-host communications market is largely a result of its EXTRA! connectivity software: EXTRA! Entry-Level, EXTRA! Extended for DOS, and EXTRA! for Windows. Other Attachmate software products include NOW!, which automates and simplifies mainframe procedures, and 3270 Gateway Option, for users wishing to use mainframe graphics capabilities. The company also offers several add-in adapter cards.

Two of Attachmate's latest products are EXTRA! Extended for DOS Version 2.2 and 3270 Gateway Option Version 2.0. Both released in June, the products support a new type of PC-to-mainframe connection called Asynchronous SNA. Using the standard COM ports of a laptop or other PC and modems, the new connection remains fully compatible with the SNA datastream and IBM's client/server architecture, thus allowing remote mainframe access without special modems or terminal protocol conversion.

"Async SNA is quite an achievement," Mike New, vice president of marketing, said. "We based the system on an IBM protocol known as ADLC

and then made some big performance improvements. The result is a fully IBM-compatible product that is more convenient, less expensive, and faster than native SNA/SDLC links."

## Software Products

At the core of the Attachmate PC-to-host product line is EXTRA! software. EXTRA! Extended for DOS allows IBM PC/XT/AT, PS/2, and compatible computers to establish up to four host sessions on an IBM mainframe. EXTRA! software supports coaxial, LAN Gateway, IBM Token-Ring Interface Coupler (TIC), and remote connections.

EXTRA! Entry-Level is a single host-session version. It offers only local mainframe connections, either through an IBM 3X74 controller or a NETBIOS-compatible LAN Gateway.

EXTRA! for Windows takes advantage of the graphical user interface offered by DOS Windows 3.0 and 3.2 while supplying the same functionality as its EXTRA! predecessors.

Attachmate's product line also includes NOW! Autoware, Host Graphics Option, and 3270 Gateway Option. NOW! Autoware constructs menu-driven front ends to the mainframe and automates mainframe procedures such as file transfer. Host Graphics Option allows users with CGA, EGA/VGA, or 8514/A graphics adapters to display, edit, and print mainframe graphics. 3270 Gateway Option, which allows an EXTRA!-equipped computer to act as a LAN gateway, supports up to 128 mainframe sessions or logical units. The 3270 Gateway attaches to a mainframe through a coaxial-DFT connection, SNA/SDLC modems, or an IBM TIC interface.

## Hardware Products

Although Attachmate concentrates its product development on software, the company also offers hardware products. Attachmate provides seven adapter boards for use with its EXTRA! software packages: Advanced 3270 Adapter and Advanced 3270 Adapter/2, which provide coaxial connectivity through an IBM 3X74 or 3276 controller; SDLC Adapter and SDLC Adapter/2, which use an RS-232-C connection to provide remote access to mainframes; Advanced Function SDLC Adapter, recommended for use in high-performance LAN gateways; SDLC Autolink Adapter, which adds an AT&T 208A/B-compatible modem to the basic SDLC Adapter; and Asynchronous SNA Adapter,

which uses the standard COM ports and modems of a laptop or other PC for remote mainframe access without special modems or terminal protocol conversion. The company also offers an RS-232-to-V.35 converter cable that allows users to use a T1 link multiplexer to establish a remote mainframe connection.

## Competitive Position

Attachmate's EXTRA! software has earned Attachmate billing as a major 3270 communications vendor, capturing 25 percent of the market. The company claims its EXTRA! software's comprehensive PC-to-mainframe products provide more features and half the memory consumption of products from its competitors—DCA, Eicon Technology, and NSA.

Attachmate, the only vendor to base its products on IBM architecture and not its own, provides the only 100 percent IBM-compatible products on the market. "Attachmate is second only to IBM in the PC-to-mainframe market," New said.

The company's products also differs from other 3270 emulation products in providing universal connectivity. Attachmate software supports all types of physical connections—including coaxial, LAN, and remote communications—within one package. Competing vendors sell separate products for coax, remote, and LAN connections.

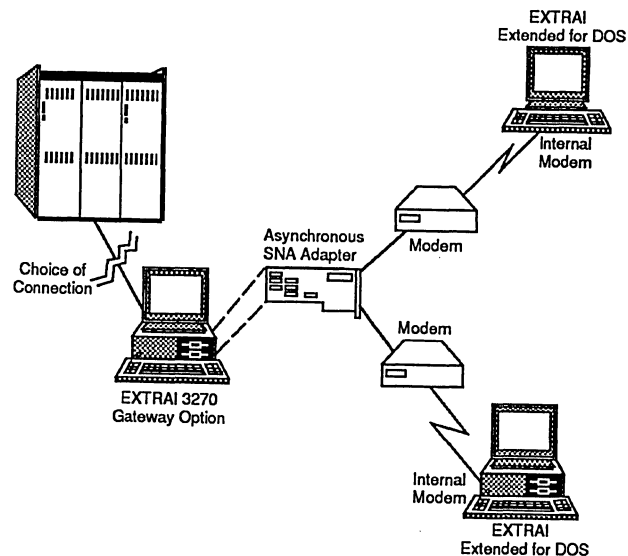
A major industry publication selected Attachmate EXTRA! its Editor's Choice for 1989 and 1990 and ranked Attachmate first in corporate satisfaction polls during those same years. Another key publication named EXTRA! 3270 Gateway Option its Product of the Year for 1989.

## Decision Points

### Versatility

In the crowded 3270 PC-to-host market, users can choose from a long menu of hardware and software products. Companies such as DCA and Novell offer extensive product lines where the menu choices, such as the type of connection (coax, remote, LAN) and support for DFT or CUT modes, require much foresight and careful consideration. Often, when a user chooses a specific configuration, the particular product soon becomes obsolete.

Figure 1.  
Attachmate Remote Access



In June, Attachmate added remote access support for EXTRA! Extended for DOS. Remote PCs and laptops may access the mainframe using standard serial ports by dialing into a PC system equipped with Attachmate's 3270 Gateway Option and Asynchronous SNA Adapter.

Attachmate, however, offers a complete package that combines several different connectivity options in a single software program. The package is menu driven, supports four simultaneous host sessions, and offers a context-sensitive help facility. Binary and text files can be transferred in the background while another session operates in the foreground. The program is feature rich and is definitely a viable option to the à la carte menu approach.

EXTRA!'s strongest feature is its support for coaxial, remote, LAN gateway, and Token-Ring Interface Coupler (TIC) connections—all in the same package. Remote connections are established with a synchronous modem. This versatility allows EXTRA! to provide a consistent user interface, regardless of the type of connection. Users not only can change communications architecture without having to learn a different interface, they are protected from the need to purchase new products to support a different connection, thus preserving their original software investment.

Attachmate's EXTRA! Extended for DOS Version 2.3, which was released in June, is one example of the versatility of Attachmate products. It

takes full advantage of the task swapping that Microsoft's MS-DOS operating system Version 5 now allows. A new modular program structure lets users swap out large modules while maintaining mainframe communication.

"The new architecture of EXTRA! 2.3 solves a tough problem," New said. "The mainframe demands constant attention, and we've found a way to move EXTRA! out of main memory and still keep the host connection alive."

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## Company Profile

Attachmate, a privately held company headquartered in Bellevue, WA, was founded in 1982 by Frank Pritt, company president. The company claims successive annual growth in size, product sales, and profits. In 1990, it earned \$78 million in product sales and considers itself highly profitable.

Targeting *Fortune* 1000 companies, Attachmate's client base includes major banks, insurance companies, and government agencies, as well as international companies. It has an installation base of more than 300,000 units worldwide.

Attachmate employs approximately 400 persons and sells its EXTRA! Software and gateway products directly and through VARs, system integrators, and resellers. It has nine international offices in Europe, North and South America, and Australia. International sales represent 30 percent of Attachmate's product sales.



## Characteristics

**Models:** Software products—EXTRA! Extended for DOS, EXTRA! for Windows, EXTRA! Entry-Level, Host Graphics Option, 3270 Gateway Option, and NOW! Autoware. Hardware products—Advanced 3270 Adapter, Advanced 3270 Adapter/2, SDLC Adapter, SDLC Adapter/2, Advanced Function SDLC Adapter, SDLC/Autolink Adapter, and Asynchronous SNA Adapter.

**Date Announced:** EXTRA! Extended for DOS, EXTRA! for Windows, Host Graphics Option—1990; NOW! Autoware—1989; EXTRA! Entry-Level and 3270 Gateway Option—1987.

**Date First Installed:** EXTRA! Extended for DOS, EXTRA! for Windows, Host Graphics Option—1990; NOW! Autoware—1989; EXTRA! Entry-Level and 3270 Gateway Option—1987.

**Number Installed:** 300,000 units.

**Distribution:** Attachmate's PC-to-host products are sold directly and through integrators, resellers, retail outlets, and OEM channels.

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## Models

**EXTRA! Software:** EXTRA! Entry-Level is coaxially connected to an IBM 3X74 controller or configured as a workstation on a LAN when connected to an Attachmate or IBM gateway. The program supports mainframe sessions and DOS sessions and allows users to hot key between the two. Users can also redefine host colors and print screens of data to a local printer once a session is established. The package also supports standard 83-/84-key and 101-/102-key keyboards and provides a keyboard remapping feature.

Attachmate's EXTRA! Extended for DOS allows PC or PS/2 users to communicate with an IBM mainframe through a coax connection to an IBM controller, through a remote connection via a synchronous modem, or by functioning as a workstation on a LAN. The nucleus of Attachmate's PC-to-host connectivity line, EXTRA! Extended for DOS supports all the same features as the entry-level product and adds support for four host sessions, a DOS session, and two notepads. The product also provides Control Unit Terminal (CUT) emulation, Distributed Function Terminal (DFT) emulation, and Extended Data Stream support.

EXTRA! for Windows takes advantage of the Microsoft Windows 3.0 and 3.2 graphical user interface. The program offers up to 26 simultaneous functions and supports windows-oriented features such as a mouse, automatic font and window sizing, hot spots for making menu selections, and the SmartPad user-defined, pop-up keyboard.

**3270 Gateway Option:** Users of EXTRA! software can upgrade the software to function as a gateway into a LAN. The IBM 3270-compatible gateway option accommodates up to 128 mainframe sessions or logical units. The gateway option is NETBIOS compatible and supports Attachmate EXTRA! workstations, EXTRA! Entry-Level workstations, IBM PC-3270 Versions 2.0 and 3.0 workstations, and IBM 3270 Version 1.1 emulation.

The 3270 Gateway option attaches to a mainframe via a coaxial-DFT connection, an SNA/SDLC modem

connection, or an IBM TIC interface. The coax-DFT connection is best suited for smaller networks. Using such a connection, the software supports up to five simultaneous mainframe sessions on a LAN. With a coax connection, the PC running the gateway software must be connected to a 3X74 Control Unit via 3270 coax cable. The remote modem connection, which is best suited for larger networks, supports up to 128 LAN workstations, provided the PC running the 3270 Gateway software is connected to the mainframe via an SNA/SDLC link. The TIC connection permits non-token-ring networks, such as Ethernet, to use the Token-Ring Interface coupler of the IBM 3174 Control Unit; IBM 3720, 3725, and 3745 Front-end Processors; and 9370 and AS/400 computers.

## Environment

**Emulation Modes:** EXTRA! emulates IBM 3278/79 Models 2/3/4/5 display terminals, 3287 LU Type 1 and 3 printers, and 3174/3274 controllers. EXTRA! Entry-Level supports 3278/79 Model 2 display terminals.

**Host Environments:** EXTRA! products support connections to hosts running IBM IMS, OS/400, OS/VS, TSO/CMS, MVS, VM/CMS, and CICS software. EXTRA! is compatible with IBM 3174, 3274, and 3276 Cluster Control units and IBM 360, 370, 3081, 3083, 3090, 4300, and 9370 mainframes. The software also works with IBM 4700 Financial Systems networks.

**Protocol:** All versions of EXTRA! support the SNA/SDLC and bisync protocols.

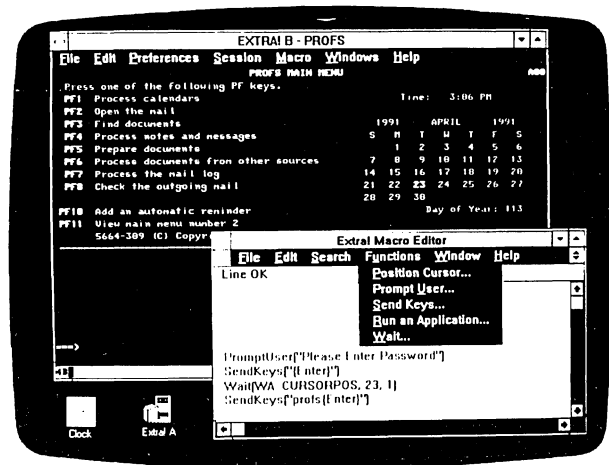
**Local Area Network Support:** EXTRA! products support all NETBIOS-compatible LANs, including Arcnet, Starlan, Ethernet, and token-ring.

**Remote Transmission Speed:** SDLC transmission speeds are dependent on the modem but can achieve a maximum of 64K bps.

**Computers Supported:** EXTRA! products can be run on IBM PC/XT/AT and all IBM PS/2 computers and compatibles. EXTRA! also runs on the IBM 3270 PC.

**Minimum Configuration:** A minimum of 37K bytes of available RAM are required for the EXTRA! Entry-Level software to run. EXTRA! Extended for DOS requires a minimum of 44K bytes of memory and two diskette drives or a diskette drive and a hard disk drive. The software works with CGA, EGA, VGA, 8514, or monochrome adapters and displays.

**Operating Systems:** EXTRA! Extended for DOS and EXTRA! Entry-Level support PC- or MS-DOS Versions 3.0 and later, and EXTRA! for Windows supports Windows 3.0 and 3.2 and is also compatible with Windows/286 and Windows/386.



*Released in May, EXTRA! for Windows Version 3.2 is PC-to-host software that adds new automation tools including host-aware DDE and a fully interactive macro editor.*

## Hardware

**Communications Interface:** EXTRA! Extended for DOS offers users local, remote, LAN gateway, and TIC connections to mainframes. EXTRA! for Windows and EXTRA! Entry-Level also offer coax and LAN connectivity but do not include remote options.

**Adapter Cards:** Attachmate manufactures seven adapter cards for use with its EXTRA! connectivity products. In addition, support is also offered for the following IBM adapter cards: IBM 3278/79 Adapter and IBM 3270 Connection, for coax connections; IBM SDLC Adapter and IBM Multi-Protocol Adapter, for SDLC links; and IBM Token-Ring, IBM PC Network, and IBM PC Network Baseband LAN Adapters.

**Advanced 3270 Adapter:** This adapter coaxially connects an IBM PC/XT/AT or PS/2 Model 25 or 30 to an IBM 3174, 3274, or 3276 Control Unit and supports coaxial links up to 5,000 feet. The adapter conforms to the IBM coax 2A protocol. The card also supports twisted-pair links up to 900 feet using an internal balun. Users configure the adapter for CUT- or DFT-mode operation.

**Advanced 3270 Adapter/2:** This adapter provides these same features for Micro Channel PS/2s.

**SDLC Adapter:** This adapter is a half-length board that allows an IBM PC/XT/AT to connect to an RS-232-C port on an external, synchronous modem communicating with a 3270 mainframe. It supports remote connections from PCs or LAN gateways using the SDLC protocol. Data rates between 2400 and 19.2K bps are supported across dial-up or leased lines. The adapter

can be used in point-to-point or multidropped connections. Users can reconfigure addresses and IRQ levels.

**SDLC Adapter/2:** This adapter provides the same features for Micro Channel PS/2s.

**SDLC/Autolink Adapter:** This adapter is basically an SDLC Adapter integrated with an AT&T 208A/B-compatible, 4800 BPS synchronous modem and automatic dialer. The full-length card can be installed in any IBM PC/XT/AT computer. All other specifications for the SDLC Adapter and SDLC/Autolink Adapter are the same.

**Advanced Function SDLC Adapter:** This hardware is a three-quarter-length board for IBM PC/XT/ATs and compatibles that supports high-speed direct or remote synchronous communications. The board uses a dedicated microprocessor and 256K bytes of RAM to ensure communications speeds of up to 64K bps, making it the board that Attachmate recommends for high-performance LAN gateway-to-mainframe connections.

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## Software

**File Transfer:** EXTRA! supports IBM Send/Receive (IND\$FILE), DISOSS PS/CICS, TSO/CMS Editor, Personal Services/PC, PASF, and PROFS/PC file transfers. EXTRA! ENTRY-Level supports IBM Send/Receive (IND\$FILE), PS/PC, PASF/PC, and PROFS/PC file transfers. Both text and binary files can be sent and received.

**Programmability:** EXTRA! products include application program interfaces that are compatible with IBM 3270 PC API (Version 3.0), IBM High Level Language Applications Program Interface (HLLAPI) Version 3.0 and its program debug utility, and Server/Requester Programming Interface (SRPI).

**Diagnostics:** None. Diagnostics are included with hardware adapters.

**Security:** Security is provided by the mainframe.

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## Support

**Telephone Support:** Users of any Attachmate product can obtain technical assistance by dialing Attachmate's technical support department at (800) 888-1187. Support is available from 7 a.m. to 5 p.m. Pacific time.

**Warranty:** All software products have a 90-day warranty. Hardware products carry a one-year warranty.

**Maintenance:** Beyond the warranty, users can subscribe to Attachmate's Central Support Program, which provides automatic maintenance updates to the customer. Central Support costs \$1,500 annually.

**Pricing:** The following are the single-unit list prices for Attachmate's products. No leasing is available.

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## Product Prices

	<b>Purchase Price (\$)</b>
<b>Software Products</b>	
EXTRA! Extended for DOS	425
EXTRA! for Windows	425
EXTRA! Entry-Level	275
NOW! Autoware	565
Host Graphics Option	695
3270 Gateway Option	50
<b>Hardware Products</b>	
Advanced 3270 Adapter	570
Advanced 3270 Adapter/2	595
Advanced Function SDLC Adapter	1,195
SDLC Adapter	270
SDLC Adapter/2	295
SDLC/Autolink Adapter	1,570
Asynchronous SNA Adapter	1,295
RS-232 V.35 Conversion Cable	395



# Avatar MacMainFrame Series

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**Product Summary**

**Editor's Note**

Avatar is a leading Macintosh communications vendor. Since our last report, the company's MacMainFrame Series has become the cornerstone of its business. This report examines the Avatar MacMainFrame Series' features, functionality, competitive position in the marketplace, and pricing.

**Description**

MacMainFrame products provide Macintosh-to-IBM 3270 connectivity, including mainframe graphics emulation, in remote or local, single workstation or gateway versions for coax, SDLC, and token-ring network connections.

**Strengths**

The MacMainFrame Series offers the widest selection of IBM mainframe connectivity solutions for the entire Apple Macintosh family of computers. Users commend its functionality—easy installation, printer support, and user interface—and its software documentation.

—By Donna Horsley  
Staff Writer

**Limitations**

Since Avatar MacMainFrame runs on a Macintosh, its routing is limited by the Mac's incapability to command multiple networks simultaneously. Users, however, can alleviate the problem using third-party software routers, such as Apple Computer's AppleTalk Internet Router Software.

**Competition**

Digital Communications Associates (DCA), Tri-Data Systems, and Apple Computer.

**Vendor**

Avatar Corp.  
65 South Street  
Hopkinton, MA 01748  
(508) 435-3000 and (800) 282-3270  
for sales inquiries.  
In Canada:  
McKenzie Brown Canada  
2176 Torquay Mews  
Mississauga, ON L5N 2M6  
(416) 821-9222

**Price**

The MacMainFrame products range from \$195 for MacMainFrame Graphics to \$6,495 for the high-end MacMainFrame Gateway with 64 sessions (board and software).

**GSA Schedule**

Yes.

# Analysis

## Product Strategy

Four years ago when Avatar Corp. decided to invest in Macintosh connectivity as an emerging growth technology, it was a move that would prove prosperous. Today, thanks to its MacMainFrame product line, the 10-year-old company is a leading Macintosh communications vendor.

With the MacMainFrame Series, Avatar boasts the widest selection of IBM mainframe connectivity solutions for the entire Apple Macintosh family of computers, including new Macintosh Models LC, Classic, and IIsi. The MacMainFrame Series has enjoyed an annual revenue growth rate of 258 percent since its inception and has passed Avatar's printer emulation products in revenue.

Avatar's MacMainFrame DX debuted in 1984 as the pioneer IBM 3270 terminal emulation product for Apple Computer's Macintosh. Since then, the MacMainFrame Series has expanded to workstation and gateway products for all Macintosh computers in coax, token-ring, and SDLC environments.

## MacMainFrame Series

The MacMainFrame Series offers various routes to the IBM mainframe—direct coaxial connections, LocalTalk-to-coax gateway connections, token-ring gateways, and SDLC connections.

Direct coaxial connections are possible with *MacMainFrame DX*. The MacMainFrame DX attaches to the serial port of any Macintosh allowing information to travel from it to the IBM control unit via coaxial cable; it offers one CUT host session.

In January, Avatar announced at Macworld Expo that it had bundled the CUT and DFT software applications of MacMainFrame Coax into one product: *MacMainFrame Coax Workstation*. Providing Macintosh-to-IBM mainframe exchange, MacMainFrame Coax Workstation includes a coax

adapter card and 3270 terminal emulation software for the Macintosh, and provides access to multiple host sessions.

*MacMainFrame Coax Gateway* uses a Macintosh server—outfitted with MacMainFrame Gateway Server software and MacMainFrame Coax Gateway card—to connect via LocalTalk, EtherTalk, or TokenTalk to Macintosh client stations. Five sessions can be shared among these clients, with specific users able to access pooled sessions as needed on a contention basis.

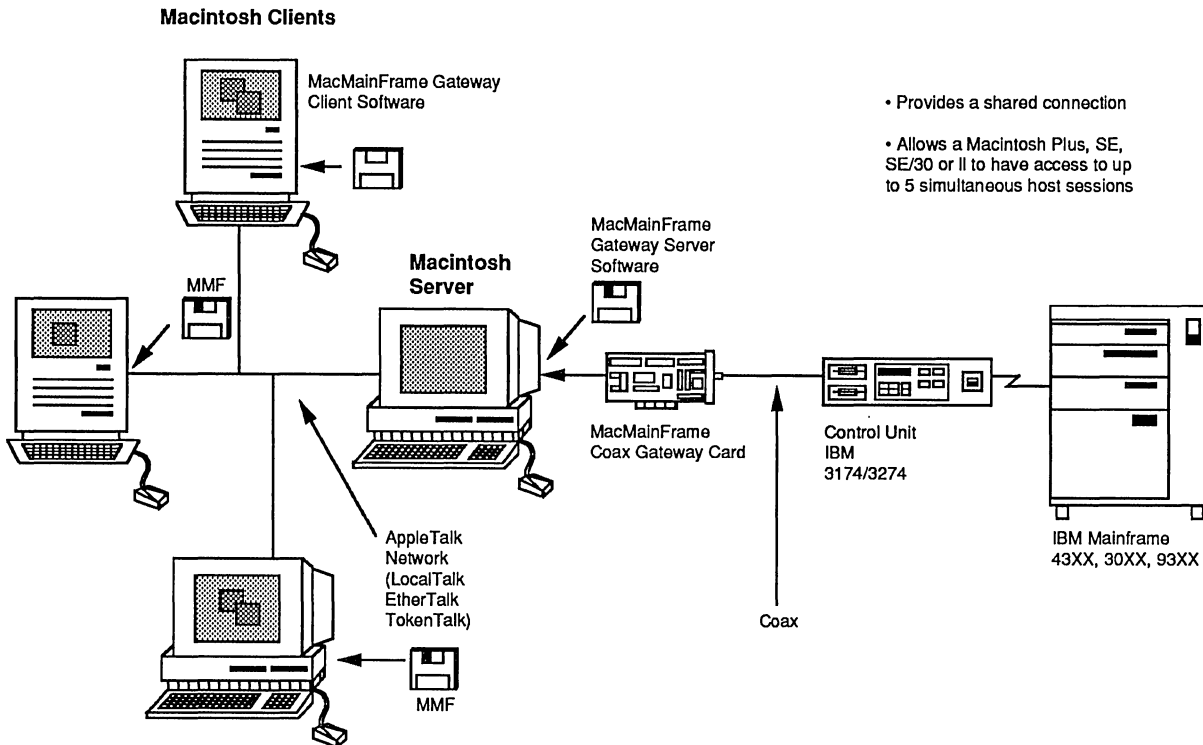
*MacMainFrame Token Ring* is offered in Workstation and Gateway versions. *MacMainFrame Token Ring Workstation* lets an individual Macintosh link to a token-ring network to reach a mainframe connected through a 3174 control unit. As many as eight host sessions can run simultaneously on this product. *MacMainFrame Token Ring Gateway* connects any AppleTalk network to a token-ring network and supports up to 8 sessions per user and as many as 64 sessions on the server. The product is available in 8-, 32-, and 64-session versions.

Avatar offers *MacMainFrame SDLC* in Workstation and Gateway versions that allow a single Macintosh, or an AppleTalk-attached gateway Mac, to link to a remote mainframe using IBM SDLC protocol. *MacMainFrame SDLC Workstation* supports eight sessions per user. *MacMainFrame SDLC Gateway*, like MacMainFrame Token Ring Gateway, supports 8 sessions per user and is available in 8-, 32-, and 64-session versions. MacMainFrame SDLC Gateway Server card attaches to a synchronous modem through a DB-25 connector.

*MacMainFrame Graphics* software allows Macintosh users to locally access mainframe graphics packages by emulating IBM 3179G and 3192G color graphic terminals using the all-points-addressable (APA) method. The graphics software package allows multiple host sessions including simultaneous graphics, terminal, and print sessions.

Last year Avatar entered joint corporate ventures with MITEM and Connectivite in product support for the MacMainFrame Series. MITEM-View is a Macintosh software development tool that enables developers to create intelligent HyperCard front ends to IBM mainframe applications. Created by MITEM, MITEMView supports the entire series of MacMainFrame Workstation and

*Figure 1.*  
**MacMainFrame Coax Gateway**



*Direct coaxial connections represent one feature of the Avatar MacMainFrame Series. Macintosh Coax Gateway uses a Macintosh server—outfitted with MacMainFrame Gateway Server software and Macintosh Coax Gateway card—to connect via LocalTalk, EtherTalk, or TokenTalk to Macintosh client station.*

Source: Avatar Corp.

Gateway products for coax, token-ring, and SDLC network environments. Masquerade 3270, an end-user development tool for front-end host applications, created by Connectivite, also supports the Avatar line.

In another step toward true Macintosh integration into IBM environments, Avatar formed comarketing agreements with Apple Computer and h-three Systems in 1990. Apple's CL/1—a SQL-based connectivity language that enables Macintosh software developers to build IBM applications without writing IBM host software—is available as part of the MacMainFrame Programmer's Toolkit. h-three Systems has a comarketing agreement to provide Macintosh PCs with IBM 3270 connectivity over token-ring networks through the use of Avatar's MacMainFrame Series IBM 3270 emulation software and h-three System's MacRing token-ring card.

### **Other Avatar Products**

Avatar's Printer Emulation Series is the market leader in printer-to-mainframe connectivity solutions. The product line allows PC printers to act as host printers and includes special internal cards for Epson printers, Hewlett-Packard LaserJet Series II/III printers, and the IBM Proprinter Series of printers. The Series includes the PA1500G, an external box allowing any PC printer to act as a system printer, and provides true IBM 3287 printer emulation.

Avatar's PA100G and PA1000G products also offer PC-to-mainframe connectivity. The PA100G is an internal card providing IBM 3278/3279 terminal emulation and is compatible with an IBM PC/XT/AT or compatible PC. The PA 1000G is an external unit that allows any ASCII terminal or PC to emulate an IBM 3278 terminal.

In September 1990, Avatar premiered InSession 3270 for NeXT and the NeXT Programmer's

Toolkit, extending Avatar's development of connectivity products beyond the Macintosh. InSession 3270, a 3270 terminal emulation hardware and software product allowing NeXT computers to communicate with IBM mainframes, provides all NeXT computer users with the ability to easily access IBM host data while preserving the NeXT computer's functionality. Avatar's NeXT Programmer's Toolkit is a set of application programming interface tools helping developers create front-end applications that combine the power of the IBM mainframe environment with the user interface of the NeXT computer.

---

### Competitive Position

Avatar dominates the market for Macintosh-to-mainframe connectivity products. The company aggressively matches Apple Computer's growing Macintosh product line with its own family of Macintosh connectivity solutions. Avatar also provides connectivity solutions made from joint ventures with corporations such as Apple Computer, MITEM, and Connectivite.

In October, Tom Bogan, president of Avatar, commented on Avatar's product development in response to the new Apple Macintosh LC, Macintosh Classic, and Macintosh IIsi PCs.

"Avatar has always provided IBM 3270 connectivity for each new Macintosh upon its introduction and these Macintosh computers are no exception," Bogan said. "These new Macintosh CPUs give users the opportunity to combine the ease of use of the Macintosh and the power of the IBM mainframe in a variety of high-performance, low-price configurations."

Avatar's sizable niche in Macintosh connectivity products is unmatched by the competition, which includes Digital Communications Associates (DCA), Tri-Data Systems, and Apple Computer. In one-on-one product comparison, however, those Mac-to-Mainframe products made by DCA and Tri-Data can compete effectively with those in the MacMainFrame Series.

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### Decision Points

#### Ease of Use

MacMainFrame Series' success lies in its functionality—easy installation, printer support,

and user interface. Each MacMainFrame product includes MacMainFrame user software that provides a standard interface across all MacMainFrame hardware platforms, whether running on coax, token-ring, or SDLC, or as a workstation or a gateway connection. MacMainFrame software appears the same to the user regardless of the type of network and requires no extra training or relearning of the product when hardware connectivity platforms change.

#### Comprehensive Product Line

Avatar has emerged as a top player in Mac-to-mainframe connectivity solutions, capping an extensive product line during 1990. The MacMainFrame features IBM 3278/3279 terminal emulation and file transfer capabilities, copy and paste, keyboard remapping, pull-down and tear-off menus, jump key facilities, customized color palettes, EasyKeys, and MultiFinder support. With multi-host sessions available, users can utilize financial, word processing, and electronic mail host applications at the same time and conduct file transfers in the background using any of those 3270 sessions.

Currently, Avatar is the only vendor to offer a coaxial gateway in the Macintosh connectivity arena. DCA's MacIRMALAN gateway supports only token-ring and SDLC connection to the mainframe. In addition, Avatar supports all three types of LANs for the Macintosh; thus, upgrades are not restricted by the gateway.

Avatar and principal rival DCA have excellent software; however, DCA's documentation is slightly better. Tri-Data recently introduced more advanced 3270 software designed to mirror its Windows-based 3270 software; it should be on par with the Avatar and DCA programs.

In terms of mainframe graphic emulation, Avatar's MacMainFrame Graphics module supports APA graphics directly for local graphics processing, while DCA's MacIRMA emulator card supports APA graphics via IBM PC Link, which requires some graphics processing on the host. Unlike MacIRMA, MacMainFrame Graphics gives users up to five simultaneous graphics sessions and its direct APA support reduces the load on host resources.

Apple Computer vies for the limelight in Macintosh connectivity solutions with SNA connectivity support. When linked to a Mac II running

to an AppleTalk network, Apple's MacAPPC delivers APPC support to the rest of the Macs on the network. The MacAPPC board is a coprocessor card; thus, the Mac II host can continue to be used as a regular workstation. MacAPPC memory requirements are low because most of the APPC code actually resides in RAM on the MacAPPC board.

### **Cost-Effectiveness**

MacMainFrame Coax Gateway allows users to distribute five sessions among five users without requiring each to have a coax interface board, which is a cost-effective approach for a small workgroup of occasional SNA users that already shares a file server.

Avatar-competitor DCA's use of a PC to provide Mac-to-IBM connectivity proves less expensive than the Macintosh-installed MacMainFrame. A PC clone as a gateway is usually cheaper than using a Mac SE or II for the same task; and token-ring add-in boards for the PC are less expensive than their Mac counterparts.

Apple Computer's MacAPPC reduces the cost of connecting Macs to mainframes. Only the Mac II actually loaded with MacAPPC requires the hardware for connecting to the SNA network with IBM mainframe-to-3270 terminal communications.

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### **Company Profile**

Targeting MIS environments in *Fortune* 1000 companies, Avatar's MacMainFrame Series is the cornerstone of its business, followed by its IBM 3287 printer emulation products.

Established in 1981, Avatar is a privately held company with some 65 employees. Avatar was initially funded by an R&D partnership and venture capital. Avatar debuted its terminal converter one year later and soon after changed its primary business to protocol conversion with its pioneering micro-to-mainframe and printer emulation products that appeared in 1984.

Following Avatar's acquisition by Oranje Nassau in 1985 and subsequent disappointing profits, the company refocused on its core 3270 business to strengthen its position in printer emulation with its proprietary gate array chip and to establish distribution channels and OEM relationships.

Through 1987, Avatar recognized and invested in the demand for Macintosh connectivity in corporate America and in 1988 strengthened its capital base with Hambro Ventures funding the management-led buyout of Avatar from Oranje Nassau. Since then Avatar has continued to enhance its Macintosh connectivity product line, and in March 1990 Avatar increased product support for the Macintosh-to-mainframe market with joint corporate ventures and comarketing moves with corporations such as MITEM and Apple Computer.



## Characteristics

**Models:** The MacMainFrame Series includes MacMainFrame DX, MacMainFrame Coax Workstation, MacMainFrame Coax Gateway, MacMainFrame Token Ring Workstation, MacMainFrame Token Ring Gateway, MacMainFrame SDLC Workstation, MacMainFrame SDLC Gateway, and MacMainFrame Graphics.

**Date Announced:** MacMainFrame DX—1985 (as PA 1000T); MacMainFrame Coax Workstation—1987-1988 (as MacMainFrame II/CUT and MacMainFrame II/DFT); MacMainFrame Coax Gateway, MacMainFrame Token Ring Workstation, MacMainFrame Token Ring Gateway, MacMainFrame SDLC Workstation, MacMainFrame SDLC Gateway, and MacMainFrame Graphics—January 1990.

**Date Installed:** MacMainFrame DX—1985 (as PA 1000T); MacMainFrame Coax Workstation—1987-1988 (as MacMainFrame II/CUT and MacMainFrame II/DFT); MacMainFrame Coax Gateway, MacMainFrame Token Ring Workstation, MacMainFrame Token Ring Gateway, MacMainFrame SDLC Workstation, MacMainFrame SDLC Gateway—August 1990; MacMainFrame Graphics—July 1990.

**Number Installed:** Information not available.

**Distribution:** Avatar's products are distributed through an authorized reseller network including computer and communications dealers and resellers, national wholesalers, and computer retail outlets. Avatar distributors

**Table 1. Avatar MacMainFrame Series**

Model	MacMainFrame DX	MacMainFrame Coax Workstation	MacMainFrame Coax Gateway	MacMainFrame Token Ring Workstation
Terminal Emulation	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b
Controller Emulation	IBM 3174/3274/3276	IBM 3174/3274/3276	IBM 3174/3274/3276	IBM 3174/3274/3276
Macintosh Support	Entire Macintosh product line	Macintosh SE, SE/30, II family	Macintosh SE, SE/30, II family, LC	Macintosh SE, SE/30, II family
Host Sessions	One	One	Five	Eight
Pricing	\$1,195	\$995	\$2,495	\$1,295

include Ingram MicroD and Merisel/MacAmerica, which distribute both the MacMainFrame and Printer Emulation Series.

### Models

MacMainFrame products connect Macintosh computers to IBM mainframes over a wide range of networks including token-ring, SDLC, coaxial, and AppleTalk. Standard MacMainFrame services include multisession support, host file transfer capabilities, 3287 printer emulation, numerous programming tools, and optional mainframe graphics support.

**File Transfer:** MacMainFrame Series' file transfer capabilities allow true sharing of text, document, and binary data between Macintosh users and the IBM host.

**MacMainFrame 3287:** MacMainFrame 3287 applications provide IBM 3287 printer emulation, giving Macintosh users the ability to use a Macintosh printer for host print jobs. One or more host sessions can be configured as a mainframe print session with MacMainFrame 3287. MacMainFrame 3287 printer sessions can run on the workstation, the server Macintosh, or a client Macintosh to route host print jobs from the mainframe to a Macintosh printer. MacMainFrame 3287 supports both LU Type 1 and LU Type 3 print streams, allowing greater compatibility with mainframe print formats.

**Programmer's Toolkit:** MacMainFrame also provides a full range of application program interface (API) tools, offering developers driver-level access to MacMainFrame products for the development of customized Macintosh-to-IBM mainframe interfaces. Programmer's Toolkit includes the MacMainFrame API, HyperCard API, and a Transfer Layer Protocol Module (TLPM) for Apple's MacWorkstation. MacMainFrame also supports the Apple 3270 SPI.

### MacMainFrame Products

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

**MacMainFrame DX:** A hardware solution providing local or remote access to any Macintosh computer. Connecting directly to the Macintosh serial port for local application or connecting to an asynchronous model for remote applications, MacMainFrame DX allows users to emulate the IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminals.

MacMainFrame DX' terminal port is RJ45 compatible and provides 300 to 19.2K bps transmission rates. Status indicators are Control Unit, Transmit Data, Receive Data, Passthru Mode, and Power On. MacMainFrame DX' coax port is IBM Type A and connects to an IBM 3174/3274/3276 control unit or 4300 Series DPA via coaxial cable, supporting a signaling rate of 2.35M bps.

**MacMainFrame Coax Workstation:** A hardware and software solution providing IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminal emulation, IBM 3287, LU Type 1 and LU Type 3 printer emulation, and file transfer capabilities for Macintosh SE, SE/30, II family, and LC computers. It provides direct coax connection of a Macintosh to an IBM 3174/3274/3276 control unit or 4300 Series DPA via coaxial cable.

**MacMainFrame Coax Gateway:** A hardware and software solution providing IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminal emulation, IBM 3287, LU Type 1 and LU Type 3 printer emulation, and host file transfer capabilities to Macintosh users connected to any Macintosh server via AppleTalk network. Installed on the Macintosh server are the MacMainFrame Coax Gateway card and MacMainFrame Gateway Server software, which are connected via coax to an IBM 3174/3274/3276 control unit or 4300 Series DPA via coaxial cable and operate on the Macintosh SE, SE/30, II family, and LC computers.

MacMainFrame Gateway Client and Server software requires Version 6.0.3 or higher of the Macintosh operating system and AppleTalk 1.0. MacMainFrame Coax Gateway utilizes the AppleTalk Datastream Protocol (ADSP) and an IBM Type A coax port that connects to an IBM 3174/3274/3276 control unit or 4300 Series DPA via coaxial cable, supporting a signaling rate of 235M bps.

**Table 1. Avatar MacMainFrame Series (Continued)**

Model	MacMainFrame Token Ring Gateway	MacMainFrame SDLC Workstation	MacMainFrame SDLC Gateway	MacMainFrame Graphics
Terminal Emulation	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b	IBM 3278-2/3/4/5, IBM 3279-2a/2b/3a/3b	IBM 3179 G, 3192G, 3278, 3279
Controller Emulation	IBM 3174/3274/3276	IBM 3174/3274/3276	IBM 3174/3274/3276	—
Macintosh Support	Macintosh SE, SE/30, II family	Macintosh SE, SE/30, II family	Macintosh Plus, Portable, SE, SE/30, II family, Classic, LC	Available for use with any MacMainFrame Series product on Macintosh SE/30, II family users
Host Sessions	8; up to 64 sessions per server	8	8; up to 64 sessions per server	Allows local manipulation and editing of host graphics data
Pricing	\$2,495 to \$6,495	\$1,295	\$2,495 to \$6,495	\$195

**MacMainFrame Token Ring Workstation:** A hardware and software solution providing IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminal emulation, IBM 3287 LU Type 1 and LU Type 3 printer emulation, and host file transfer capabilities to Macintosh users connected to token-ring networks. Providing direct connection of a Mac to a control unit or host, the MacMainFrame Token Ring operates with the internal MacMainFrame Token Ring Workstation card, which transmits and receives data at 4M bps and complies with the MAC and LLC standards for token-ring networks. MacMainFrame Token Ring Workstation provides IBM 3270/SNA PU Type 2 emulation protocol and supports eight sessions.

MacMainFrame Token Ring Workstation is available for the Mac SE, SE/30, and II family computers. It requires Macintosh Operating System Version 6.0.3 or higher and IBM 3270/SNA PU Type 2 emulation protocol.

**MacMainFrame Token Ring Gateway:** A hardware and software solution providing IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminal emulation, IBM 3287 LU Type 1 and LU type 3 printer emulation, and host file transfer capabilities to Macintosh users connected via AppleTalk networks to token-ring networks.

MacMainFrame Token Ring Gateway is comprised of server and client components. MacMainFrame Token Ring Gateway Client software is installed on each client Macintosh and requires Version 6.0.3 or higher of the Macintosh Operating System and AppleTalk Version 1.0. MacMainFrame Token Ring utilizes the AppleTalk Datastream Protocol (ADSP). Fitting into the expansion slot of the Macintosh SE, SE/30, and II family computers, the MacMainFrame Token Ring Gateway provides IBM 3270/SNA PU Type 2 emulation protocol, and MAC, LLC control standards.

**MacMainFrame SDLC Workstation:** Combining MacMainFrame SDLC Workstation internal card and MacMainFrame SDLC Workstation software,

MacMainFrame SDLC Workstation provides the Macintosh SE, SE/30, and II family of computers with IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminal emulation, IBM 3287 LU Type 1 and LU Type 3 printer emulation, and file transfer capabilities over an SDLC connection.

MacMainFrame SDLC Workstation eliminates the need for an IBM 3X74 control unit by providing synchronous communications to the host environment. The MacMainFrame SDLC Workstation card is installed in the option slot of Macintosh SE, SE/30, and II family computers. An RS-232 cable is connected from the DB25 connector on the card to a synchronous modem. MacMainFrame SDLC Workstation operates over leased lines or switched lines in point-to-point or multi-drop configurations, and supports data rates of 1200 bps to 56K bps. Its software provides IBM 3270 SNA/SDLC PU Type 2 emulation protocol and provides up to eight concurrent host sessions.

**MacMainFrame SDLC Gateway:** The MacMainFrame SDLC Gateway enables Macintosh users in an AppleTalk network to share Mac-to-mainframe services including IBM 3278-2/3/4/5 and 3279-2A/2B/3A/3B terminal emulation, 3287 printer emulation, and file transfer capabilities. MacMainFrame SDLC Gateway eliminates the need for an IBM 3X74 control unit by providing synchronous communications directly to the host over switched and leased lines.

MacMainFrame SDLC Gateway consists of server and client components. MacMainFrame SDLC Gateway Client software is installed on each client Macintosh (Plus, Portable, SE, SE/30, II family, Classic, and LC). MacMainFrame SDLC Gateway requires Version 6.0.3 or higher of the Macintosh Operating System; AppleTalk Version 1.0 runs the client software.

The MacMainFrame SDLC Gateway Server card and Server software are installed on the Macintosh server. RS-232 cable is connected from the DB25 connector on the card to a synchronous modem. MacMainFrame SDLC Gateway can operate over leased or

switched lines in point-to-point or multidrop configurations and supports data rates of 1200 bps to 56K bps.

MacMainFrame SDLC Gateway resides on an AppleShare server, allowing for the sharing of computing resources. The MacMainFrame SDLC Gateway Server distributes up to 64 IBM 3270 SNA sessions over any AppleTalk network configuration including TokenTalk, EtherTalk, and LocalTalk. Utilizing ADSP protocol, host protocol includes IBM 3270 SNA/SDLC PU Type 2 emulation.

**MacMainFrame Graphics:** MacMainFrame Graphics software allows Macintosh SE/30 and II family users to access and manipulate host graphics locally on their Macintosh. It emulates IBM 3179G and 3192G color graphics terminals and allows users to upload and download color graphics files into Macintosh-compatible files. MacMainFrame Graphics is available for use with any MacMainFrame Series product in standalone workstation and gateway configurations for token-ring, SDLC, coaxial, and AppleTalk networks. With MacMainFrame Graphics, users can access mainframe graphics packages such as SAS/Graph and Tell-a-Graf through IBM's Graphics Data Display Manager (GDDM), a protocol used for graphics display and printer devices. MacMainFrame Graphics is based on DFT/SNA technology that enables users to access multiple host sessions and concurrent graphic, terminal, and printer sessions. It utilizes graphics method all-points-addressable (APA) and supports IBM's CICS, TSO, or VM/CMS host operating environments. For file transfer capabilities, MacMainFrame Graphics is fully compatible with IBM's IND\$FILE and Avatar's Host File Transfer software.

MacMainFrame Graphics uses Macintosh Operating System Version 6.0.4 or higher and 32-bit Quick-Draw system software. MacMainFrame Graphics

hardware provides connectivity for the Macintosh SE/30, and II family computers; its software is Version 3.2 or greater of MacMainFrame multiple-session software.

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## Support

**Phone Support:** Avatar's technical support staff is available Monday through Friday, from 8 a.m. to 7 p.m. EST, at (800) 282-8276.

**Warranty:** All MacMainFrame Series hardware and software carries a one-year warranty for repair or replacement of defective components. The warranty is valid only for the original end-user purchaser.

**Maintenance:** Avatar offers fixed-rate repairs at its factory for equipment no longer under warranty.

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## Product Prices

	<b>Purchase Price (\$)</b>
MacMainFrame DX	1,195
MacMainFrame Coax Workstation	795-995
MacMainFrame Coax Gateway	2,495
MacMainFrame Token Ring Workstation	1,295
MacMainFrame Token Ring Gateway	2,495-6,495
MacMainFrame SDLC Workstation	1,295
MacMainFrame SDLC Gateway	2,495-6,495
MacMainFrame Graphics	195



# Banyan Vines Network Products



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**Product Summary**

**Editor's Note**

While the rest of the industry has caught up with many of Banyan's once unique features, the company continues to offer innovative enhancements to its robust network operating system, Virtual Networking System (Vines), and to upgrade its server hardware to take advantage of the newest processor technology.

**Description**

Network operating system and server hardware to support large, enterprise-wide networks.

**Strengths**

Network operating system based on industry-standard UNIX OS; good wide area connectivity; support for emerging standards.

**Limitations**

No major limitations.

**Competition**

Novell, 3Com, Microsoft, IBM.

**Vendor**

Banyan Systems, Inc.  
 120 Flanders Road  
 Westboro, MA 01581  
 (508) 898-1000

**Price**

Price depends on configuration.

**GSA Schedule**

Yes.

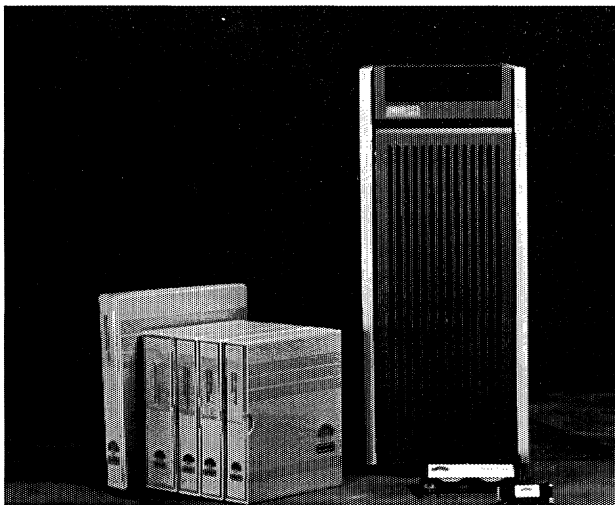
—By *John Krick*  
 Associate Editor

# Analysis

## Product Strategy

In the network operating system sweepstakes, Banyan has been the perennial third place finisher behind Novell and 3Com. In a sense, these three vendors' approaches to network operating system implementation define three different paths to the same goal. Novell designed its own, proprietary NOS and has continued to adapt and refine it. 3Com took two widely used network operating systems developed by a leading software vendor, Microsoft's MS-Net and OS/2 LAN Manager, and added value to them to come up with products uniquely its own, 3+ and 3+Open.

Banyan took a widely used and highly regarded multiuser, multitasking operating system, UNIX, and built a network operating system layer on top of it. Banyan's Vines network operating system and its UNIX-based design can be seen, today, as somewhat ahead of its time. Several manufacturers, including AT&T and Hewlett-Packard, have recently brought to market UNIX-based implementations of Microsoft's OS/2 LAN Manager, and



*The Banyan CNS486 Corporate Network Server is the company's latest hardware offering. Based on a 25MHz Intel 80486, it includes 8M bytes of memory.*

there is growing interest in converting existing minicomputers and even mainframes to new functionality as network servers.

Another aspect of Banyan's Vines that is considered to have been ahead of its time is its global naming and directory service, StreetTalk. Network vendors have lately realized that addressing resources and data on a sprawling internetwork quickly becomes an unwieldy task when DOS-like subdirectory names must be specified. StreetTalk simplifies the task of finding paths through networks by assigning three part names to every network node.

Banyan's network servers were capable of handling the demands of wide area networking before most of the rest of the industry turned its attention to this area. The UNIX-based nature of the Vines operating system lent itself to wide area connectivity in a manner not possible at the time in DOS-based systems, both because of the broad base of connectivity solutions developed in the UNIX world and because of the multitasking nature of the operating system itself.

Banyan, like competitors Novell and 3Com, has recently taken steps to trim its product line down to a slimmer, more competitive profile. Vendors that have been offering several models of servers have found themselves faced with a two-pronged attack from low-cost 386 clones on one side and from network-optimized superservers on the other. Consequently, Banyan has dropped its low-end DeskTop Server (DTS) product line, to concentrate on its 386 and 486 CNS models. Banyan also continues to offer versions of Vines for 286-, 386-, and 486-based PCs and compatibles in its Vines/286, Vines/386, and the new Vines/486 products.

Banyan has taken steps to ensure wider interoperability with at least one other important network operating system—Microsoft's OS/2 LAN Manager. In February, Banyan demonstrated Vines support of OS/2-based machines as clients. In May, the company announced an agreement with Microsoft to exchange specifications and product plans to ensure that OS/2 LAN Manager networks will interoperate with Vines networks. Both systems support the Server Message Block (SMB), NETBIOS, Named Pipes, and mailslots protocols, which means that LAN Manager clients will be able to access Vines servers and vice versa.

## Company Profile Banyan Systems, Inc.

### **Corporate Headquarters**

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Westboro, MA 01581  
(508) 898-1000

### **In Canada**

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Mississauga, ON  
L5K 2N6  
(416) 855-2971

### **Officers**

*President/Chairman/CEO:*  
David C. Mahoney  
*Executive VP/COO:* Roger  
E. Weismann  
*Sr. VP/Gen. Mgr.:* Dr.  
James E. Allchin

### **Company Background**

*Year Founded:* 1983

*No. Employees:* 540

*Installed Base:* Approx-  
imately 563,000 nodes.

Founded in August 1983,  
by David C. Mahoney, Dr.  
Anand Jagannathan, and  
Lawrence Floryan, Ban-  
yan Systems has long  
been considered a leader  
in the design of innovative  
network operating sys-  
tems and server hard-  
ware. Headquartered in  
Westboro, MA, the com-  
pany's executive, market-  
ing, research and  
development, and cus-  
tomer support depart-  
ments are housed in two  
buildings there. Manufac-  
turing takes place in a

third building in nearby  
Marlboro, MA.

### **Business Overview**

Banyan designs, manu-  
factures, and sells local  
area networking hard-  
ware and software aimed  
at the upper end of the  
networking market. Ban-  
yan's Vines network oper-  
ating operating system  
and its CNS line of high-  
performance servers are  
its chief offerings.

Banyan maintains sales  
and support offices  
throughout the U.S. and  
Canada. A wholly owned  
subsidiary, Banyan UK  
Ltd, sells the company's  
products in Great Britain  
and on the continent.

Banyan products are sold  
through direct marketing,  
OEMs, and value-added  
resellers.

### **Financial Profile**

Banyan Systems is a pri-  
vately held corporation,  
so detailed financial infor-  
mation about the com-  
pany is unavailable. The  
company is projecting  
revenues of \$100 million  
for 1990.

### **Management Statement**

In a recent "Corporate  
Update" presentation  
aimed at industry ana-  
lysts, Banyan President  
and CEO David C. Ma-  
honey outlined five dimen-  
sions of Banyan's product  
strategy:

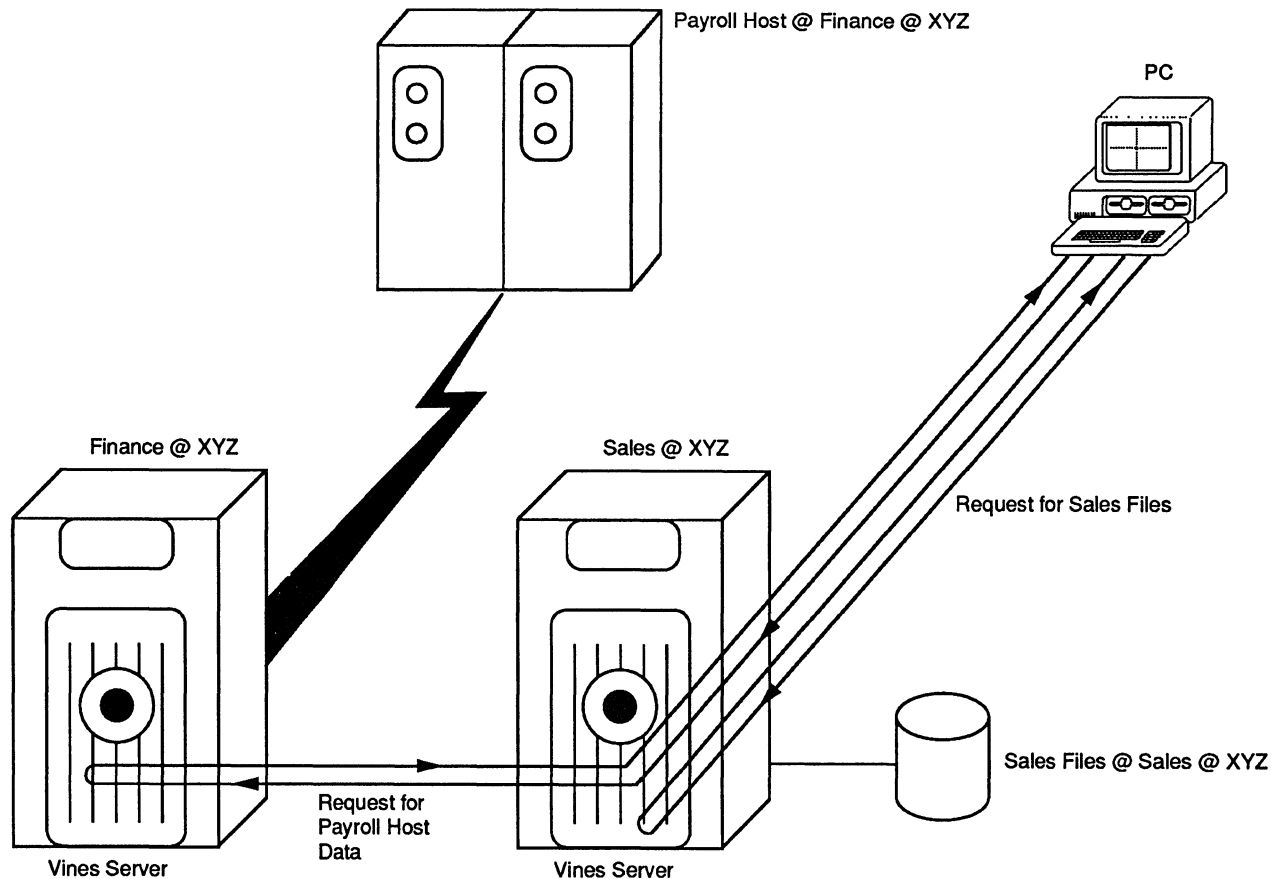
- Interoperability/  
compatibility/  
standards
- Heterogeneous client/  
server computing
- Distributed system ser-  
vices
- Comprehensive data  
support
- Comprehensive messag-  
ing

Development of network applications that will run under both systems will also be easier. At the same time, Banyan endorsed the Microsoft Network Device Interface Specification (NDIS), which is quickly being recognized as a standard adapter to which card drivers must adhere. Banyan was the first vendor not an OS/2 LAN Manager OEM to endorse NDIS. Banyan also announced support for Microsoft Windows 3.0 under Vines 4.0.

What could be the most important new announcement for the company, given its position as a vendor of network server hardware as well as software, is also its most recent. In August, Banyan announced support for symmetric multiprocessor machines, specifically the Compaq SystemPro line. Symmetric multiprocessing computers have several

CPUs that divide incoming tasks among themselves to speed operation. Widely viewed as the next step in the development of server hardware, multiple processor servers have been brought to market by new companies such as NetFrame and Tricord in recent months, as well as by Compaq. Regardless of whether Banyan decides to stay in the increasingly competitive server hardware end of the network business by releasing a multiprocessor CNS server, with this software the company should be excellently positioned to take advantage of the many new server designs that are certain to appear. Vines SMP (Symmetric Multi-Processing) is optimized for use with any Intel 386- or 486-based multiple processor servers. Though the initial release supports the dual-processor Compaq

Figure 1.  
*StreetTalk Naming Convention*



*The StreetTalk Naming System puts names of network resources into a three-part format: Item@Group@Organization. Each group occupies a single server. Organizations are logical groupings that are not permanently tied to physical devices.*

machine, the software will be capable of working in systems with as many as eight symmetrically implemented processors.

### Competitive Position

The once unique aspects of Banyan Vines have largely lost their uniqueness today. There are other multitasking network operating systems; wide area connectivity is a major feature of most vendors' product lines; and global naming and directory services, especially those that comply with the emerging CCITT/ISO X.500 standard, are quickly becoming a focus of attention for all the major vendors.

Given these facts, and Banyan's position behind Novell and 3Com, it may be somewhat surprising to note that Banyan is from all indications

a healthy and growing concern. 1989 revenues were \$80 million, which represents a 70 percent increase over 1988's \$47 million. While the company fell short of its projected \$100 million in 1989, and is again hoping to reach that high watermark in 1990, these are respectable figures.

Banyan's growth in the technical realm continues as well. As noted above, the company has maintained an aggressive policy of keeping up with the newest developments and emerging standards in a rapidly evolving industry. This is still Banyan's major strength, and if the company can continue to come up with innovative enhancements, its products should find a ready market among buyers who respect this sort of technological awareness.

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## Decision Points

Whether to go with Banyan over Novell NetWare/386 or any of the many OEM versions of Microsoft's OS/2 LAN Manager, such as 3Com's 3+Open, is a tough call. That Banyan has been capable of competing in this league and staying on the cutting edge of this rapidly evolving technology, says much about the company, however. It is clear from recent announcements that Banyan has the technical know-how, as well as the financial wherewithal, to continue to develop Vines along the innovative lines that the company has hewn to in the past.

More to the point, perhaps, are the charges that much of the trade press levels at each of the other leaders. Some say that Novell's NetWare/386 is an overextended version of the old NetWare, brought to market with many important features either still promised or missing altogether. Others charge that OS/2 LAN Manager, in versions released so far, is bug ridden and difficult to work with.

Banyan's Vines has been largely left out of this sort of mudslinging, and a quick perusal of back issues of the industry weeklies will reveal little negative comment about the Vines system. It is doubtful that this is because many view Banyan as a player on the periphery of the game, despite the fact that Banyan's market share is slim compared to Novell's 60 to 70 percent. When considering these figures, it should be remembered that Banyan targets a much more sharply defined segment of the market than either of its larger competitors. Banyan is seeking the enterprise-wide network customer, and not the entry-level shop with a few PCs, while both Novell and 3Com market versions of their products aimed at the small network builder.

Nevertheless, it is clear that both NetWare/386 and OS/2 LAN Manager will be major forces in the marketplace for some time to come. Essentially, Vines is the only remaining alternative to these two at the high end.

# Characteristics

**Model:** Vines/386 and Vines/486.

**Date of Announcement:** Vines/486—July 1990; Vines/386—May 1988.

**Date First Installed:** Vines/486—June 1990; Vines/386—June 1988.

**Number Installed:** approximately 563,000 nodes.

**Distribution:** Direct from Banyan, OEMs, and through authorized VARs, domestic and international.

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## Architecture

Vines, a network operating system, integrates PC LANs with local and remote computing and communications resources. In the Banyan virtual networking concept, three major functional integrations are addressed: PC clustering, integrated wide area networking, and distributed network applications. Vines can run on a variety of server hardware platforms, including Banyan's own Vines-optimized network servers, the IBM PS/2, the IBM PC AT and compatibles, and the Compaq Deskpro 386 and compatibles.

Vines and the Banyan servers allow dissimilar network hardware, topologies, access methods, and media to coexist on the same network. Any number and type of Banyan servers can be interconnected to form a virtual network system. Virtual networks can be operated on a local area networking basis (all Banyan servers physically reside within one premise) and on a wide area networking basis (some Banyan servers reside in geographically dispersed premises). In both cases, the network appears to the user as one locally attached resource. Any user connected to a server can access any network service transparently—without knowing where that service physically resides or how the actual connection is made. High-speed LAN and asynchronous/synchronous serial links also can be used to connect multiple Banyan servers.

Access to local host resources, mainframes, and minicomputers is accomplished through direct attachment between a serial port interface board on the Banyan server and the host serial port interface or through token-ring attachment to SNA. Authorized users can

dial into a Vines network and operate as a locally attached device with a full range of network services. A serial port interface board is required for remote access.

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## Hardware

### Servers

Banyan currently offers two models of the Corporate Network Server (CNS). The CNS is a pedestal-style unit based on either the Intel 80486 (CNS486) or 80386 (CNS386) processors. Banyan also offers Vines/486, Vines/386, and Vines/286—versions of its network operating system that convert 486- or 386-based DOS machines or IBM PC ATs and true compatibles into network servers.

**Banyan/CNS486:** A high-performance, high-capacity server designed for use in large network environments, the CNS486 is based on a 32-bit Intel i486 CPU with 25MHz clock speed, 8M bytes of main memory, 32K bytes of cache memory, and no-wait-state operation. Housed in a pedestal-style unit, it contains a triple-bus architecture: a Small Computer Systems Interface (SCSI) bus, a proprietary bus to handle memory management, and an IBM PC-compatible bus.

The high-speed SCSI bus, an industry-standard storage expansion bus, supports concurrent disk I/O and tape streaming. It provides 625K bps sustained throughput for direct memory access (DMA) transfers between memory, disk, and tape. Streaming transfers to tape and one-to-one interleaved exchanges from disk are offered. The bus supports up to seven SCSI controllers with deselect/reselect for high-speed parallel operation.

The memory bus provides no-wait-state operation with high-speed simultaneous access from the CPU, the SCSI storage bus, and the PC bus. The Banyan/CNS' main memory is expandable to 24M bytes.

The PC-compatible bus supports seven expansion slots, up to seven PC card interrupts, and four DMA channels. The server is connected to a network by installing a LAN interface board in one of the expansion slots.

The CNS486 can be configured with up to four 146M-byte, 320M-byte, or 660M-byte (formatted) hard disk drives. A 2.2G-byte, ¼-inch tape backup is also offered. In addition, the CNS486 has a CMOS battery-backed time/date clock.

**Banyan/CNS386:** Similar in most respects to the CNS486, the CNS386 is based on the Intel 80386 processor running at 20MHz and has 4M bytes of RAM.

**CNS386-to-486 Upgrade:** A field upgrade for users of 20MHz and 25MHz CNS386 systems, this package consists of a 486 motherboard and a Burst Mode Memory Add-On board.

### Workstations

Banyan does not manufacture or market network workstations. IBM PC/XT/AT and most compatible DOS-based computers, IBM PS/2 models running DOS or OS/2, and Compaq Deskpro 286/386 and most compatible computers are supported as workstations on a Vines network. Also, Apple Macintoshes are supported through such products as Miramar MacLAN Connect and through Banyan's own Vines MacMail Gateway.

### Network Interface Cards

Banyan does not manufacture its own network interface cards but does support and market several popular network boards.

### Additional Products

Banyan markets system enhancement and expansion products for its dedicated servers. Among these are memory expansion boards, add-on disk drives, and cartridge tape subsystems. Additionally, Banyan sells a number of communications adapter boards, such as the six-line serial ICA and the NM127 X.25 synchronous adapter.

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## Software

### Network Operating System

Designed to run on a variety of hardware platforms (Banyan/CNS, IBM PS/2, IBM PC AT, and 486- and 386-based EISA and ISA bus systems such as the Compaq SystemPro), Vines is a UNIX-based operating system that connects PC workstations, minicomputers, mainframes, and remote networks for resource sharing, information exchange, and communications. Some of the features of the Vines operating system are file sharing, disk sharing, printer sharing, electronic mail messaging, synchronous and asynchronous communications, file backup and recovery, and internetworking.

The latest Vines release, Version 4.0, features new enhancements to its IBM connectivity capabilities, increased performance of the StreetTalk directory service and the file system scheduling algorithms, and support for Microsoft Windows, among other improvements.

Version 4.0 is also the first multilingual network operating system, allowing users of multiple nationalities to log in and perform all network-related tasks in their native language. Vines 4.0 supports English-, German-, and French-speaking users simultaneously on a single network. Designed in accordance with the ISO Standard 8859/1 for international characters, Vines 4.0 delivers screen menus and status messages to the user in the language with which he or she is most comfortable. Banyan says multilingual Vines will be capable of supporting 10 different languages per server, and a network with several servers could support an unlimited number of languages simultaneously.

Because it is based on UNIX, Vines provides a multiuser, multiprocessing architecture with the Vines communications subsystem integrated with the UNIX kernel for fast throughput and response. All Vines services execute as standard UNIX processes. Each process features a built-in tasking system to facilitate multi-PC response to a service.

The following are among the salient features provided by a Vines system:

- Integration of multiple communications technologies and protocols, including LANs, WANs, and remote hosts;
- Independence from network topology, communications media, and communications protocols;
- Access by any user to any resource on the network, regardless of physical location;
- A network-wide naming and addressing system that allows users to locate and access any resource without having to know the network topology, i.e., transparent access to network resources as an extension of the PC;
- Expansion of the physical environment and network services;
- Sharing of files, printers, and communications facilities; and
- Mainframe-level security.

When attached to a Vines network, users are not aware of system operations carried out by the UNIX kernel. They are aided by the use of menus, and tasks are invoked via standard DOS commands. In addition to providing the necessary services for the sharing of files and resources, Vines also provides for the interconnection of multiple LANs and allows users to build enterprise-wide communications systems. Large, distributed networks can be configured by connecting multiple servers on the same network as the PCs, on a separate high-speed backbone, or on a corporate network. Leased or dial-up lines using synchronous (HDLC) or asynchronous protocols, or public or private global data networks using X.25 packet switch technology, are supported.

### **StreetTalk**

Vines network services can be selected via a menu-driven user interface or by using the traditional command line interface. The user interface, a transparent extension of the PC operating environment, provides access to all resources on the network. This is accomplished through Banyan's distributed naming system, called StreetTalk.

Under StreetTalk, names consisting of three parts—item, group, and organization—are assigned to users, lists of users, file volumes, printers, gateways, and any other network objects. This three-part naming convention allows for a distributed application implementation while maintaining global uniqueness. Names

can be specified with meta characters ("wild cards") for pattern matching. Each name also can have nicknames defined for it.

StreetTalk names form the basis for ensuring security in the system, as well as for defining administrative control. Usernames in StreetTalk have associated profiles that establish the user's network resources and drive mappings. User authentication is controlled through a password mechanism at login time, and users can log in from any PC on the network (or dial in) and operate with the same preestablished environment. PC-based utilities are provided for managing, maintaining, and browsing through the naming system. Central to the Vines operating system, the StreetTalk naming and addressing database "knows" and identifies all network objects, be they users, devices, or software services. Globally distributed, StreetTalk maintains names and associated attributes for every user, service, communications link, and peripheral device.

The newest version of StreetTalk includes StreetTalk Directory Assistance (STDA), an easy-to-use lookup service that provides instantaneous searches of, and access to, directory information. Users, lists, printers, and other resources, file volumes, and nicknames can be found by users with no knowledge of the overall organization of the network or StreetTalk groups. STDA searches may be conducted using a name, a description, or a pattern.

### **Network Services**

Vines provides a number of network services, including file and print sharing; administrative capabilities such as system management and backup/restore; network management; and such multiuser functions as Banyan Mail. File Services manage file volumes on the network and conform to PC-/MS-DOS (Versions 2.0 and up) filing system specifications. When configured, the services create logical dynamic partitions on the server disk with unique root directories. Files can be shared by multiple PCs, and file/record locking conventions are also compatible with PC-DOS (Versions 3.10 and later). Single- and multiuser DOS applications will run unchanged on the network. Hierarchical directories, multiple root nodes, transparent mapping into the PC file systems, and full per-user access control are provided. Security, based on access control lists, is effective at each directory level.

Print services include spooled sharing of printers, multiple printer types, and print queue control. Spooling and queuing are automatic. From local PCs, users can view and change printer status, form type, and job sequence. Queue information can be displayed by printer name and username; print commands can be extended to include full forms and header controls; and user access to printers is controlled by system administrators.

Time/date synchronization between servers and all PCs is implemented automatically. The PC time/date is automatically set when users log on to the network. In large systems, Vines supports multiple time zones and daylight saving time.

Integrated with Vines but offered as an option is an E-Mail package called Network Mail. Network Mail provides a menu-driven electronic mail facility for all system users. Features include the ability to view/send mail at any time from any point on the network; protection from unauthorized access; online help facilities; mail facilities to all StreetTalk lists; automatic return of undeliverable mail; store and forward; file-attachment transfer; received mail answer; and forward, delete, save, and print forwarding. An informal mail/messaging system, called Chat, allows users to exchange short messages simultaneously and to hold "conference calls" with up to four network users.

An industry-standard NETBIOS interface is integrated with Vines. This interface is implemented on top of the Vines communications system, allowing NETBIOS communications across different LANs and over a wide area network. Since NETBIOS supports simple names, a NETBIOS service on Vines defines a naming domain and arbitrarily generates the NETBIOS names.

### Communications Software

Support for communicating with remote minicomputer or mainframe hosts, larger networks that include additional Banyan servers, and commercial databases and public data networks is available through a number of asynchronous and synchronous communications options. Vines connects to resources, services, users, or Banyan servers through a number of WAN interconnect services. Servers at multiple, geographically dispersed sites can communicate through HDLC dedicated (leased) lines, dial-up links, X.25 public or private global data networks, or TCP/IP backbone networks.

The X.25 server-to-server connection links directly to an X.25 network through a synchronous modem, eliminating the requirement for a local packet assembler/disassembler (PAD). Up to 64 virtual circuits can be supported.

### TCP/IP

Banyan offers two TCP/IP options to run on its CNS and Vines/386 servers with Release 3.0 or above of the server software: TCP/IP Server-to-Server and TCP/IP Routing. The TCP/IP Routing option allows a Vines server to route IP frames by connecting a single Banyan server or a network of Banyan servers to multiple TCP/IP networks. This option supports connections between TCP/IP networks and Banyan servers over selected Ethernet and token-ring networks and HDLC links. The TCP/IP server-to-server option allows two or more Vines servers to communicate across a TCP/IP network. IP internetting is available across all Release 3.0-supported Ethernet and token-ring interfaces and HDLC links. Although Vines will operate with any PC-based TCP/IP product, Banyan recommends the PC/TCP from FTP Software, Inc. for the PC, as this has been integrated with Vines. PC/TCP provides Vines users simultaneous access to TCP/IP applications (virtual

terminal—TELENET, file transfer protocol—FTP, and simple mail transfer protocol—SMTP) and Vines services from their PCs.

### IBM Mainframe Connections

Connections with IBM front-end processors (37XX) over an SNA network are accomplished through the use of the serial port interface board operating synchronously under Banyan's 3270/SNA or bisynchronously under the 3270/BSC Emulation program. This feature enables PCs and Vines servers to emulate IBM 3270-type devices, including the 3X74/3276 control unit (the server), 3287 printer, 3278 display stations, and 3279 color display stations (PC workstations). The Vines interface enables program-to-program communications between PCs and host computers. Logical Unit (LU) sessions of 32, 64, or 96 are supported by the 3270/SNA emulation software, and 32 or 64 sessions by the 3270/BSC emulation software. File transfer capabilities are available to all PCs attached to a server through products such as Tempus-Link from Micro Tempus (Montreal, PQ, Canada) or Send/Receive from CDI Systems (Champaign, IL).

### Advanced 3270/SNA

Announced in May 1990, Advanced 3270/SNA allows up to five concurrent displays of print sessions to be run on a PC emulating an IBM Model 2, 3, 4, or 5 3270 screen. IBM EEHLAPI 1.21 and LLAPI 2.0 interfaces and applications using a light pen for data entry are supported. Type-ahead capability, support for international and multinational 3270 foreign-language tables, and the ability to map the IBM 101-/102-key keyboards are also featured. The Advanced 3270/SNA option requires as a prerequisite that the 3270/SNA option be installed. The 32-, 64-, and 96-Logical Unit versions are offered. A 96 LU Enterprise Package, which includes both the 3270/SNA and Advanced 3270/SNA software, is also available. An additional option, Advanced 3270/SNA Graphics, offers display, editing, and printing of IBM mainframe graphics. Advanced 3270/SNA Graphics runs on top of the Advanced 3270/SNA option, which is required.

### Asynchronous Communications

Asynchronous connections with minicomputers and IBM front-end processors can be accomplished under Banyan's Asynchronous Terminal Emulation program using the same ICA board. User workstations can emulate Digital VT100/VT52, IBM 3101, and TTY terminals. The Vines programmatic interface enables program-to-program communications between PCs and host computers. The Kermit file transfer program is integrated into this program. Banyan's Asynchronous Terminal Emulation also supports transparent access to remote hosts using shared modems on the server.



### **Utility Software**

PC-based utilities are defined for all aspects of system administration on a network-wide and server-wide basis. These utilities can be invoked from any workstation or PC on the network. System administrators can add and/or remove users, set up user profiles, administer the StreetTalk naming system, configure resources, and back up and restore files automatically on a prescheduled basis. Vines allows system administrators to establish security restrictions so that only authorized users can perform system maintenance tasks.

### **Network Security**

Vines had reasonably good network security features in the past, but with Release 3.0 security was enhanced and strengthened significantly. The major security feature introduced in Vines 3.0 was VANGuard, which adds four system-wide enhancements: password encryption, unauthorized login protection and tracking, no session replay, and restricted network merger. Restricted network merger bridges two networks for occasional file and mail exchange in a manner that does not pass entire network database information from one to the other, but only names of the connecting servers. This feature can be implemented for both security and performance reasons.

Another significant security enhancement introduced with Vines 3.0 is tighter password management. A network administrator can now specify the length of passwords, force password change on first login, and set the time period a password remains valid. Other enhancements allow specifying the time of day/week a user can log in to the network and restricting physical login locations.

Security on a Vines network can be controlled at different levels. The first level of network access control and overall system security is maintained through a user ID and password scheme. The next level is based on Vines access rights lists (ARLs). ARL is a mechanism by which the network administrator assigns specific network resources and access rights to a user. After StreetTalk authenticates a user's ID and password and grants access to the network, the ARLs take over and grant or deny access to specific services/resources.

Three levels of security may be assigned to a user: Vines default security, group security, or individual security. The levels can be combined in setting up individual user security. If a network administrator does not assign group or user security, Vines assigns default settings. When security settings are assigned to a group, the settings become the defaults for all users in that group. When a network administrator assigns specific settings to a user, all conflicting Vines default or group security settings are overridden by the ones the administrator enters. Vines copies the group settings that have not been specifically overridden and assigns them to the user as if the administrator had entered them.

The MANAGE command is used to invoke the System Management menu from which the network administrator can manage services, users, groups, and

organizations. User access profiles and security settings, including the management of passwords, are accomplished from various submenus.

### **Network Management**

Vines' network management service provides a realtime snapshot of server performance. In addition, it offers hardware (PCs, LANs) and software (services) configuration and performance data. Displays provide server interface statistics, data transmission rates, CPU utilization, LAN-specific statistics, interface detail reporting, service statistics, information about all servers attached to the network, and fault isolation. Diagnostics for all system hardware, network media, and serial communications are included. Network management, monitoring of statistics, and diagnostics can be performed from any local or remote PC on the network.

Vines network management is fully integrated with StreetTalk and all other Vines services. Users, servers, disks, printers, and communications links are identified by simple StreetTalk names and managed through Vines menus, regardless of where they are located on the network. Such location-independent resource identification capability lends itself to either centralized or distributed network management (or a convenient mix of the two). For example, administrators at remote sites may be authorized to manage their local resources (users, files, and peripherals) but restricted from obtaining management data associated with other groups and communications links which tie their servers to sensitive central network resources.

### **Applications Software**

Vines is compatible with most applications developed for DOS 3.X and the IBM NETBIOS standard. Banyan regularly publishes an Applications Directory which lists all applications that have been tested by the vendor and found to be compatible with its network. The fourth edition is a 233-page volume listing applications in 13 functional categories.

Integrated with the Vines network software are several optional communications application programs. These include E-Mail services, such as Vines Network Mail; terminal emulation and file transfer services, such as IBM 3270/SNA and 3270/BSC terminal emulation with CDI Systems' Send/Receive file transfer capability or asynchronous terminal emulation (VT100/VT52, IBM 3101, or TTY) with Kermit file transfer protocol; and TCP/IP software options with such integrated applications as TELENET, FTP, and SMTP.

### **MacVines Mail Gateway**

MacVines Mail Gateway, an electronic mail gateway for the Macintosh environment, allows Apple Macintosh users and DOS-based PC users to exchange electronic mail and file attachments over a Vines network. Built on the UNIX-based Mail\*Link software offering from Star-Line Technologies, Inc. (Berkeley, CA), the MacVines mail gateway software specifically links Vines Network Mail with Macintosh QuickMail, a popular Macintosh

electronic mail product developed and marketed by CE Software (Des Moines, IA).

The MacVines program has two components: the listener and the bridge. The listener runs as a Vines service on Vines/486, Vines/386, or CNS servers, while the bridge runs on a nondedicated Macintosh along with the QuickMail Administrator program. The listener and bridge communicate using the AppleTalk networking protocol, which is supported by Banyan servers. Although all Macintosh systems participating in the mail exchange service need not be physically connected to a Vines network, at least one Macintosh running the MacVines bridge component must be physically connected to a Vines server. Macintoshes can be connected directly to a Vines server via Ethernet or using an Ethernet-to-LocalTalk bridge such as, for example, FastPath from Shiva.

#### **Oracle Server for Vines**

This SQL-based distributed data management product was developed by Oracle Corp. based on Oracle Version 6. It is specifically designed for the 32-bit Intel 80386 architecture. The product runs on all Vines-compatible 386 machines (including the Compaq Deskpro 386 and the Banyan/CNS) and supports client applications (Professional Oracle, Oracle for 1-2-3, Oracle Quicksilver, and Oracle dBXL, for example) running under DOS, Macintosh, and UNIX environments. Jointly marketed by Oracle and Banyan, the \$4,999 Oracle Server for Vines is targeted at large-account customers' MIS/DP departments.

#### **Vines Applications Toolkit**

For large installations with an in-house programming staff, Banyan offers a Vines Applications Toolkit to enable programmers to develop network applications. The toolkit includes an advanced UNIX System V development environment (including C Compiler, Assembler, Linker, Debugger, choice of Bourne or C Shells, and UNIX Utilities); applications programming interface (API) suites for Vines services, resources, and communications protocols (APIs can make use of StreetTalk, VanGuard, Banyan Network Mail, and Vines Socket Interface and provide interfaces to such industry-standard protocols as X.25 and TCP/IP); and developer's productivity tools (such as Vines Network Compiler and Vines Tasker). The latest version of the Applications Toolkit for Vines 4.0 features new APIs to support the new international naming and StreetTalk Directory Assistance (STDA) features of Vines. All tools, including the compiler, assembler, and linker, have been enhanced to support the Intel i486 environment.

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## **Support**

Banyan offers three levels of support on an annual basis. The Software Subscription Service provides software updates and supporting documentation, technical bulletins, and notice of product enhancements. The second level provides telephone support in addition to the services provided in the software subscription service. The third level is Banyan's comprehensive plan that provides all assistance included in the aforementioned plans with the addition of on-site support and remote diagnostics. Banyan has 50 customer support and field service technicians at its home office involved in various levels of system support and customer telephone support services.

Banyan's 16 national sales offices have local support and service capabilities. Third-party maintenance service is provided by Intel. Additionally, the company's 147 VARs, authorized distributors, and OEMs also offer their own customer support services.

**Installation:** Banyan installations are handled through its authorized VARs and directly from Banyan Systems.

**Training:** Banyan provides in-house and on-site training for its VAR and OEM distributors, as well as large-account customers.

**Warranty:** Banyan provides a 90-day warranty on its servers and Vines software.

**Maintenance:** Maintenance contracts are available for hardware repair directly from Banyan on an annual basis. Depending on location, maintenance service may also be arranged through GE Service.

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## **Pricing**

Banyan Vines network software products and network servers are sold on a purchase-only basis direct from the vendor and through its various other distribution channels.

## Equipment Prices

		<b>Purchase Price (\$)</b>
<b>Banyan/CNS Systems and Options</b>		
CNS44D	CNS486 Corporate Network Server based on 25MHz i486 with 8M bytes of memory and 146M-byte hard disk	31,395
CNS54D	CNS486 with 8M bytes of memory and 320M-byte hard disk	31,895
CNS64D	CNS486 with 8M bytes of memory and 660M-byte hard disk	33,995
CNS22C	CNS386 Corporate Network Server based on 25MHz 80386 with 4M bytes of memory and 80M-byte hard disk	21,995
CNS44C	CNS386 with 8M bytes of memory and 146M-byte hard disk	25,195
CNS54C	CNS386 with 8M bytes of memory and 320M-byte hard disk	25,695
CNS64C	CNS386 with 8M bytes of memory and 660M-byte hard disk	27,795
BSU24D	CNS486 upgrade for CNS server includes i486 motherboard and 8M-byte burst mode memory	11,995
EMB104	4M-byte Memory Expansion Board	2,495
EMB108	8M-byte Memory Expansion Board	4,795
EMB204	4M-byte burst mode memory board	2,795
EMB208	8M-byte burst mode memory board	4,995
ESD140	CNS 146M-byte SCSI Disk Drive Unit	2,195
ESD150	CNS 320M-byte SCSI Disk Drive Unit	2,695
ESD160	CNS 660M-byte SCSI Disk Drive Unit	4,795
EXT322	2.2G-byte tape drive for CNS	7,495
BSU115	150M-byte tape drive for BNS/BNS386 servers	1,795
ICA108	Intelligent Communications Adapter (six serial ports)	1,495
ICA210	Intelligent Communications Adapter for IBM PS/2 Micro Channel Architecture machines	1,995
<b>Vines Server Software and Options</b>		
VNS486R4	Vines for Intel i486-based DOS machines	7,490
VNS386	Vines/386 Software, Version 4.0 for i386-based DOS machines	5,995
VNS/386D3	Vines for i386 PS/2 Micro Channel machines (supplied on 3½-inch diskettes)	5,995
VTM386	Vines i386 Team (entry-level Vines system for up to 10 users)	2,495
VNS286	Vines/286 Software Version 4.0 for IBM PC AT and compatibles	995
UTM386	Vines i386 Team to Vines i386 upgrade	3,495
VNS224R4	Vines i386 to Vines i486 upgrade	1,495
VNS223	Vines/286-to-Vines/386 Upgrade (upgrades any Vines/286 version to Vines i386 Version 4.0)	5,000

## Vines Application and Communications Software Options

PA100	Network Mail	995
NA100	PC Dial-In (remote PC dial-in into a Vines network; requires a Banyan ICA or an NM110 serial communications adapter)	1,495
NM130	Vines Network Management	995
PCP100	PC Network Printing	495
HA101	Asynchronous Terminal Emulation with Kermit File Transfer	1,695

## IBM 3270/SNA Emulation with File Transfer

SNA200	Advanced 3270/SNA, 32-Logical Unit (LU) version	4,500
SNA201	Advanced 3270/SNA, 64-LU version	6,000
SNA202	Advanced 3270/SNA, 96-LU version	7,000
SNA300	Advanced 3270/SNA Graphics, 32-LU version	2,000
SNA301	Advanced 3270/SNA Graphics, 64-LU version	3,000
SNA302	Advanced 3270/SNA Graphics, 96-LU version	4,000
SNA400	3270/SNA Enterprise Package (3270/SNA and Advanced 3270/SNA, 96-LU package)	12,000
SNA103	Supports 16 Sessions	2,990
SNA100	Supports 32 Sessions (one-line maximum; for all Vines servers except Vines/286)	4,000
SNA101	Supports 64 Sessions (32 sessions per line, two lines maximum; available for all Vines servers except Vines/286 and Vines/386)	6,500
SNA102	Supports 96 Sessions (32 sessions per line, three lines maximum; available for all Vines servers except Vines/286 and Vines/386)	6,000
SNA105	3270/SNA File Transfer (software option upgrade; adds Send/Receive capability to existing Vines 3270/SNA emulation; requires Vines Release 2.1 or later)	495

## IBM 3270/Bisync Emulation with File Transfer

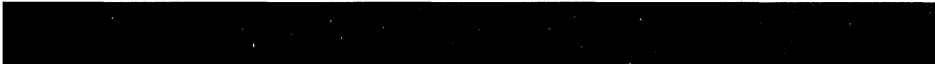
BSC100	Supports 32 Sessions (one-line maximum)	4,390
BSC101	Supports 64 Sessions (32 sessions per line, two lines maximum)	6,040

## TCP/IP Networking Software

TCP100	TCP/IP Routing	1,995
TCP110	PC/TCP Server-Based License with Routing (option combines TCP100 and TCP120 options features)	3,995
TCP111	PC/TCP Server-Based License with Routing (option combines TCP100 and TCP121 option features)	3,995
TCP120	PC/TCP Server-Based License	2,995
TCP121	PC/TCP Server-Based License (same as TCP120 except for Ethernet LANs only)	2,995
TCP200	TCP/IP Server-to-Server	1,995
IM100	LAN Server-to-Server	1,000
IM101	WAN Server-to-Server	1,755
PDN100	X.25 Server-to-Server	2,495
MAC100	MacVines Mail Gateway	795
VDT100 <sup>7</sup>	Vines Application Toolkit	1,995



# Barr Systems PC-to-Host Products



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**Product Summary**

**Editor's Note**

Since our last report Barr has introduced products providing interfaces for connecting PCs to S/370 channel-attached printers and to printers with the Dataproducts interface, PRINT370 and BARR/DPI, respectively.

**Description**

Barr products link IBM PCs, PS/2s, and compatible computers to mainframes or other PCs and provide remote printing capabilities. The products are designed for the remote job entry (RJE) market.

**Strengths**

For users requiring high-speed (more than 1,500 lines per minute), high-volume remote printing, Barr is clearly the leader, offering products supporting speeds of up to 20,000 lines per minute.

**Limitations**

With the exception of the 3270 product, Barr's product line does not include support for any APIs.

**Competition**

Network Software Associates (NSA) and Passport Communications.

**Vendor**

Barr Systems Inc.  
 2830 NW 41 Street  
 Gainesville, FL 32606  
 (800) BARR-SYS, (904) 371-3050  
 In Canada:  
 Contact vendor's U.S. office.

**Price**

Prices range from \$200 for a single BARR/TRAN RJE station to \$5,290 for PRINT370.

**GSA Schedule**

No.

—By *Dave Hickey*  
*Staff Writer*

# Analysis

## Product Strategy

Since its founding in 1978, Barr Systems has established itself as a solid competitor in the PC-to-host marketplace by concentrating on developing Remote Job Entry (RJE) products. Barr's products allow PCs and PS/2 computers to function as RJE terminals when communicating with IBM mainframes. The Barr Series includes five software solutions that use a variety of RJE protocols to perform batch file transfers and printing.

Barr's product line includes a number of synchronous communications packages that link PCs, PS/2s, and PC compatibles to mainframes or other PCs. All products provide some sort of PC-based remote job entry. What differentiates the products is the protocol used for communications. Packages are available supporting the 3780, 2780, HASP BSC multileaving, and SNA RJE protocols. All of the products can also be used as gateways on a LAN, allowing all PCs on the LAN to access mainframe files. One product allows a PC to perform SNA RJE communications on a token-ring LAN.

Although the BARR/HASP product has the largest installed base of the Barr products, the company's best-selling product now is BARR/SNA RJE, which has a base of 4,000 installed units. Barr's RJE+3270 performs RJE printing while the PC concurrently emulates a 3270 terminal accessing the mainframe. Barr sees many lucrative avenues in the RJE markets but expects to gain a lot of revenues from the gateway market. The 3270 gateway market is growing, but not many entries have been designed for RJE applications.

In addition to its communications packages, Barr manufactures several adapter boards that are bundled with the software. Users simply choose the adapter board best suited for their applications. The company also sells a line of internal synchronous modems for IBM PC and PS/2 computers.

Barr also offers several enhancement products, including PRINT370, BARR/DPI, BARR/TRAN, and BARR/TAPE.

Barr sells directly to end users and through OEM agreements, with OEM sales accounting for about 25 percent of the company's revenues. Typically, end users of Barr's products do a lot of high-speed volume printing on remote printers. The company cites the U.S. Park Service, which uses the products to link PCs at individual parks to a mainframe at the headquarters facility. Other customers include Anheuser-Busch Co., the Bureau of Labor Statistics, Duke University, IBM, Intel Corp., NASA, Polaroid Corp., Procter & Gamble, and Revlon Inc.

## Competitive Position

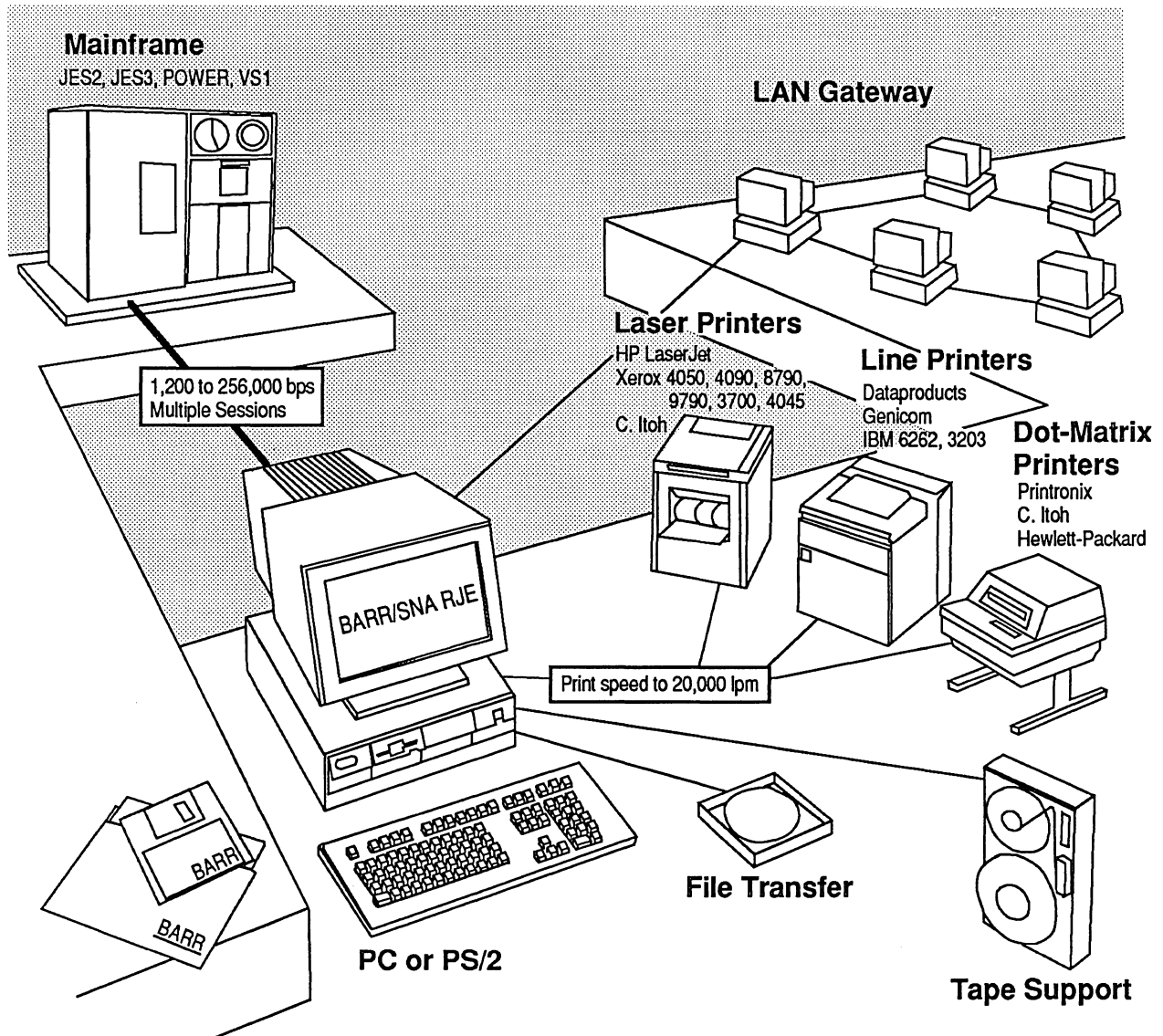
Barr produces products for the RJE protocol, a communications protocol designed for batch processing. RJE has no interactive capabilities, making it best suited for applications that can be processed at night in batches. Although some vendors, including IBM, have dropped out of the PC-based RJE market, remaining companies report that the market is still lucrative.

Barr's commitment to RJE attests to its strengths. The company plans to continue developing products for the protocol. Barr, in fact, is the only company dedicated solely to producing products for RJE applications. The company competes with a number of vendors that remain in this market, including Network Software Associates, IDE-Associates, and ICOT Corp. Its principal competitor, however, is Passport Communications.

Passport markets SNA/SDLC-based, micro-to-mainframe communications products that perform 3771 RJE emulation. The products support remote and gateway connections but use the bisync protocol for file transfers. Barr's products support the 3780, 2780, HASP BSC multileaving, and SNA/RJE (SDLC and token-ring) protocols. The products support data rates up to 19.2K bps, while Barr's products support data rates up to 256K bps.

Network Software Associates (NSA) offers a single RJE product that emulates 3770 RJE workstations, operating at 19.2K bps over dial-up or leased lines. Again, Barr's data rates for the same type of emulation are much faster. NSA's Adapt-SNA RJE product includes an API. According to

Figure 1.  
*BARR/SNA RJE Connectivity*



*BARR/SNA RJE allows standalone PCs or PS/2s, as well as PCs and PS/2s on a LAN, to communicate with a mainframe.*

NSA, its RJE product can also be used over a number of links, including remote SLDC communications, a coax connection, an asynchronous connection, and a connection on a token-ring or NETBIOS-compatible network. The buyer simply requests a software driver that facilitates the connection he or she needs.

All vendors provide a common user interface across the product line to make changing from one type of application to another relatively simple. Barr's RJE product line is more diverse than its

competitors', offering solutions for more specialized RJE applications. In addition, for applications requiring high-speed, high-volume printing, Barr remains the clear leader. Companies such as NSA and Passport compete in a lower speed printing market.

IBM meanwhile promotes System/36 and AS/400 minicomputers for high-speed RJE applications. Barr commented that its PC-based RJE products provide similar functions and higher performance at far less cost.

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## Decision Points

### Remote Printing

According to Barr, the essence of its product line is that it provides high-performance remote printing. The company recently introduced two new products, BARR/DPI and PRINT370, which further bolster its printer support. In addition, all Barr products support print spooling, which manages the printing of files on as many as eight printers from a single PC.

Typically, end users of Barr's products do a lot of high-speed volume printing on remote printers. For high-speed, high-volume printing, Barr's products are also a cost-effective solution. BARR/SNA RJE, for example, supports printer speeds of more than 20,000 lines per minute, while most RJE solutions support printing of less than 1,000 lines per minute. For applications where users want to print 1,500 lines a minute or more, Barr Systems has no competition, according to a Barr spokesperson.

### Functionality

All of Barr's packages come with a friendly user interface that can be menu and command driven. Novices will find the programs easy to learn, with support for on-line help and prompts that guide the user through the communications process via a series of logically designed menus. As users become more proficient, they can bypass menus by issuing commands.

Barr's biggest advantage is high-speed performance, supporting line speeds of up to 256K bps for SNA and 64K bps for 3780 and HASP. Most similar products support speeds only up to 19.2K bps. Barr's products speed batch transmission to the mainframe through data compression techniques. Users can also benefit from batch transmission's inherent capability to send files at night, when phone rates are cheaper. Bidirectional file transfers are also supported over dial-up or leased lines.

### API Support

Though Barr's products are known for their reliability and ease of use, one feature missing from the product line (with the exception of the 3270 product) is support for application program interfaces (APIs). Some other products, such as Passport Communications' offerings, come with a

proprietary API. Barr officials, however, commented that an RJE API is unnecessary since the products include complete, built-in facilities for creating user applications. Barr programs can be called from a shell with the files to be sent and will dial the phone, send the files, receive output, and return to the shell. Barr added that the products' batch capability provides instructions on how to send files.

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## Company Profile

At a time when many companies are dropping out of the remote job entry (RJE) market, Barr remains the one company whose sole purpose is designing RJE communications hardware and software for IBM PCs and compatibles. Barr Systems was founded by Anthony J. Barr, president, in 1978. Seeing little competition in the RJE market and having extensive experience in RJE development, Barr decided to build his company around RJE technology.

Over the last 13 years, the Gainesville, FL-based company has grown to a staff of 24. Although the size of the shop may be small, Barr claims comfortable revenues of \$4 million annually and an installed base of over 10,000 products.



## Characteristics

**Models:** BARR/SNA RJE, BARR/SNA RJE (TRN), RJE+3270, BARR/HASP, BARR/3780, BARR/TAPE, BARR/TRAN, BARR/DPI, PRINT370.

**Date Announced:** BARR/HASP—1983; BARR/SNA RJE and BARR/TAPE—1987; BARR/TRAN, BARR/SNA RJE (TRN), BARR/3780, RJE+3270, and BARR/DPI—1989; PRINT370—1990.

**Date First Installed:** BARR/HASP—1983; BARR/SNA RJE and BARR/TAPE—1987; BARR/TRAN, BARR/SNA RJE (TRN), BARR/3780, RJE+3270, and BARR/DPI—1989; PRINT370—1990.



**Number Installed:** BARR/SNA RJE—4,000; BARR/SNA RJE (TRN)—100; RJE+3270—100; BARR/HASP—6,000; BARR/3780—200; BARR/TAPE—300; BARR/TRAN—300; BARR/DPI—150; PRINT370—100.

**Distribution:** Barr's products are sold directly and OEM'ed to other companies.

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## Models

At the heart of Barr's products are five communications software packages that support different protocols for RJE applications. BARR/SNA RJE, BARR/SNA RJE (TRN), RJE+3270, BARR/HASP, and BARR/3780 allow IBM PC/XT/AT and compatibles and PS/2 computers to communicate with host systems. Each package is bundled with cabling, a manual, and an adapter card. The packages support specific host environments, and some support multiple sessions.

All of the software provides a friendly menu-driven and command-driven user interface. An automatic installation program is also menu driven. Each software package guides the user step-by-step through the communications process with menus, screens, and prompts. Function keys are also used to call up menus or execute commands. On-screen instructions, on-screen help, and self-explanatory error messages make the product easy to learn. Other features include automatic answer, unattended execution, and automatic dialing and redialing if used with Barr internal modems.

Each of the five packages can be installed in a personal computer equipped with a synchronous modem and an adapter card. The PC must be running DOS 3.0 or later. Communications are established through the interface on the adapter board. Barr produces a number of adapter cards, shown in Table 1. The user simply chooses the card most suitable for his or her application. The products communicate over dial-up or leased lines, supporting data rates up to 256K bps. (RJE+3270 supports rates up to 9600 bps on a dial-up line and 256K bps on a leased line.) When a product is installed on a local area network, any PC user on the LAN can send files to the mainframe. Files received from the mainframe are sent to a standalone print server.

Each product supports bidirectional transfers of binary and ASCII files, using data compression. Record formats and character sets are automatically translated. Files can be transferred in batches, including overnight transfers when using unattended auto answer operation. Each product implements a CRC error-checking protocol that automatically retransmits faulty data. If a session is interrupted or disconnected prematurely, the package automatically redials the host and logs back on to the system. Files can be sent to a disk, plotter, printer, or any other device specified by the user.

All products support print speeds up to 20,000 lines per minute. Up to five printers (serial or parallel) are supported concurrently; two more print streams can

be directed to disk. Products also support print spooling. Users can optionally purchase BARR/TAPE software, which allows transfer of tape files between the PC and host.

Barr's products can also handle special printer forms, such as checks, invoices, and tax forms. Up to 100 forms can be either directly entered into the RJE product or received from the mainframe via the FCB-LOAD mechanism. All Barr products allow the PC to retain its local functionality while simultaneously communicating with the mainframe. BARR/SNA RJE and RJE+3270 are among the few RJE products that operate in true full-duplex mode.

Diagnostics, such as a loopback program, a status line, and a Communications Scope, help users troubleshoot their systems. The Communications Scope contains all the control messages and block numbers for the last 40 communications sessions. Its screen allows users to monitor each phase of BARR RJE communications—dialing, establishing the connection, sending and receiving data, and diagnosing and correcting transmission errors. Users can troubleshoot communications and hardware problems; display statistics from the beginning of the BARR RJE session; test the adapter, cable, and modem; dump a record of all information frames to a file; display data defining the operating rules for each party on the session; verify VTAM operation; and do a memory dump.

Listed below are the five RJE products and their specifications.

**BARR/SNA RJE:** This product is an SNA multiple-session RJE communications software product that emulates IBM 3777-3 printers, System/36 minicomputers with MSRJE workstations, and 8100 and 3790 RJE workstations. The product works in IBM JES2, JES3, VS1/RES, VM/RSCS, and POWER host environments, providing PU2-LU1 communications using the SDLC protocol. Up to 16 LU sessions can run concurrently, including 7 printer streams; 4 reader streams; 2 punch streams; and 1 console and 1 keyboard, printer, or print stream. The software requires at least 320K bytes of RAM for proper operation.

**BARR/SNA RJE (TRN):** BARR/SNA RJE (TRN) provides the same functions as BARR/SNA RJE, additionally supporting a token-ring interface. The product allows PCs on a LAN to communicate with the mainframe via a Token-Ring Interface Coupler (TIC) card that is installed on a 3725, 3745, or 3174 controller attached to the mainframe. The PC is connected to the token-ring LAN through an IBM or 3Com token-ring adapter, using a NETBIOS software interface. The product is especially well suited for departmental JES print station applications and batch submission of files from a LAN to the mainframe. BARR/SNA RJE (TRN) can optionally work with BARR/TRAN, a file transfer package for communications between PCs or PS/2s and mainframes running MVS.

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**Table 1. Barr Adapter Boards at a Glance**


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<b>BARR/3</b>	An adapter board for IBM PC/XT/AT and PS/2 Models 25 and 30 computers. Users can purchase the adapter with an RS-232 or V.35 interface.
<b>BARR/6BBB</b>	An adapter board for IBM PS/2 computers that is available with an RS-232 or V.35 interface.
<b>PC-SYNC Modem</b>	A synchronous internal modem and emulation hardware on a single adapter board. Designed for IBM PC/XT/AT and PS/2 Models 25 and 30 computers. Available in 201C, 208AB, and V.32 versions.
<b>PC-SYNC/2 Modem</b>	A synchronous internal modem and emulation hardware on a single adapter board for IBM PS/2 MCA computers. Available in 201C, 208AB, and V.32 versions.

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**RJE+3270:** RJE+3270 supports concurrent SNA RJE and 3270 sessions. Users simply toggle between sessions without logging off. While the other Barr products support data rates up to 64K bps, RJE+3270 transfers data over dial-up lines at 9600 bps, using the PC-SYNC V.32 modem/adaptor card, and at 256K bps on leased lines. The product supports four simultaneous LU type 2 3270 sessions, emulating 3278/79 Models 2A, 2B, 3A, 3B, 4A, 4B, 5A, and 5B terminals. The product also provides IBM 3270 HLLAPI support, as well as 3287 (Model 1 and 2) printer emulation. RJE+3270 also supports IBM's IND\$FILE file transfers.

**BARR/HASP:** This product emulates the IBM 360 Model 20 or IBM 3777-2 BSC Multileaving RJE workstations, providing HASP BSC multileaving communications between a PC and a mainframe. The product works in MVS/JES2, MVS/JES3, VM/RSCS, VS1/RES, and CDC NOS host environments. BARR/HASP supports a single communications session. The product requires at least 256K bytes of RAM for proper operation.

**BARR/3780:** BARR/3780 emulates the 3780 or 2780 BSC protocols, allowing a PC to function as a high-performance RJE workstation for communications with a host system. The product works in any host environment supporting 3780 applications. BARR/3780 requires a minimum of 288K bytes of RAM for proper operation.

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## Enhancement Products

Barr offers a number of products for use with the five products detailed above. The adapter/modem products are shown in Table 1.

**PRINT370:** PRINT370 allows users to drive up to four S/370 channel-attached printers from a single PC. Using any of the BARR RJE products, a remote connection is established through a Barr synchronous adapter or a token-ring adapter. The product does not require the addition of any special hardware for the mainframe. PRINT370 offers print speeds of up to 266 pages per minute and supports printers from IBM, Xerox, Kodak, NCR, Siemens, STC, and Bull. The package requires an IBM PC, PS/2 MCA, or compatible computer, running DOS 2.0 or later with at least 512K bytes of RAM. A PRINT370 package includes the PRINT370 software and adapter, Barr RJE software, a 20-foot BUS and TAG shielded cable, and BUS and TAG cable terminators and test plugs.

**BARR/TAPE:** This product can be used with any of the five packages described above, enabling the PC or PS/2 to send and receive nine-track tape files between the computer and the mainframe. Files received from the mainframe can be printed to disk locally. Tape files can also be sent from PC to PC. Print streams are captured in a standard print tape format. BARR/TAPE allows a PC to have the same tape support as DATA100, Mohawk, and Harris RJE workstations. Using the 3780, 2780, and HASP BSC multileaving protocol, the software supports data rates up to 64K bps. The SNA RJE protocol used with an SDLC connection supports speeds up to 256K bps. SNA RJE with a token-ring connection supports 4M bps or 16M bps transfer rates. The product requires the use of one of the five software packages, a synchronous BARR adapter board, and an IBM PC/XT/AT or PS/2 with at least 512K bytes of RAM available. Using BARR/TAPE also requires a nine-track tape drive with a Pertec interface.

**BARR/TRAN:** BARR/TRAN provides high-speed file transfer for MVS, MVS/XA, MVS/ESA, and VS1/RES host environments. The product supports PC-to-mainframe and PC-to-PC file transfers. A BARR/TRAN file transfer option automatically reformats files from any of the mainframe MVS formats to any of the PC-DOS file formats. File transfer rates up to 64K bps are supported when using the 3780, 2780, and HASP BSC multileaving protocols. Using SNA RJE with an SDLC connection will support speeds of 256K bps. SNA RJE with a token-ring connection supports file transfers at 4M bps or 16M bps. BARR/TRAN automatically handles PC and MVS file structures. The product can be purchased by the station or in a site license, supporting 25 or more RJE workstations per mainframe. BARR/TRAN requires the use of one of the five software packages, a synchronous BARR adapter card, and an IBM PC/XT/AT or PS/2 with at least 256K bytes of RAM.

**BARR/DPI:** This product is available in two versions, BARR/DPI and BARR/DPI2, the difference being that the BARR/DPI2 product is for use with IBM PS/2 MCA computers, while BARR/DPI is compatible with PC/XT/AT and non-MCA PS/2 computers. Both versions implement the Dataproducts interface for driving high-speed printers and typesetting equipment. The products provide full compatibility with all other Barr products and offer support for both the short line (up to 50 feet) and long line (up to 500 feet) versions of the Dataproducts interface.

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## Support

**Phone Support:** Free technical support for Barr's hardware and software products is available over the phone by calling, toll free, (800) 227-7797 between 9 a.m. and 8 p.m., Eastern time.

**Warranty:** Barr products come with a free one-year service agreement that covers all product updates and immediate hardware replacement.

**Maintenance:** The service agreement can be extended after the first year.

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## Pricing

Shown are current prices for BARR products. Quantity, government, and educational pricing is also available.



## Equipment Prices

	<b>Single- Unit Pricing (\$)</b>
BARR/SNA RJE	1,590
BARR/SNA RJE (TRN)	1,590
RJE+3270	1,990
BARR/HASP	1,290
BARR/3780	1,290
BARR/TAPE	1,900
PRINT370	5,290
BARR/TRAN (cost per RJE station for up to 24 stations)	200
BARR/TRAN site license per main- frame (25 or more RJE stations)	5,000
V.35 Option	300
BARR/DPI	400
BARR/DPI2	500
PC-SYNC	1,090-2,790
PC-SYNC/2	1,990-2,790



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# BICC Communications Networking Products

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**Product Summary****Editor's Note**

BICC offers a large and diverse product line that attempts to answer all the needs of the Ethernet and 802.3 network user.

**Description**

An Ethernet modular concentrator with cards for all types of media. A line of standalone local and remote bridges, repeaters, transceivers, and other network hardware. A window-based network management system.

**Strengths**

Product line broad enough to be a single-source supplier for virtually all Ethernet networking needs.

**Limitations**

Though BICC has been an innovative company, some products introduced in advance of the rest of the industry are now reaching maturity.

**Competition**

Chipcom, David Systems.

**Vendor**

BICC Communications, Inc.  
103 Millbury Street  
Auburn, MA 01501  
(508) 832-8650

**Price**

ISOLAN EtherConnect ECS/10 Hub without line cards: \$2,390.

**GSA Schedule**

Yes.

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—By *John Krick*  
Associate Editor

# Analysis

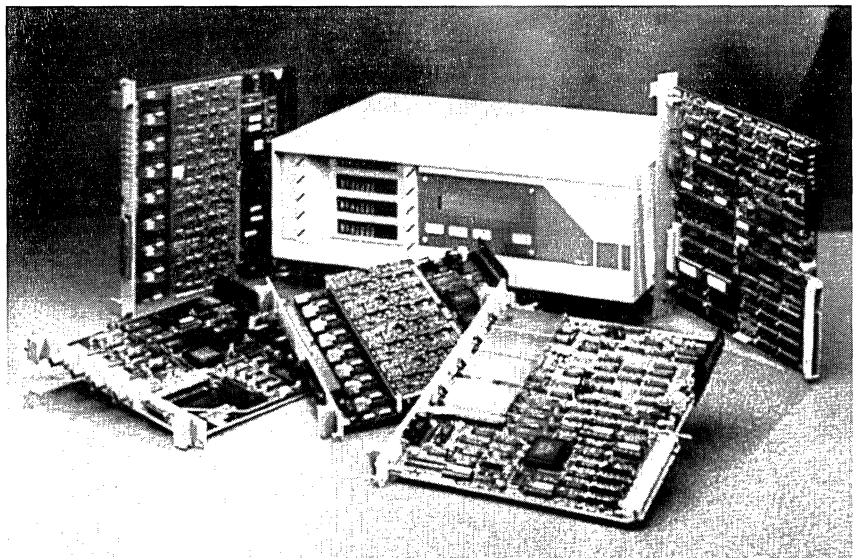
## Product Strategy

BICC has tried, and rather successfully on the evidence of its product line, to cover all the bases. In its ISOLAN EtherConnect product line, the company supplies a high-end concentrator chassis with multiple types of cards providing many networking and internetworking options. Recently, BICC announced an infrared wireless networking system.

BICC has a history of providing innovative solutions. The EtherConnect System (ECS) was first introduced in late 1989, well before most other vendors had such a modular concentrator available. The company's early and comprehensive offering of products for fiber optic networking is another case in point.

Now BICC has entered the emerging wireless LAN market, but not with a radio-based LAN like those Motorola and NCR are offering. BICC has chosen to champion infrared wireless connectivity. The uniqueness of the BICC wireless system does not end there, though. InfraLAN is a token-ring LAN that runs at either 4M or 16M bps, the same speed as the hardwired elements of the LAN. Most

*The BICC ISOLAN EtherConnect ECS/4 is a four-slot, modular chassis that can house a variety of line cards, including modules for unshielded twisted-pair (10BASE-T) Ethernet, bridging, and network management. A 10-slot chassis, the ECS/10, is also offered.*



other wireless systems connect to Ethernet and transmit data at a fraction of the 10M bps speed of the wired part of the LAN. BICC forged an OEM agreement with high-tech start-up UnTied Technologies to acquire the InfraLAN infrared hardware, and is the first large vendor to support infrared.

BICC has recently formed another agreement with Datability, a maker of terminal server equipment for the Digital Equipment VAX Ethernet environment. Datability and BICC will codevelop a card for the ISOLAN EtherConnect System based on Datability's VCP300 that connects 16 terminals to an Ethernet network. The card should enhance the interconnectivity possibilities of PC networks and VAX minicomputer systems in a significant way. BICC will be the first vendor to incorporate this kind of interoperability into a modular concentrator platform aimed at PC networking.

## Competitive Position

While BICC Communications is at the bottom of the sort of corporate hierarchy that is usually characterized as "multinational," it is not at the bottom in terms of inventiveness. It is a part of BICC Technologies, which is itself a part of the giant BICC Group, which, among other things, is involved in ultralarge-scale construction projects such as the Channel Tunnel and also manufactures cable for telephony and power distribution needs worldwide, and is the third largest supplier of fiber optic media in the world.

BICC's position in this country has been almost low profile compared to many other network hardware vendors. While the company has long marketed LAN products, few analysts or end users would claim that BICC's name recognition is as high as, say, 3Com's. Yet BICC's product line approaches the size and diversity of 3Com's.

All that could be about to change—the parent company's recent move to consolidate its networking-oriented businesses operating in the United States could give the company a more solid foothold on the market. Indeed, Janice M. Roberts, president of BICC Technologies' worldwide Communications Division, and now president of BICC Technologies, Inc. in the U.S., said recently, "Since this market will usually adopt a new technology up to 18 months ahead of the European market, a strong North American presence should help us attain market leadership worldwide as well."

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### Decision Points

BICC has the product line breadth to be a single-source supplier for those who believe there is an advantage to such a solution. Most conceivable needs of the 802.3 network user are covered in the ISOLAN product line, at all levels from entry to enterprise-wide.

As previously noted, BICC has been an innovator. The downside of being an innovator is that sometimes innovative products serve as lessons for the rest of the industry that has to play catch-up. When serious competition catches up to the innovator, it is likely to have made improvements to the original concept that leave the truly innovative product looking less than state of the art.

BICC's ISOVIEW Network Manager is a case in point. While it appears to be a quite capable package that BICC continues to enhance, it arrived rather early on the network management scene. Where most newer network management packages are built around Microsoft Windows or the UNIX X Windows interface, BICC's rides in a proprietary windowed user interface that looks much like the standard Microsoft environment but which BICC built itself. Well before the rest of the industry settled on UNIX workstations as the de facto standard hardware platform for high-end network management use, BICC chose to base its package on DOS and, later, OS/2. While neither of these

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## Company Profile

### BICC Communications, Inc.

#### Corporate Headquarters

103 Millbury Street  
Auburn, MA 01501  
(508) 832-8650

#### Officers

*President, BICC Technologies:* Janice Roberts  
*Exec. V.P., BICC Communications:* Michael Noonan  
*V.P. of Finance, BICC Communications:* Brian Mitchell

#### Company Background

*Year Founded:* 1990  
*No. Employees:* Information not available.  
*Installed Base:* Information not available.

#### Business Overview

BICC Communications, headquartered in Auburn, MA, is a North American subsidiary of BICC Technologies. BICC Technologies is a division of the BICC Group, a multinational engineering corporation based in London, England. BICC Group is one of the world's largest manufacturers of fiber optic components, building controls, and electrical cabling. BICC Group has over 47,000 employees worldwide.

BICC Technologies is based in Westborough,

MA. Its North American subsidiaries include Andover Controls of Andover, MA; Transmittion, Inc. of Pittsburgh, PA; and BICC-VERO Electronics of Hamden, CT.

BICC Communications was formed in early 1991 through the merger of two existing operating companies, BICC Data Networks, Inc. and BICC Network Solutions.

#### Financial Profile

BICC Group as a whole had sales of approximately \$7.5 billion in 1990.

#### Management Statement

"By listening to customers, we found they have a strong need to work with a supplier that offers them a total system solution. The formation of BICC Communications combines the product lines, resources, and systems expertise of two businesses and enables BICC to provide an unprecedented total networking solution to end users."—Janice Roberts, president of BICC Technologies.

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choices was bad in and of itself, BICC failed to correctly anticipate the direction of the market, and moved the wrong way.

# Characteristics

**Model:** ISOLAN EtherConnect System.

**Date of Announcement:** September 1989.

**Date First Installed:** December 1989.

**Number Installed:** Information not available.

**Distribution:** Value-added resellers, systems integrators, distributors, and OEMs.

## Architecture

Ethernet and its standardized cousin, IEEE 802.3, are characterized as Carrier Sense Multiple Access with Collision Detection (CSMA/CD) networks, meaning that stations wishing to transmit data over the network must first check the line to determine if a carrier is present. If it "senses" the presence of a carrier, it defers its transmission for a random period of time before trying again. Since two or more stations can begin transmission at the same time, collisions of packets occur from time to time. When a collision is detected, both stations involved cease transmitting and wait a random time before attempting to retransmit their messages. Ethernet differs from 802.3 networking in that it does not follow the IEEE 802.2 Logical Link Control standard for interfacing the physical (hardware) layer to the higher layers of the OSI model.

Traditionally, Ethernet and 802.3 networks have been connected in a linear bus topology, first over thick coaxial cable, and later, over thinner, more easily handled coaxial cable. In recent years, new media and a new topology have come to the fore. A star topology with a central hub is used for both unshielded twisted pair (UTP), standardized under the 10BASE-T subsection of the 802.3 guidelines, and fiber optic Ethernet, described by the as yet unfinalized 10BASE-F subsection of the 802.3 standard.

## Hardware

### Concentrators

**1200-2 EtherConnect System/10 Enclosure (ECS/10):** The ECS/10 is a rack-mount enclosure that holds up to 10 line cards and an optional management card. Its modular design, coupled with the array of line cards

available, allows the ECS/10 to support most popular LAN media in use today, including shielded and unshielded twisted pair, thick and thin coaxial cable, and fiber optic cable. All line cards can be "hot swapped" while the network is up, eliminating much maintenance downtime. The optional management card provides an LCD display and control keys on the front panel, so that configuration and diagnostic tasks can be performed locally. Remote management functions can be performed from an ISOVIEW Network Manager station. An optional redundant power supply can be installed in the ECS/10 to share the power load during normal operation and provide backup power in the event of failure of the primary supply. Cable connections are made at the rear of the enclosure, and an optional Cable Tray is available that reduces cable and connector strain, enhancing network reliability.

### 1210-0 EtherConnect System/4 Enclosure (ECS/4):

Similar to the ECS/10 described above, the ECS/4 is designed for departmental or small business use. It holds a maximum of four line cards or, optionally, three line cards and a management card.

**1203-0 Management Card and Front Panel:** The ISO-LAN Management Card provides network administrators with the capability to perform network management tasks on the EtherConnect concentrator locally or from a remote location using BICC's ISOVIEW Network Manager. Ports can be individually or simultaneously enabled or disabled. The front panel provides local control through a four-button keypad and a two-line, 24-character LCD display. The front panel can be password protected for security. Descriptions of line card and port types can be displayed on the LEDs and bandwidth utilization and CRC error counts can be monitored as well, both at the port level or for the whole concentrator.

### Concentrator Line Cards

#### 1201-0 4-Port Coaxial/AUI Repeater Line Card (RLC):

The 4-Port Coaxial/AUI RLC comes with five connectors that can be configured in two ways—it has four BNC connectors for thin coaxial cable and one AUI connector for attachment to a thick coaxial, unshielded twisted-pair, or fiber optic transceiver. Either all four BNC connectors or three BNC connectors and the AUI connector can be made active using an external switch. The card features LED indicators for power, packet reception, and collisions, and a port status LED for each port.

#### 1201-1 4-Port Fiber Optic/AUI Repeater Line Card

**(RLC):** Like the 4-Port Coaxial/AUI card described above, the 4-Port Fiber Optic/AUI RLC has five ports, four of which can be connected. Either all four fiber ports or three fiber ports and the AUI connector can be enabled, so that the maximum variety of network connections can be implemented. Fiber optic connectors are the industry-standard SMA type. The card features LED



indicators for power, packet reception, and collisions, and a port status LED for each port.

**1201-2 8-Port Unshielded Twisted Pair Repeater Line Card (RLC):** This is an eight-port 10BASE-T interface card for the ISOLAN ECS chassis. The card connects to a patch panel or telco-type 66 block through a 50-pin Amphenol connector. The repeater circuitry performs full signal retiming, preamble regeneration, fragment extension, MAU jabber lock-up protection, partition, and automatic reconnection. LED indicators for power, packet reception, and collisions, and eight-port status LEDs are located on the front panel. The rear panel has LEDs for link status for each port and a single LED to indicate the configuration of port 1, as a link to another line card or to an unshielded twisted-pair transceiver.

**1201-3 8-Port Shielded Twisted Pair Repeater Line Card (RLC):** This is a system that includes a card for the ECS chassis, a distribution panel, and a connecting cable. The distribution panel mounts in a standard patch panel rack and has eight 9-pin D connectors for attachment of shielded twisted-pair cabling. A 50-pin Amphenol connector on the repeater card is attached by the cable that is included. The front panel has LED indicators for power, packet reception, and collisions, and eight-port status LEDs. The rear panel has LEDs for link status for each port and a single LED to indicate the configuration of port 1, as a link to another line card or to a shielded twisted-pair transceiver.

**1201-4 Multiport Transceiver (Fan Out) Line Card (LC):** The Multiport Transceiver LC provides four transceiver ports for connection of devices such as bridges and terminal servers. The card is equipped with four 15-pin, D-type AUI connectors. A repeater chip included on the card performs signal retiming, preamble regeneration, automatic partition and reconnection, and other repeater functions. Each transceiver port can be configured independently with or without the SQE "heartbeat" test. LEDs on both the front and rear panels indicate various aspects of the operational status of each port, such as packet reception; collisions; port enabled, disabled, or partitioned; and jabber protection status.

**1201-6 12-Port Unshielded Twisted Pair Repeater Line Card (RLC):** This is a 12-port 10BASE-T-compatible card for the EtherConnect concentrator. Used in the ECS/10 concentrator, these cards can provide up to 120 unshielded twisted-pair connections. Like the rest of the EtherConnect line cards, the 1201-6 is built to the Distributed Repeater Architecture (DRA), that puts repeater logic on each card, eliminating a single point of failure. The 1201-6 is equipped with a 50-pin AMP connector that attaches via a cable to a standard telco punch-down block or an RJ-45 patch panel for connection of twisted-pair wiring. LEDs on the front panel of the card indicate power status, packet reception, collision detection, and port status. Optional transceiver modules, described below, allow connection of the

1201-6 to a thick coaxial or fiber optic backbone without the need for a separate card.

**1205-0 Managed Bridge Line Card:** This is a transparent bridge for ISOLAN EtherConnect systems that supports the IEEE 802.2 Logical Link Control (LLC) and Spanning Tree Algorithm standards. Spanning Tree bridging allows the use of redundant bridged connections by disabling one of a pair of parallel bridges until a failure of the primary bridge occurs. Packet filtering can be configured by the user based on source or destination address, protocol type, and data content. The Managed Bridge Line Card filters packets at a rate of 15,000 packets per second and forwards at 11,000 packets per second. An EtherConnect System can be used as a bridge hub with multiple Managed Bridge cards installed to connect other concentrator-based subnetworks.

### **Wireless Networking Equipment**

**1000-0 InfraLAN:** InfraLAN is a line-of-sight, wireless networking system based on invisible infrared light beams transmitted between two optical nodes. An optical node attaches to a base unit that is a six-port 802.5 token-ring Multistation Access Unit (MAU). Up to six workstations equipped with 802.5-compliant 4M or 16M bps token-ring adapter cards can be connected to the InfraLAN MAU. Alternatively, ports 1 and 6 of the base unit can be used as Ring In and Ring Out ports to expand the network by connection to other 802.5 MAUs. The InfraLAN base unit uses IBM standard connectors to attach workstations via shielded twisted-pair cabling. Optical nodes are mounted on five-foot-high poles that attach to office partitions, walls, or floor stands, and can be up to 80 feet apart. Easy reconfiguration of the physical layout of the network is possible by moving the optical units. LED indicators on the optical nodes display signal strength to help installers align the units correctly. InfraLAN features a backup signal path that carries data over the ring in the reverse direction in case the infrared beam becomes obstructed. If both the primary and backup signal path are blocked, the base unit holds the data until it can be successfully transmitted.

### **Network Interface Cards**

**4101-0 Unshielded Twisted Pair IBM AT Controller Card:** The 4101-0 is a 10BASE-T adapter card for the IBM AT 16-bit bus. It is equipped with an RJ-45 connector for unshielded twisted-pair attachment and an Attachment Unit Interface (AUI) connector for thick coaxial transceiver connection. The card has no onboard RAM, relying instead on busmastering—direct control of the system bus using the PC's Direct Memory Access (DMA) capabilities.

**4102-0 Fiber Optic AT Network Interface Card (NIC):** The 4102 Fiber Optic AT NIC is a 16-bit card for the IBM PC AT bus that features busmastering capability for maximum throughput. Like 4101 unshielded twisted-pair

card described above, it has no onboard RAM, relying instead on DMA to move data directly to and from system memory. The 4102-0 NIC is equipped with SMA connectors.

**4102-1 Fiber Optic AT Network Interface Card:** The 4102-1 NIC is identical to the 4102-0 NIC described above except that its equipped with ST-type connectors.

**4110-2 Thin Net AT Network Interface Card:** The 4110-2 is a 16-bit Ethernet adapter card for the IBM PC AT bus. It includes both BNC and AUI connectors for thin coaxial and Ethernet transceiver attachment, respectively. Like the rest of the interface cards in the BICC line, the 4110-2 has no onboard memory— incoming and outgoing network transmissions are moved directly to and from system memory via Direct Memory Access (DMA), delivering higher performance than most adapter cards.

**4110-3 Thin Net MCA Network Interface Card (NIC):** The 4110-3 is similar to the AT card described above, but is designed for the IBM Micro Channel Architecture bus used in the PS/2 Models 50 and above.

## Transceivers and Repeaters

**1114 Transceiver:** The 1114 transmits and receives data from an Ethernet bus cable, detects collisions on the network, and protects the network from “jabber”— the transmission of data packets which are too long. It connects workstations to a thick or thin Ethernet coaxial cable using a 15-pin, male, D-type AUI connector and interchangeable cable-piercing, N-series, or BNC connector taps. An SQE “heartbeat” test is user selectable, and a “power on” LED is included. The 1114 is available in three models with three different interchangeable coaxial cabling connections. The 1114-1 comes with a cable-piercing tap to connect to a thick Ethernet bus cable. 1114-2 has an N-series tap for thick Ethernet. The 1114-3 has a BNC connector for thin Ethernet connection.

**1180 Fiber Optic Transceiver:** The 1180 connects PCs or terminals to a 10M bps CSMA/CD fiber optic LAN. It features an AUI port for connection to the workstation and two SMA fiber optic connections, one for transmit and one for receive. The 1180 can use 50/125, 62.5/125, 85/125, or 100/140 fiber optic media and can detect fiber breaks (loss of light) or low light conditions. A selectable SQE “heartbeat” test is included, as well as standard 802.3 functions, such as loopback, jabber protection, collision detection, and idle signal modulation.

**1181 Unshielded Twisted Pair Transceiver:** The 1181 UTP Transceiver provides connection of any 802.3 or Ethernet V2.0 adapter card equipped with the standard Attachment Unit Interface (AUI) connector to an unshielded twisted-pair network. The 1181 is supplied with

one 15-pin, D-type AUI connector and one RJ-45 modular connector. Six LED indicators monitor transmit and receive activity, power status, link status, SQE test status, and collisions.

**1182 Shielded Twisted Pair Transceiver:** The 1182 is a transceiver for 802.3 and Ethernet Version 2.0 applications that allows connection of workstations and other network devices to shielded twisted-pair (STP) cabling such as IBM Type 1. It is equipped with a 15-pin, D-type AUI connector for device attachment and a 9-pin, D-type connector for STP. The 1182 features a selectable SQE “heartbeat” test. Six LEDs indicate receive and transmit, power, collisions, link, and SQE status.

**1120-2 Two Port Diagnostic Repeater:** This repeater connects up to five Ethernet network segments to permit a total length of up to 3 kilometers. The 1120 front panel features a set of diagnostic and status indicators to allow monitoring of network conditions. It supports all types of Ethernet cabling, including twisted pair and fiber optic. The 1120 Repeater is equipped with two 15-pin, D-type AUI connectors, and all types of cabling require the use of a transceiver without its own SQE test capability. Front-panel LEDs monitor partitioning on ports 1 and 2, packet activity, and power.

**1125-1 Multiport Thin Net Repeater:** This repeater features six thin Ethernet BNC connectors and two AUI connectors. Used as a standalone device, it can form the hub of a star topology and can also connect up to six full-length Ethernet segments to a backbone cable. The 1125 performs all repeater functions including preamble regeneration, fragment extension, and signal retiming. Automatic and manual partitioning and reconnection of faulty segments protect the network from total failure in the event of malfunctions.

**1126-0 Multiport Fiber Optic Repeater:** This repeater features seven fiber optic ports that use pairs of SMA connectors and one AUI connector for the eighth port. It performs IEEE 802.3 repeater functions including preamble regeneration, fragment extension, and signal retiming. Faulty network segments are isolated from the rest of the network by automatic partitioning and are also reconnected automatically when the fault is corrected. Network segments can be partitioned manually as well. Multimode fiber types 50/125, 62.5/125, 85/125, and 100/140 can be used. Fiber alignment is not necessary.

**1126-5 Multiport Fiber Optic Repeater:** This repeater is similar to the 1126-0 described above but uses ST-type fiber optic connectors.

**1131 Fan-Out Unit:** The 1131 connects up to eight devices to a single Ethernet transceiver to provide easy expansion of existing network installations. The 1131 can also function as a standalone concentrator, allowing network connections of stations up to 50 meters away. In the standalone mode, the 1130 performs the

functions of a transceiver itself and provides the SQE "heartbeat" test. Fan-Out units can be connected in series for a total of up to 64 nodes on each transceiver. The 1130 features eight male, 15-pin, D-type connectors and one female, 15-pin D for connection of the transceiver. Front-panel LEDs monitor internal and transceiver power, packet activity, and loopback status.

**1150-2 Diagnostic Fiber Optic Repeater:** This repeater allows the connection of copper Ethernet cable segments to a duplex fiber optic backbone for links of up to 2 kilometers between repeaters. The fiber optic ports use SMA-type connectors, and the copper network segment connects to a 15-pin, female, D-type AUI connector through a transceiver. The transceiver must be of a type without the SQE "heartbeat" test. The 1150 performs all functions associated with an 802.3 repeater, such as preamble reconstitution, fragment extension, data retiming, and automatic partitioning in case of network failures. In addition, the 1150 performs fiber optic transceiver functions, including loopback, jabber protection, collision detection, idle signal modulation, and loss of light detection and indication.

**1150-5 Diagnostic Fiber Optic Repeater:** The 1150-5 repeater is similar to the 1150-2 described above, but is equipped with ST-type connectors.

## Hubs

**1160 6-port Fiber Optic Hub:** The 1160 Fiber Optic Hub forms the central node of a star-shaped 10M bps CSMA/CD fiber optic network. Network nodes can be located up to 2 kilometers from the hub. All popular diameters of fiber media can be used—50/125, 62.5/125, 85/125, and 100/140. No alignment of fiber is necessary, allowing easy installation. LEDs on the back panel indicate loss-of-light condition for each port, and front-panel LEDs are provided that monitor packet reception and collision and jabber conditions. The 1160 Hub has six fiber optic ports and is available in two configurations—the 1160-0 with SMA connectors and the 1160-5 with ST connectors. An AUI connector is also included for connection of a seventh port to other network resources.

**1161 12-port Fiber Optic Hub:** The 1161 Hub is identical to the 1160 Hub described above, but is equipped with 12 fiber optic ports and two AUI ports. As with the 1160, both SMA- and ST-equipped models are available—designated the 1161-0 and 1161-5, respectively.

## Bridges

**1400-0 Primary Bridge:** The 1400 Bridge connects two local 802.3 or Ethernet networks. Used with the proper transceivers, this device can link network segments running on standard Ethernet coaxial cable, thin Ethernet coax, fiber optic media, or any combination of the three.

The 1400 features dynamic address learning and filters packets based on their destination at a rate of 17,100 packets per second. It forwards 13,000 packets per second. No user configuration or setup is required. The 1400 can span distances of up to 4 km. between LANs using low-loss fiber cable.

**1410-0 802.3 Managed Bridge:** The 1410 Bridge is a local bridge designed to connect 802.3/Ethernet networks. It conforms to the IEEE 802.1 Logical Link Control (LLC) standard and implements the Spanning Tree Algorithm described under that standard to allow redundant bridged paths between networks. The 1410 Bridge is a high-performance device that uses a hardware-based, fast look-up table. A front-panel display and a keypad are provided to allow bridge parameters to be configured by administrators. Remote configuration can be performed from an ISOVIEW Network Manager workstation. The bridge can also provide the network management station with an inventory of all stations on its network segment, and forward alarm information about significant network events. The 1410 filters packets at a rate of 21,800 packets per second and forwards 13,600 packets per second.

**1420 FDDI/802.3 Bridge:** The ISOLAN FDDI/802.3 bridge connects 10M bps 802.3 LANs to a 100M bps Fiber Distributed Data Interface (FDDI) backbone. The bridge is equipped with one 15-pin, D-type AUI connector for attachment of the 802.3 subnetwork, and two FDDI MIC interfaces. The FDDI/802.3 bridge can filter 460,000 packets per second and forward 14,000 packets per second.

**1435-1 Remote Bridge:** The 1435 Remote Bridge connects 802.3 LANs over wide area network facilities. It supports two WAN connections via RS-232, RS-449, V.35, or X.21 interfacing. Transmission speeds of up to 128K bps over WAN links are supported. The programmable filtering database allows source, destination, priority, and protocol filtering. The 1435 Remote Bridge implements the IEEE Spanning Tree Algorithm for configuring redundant bridged paths.

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## Software

**ISOVIEW Network Manager Version 3.0:** The ISOVIEW Network Manager Version 3.0 is a window-based, mouse-driven, color graphics-intensive network management package. ISOVIEW Network Manager Version 3.0 requires the OS/2 operating system and features a modular design that allows users to purchase only the amount of network management functionality they require. A Kernel Module delivers the basic functionality of the network management system, while additional Support Modules provide further capabilities. Support Modules include the ISOLAN Managed Bridges for Ethernet Module, the ISOLAN EtherConnect System Module, and the ISOLAN FDDI/802.3 Managed Bridge Module.

A multilevel network map allows the manager to zoom from an overall view of the network down to an individual port. A toolbox of icon-based management and administration functions is supplied. A database maintained by the system contains information about device and port configuration, performance statistics, an inventory of all attached devices, and a log of network alarms and other events. ISOVIEW maintains this database automatically, but manual data input and updating can be accomplished through the user interface. Statistics and inventory data can be output to a Lotus 1-2-3 format file, or to a printer.

## Support

### Installation

Installation is provided by resellers and distributors.

### Warranty

BICC warrants all of its products for a period of one year. Extended warranty plans are available.

### Maintenance/Support

Maintenance of BICC equipment is provided by resellers and distributors. BICC maintains a toll-free technical support line for use by end users.

## Equipment Prices

		Purchase Price (\$)
<b>Hardware</b>		
<b>Modular Concentrator Chassis</b>		
1200-0	EtherConnect ECS/10 Hub (10 slot)	2,390
1210-0	EtherConnect ECS/4 Hub (4 slot)	1,595
<b>Line Cards for Modular Concentrator Chassis</b>		
1201-0	4-port Coaxial/AUI Line Card	945
1201-1	4-port Fiber/AUI Line Card (SMA connectors)	1,895
1201-5	4-port Fiber/AUI Line Card (ST connectors)	1,895
1201-2	10BASE-T Unshielded Twisted Pair Line Card	1,195
1201-3	Shielded Twisted Pair Line Card with Distribution Panel (DB-9 connectors)	1,595
1201-4	Multiport Transceiver (Fan Out) Line Card	495
1201-6	12-port Unshielded Twisted Pair Repeater Line Card	1,795
1206-0	AUI Transceiver Module for 1201-6 Line Card	175
1206-1	Fiber Optic Transceiver Module with SMA connectors for 1201-6 Line Card	500
1206-5	Fiber Optic Transceiver Module with ST connectors for 1201-6 Line Card	500
1203-0	Management Card and Front Panel	1,995
1205-0	Managed Bridge Line Card	4,495
<b>Wireless Networking Hardware</b>		
1000-0	InfraLAN base unit with two nodes	2,995
<b>Standalone Bridges</b>		
1400-0	Primary Local Bridge	2,195
1410-0	802.3 Managed Bridge	5,495
1420-0	FDDI/802.3 Bridge	27,500
1435-0	Remote Bridge	5,495
<b>PC Network Interface Cards</b>		
4101-0	Unshielded Twisted-Pair IBM AT Controller Card	375
4102-0	Fiber Optic AT Network Interface Card with SMA connectors	695
4102-1	Fiber Optic AT Network Interface Card with ST connectors	695
4110-2	Thin Net AT Network Interface Card	349
4110-3	Thin Net MCA Network Interface Card	375
<b>Fiber Optic Hubs</b>		
1160-0	6-port Fiber Optic Hub with SMA connectors	2,995

		<b>Purchase Price (\$)</b>
<b>Fiber Optic Hubs (Continued)</b>		
1160-5	6-port Fiber Optic Hub with ST connectors	2,995
1161-0	12-port Fiber Optic Hub with SMA connectors	5,995
1161-5	12-port Fiber Optic Hub with ST connectors	5,995
<b>Repeaters and Transceivers</b>		
1120-1	2 AUI Port Repeater	1,125
1120-2	Diagnostic 2 AUI Port Repeater	1,250
1121-0	Diagnostic 2 Port Thin Net Repeater	995
1125-1	Multiport Thin Net Repeater	2,195
1126-0	Multiport Fiber Optic Repeater (SMA connector)	3,995
1126-5	Multiport Fiber Optic Repeater (ST connector)	3,995
1131-0	Fan-Out Unit	945
1150-1	Fiber Optic Repeater (1 AUI port to 1 SMA fiber port)	1,795
1150-2	Diagnostic Fiber Optic Repeater (1 AUI port to 1 SMA fiber port)	1,995
1150-5	Diagnostic Fiber Optic Repeater (1 AUI port to 1 ST fiber port)	1,995
1114-0	Coax Transceiver w/o tap	165
1114-1	Coax Transceiver with Piercing Tap	189
1114-2	Coax Transceiver with N-Series Tap	189
1114-3	Coax Transceiver with BNC Tap	189
1180-0	Fiber Optic Transceiver with SMA connectors	495
1180-5	Fiber Optic Transceiver with ST connectors	495
1181-0	Unshielded Twisted Pair Transceiver	195
1182-0	Shielded Twisted Pair Transceiver	195
<b>Software</b>		
	ISOVIEW 3.0 Network Management Kernal	5,000
	ISOVIEW Network Management Support Module for Ethernet Managed Bridges	500
	ISOVIEW Network Management Support Module for EtherConnect System	500
	ISOVIEW Network Management Support Module for FDDI/802.3 Managed Bridge	1,000

