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ATTACHMENTS TO SECTION 8

3 MARCH 1987

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The following attachments are referenced in section 8 of the basic document. They are provided as additional supporting material for the review of bar code readers, local area networks, and data base systems.

Attachment	Name
A	Portable Bar Code Readers
B	Tethered Bar Code Readers
C	IEEE Standard 802.3
D	Builder Picks Lan Over Mainframe
E	Cost Comparison (Mainframe/Lan)
F	Network Standard
G	Companies Use PC LAN for Tasks Formerly done By Minis
H	Wang Hurt By Closed Architecture
I	Listing of Inventory Systems
J	Software Comparison
K	R:BASE: The Promise Expressed
L	Selected Bibliography

ATTACHMENT A

PORTABLE Bar Code Readers

Model	Programming	Prog. Host	Max Mem	Scrn Size	Mem Time	Data Connection	Mem Low	Test Rslt	EPROM	Price	Laser
MSI PDT I	BAS/PAS	PC/AT, DEC	16K	2X16	15 min	Sngl Opt Sled	yes	Fair	Req Technician to install OPSYS only!		
MSI PDT II	BAS/PAS	PC/AT, DEC	16K	2X16	15 min	Sngl Opt Sled	yes	Fair	Req Technician to install OPSYS only!		
MSI PDT III	BAS/PAS	PC/AT, DEC	256K	2X16	15 min	Sngl Opt Sled	yes	Fair	Req Technician to install OPSYS only!	>$2000	>$1700
Telxon 620	Menu	PC/AT	16K	2X16	1000 hrs	RS 232	yes	N/A	user installed, no training required	$577/8k	N/A
Telxon 701	TCAL (COBOL) Menu	PC/AT	16K	2X16	400 hrs	RS232	yes	good	user installed, no training required	$629/16k $1470/64k	$1325
Telxon 750	TCAL (COBOL) Menu	PC/AT	1MB	16X16	400 hrs	RS 232	yes	N/A	user installed, no training required	$1750/128k $2145/64k	$1352
HHP MicroWand II	TCAL (COBOL) UDL dB II	PC/AT	128K	2X16	60 min	Sngl Optical Int.		N/A	Req Technician to install	$1490	N/A
Videx TimeWand	N/A PC sort	N/A	16K	None	None	Sngl Optical Int.		Poor	N/A	$330	N/A
Data Net *	Menu	IBM PC/AT IBM MF	256K	2X40		RS 232, 128 Serial devices		N/A	N/A	$2215	N/A

* Data Net also works as a fixed station reader

Tethered Bar Code Readers

Model	Prog Lang	Host	Max Mem	Scrn size	Mem Save	Data Connection	Test	Rug-ged		Read Dist	Price
Burr-Brown	Menu		8K	2X40	2k 10 years	Serial devices	N/A	yes		0	
Data Net *	Menu	IBM PC/AT	256K	2X40	None	128 Serial devices	N/A	Yes		0	$2040
		IBM MF									
TRAQ-NET	DBMS	IBM PC/AT	N/A	NONE	NONE	RS232 only	N/A	No		6 in	
	Prop.	or Prop.									
Metrologic	DBMS	IBM PC/AT	N/A	NONE	NONE	RS232,Cent.	N/A	Yes		12 in	$1595
MS190											
Galileo	BASIC	IBM PC/AT	N/A	NONE	N/A	Internal to PC/AT	N/A	Yes		0	
Glasscan 100	MASM										
Compsee 600	N/A	IBM MF		NONE	YES	Keyboard	N/A	Yes		0	$495
		IBM PC/AT									
Tips 300	N/A	IBM PC/AT	N/A	NONE	NONE	Keyboard	N/A	No		0	$795

*--Data Net also works as a protable using an optional, special mount.

ATTACHMENT B

The Institute of Electrical and Electronics Engineers has been involved with developing standards for computers and communications for several years. They are recognized as the most important standards group in these areas and have more accepted standards in the area than any other group.

IEEE 802.3 Standard

This standard specifies the minimum specifications for an Ethnet interface, at layers 1 and 2, and part of layer 3 of the International Standards Organziation (ISO) model for Open Systems Interconnect (OSI). The ISO OSI model is a seven layer model for specifying standard communications procedures. Each Layer represents a different function that is required for communications between "nodes." A node can be a computer or a communications device.

ATTACHMENT C

LAN WEEK CONNECTIVITY

SECTION 2

LAN Focus: Gateway Options and 386-AT Servers, Page C/22
Review: Attachmate Takes on IBM, DCA Emulators, Page C/29
Explanation: Bankers Trust Puts Trust in T1 Lines, Page C/32

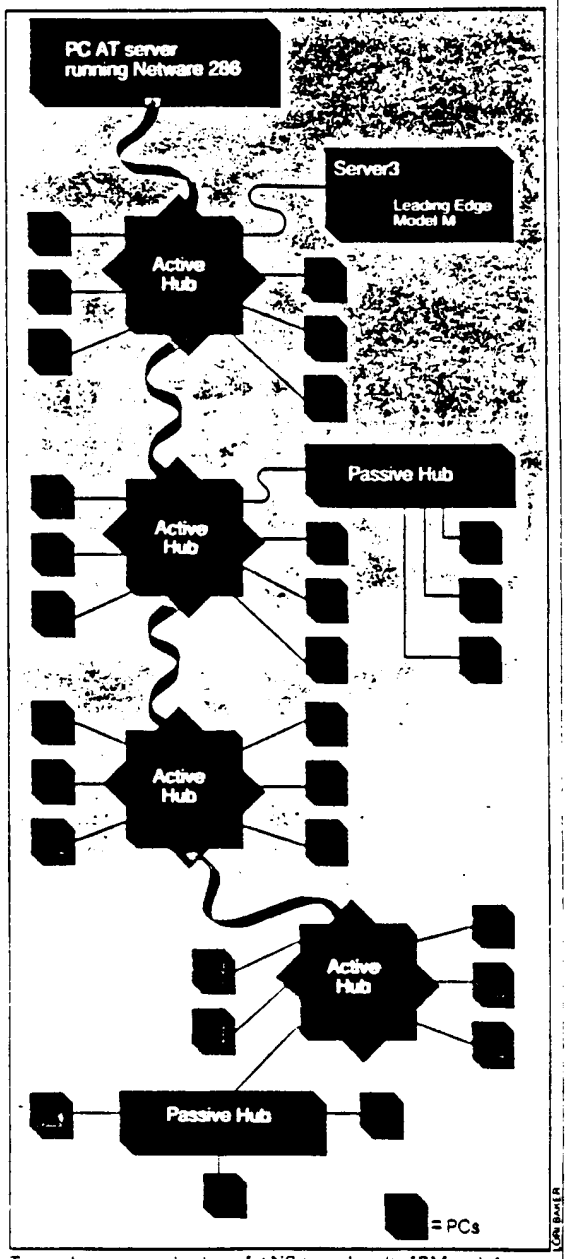
4 JANUARY 13, 1987 VOL. 2

Builder Picks LANs Over Mainframe

By Paul Bonner

Back in 1923, when Roland C. Tanner of Phoenix, Ariz., started his road-building business, his employees consisted of a team of oxen and his equipment was a wooden scraper for the oxen to drag over the dusty Arizona earth.

At the time, his data-processing needs probably weren't too complex. The company has grown a bit since then, however. Today, Tanner Southwest is the second-largest privately held firm in Arizona, with some 2,500 employees and projected sales of $300 million for fiscal year 1987.



Tanner hopes to use intricate LANS to replace its IBM mainframe.

Tanner Southwest Inc. has been in the road-building business for 64 years. Today, it's blazing new trails in the information-processing area by embarking on a bold plan that will move all the company's computer resources from mainframes to PC-based LANs within five years.

Tanner Southwest's information-processing requirements have grown in kind. Along with the standard complement of word processing, messaging and other office-automation tasks, the company leans heavily on a number of highly specialized software systems it considers critical to its livelihood. These include a project-scheduling system used by several of the company's divisions, a cost-estimating system used by its construction division, a truck dispatching system used by its concrete division and a complex accounting system.

Move from Mainframes

As might be expected in a company of Tanner Southwest's size, most of those critical systems reside on a mainframe—in Tanner's case, a leased IBM 4381 with 16M bytes of RAM and 10 gigabytes of on-line storage—and most employees access those systems either through 3278 terminals or PCs equipped with 3270 emulation cards.

That will change in the near future, however. Ron Tanner, Roland Tanner's grandson and the company's manager of systems and programming, believes that within five years all the company's computer systems can be moved to network-based PCs.

Based on the company's two years of experience with Novell NetWare running on Arcnet hardware, "I think everyone around here would agree that the networks have proven themselves," Mr. Tanner said.

He added that he believes Tanner Southwest will gain increased performance, data security, hardware reliability and vastly decreased costs from the switchover from a mainframe-based system to one dominated by PC LANs.

Currently, Tanner Southwest has approximately 200 3278 and 3276 terminals and 300 PCs. About 80 percent of the company's PCs are connected to one of its half-dozen LANs (which range in size from 80-plus PCs at its headquarters to five or six PCs

Continued on Page C/9

ATTACHMENT D

At Tanner Southwest, Mainframe Heads For Scrap Heap; PC LANs To Take Over

Continued from Page C/1

n a construction-site trailer), and about 75 ercent of the PCs engage in communica- ions with the mainframe.

The lease on the mainframe expires in ess than three years, and the company loesn't intend to renew it. Instead, most of he current mainframe applications will be noved to PC networks. The company's ac- ounting system will take a bit of a detour, moving to an IBM System/38 minicom- puter for two or three years before it ends up on the PC network.

The idea of scrapping the mainframe wasn't made overnight, or capriciously. There were a number of factors beyond the expiration of the lease that led Tanner Southwest to the decision. Primary among those was dissatisfaction with the main- frame's performance.

For instance, the software the company used for its accounting was outdated and needed to be replaced. After an extensive search, the company found a modular ac- counting system that seemed to fit the bill, and installed the general-ledger module.

According to Ron Tanner, the experi- ence was "a disaster." The company found it had to double the mainframe's capacity just to run the general ledger, and even after doing so, the package ate so much of the mainframe's resources that the compa- ny couldn't install the other modules of the accounting system.

Mr. Tanner also recalls that other user problems had created a situation where "companywide, the sentiment was against the mainframe."

Meanwhile, the company's early experi- ences with PC networks were good and suggested that the networks could expand to handle every task that was then being done by the mainframe. In addition, doing so would save the company some $80,000 per month in software license fees for CICS and the mainframe system software, and enable it to reduce the data-processing staff from 40 employees to 20 over a five-year period. Thus, the decision was made—the mainframe became a lame duck.

Anyway you look at it, it's an audacious plan. Distributed processing is one thing, and treating the mainframe as a giant file server is another, but eliminating both the mainframe and minicomputers with a net- work of PCs?

Sounds outlandish, but if you listen to Mr. Tanner and the people he works with, it becomes obvious they've thought this through carefully and seem to have solid answers to every possible objection.

For instance, conventional wisdom would have it that the mainframe would beat a PC-based network hands-down in three critical areas: security, reliability and performance. Mr. Tanner disagrees.

"We've got an on-staff EDP auditor who found that the security on the network was much better than what we had on the main- frame," Mr. Tanner said.

"Novell has really good security facili- ties, plus we use a utility that we developed and sell, called Hot Print, that adds anoth- er layer of security [Hot Print automatical- ly password-locks a system that has been inactive for a specialized period of time, and allows the user to lock the system with a single keystroke]. And, we lock people into our menu system so that they can't get to DOS," he said.

Extra Layers

David Keeney, Tanner's microsystems technical analyst, added, "I'm the one who wrote the menu system, and I can't break out of it. And even if somebody did figure out how to get to DOS, they've got to deal with Novell's security. Novell has security by user, by group, by directory and by file."

As for reliability, Mr. Keeney noted that "Before we moved to our new building, we had our server up for 6½ months, 24 hours a day, seven days a week, without a hiccup. Then we had a power failure. The server was back up immediately when the power came back on, while the mainframe was out all morning because its IPO [initial power- on] is so long."

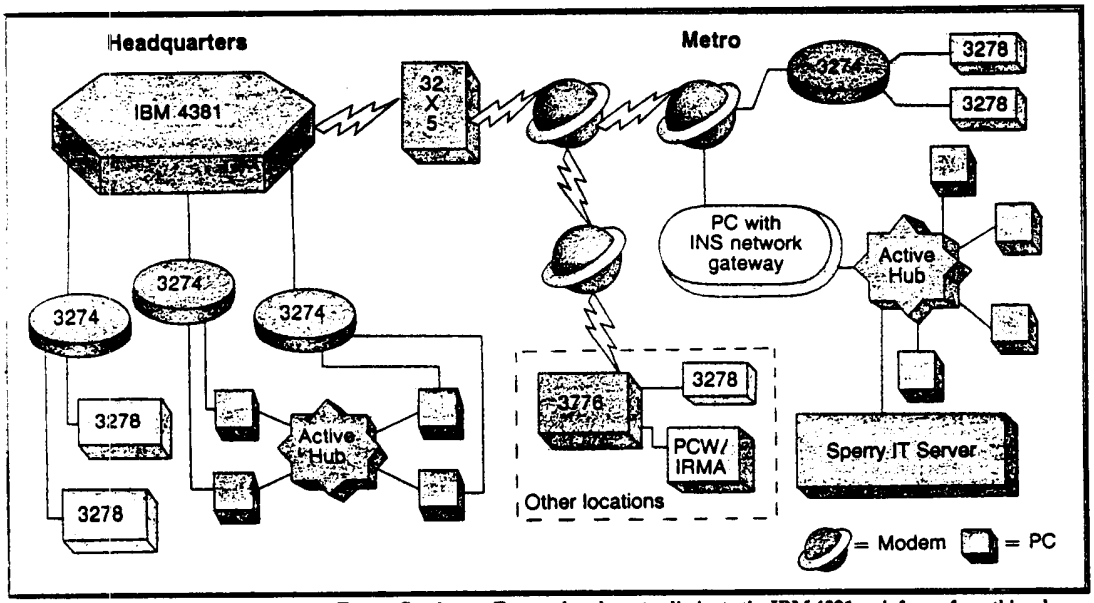
To augment the reliability of the net- work-based systems, the company main- tains an inventory of spare parts—extra network adapters, network hub control- lers, disk controllers and an extra hard disk—that can be put on-line within a short time should any of the network's compo- nents fail. The company also plans to adopt Novell's system fault-tolerant NetWare— which uses a redundant hard disk—when that system is available.

Mr. Keeney said the network is already more reliable than the mainframe in many ways, if only because PC-based software systems can survive the failure of a key component better than mainframe-based systems.

He cited, as an example, the truck-dis- patching system used by Tanner's Unitec Metro Material Division to schedule and account for the location of 200 to 300 con- crete-mixer trucks. The trucks cost about $100,000, and the drivers receive union wages. The internally developed dispatch system uses radio boxes in each truck to track them on a minute-by-minute basis.

In the eight years the internally devel- oped dispatch system has been in use, it has

(Continued on Page C/10)



The present corporate computer setup at Tanner Southwest. Future plans hope to eliminate the IBM 4381 mainframe from this scheme.

COST COMPARISON

Proposed Mainframe Solution Cost Summary

	Initial Cost (thousands)	Annual Cost (thousands)
Hardware		
IBM 4361 Model 3	$200	$ 9
4 IBM 3370 Disk Drives	175	9
IBM Printer	15	2
IBM Magnetic-Tape Unit	30	6
Software		
DOS/VSE Operating Systems	55	5
Software Application	135	50
Other		
Facilities	30	10
Technical Support	10	50
Total	**$650**	**$140**

Proposed PC-LAN Solution Cost Summary

	Initial Cost (thousands)	Annual Cost (thousands)
Hardware		
5 IBM PC ATs	$17	$ 4
2 Novell Disk Drives	14	3
2 Printers	3	1
1 Magnetic-Tape Unit	2	1
Network Hardware	4	1
Software		
Operating Systems	3	1
Micro/OGS	37	4
Other		
Facilities	5	3
Total	**$85**	**$18**

Conoco Inc.'s accounting demands and multinational field sites seemed to dictate a mainframe solution, but even the most skeptical engineers were won over by an inexpensive, fully functional LAN-based system.

ATTACHMENT E

PCWEEK CONNECT

LAN Focus:
Review: Att
Explanation

VOL 4 JANUARY 13, 1987

Network Standard:

Novell Netware Becoming System Of Choice for IBM Token-Ring

By Paul Bonner

Novell Netware appears to be on the verge of becoming the de facto standard network operating system on IBM's Token-Ring Network, according to numerous corporate users.

As corporate installations of the Token-Ring hardware begin to grow in size and number, many network evaluators report that, while they want to use IBM Token-Ring hardware, they have found the IBM PC LAN program inadequate for corporate use and have turned to Novell Netware as an alternative.

"I wish someone had told me in advance what I know now. The IBM LAN program is a waste of time," said Patrick Power, senior network analyst at New York University Medical Center. Mr. Power is in the process of switching from the IBM software to Novell Netware on a LAN he believes will grow to 500 PCs in the first quarter of this year.

"We tested the two operating systems side by side on the same hardware. The IBM software wasn't even close to Novell," said Mr. Power. He claimed that Netware was superior to the PC LAN program both in terms of performance and in ease of setup and administration. Other network coordinators had similar comments.

Warren Knox, computer tech-

Continued on Page C/7

ATTACHMENT F

Novell Netware Is New Standard For Token-Ring

Continued from Page C/1

nical specialist for the city of Corpus Christi, Texas, runs the PC LAN program on the network he controls, but is considering a switch to Netware. "It seems to be a slicker package both in performance and in the user interface," he said.

The Corpus Christi network will eventually grow to 50 to 75 workstations. One reason Mr. Knox is considering a switch to Netware is that, "I don't think the IBM software would perform adequately on a 50-node network. We only have five nodes right now, and I've seen some real problems with performance already."

Banker's Trust of New York also recently decided to go with a combination of IBM Token-Ring hardware and Novell Netware software. Pam Oehlberg, manager of office technology, said her department's benchmark tests showed that Netware was much faster than the IBM PC LAN program as the number of the users on the network grew.

Craig Burton, Novell vice president of corporate marketing and development, estimated "about 50 percent of the Token-Ring sales have Netware involved with them." He added, "People who are installing the Token-Ring are usually looking for performance, reliability and a network they can be serious with. They look at the IBM software and at Novell and say it's not difficult to decide which one to do that with."

Performance Wins Out

Mr. Burton may be oversimplifying the ease with which most firms can turn away from IBM for something like a network operating system. Several of the network coordinators interviewed who had decided to switch to Novell software first worked at length with IBM representatives in an effort to improve the performance of the PC LAN program.

Mr. Power noted that he "spent several days at 590 Madison Ave. [IBM's headquarters], spending time with their people and experimenting with the networks they've got set up there. The end result was that you just couldn't approach the level of performance of the Novell software."

Mr. Knox said his IBM representatives told him that the performance problems his group encountered in Corpus Christi city government LANs "just may be a matter of not having the network tuned properly," but added that neither the PC LAN Program manual nor the representatives have explained clearly "how to balance the parameters to get optimum performance."

In some cases, IBM's representatives appear to have done Big Blue more harm than good while trying to sell customers on the merits of the PC LAN program. "After having a demonstration of Netware, I went to the local IBM branch office, and they told me, 'You can't do this with a network,' after I'd already seen those things done with Novell," recalled Alan Kass, microcomputer coordinator for Sierra Pacific Power Co. in Reno, Nev. "IBM says the network is just basically good for sending files back and forth. It sounded to me like they really didn't know what they were talking about."

Often, the decision not to go with IBM network software has to be made in the face of objections from senior management, who prefer an all-IBM solution in a move as strategic as choosing a local area network. Ms. Oehlberg of Banker's Trust noted that she was reluctant to pick Novell for that reason, but added, "the performance disparity between IBM's software and Netware was too much to ignore."

Most of the network coordinators interviewed felt it was important to select IBM hardware for a LAN in order to remain compatible with IBM's future connectivity moves. However, they generally did not feel that it was as necessary to select IBM software for use on the LAN.

"I'm not worried about going with Novell. How often does IBM come out with an overwhelming software product?" Mr. Power said. "The worst case is if IBM does come out with a dramatically new operating system next year, then we burn the [Novell] software; we still have the IBM hardware."

Sierra Pacific's Mr. Kass also feels confident in going with Novell. "I would hesitate to go with an unproven vendor's product, but Novell has demonstrated that they know what they're doing with networks," he said.

Summing his experiences in planning the NYU Medical Center's network, Mr. Power said, "We've made an investment in IBM hardware. We need to do that in order to feel safe, but we also need a viable network operating system that we can offer to the users."

Fulfilling that need today appears to be the bottom line for those choosing to run Netware on IBM's Token-Ring hardware. ■

PC WEEK

VOL 4 FEBRUARY 24, 1987

INCREASING MIGRATION:

Companies Use PC LANs for Tasks Formerly Done by Minis

Lower Costs, Improved Performance and Flexibility Persuade Managers To Switch to Local Networks

By Paul Bonner

PC-based local area networks (LANs) are taking over in corporate computing situations that traditionally have been handled by minicomputers.

According to corporate planners who have made the switch, LANs are finding favor both as replacements for existing minicomputer systems and as machines of choice for solving new minicomputer-style problems.

Corporate computer managers cite several reasons for going the PC LAN route. One is cost savings—a PC LAN may work out to cost as little as one-fifth as much as a comparable minicomputer system.

Performance Boost

But equally important, they say, are dramatic performance increases that can be achieved with a well-planned local area network. Managers also cite a tremendous increase in terms of system flexibility and the ability to add new applications almost at will with a LAN-based solution.

One site where a PC LAN is taking over for a minicomputer is Greenfield Partners, a stock brokerage firm based in New York. Douglas Ohlman, chief operating officer of the firm, reported that until recently Greenfield Partners relied upon a variety of systems for its DP needs.

In addition to usual accounting procedures, a stock brokerage must calculate a variety of financial results on a daily basis in order to meet Securities and Exchange Commission (SEC) regulations, Mr. Ohlman said.

"We ended up using several computer systems to do different aspects of the job. We used an outside service bureau for back-office accounting, PCs for subdivisions of the back-office operation in our own accounting department, PCs in the secretarial area for word processing and computers in the trading area to crunch numbers there."

The problem with this approach, according to Mr. Ohlman, was that "None of the data was available from one area to another, and none of the computers were sharing any peripherals in common."

The obvious solution was to link all of Greenfield Partners' computer users through a minicomputer system, and so the firm looked at minis from IBM and Hewlett-Packard.

But when Mr. Ohlman saw that it would cost $150,000 to support the back-office accounting operation alone, and that the system would have required additional expensive software to support other areas of the firm, he decided to look beyond the obvious.

What he came up with was a PC-based LAN, built around the Lifenet network from Lifeboat Design Team, of Troy, Mich.

The firm is implementing the LAN in sections, starting with the

Continued on Page C/8, Column 1

ATTACHMENT G

PC Local Networks Are Taking Over Minicomputer Tasks

Continued from Page C/1

less critical functions and then adding more important ones.

"We did the word-processing area. Then when that seemed to work well, we added in the general ledger and posting area from accounting. Now we're putting part of our back-office operation on the LAN. The final step will be replacing the outside service bureau—that would save us $160,000 a year," Mr. Ohlman said.

He noted that, to date, the PC LAN has cost the firm about $50,000, compared with the $150,000 that a minicomputer solution would have cost. Of course, he conceded, "There are two sides to the issue. The packages available on the minicomputers would be more sophisticated than generic PC applications.

Customized Software

"We bought a standard PC accounting package for about $1,000 that worked fine, except we learned it doesn't handle billions," Mr. Ohlman recalled. "That was a liability. But we solved that by bringing in a consultant who modified the program so it handles billions for another $1,000. We're still ahead by $4,000, since the minicomputer accounting software would have cost $6,000."

Brad Waddell, DP manager at Iatric Corp., in Tempe, Ariz., reported equally dramatic cost savings via a switch from a top-of-the-line Prime Computer Inc. minicomputer system to a Novell Inc. S-NET LAN.

But in Mr. Waddell's case, it wasn't cost so much as performance and flexibility that dictated the change.

Iatric, a subsidiary of FCS Laboratories, is an allergy-testing laboratory. Another FCS subsidiary, Bioproducts Inc., also of Tempe, Ariz., markets Iatric's services through its telemarketing force to physicians around the country. Until recently, the firms had separate DP departments. Iatric used a Novell S-NET PC LAN to compile the results of its tests and to produce graphically illustrated reports, while Bioproducts used the Prime minicomputer system for order entry, accounting and keeping track of its telemarketers' sales.

As time went on, Bioproducts' management began to pressure its DP department to produce the kinds of reports that Iatric was able to produce on its PC system. Since Bioproducts had only 40 users on a minicomputer system designed for 120 users, the system should have had the capacity to do the additional work. Nevertheless, Bioproducts' DP department was unable to deliver what its management wanted.

At that point, Mr. Waddell submitted a proposal showing that the existing minicomputer could be replaced by a Novell S-NET joined to the Iatric network.

Further, he showed that the current tasks of the minicomputer and the additional reports Bioproducts' management wanted could be produced using a combination of the Dataflex multiuser DBMS, Lotus 1-2-3, Decision Resource's Chartmaster and word-processing software.

PC 'Does It All'

The ease with which the desired applications could be performed on the PC LAN, according to Mr. Waddell, is due to the flexibility of PCs. "We can run anything that runs on PCs. If we find one product doesn't specifically do the job, we can get another one. On the minicomputer, the choice of software was so limited that the DP people would say, 'It can't be done,' rather than taking the time to hand-code an application."

Mr. Waddell developed a test system on a single PC and demonstrated it to Bioproducts' management. "It was a cheap way to go," he said. "If it didn't work out, what were we out? The cost of a single PC."

Bioproducts' management accepted Mr. Waddell's proposal and at the same time joined the DP departments of the two firms into one.

The most dramatic payback from replacing the minicomputer with the LAN was cost.

The Bottom Line

The minicomputer was costing the firm $11,000 per month to lease and would have cost $350,000 to purchase. The total cost of the Novell network and the PCs to use on it was less than $150,000.

In addition, maintenance costs were lowered, and fewer DP personnel were required to operate the system.

According to Mr. Waddell, however, there were even more important paybacks from the switch. One was system performance. The network, he said, "has incredible performance for our applications."

He stated that the PC LAN can find and update records five to 20 times faster than the minicomputer, and that "We can run other jobs anytime we want without worrying about weighing down the system."

"Distributed processing is behind the increase in performance," said Mr. Waddell. "The amount of time that the PC is actually communicating with the network is very, very small. So there's no time that the network itself is being overloaded.

"In contrast, the minicomputer is just one big microprocessor that is serving the needs of many terminals that know nothing except 'Show this data on the screen and send the keyboard data back.' So with the minicomputer you have to allow for all these programs to be running concurrently in one processor, and the more people you add the more you divide the processor between them."

The power of the network has allowed Bioproducts to add considerable functionality to its systems. For instance, its sales transactions are now validated field by field against the central database as they are entered, where before an entire screenful of information had to be entered before any validation could occur.

In addition, Bioproducts' telemarketers are now tied into the test-results database, so they can supply test reports to physicians over the telephone, where before they were unable to do so.

In the long run, the flexibility of PC-based LANs might be an even stronger selling point than their cost advantages. As the manager of one information gathering service which recently installed a PC LAN in lieu of a minicomputer noted, "One advantage is cost. But I would not necessarily argue that at this point. There might not always be an immediate savings."

The biggest advantage of PC LANS, he said, was "You have flexibility in adding workstations according to your workload. If you have a fluctuating workload or a need to put additional stations on at peak times, you can do so. With minicomputers you have to buy a bigger CPU to add terminals. In a LAN you simply add another PC."

Mr. Ohlman of Greenfield Partners underscored that point. While saying that "It was much more cost-effective to implement a LAN system which could have multiple-processing capability and therefore operate even faster than a minicomputer at a fraction of the price of a minicomputer," he added that the flexibility afforded by the LAN was a major selling point for his firm.

Better Software Selection

"When you buy a minicomputer you're stuck with whatever software the manufacturer makes available, while with the IBM PC or machines of its genre, software is available from many different vendors and you're not restricted to one manufacturer's software," he said.

The performance advantages of LANs can also be impressive. Mr. Ohlman feels that these advantages are due to the computing power concentrated in each PC on a LAN.

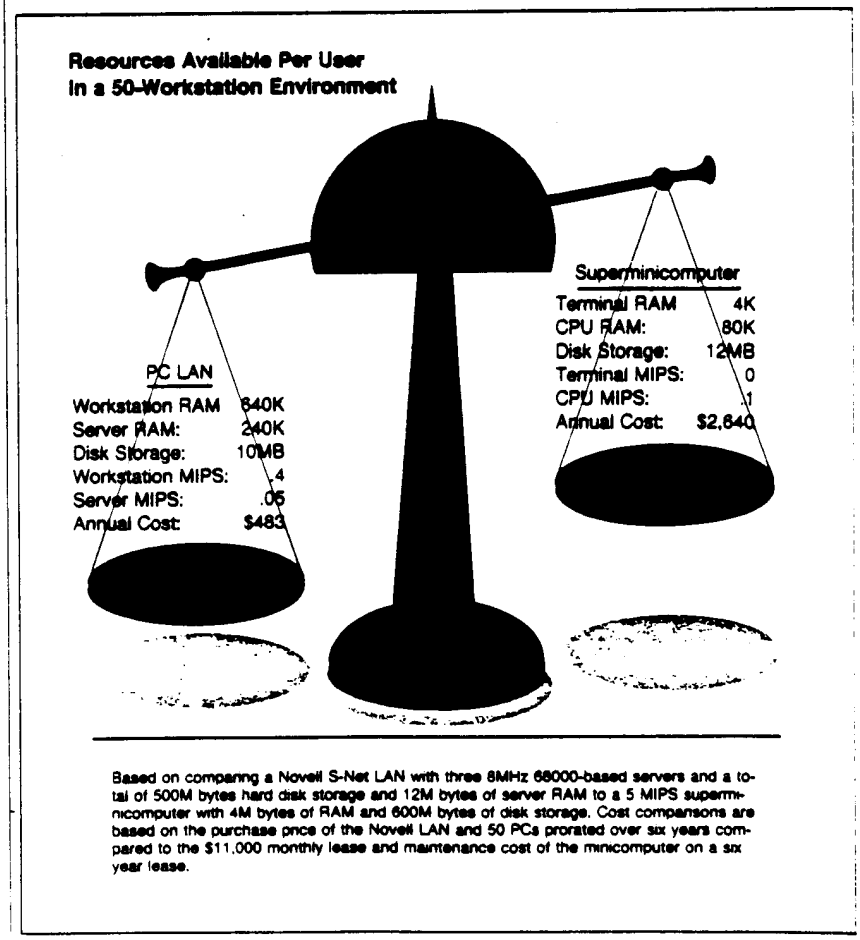
At Greenfield Partners, that power is considerable, since the standard PCs used as workstations on the LAN are equipped with 10MHz 80286 coprocessor boards.

"A minicomputer just can't compete with a network of PCs running at 10MHz, because each PC has its own processor," Mr. Ohlman stated. This advantage, he predicted, "will enable almost any company to use standard PCs and do distributed processing."

This is not to say that minicomputers are about to be swept into obsolescence by PC-based LANs. As Fred Federlein, network product manager for Corporate Software, of Canton, Mass., noted, "Minicomputers have a valid place for batch-processing large amounts of information or having centrally controlled storage—especially in things like manufacturing or distributed inventory control where you have a single-function system."

But, he added, in a situation such as that at Bioproducts "where there's a lot of processing of a shared central database, the network might provide better performance than the minicomputer."

Iatric's Mr. Waddell has also considered the relative merits of minicomputer systems and PC-based LANs. He concluded, "The minicomputer is best served with a small work group that maybe does a lot of calculations. But as far as moving a lot of data around goes, the LAN definitely beats it." ■



Based on comparing a Novell S-Net LAN with three 8MHz 68000-based servers and a total of 500M bytes hard disk storage and 12M bytes of server RAM to a 5 MIPS superminicomputer with 4M bytes of RAM and 600M bytes of disk storage. Cost comparisons are based on the purchase price of the Novell LAN and 50 PCs prorated over six years compared to the $11,000 monthly lease and maintenance cost of the minicomputer on a six year lease.

Wang Hurt by Closed Architecture

By Emily Kay

LOWELL, MA—Wang Laboratories' early failure to hook into the IBM world has led the company to its current woes, according to Wang watchers.

After growing rapidly from 1977, Wang hit the wall in 1981 when IBM announced its PC. That was the beginning of the end of Wang's "fat" years, according to George Colony, president of Forrester Research, a market-research firm in Cambridge, Mass.

The latest in Wang's seemingly endless series of problems was its announcement last week that it will report an operating loss of $35 million for its second quarter, ended Dec. 31. The company blamed weak sales.

The loss is Wang's second consecutive quarterly loss. For the previous quarter, it suffered a $30 million loss. Just a year ago, the company reported a healthy $21.7 million in earnings on sales of $679.5 million.

In addition, officials said Wang will eliminate 1,000 of its 30,900 jobs worldwide and will cut salaries by 6 percent in an effort to save $50 million in the next six months. The job reductions will be accomplished through layoffs and attrition, they said.

Wang reached its current state by failing to understand the importance of an open architecture and IBM connectivity, according to analysts.

"Wang was stubbornly proprietary," said Mr. Colony. "Their PC didn't support the IBM world. Their communications networks were Wang proprietary. In a time when users were banging on vendors to open up, Wang continued to be closed."

Christine Hughes, an analyst with the Gartner Group, a market-research firm in Stamford, Conn., agreed.

"Wang was slow to react even at the workstation level in the PC area," said Ms. Hughes. "They should have realized sooner that IBM was the standard, accepted that and differentiated themselves

Continued on Page 131, Column 4

Wang Troubles Due to Lack Of IBM Hook, Analysts Say

Continued from Page 129

through software rather than try to build a slightly incompatible workstation."

Other oft-cited reasons for Wang's problems have been its late product deliveries; the inability of its sales force to sell anything other than word processors, especially systems; and its lack of success in moving from the word-processing/office-automation business to being an integrated systems supplier.

Wang's rivals—Digital Equipment Corp., IBM, Data General and Hewlett-Packard—all came out of the data-processing world and had an easier time making the shift, according to Ms. Hughes.

Wang also chose to sit on its laurels rather than to do what it had to to keep up with a maturing industry, analysts said.

"If you're riding the wave of success, you can't become a dinosaur," Ms. Hughes said. "You must constantly keep up with what your users want in terms of solutions."

"In a fast-changing business, a company can't extrapolate past successes into the future," said Mike Geran, an analyst with the Wall Street firm of E.F. Hutton. "It has to change with the industry, and transitions take longer and are more expensive than anticipated." ■

ATTACHMENT H

LISTING OF INVENTORY SYSTEMS

The following inventory control systems were reviewed between 1 October 1986 and 23 December 1986. They are presented here for informational purposes.

Acuity
MCBA
Pioneer
Tolas
FMS
Champs
Advanced Mfg. Sys.
Impcon
IMMS
MAN MAN
BOMS IMCS
PMIS

All these systems are minicomputer based. The Pioneer product was installed on a VAX and tested for suitability. All products would have required extensive modification and did not allow for the operations particular to the study at hand.

ATTACHMENT I

SOFTWARE*

	dBase III+	RBase System V
Number of fields/record	128	400
Record Size (maximum)	4000	4096
Records/Data File	1,000,000,000	Unlimited
Records/Database	10,000,000,000	Unlimited
Field Size (maximum)	254	4092
Data Types	char,int,real,logcl,date,time,long text	char,int,real,logcl,date,time,lng txt,money
Range Testing	yes	yes
Table Oriented Structure	no	yes
Default Values	no	yes
Specific Value	no	no
External Table Lookup	no	yes
Forced Upper Case	yes	no
Unique Fields	yes	yes
Date Conversions	yes	yes
Automatic Data Entry	no	yes
Calculated Fields /Entry Scrn	no	yes
Error Processing	yes	yes
Number of Index Files	7	400
Compound Indexes	yes	no
Max Number of Open Files	10	40
Math Updates	yes	yes
Text Updates	yes	yes
Table Merging	yes	yes
Multiple Record Updates & Del	yes	yes
Dynamic Menus	yes	yes
On-Line Help	good	Excellent
High Level Language Interface	Pascal and C Optional	Optional
File Locking	yes	yes
Record Locking	yes	yes
Macros	no	yes

*--PC Nomad data not available, Dunn & Bradstreet (the program developers) say PC Nomad is not comparable to these systems until at least the next release in November

ATTACHMENT J

Software Continued
Report, Screen, Query and Program Generator Data

All capabilities listed below are achelved with no programming.

	dBase III+	RBase System V
Painting	yes	yes
Coordinate Specification	no	no
Screen Programming	yes	yes
Number of Screens/File	16	Unlimited
Number of Files/Screen	10	5
Prompt Messages for Fields	yes	yes
Arithmetic Functions in Fields	yes	yes
Multiple Tables	yes	yes
Report Subtotals	2 levels	10 levels
Columnwise Reports	yes	yes
Rowwise Reports	no	yes
Multilevel Menus	no	no
Integrate Custom Forms	no	yes
Integrate Custom Reports	no	yes
Custom Help Screens	no	yes
Edit Applications	no	yes

R:base: The Promise Expressed

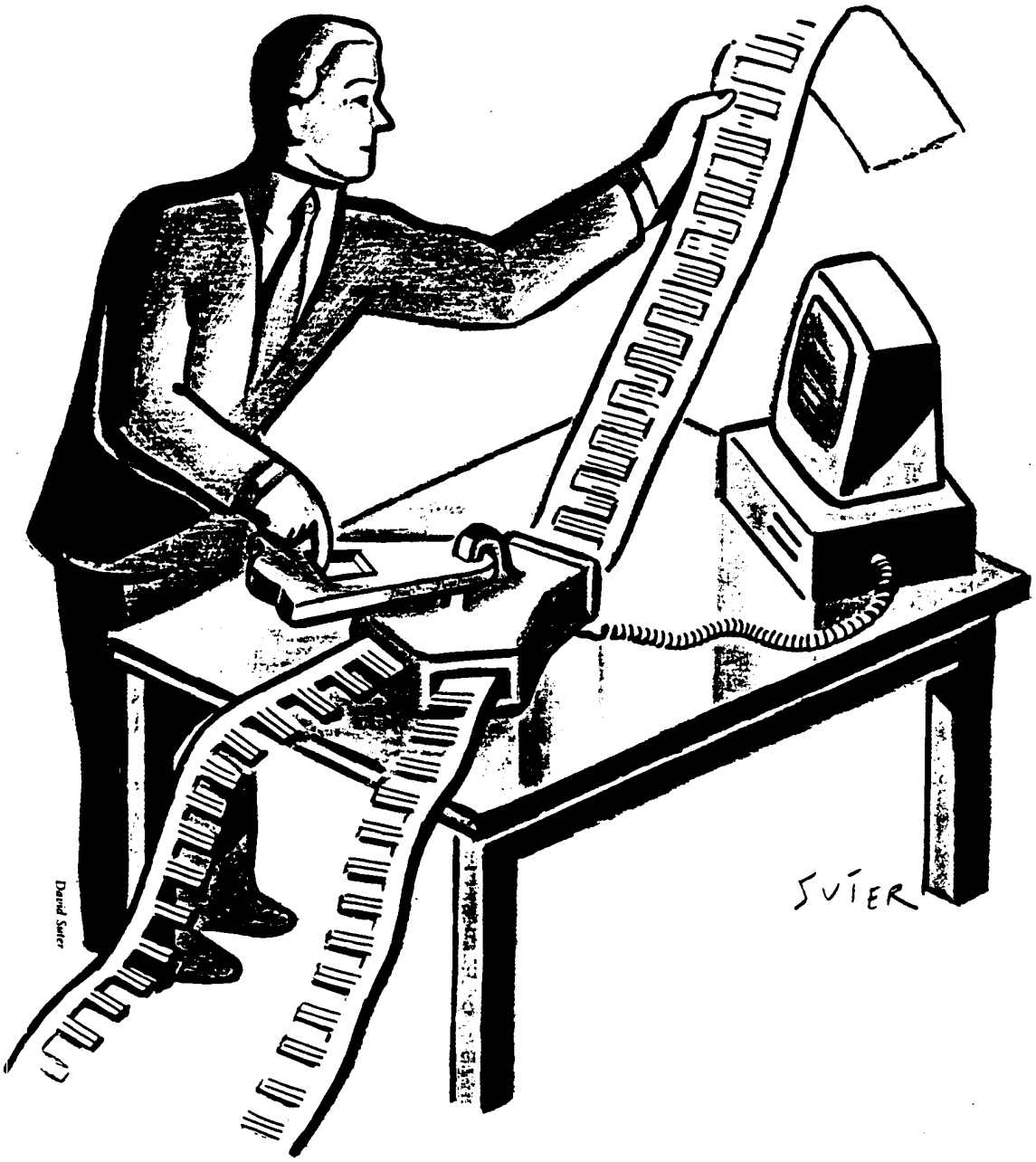
Has dBASE finally met its match? Microrim's R:base System V successfully bridges the gap between ease of use and capable data management and offers a menu-driven system that can create drum-tight turnkey applications without programming.

William Urschel

The synergistic rivalry between *dBASE* and *R:base* continues. But unlike many other free-market contests, the customer has walked away the winner. *dBASE* has become, dare I say it, almost user-friendly. And *R:base,* once an amiable file manager with promise, has evolved into a mature, full-featured data base manager complete with command language.

Yet a feeling of unfinished business persists. For all its improvements—a more astute menu-driven interface, plus a screen and program generator—*dBASE III Plus* is still a forbidding product for workaday users. When it comes time to forge a complex custom application, you usually find yourself back at the infamous dot prompt, tapping in commands—or on the phone to a programmer. *R:base 5000* eliminated much of this unpleasantness with its diagrammatic prompt feature, hand-holding menu system, and capable Application Express. Yet Microrim failed to fully extend the Express concept to reporting and forms generation. The promise remained unfulfilled.

No longer. With the release of *R:base System V* complete programming power is only a menu away. Microrim's answer to *dBASE III Plus* heals the schism between power and ease of use in the only way possible: with multiple solutions. *System V* includes the programming features that power users and developers pine for and introduces three menu-driven front ends—Definition Express, Forms Express, and Reports Express—that enable tyros and pros alike get to the heart of *System V* fast. With the tried-and-tested Application Express already in place, do-it-yourself business users can wrap all the elements of an application into one neat package.



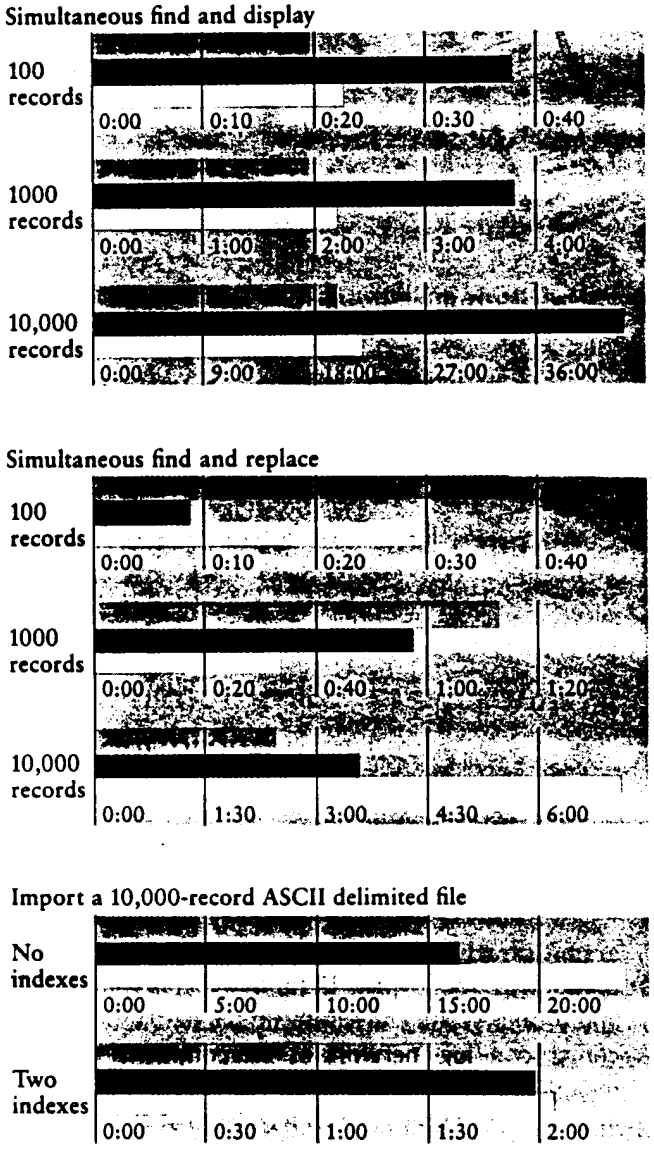
A Confederacy of Solutions

System V is not a single program, but a collection of like-minded modules. You can define a file's structure, enter data, or create reports at ground level by typing simple English-like commands at the R prompt and combining them with file names, field names, Boolean operators, and so on. Place Prompt before a command and *System V* will not only describe it but list the file names, keywords, and other parameters that would logically follow. The commands are relatively straightforward, but mastering the entire *R:base* lexicon is not something you can do in an afternoon.

Save your synapses. With *System V*'s new menu-driven Express modules, you can put the program through its paces without ever typing a command. If you follow the Definition Express menus and prompts, you can set up simple data tables or construct a huge network of interconnected tables, including lookup functions, cross-field calculations, and data validation. Forms Express and Reports Express give you the same automated power in creating reports and on-screen data entry/retrieval forms. And as we shall see, the Application Express can spin the necessary program code that fuses the parts.

Figure 1: R:base System V, dBASE III Plus, and R:base 5000 single-user performance compared (times in minutes:seconds)*

■ R:base System V
■ dBASE III Plus
R:base 5000



*All tests were conducted on an AT-compatible, 8-MHz Hewlett-Packard Vectra.

Movin' On Up

This kind of power doesn't come cheap—but at least you get your money's worth. The *System V* package tips the scales at nearly 8 pounds and includes three manuals, seven pamphlets, a hard-shell disk case, and 11 floppy disks totalling 4MB. However, *System V*'s core program and overlay files occupy less than 1MB, so once you've created applications with the Express modules, you can remove the modules from your hard disk.

Although moving up to *System V* is relatively simple, it involves more than clearing out the back forty on your hard disk. Irritatingly, *System V* can't read *R:base 5000* data base files directly, but a supplied utility makes the necessary transformation. The process isn't speedy: For example, on an AT-compatible hard-disk HP Vectra, converting a 10,000-record file with 13 fields per record and 2 key fields into *System V* format took almost 1½ hours.

Likewise, *System V* can't directly run programs created with *R:base 5000*'s Application Express module. But converting an application is simple: Use the 'Modify Existing Database' option from *System V*'s Application Express menu to select the application and then save it back to disk. Because the Application Express generates highly stylized, structured code, you cannot convert programs written from scratch or Express applications that have been heavily modified by hand.

R:base and dBASE Basics

As Table 1 shows, *System V* can handle twice as many data bases as *R:base 5000*, concurrently manipulating 80 files or 800 fields, whichever comes first. Humble *dBASE III Plus* is limited to 15 open files, with a maximum of 128 fields. This may sound paltry by comparison, but don't base a purchase decision solely on this factor—few applications require more than 5 or 6 files.

More practical additions are the note field and the double field. Note fields can store as much as 4K of text. Since they're variable length, they take only the disk space an entry requires, making program operations more efficient. Double fields can hold real numbers of up to 15 digits' precision, useful for many scientific and statistical applications.

System V has the speed advantage, too (see Figures 1 and 2). In a simple find-and-display test, *System V* was 40 percent faster than *dBASE III Plus*, re-

gardless of file size or the number of people using the product on a local area network (LAN). *dBASE III Plus* worked twice as fast on smaller data bases during a more complicated find-and-replace test, but turned snail-like when either the file size or the number of network users increased. In the same test, *R:base 5000* generally placed a respectable second.

Commands and Functions: New Faces

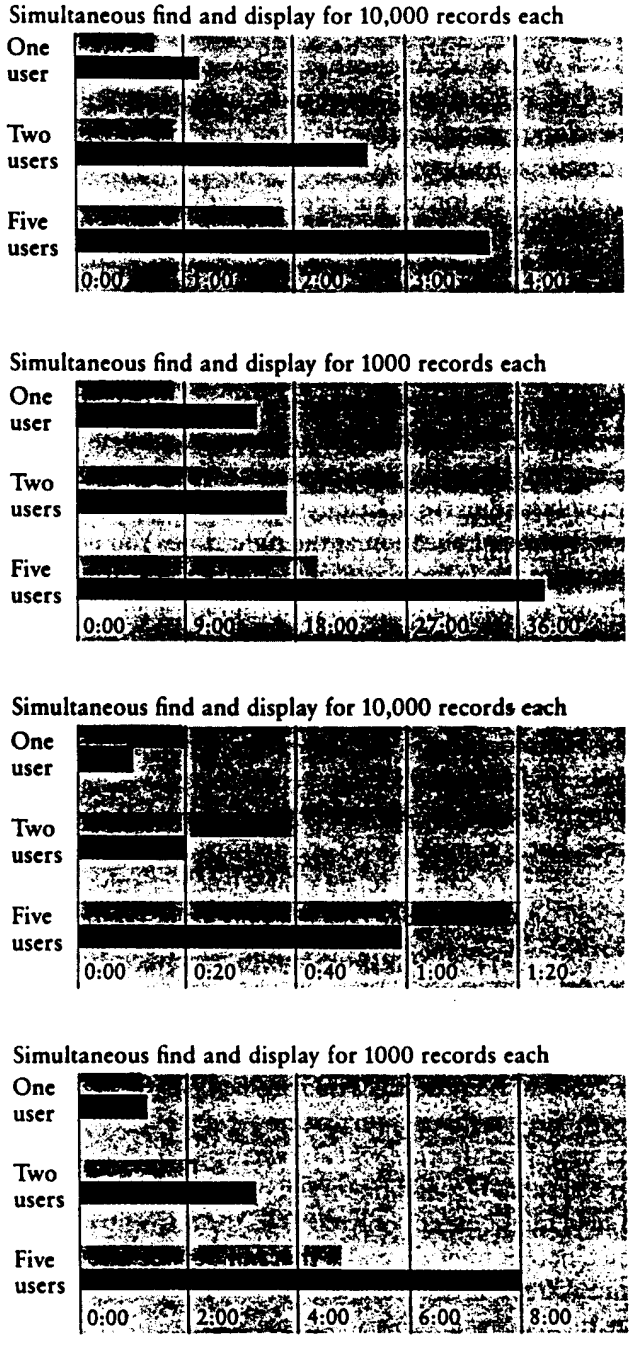
Except for a few new network-specific commands, *System V* largely adopts the *R:base 5000* command set. However, there are some notable additions. The View command creates a temporary table that draws fields from a number of sources—a quick way to visualize how different data bases might be combined without actually altering their data structures. And by popular request, Microrim has included a Record command that stores keystrokes like *ProKey* does. Naturally, you can play back a macro file, edit it with a text processor, or use it when building custom applications with *System V*'s command language.

Those with a yen for financial analysis will undoubtedly turn to Crosstab, a cross-referencing form of the Tally command that lets you zero in on two unique fields in a table. For example, if you manage a fleet of trucks and your data base lists each truck and its model type, carrying capacity, and current location, you could use Crosstab to list the trucks by location and capacity (see Screen 1).

If you keep the books with *dBASE* and are continually frustrated by the lack of specialized financial functions, fume no more. *System V* users can draw on a collection of new "supermath" functions that, among other things, help compute payment schedules, various forms of future and present value, and interest rates. But don't be misled by Microrim's enthusiastic advertising—these functions don't provide immediate gratification, as do their spreadsheet peers. You can use them only when assigning values to a variable or formula. Note, too, that *System V* permits only 10 calculated fields in a file.

The Supermath set also includes mathematic, string, trigonometric, type conversion, date and time, and logic functions. The math contingent deals with

Figure 2: R:base System V and dBASE III Plus on the LAN (times in minutes:seconds)*



*These tests were performed using PC's Limited AT computers with 6-MHz clocks, 1MB of RAM, 40MB Seagate voice-coil drives, and Gateway Communications G-Net Key Cards at the workstations and file server. The Novell Advanced Netware/86 V2.0 operating system was used at the file server.

absolute values, exponents, logarithms, and remainders; string functions convert text from lowercase to uppercase and vice versa, fill in spaces with a given character, center text, and return a string to its original function or program.

Extra Express

When the Application Express debuted in *R:base 5000,* the aim of turning data base application development into a simple menu-driven process was somewhat hampered by the fact that you still had to create tables, forms, and reports with *R:base* commands. *System V* finally brings these key functions into the fold with Definition Express, Forms Express, and Reports Express. Building a table that cross-references five other data bases, an on-screen form that validates data, or a report that subtotals stock on hand by part number involves picking options from menus offered by the appropriate module. The Application Express will likewise lead you along the straight and narrow, helping you pull together the parts of an application at the right time. You never confront the R prompt or experience the Sturm und Drang of command-language programming.

Some highlights in the expanded Express clan:

Definition Express. The groundwork for a data base is laid here. Pick 'Define a New Database' from the Definition Express main menu; name the file, records, and fields; and then specify field types and lengths as you go. A number of field types are available, but computed fields are perhaps the most useful because they can calculate values (such as subtotals) based on other fields. This not only saves typing time but provides some answers before you even generate a report. Definition Express also lets you secure a file (such as a payroll data base) with a password, create temporary tables with the View command, and most important, impose rules on specific fields.

Rule is just another name for data validation—an important feature when novices are entering data in a system. Depending on the parameters you supply, a field might accept only dates in the *dd/mm/yy* format, accept only zip codes that fall between 80000 and 90000, or double-check an entered part number by referencing another table (see Screen 2).

Fashioning rules is a complicated operation with most data management programs, but the Definition Express is positively avuncular during the process. Choose 'Rules' from the Definition Express main menu, select 'Add a New Rule' from the menu that follows, and identify the targeted table from the list displayed by the module. Next, supply the error message you want the application to display if the rule is broken. When you identify the field the rule applies to, the program displays a "setting sheet" in which you specify operators (greater than, less than, equal to, and so on) and the value or field the entry is being compared to. You can apply as many rules as you want to a field using AND, OR, AND NOT, and OR NOT connectors.

Forms Express. Once a data base is defined, you move on to the Forms Express, which initially displays a blank screen. To design a form, you type in permanent text, such as headers, footers, and field labels, and then point to the spots where data will actually appear when printed out (see Screen 3). To speed data entry, a form can even fill in its own blanks with fixed values (such as today's date), values taken from the previous record (a great timesaver if you are entering several records for the same company), or values grabbed from a field in some other file. A form can span five pages; include computed fields; and, for security's sake, restrict user access to a file on a read-only, edit-only, or enter-only basis.

A form can also display the results of a lookup. For example, I stored the expression 'vname = vname in vendors where vnumber = vnumber' in a computed field and retrieved a vendor's name, address, and credit rating simply by entering the vendor number (vnumber). I devised this construct without ever consulting the manual, and it worked just fine—a testament to *System V*'s logical design.

A form isn't glued to a single file, either. With the Region and Tier features, you can open windows into five different files and display or collect data for all of them. For example, a single form could route selected sales data (customer name, address, company, and so on) to a customer file and funnel shipping orders to an inventory file (see Screen 4).

Of course, menus can sometimes lead you down electronic rabbit holes. If you're not careful, you can inadvertently create circular dependencies and discover several files frantically locked together, each expecting vital results from the other. In general, make sure formulas forward results from file to file in only one direction.

Reports Express. Part of *System V*'s charm is the similarity among its modules. Laying out report

```
R>CROSSTAB
-ERROR- Syntax is incorrect for the command

                              SYNTAX
  CROSSTAB ----------------------------- colname1 BY colname2 --...
            |- COUNT   -|                |
            |- MINIMUM  |                |
            |- MAXIMUM  |- colname3 FOR -|
            |- AVERAGE  |
            |- SUM     -|

          ,- tblname  -,
  ...-- FROM           |--------------------
          '- viewname -'  '- WHERE condlist -'

R>CROSSTAB location BY capacity FROM trucks WHERE capacity GT 4000
capacity : Lot_A    Lot_B    Lot_C    (Total)
-------- : -------- -------- -------- --------
4000     :        1        1        1        3
6000     :        1        1        0        2
8000     :        0        0        1        1
-------- : -------- -------- -------- --------
         :        2        2        2        6
```

Screen 1: Error-handling is System V's forte. In this case, the error screen depicts the proper syntax for a cross-tabulation and, at the bottom, a successful Crosstab operation. This table collates trucks by carrying capacity and storage log.

```
                              SYNTAX
                          ,- AVE      -,
                          |- COUNT    -|  ,- colname    -,      ,- tblname  -,
COMPUTE ----------------- |- MAXIMUM  -|--|              |-FROM-|            |--------------------
         '- varname AS -' |- MINIMUM  -|  '- expression -'      '- viewname -' '- WHERE condlist -'
                          |- SUM      -|
                          |- STDEV    -|
                          '- VARIANCE -'

                                      ,- tblname  -,
COMPUTE ALL ,- colname    -,-- FROM   |            |--------------------
            '- expression -'          '- viewname -' '- WHERE condlist -'

COMPUTE ----------------- ROWS FROM tblname
         '- varname AS -'

For additional HELP text, enter a command name. To leave HELP, enter END.
For the previous help menu press [ESC]
H>-
```

Screen 2: The rules-creation worksheet in the Definition Express. This rule references the vendor table to ensure that the vendor number entered in the product table is legitimate.

```
                    Form Definition Menu
 Edit  Expression  Customize  Draw

  Invoice: S         E                              Date: S          E

    First: S           E          Last: S                   E
    Title: S       E           Company: S                            E
   Street: S                         E
    Suite: S                         E
     City: S                 E   State: SE         Zip: S   E
    Phone: S           E    Pay Method: S       E  Shipping Type: S      E

  S       E S                                  E S           E S E
  S       E S                                  E S           E S E
  S       E S                                  E S           E S E
  S       E S                                  E S           E S E
  S       E S                                  E S           E S E

 Merchandise: S                E
         Tax: S                E
    Shipping: S                E
       Total: S                E
[ESC] Return  [F3] Review  [F7] Prev table  [F8] Next table  [F10] Help
```

Screen 3: The Forms Express definition screen. Field labels have been typed in; 'S' and 'E' tell System V where a field starts and ends.

headings, footers, control breaks, and fields and defining variables and lookup functions are almost the same as designing a data entry/retrieval form. But it wasn't always so easy. In *R:base 5000,* pasting down the city, state, and zip fields in an address line meant defining three variables and concatenating them. Worse still, report width was limited to 131 characters.

System V's Reports Express corrects these deficiencies and completely supplants the *Extended Report Writer* utility created by Microrim for disgruntled *R:base 5000* users. Among other improvements, a report can span 255 characters across a page, and editing a format is easier thanks to an expand mode that inserts lines in a section as needed.

After mastering the Forms Express, I quickly jumped into the Reports Express and created single-record vendor profiles, lists that subtotaled sales by product, and labeled summary reports that tallied sales activity by vendor. For simple tasks like this, leaping before you look is seldom fatal. As we shall see, putting an entire system together with the Express modules takes planning.

The Sum of R:base's Parts

Once a data base and its forms and reports are defined, you can run the assemblage from the R prompt or tightly bind the elements together with a program written from scratch or generated by the Application Express. Opt for the command approach if you're not sure how the data will be used. For example, if you're a Civil War historian and your data base contains bibliographic entries for books, journal articles, and unpublished diaries, plus sketches of key officers, battles, and campaigns, setting up *System V* like an accounting program doesn't make much sense. Instead, you will probably need to root around in files, spontaneously concoct cross-references, and enter and edit data on the fly.

If free-form data management isn't appropriate, a *System V* program might be in order. Writing a large, bug-free application from scratch with menus, help screens, automatic data conversions, and so on, is a major undertaking—but not if you rely on the Application Express.

The Application Express poses questions and, based on your answers, builds menus to run the application. Typically, you name each menu, select the menu type (either table of contents or *1-2-3* command-line style), and declare whether the user will be allowed to back up to the previous menu using <Esc>. If a help screen is needed, the Application Express produces a blank screen for you to fill in. Finally, you type in the options that will appear in each menu.

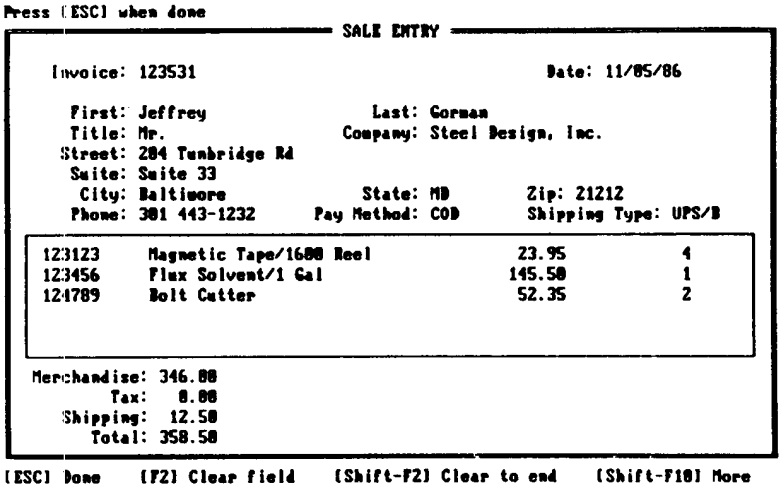
Here's where program design rears its head: Each option must be assigned an action (see Screen 5). The actions, which parallel *System V* commands such as Load, Edit, Modify, and so on, are plucked from a menu at the bottom of the screen. If an option forces the program to open a file, display a data-entry form, or print out a report, Application Express will list and integrate any files, forms, and report formats you created earlier.

The last question is the knottiest: Does any menu option lead to a submenu? If it does, follow the same steps, assigning actions to submenu items and creating still more submenus if necessary. This is how an application grows and, sometimes, takes on a life of its own. Planning is key—don't immediately sit down in front of the PC and start rattling away at the keyboard.

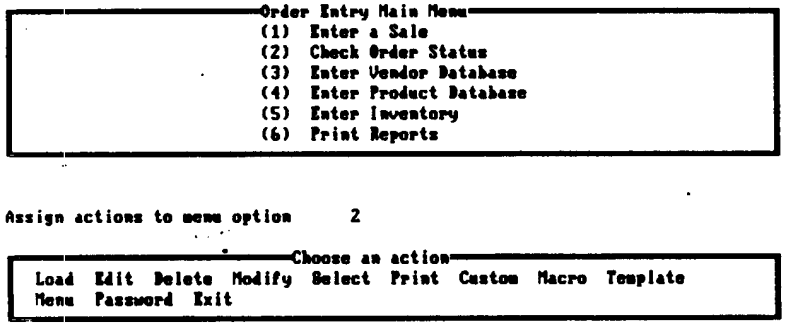
Once an application is complete, the Application Express drops the source code into an ASCII file, saves a special version for editing with the Modify an Existing Application function, and creates a binary file that *System V* can execute. The latter is a little bulky and inefficient by professional programming standards, but it's just as powerful as any handwritten application. If you want to protect your code and perhaps squeeze some extra performance out of it, you can convert the binary file to an unmodifiable form with *System V*'s CodeLock utility.

Multiuser R:base

Although the Year of the LAN has yet to arrive, both Microrim and Ashton-Tate have taken care to add network components to their latest data managers, just in case. Like *dBASE III Plus, System V* is compatible with the IBM PC Network and runs on 3Com and EtherLink LANs using *3Com3 +* or *Novell Advanced Netware/86* software, and Ungermann-



Screen 4: One form, two files. With the Region and Tier features, you can enter data for two different files from one form.



Screen 5: With System V, you follow the menus and answer the prompts to build a custom application. Here, the choices on an Order Entry menu have been entered, and a System V function has been linked to the second option.

Bass Net/One using IBM's *PC Network Program, Microsoft Networks,* or the *U-B Personal Connection.* However, similarities between the two data managers end there (see "A Plus for dBASE III," *PCW,* October 1986).

As Figure 1 shows, *System V* cleans *dBASE III Plus*'s clock in most network operations, particularly when five users are working on the system at once. However, add a sixth user and *System V* either crashes the network or denies the new user access. Increasing the wait value (the length of a time a user can stand in line for a file) has no effect. *dBASE III Plus,* on the other hand, picks up a sixth workstation uncomplainingly, although the network runs noticeably slower.

In *System V*'s favor, file locking is performed smoothly and automatically. (This is a manual operation in *dBASE III Plus.*) Neither program supports record locking, but *System V* alerts you if someone changes and saves the record you're working on. You can then either save your changes (and overwrite the previous user's edits) or exit the system.

Like most networked data management programs, *System V* provides several levels of security. A network manager can allow a user to read and change all data at will, record and change data in

Table 1: R:base System V, dBASE III Plus, and R:base 5000 features side by side

		System V	dBASE III Plus	R:base 5000
Requirements	Memory	512K/640K[1]	256K/384K-640K[1]	256K
	Hard disk	required.	recommended	recommended
Capacity	Maximum number of open files	80	15	40
	Maximum number of fields	800	128	400
	Maximum record length (characters)	4096	4000	1530
	Command-line length (characters)	5000	254	1600
	Number of digits of precision	15	15	6
	Calculated fields	10	0	N/A
	Variable-length fields	●	●	
	Maximum number of sort keys	10	10	5
Relational operations	Project, join, append	●	●	●
	Union, intersect, subtract	●	●	●
	View	●	●	
	Cross-tabulation	●		
Functions	Mathematical	●	●	
	String	●	●	
	Statistical	●	●	
	Financial	●		
	Date and time	●	●	●
	Logical	●	●	
Data base definition	Visual setup	●	●	●
	Intercolumn math	●		
	Data entry validation without programming	●		
	Note field type	●	●	
	Search on note	●		N/A
	Views without programming	●	●	
Form generation	Multiple tables in single form without programming	●	●	
	Multiple rows in form with scrolling	●		
	Custom colors	●	●	
	Custom borders	●	●	
Report generation	Subtotal levels	10	2	10
	Maximum report width (characters)	255	255	131
	Columnwise reports	●	●	●
	Rowwise reports	●		●
	Custom borders	●		
Application generation	Automatic generation	●	●	●
	Multilevel menus without programming	●		●
	Edit applications without programming	●		●
	Integrate custom forms and reports	●		●
	Incorporate custom help screens	●		
Networking	File locking	●	●	
	Record locking	●	●	N/A
	Cost per workstation	none	$199	N/A
File import	ASCII delimited	●	●	●
	ASCII text	●	●	●
	dBASE II	●	●	●
	dBASE III	●	●	
	dBASE III Plus	●	●	
	R:base 5000	●		●
	1-2-3	●	●[2]	●[2]
	Symphony	●	●[3]	●[3]
	pfs:file	●	●	●
	DIF	●	●	●
	SYLK	●	●	●
Miscellaneous	Copy protected			
	Macros	●		
	User-defined function keys	40	9	0

[1] For network server and workstations [2] Only .WKS format [3] Only .WRK format

some files but not in others, or merely browse. Passwords can also be used to bar unauthorized users from sensitive areas.

But for many, *System V*'s overriding advantage is simplicity. Once the LAN manager installs *System V* on the network's server, you merely run a brief installation program (which creates a CONFIG.SYS file) and type ***set multi on*** to get in on the action. In the *dBASE III Plus* world, life is not as simple. Every workstation must have its own access disk. Unfortunately, *dBASE III Plus* comes with only one access disk, so you must lay out a cool $995 for an Ashton-Tate LAN Pack to get five more disks.

Not-So-Light Reading

When you consider *System V*'s scope and multiplicity of modes, it's not surprising that the documentation sometimes fails to impart the lay of the land. Given the complexity involved, Microrim deserves a round of applause for providing a complete and logically organized set of manuals. The user manual, learning guide, and building applications/command dictionary are your primary sources; Microrim throws in pamphlets covering single and multiuser installation, *R:base 5000* file conversions, and error messages, as well as a handy template for designing complex forms. However, the de rigueur disk tutorial is absent, as are thorough programming samples. Although *System V*'s Prompt feature, help screens, and menus greatly aid the new user, I hope the next vintage of *R:base* includes a disk tutorial.

dBASE on the Run?

Although garlands such as "user-friendly" are tossed about when *System V* is discussed, user-friendliness is a relative thing. Although the Express modules shelter you from *System V*'s commands and syntax, they can't help you devise the underlying plan that dictates how data is organized and interconnected. That's up to you, so study *System V* carefully. Unless you are thoroughly prepared or very familiar with data management and programming structures, your application will probably end up snarled despite pretty forms and comprehensive reports.

Nonetheless, *System V* succeeds in satisfying users of almost all stripes. If you yearn to escape the limitations of your current file manager, *System V*'s foolproof menu system may be enticement enough. If you're an intermediate user who's tired of *dBASE III Plus*'s halfhearted menu system and patchwork program generator, you're another candidate for conversion. And if you're a professional developer, *System V*'s superior applications generator could cut programming time down to size.

In short, *System V* might be the only data manager you'll ever need. It offers the raw power of *dBASE III Plus* (and then some), a nose-to-the-grindstone applications generator, simple yet accomplished forms and reports generation, and no-penalty networking.

Still, the last word has not been heard. If *dBASE III Plus* pushed Microrim to produce *System V*, I'm eager to see what comes next. ●

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R:base System V
Microrim, Inc.
3925 159th Ave. NE
Redmond, WA 98073-9722
206/885-2000
List price: $700, upgrade for registered R:base 5000 owners $200
Requirements: 512K (640K for local area network operation); hard disk drive; DOS 2.00 or later version for single user setups, DOS 3.10 or later version for networking
Not copy protected

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ATTACHMENT L

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