IBM'S NEW PERSONAL COMPUTER

Everyone and his brother is giving his computers 3270 capability. IBM, we hear, is thinking of a different approach. Why not give all its 3270s PC capability? This would be easy enough to do with the mere addition of an Intel chip -- the 80186, say.

We don't know much more than that, but it's interesting to muse about.... There are about 1.5 million 3270 programmable terminals installed, we estimate, and about 40,000 being added each month. With that installed base, mostly in large corporate accounts and by definition with communications capability, IBM should further tighten its grip on the corporate PC marketplace. Mind you, not every 3270 is magically going to sprout PC characteristics. DEC, for example, has offered a CP/M capability upgrade for its VT-100s, called VT-180 (or the Robin), since early last year, but its lackadaisical marketing effort for the product has probably converted less than one percent of the 300,000-plus installed base.

The significance of this within the internal IBM marketplace is intriguing as well. As we noted last month (Rosen Electronics Letter, Dec. 20), we expect IBM eventually to bring the PC back into the company's mainstream from its present tenuously controlled outpost in Boca Raton. Now IBM's mainstream has a PC too.

A PRIMER ON NETWORKS

With our plans for a winter sojourn in Jamaica fallen through, we cast about for another way to escape the real world -- and came upon the study of local-area networks for microcomputers. At present, this is mostly an academic area, although there are indeed some local-area networks in operation (about 20,000, with the vast majority devoted to microcomputers). To simplify a little, here are some major areas of study:

- What is a local-area network? Could any other approach serve as well?
There's a lot of disagreement around this issue, with many vendors claiming that their competitors are selling only components of a network, or dial-up communications links that don't constitute a true network at all.

- What are the purposes of a local-area network? Sharing of peripherals and processing resources; sharing and transfer of data; communications, especially between incompatible systems; incremental growth.

In assessing a particular network, one must ask:

- How fast and far does the network run? What applications can it handle? Does it allow linkage of incompatible systems?
- Can different nodes share processing power, or only data and peripherals?
- What must the user know and do in order to use the network?

From a vendor's point of view, the questions are quite different. Taking it as a given that he should adopt some standard (only IBM has the clout to set its own), the list begins with:

- Which standards should I adopt?

But the most interesting question of all is that asked by the financially-interested observer:

- Who is the vendor? Who will make money off the proliferation of networks? Will it be chip vendors, like Intel and Seeq? Network vendors, like Nestar, 3Com or Corvus? Or will it be the usual suspects, the equipment vendors, like Datapoint, Apple, IBM? Are the network companies in fact becoming equipment companies?

In the dissertation that follows, we'll discuss some of these theoretical questions and then briefly describe a few of the market participants.

The Structure of the Network Business

Right now the network business is barely structured. It consists of a variety of participants espousing different approaches, many of them crossing over into each other's territories. There are the components makers, such as Intel and Seeq Technology; the pure-play micro network sellers such as Nestar, 3Com and Corvus; the high-end integrators, such as Sytek and Ungermann-Bass, who don't sell peripherals; and the equipment sellers, such as Apple, Datapoint, Tandy, Xerox. And then there are the hapless retailers and dealers trying to put all this stuff together -- de facto integrators.

How much does a network cost? Too much in both dollars and knowledge. A network should operate like mayonnaise -- an invisible ingredient whose presence somehow integrates all the other elements. People do not specify mayonnaise when they order sandwiches, nor do they pay separately for it. In the long run, we expect, this will also be true of local-area networks: Kraft or Hellmann's, IBM token-passing or Ethernet -- all the customer demands is that it work.

At the moment, this isn't so. Users are caught up in discussions of token-passing vs. carrier-sense, multiple-access/collision-detection (CSMA/CD), broadband vs.
baseband -- none of which should have any meaning to them. (The users we mean here are individual and small-company users, rather than big-company MIS departments, who are in essence in-house systems integrators.) But, if you're paying $10,000 or more per station for something, it's natural you should want to know a little about it. Likewise, if a vendor is paying that amount for something, he doesn't want just to bundle it as another nice feature; he wants to highlight it and make a full margin on it.

It's like 8-bit vs. 16-bit discussions: There are enormous differences in power and other capabilities, but there are so many other variables that this distinction merely gives users an illusory sense of knowledge. What is more important to users is the elusive area of software connections where the ability to link systems -- let alone standard ways of doing so -- is still touch-and-go.

The natural thing would be to include network capabilities in systems as they are sold, but costs right now generally won't permit that. There's also another force working against bundled-in network capabilities: users' pesky insistence on buying their computers from more than one vendor.

The Structure of Network Connections

It's fairly easy to connect identical computers, and ship data back and forth. As long as they are multi-user, they can even share processing power, albeit sometimes only clumsily. The interesting part comes when you try to make them do so automatically ("transparently"). It's one thing to access a remote data base; it's another thing to ask for a file and leave it to the system to find it. Likewise, it's one thing to notice your machine is overloaded and borrow a friend's down the hall; it's another thing for the system to notice you're overloaded and automatically switch you to an idle node (and with permission?).

Another level of complexity shows up when the machines connected are not alike. There are three (major) points of variation: the processor itself, the operating system, and the applications. Networks simply make the issues of "integrated" software and standard operating systems more pressing (although they can overcome physical disk incompatibilities by allowing otherwise compatible programs to be transferred from a 5.25-inch-disk machine to 3.5-inch-disk one).

If you have integrated software, which implies standard data formats for a variety of applications, you can move data from one application to another, whether on the same machine or a different (but identical) one. If your different machines are of different architectures but use a common operating system, you may still have problems moving from application to application, but you can share some files easily. However, most Apple-DOS-based applications files can't be automatically read by, say, an IBM PC-Dos-based version of the same application, because each version of the application is configured differently and generates different file formats for each target machine/operating system.

This means that if you have similar processors, you might as well use a common operating system.... However, even if your Apple and your PC use the same operating system -- CP/M, say, or the UCSD p-System -- you can still run into trouble when you start dealing with hardware-specific things such as graphics and printer protocols.

(text continues on page 6)
to make serious headway against WordStar, PFS:Write, Volkswriter, VisiWord, Micro-
soft's Word, et al. Fortunately Einstein has the open-mindedness to offer its
EinsteinLetters as ASCII files, for use with all these other word-processors.

One feature of the EinsteinLetters is helpful annotations which automatically fail
to print out, as in "[State the reason for your disappointment.] My poodle failed
to arrive as promised." The flavor is quite different from Letterform's, with
Einstein's efforts far more tongue in cheek and specific, while Letterform offers
mostly generalities and even blanks that the user can make specific. In addition,
Einstein has a limited thesaurus, offering synonyms for "sincerely," for example,
or eight other ways to say "disappointed": displeased, angered, dissatisfied,
perturbed, discouraged, disgusted, frustrated, embittered.

Gold-Letters, like Letterform 1000, is simply text files, but with only 101
letters for $159. For $495 total, you can get WordStar thrown in. Its vendor,
Data Base Industries, is a small software house in Escondido, California. We're a
little dubious of the product's consistency, since Gold-Letters is spelled both
with and without a hyphen in the same flier.

For the imaginative

Another interesting word-processing-related product (not a template) is Living
VideoText's ThinkTank, an aid for creative writers. The chief attribute of
ThinkTank is what data base management systems call a zoom feature -- the ability
to mask or reveal different levels of a hierarchically structured document. Thus
you can compress an entire outline into the title, or you can extend it to its
full extent, with several levels of heads, subheads, etc., and paragraphs at the
lowest level. This can be done selectively, with one subsection expanded while
the rest are compressed, so that the writer can write or edit while still seeing
where he is in the context of the whole document. ThinkTank can also do tables of
contents (with specifiable levels of detail) and indexes. TT has its own word-
processor, but it can also be used with the usual WordStar, PFS:Write, and other
word-processors. The product carries out its promise of making the user a tidier
thinker, as opposed to writer.

To market, to market

All of these products need a little glamorizing. All are interesting and useful,
but suffer from limited promotion. The first three are probably more immediately
practical and will save more energy for more people than ThinkTank (just as
spreadsheets do greater amounts of useful work than TK!Solver, a fundamentally
more interesting product). ThinkTank, on the other hand, is a fine example of
using computers to enhance qualitative, not just quantitative, productivity.

Dear Will, I'm sorry I missed you last weekend at Softeach Chicago, but
Dear Mrs. Hollowhead, We were surprised to hear about your exploding
Dear Bill Goodm: We are delighted to inform you that you have just won
Dear Mush-for-Brains: After examining your recent shipment to us of 200°
Dear Jay Prufrock Lingerie Company, On May 9 I ordered a pair of black lace
Hi there! Do you wish you had more friends, a better job? Then you'll
Dear Mr. Wilkes: Re #4536177327998. Your so-called automatic teller machine
Dear Occupant, I'm sure you know how much we value you as a subscriber,

"Copyright Apple Computer

RELease 1.0, September 12, 1983"
HERETH A BRIEF DISCOURSE ON THE INTERNATIONAL STANDARDS ORGANIZATION'S REFERENCE NETWORK MODEL, WHICH SHOULD MAKE DISCUSSION EASIER. (NOTE THAT THE ISO MODEL IS NOT ITSELF A STANDARD, BUT MERELY A WAY OF CLASSIFYING (WOULD-BE) STANDARDS. MOREOVER, FEW PROTOCOLS FIT PRECISELY INTO THE ISO LAYERS, WHICH ARE THEMSELVES ONLY LOOSELY DEFINED.)

In essence, a network works on many different levels. Thus, the "typical mainframe protocols" shown in the table opposite can be used in conjunction -- or they can be matched up with other protocols not listed. (On the other hand, some approaches at one level require certain criteria at another level: Ethernet's two layers, for example, are inextricably linked.)

The layers start with the physical transfer of data -- wire (baseband or broadband, twisted-pair), radio wave, optical fibre, tin can & string -- and how it gets into and out of the node. Then there's the format of the data links: in packets of varying lengths and configurations, with addresses and end-of-message sequences.... Each layer encapsulates and depends upon those below it. The list goes as follows:

**Application layer** -- end-user applications which employ lower-level communications facilities (e.g. Advanced VisiCalc, electronic mail)

**Presentation layer** -- file conversion, translation of character sets, byte sizes, from one format to another; in short, mapping machine-dependent data formats into a virtual representation and back into another format

**Session layer** -- procedures for recovering if a session (connection) fails at lower levels; fail-soft conventions

**Transport layer** -- byte stream management (includes error detection and correction, etc.) to ensure reliable data stream

**Network layer** -- routing conventions for datagrams (packets); addresses

**Data link layer** -- access methods: token-passing, CSMA/CD, -CA; packet framing conventions: length of packets, format of headers and trailers

**Physical layer** -- transmission medium: voltages; broadband vs. baseband

The choice of the two lowest levels should depend on criteria such as the system size, intensity of use, delay-tolerance and financial position of the purchaser. Because networks can be linked together -- easily if the network layers are compatible -- a single user may well operate several different kinds of networks for different segments of his business, and link them all together with another network or perhaps a PBX. (Datapoint, with its ARCnet and its ISX, is a big proponent of this approach; so is Ungermann-Bass, with its compatible broadband and baseband networks.) However, the purists contend, a network of networks is not a true network, because time delays and the like interfere with the closeness needed for remote nodes to look local.

The choice of the rest of the levels depends on whom you want to talk with; there are few clearly established standards, and even those are more guidelines or prototypes than concrete implementations.

Most "network" systems address only some of these layers, leaving selection or desiging of the rest up to the user or systems integrator. In particular, the software-intensive top layers are the most complex, the most confusing, and the least standardized.
<table>
<thead>
<tr>
<th>LEVEL</th>
<th>VENDOR OR STANDARD</th>
<th>7 - Application</th>
<th>6 - Presentation</th>
<th>5 - Session</th>
<th>4 - Transport</th>
<th>3 - Network Protocol</th>
<th>2 - Data link</th>
<th>1 - Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical mainframe standards</td>
<td>3Com</td>
<td>coming soon....</td>
<td>Datapoint applications</td>
<td>electronic mail, etc.</td>
<td>Concept applications</td>
<td>Concept applications</td>
<td>Ethernet</td>
</tr>
<tr>
<td></td>
<td>ASCII or EBCDIC</td>
<td>3Com</td>
<td>XNS</td>
<td>RMS</td>
<td>PLAN 4000</td>
<td>Constellation</td>
<td>Constellation</td>
<td>Net/One</td>
</tr>
<tr>
<td></td>
<td>XNS</td>
<td>XNS</td>
<td>RMS</td>
<td>PLAN 4000</td>
<td>Constellation</td>
<td>Constellation</td>
<td>Net/One</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECMA or TCP</td>
<td>XNS</td>
<td>XNS</td>
<td>RMS</td>
<td>XNS</td>
<td>nothing—not a true ISO &quot;network&quot;</td>
<td>Omnitel</td>
<td>Net/One</td>
</tr>
<tr>
<td></td>
<td>X.25 or Internet Protocol</td>
<td>XNS</td>
<td>XNS</td>
<td>RMS</td>
<td>XNS</td>
<td>nothing—not a true ISO &quot;network&quot;</td>
<td>Omnitel</td>
<td>Net/One</td>
</tr>
<tr>
<td></td>
<td>HDLC or SDLC</td>
<td>Ethernet</td>
<td>Ethernet</td>
<td>Ethernet</td>
<td>ARCnet</td>
<td>ARCnet</td>
<td>switched access</td>
<td>Ethernet or CSMA/CA</td>
</tr>
<tr>
<td></td>
<td>RS-232</td>
<td>Ethernet</td>
<td>Ethernet</td>
<td>Ethernet</td>
<td>ARCnet</td>
<td>ARCnet</td>
<td>flat cable, RS-232</td>
<td>twisted pair</td>
</tr>
<tr>
<td></td>
<td>Ethernet</td>
<td>3Com</td>
<td>Xerox</td>
<td>Datapoint</td>
<td>Nestar</td>
<td>Corvus</td>
<td>Corvus</td>
<td>Unger-</td>
</tr>
</tbody>
</table>

VENDORS OR STANDARDS: Ethernet 3Com Xerox Datapoint Nestar Corvus Corvus Unger-Mann-Bass Net/One
Rather than accept the recession gratefully, company management attempted to convince themselves and Wall Street that they were invulnerable, so that reality, when it came, found the company defenseless.) The second is being remedied as the company offers the use of ARC technology under license to other system vendors. As Xerox, Intel and Digital Equipment have amply demonstrated with Ethernet, the best way to create a standard is to let others use it. An initial effort with Tandy has been delayed for vague reasons, but the first outside implementation of ARCnet is up and running on Nestar customer sites. (See below.) Interestingly, this offering is a combination of ARCnet for the physical connection and the Xerox Network System for the software protocols.

The point here is not Datapoint's technology, however, but its strategy of making the network an integral part of its offerings, including its RMS operating system which incorporates ISO levels 3 to 6. (In fact, this approach enabled it to exploit 8-bit technology way beyond its natural limits while other vendors were forced to turn to 16-bit and even 32-bit machines.) Although the strategy turned out to be no charm against mistakes elsewhere, Datapoint, a premier marketing company, has grasped the essence of the network business: It's a capability that contributes to hardware sales.

Just as Datapoint earlier led the rush to "distributed data processing" (a vague term that implies the use of two or more computers rather than a single computer with terminals), so now every company offers its own "--NET."

The Issue of Vendor Specificity

Dealing with cost is one thing; all it requires is space-age technology, pains-taking chip design, and world-class quality control. Dealing with intervendor links, by contrast, is a software problem, and one that requires different software for each vendor. Also, many vendors are not eager to develop that software. Again we get into the open vs. closed issue: Is it better to control all the networks using your equipment, or to sell more equipment both because your equipment works on others' networks and because your networks are more popular given their accessibility to foreign equipment?

The slow resolution of this issue is creating a nice window for vendors such as Corvus, 3Com, Ungermann-Bass and Nestar, who sell cross-vendor networks, while people like Apple and Altos sell their own proprietary systems. But Apple and Altos, among others, are using Ethernet -- although not necessarily exclusively. And Ethernet is only part of a network. In the long run we expect to see the micro world follow the mainframe world, where companies like NCR, Burroughs, and Honeywell all boast that they offer IBM communications protocols and file conversion software at the higher network levels.

Although even for some IBM systems the standard physical and data link protocols may be Ethernet (which is already available from 3Com for the IBM PC), the higher levels of everyone's interfaces are likely to revolve around IBM formats. Virtually everyone -- including some who've already announced it -- is working on incorporating the IBM 3270 protocol, among others, into their equipment. (We expect IBM itself eventually to support Ethernet as well as the token-passing approach.)

Thus the multi-vendor problem is not actually a communications one at all, to be solved by network vendors, but rather the same old compatibility issue. Communications just makes it more pressing.

The Rosen Electronics Letter, January 6, 1983
Back in the Real World: Pseudo-Networks

Right now, networks are still in their infancy, and are being sold one-by-one rather than as a standard offering. In the personal computer world, the first networks were actually peripheral-sharing arrangements — even now frequently a perfectly adequate solution to users' needs. This is the approach taken by Corvus with its Multiplexer network, way back in 1979 when it was simply looking for a way to help its customers afford a hard disk by sharing the cost among several workstations. (In those pre-floppy days, a hard disk was especially useful for storing programs, which came exclusively on tape.) Hook up a printer or a hard disk to several users, and you can share data and expensive resources simply and cheaply. You can even send mail (as long as your users remember to query the hard disk to see if anything is there for them.) What you cannot do is share processing power or communicate directly with other nodes.

Another useful function is simply to be able to access a mainframe. The RS-232 connection, a standard physical interface, has been used for this purpose for years. Plug it in, and you're on-line. RS-232 connections are widely used also as the access method into networks. This somewhat defeats the purpose of networking as RS-232 is very slow — rarely more than 20 kbps, vs. up to 10 Mbps for Ethernet. The advantages are (one) you can multiplex several nodes onto a single RS-232 port and save connection costs, and (two) there are a lot of machines out there that already have RS-232 ports. Many of Ungermann-Bass' networks and Corvus' Multiplexer, among others, use RS-232. (For Ungermann-Bass, it's an access method to the network; for Multiplexer, it's part of the network.)

But there's still the problem of comprehensible communication once you're linked up. For years terminals vendors have been selling IBM-3270 compatible terminals; now most personal computer vendors offer 3270 emulation, as do a host of third-party software vendors. Another company in the terminal emulation market, Datalex Co. of San Francisco, uses the UCSD p-System, enabling its software to work on many different microprocessors and connect with variety of mainframes.

The trick, however, remains to share programs and capabilities as well as data; that takes protocol conversion capabilities that are harder to supply. So far, most of these offerings merely provide for transfer of data.

One of the few existing products at the micro-mainframe application-linking level is the Peachtree/MSA software offering. This is a very specific applications-oriented approach, dealing only with the top levels of the ISO model — the ones that users and resellers are usually left to struggle with after their network is set up. Sure, I can shift data around, the user asks, but what can I do with it once it gets there? PeachLink (in conjunction with the other MSA packages) lets him do accounting, financial modeling, word processing, etc. It allows for the transfer of formatted files between mainframes and micros, so that data manipulated and formatted under one system's applications are meaningful to the other. The physical construction of the network is left to the hardware vendors.

A more generalized module, for micro-to-micro conversion, comes from Alpha Software. It translates Apple II and IBM PC files back and forth, and also offers electronic mail. For $195 retail, it's a nice package, although we expect this function to be subsumed by the network vendors in time.
The Real World: True Local Networks

Right now the leaders are Corvus in units, with about 6,100 installations (including 4,000 Multiplexers), and Nestar in revenues, with about 600 installations at a higher unit price. 3Com has about 2,000 Ethernets out there, to somewhat less than 1,000 from Ungermann-Bass and about 1,000 from Xerox, Intel and DEC combined. (Datapoint leads both with close to 5,000 networks installed, but it is not really in the microcomputer market.)

Corvus, a public company, offers Omninet, a true local network, in addition to the Multiplexer. Both these systems use the same higher-level networking software, called Constellation, which surrounds the operating systems of several supported machines. (Each OS requires a different version.) Constellation handles such invisible-to-the-user functions as peripheral drivers (making remote peripherals and resources look local to the OS) as well as hooks for user-implemented utilities such as electronic mail, printer spooling, and the like.

But these "networks" by themselves account for only about 15% of Corvus's revenues (which were $27 million in the year ended last May), and the company has now come out with the Concept, a classy 68000-based workstation. Corvus began life as a hard-disk company and recognizes that as the cost of networking goes down, it needs to add new lines as well as more units to keep revenues growing. The answer: Sell the workstations as well as the network.

Nestar, a private company, beefs up its revenues by supplying a lot of software along with its network components. Nestar started out with Cluster/One Model One 1979, a limited-function disk-sharing system which supported Apples, TRS-80s, PETS. Next came Cluster/One Model A, which links up Apple US and ///s using CSMA/CA (collision avoidance).

The company's most recent offering, announced in November, is PLAN 4000. PLAN 4000 uses a combination of Datapoint's ARC technology for the physical data transfer (ISO levels 1 and 2), and the Xerox Network System protocols for message handling and various other software issues (levels 3 and 4). PLAN 4000 supports the top three levels with its own format conversion routines that enable Apples and IBM PCs with a variety of operating systems to transfer data files, and with applications such as electronic mail. Also part of PLAN 4000 are file servers and communications servers offering Telex, 3270 and 3780 emulation. The system runs at 2.5 megabits/second, ten times the speed of Cluster/One.

Of Nestar's revenues of about $10 million (our estimate) in 1982, roughly 60% came from network peripherals, 40% from network cables, cards, and the like, and 20% from software. Harry Saal, president, estimates Nestar gets about half the price paid for each network; the workstation vendor (typically Apple) gets the rest.

3Com is the first one on the block with a real-live chip-based Ethernet controller for the IBM PC, courtesy of Seeq Technology. 3Com's network interface unit, supporting various Ethernet protocols, costs $950 and fits into the processor it supports; its file server, off which it's likely to make a lot more money, costs $11,500. Then there's the software, for print-spooling, electronic mail, disk-sharing and the like.

3Com is partially an OEM company, with a recently-announced contract from Apple a big feather in its cap. The contract's size is big enough to be kept secret, but it means that Apple will look to 3Com as a supplier of local-network offerings for
the Apples IIs and ///, the Lisa, and whatever else might fall off the tree. 3Com also has an off-the-shelf product, its IBM PC hookup, that it distributes to retail dealers and others through TecMar, a Cleveland distributor and maker of a host of IBM PC equipment. (TecMar's president, Marty Alpert, is the man who fingered some of IBM's allegedly treasonous employees.)

Ungermann-Bass is a catholic-minded network integrator whose Net/One network management software (ISO levels 3 to 6) interacts with a variety of physical network arrangements, including mostly Ethernet as well as CSMA/CA protocols and token-passing; and baseband, broadband and fiber optics. Net/One also offers gateways into a host of long-distance networks and IBM communications protocols.

Although it began life more as a mainframe-oriented outfit, Ungermann-Bass is extending its reach to include micros now that it has an Ethernet chip developed with Fujitsu. The focus is still on large installations at large companies, however. U-B, a private company, had revenues of about $12 million in 1982 and hopes to double that this year. Its largest single source of business is Xerox, for whose customers it sets up networks under an OEM agreement.

Ethernet is neither a company nor an actual network offering, but rather a standard (specifying only ISO layers 1 and 2) which actual networks may incorporate. Ethernet is being promoted jointly by Intel, DEC and Xerox. (Much of it was developed at the Xerox Palo Alto Research Center (also home of the Xerox Star) by Bob Metcalfe, now chairman of 3Com.) We estimate that there are 4-5,000 Ethernet networks in existence, only about 1,000 of them sold directly through Xerox, DEC or Intel. Given that the network layer (among others) isn't specified, not all "Ethernet" networks work with each other, but bridging the gaps is relatively easy -- and a good source of business for companies such as Bridge Communications, which sells gateways between similar and dissimilar networks, such as Ethernet and X.25 long-distance networks.

Xerox is now trying to make standard an upwards extension of Ethernet, called Xerox Network System (XNS). So far, levels 3 and 4 are fairly well-defined, and are used by Interlan and 3Com, among others. But the topmost layers of XNS haven't yet shaken down, and so each company uses its own protocols on top.

More to Come

Many vendors, including converts such as HP and Data General, are rallying around the Ethernet standards, as announced in the recent 15-company endorsement of the IEEE 802 standards (acknowledged as substantially similar to Ethernet). Other companies such as Datapoint and its followers (and soon IBM) have adopted token-passing. These implementations may not be the best in the world, and they're certainly not final, but they do give you someone to talk to.

And, that, after all, is what networks are all about. They're not a product in themselves; they're facilitators. They facilitate communication, they facilitate sharing of scarce resources for the customer, they facilitate sale of expensive resources such as processors and peripherals for the vendor.

The Rosen Electronics Letter, January 6, 1983
Or, to put it more intelligibly:

<table>
<thead>
<tr>
<th>Identical ..... at each node</th>
<th>Degree of compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU, OS, applications</td>
<td>Everything</td>
</tr>
<tr>
<td>CPU, OS</td>
<td>Need &quot;integrated&quot; applications line-up</td>
</tr>
<tr>
<td>CPU, applications</td>
<td>Easy transfer of data except for hardware-oriented items, typically graphics</td>
</tr>
<tr>
<td>CPU only</td>
<td>Limited communications, need file conversion</td>
</tr>
<tr>
<td>OS only</td>
<td>Easy except for hardware-oriented items, graphics; need file conversion to join &quot;unintegrated&quot; applications</td>
</tr>
<tr>
<td>Applications only</td>
<td>Need file conversion</td>
</tr>
</tbody>
</table>

In other words, there are different levels of compatibility and they are not cumulative.

What this all means is that networks are going to accelerate the trend towards standard or portable operating systems. (VisiCorp's new Visi operating environment, written in the portable C language, is an example of this trend. N.B. that portability in this context means it's easy to convert the OS or environment from one machine to another — thus making it easier for it to become standard.) A large corporate user with Apples, IBMs, Displaywriters etc., all over the place, can just slap on the UCSD p-System and he's set — almost. Or he can wait a year or so, and by then most machines will have some kind of MS-DOS option. As buyers of new machines have to deal not just with moving data and software from old machines, but also with communicating with that installed base, it will get harder and harder to justify the use (or sale) of machines without standard operating software.

Lowered Costs Will Change the Structure

The cost problem at least won't last for long. Datapoint's once proprietary token-passing (plus other attributes) chip, made by Standard Microsystems, is now publicly available (and in use at Nestar). Seeq, in conjunction with Silicon Compilers and 3Com, has not just announced but is also selling its Ethernet chip. This chip, publicly available, is part of 3Com's EtherSeries which now connects IBM PCs (and will soon connect the full range of Apple machines under an OEM contract with Apple). Ungermann-Bass will be using an Ethernet chip from Fujitsu. IBM, with some implementation help from TI, is working on a token-passing controller chip. These developments, first, drop the cost per connection potentially well below $1,000, and second, make the stuff small enough to fit inside, rather than next to, the workstation, file server, or whatever.

The best example of this is what Datapoint has already been doing since 1977 with its ARCnet (for Attached Resource Computing network). The company began by offering RIMs (resource interface modules) that stood between each node and the network, which was made of co-ax cable (or, on occasion, infrared connections). Later, the RIMs got smaller and cheaper (from $1,500 down to $250, roughly), courtesy of Standard Microsystems, and sat inside most of Datapoint's boxes.

Providing a Bandwagon for Others to Board

Datapoint, however, made two mistakes. One, not our concern here, had to do with internal management controls and led to the company's current earnings problems.
IBM ADOPTS INTEL

Everyone is scared of IBM, so what's IBM scared of? The Japanese and the U.S. government. Liberated from one fear by the abandonment of the U.S. government's antitrust suit, the company that is known as IBM Nation in the land of Japan Inc. has made a move to secure a domestic source of semiconductors against the depredations of Japanese competition. This move, the direct purchase of a 12% interest from Intel, indicates IBM's desire both to share in and to enhance the company's future. The $250 million (6.25 million shares at $40 apiece) IBM is laying out goes directly to Intel, rather than to other shareholders (whose percentage interest is diluted although their book value per share will rise from about $12 to almost $18).

This is not IBM's first aggressive move in the wake of the U.S.'s capitulation a year ago. It has already showed a new fierceness in competitive practices such as software sales via third parties, leasing arrangements, purchases of some German instruments businesses, and its information services network. But the move to link up with Intel (although it is stopped out at 30% of the company for eight years) is by far the most notable.

One of our more cynical friends suggests IBM is trying to focus attention on the Japanese so that it can monopolize the U.S. market. Although IBM doth perhaps protest too much, that's one of many interpretations that probably partake of some truth. Another:

IBM genuinely wants to nurture a semiconductor supplier. This seems absolutely clear. Intel is IBM's biggest outside supplier of advanced technology semiconductor components, and its semiconductor fabrication capabilities are leading-edge. To the extent that the data-processing business is becoming both more chip-intensive on the one hand and more people-intensive on the other (what with smaller unit sales), IBM sees Intel as an important factor in its own business.

Meanwhile, the semiconductor business is becoming far more capital-intensive just at the time when the combination of Japanese competition and worldwide market conditions make capital difficult to earn or to raise. IBM's $250 million is a little more than twice Intel's 1982 capital expenditures.

Nonetheless, if Intel were owned by Motorola and Motorola's semiconductor operations were free-standing, would IBM have acquired Motorola semi? Probably not -- or at least not so eagerly.

From Intel's Angle

Does IBM's move signify that it will standardize around Intel chips, that it has already standardized around Intel chips, or neither of the above? Although IBM does indeed use Intel chips in the PC line (see above), the Displaywriter and the Datamaster, as well as in lots of add-on memory, these are only a fraction of its offerings. Although most of the company's chips are internally developed and manufactured, a small number come from such other outside sources as Motorola (for the CS-9000, a scientific micro that uses the 68000). We expect IBM to continue to buy -- and de facto endorse -- the Intel line, but the investment in Intel was probably more a result than a cause of IBM's liking for Intel's products.

Will IBM's endorsement strengthen Intel's hand in the microprocessor design-win game? Although the IBM PC, in its current and future forms, is a highly visible

The Rosen Electronics Letter, January 6, 1983
flagship for Intel, Motorola's not doing badly either. First, its 68000 is the basis of most of the UNIX machines now rushing to market, including Fortune's 32:16, Tandy's Model 16, Valid Logic's SCALDsystem (for LSI design), Corvus' Concept and a host of others, as well as of Apple's Lisa and Mackintosh. Moreover, in the less visible workstation marketplace, Motorola is doing even better. To the application-minded, technically sophisticated people who are making the 68000 a success, IBM's stamp of approval isn't going to mean much.

For both companies, the prize is more than just the number of design wins. Each design win brings in an indeterminate number of units; each unit drags along maybe three peripheral chips, plus development systems, buses and the like. In Intel's case, there's a lot of software and support as well.

This points up an interesting contrast between Intel and Motorola. While Motorola may end up selling more microprocessors, Intel is working hard to make more money off each microprocessor it sells. In addition to a host of co-processors (math and I/O chips, for example) for each cpu, Intel is busily building up its systems and software support capabilities. Its recently announced data base processor, for example, consists of $2,000 worth of chips plus enough ancillary equipment and value-added to raise the asking price to $20,000. And the company is setting up a 600-man team to provide support not just for Intel's own offerings, which are growing in number, but also for third-party software such as CP/M, MS-DOS and applications which run on its chips.

This approach certainly makes it likely that Intel and IBM will get along -- but Motorola and a lot of others might have made needier pupils.

The Competitors' Angle

This event should serve only to reinforce the Japanese conviction that IBM is leading a cabal against them, but it's unlikely to make relations much worse. In the domestic market, IBM's presence may in fact lessen other buyers' enthusiasm for Intel's wares -- except among those who are purposely trading in IBM's footsteps. Although electronics companies are all used to doing business with their competitors as distribution channels multiply and vertical integration overcomes the industry, they don't do so out of choice.