

PC

The Independent Guide to
IBM Personal Computers

Volume 2 Number 4
November 1983 \$2.95

ON THE IBM ASSEMBLY LINE

IBM NETWORKS: Which Ones Fly?

Trading Commodities
by Computer

Reviews: VisiWord
and WordPerfect

Software for the
Classroom

Transferring
Apple Files

WordStar
Learning Aids

Controlling your
Videodisk Player

SCAMP: The
First IBM Micro





The Independent Guide to
IBM Personal Computers



In This Issue

NETWORKS

Battle Of The Network 92

Stars: Bill Machrone
How well did these seven local area networks perform?

Getting Hooked On 107

PCnet/Ken Jeffries
A low-cost local network system.

Getting The Net 123

Working: James Chumbley
How to plan and install an office PC network.

IBM EYE

IBM's Post-PC Image 121

Wynn Rosch
Wall Street has taken a new look at IBM because of the PC.

IBM Assembly: The 138

Inside Story: Bill Machrone
Building PCs in Boca Raton.

The Talk Of Boca 182

Martin Porter
IBM programmed the success of this Florida city.

SCAMP: The Missing 190

Link In The PC's Past: Paul Friedl

A portable personal computer was invented 10 years ago—by IBM.

Why The Good Guys 404

Don't Use PCs: Steven Mares
The Whiz Kids' behind-the-screen dealings with IBM.

WORD PROCESSING

Why We Like 208

WordStar: Paul Somersson
There's life in the old program yet.

WordStar Training 234

Aids: The Whole Works/
William K. Howard
Books, cassettes, and tutorial disks for learning word processing.

WordPerfect Gets 315

Personal: Will Fastie
Personal WordPerfect is a budget version of a powerful program.

VisiWord: What You 328

See Is (Almost) What You
Get: Stephen Mares
This program has some savvy operations.



SOFTWARE

Software Migrations/ 331

Todd Katz
Programs made for mainframes are en route to the PC.

Surviving An Appia 373

To PC Switchover: Gordon
McComb
Several programs help you convert programs and data.

This Little PC Went To 463

Market: Bruce Nissen
Auto Trader guides you through the commodity markets.

Evaluating Educational 519

Software: Dick Walker
A guide to instructional programs that run on the IBM PC.

Family Roots Puts A 540

Cursor On Your Precursors/
Eric Freedman
Save your family tree and history on disk.

Engineering 567

Applications For The PC/
Steven Rogers
PSI's software packages aid in system analysis.



Report Manager: Not 571

Just Another VisiClone/
Jared Taylor
This three-dimensional spreadsheet handles a wide range of data.

Counting Your Coins/ 599

Eric Freedman
Two numismatic software packages.

BATTLE NETWORK

NETWORKS/BILL MACHRONE

The manufacturers of networks have been sending up smoke signals to let the world know their products are ready.

While it's often true that where there's smoke there's fire, you can get burned, too.





OF THE KISS STARS

Are you ready for networking? Here are a few qualifiers that may help you decide. Do you have several PCs and only one letter-quality printer? Do people line up at the printer to wait for their turn? Are there several PC-equipped "stations" through which work must flow? Are you shuffling disks? Is one PC user creating information to be used by others on their machines? Do you wish all your PCs were XT's or had hard disks?

If you answered yes to any of the above questions, read on; you could be a candidate for a network.

We've seen a sudden proliferation of courses purporting to teach you how to network your micros. A course? How tough can it be? For 3 days and anywhere from 500 to 1,000 bucks, you can learn everything from the history of micros to

network topologies to how to negotiate the contract with your chosen vendor. Maybe there's more to this than meets the eye, we figured.

We read the ads, attended the seminars, and dropped by the booths at the shows. Yet through it all, we had nagging doubts about some of the claims being made about performance, capabilities, and price per work station. Our solution was to assemble in our offices one of every kind of network we could lay our hands on. We were tough with the vendors: "If we can't see it work on our machines in our environment, it doesn't exist," we reasoned. The vendors were cooperative. Some sent technicians, some sent marketers, but all sent networks. Our requirements were simple: just tie two PCs to an XT. This, we figured, was the bare minimum configuration we would want as a foundation for a network. When we actually set them up and ran them, we expected the results to be interesting, and we found more than a few surprises.

In order to test the networks, we

devised a group of standard tasks that would be either real-life examples or measurements that would indicate how the networks were likely to perform in real situations. The first thing we wanted to test was how well the network provided shared access to large, commonly used programs. These could be anything from a word processor to a compiler or a spreadsheet program. We chose WordStar as our benchmark for this test and measured the amount of time necessary to load it over the network from a hard disk file server.

Do you wish all your PCs were XTs or had hard disks?

Our next test was to see how fast we could pump out characters from the printer part of a print server and to what extent

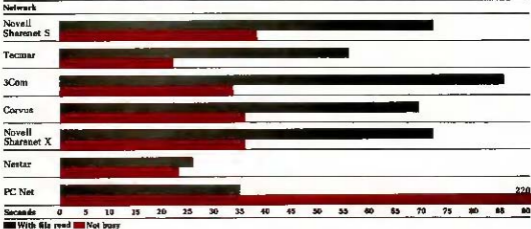
activity on the network slowed the printer part. For this, we built an "infinitely fast printer," which acknowledged characters as fast as they were transmitted and counted the number of characters sent in 1-second or 10-second intervals. A short compiled BASIC program LPRINTed a character pattern continually.

The first of our file-oriented tests was another BASIC program, which continually created files in random access mode. Each record was 1,024 bytes long, and the file length was 20 records. We recorded the time every ten times the file was created. Another test read 20 records at a time from a file of 1K records, and here, too, we checked the time every ten repetitions.

Finally, we combined tests to see what effects they would have on each other. What constitutes reasonable performance in a network? In terms of what a file server can do, it merely needs to be faster than a floppy disk or, if speed is truly immaterial, provide more storage than a floppy disk. Can it live up to its claims? Can it share expensive resources such as fast or

A comparison of the time the networks take to read a file when the networks are not busy and when they are creating a file at the same time.

File Create Time



THE FILE server looks for all the world like a trash compactor. Inside, however, beats a heart of the purest silicon.

letter-quality printers? Can it keep them printing fast enough to be worthwhile? Speed may well be secondary. Who cares how many megabits per second a network can transfer. If it does things wrong?

AST and Orchid PCnet

PCnet is a single product offered by three vendors. Orchid, Santa Clara Systems, and AST have a technology-sharing and cross-licensing agreement covering

their network products. The network consists of a board, coaxial cable, and software. Each board has a settable 16-bit address, so theoretically a maximum of 65,535 devices could share the network, although more than ten may be optimistic. The stated speed of the network is 1 megabit per second, or approximately 100,000 characters per second. We did not test Santa Clara Systems' version of the network, so we will only describe functional differences where they exist.

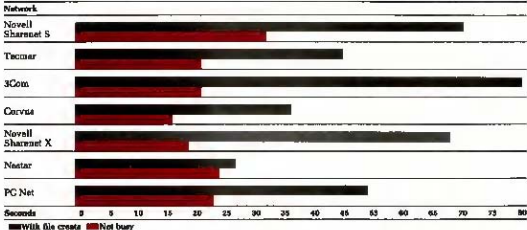
One feature of PCnet is that any PC can be a server or a user. In setting up the system you specify which drives are to be private to the local user and which are to be available on the network. The file server remains usable as a work station. Any station equipped with a printer can be a print server, since each printer is given a network ID, and there is an assignment program that allows you to redirect your print output to any on the network. Security is taken care of at the drive level. If you want to keep a file private, it must be on a non-network drive. There is no real provision

for file sharing, other than having one copy of .COM or .EXE programs available to all users on the network. As with other networks, that means that single-drive or even driveless PCs can be a cost-saving practicality. PCnet provides a convention for locking data files so that they cannot be accessed by multiple users at the same time. This is usually done through latch files, which set a lock flag on a given file while it is in use and relinquish it when the user is finished with it. Since PC-DOS doesn't provide any means of locking or sharing files, PCnet's conventions sit atop PC-DOS—an extra "layer" of checking required before a file can be accessed.

PCnet installed with relative ease on our PCs and XT, after we removed a few cards (a modem, some combo cards, and a non-IBM graphics card), which conflicted with the interrupts used by the AST/Orchid card. WordStar loaded onto a remote PC from the XT in 2.7 seconds with no traffic on the network; the time increased to 5 seconds with our file read and create programs running. The file cre-

Comparing the time it takes the networks to create a file when the networks are not busy and when they are simultaneously reading a file.

File Read Time



ate program took 220 seconds to execute across the network, while the read test took 23 seconds. When we ran them at the same time, the write test went up to 334 seconds, and the read time went to 54 seconds.

Since PCnet modifies the standard DOS running in your PC, it slows down all operations on the machine. For example, a non-networked XT can execute the file create test in a mere 18 seconds. With PCnet running, it increases to 80 seconds, whether or not there is a communications board in the machine. There is a similar effect on the printer. Our printer benchmark, in compiled BASIC, is capable of pumping 840 characters per second out the parallel port. With PCnet running, the speed was immediately cut to 687 cps. The fastest PCnet could send printer-defined characters to another machine was 320 cps—still fast enough to keep most printers more than busy. With the file create running, there was a precipitous drop to an average speed of 80 cps. Adding the write test to the fray cut that speed by half.

A number of findings in our tests indicated that large blocks of writes to disk tend to clog the network, while reads have much less effect. We encountered a major problem in our printer test. Since BASICA and the BASIC compiler were not designed for a multitier environment, they do things to the network that are, at best, impolite and, at worst, intolerable to the network. Chief among these offenses is the whole printer output scheme. First, BASIC doesn't go through DOS as most other programs do; it has its own printer driver. Second, it not only clears the screen when it begins operation, it also resets the printer. If the printer happens to be a shared device, and it happens to be printing, guess what? It stops. Furthermore, a BASIC program that doesn't print "hogs" the printer, since the reset and the driver makes it appear that it is using the printer. Programs with better manners, such as WordStar, merely relay a message from the network control software to the effect: "The printer is busy; try again later."

WordStar and other programs like it

can really be hell on a network system for other reasons. Typically, full-screen word processing programs continually ask DOS whether you are pressing a key. If the machine on which you are running such a program is being interrupted by a network program, you undoubtedly will notice a

IT WAS
*pretty amazing to see
this kind of performance
over two rather
ordinary pieces of wire.*

deterioration in performance.

AST and Orchid recommend use of AST's SuperSpool and SuperDrive spooler and RAM disk software in conjunction with PCnet. While these programs speed things up and lessen printer contention, they make the network a bit more "fragile" and more confusing to set up and operate. In addition to real drives, you also have the option of sharing RAM drives, and you have to remember which is which, especially if you are sharing memory between multiple RAM disks and spoolers. Typical of all the networks in our test, network drives are assigned over and above whatever you have defined in a local machine. So on a normal PC, if you have only the two floppies, the first network drive will be C; on an XT, however, the very same drive is likely to be D. If you have defined one or more RAM drives on the machine, the first network drive goes further in the alphabet.

Santa Clara Systems offers a Network Cache unit for use with PCnet. It consists of a small expansion chassis, which sits above or below a file server PC and contains from a quarter megabyte to a megabyte of error-correcting memory. It buffers disk accesses, which, according to the manufacturer, increases the speed of some operations by a factor of 10. The error-

correcting memory reportedly scans the entire memory several times per hour, checking for and fixing soft memory errors, without interference with normal operations.

A side effect of PCnet's design is that it's hard to get anything done on the server if others are using the disk. The server's network board, of course, interrupts the server's program every time something comes across the network. Given the time it takes to fulfill the response and get back to the task at hand, things slow to a crawl. This phenomenon is virtually unavoidable in collision-detecting networks and raises questions regarding the validity of a file server (at least one as slow as a PC) also running application programs. Santa Clara Systems' Network Cache option would lessen this problem, since accessing data in the buffers would be far less taxing on the file server than a full disk access. Along these lines, AST recommends that programs using overlays be copied down to the user station in their entirety to maximize performance. This presupposes sufficient memory in the local machine to hold it in a RAM disk. The combination of write time and potential lack of room on a floppy makes this alternative unacceptable, and it violates the purpose and spirit of networks.

AST has a new electronic mail package in the works, which was not available when we tested the network. Also, both AST and Santa Clara Systems are working on a multi-document spooling program, which will be ready by the end of the year. This should eliminate any bottlenecks associated with the printer, but we don't know how it will address the reset problem while in BASIC.

PCnet has one nice, rather unique feature: the ability to run jobs remotely from another PC on the network. While such a function may have limited use, it has been developed to such an extent that the slave PC sends a signal over the network when the task you assigned it is complete.

Nestar PLAN 4000

Nestar's network system is noticeably different from virtually every other system

we tested. The heart of the system is the file server. In its sober gray vertical cabinet, it looks for all the world like a trash compactor. Inside, however, beats a heart of the purest silicon. A 88000 with 256K of memory takes care of network administration tasks, while a 60-megabyte Primar drive (the smallest available; you can go over 500 megabytes) stores your files. Topping it off is a cartridge tape drive that backs up the hard disk in 20 or 45 megabyte increments. PLAN 4000 permits as many as 255 PCs to be connected to a file server, either directly or through a concentrator. The network speed is stated at 2.5 megabits per second. Nestar's network is of the token-passing variety, meaning that each device gets its chance to speak in turn, without interruption.

Our first test yielded a 2.5-second load time for WordStar when the network was quiet, and which rose to 4.2 seconds when the file create and read tests were running. We added a third PC to the fray and had three copies of the file create program running at the same time. This only slowed WordStar to 5.0 seconds. The file create time was a quick 24 seconds, which increased to only 26 seconds when the read test was running. The read test took only 24 seconds by itself and 25 seconds while the create was running.

The speaker on the PC "ticks" to indicate that communication is occurring between your PC and the file server; so, even in lengthy data transfers, you know that something is happening. A unique feature of Nestar's system is that it is not limited to PCs. It supports a large variety of microcomputer operating systems, including Apple II DOS, Apple SOS, CP/M, and others. Thus, many different kinds of machines can utilize the file server and share system resources. The print server software for the PC was in beta test at the time of our trial, so we didn't get a chance to write it out. There is a fully developed print server for Apple, and the PC system will work the same way. Our impression of the Nestar is one of quality—albeit expensive—workmanship and high performance. The degradation curve appears to be rather low, meaning that this server

can tolerate heavy activity from many users without becoming objectionably slow.

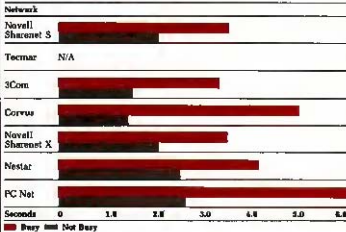
Features abound on the file server. It requires a terminal for operation and needs to be brought up and shut down each day. Operation of the server requires a bit of training and expertise, as there are commands to monitor the file system, backup files, create users, set read/write permissions, and a host of other features. File protection and sharing provisions are good, and there is a sophisticated electronic mail program. Any machine in the network can use electronic mail, regardless of its make, providing a vehicle for interbrand data transfer. Another neat feature is that the PLAN 4000 can act as a gateway to mainframe systems by installing the optional 3270 communications device in the file server. The documentation is in two thick volumes, one for the server and one for the user stations.

Corvus Omninet

Corvus is the grand old man of this test, claiming to be the largest networking company in the world, based on the number of user stations running under their software. We believe them. They were on the scene early with a file server that could tie Apples or 5-100 machines together over a ribbon cable to a host hard disk. They also came up with an innovative backup system for hard disks known as the Mirror, which uses a videotape recorder as the storage medium. Today, they use twisted pair cable for the network, unlike all the others we tested. Still, it pumps 800,000 bits per second across the line and uses a collision detection scheme to keep everyone communicating. Just to be sure that we got the point, Corvus sent us 1,000 feet of twisted pair cable, four IBM interface boards, and a bunch of network connectors (or taps). Installing a Corvus network entails cutting and stripping the cable and

A comparison of load times for WordStar when the networks are busy and are not busy.

WordStar Load Time



Inserting the wires into the tap boxes. You then plug each PC into a tap box. Corvus' manual says they even supply a wire stripper, but we didn't receive one. The Corvus cable looked less substantial than the co-ax, but it was just as effective. The only drawback we were able to detect was radio frequency emission from the cable. It was weak but clearly detectable on our oscilloscope and could be heard in a radio if placed near the cable. The co-ax, of course, showed no such effect. If we were installing a Corvus network, we would prefer to use a more expensive shielded cable, despite the weakness of the radiation. The shields would have to be connected together in the tap boxes, but we think it would be worth the extra effort. Actually, though, it was pretty amazing to see this kind of performance over two rather ordinary pieces of wire.

Corvus' file-locking technique is similar to PCnet's. There is a semaphore, or

flag table, maintained by the file server, and the Corvus-modified BIOS consults it before opening files for read or write. You can set up a read/write permission scheme on a per-drive basis.

Corvus' spooling technique is a bit different from that of the other systems. There is a reserved spool area on disk and a utility program sets up "pipes" to steer printer output or files to the spool area. It stays there indefinitely, until you invoke the despooling program from one of the user PCs on the network. You can specify which queue or pipe to read from, and it is then redirected over the network to the printer on your PC. Alternatively, you can start the despooler and it will wait patiently for files to show up in the print pipe, printing them as they arrive. This makes a PC a dedicated print station, but you can easily interrupt the despooler at any point, use the PC for other tasks, and return it to printing when you are done. Individual

PCs can, of course, print locally without spooling the output. An interesting feature of the spooler is that it uses compression techniques to reduce the size of the files in the spool pipe.

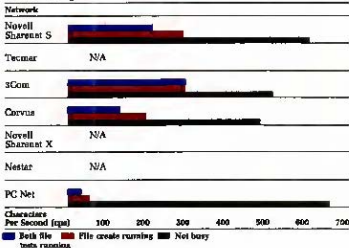
There is an optional electronic mail system produced by a third party vendor:

3COM'S
software provides nifty
page divider sheets
separating one user's
output from another.

for use on the Corvus network. While we didn't have the chance to write it out in our test, we understand that it is a competent package and will be the basis of PCnet's electronic mail system as well.

A comparison of the speed of printer outputs (characters per second) when the networks are not busy, when they are creating a file and when they have both file tests running.

Printer Output



3Com EtherSeries

The only true Ethernet system in our test is 3Com's EtherSeries. 3Com is the Ethernet company. Yes, Xerox has the name and the patents, but 3Com has all the big guys who developed it at Xerox. In addition to a host of products that cover Ethernet applications from mainframes down to pieces of cable, it offers FC-oriented systems in two flavors: one that uses a PC-XT as a dedicated file server and one that uses an Altos 566 as the server. We chose the latter for our test.

The Altos 566 taken by itself is an impressive machine. In its normal guise it is a five-user system with an 6806 running at 10 MHz, half a megabyte of memory, 10 or 30 megs of hard disk, Xenix operating system, and it's fast. 3Com's version is set up as a dedicated file and print server, with the Ethernet drivers, electronic mail, file system, and print spooler all running as tasks under Xenix. For file integrity and security reasons, no users other than the monitor terminal and the Ethernet tap are permitted on the 566. While the software

is capable of handling 100 users, the reasonable number is probably somewhere between 10 and 40, based on the mix of tasks. We tested the 10-megabyte version of the Altos. The 30-megabyte version's hard disk is about twice as fast. You wouldn't see all that much difference in maximum throughput, but the degradation curve would necessarily be lower in the server with the faster drive.

Having a system with real Ethernet rather than an Ethernet-like protocol has important implications. You can hook it up to anything that is supported by Ethernet communications. This means larger computers or entire computer networks, plotters, laser printers, word processors—the works. That's not to say that you plug in a piece of coax, and all is bliss. You still have to consider protocols, passwords, and compatibility, but the potential is there.

3Com's print server is different from the others. Print spooling and output are done from the file server, the Altos 588, in a minicomputer-like manner. It provides a serial port to drive the printer at rates up to 9600 baud. A potential drawback if you already have an investment in PC-compatible printers is that you can't hook them up to the file server, since they use a parallel interface. Your only recourse is to get a serial-to-parallel protocol converter.

The operation of the spooler, interface considerations aside, is quite good. Its overall speed drops slightly as the network becomes busy but stays about the same from that point on. It is similar in many ways to the performance of the Altos when running straight Xenix in multiuser mode. As you can see from the chart, the maximum speed we got over a 10-second interval was 540 characters per second; these actually are bursts at the full 9600-baud rate. That's more than enough to keep all but the fastest printers going full tilt. Ditto for the 320 cps throughput rate when the network was loaded. 3Com's software also provides nifty page divider sheets separating one user's output from another—very professional.

3Com is working with a number of software companies on products that will fit

into the network environment better than the current crop. A database manager derived from dBase II is one, and the entire Vist-series is another. Developments such as these will move networks from being merely convenient to indispensable.

Novell ShareNet X

Novell, like 3Com, produces two PC-related network systems. One, ShareNet X, uses a PC-XT as a dedicated file server, with a network based on Ethernet. The other product, ShareNet S, uses a 8800-based dedicated file and print server in a star topology. Unlike Nestar's PLAN 4000, it uses a multiwire cable to exchange data with the user stations. We'll look at ShareNet X first.

In contrast to PCnet, ShareNet X completely occupies the file server PC-XT.

THERE are few operational differences between ShareNet S and ShareNet X.

The only functions you can execute on the host are network status and a few file server-oriented utility programs. At the time we tested ShareNet X, the print spooler was still under development. Therefore, our tests were limited to file server functions only. Like most of the others, Novell's systems require a modification to PC-DOS on the user stations. It intercepts only those calls having to do with disk drives defined as network drives and passes everything else through to your system.

ShareNet X boasts a 1.4 megabit per second data rate and uses some sophisticated buffering techniques on the XT for speed. For instance, WordStar takes an agreeably quick 1.8 seconds to load across

the network. If you exit and load it again without having done anything else, it loads in only 1.3 seconds—with no disk accesses. It has been buffered in a memory cache on the host XT. We found that it would buffer up to 64K, resulting in some dramatic throughput gains for small or moderate-sized files. The disk caching, combined with a few other nifty techniques, was a clear indication that Novell knows its way around an operating system. Indeed, maybe it should have written DOS 2.0. The utility programs are UNIX-like, providing the gamut of user and file administration functions. ShareNet comes with a neat little programming tour de force called Snipes. It's a classic game in which your character can cruise through a maze, where it shoots a variety of objects and critters. The difference is that when two or more of you play it on the network, you're in the same maze. There you are, happily blasting everything in sight when another user's character glides into your maze and blows you to smithereens. The network version of Snipes runs on monochrome monitors and, in addition to being fun, is indicative of the way data can be shared among multiple stations, given the right programming.

There is an optional electronic mail subsystem, which provides the usual message storage for users and has an "urgent" feature that alerts a user to important messages. Quite a bit of attention has been given to security provisions on ShareNet, allowing users to certain drives, directories, and files. As with UNIX, a user may belong to a group and have all the privileges of the group automatically, while maintaining private files that the rest of the group does not have access to.

Novell's system monitor, the visible portion of the program that operates on the file server XT, is well thought-out. It shows the activity of up to six PCs and gives continuous information on network activity and the number of disk I/Os pending. While some of the information might be described as a little "gee whiz," it certainly keeps you informed.

ShareNet appears to be as strong a foundation as any, given the number of

extensions to DOS that can be coded by a programmer writing application programs. It permits the full range of multifuser functions, including file and record locking, security levels, and hierarchical directory navigation.

Novell ShareNet S

For networks that look so different physically, there are few operational dif-

ferences between ShareNet S and ShareNet X. Like PLAN 4000, ShareNet S uses a 68000 to run the file system. Unlike PLAN 4000, there is also a Texas Instruments 16-bit microcomputer chip for every two users hooked up to the network. It provides sufficient intelligence that communications can be overlapped among stations, raising the overall effective speed beyond the nominal 500,000

bits per second on each line. Remember, ShareNet S is a star configuration, with a direct line running from every device on the network to the server. All user-to-user communications go through the server. You can increase the capacity of a ShareNet S server in increments of six users at a time to a maximum of 24. It uses a terminal, like 3Com and Nestar.

As you can see from the charts, the per-

Definitions for Networks

An explanation of networking terms that appear in the article.

When we say network, we are referring to a generic means of hooking machines together. There are two major types of networks: collision-detecting and token-passing. The former is the idea on which Ethernet is based; that is, each machine on the network has an "address" or code to which it responds. Any machine can send a message (of standard length and format) to any other machine on the network. The recipient of the message replies with an acknowledgment to let the sender know that the message got through okay. If two devices attempt to transmit at the same time, a collision will result, forcing each device to retransmit. Each board pauses a brief, random amount of time before retransmitting, minimizing the chance of another collision. Each board listens for a carrier signal before transmitting, indicating that no other user is on the network, avoiding unnecessary collisions and retransmissions. Since the speed of the network is usually a million bits per second or higher, collisions are not a big consideration to network performance. Even on busy Ethernet systems, it's unusual to have more than a few collisions a day. The formal name for this routine is CSMA/CD, for Carrier-Sense Multiple Access/Collision Detection.

Token-passing networks are based on a

device or central computer that supervises the network, giving each device permission to send information. There are no collisions, since no two devices can transmit at the same time. Token-passing network supervisors usually are capable of balancing the load on the network by telling a very busy sender, "Shut up for a while and let somebody else talk." Neither type of network is limited by the speed at which it can transmit characters, but a megabit (one million bits per second) is typical, and 10 megabits is the maximum you're likely to see. The Ethernet standard covers networks with a speed of 1 to 20 megabits per second.

A network user is a station that uses the resources of the network. An example is a PC with only a floppy disk and no printer. A network server is a device or station that provides resources to the network. There are two kinds of servers, dedicated and shared. A dedicated server may be a PC-XT, which is unusable except by the network. Some vendors provide non-PC computers as dedicated servers. Shared servers also may be used as computers, even though their resources are shared by other machines on the network.

A file print server provides only hard disk to the network. It may be dedicated or shared.

A print server is a station that provides printing facilities to the network. It is shared, by definition, and may be part of the file server.

Print spooling is special software that coordinates and controls printing on the system. It stores characters headed for the printer, on disk or in memory, much faster than the printer could actually accept them, releasing network users far faster than if they had to wait for the printer. The software then directs the characters to the printer or holds it to be despoiled by a user.

You'll see the word node just about everywhere but here. It means any station on the network, whether it is a user, server, printer, or what have you. Its vagueness makes it useless.

Topology is another good networking word, a favorite of uninformed salesmen. It describes the way in which all the devices on a network hook up to one another. Most of the networks you will encounter are based on bus or star topology. Bus networks are simply a transmission medium (coaxial cable, fiber-optic cable, or twisted-pair cable) that runs from one device to the next, in no particular order. Star networks have a separate line running from every device on the network to a network controller or file server.

—B.M.

formance of ShareNet S was slightly worse than ShareNet X for tasks that did not stress the file server heavily. There were strong indications, though, that an XT-based network would be hopelessly bogged down in work that the 68000-based server would take in stride. Once again, the degradation curve becomes important as network loading increases.

Operation of the network from the file server is similar to ShareNet X, except that there are additional commands to handle the print spooler. In operation it is similar to 3Com's, except for additional features such as changing the priority or order in which spooled documents will be printed. From the user's point of view, there is no difference between ShareNet X and ShareNet S. An interesting feature of the ShareNet S interface boards is that they contain a bootstrap program in read-only memory. PCs without any disk drives can thus use the system as intelligent terminals.

Teccmar

Yes, Teccmar has a network, too, and you've been hearing about it for months. At press time, it was just coming out of the lab. Teccmar uses 3Com's communication boards, but shares little else with the 3Com system. Instead of concentrating on the minicomputer-like functions exemplified by most of the other networks in this article, Teccmar chose to exploit other capabilities of Ethernet and some of their other technologies. Basically it has combined voice and data on the same network and integrated it with telephone control hardware and software. The result is a unique communication system, one that nearly defies classification.

The big news with the Teccmar system is that not only can you send voice communications over the Ethernet cable, but you can digitize it, store it, and play it back. At the most trivial level, this means that you can make a PC into the world's most expensive phone answering machine. At the other end of the scale, it is the foundation for a sophisticated phone and communication management system. You can record a voice message on disk (4,000 bytes per second of speech) and

send it to one other person or an entire distribution list. It can play prerecorded messages and record responses for later playback. The digitized sounds can be analyzed or processed to modify the sound. Mostly, though, you'll just want to

THE TECMAR system is the foundation for a sophisticated phone and communication management system.

retrieve them and play them back over a speaker or telephone. The design criterion was for speech quality that sounded as good as normal telephone conversation, and Teccmar has achieved that and. The Ethernet companion board, as it is called, permits attachment of a tape recorder, footswitch, and a few other goodies, in addition to the telephone. Indeed, it can become your telephone, with only the handset plugged into the companion board. The software will dial, record phone usage, time calls, and figure out charges. The voice messaging system is truly a store-and-forward design, so the messages can be moved easily among PCs in the network.

In terms of more traditional networking activities, we caught Teccmar a little early in the design cycle. The software we tested was capable of moving data from one machine to another, but full file- and print-server subsystems were still in beta test. We were, however, able to simulate our file read and file creation benchmarks on the network to test its speed. It proved to be fast, executing the file create test in 23 seconds, while the phone management software was operational (but not busy) in the host PC. While we look forward to wringing out a full-blown data and voice network from Teccmar, the data portion

has taken a back seat to voice. While it appears that their system will have the same functionality as everyone else's, we will have to wait and see. Teccmar's use of the 3Com board would seem to guarantee full compatibility with Ethernet—a potential advantage.

In this new, nontraditional network application, voice messaging, Teccmar may very well have a tiger by the tail. We've used some mainframe-based voice messaging systems, and Teccmar's appears to be every bit as flexible—more so, if you have or will have an in-house PC network.

Documentation

There was great disparity in the quality and amount of documentation available with networks. 3Com's was the best, end, while there wasn't a "worst." PCnet's documentation could have been more detailed and better developed. For instance, in order to use the low-level file-locking protocols available from PCnet's BIOS, you have to request the documentation for that feature from AST or Orchid. There were minor differences in the AST and Orchid versions of the documentation, with the nod for quality going to AST. Only two of the vendors' manuals discussed interrupts and the potential for conflict, and only one of the two gave any suggestions on what you could do about conflicts.

Corvus' documentation, while brief, covered what needed to be said and did it succinctly. It actually went into a fair bit of detail on things like dealing with media defects, programming with semaphores, and even configuration for proper operation with programs like Visicalc and those from the Peachtree accounting series.

We mentioned Nestar's two thick volumes. If they had been typeset instead of typewritten, they would be two moderate volumes or one thick volume. The appearance of the Nestar documentation is not up to the level of professionalism so evident in its product. The contents, however, are just fine. The documentation is nicely broken down into user-oriented and system manager-oriented chapters.

Part of the ponderousness is due to the inclusion of the non-IBM operating system options as well as PC-DOS. There's a fair bit that could be eliminated from this manual for a PC-only network.

Novell's manual is typewritten in a large three-ring binder. It covers everything from physical installation of the system to use of the extended DOS calls for multiuser operation. We were able to review a proof copy of new documentation on the way to the typesetter. It looked even better than the original—more tutorial and detailed.

We said that 3Com's documentation was the best, and it is. It covers all that you need to know about installing and using the product, including some how-not-to's and what to do about it if you've done it wrong. The manual is typeset and index tabbed, with good illustrations where appropriate, something that most of the others lacked. Corvus had the only other manual with effective illustrations.

Conclusions

Throughout this article, you've read

the words new, development, beta test, coming soon, and under development. Our purpose was to separate the snooks

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*appearance of the
Nestar documentation is
not up to the level of
professionalism so
evident in its product.*

from the fire, and there is no doubt that there is a bit of each in networking. You've seen what we've seen—everything from promises to products. Several manufacturers wanted a full mention in this article based on specifications of forthcoming products, anywhere from 2 weeks to 4 months away from introduction. Sorry, guys. Reality was required to make the

team. We grant you that this market will be considerably more mature 6 months from now, but one thing will remain the same: it will be divided between those companies that have their acts together and those who don't. We were frankly surprised that the market is as good as it is, this early in the game.

We didn't really have to call for help in installing any of the systems, but then we're not neophyte PC users. Based on the overall level of documentation, we recommend that if you're interested in networks that you pursue them through a dealer. Indeed, most of these products are available only through dealers. That's to your advantage: you have someone to bang it on when it doesn't work the first time.

Performance numbers: how much do they really matter? One of the networks we tested was clearly the fastest, another undeniably the slowest. Did that make one the winner and the other the loser? We called some users of PCnet, the slowest in our test, to find out if performance was a problem.

Name cited speed limitations as an

| Network | Type | Dedicated File Server? | Terminal Required? | Print Spooler? | Printer Type | Other (Non PC) Operating Systems? | Security 1-Poor 3-Excellent | Ease of Installation 1-Difficult 3-Easy | Cost: Board Server |
|------------|---------|------------------------|--------------------|----------------|--------------|-----------------------------------|-----------------------------|---|--|
| PC Net | CSMA/CD | No | No | Yes | Par. | No | 2 | 2 | \$595 N/A |
| Sharenet X | CSMA/CD | Yes (XT) | No | No | — | No | 4 | 3 | \$595 \$4995 (XT) |
| Sharenet S | Token | Yes | Yes | Yes | Ser. | No | 4 | 3 | \$250 \$8785 (20MB) |
| Nestar | Token | Yes | Yes | No | — | Yes | 4 | 4 | \$595 \$19,995 (64 MB) |
| Tecmar | CSMA/CD | No | No | No | — | No | N/A | 3 | \$1645 (Voice) \$950 \$4895 (XT) |
| 3 Com. | CSMA/CD | Yes | Yes | Yes | Ser. | No | 5 | 4 | \$950 \$12,500 (30 MB) |
| Corvus | CSMA/CD | Yes | No | Yes | Par. | Yes | 2 | 2 | \$495 \$2085 |

MB=megabytes

Considering Cost Effectiveness

When it comes to networks, the price tag depends on more than the cost per work station.

You've decided to buy a network, and you've read all about each system's capabilities and limits. Now you want the bottom line: the best network for your money. For all the networks, cost-per-user levels off at about nine work stations. The seven networks divide into two basic price ranges. Keep in mind that our prices are rough figures and do not include the cost of wire and some utility software.

The lower-priced networks include PCnet, Corvus, and Novell's Sharenet X and S. Obviously, PCnet is the least expensive network, provided you can live with the system's limitations. Although Novell's Sharenet X and Sharenet S basically performed equally, you must remember that the X system is limited to six users. If you have more work stations, the Sharenet S network is better in terms of price and capability. However, the Sharenet X price includes a PC-XT for a

server. The Corvus is cheaper than either Sharenet system and has the extra advantage of accommodating different microcomputers, such as the IBM PC and Apple. The only other network that offers such flexibility between microcomputers is Nstar, the most expensive system we tested. Corvus uses twisted pair cable, which is about one-fifth the price of coax.

Nstar, along with Tecmar and 3Com, are in the higher price range. Nstar remains the most expensive network. However, it includes the largest disk and a tape backup and the price becomes competitive when there are 13 or more users on the system.

The price from 3 to 20 users does not vary much for the Tecmar network. The big advantage of the Tecmar system is its capability for voice digitization. Further, the Ethernet companion board for this function is included with each machine.

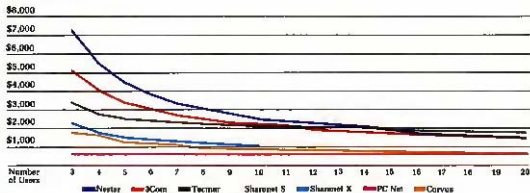
The price quoted in the chart for the Tecmar system also includes an XT server (not dedicated), since we can't imagine using this network without a hard disk. You may prefer Tecmar's expansion chassis and hard disk as an alternative.

The 3Com EtherSeries, which is priced between the Nstar and Tecmar, has several advantages that justify its price. It is the only true Ethernet system, which makes it compatible with many other Ethernet products. The system also has great flexibility, because it is fast and can accommodate many users. The system also has numerous powerful utility programs.

The advantages and disadvantages of each network must be weighed against price. The bottom line is that the least expensive system may not be the one for you.

—Lisa Ellen

Cost Per User



obstacle. One user, who was using dBase II across the network (although not in multi-user mode) liked the ease with which it could be accessed from any terminal. She had set up the recommended batch files to lock data files in use, and while the process was a little unwieldy, she found it effective. Most users liked the low cost of PCnet and because of it, were willing to live with its other shortcomings. One user

cited difficulty of installation, mentioning conflicts with other boards in the system using the same interrupt.

We found this to be a problem with network boards as a whole, not just with PCnet's. There are precious few interrupt lines available on the PC, and there is no agreement on which manufacturers or functions will use what line. Expect some problems if you have various multifunction boards in your PCs. Expect more problems if you have the older, 64K system board. Oh, you'll get it to work, but you may wind up disabling COM2; or some such thing on the system. Another problem that surprised us was the poor quality of coaxial terminations on all but the 3Com cables. After experiencing some flaky behavior, we hooked random pieces of coax, supplied by the manufacturers, to the oscilloscope and a signal source. We found lousy, attenuated cables, bad joints, and general junk. Overall, the quality was bad enough that we couldn't single any manufacturer out as a culprit. Maybe these cables have been to a lot of shows and have been abused, but we didn't expect them to be this bad. In any case, they are something for you to look out for if you find yourself in the market.

We were glad to hear that 3Com is supporting the efforts of software houses to produce network-compatible products, such as database managers and spreadsheet programs. Doubtless, other network vendors will follow suit. We fear, however, that such efforts are subject to repetition, if not to failure. MS-DOS is not a multi-user operating system. Each network vendor adds his own extensions to it, and the software authors must conform to these extensions. Perhaps the next release of DOS will have multiuser extensions that remove the dependencies on nonstandard DOS calls. Maybe there even will be a standard way to recognize and integrate calls to a nonlocal resource, such as Digital Research's CP-Net or some of the distributed processing schemes found on minicomputers. Until then, distributed databases will be unlikely, and you may have to buy your database manager and other software from the network vendor or

his dealer if you want full utility.

There are large disparities in the effectiveness of security provisions on the various networks. Some, like PCnet, are strictly for people who like each other and understand the way things work. Corvus' protection scheme is in the same league, maybe half a step up. The big boys in file protection—Nectar, 3Com, and Novell—are all very minicomputer-like, with security provisions that most resemble VAX VMS or UNIX. The system administrator has complete control over group and user permissions, use of system facilities, and the like. Users are adequately protected from one another and from themselves. These high-end systems, especially 3Com and Novell, also have the best print-queueing facilities, if use of a serial printer isn't a drawback. (See the chart for a complete

Product Information

For list prices of the products, see chart.

Corvusnet

Corvus Systems, Inc.
2029 O'Toole Ave.
San Jose, CA 95131
(408) 946-7700

CIRCLE 548 ON READER SERVICE CARD

Plan 4000

Nectar Systems, Inc.
2582 East Bayshore Rd.
Palo Alto, CA 94303
(415) 493-2233

CIRCLE 547 ON READER SERVICE CARD

EtherSeries

3Com Corporation
1390 Shorebird Way
P.O. Box 7390
Mountain View, CA 94039
(415) 961-9602

CIRCLE 546 ON READER SERVICE CARD

Slipnet

Tecmar, Inc.
8225 Cochran Rd.
Solon, OH 44139
(216) 348-0600

CIRCLE 545 ON READER SERVICE CARD

Sharenet X and S

Novell, Inc.
1170 North Industrial Park Dr.
Orem, UT 84057
(801) 228-8202

CIRCLE 543 ON READER SERVICE CARD

PCnet

Orcid Technology
47790 Westinghouse Dr.
Fremont, CA 94539
(415) 480-8386

CIRCLE 542 ON READER SERVICE CARD

OUR
purpose was to separate
the smoke from the fire,
and there is no doubt
that there is a bit of
each in networking.

(listing of usable printer types.)

Overall, our tests were very enjoyable. It was a real pleasure to use most of these networks. As we said before, they were, overall, surprisingly good. Oh, we have our complaints, but they're mostly the result of immaturity in the marketplace. We anticipate, though, that the good ones will get better and that there will be some quick-and-dirty entries in the market, whose only claim will be low price. Our advice: Assess your needs carefully, make your choices, and don't be afraid to pay for the capabilities you need. /PC

Editor's note: See also "Getting hooked on PCnet," and "Getting the Net Working," in this issue.