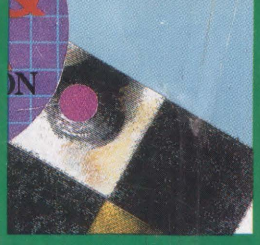

VISUALIZATION

PV-WAVE

- Getting Started With DECwindows,™ Part 2
- Workstations And Graphics Terminals: Room For Both?
- DEC's View Of CASE, Part 2

JULY ■ 1989

DEC Professional

An Independent Magazine from Professional Press

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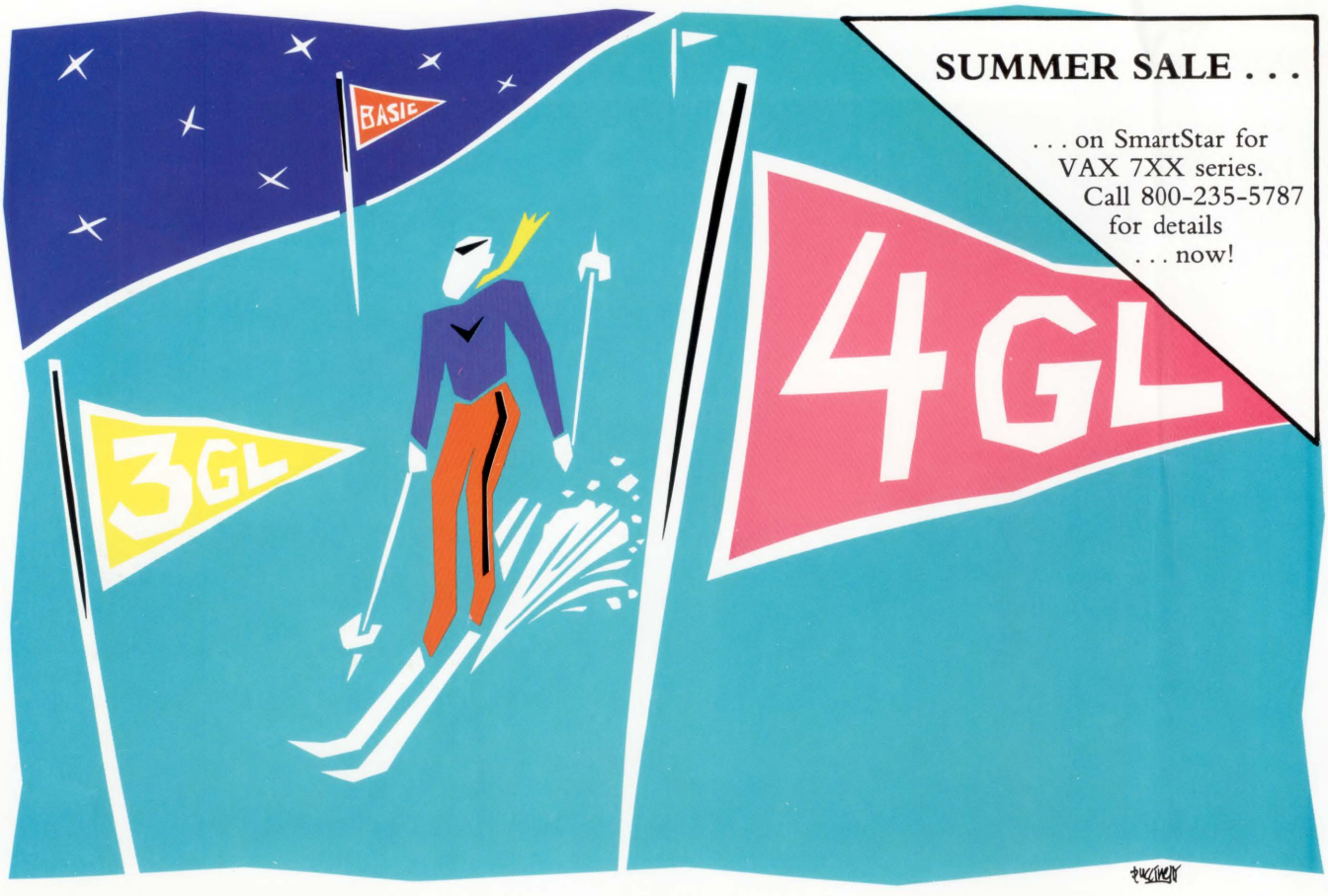
The Graphics Spectrum



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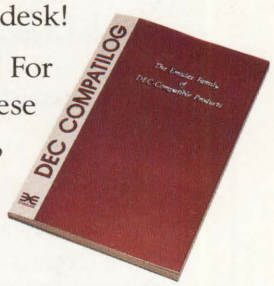

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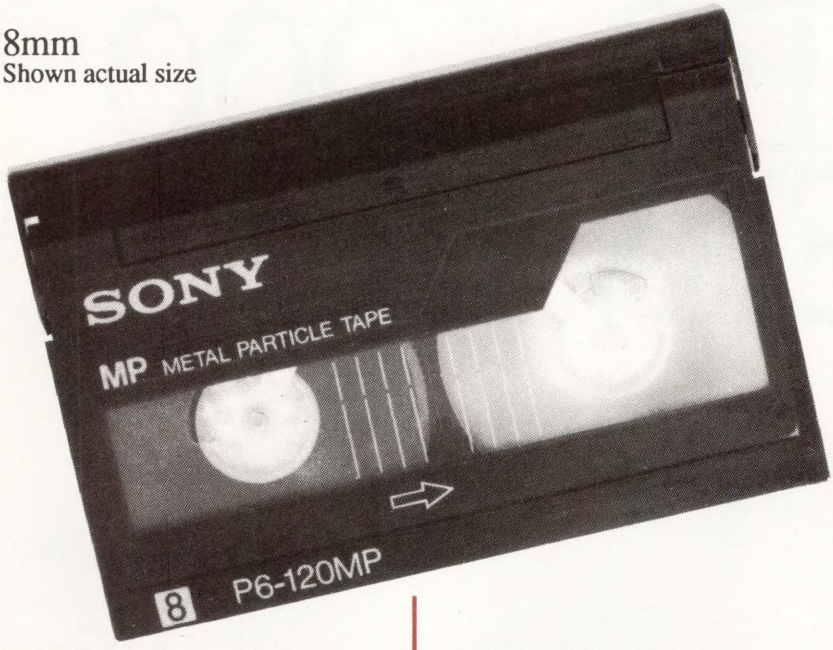

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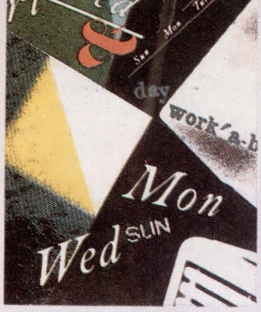

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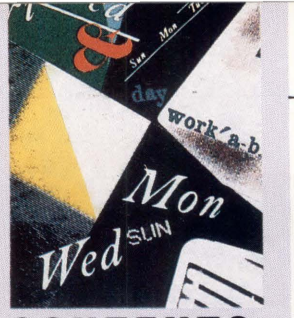

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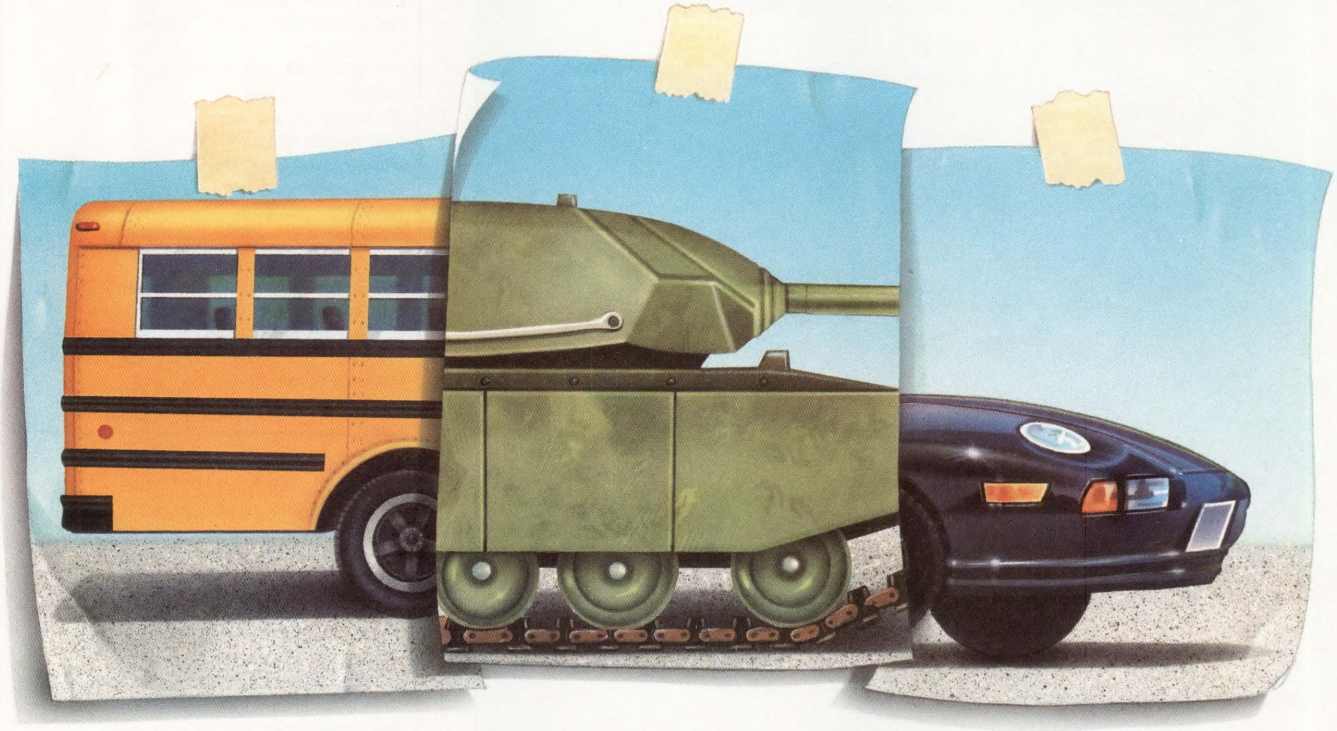

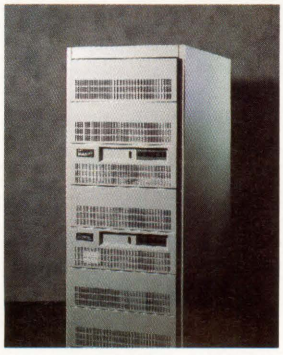

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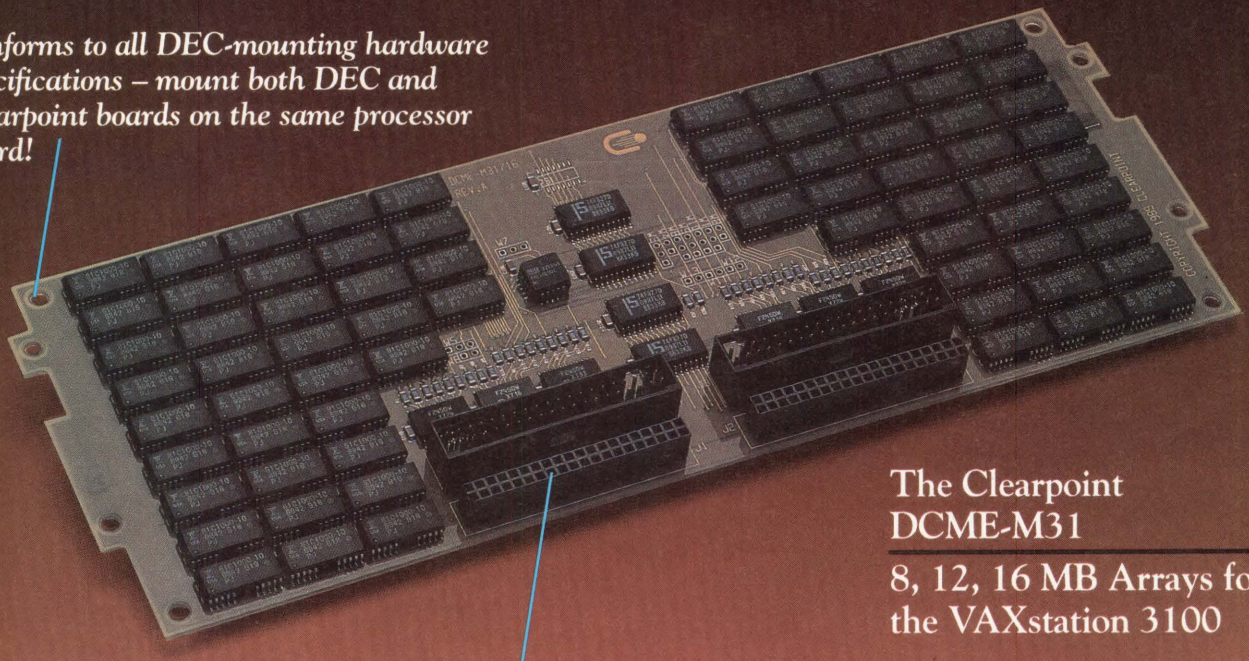

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CIRCLE 151 ON READER CARD

SYSTEM PERFORMANCE ENHANCEMENT

Cure for Slow VAX Revealed

Craig Jensen

Through my company, Executive Software, I have been engaged in extensive study of VAX™ Management and VAX Managers for the past three years. It was from the early stages of this market research that DISKEEPER®, the online defragmenter, emerged as the ultimate answer to the VAX Manager's number one headache — fragmentation.

When this research was begun three years ago, it was obvious to nearly every VAX Manager what was causing their VAX to slow down. They knew that running the same VAX, with the same users and the same job mix, should not result in steadily worsening performance. They knew that fragmented files were the number one reason for slower and slower response time. And they knew that long hours spent doing backup and restore of each disk was the only solution.

So it was easy for me to sell DISKEEPER. All I had to do was announce its availability and I was swamped with inquiries and orders — tens of thousands of them. Today, two-thirds of the Fortune 500 companies use DISKEEPER.

Some people think that's good enough. They say I should sell my company and retire. Everyone who will ever buy a defragmenter has already done so, they say. There's no more market, so sell out and move on to something else. I think that's nonsense, and I'm ready to prove it.

Who Buys Defragmenters?

According to Computer Intelligence Corporation, a highly respected source of information about the VAX market, only 1% of all VAX sites had a defragmenter installed in October 1987. By October 1988, the number had grown to 4%. By April 1989, it stood at 10%. That's a remarkable increase and 10% penetration constitutes a market with which many companies would be satisfied. But 90% of all VAXes are still suffering the full effects of fragmentation. Why?

The VAX market has experienced astounding growth in the past three years, primarily due to the MicroVAX II. In that time, the number of VAXes has risen from under 100,000 to over 250,000. Not surprisingly, the ranks of VAX Managers have swelled, too. In fact, most VAX Managers today have three years' experience or less. The second largest group has eight years' experience.

Guess what? It's the eight-year veterans who bought up all those DISKEEPERs when they first came out. It's the ones who know what real VAX performance should be; the ones who could spot steadily decreasing performance and slow response. They know the symptoms: system response time increases; the system slows down; system performance degrades; and the MONITOR facility confirms it: window turns and split transfers = fragmentation.

The old solution to the fragmentation problem was simple: backup the disks to tape, reinitialize the disks and restore the files in fresh, contiguous form. It was simple, but what a headache! You had to take the system down or at least remove the disk from service, which meant nights and weekends only. You had to choose between the lesser of two evils — lousy performance or being down for several hours (per disk)! Then the sheer boredom of watching tapes spin while you endlessly backup and restore each disk. And those sinister thoughts that you just couldn't push out of your mind: "Everyone else is out having a good time," and, "What if the tape is bad and the disk won't restore after I've reinitialized it?"

It's no wonder these knowledgeable VAX Managers snapped up DISKEEPER the instant the opportunity arose. The day they installed DISKEEPER, they got better system performance, more personal time and could spend their time more productively. They never had to defragment with backup and restore again. Never.

Word got around, too. The grapevine was alive with, "Have you heard?" and "It sounds too good to be true." But it is true, and today virtually every large VAX site in the country has a defragmenter. And more than half of those use DISKEEPER.

Why DISKEEPER?

The large-site VAX Manager uses DISKEEPER because it doesn't force him to stop what he's doing and RUN it. It isn't a utility that has to be told what to do; it's an operating system enhancement that eliminates fragmentation forever from the day you install it on your VAX. Just set it and forget it.

Moreover, they trust DISKEEPER because it doesn't use scratch space to store your data file while scrounging some space to make it contiguous. Your file would be at risk if it were on hold in a scratch space somewhere. What if the system went down or the defragmenter were interrupted? Oh well, let's hope that file was nothing important. With DISKEEPER, your user data files are always intact and accessible by name. We guarantee it.

And you don't pay for defragmentation with costly CPU resources. The overhead of running DISKEEPER is typically under two minutes of CPU time per day, per disk.

Optimization Versus Defragmentation

Some have raised the issue of "disk optimization." They ask why not position files at precalculated optimum locations on the disk; put the most frequently accessed files close together and the rarely-used files off in a far corner of the disk somewhere.

There are three excellent reasons why this should not be done:

1. Common Sense

In a laboratory environment, with only one user on a single VAX with a single disk, it is theoretically possible to calculate in advance the optimum path a disk read/write head should take to access each file with the minimum wasted motion. But VAX/VMS™'s automatic bad block replacement makes it impossible for you to be sure exactly where any particular disk block is physically located on the disk. VMS™ is designed to make this information unnecessary. In fact, the VMS file system contains no mechanism for keeping track of file access frequency.

Even so, chances are you don't have a laboratory environment. Or, if you do, that's not the environment in which you need a defragmenter. You have a VAX or VAXcluster with lots of disks being accessed simultaneously by lots of users. There is simply no way to determine the exact sequence in which files will be accessed. If you don't KNOW the sequence, and you have no way of finding out access frequency, how can you possibly optimize disk head movement?

You can't. You can only guess and pretend. And we know that you don't want a critical piece of system software guessing or pretending ANYTHING where the safety of your user data is concerned.

2. Safety

DISKEEPER is designed to restore your file system's peak performance with no risk to user data files. Risk is limited primarily by keeping the scope of DISKEEPER's processing to a single file at a time. Disk optimi-

zation requires analyzing and shuffling an entire disk's worth of files all at once. It's like throwing a pack of cards high in the air and hoping they will all land face up and in the correct sequence. This level of risk is many orders of magnitude greater, and we know you don't want us taking ANY chances with your user data files.

3. Performance

Every disk has fragmentation unless it has just been defragmented and not used since. And, if you used our Disk Analysis Utility, you know that the costs of fragmentation are enormous. A file fragmented into two pieces can take twice as long to access as a contiguous file. A three-piece file can take three times as long, and so on. Some files fragment into hundreds of pieces in a few days' use. Imagine the performance cost of 100 disk accesses where only one would do! Defragmentation can return a very substantial portion of your VAX to productive use.

Now consider optimization. Suppose, for the sake of argument, that disk data block sequencing really did correspond to physical block locations and you really could determine which files are accessed most frequently and you really knew the exact sequence of head movement from file to file. By carefully analyzing the entire disk and rearranging all the files on the disk (throwing them up into the air and forcing each one to come down in the right spot), you could theoretically reduce the head travel time. The theoretical maximum reduction in average travel time is one-quarter the average head movement time, after subtracting the time it takes to start and stop the head. If the average access time is 33 milliseconds (RA81) and 24 milliseconds of this are head travel time, the best you can hope for is a 6 millisecond reduction for each file that is optimally optimized.

Each defragmented file, on the other hand, saves one disk I/O per fragment. That's FIVE TIMES the optimization savings even with the bare minimum level of fragmentation. With badly fragmented files, the difference is astounding.

On top of all that, what do you suppose it costs your VAX to analyze and reposition every file on your disk? When you subtract that from the optimization savings, it is actually COSTING you performance to "optimize" the files.

The fact is that it takes only a tiny amount of fragmentation, perhaps only one day's normal use of your VAX, to undo the benefits of optimizing file locations. While "optimization" is an elegant concept to the uninitiated, it will do you no good at all.

That's why DISKEEPER doesn't do it.

Know Your Vendor

You can learn a lot about a product by looking at the company that makes it. How important is that product to the company? What is the company's apparent motivation?

DISKEEPER is not just another item in a product line. DISKEEPER has 100% of Executive Software's resources behind it. We're experts in defragmentation.

There has been a rash of company buy-outs in the VAX/VMS system software market recently. Kind of makes you wonder what the management priorities were, doesn't it? Were they looking out for you, the customer, half as much as they were building an image for the venture capitalists?

Many of these acquirers are ex-IBM™ers who think you're the same type of customer as an IBM system manager. One has even publicly stated that today's VAX system software market is the same as the IBM system software market of 15 years ago! Boy, are they in for a surprise! My advice is, if they couldn't make it in the IBM market, they shouldn't even bother tackling you guys.

I have no intention of selling Executive Software. I LIKE what I'm doing and so do all the staff here. We love our product and our company too much to sell out to anyone. Instead, we are dedicating ourselves to being the best in the business, from myself (the company's owner) on down: to the technical support staff who carry beepers so you can reach them at any hour of the day or night, to the shipping people who send your order via Federal Express so you get it FAST, to the salespeople proficient enough to understand and enlighten on the subject of VAX performance and defragmentation, to the marketing people who continually consult VAX Managers for their views.

Our product is based on market research telling us what YOU want in a defragmenter, not what some programmer dreamed up in a laboratory somewhere. Our software engineers are professionals who are always striving to make DISKEEPER as good as YOU want it to be; and that's no simple task.

In a recent survey of a large group of DISKEEPER customers, all but six had nothing but praise, and more than half rated DISKEEPER as a 10 on a scale of 1 to 10.

These are the things that make DISKEEPER a great software product and Executive Software a company you can depend on.

DISKEEPER was the last defragmenter to enter the market. Now it owns the market and the others have all sold out. Doesn't that tell you something?

Waiting for Digital

Maybe you're waiting for Digital to come out with their own defragmenter so you can have a stable, reliable product with a large installed base. Well, you don't have to wait. DISKEEPER, unique amongst third party system software products, has achieved that status. DISKEEPER's stability and reliability is backed by a 100% money-back guarantee. And as for a large installed base, by way of comparison, Digital recently issued a press release announcing the sale of the 10,000th unit of their RDB product. DISKEEPER passed that milestone long ago.

I have been working personally with Digital Equipment Corporation computers since 1969. I collaborated with our resident VMS expert, Rick Cadruvi, on the development of DISKEEPER. We both tackled the matter from the viewpoint of the VAX Manager, because we were both VAX Managers at the time. That's why we chose to eliminate the problem completely instead of providing another utility for you to worry about. We decided to AUTOMATE this one drudgerous portion of the VAX Manager's job. We hoped you would believe, as we do, that Automated VAX Management is better than weekends in the computer room. Now we know we were right, and we're going to continue in that same vein, making DISKEEPER more automatic and hassle-free than ever.

Ask Your Friends

You don't have to take my word for it. Ask your VAX Manager friends. Do they use a defragmenter? Which one? What do they think of it?

Listen carefully to what they say. Watch out for rumors about "defragmenters" in general. Your user data is too important to base such a decision on rumors. Get specifics and get them from the source, not second- or third-hand. And be sure to ask the right questions. Some VAX Managers think an "occasional" crash or just a few lost files is OK. Find out who you know that uses a defragmenter and has NO CRASHES and NO LOST FILES — EVER. Ask them what they use for defragmentation. We think we know what you will find. And we are confident you will call Executive Software to find out more about putting DISKEEPER on your VAX.

Get IMPROVED SYSTEM PERFORMANCE and SPEND YOUR TIME MORE PRODUCTIVELY by letting DISKEEPER eliminate fragmentation from your disks forever.

— Craig Jensen, Chairman and CEO, Executive Software, Inc.

Executive Software, Inc. welcomes letters from our customers and future customers regarding DISKEEPER. Please feel free to write us at 2219 Broadview, Dept. 2317, Glendale, California 91208.

If you have any questions or would like more information on DISKEEPER — the award-winning defragmenter — call 1-800-VAX-HELP Ext. 2317 today.

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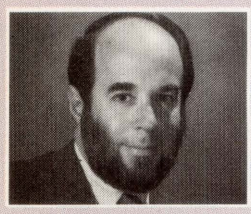


PUBLISHER

Carl B. Marbach

Wall Street Wins Out

Recently, DEC introduced several cost-cutting measures in response to earnings that were lower than those expected by Wall Street. One of these measures was a wage freeze for domestic employees, starting July 2.

But DEC's sales were up, and it reported a net income of $256 million for the third quarter. If you're making money, developing exciting new products and growing rapidly in a fast-changing market, why would you cut back? The answer appears to be to satisfy Wall Street and DEC's investors.

Although cutbacks and wage freezes help the bottom line, they do nothing for Digital's most important entity: the customer. Shipping record numbers of VAXs, workstations and now RISC machines, DEC has increased the size of its customer base significantly. Many of us wonder how DEC will support this large community.

Digital salespeople are notorious for their apathetic response to prospects. DEC increased its sales force dramatically and was to take a new direction by "college" training new industry experts. But recently, our calls for sales help at Professional Press were unanswered or shunted to an even more lackadaisical distributor. DEC is starting to lose regularly again in competitive situations. Its technology has kept it number two in computers. Still, in the era of interactivity, connectivity and midrange computing — all DEC strengths — DEC hasn't gained much on IBM, which holds a commanding five-to-one lead in dollar volume. Cutting costs and freezing salaries is no way to motivate a sales force.

Those of us with active systems know that they become more and more complicated as we add clusters, multiprocessors and foreign processors to our networks. But has field service kept up?

In the late 1960s, DEC delivered the first disk drive we'd ever seen to my PDP-6 installation. Our resident DEC engineer (every system needed a full-time field service person) also had never seen the device he was about to install as our system disk. "No training?" I asked. "No time," he replied, and then set about teaching himself how to install, set up and test the device.

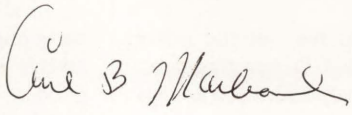
Twenty-five years later, I'm still impressed. If Digital had more technicians like this person, I wouldn't be writing this. Too often, DEC's first cut at field service today is a technician who is nothing more than a board swapper. This person comes equipped with a telephone number back to his office so someone there can guide him through the harder work by remote control. It's efficient for DEC but hell for the customer.

For example, it took a week to update the microcode in a friend's CI780, because no one knew where to look or whom to ask. The field service people we see are fine folks who work hard and give it their best effort, but the company behind them doesn't. By failing to train these front-line personnel, DEC throws them to the wolves. The answer is more training and more people — but that costs money and Wall Street says profits must go up.

The new licensing enforcement program will complicate things further. Only a select few within DEC fully understand how this works.

Customers have a tremendous stake in DEC's continued success. In many cases, we've bet our companies on the quality and performance of DEC's systems. Professional Press and many other businesses can't flourish without nationwide networks linking remote offices and providing critical information to people who need it to do their jobs. When Digital cuts back, we feel the pinch: less service, less support, less caring.

Digital's vision of the future of computing has always been one of its virtues. Wall Street has no such vision. For Wall Street, only the next reporting cycle's financial results matter. It's time for DEC to realize that the customer *always* comes first.



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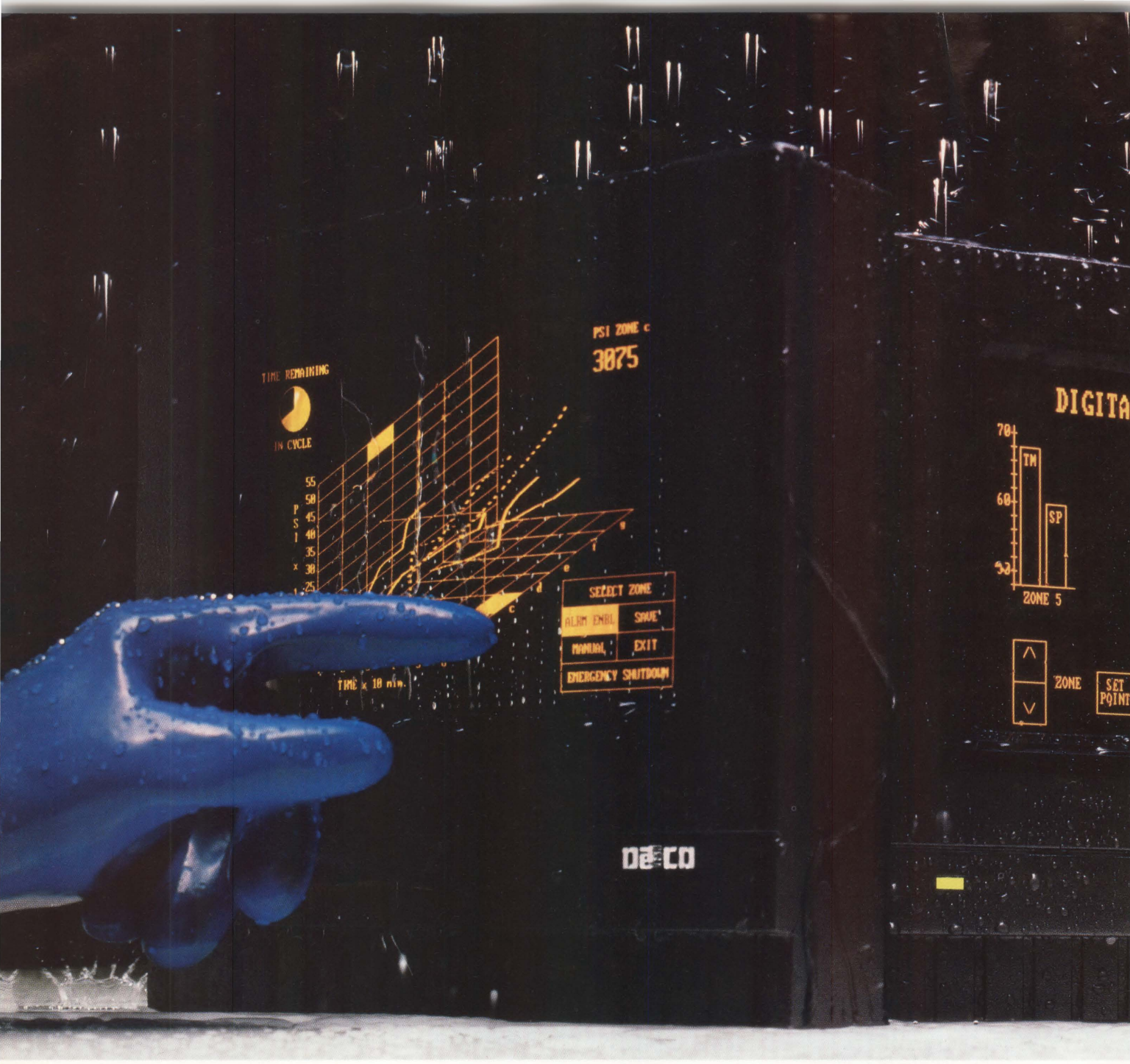

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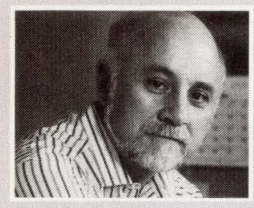


EDITORIAL

Dave Mallery

Taking License

Like many DEC professionals, we spent our Memorial Day weekend in a sequence of 18-hour days upgrading the Professional Press VAXcluster from VMS V4.7 to V5.1-1.

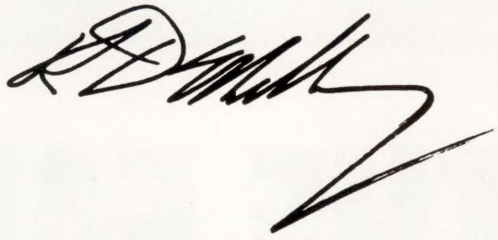
A significant number of our problems involved upgrades and changes to our licenses. In several instances, we were licensed one moment and not licensed the next. At least one hardware problem was obscured because of an erroneous license problem. We weren't only working for ourselves, we were working for DEC, unscrambling licenses with help from the Colorado Customer Support Center.

Do you remember the gasoline crisis? The oil companies raised the price of a gallon of gasoline from 35 cents to $1.75, held it there for a few months, then backed it off to $1.00. And you were grateful when it went "down" to a buck.

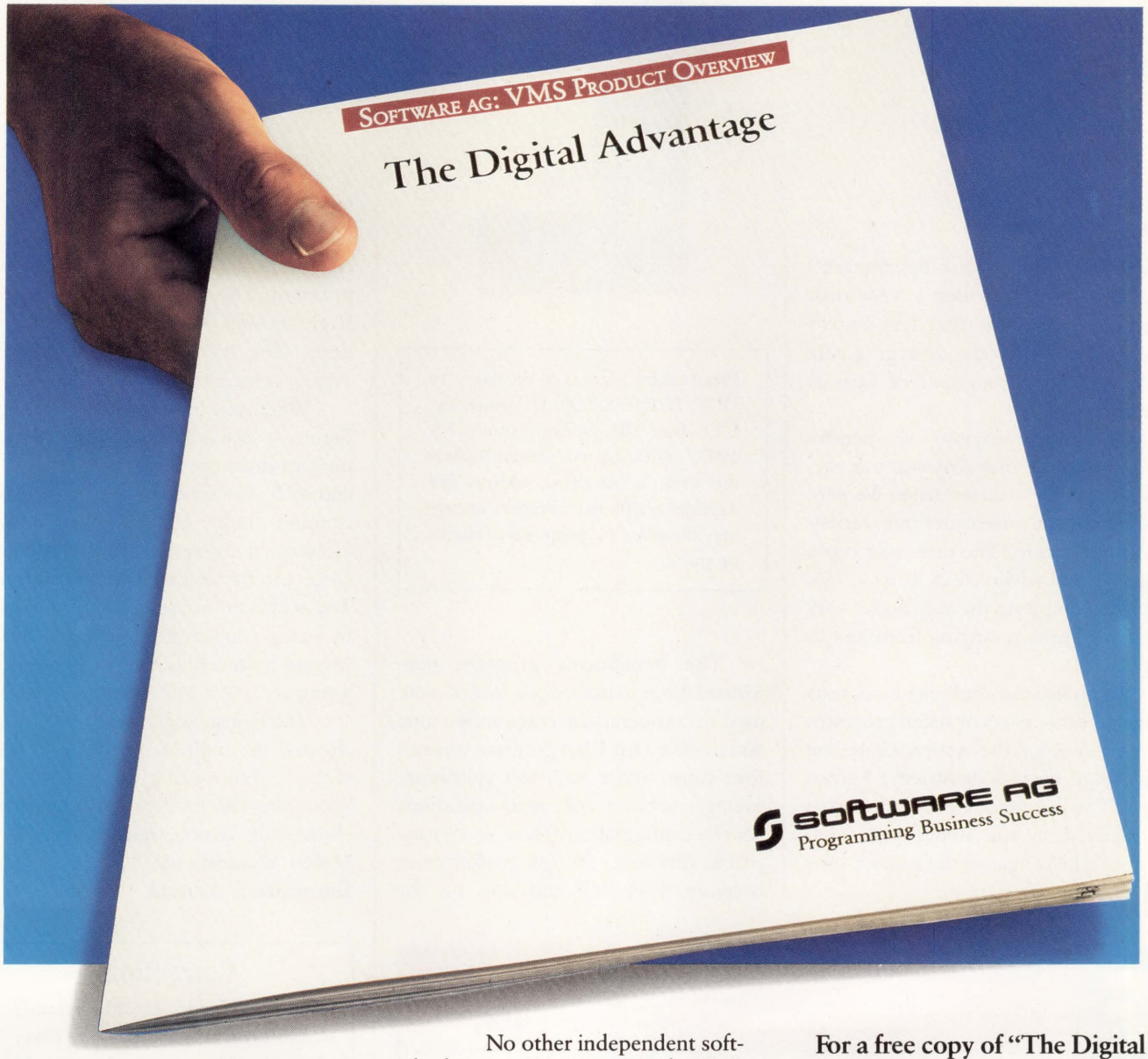
The License Management Facility (LMF) and DEC's new licensing policies aren't unlike the gas crisis: Saddle users with an unbearable pain, ease their pain slightly by doling out the Product Authorization Keys (PAK), then turn on the heat as soon as you have it firmly installed in the entire user base. It may be the greatest corporate revenue enhancer since the $1.00 gallon of gas.

It doesn't have to be like this. Ask the vendors of copy-protected software. People just stopped buying it. The thought of having a DEC software police station inside my VAX makes me sick.

I agree that any software vendor has the right to its intellectual property. But I question whether the vendor should make the customer spend management time and CPU cycles to enforce the vendor's property rights. Will DEC pay a timesharing bill for the LMF disk space and CPU cycles that it's consuming in *my* computer?



Guess who wrote the book on how to make the most of your DEC hardware?



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LETTERS

BENCHMARKING DISK DRIVES

David W. Bynon's "Disk Benchmark" (October 1988) provides a VAX disk benchmark program that lets system managers compare the average access time and data throughput of various disk drives.

Using this program, we benchmarked the VAX disk drives at our site, including a RA90-series drive. We performed the measurements in a variety of configurations. The processor types ranged from a MicroVAX II to a VAX 8700. We completed the tests under VMS operating systems ranging from V4.4 to V5.01.

We carried out the benchmark tests when no other users or batch processes were running on the system. Only one non-DEC drive was evaluated: a Fujitsu Eagle. The benchmark program had to be relinked to run under VMS V5.0, because it links against the system symbol table.

Please address letters to the editor to *DEC PROFESSIONAL* magazine, P.O. Box 503, Spring House, PA 19477-0503. Letters should include the writer's full name, address and daytime telephone number. Letters may be edited for purposes of clarity or space.

The benchmark program performed 256 read operations, which were used to compute an average access time and transfer rate. Each program was run four times under each test condition, giving a total of 1,024 read operations per test configuration. There was no apparent difference in disk performance between VMS V4.7 and V5.0 on the VAX 11/780.

The Figure summarizes the test conditions and results of the benchmark program. The RA90, RA82 and Fujitsu Eagle showed the fastest average access times. The RA81 showed the slowest average access time.

When you look for patterns in the Figure, it seems that the average access time for disks operating under VMS V4.4 and V4.5 was faster than that of disks running under VMS V4.7 and V5.0. However, it also seems that the faster the CPU, the better the disk access time. The access time for the RA81 improved by one second in going from a 780 to 785 and by an additional two seconds in going to a VAX 8700.

The Fujitsu Eagle on the VAX 11/785 showed the highest transfer rate (KB/second), followed by the RA82 on the VAX 8700. The RA81 on the VAX 11/780 showed the lowest transfer rate.

Helen Vanderheide
Edmonton, Alberta ■

FIGURE.

Disk Type	CPU	VMS Version	I/O Bus	Controller Type	Benchmark Measurements: Average Access Time (MSEC)	Benchmark Measurements: Average Transfer Rate (KB/SEC)	Size of Disk in Blocks
RA81	785	4.4	UNIBUS	UDA50	39.7	370	891,072
	780	4.7	UNIBUS	UDA50	40.7	351	
	780	5.01	UNIBUS	UDA50	40.7	359	
	8700	4.5	VAXBI	KDB50	37.7	435	
RA80	780	4.7	MASSBUS	-	37.1	440	242,606
	780	5.01	MASSBUS	-	37.2	430	
Fujitsu Eagle	785	4.4	MASSBUS	System Industries	33.2	566	808,320
RA82	MicroVAX II	4.7	Q-bus	KDA50	34.3	376	1,216,665
	8700	4.5	VAXBI	KDB50	32.5	487	
RA90	6210	5.01	VAXBI	KDB50	33.0	465	2,376,153

Comparison of various disk drives evaluated in benchmark.

Correction

In Bradford T. Harrison's "Building X Hardware Platforms" (May 1989), Northwest Digital Systems was incorrectly listed as a vendor of X terminals. While the firm plans to enter this market, it does not currently offer an X terminal. Northwest supplies Tektronix 4010/4014- and VT220-emulation terminals.

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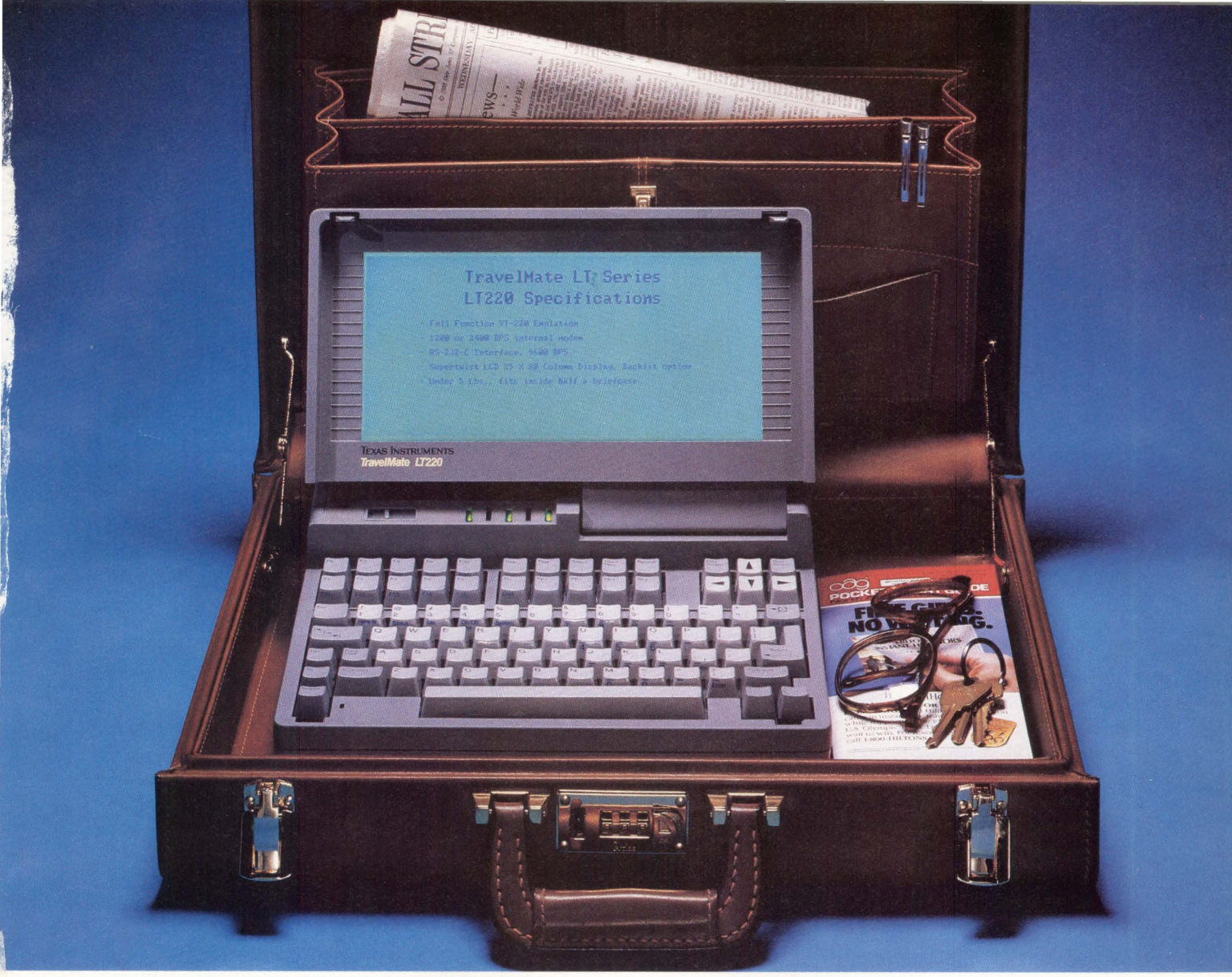

TI's new TravelMate™ LT220. It's the closest thing to carrying a VAX™ in your briefcase.

Texas Instruments introduces the LT220 lap-top terminal — the next best thing to being there when you need remote access to your company's VAX.

The LT220 provides full VT220 emulation in a 4.8-lb. package, without sacrificing functionality. It features a 25-line screen that's easy to read. It even has a full-function keyboard like the one on a VT220.

The terminal communicates at 1,200 or 2,400 bps through one of its optional internal modems. For hard copy, just slide the LT220 into one of its optional cradles to add an ink-jet or thermal printer.

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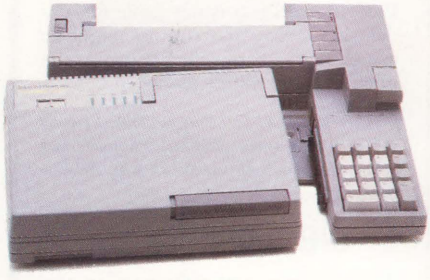

let you create, update and store files. They're also handy for programming the LT220 to your specific application.

Like its Silent 700™ predecessors, the LT220 sets new standards for portability, durability and reliability. All of which makes it the perfect tool for anyone who's ever wished for a VAX in their briefcase. In short, this may be the best little terminal in the world.

So go ahead. Take the first step toward improving your productivity today. Call Texas Instruments for more information or to arrange a demonstration of the LT220. **Phone toll-free, 1-800-527-3500.**

TEXAS INSTRUMENTS

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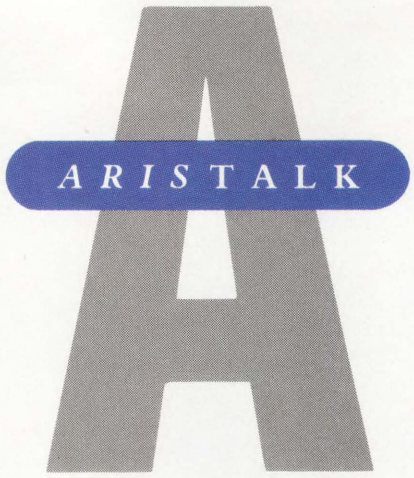

ANTIVIRUS STRATEGIES

QUERY:

David Raich *(SIG 12/MESS 266):* Concerned about viruses, our management instituted a policy of only using in-house software or that bought from trusted vendors. Unfortunately, they don't consider DECUS trustworthy, which makes a lot of programs and useful symposium tapes inaccessible.

We'd like to convince them of a plan for certifying DECUS materials, perhaps testing them on an isolated node, examining source code or waiting for reports from other users.

Does anyone have any thoughts or comments?

REPLY:

Phil Anthony *(SIG 12/MESS 267):* In the PC field, careful users make a distinction among distributions that contain executables only, executables plus documentation with the creator's name and address, and executables accompanied by both documentation and source code. I wouldn't have any of the first category on any system I'm responsible for.

The second group is almost always trustworthy, but on systems where there's concern, contact the creator and verify the filesize and the checksum. Better yet, check the CRC using a known public formula of the distributed executable. The filesize tells you very little in a positive sense, because a clever person could find a place to stick his virus without changing its size. Checksums are also relatively easy to doctor by adding a few meaningless bytes in a safe place. I have source code for 16-bit CRC-CCITT written in C, if you're interested; you could plug it into your own in-house file checking program and ask the source of a DECUS executable to run the same program against his original as verification. Maybe such a procedure should become a DECUS standard.

I've never heard of any software in the third category not being trustworthy. However, you should examine the source code carefully and compile or assemble it yourself, which is the safest way, or follow the same verification procedures for the second category.

On DECUS tapes, the author always is known and there's a verifiable audit trail from the person who submitted the software to the tape librarian to you.

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To log in, you'll need your subscription number from your mailing label. Set your terminal to seven data bits, one stop bit and space parity, or eight data bits, one stop bit and no parity, and dial:

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XMODEM and KERMIT are available. Starting this month, you must key in your name and subscription number before the ARIS/BB Welcome Screen appears.

SIG Identification

The SIG categories referenced in this month's *ARIS*talk are:

11 .....Clustering/Networking
12 .....Site Management
46 .....Utilities

UNKNOWN PROCESS STATE

QUERY:

Pedro Crespo *(SIG 12/MESS 269):* Sometimes processes tend to hang on our MicroVAX II, which is connected through a terminal using a MUXMASTER. SHOW SYSTEM indicates the status is RWMBX. I can't find a description for this code. We're running VMS version 4.7. Any comments or suggestions will be appreciated.

REPLIES:

Ron Salazar *(SIG 12/MESS 271):* According to information I received from DEC's

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System Architecture course, the process state, RWMBX, falls into the category of miscellaneous wait states. RW means the process is waiting for a resource to become available. MBX indicates it's waiting for the mailbox resource. When the non-paged pool becomes empty, the routine calls another VAX/VMS routine to save the process context and place it in a resource wait state. During this time the process may be swapped out of memory. When the non-paged pool becomes available, the scheduler reschedules the process. This is vaguely covered in the *Device Driver* manual, although the wait state names aren't given.

Philip Gravel *(SIG 12/MESS 273):* Another good way to track down RWxxx states is to look in the *Monitor Utility* manual under STATES (version 4.n). It lists the mutex states. From there, the *VAX/VMS Guide to Performance Management* can help you determine what resource is causing the wait state and how to rectify it. The RWMBX status is the result of a full mailbox, for which an application program, rather than VMS, is responsible.

Pedro Crespo *(SIG 12/MESS 274):* We aren't running anything out of the ordinary other than version 4.7 and compilers, and ORACLE, which we had running before the problem showed up.

What really bothers me is that the processes hang, and our users just log in again from another terminal. After taking your username and password and showing the last time you logged in, the system won't respond. Looking at the system, the process is in RWMBX state.

EBCDIC-TO-ASCII CONVERSION

QUERY:

Stuart Masch *(SIG 46/MESS 355):* Periodically, we get EBCDIC tapes from other data centers. How can we convert to ASCII and load onto an 8250/RA81 configuration?

Richard B. Gilbert *(SIG 46/MESS 356):* There are routines in the run-time library to translate from EBCDIC to ASCII and from ASCII to EBCDIC. There are also BCDIC to ASCII and vice versa. I believe you want LIB$TRA_EBC_ASC. This function takes two arguments: an input string, passed by descriptor, and an output string, also passed by descriptor. If you would rather have a whole program, I have one that reads unlabeled tapes with fixed-length blocked records "DCB=(RECFM=FB, ...), deblocks the records, translates them to ASCII and writes them to a VMS text file. It's written in FORTRAN. A program called MTEXCH, written by Gary Grebus, handles more complicated IBM tape formats, plus RT-11, TOPS-20 and DOS-11. MTEXCH is available on DECUS tape No. V-SP-39.

MIXING VMS VERSIONS 4 AND 5

QUERY:

John P. Flynn *(SIG 11/MESS 381):* I have a homogenous cluster of two VAX 8250s running VMS V4.6, six HSC-served RA81 disks, two TA81 tape drives and many LAT terminals. I'm unable to convert to V5.0, because one of our third-party software packages doesn't yet run under V5.0.

We're about to add a 6310. Is it true that it must run V5.0? If so, we'll run the V4.0-only application on the 8250 cluster and run the other application under V5.1 on the 6310.

Is it true that V4.0 and V5.0 can't be mixed in a cluster, even if it's a heterogenous cluster? If so, we'll leave the 8250 cluster as it is but connect some of the disks directly to the 6310. We'll Ethernet everything so that LAT and DECnet can be used.

What are the possibilities for sharing files and disks between the decoupled 6310 and 8250 cluster? Is DECnet efficient for this? Can we still backup all disks from one system? What are the implications in dual-porting the RA81s between the two systems? If my assumptions are correct, we'll be relying on DECnet for the "not-huge" amount of data sharing we need to do. What are the major restrictions of DECnet that might cause us problems?

REPLIES:

Robert G. Schaffrath *(SIG 11/MESS 382):* Regarding 6310 requirements, you must be running VMS V5.1. You can have a mixed V4.7, V5.0 cluster, but it's a pain. You can't fully upgrade to V5.0. You must run a version called A5.0. This applies to homogeneous as well as heterogeneous clusters. I don't believe V5.1 is supported in a V4.7 environment under any circumstances.

File sharing with DECnet works, but it's inefficient. If you're going to be doing extensive file sharing, work on getting the cluster back up. Disk sharing is possible with the dual-ported drives. It requires some additional SDI cables and hooking each disk to both systems. You can share any disk this way except the system disk. To move the disk to another system, you'll need to dismount it on one system and remount it on the other. If files are open or installed on the disk, it can't be dismounted.

Marty Johnson *(SIG 11/MESS 383):* If you're going to share disks, I recommend frequent backups, saved for the duration. I also recommend a checklist for switching the disk from one machine to another.

If you manage to mount a disk on more than one machine and each machine thinks it's the sole owner, i.e., no distributed lock manager, you can kiss the data goodbye. It happened at a site where the SYSGEN parameters were set to never load the cluster software, and the system manager put a second CPU on the HSCs. Luckily, he only dual mounted one disk. By the time the problem was found, so many blocks had been double allocated, the disk was useless.

With regard to a mixed-mode cluster, I've heard of problems with some of the layered products, such as CDD and Rdb. Check with Digital about problems with any of your layered products. ■

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CIRCLE 243 ON READER CARD

PRODUCT WATCH

Corporate Mouse Solution

Itac Systems Inc.'s Mouse-Trak Replaces VAXstation 2000 Mouse

If you prefer the feel of a trackball more than that of the standard VAXstation 2000 corporate mouse, Itac Systems Inc. of Garland, Texas, has an alternative that may be for you.

The Mouse-trak trackball unit is 2.5 inches high, 4.06 inches wide and 7.9 inches long. It plugs into the same socket that the DEC corporate mouse uses. The buttons to the left and right of and below the rotating ball function in the same manner as those of the corporate mouse.

The trackball can be custom configured. The key used for the Enter key can be relocated from the left button to either the middle or right button. Pencil switches under the Mouse-trak can be set to change the action of the keys. Each key can function as a toggle switch. Keys also can be configured to remain active for the length of time that the button is depressed.

A speed-change button, located near the ball, causes the cursor to slow to one-fourth its normal speed. This is a toggle switch, so pressing the speed button again will return the cursor speed to normal.

The trackball can overcome the space restrictions that often are present with a mouse. Because the unit remains stationary, there's no need to pick up the trackball and relocate it to move the cursor around the screen.

In addition, a soft wrist pad lets you rest your hand comfortably on the Mouse-trak. All three buttons are within easy reach.

Because the Mouse-trak directly replaces the DEC corporate mouse, very little documentation is needed. You can install and use the device immediately.

The price for the DEC version of the Mouse-trak is $179. Models are available for other workstations and PCs, such as those from HP, IBM and Sun, at similar prices.

For more information, contact Itac Systems Inc., 3121 Benton Dr., Garland, TX 75042; (214) 494-3073. **Circle 492 on reader card**

—David B. Miller

Itac Systems Inc.'s Mouse-trak directly replaces your VAXstation 2000 corporate mouse.

DIANA WALKER/TIME MAGAZINE

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Bulk Data Distribution

Empress Software's RDBMS Touts High-Level Features For Sophisticated Environments

It used to be that information stored in a database was easy to visualize. Data was kept in single, large files. Every record had the same number of fields with specific field lengths assigned to them. Data was displayed or printed as text only.

However, the increased use of graphical interfaces and the increased sophistication of applications require database systems to handle a wide variety of data types, including non-structured, free-form data. In addition, data often needs to be stored on separate computers while being accessible in total by anyone, anywhere.

Empress version 4.0, from Empress Software Inc. of Greenbelt, Maryland, is designed to provide the functionality of a traditional RDBMS, as well as capabilities to handle unstructured, bulk data and to distribute data across various nodes in a network or VAXcluster.

Empress runs on VMS systems with 1 MB of main memory. Only your disk's directory structure will limit the number of databases you can create. Each database can contain up to 9,999 tables, each table possessing up to 9,999 attributes. Each table can hold more than 2 billion records, and records can be more than 2 billion bytes long. Depending on the capabilities of the host computer, from 50 to 100 databases can be accessed simultaneously. Up to 9,999 keys per sort are allowed. SELECT commands can be nested up to 100 levels.

Data types supported include Character, Date, Decimal, Floating Point and Integer. Empress' Bulk data type allows for the storage of free-form, complex data, such as graphic images.

Empress provides easy data access. Empress' SQL meets ANSI SQL standards. Anyone who knows SQL from another database system will have no trouble moving to Empress. Data entry can be accomplished with single insert commands. Data can be imported from other files. An Interactive Interface with full prompting also can be used to enter data easily. A command line editor with command recall can simplify operations. Custom I/O screens can be created with Empress' Screen Painter facility.

Although Empress lets multiple users access the same database, security features ensure data integrity. Access privileges of varying levels can be granted to users. System catalogs keep track of granted privileges on the system. Database, table and record locking keep multiple updates synchronized. Checkpoint and recovery utilities recover data after a major failure.

Empress supports the distribution of data across nodes in VAXclusters and in DECnet environments. Data can be distributed as a single database comprising many tables across several nodes. Multiple databases can be set up on individual nodes. Empress looks at the overall picture as a single database. You don't need to know where the data is. All Empress commands operate on distributed data as they do for a single database. A two-phase commit protocol ensures that transactions involving multiple databases will be completed intact.

In addition to generating various ad hoc reports, Empress provides a scripting report writer, M-Writer, when you need more sophistication. M-Writer's procedural language supports variables, data retrieval, numeric calculations, picture formats, page headers and footers, and text justification.

Empress can interface to VAX C and FORTRAN. Calls to Empress' SQL can be made from the host program.

M-Builder, a 4GL and application generator, also is supplied with Empress. M-Builder can generate a default application for any database table, providing full-screen access to the table's records with function keys to perform record selection, insertion, update and deletion. M-Builder can be used to generate custom applications, as well.

For more information, contact Empress Software Inc., 6401 Golden Triangle Dr., Ste. 220, Greenbelt, MD 20770; (301) 220-1919.

Circle 495 on reader card

—David B. Miller

Empress' RDBMS processes bulk data in a usable format. Data is used in a relational model and accessed through a 4GL.

TALARIS PRINTSTATIONS

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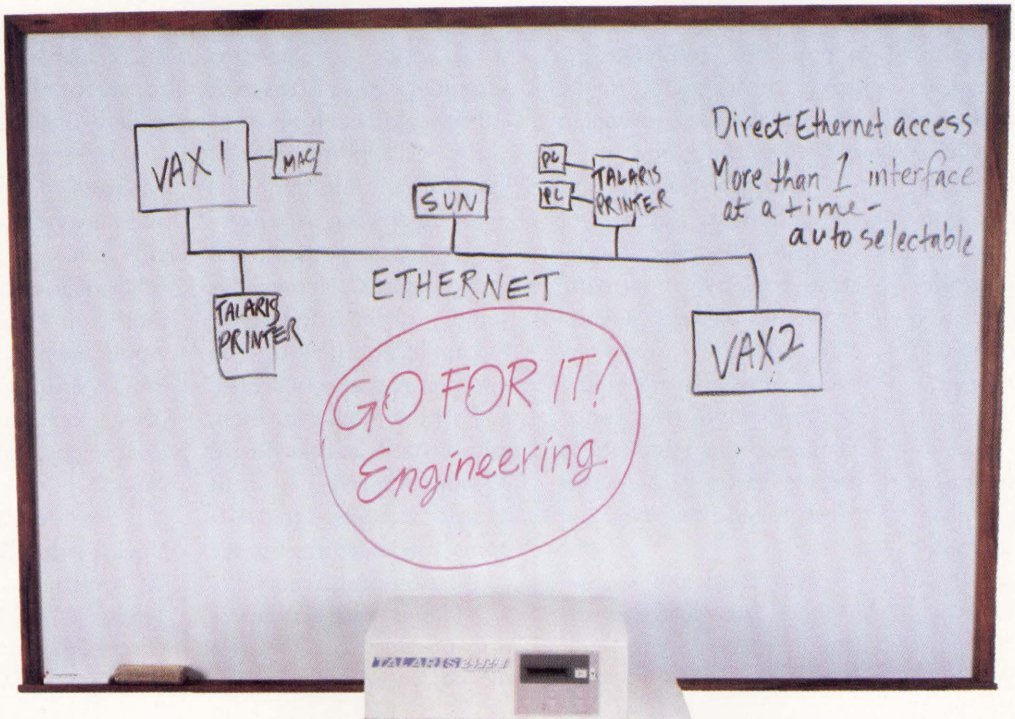
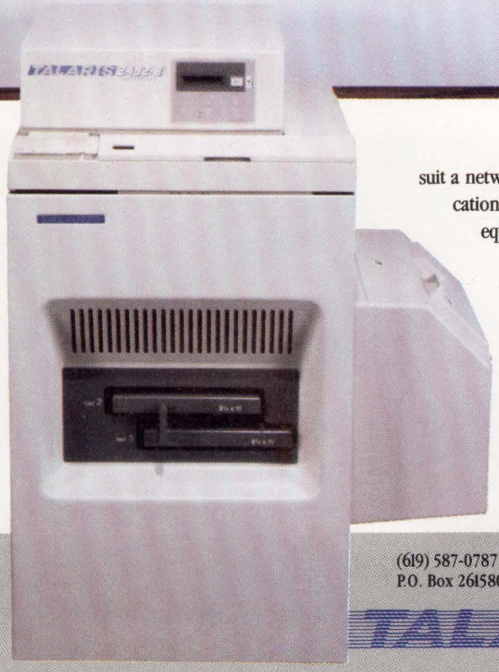


There's no better way to keep your multiuser system friendly than by connecting it all together via Ethernet. And now, thanks to Talaris Printstations, your network of users can even share printers. That's share and share alike — because the 2492-B Printstation doesn't play favorites. It has emulations, fonts, and options to suit a network full of different applications. Then too, the 2492-B is equally at home with DECnet and TCP/IP networks. So why not go for it? You'd have to go a long way to find a better laser printer to be friends with your network users.



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TALARIS SYSTEMS INC.®

CIRCLE 142 ON READER CARD

Lots Of Hoopsla

Ithaca Software's Hoops Creates Interactive Graphics Applications

Hoops, from Ithaca Software of Ithaca, New York, is a C-based library of routines used to create graphics applications for science, business and engineering. It's an object-oriented system that allows applications to be developed and run across a wide range of hardware platforms.

The core of Hoops is its graphical database. Elements of an image are stored hierarchically. Commands can be issued to change an image's rendering and other display attributes.

Hoops' drawing primitives — lines, polylines and polygons — are available to create 2- and 3-D objects. Text and marker symbols also can be added. Pixel arrays of raster data can be used in image processing applications. Object libraries can be created to collect and hold frequently used objects.

Objects can be rendered as wire-frame representations or as shaded solid objects. Hidden-line and hidden-surface removal are performed automatically. Shaded images can be produced by adding multiple light sources to an image. Rendering attributes, such as the color and pattern of lines, edges and polygon faces, are user selectable. Text size, spacing, color, path and justification also can be adjusted.

Rendering attributes can be collected into a Style Library. For example, the attributes needed to create a chrome effect can be grouped, named and applied to objects as a unit.

The database stores drawing primitives, such as lines, polygons and attributes, into basic elements called segments. Within segments, drawing primitives can be grouped and named for reference. A group of segments can be changed with one command applied to the group.

An application can have an unlimited number of segments. Segments can be created relative to existing segments. Hoops' hierarchical structure causes attributes given to a segment to propagate down to subsegments. Changing a segment at one level ensures that subsegments are updated, as well.

Modeling and motion routines also can take advantage of Hoops' hierarchical structure. Motion commands, such as rotate, applied to one level of the object's hierarchy affects the sublevels, as well.

Objects are viewed through "cameras." Perspective and orthographic camera "lenses" are available. Utilities exist to pan, zoom and orbit cameras to allow you to walk or fly through the scenes you create.

Cameras' views are projected through windows. Windows can be resized, overlaid and moved. The scene inside the window automatically is resized to fit a new window. Hoops provides X Window System integration in addition to its own windowing system.

A set of inquiry and show routines allows developers to generate interactive applications. Hoops can interpret mouse-key presses and report mouse location, button status and keyboard selection. Specific segment names, windows and 3-D points can be returned to the application program.

Hoops' modular structure provides control over the objects in the database. The procedures needed to perform object movement, change an object's color or reveal or hide an object are cared for by the system. Application developers need not write code to perform such operations.

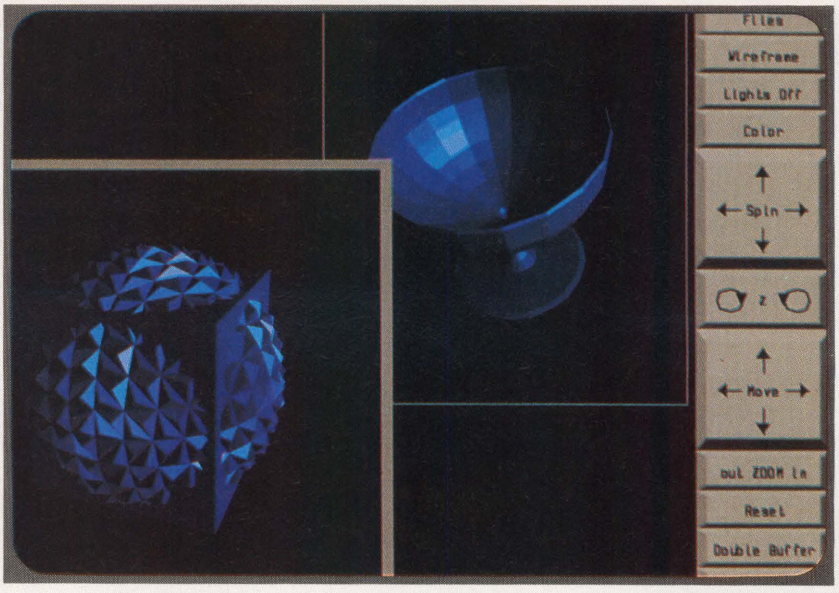
Commands are issued as English statements. In addition to being easy to use, Hoops is device independent. Applications developed on one platform will run without modification on another. Run-time options are available for each platform to allow access to system-specific features.

Hoops runs on MicroVAXs and VAXstations running VMS or ULTRIX. It also runs on a variety of other platforms, including those from Hewlett-Packard, Apple and Sun, as well as on PCs. Supported output devices include those that are PostScript and HP-GL capable.

For more information, contact Ithaca Software, 902 W. Seneca St., Ithaca, NY 14850; (607) 273-3690.

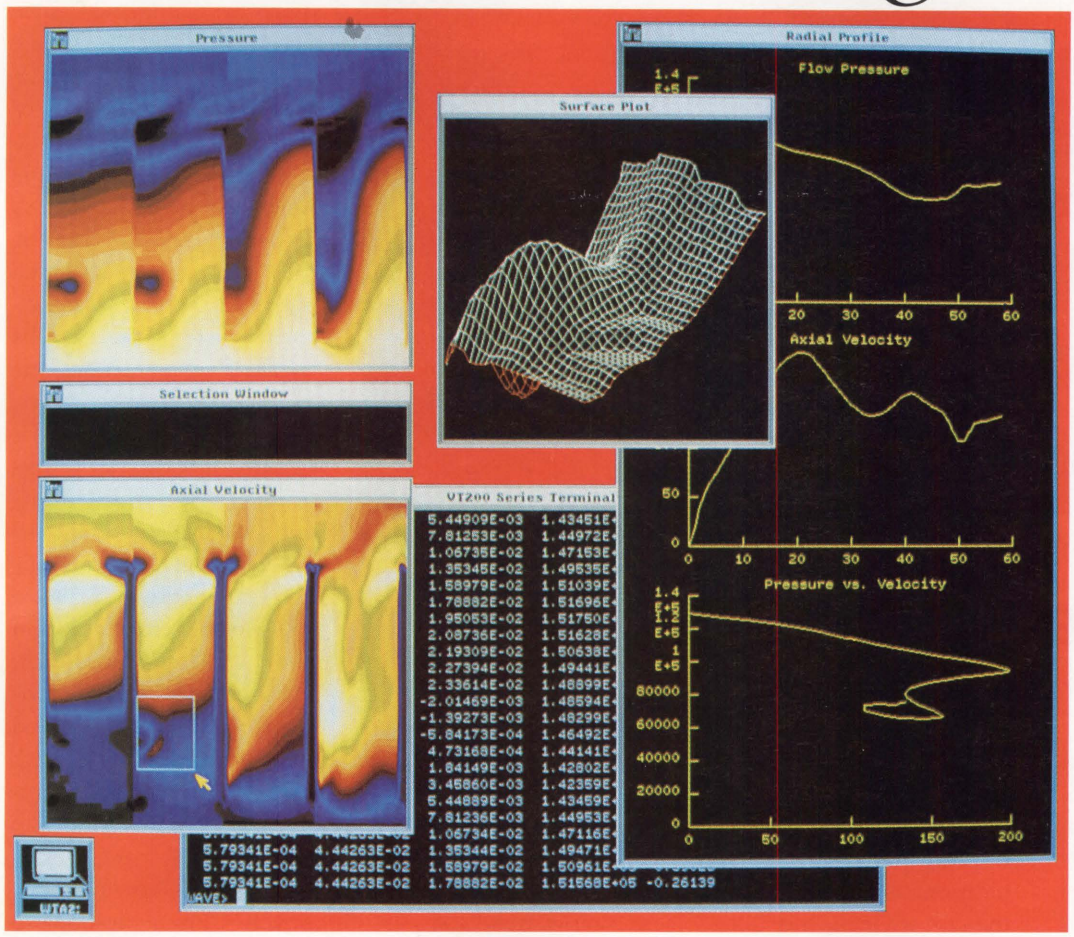
Circle 502 on reader card

—David B. Miller



Hoops' graphics library can be used to develop complete, interactive applications.

Better Science Through Pictures



Results of computational fluid dynamics (CFD) analysis using data from Holset Engineering as visualized on a VAXstation 2000. At the left, powerful image processing features quickly show an overview of the full data set. From there, features and trends are identified interactively and displayed as surfaces and line graphs. PV~WAVE is ideal for quickly viewing large data sets to gain important insights. Using this new information, it is then possible to select features and subsets for further review and analysis.

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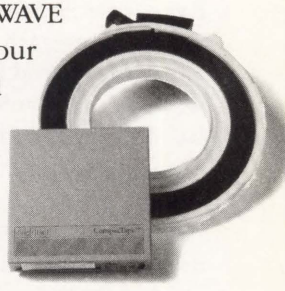

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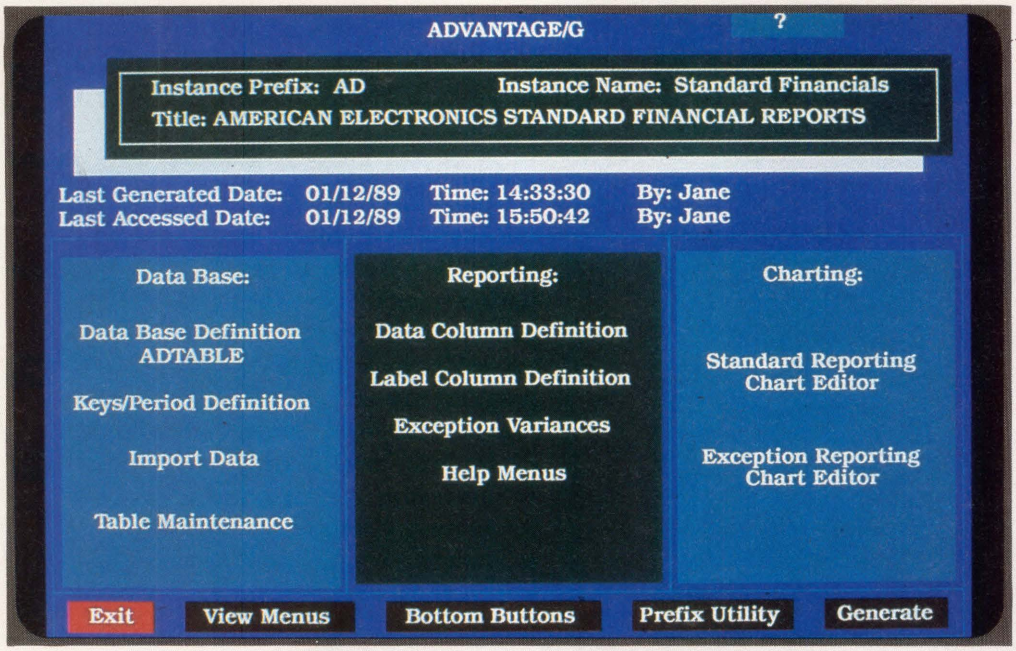


This code generator enhances Advantage/G, a financial-analysis package.

CASE Tool For Execs

Pilot's EIS/G Generation Helps Customize Applications

Executive information systems (EIS) let corporate higher-ups drill down through a company's applications and databases using a single software interface to glean important information on key business issues. For example, EISs are used to review corporate sales and finances, track progress of internal programs, access spreadsheet data or tap online news services for stock information.

The EIS, from Pilot Executive Software of Boston, is just such a system. It uses a front-end PC or PS/2 with an adaptable menu-based interface and pulls information into customizable charts and reports from a variety of applications residing on VAX databases.

Pilot's fundamental module is Command Center. It lets MIS managers develop systems that compress internal and external applications into needed bits of information. Database and communications software reside on the VAX while the user interface, graphics and PC communications are located on the PC.

Pilot has added the EIS/G Generation, a series of EIS applications that use code-generators operated from menus to set up applications. After menu selections have been made, the generators write the underlying code to compile a ready-to-boot application.

The first of Pilot's off-the-shelf applications to incorporate this back-end CASE technology is Advantage/G, a program specifically designed for retrieving and analyzing financial information. It's often used for balance sheets, human-resources forms or cash-flow statements. In Advantage/G, the menus let users customize screen layouts, report formats and charts to display data, including exception reports, text annotation and time series trend analysis.

When setting up applications, the developer must tell the system where the data resides; set formats and display options, columns and headings; add comments and change the default settings; and organize charts and screen functions using editors and exception handling. The code generation is unnoticed by the user. Data can be displayed on-screen or printed in customized reports.

By clicking the mouse on a menu title, the executive can access more detailed information on a given topic progressively, like peeling layers from an onion. Every part of the program runs on the PC except for the requests for data. Priced at $25,000, Advantage/G requires the Command Center development environment.

Pilot's other modular EIS applications eventually will be equipped with code generators. These include Dimension, which provides a relational view of data for sales and expense analyses; Target, a project management system that tracks marketing programs or product development cycles; NewsTrack, which provides external news tracking; Executive Mail, which front-ends VAXmail and ALL-IN-1; and programs for economic and competitive analyses. The modules are priced from about $5,000 to $15,000 each.

On the PC side, the program requires IBM PCs and PS/2s running DOS 3.1 with 640 KB of memory. Prerequisite hardware includes an EGA or VGA card, and a MicroSoft mouse or touch screen. Communications to the host database are established through an asynchronous serial port to the VAX or an Ethernet connection running DECnet/DOS version 1.2 LAT protocol.

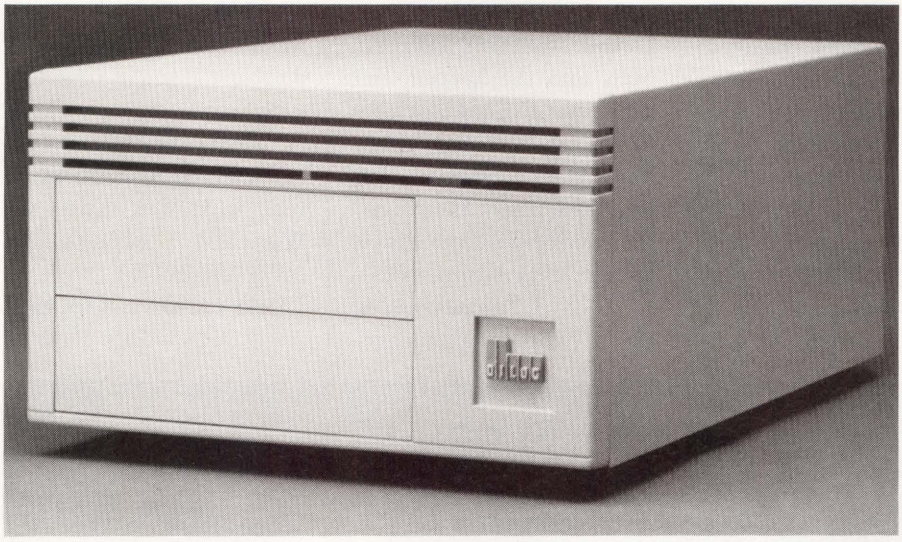
The VAX part of the program requires 6 MB of physical memory, 20 MB of disk space and a user minimum of 8,000 virtual pages. It runs with VMS version 4.6 and later. For remote access, Pilot recommends a 2,400-bps asynchronous modem. EIS/G is compatible with the HP LaserJet and IBM personal color printer.

For more information, contact Pilot Executive Software, 40 Broad St., Boston, MA 02109; (617) 350-7035.

Circle 496 on reader card

—Evan Birkhead

DILOG INTRODUCES THE TWO THINGS MISSING FROM YOUR DEC 3100:



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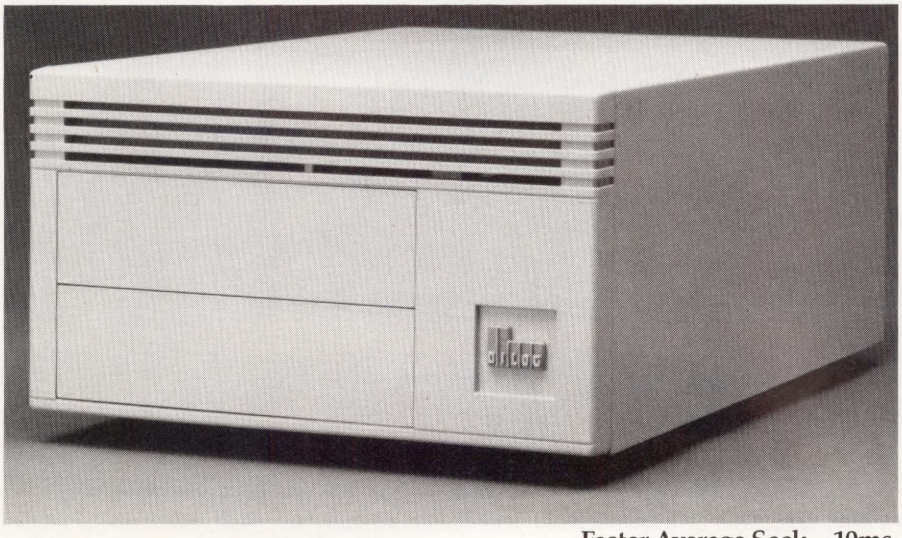

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CIRCLE 243 ON READER CARD

Usurping DCL

Hancock Software's Filemaster Provides A VMS Layered Utility For Organizing Files

If you talk to VAX/VMS system managers about file maintenance or disk management, you'll hear several recurring complaints:
1. The files are too large to manipulate.
2. DCL is too difficult to figure out.
3. When scattered across DECnet devices, files are hard to organize and track.

Hancock Software Inc., a start-up based in Watertown, Massachusetts, has developed VMS file-management software that purports to solve many of these problems. Filemaster maintains and organizes large numbers of large files via a window-based interface that lets you bypass operations usually performed by DCL commands. Additionally, Filemaster takes some of the tedium out of file organization, speeding management tasks. DCL is still accessible for applications that require it.

The system provides powerful file selection and sorting commands in a format that lets you select lists of files by any of seven file characteristics.

The user interface consists of three windows that can be stretched or shrunk. The first is a directory tree that Filemaster builds from reading VMS files. It shows the relationships of files within the directory structure. All files are listed in selectable order, regardless of the network node or disk on which they reside. You can select a file to open by scrolling with the arrow key and hitting Enter. Files can be ordered in any of 16 ways; alphabetical order is the default.

The second window lists statistics of the selected file, including its name, size, date created and last user, or any other VMS attribute you select. The third window displays the contents of the file and lets you browse and edit without disrupting figures in the other windows.

Filemaster uses Lotus-style / commands that bring up a descending menu system at the top of the screen. Typing / CUSTOMIZE, for example, lets you set statistics you wish to have displayed on the screen. / CUSTOMIZE VMS EDITOR invokes EDT, TPU or any other on-line editor. The system manager can make menu functions invisible to restrict user access. Filemaster features a Soft-delete capability that allows you to bring back deleted files using the UNDELETE menu command.

Conventional VAX keystrokes are used for file management. The arrow keys are used to scroll through these windows. Default function keys are built into the keypad, but other user-defined functions easily can be written into these keys. A Help facility that describes the highlighted menu command is accessible by hitting PF2.

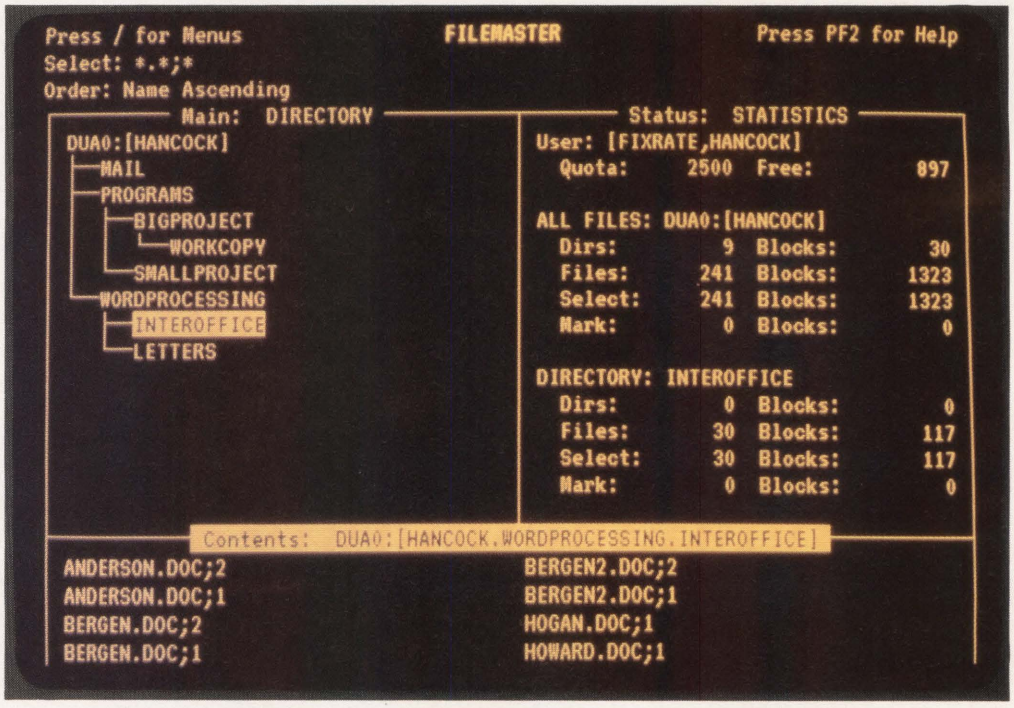
Across DECnet nodes, the network disk-management capabilities provide security functions that protect files and allow files to be customized to different users. System managers don't have to worry about directory names, thanks to an all-encompassing list function called ALLFILES. An audit trail keeps a log of file-management activities, allowing the system manager to reconstruct new programs for security protection. The program is layered over VMS by running a standard VMSINSTAL and takes up little executable and disk space.

Filemaster prices range from $495 to $7,950, depending on the size of your VAX processor.

For more information, contact Hancock Software Inc., 115 Watertown St., Watertown, MA 02172; (617) 924-0017.

Circle 493 on reader card

—Evan Birkhead



Filemaster's three extendable windows display your overall directory tree (left), file statistics (right) and the editable file (below).

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CIRCLE 102 ON READER CARD

Let's C PostScript Now

UniPress Software's C2PS Compiler Converts C Code To PostScript Code

If you're a programmer who writes a lot of his own code but isn't familiar with or doesn't like to work with PostScript, the C to PostScript (C2PS) Compiler may be for you. The C2PS Compiler, from UniPress Software Inc. of Edison, New Jersey, converts C source code into PostScript code. It allows programmers to write PostScript-based applications in C.

Adobe Systems' PostScript language is unlike other page-description languages because it's a true programming language. PostScript most often is generated automatically by application programs from a higher-level description. However, as PostScript finds use in window systems and graphical user interfaces, such as Sun Microsystems' NeWS, developers find they must write large bodies of PostScript code by hand.

C2PS overcomes problems associated with writing PostScript code. Infix rather than reverse Polish notation is used to write expressions. C data types can be used. They are translated into PostScript objects. Function calls and control statements written in C are more likely to be understood than their PostScript equivalents.

C2PS was developed for use in NeWS and other environments that require the production of PostScript code, such as Adobe's Display PostScript, X/NeWS and PostScript printer applications. C2PS lets programmers write entire PostScript applications in C. It eliminates the PostScript learning curve and reduces the effort of creating windowing applications. C2PS is useful to those who would rather work in C or who already have written code in C and want it to work in a PostScript environment.

"Many C programmers aren't conversant in PostScript," says Mark Krieger, UniPress president. "C2PS eliminates the pain of learning PostScript."

In the normal course of NeWS development, for example, a C program implements most of the application. The graphic interface then is written in NeWS and connected to the C portion by CPS, a program provided with NeWS. CPS provides a remote procedure call (RPC) mechanism between C clients and NeWS servers anywhere on a network. PostScript subroutines thus can receive arguments from and return values to C code transparently.

After C2PS generates a PostScript module, that code can be used directly (e.g., sent to a printer to produce a graphic image) or with other PostScript packages to build an application. Because code generated by C2PS follows normal PostScript calling conventions, no extra work is necessary to use it with existing packages. C2PS output can run under NeWS or on an Apple LaserWriter.

C2PS is part of UniPress' PostScript working environment. When used in conjunction with the UniPress Emacs editor, you can edit and view C code in one window while viewing the produced PostScript in another. The graphic output then can be shown in a NeWS window or on a printer. UniPress Emacs also has a PostScript editing mode that provides features such as PostScript construct expansion and on-line databases of PostScript and NeWS terms and descriptions.

C2PS is available on a number of computer systems, such as the VAX, with binary code priced at $2,995 and source code priced at $14,995. University discounts are available.

```
#define pickfont (fn,sz) setfont (scalefont (findfont (fn),sz))

main ()
{
     int i, s;

     pickfont ("Times-Bold", 24);
     erasepage ();
     for (i = 20; i < 600; i += 40)  {
          gsave ();
          moveto(300, i);
          s = i < 350 ? (400-i)/250 : (i-300)/250;
          scale (s, s);
          cshow ("C for yourself -- PS for NeWS!");
          grestore ();
     }
     showpage ();
}
```

```
!PS-Adobe-2.0
/main  {
     (Times-Bold) findfont 24 scalefont setfont
     erasepage
     /_i 20 store
     {
          _i 600 lt not {break} if % for condition
          gsave
          300 _i moveto
          /_s _i 350 lt {
               400 _i sub 250 div
          } {
               _i 300 sub 250 div
          } ifelse
          store
          _s _s scale
          (C for yourself -- PS for NeWS!)
          cshow
          grestore
          _i 40 add /_i exch def
     } while
     showpage
} def
```

A C program ready to be compiled is shown at left. C2PS-generated PostScript of the same C code appears on the right.

For more information, contact UniPress Software Inc., 2025 Lincoln Hwy., Edison, NJ 08817; (201) 985-8000.

Circle 497 on reader card

—Eric Schoeniger

EM4105 is a sophisticated Tek 4105/DEC VT220 terminal emulator that converts your IBM PC into a color graphics workstation. EM4105 costs thousands less than a dedicated graphics terminal.

4105 EMULATION

EM4105

- *16/64 colors*
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- *Loadable Character Sets*
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3775 Iris Ave. Suite 1B, Boulder, Colorado 80301
FAX: 303-447-1406 (303) 447-9251

Other DCS emulators: EM220 — DEC VT220 Emulation
EM4010 — Tek 4010/VT220 Emulation

Trademarks: VT102, VT220 — Digital Equipment; IBM PC, XT — IBM Corp.; Hercules — Hercules Computer Technology; Tektronix — Tektronix, Inc.; Precision Visuals — Precision Visuals, Inc.

CIRCLE 329 ON READER CARD

Out Of The Blue

Berkshire Spins Off IBM Market With DEC-Compatible Storage Subsystems

A new company called Berkshire Computer Products of Framingham, Massachusetts, has entered the DEC-compatible storage subsystems realm with three product-family introductions. Berkshire is a spinoff of Acknowledge Inc., a manufacturer of mass storage devices for IBM midrange and mainframe computers. It will function independently.

The initial product families include:

1. The Maximizer series of subsystems, which plug into any of DEC's SDI controllers and feature formatted capacities ranging from 665 MB for one subsystem upgradable to 3.5 GB in a cabinet that stacks seven subsystems.
2. The Discovery I, a series of four nine-track tape drive subsystems for the UNIBUS and Q-bus.
3. The Discovery II series, an 8mm helical-scan cartridge tape drive called the E1000, also for the UNIBUS and Q-bus.

The Maximizer disks are compatible with the HSC 70/50/40, KDB50, KDA50 and UDA50 disk controllers. The incremental design of the cabinet yields the following storage capacities: the Maximizer 650, 665 MB; the Maximizer 850, 875 MB; the Maximizer 1350, 1,330 MB; the Maximizer 1750, 1,750 MB; the Maximizer 2000, 1,995 MB; the Maximizer 2600, 2,625 MB; and the Maximizer 3500, 3,500 MB. The fully configured seven-member cabinet uses one SDI port per disk. The rack-mountable unit is installable in slots on RA81 cabinets or TU-series tape drives.

The Maximizers easily can be field upgraded to higher-capacity drives as your VAX system grows. Berkshire reports that its prices for competitive drives will be 20 to 30 percent less than DEC's. Each drive is based on an eight-inch Winchester disk with a peak data transfer rate of 2.8 MB per second and an average seek time of 16 ms. MTBF is estimated at 50,000 hours.

Two high-capacity preconfigured disk subsystems also are available from Berkshire. The Maximizer 7000 offers 7.0 GB of storage; the Maximizer 12000 has a 12.25-GB capacity and costs $205,000.

The four tape drives in the Discovery I line accommodate different tape media. The 200-ips F3200 features a data-transfer rate of 1.25 MB per second. The tri-density 125-ips S3125 features a maximum transfer rate of 781 KB per second. The tri-density 100-ips P3100 features a transfer rate of 625 KB per second and, like the others, support for 800-, 1600- and 6250-bpi tapes. The dual-density 100-ips P2100 features a transfer rate of up to 320 KB per second. The P2100 is positioned as the entry-level subsystem, supporting 1600-/3200-bpi tapes. Berkshire claims 30 to 60 percent performance increases over DEC's comparable drives.

The Maximizer 12000 combines 14 Maximizer 850s or seven Maximizer 1750s (shown) into a 12.25-GB subsystem.

The subsystems come equipped with the tape transport mechanism, tape controller, power supply and cabling. Each controller has a 64-KB cache buffer to facilitate streaming by providing a smoother data flow from the system to the tape drive. An automatic loader also is provided. The MTBF of all Discovery I tape drives has been estimated at 15,000 hours.

The sole member of the Discovery II line is the E1000, a 2.3-GB 8mm helical-scan tape drive. Up to four tape drives can be configured on the same controller. The 8mm cartridges are designed for unattended backup of large amounts of data. The E1000 has a burst transfer rate of 1.25 MB per second and a sustained transfer rate of 246 KB per second. It includes a 256-KB buffer. MTBF is estimated at 30,000 hours.

The cartridge drive subsystem kit includes the tape transport, tape controller, power supply and cables. It's available in rack-mount or desktop versions and is priced at $7,500, including installation and a one-year warranty, with additional drives available for $6,000.

For more information, contact Berkshire Computer Products, 100 Pennsylvania Ave., Framingham, MA 01701; (508) 620-8843.

Circle 494 on reader card

—Evan Birkhead

Terminal emulation doesn't have to be this way.

We've all been there. Trying to remember whether the "Do" key is really <Ctrl-F1>. Or was it <Alt-F1>? And the editing keypad. Can you be absolutely sure you're about to press the "Select" key and not the "Remove" key? The results can be disastrous.

That's why KEA developed the PowerStation. The PowerStation, an exact VT200 layout keyboard bundled with VT240 or VT220 terminal emulation software, turns your IBM PC or compatible into a key-by-key replica of a DEC terminal – without messy labels!

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Peace of mind. The PowerStation keyboard takes the frustration out of switching between a DEC terminal and a PC *because each key is right where you'd expect it to be.* And our "Gold Key" version makes ALL-IN-1 and WPS a breeze.

Savings. If you think you can't afford both emulation software *and* a keyboard, think again! The PowerStation can actually save you money by eliminating the time you waste every day translating between VT and PC keystrokes. And with the PowerStation, *startup training costs are virtually eliminated.*

Consistency. The PowerStation keyboard provides a consistent interface for both VT emulation and regular PC applications. In emulation mode you get the 105-key functionality of a real DEC keyboard and in PC mode you get a super enhanced keyboard. *And* you can use the PowerStation on virtually any PC! Move between an XT, AT, PS/2, AT&T PC and a DEC terminal *without missing a keystoke.*

The best in terminal emulation software. With the PowerStation keyboard you get the fastest, most precise, DEC terminal emulation software available: ZSTEM. You have the choice between two popular software packages: ZSTEM 240, our VT241/VT340 graphics emulator and ZSTEM 220, our VT220 text emulator. Both packages will impress you with their speed and feature-by-feature accuracy.

To top it off, the PowerStation gives you all this at a surprisingly low price. But find out for yourself why Digital Review Labs says "the PowerStation 240 is a godsend." Call us at 800-663-8702.

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CIRCLE 119 ON READER CARD

DIGITAL WATCH

Evan Birkhead

Continental Drift

It's time to put to rest the conventional wisdom that the European market is two years behind the U.S. in high technology. To the contrary, sales of computers in Western Europe have kept the giant system producers — IBM, Digital and Hewlett-Packard — in the black this fiscal year, while U.S. sales sag.

Overall, the U.S. drought has hurt Digital badly. For the third quarter, Digital announced a net income of $256.4 million, down 16 percent from $305.1 million during the same quarter last year, even though total operating revenues were up 11 percent. Without its impressive international sales figures, Digital would have posted huge losses. The company reported that in that quarter, 56.8 percent of overall sales were to the international market, with the bulk of that coming from Europe. One year ago, the figures were 51 and 49 percent, slightly favoring international sales.

Digital's internal salary freeze, which begins July 2nd, further dramatizes the enlarging market chasm. The freeze affects all of the company's 75,000 U.S.-based employees, while the 50,000 employees abroad are spared. The explanation was that they won't be affected because the demand and profitability for Digital remain strong internationally.

According to Mark Steinkrauss, Digital's Financials spokesperson, the sales effort abroad will be augmented this year with the expansion of international research and development facilities. "The R&D is fairly diversified throughout Europe, Japan, and Israel, but more than 50 percent is still in the U.S," he explains. "Europe is growing at a faster pace, so we're more active there."

The Rationale

Lee Cooper of Digital's Networks and Communications Division spent 1988 in Europe and reports that the continent is undergoing tremendous growth in computer networks. The spurt in buying behavior is characteristic of Europe, he explains. "Where we [Americans] will readily throw away and replace, Europeans will devote longer lengths of time to allow technologies to mature," says Cooper. "After a flurry of upgrading, they'll lag behind for a few years, then another flurry will bring them even again. They're in the midst of a major flurry right now."

Cooper adds that Europe is in the right place at the right time regarding several technologies, notably fiber optics. "Companies are moving out of the [more expensive] inner cities and building new buildings out in the countryside. They're looking at FDDI ahead of us and are installing fiber, even in backbones."

As in the U.S., multivendor networks, increasingly featuring workstations, are the norm. (Clearly, Digital has Europe to thank for making the VAXstation 2000 the top-selling workstation line in the world.)

Per user, Europe has installed more RISC workstations, optical storage devices, office information systems and fiber optic telecommunications systems than the U.S. That's good and bad for the major systems vendors and their third parties. It's good because they show profits for the newer technologies where there might otherwise be a void. But it's bad because accompanying this increased success will be an increased reliance on the historically unpredictable European market.

Besides the state of technology, the prevailing economic conditions are also a factor in Europe's impending dominance. The U.S. economy is fragile at best, while the European market is strong, spurred primarily by the strong British pound and spectacular export performance by West Germany.

Also, confidence is growing as 1992 nears. In that year, the 12 nations of the European Economic Community (EEC) will unite to form a free-trade state without barriers, much like trade between states in the U.S. The only difference will be the relative strengths of the different currencies.

Analysts agree that the new policy will put U.S. companies at a severe disadvantage. While lowering its internal barriers, the EEC will be building new ones against outside competition. Among the most controversial of the restrictive policies is "reciprocity," which states that for every company the U.S. sets up in Europe, the EEC must be allowed to set up its own organization for that industry in the U.S. This and other internal policies, such as an increase in intra-EEC mergers and new quotas on foreign imports, have heightened fears that the EEC, a key economic ally, will disappear as a trade partner. Fortress Europe is the term many have applied to this unified market.

The spectre of 1992 has prompted the major American computer producers to scramble for footholds throughout the continent. IBM had a head start — it's been operating in

Europe since the 1920s — and recent activity has pushed its European employment total over 100,000. According to IBM Europe, IBM now has 13 manufacturing plants, nine R&D facilities and seven scientific centers based in Europe, not to mention countless sales, training and support locations. AT&T, for its part, has built a semiconductor factory in Spain and bought part of a research laboratory in England.

Digital Abroad

Like IBM, Digital is all over the map. The number two vendor in most countries (number one only in Ireland and Israel), Digital, which has had a sales and marketing presence in Europe since the mid-1960s, has built manufacturing and design engineering sites in France, Germany, Ireland, Scotland (semiconductors) and Italy. It also has set up five Digital Competency Centers (DCCs), the European equivalent of an Application Center for Technology (ACT) in the U.S. The huge Digital site in Valbonnes, France, is the home of the Networking and Telecommunications DCCs; London is the location for the Financial DCC; Munich hosts the Manufacturing DCC; and Switzerland is the home of the Government Systems DCC.

Digital's DECstation PCs that are sold in Europe won't be manufactured by Tandy but by Olivetti, an Italian-based PC-clone manufacturer. Although virtually unknown in the U.S., Olivetti has a giant presence and name recognition in Europe.

Others with a big presence include Bull in France and Unisys in the U.K. Hewlett-Packard reports that orders in the overseas market grew 29 percent in the last fiscal year, while domestic orders increased only 17 percent. HP has had a lot of success selling its workstation and precision architecture machines abroad.

The Third Party

Digital third-party hardware and software producers also have been active in Europe and have developed their own market savvy. "Each country has its own distinct way of doing business," says Howard Exton-Smith, director of marketing at Cortex, a producer of VMS CASE systems. "That makes it very difficult to give your European operations one label. What sells in England won't necessarily sell in Belgium and the big industries in France are quite different than those in Germany."

The complexities aren't lost on Jim Bender, president of Logicraft, which makes PC-to-VAX systems. Logicraft, a Digital Cooperative Marketing Program (CMP) participant in the U.S., has had to re-establish a CMP-like agreement in every European country, each with a different name and a different bureaucratic system. "We're also lined up with Digital in the Pacific Rim," claims Bender. (DEC has seven ACTs spread across the islands of Japan.)

Dennis Vohs, chairman of Ross Systems, which produces a VMS accounting system, has faced a different barrier — language. "Simple things like the language your software is written in and training become obstacles in Europe," explains Vohs. "Sixty percent of our customers are multinationals, so we had to make some choices."

Ross's first move was to become a CMP in the U.K. and a Complementary Solution Organization (CSO) in Western Europe, which gave it additional sales leverage. Next it founded Ross Systems Europe in Brussels and began writing localized versions of the Renaissance financial package. Vohs is now in the midst of finalizing similar agreements in Hong Kong.

Access Technology, which makes the 20/20 VAX spreadsheet, has complemented its U.K operation with its own Applications Development Group (ADG), a team of specialists that provide consulting services ranging from technical assistance to solutions development. It also has opened new facilities in Switzerland and Holland and established a distribution and support alliance with Digital.

Like Digital, American heavyweights IBM and Hewlett-Packard also are relying on Europe. All indicators are that the figures will continue to get more lopsided for all computer makers. "There's no question that's where the action is going to be," explains Exton-Smith of Cortex. "Everyone considers a head start in Europe to be key for the 1990s." ■

Companies Mentioned In This Article

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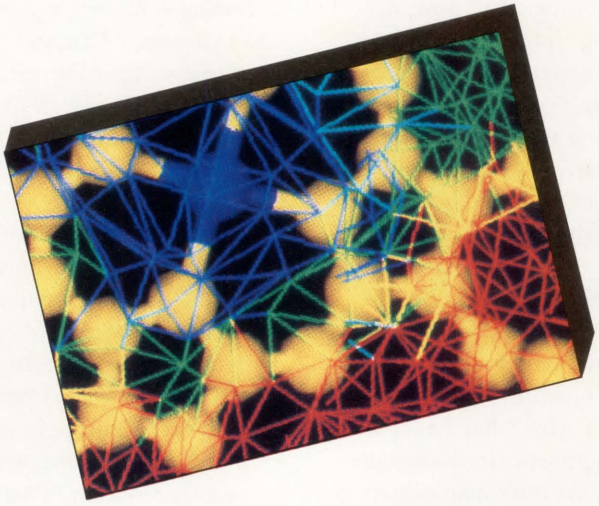


Image Processing And Visualization

Graphics grows up as workstation power improves and rendering techniques evolve.

BY ELAINE L. APPLETON

HUMANS ARE VISUAL creatures. Approximately 50 percent of the neurons in our brains are associated with vision. Thus, it makes sense that we learn first and foremost by seeing.

Computer technology began to let us understand the real world through visual processes about 25 years ago, when rudimentary image processing techniques were born. Image processing, which enhances or otherwise alters data gained through various sensory means, allows us to understand such things as weather and terrain through satellite information; military tactics and placement of personnel and weaponry through radar; and the human body through medical imaging techniques.

As workstation power improves and more highly developed graphical rendering techniques evolve, the use of computer-aided visual techniques for understanding has become more attractive and more readily available. Digital confirmed this in March when it announced its Integrated Visualization Environment (IVE), a multiple-platform, multiple-software program built on the graphics industry's newest buzzword: visualization.

Like other complicated and flexible technologies, visualization as a market and an application is difficult to define. Says graphics industry guru Ken Anderson, publisher of *The Anderson Report* of Simi Valley, California, "We can't define the computer-aided visualization market yet. If I could, I'd be wealthy."

The term has come to mean the use of computers to graphically depict masses of data, generally scientific, in ways that are easy to understand. Al-

though image processing attempts to reach similar objectives, it starts with real-world data, such as scanned photographs or thermal imagery, and digitizes the information. Those digitized bits then are processed in a supercomputer or a workstation to filter out noise, enhance hard-to-understand information, detect edges of objects, colorize specific areas and otherwise make images easier to grasp and analyze. The processed data then is rendered with 2- or 3-D graphical techniques and is displayed on a screen.

Visualization, on the other hand, encompasses multiple techniques, including image processing, graphical rendering and animation, signal processing, and output technologies such as electronic publishing. Its intent is to show graphically the previously unseen or hard to see.

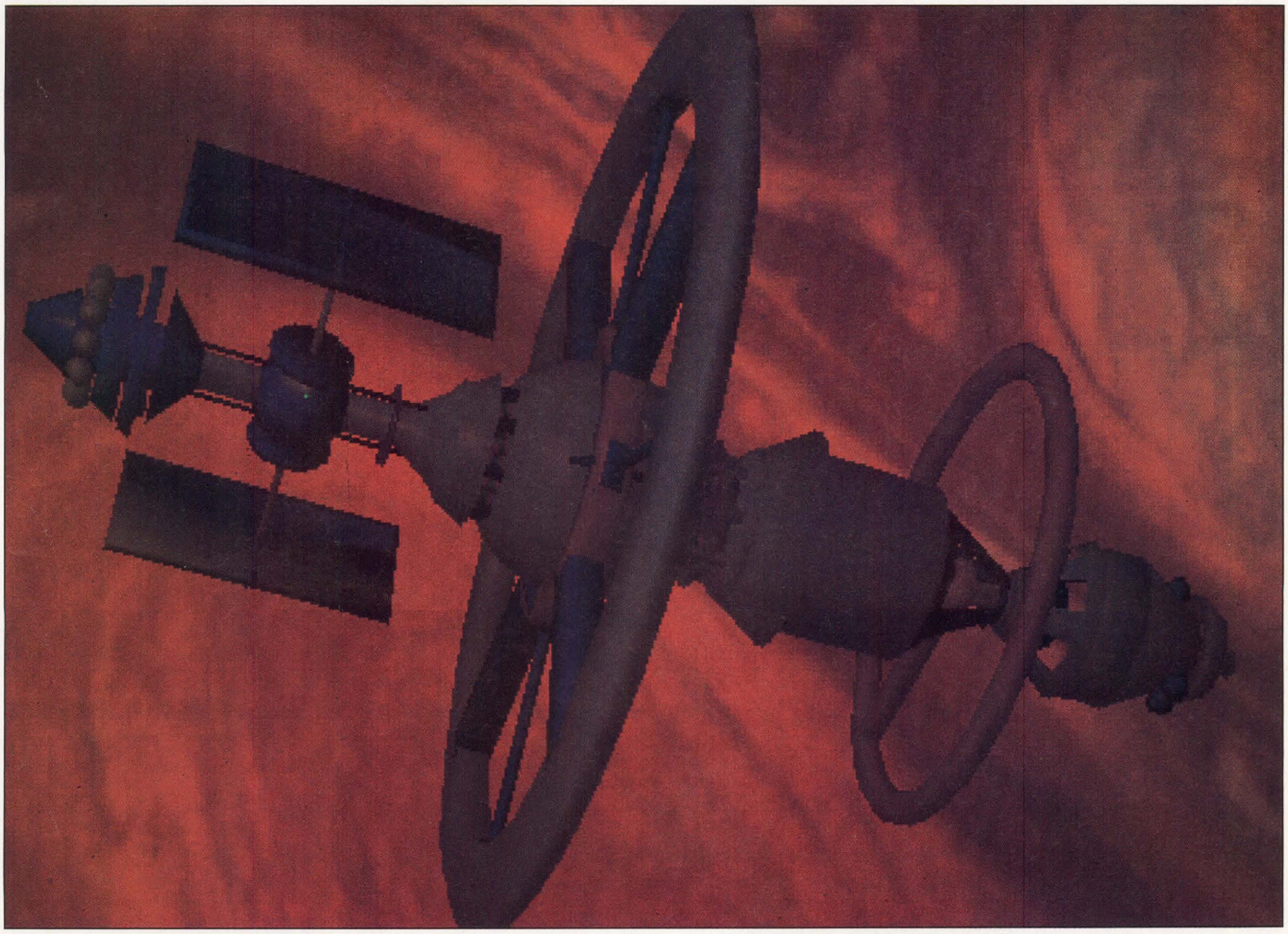
Image processing generally is used in areas such as remote sensing and medical studies. Visualization, by comparison, has the potential for use across all scientific and research applications, from astrophysics to fluid dynamics to high-energy physics. It's intuitive and, being picture oriented, it's language independent, applicable to many areas but defined by none.

Why is the term visualization popping up more frequently? Primarily, it seems that visualization is attractive because it's now possible. This means:

1. Powerful computers at prices that universities and other research organizations can afford.
2. Useful human interfaces, such as the X Window System and DECwindows, that allow scientists to call applications from windows or 4GLs, rather than program at the system level.
3. Sharing visual data across remote networks.
4. Computers that have enough memory, processing power and sophisticated graphics-rendering capabilities, such as multiple light sources and animation, to handle the requirements for visualization.

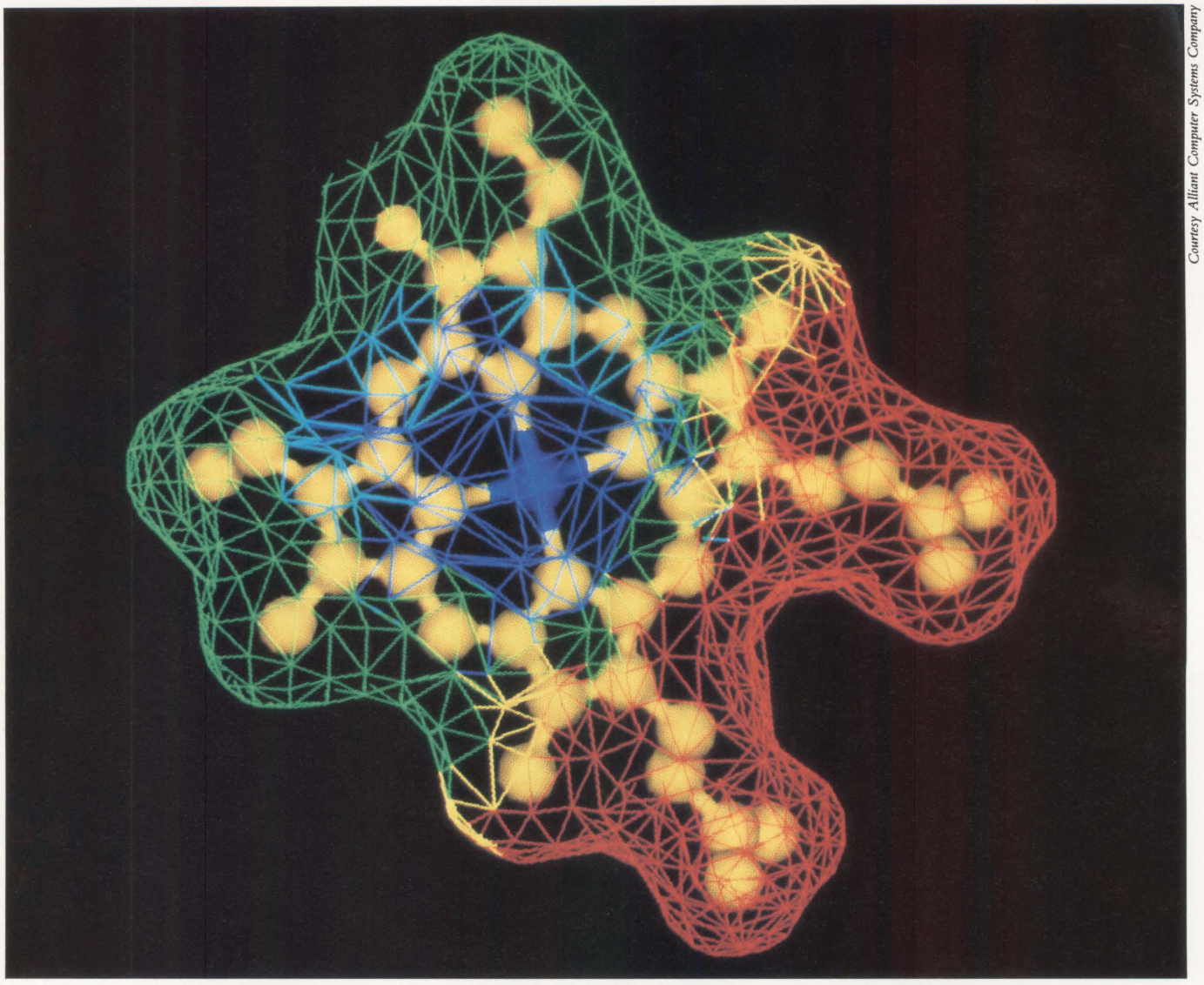
Just A Strategy, So Far

The consultant community, for the most part, slept through Digital's recent IVE announcement, because it contained no news of new products. Rather, Digital packaged already existing hardware platforms, Ethernet-TCP/IP protocols and a handful of software vendors into



Courtesy Digital Equipment Corporation

A superimposed image of a space station on Jupiter developed on the VAXstation 3540 workstation. The space station model was created by Digital Productions and the image of Jupiter was digitized from a NASA/JPL image.



Courtesy Alliant Computer Systems Company

In this example of visualization, representations of a heme group from Cytochrome C3, an enzyme present in most plant and animal cells, are colored according to electrostatic surface potential.

this environment. It seems to be a strategy statement that confirms Digital's continued interest in the scientific community. That community currently analyzes only about 10 percent of the data it collects, according to the National Science Foundation. With visualization tools, Digital claims, that percentage will increase dramatically.

Currently, Digital provides base platforms for software vendors that supply specific application packages. Those packages run the gamut from data analysis (e.g., SAS Institute's SAS Graphs) to graphics rendering in 2- and 3-D (e.g., SAS Institute's NeoVisuals); from integrated, interactive visualization packages (e.g., Precision Visuals' PV-Wave) to hardware processors that do compute-intensive processing and then download the processed data to Digital workstations for display and image transfer (e.g., Pixar's Image Computer). Among this diversity, however, there are constants, which Digital refers to as program standards. They are:

1. Standard networking protocols, including TCP/IP and DECnet/OSI.
2. DECwindows.
3. Compound Document Architecture (CDA) for data format.

There's nothing new here, but the articulation of these program standards is a clue to the needs of the visualization user. The lack of standards available for image transfer, says David Prawel, marketing manager, analytical products, at Precision Visuals, is a critical drawback.

Digital allows conversion of graphics files into the Digital Document Interchange Format (DDIF), part of CDA, for transfer to other Digital machines or output to hard-copy devices. Within DDIF is the Image Interchange Format (IIF), which deals specifically with images. The VAX Image Services (VAS) version 1.0 can convert IIF or DDIF files into formats needed for various applications,

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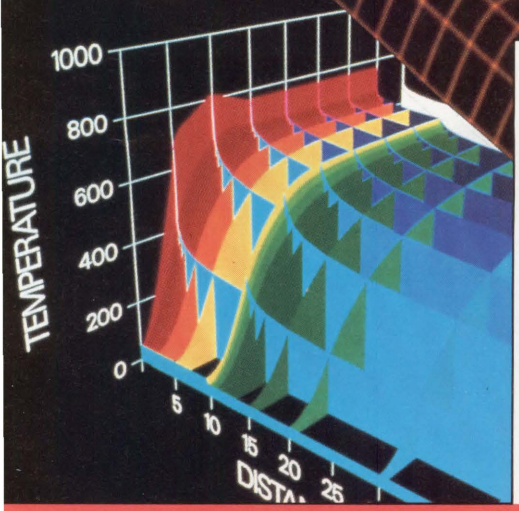

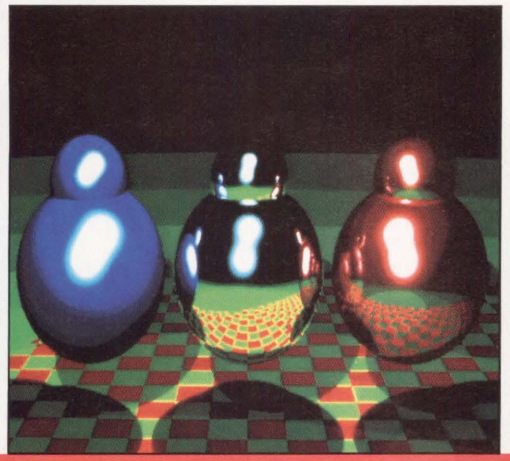

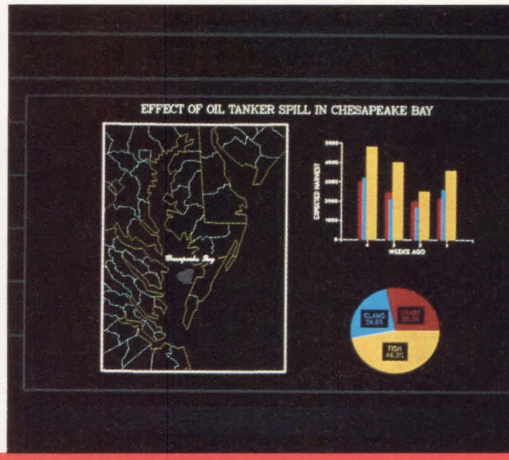

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says Jack Gold, Digital imaging marketing manager for scientific visualization. For instance, you can convert a DDIF or IIF file into PostScript format, allowing integration into documents or output to a PostScript printer.

However, no standard image format allows the Digital user to transfer a file easily to a Sun machine, for instance, states Prawel. Transfer needs to be hardware independent, he says, but ANSI and ISO committees only now are beginning to work on this problem.

Moving Pictures — Or Pixels?

DECwindows allows you to move pixel-based graphics over the network. Pixels are picture elements, the smallest point on a computer screen to which color can be assigned. When you originate a computer graphic on the screen (e.g., for CAD/CAM applications) you're processing vectors (lines) as you draw from one point to another. You aren't working with pixels until you display the image. But pixels, rather than primitives, such as vectors, polylines (several vectors connected at endpoints) and polygons (a closed-loop figure drawn from vectors), are at the heart of image processing and visualization.

By assigning colors from a hardwired color lookup table to various pixels, you can render an image realistically or enhance it with pseudocolors. You can make a lake blue, for instance, on a satellite image that had been originally recorded in gray tones. The number of colors available is based on the hardware. For example, an eight-bit plane workstation such as the VAXstation 3520 provides 2^8 or 256 colors. A 24-bit plane system such as the high-end VAXstation 3520 or the VAXstation 3540 allows use of 2^{24} or 16.7 million colors. The latter is approximately the number of colors the human eye can recognize. It takes this many colors to render true or realistic color, says Digital's Randy Nickel, marketing manager for the two 3-D VAXstations.

MOVING MASSIVE NUMBERS of pixels across a network can be a slow process, as an image easily can use 45 or 50 MB of data.

Moving massive numbers of pixels across a network can be a slow process, as an image easily can use 45 or 50 MB of data. When processor and display workstation are separate devices, high network bandwidths are necessary, says Digital Senior Applications Marketer Ralph Rio. This becomes even more critical when you want to alter the parameters that result in the image (so-called interactive visualization) or look inside an image — say to examine a cross-section of the human body rather than look at the surface of an organ. When doing so, you work with volumetric representations of pixels, or voxels.

Putting It All Together

Although visualization can be performed in many ways, with results that range from a simple plot to a photorealistic, animated image, it has two fundamental needs: capabilities for compute-intensive performance and rendering features (see Figure). According to Digital, such techniques as data transformation, hidden surface removal, transparency, depth cuing and motion are essential.

For years, scientists have attempted to process huge amounts of data on

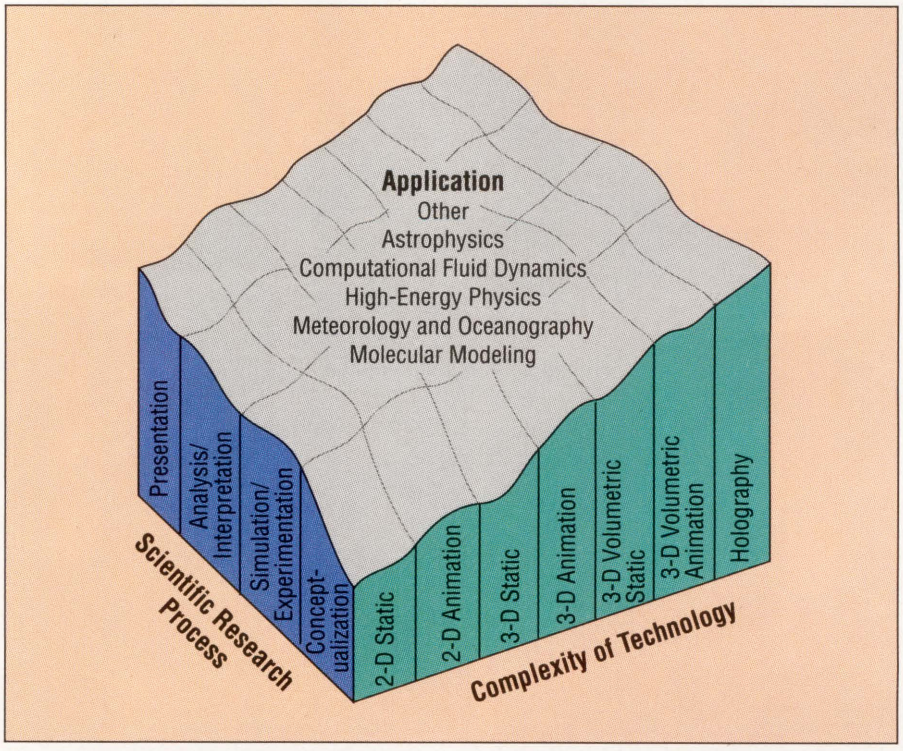

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Figure: Digital's strategic model for visualization. At the top are scientific fields that benefit from computer-aided visualization. On the right are levels of technology with which visualization can be performed. On the left are activities involved in the research process.

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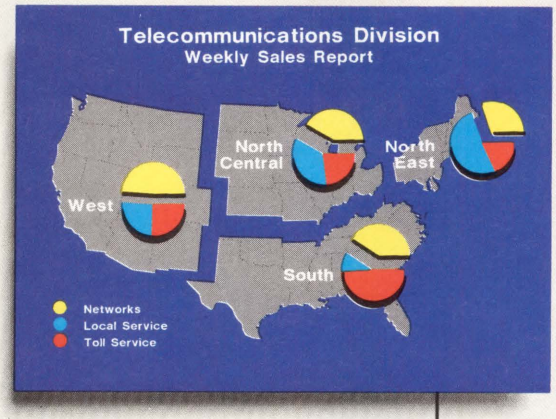

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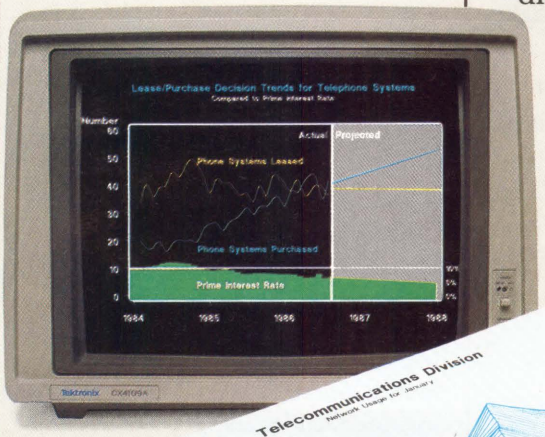

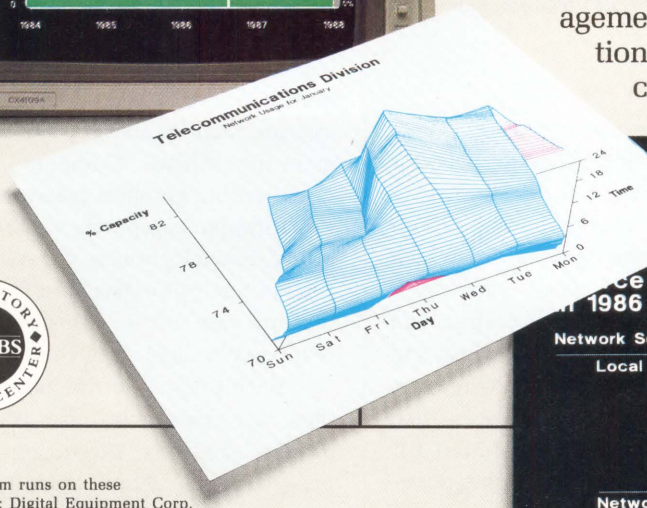

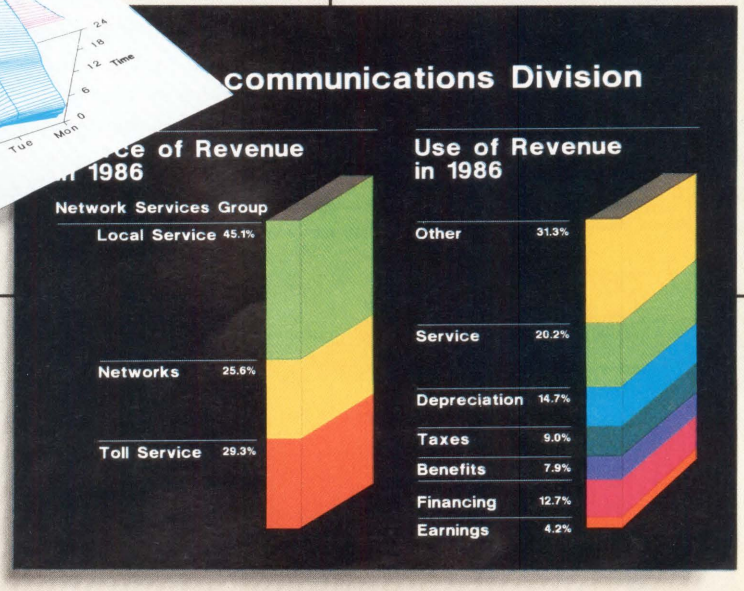

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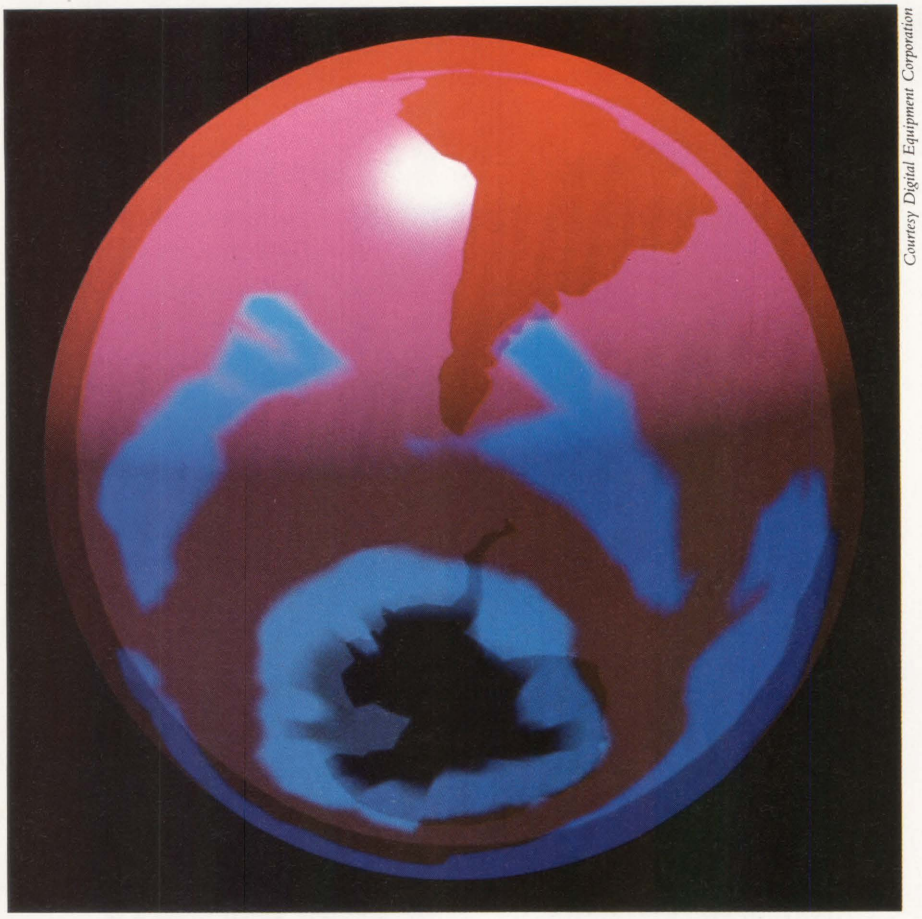

Courtesy Digital Equipment Corporation

In this image of the Earth, atmospheric ozone concentration is represented using 3-D animation and rendering software from Wavefront Technologies. Areas of high ozone are depicted in blue and red, while the prominent ozone hole over Antarctica is displayed using white and transparent materials. The image represents data from a single day in October 1987 and is one frame of a 210-day sequence showing the growth and decay of the ozone hole. The data was obtained from NASA's Goddard Space Flight Center, and conversion to Wavefront format was completed at the National Center for Atmospheric Research (NCAR). Final rendering by Wavefront Technologies was accomplished on a Digital VAXstation 3520.

Cray or, more recently, Alliant and Convex supercomputers. Crays, however, aren't display stations: you must take the processed image and transmit it to a workstation or display terminal to view the results graphically. Digital developed a Cray link that allows transmittal of data from a VAX to a Cray and transmittal of processed images back to the VAX for display. Digital's VAX Supercomputer Gateway is a cable-and-software connection that lets the VAX access the Cray's Low-Speed Channel, which by Gold's estimation runs at 100 megabits per second. VAX software translates data into formats that can be read by the Cray or the VAX.

Another set of solutions is based on specialized graphics processors, which can calculate data (e.g., perform a compute-intensive function such as fluid dynamics or molecular modeling) and render the results into 3-D images on the same device. Such processors often are equipped with high-resolution 3-D monitors. Graphics power makes possible such sophisticated techniques as rotation, volumetric rendering and animation, allowing you to look at different views of the same picture. Digital makes use of such specialized hardware by linking it with Digital machines and taking advantage of its graphics processing power, rendering on the graphics processor and transferring images onto Digital networks.

Splashy rendering techniques often come from software vendors with backgrounds in broadcast and film animation. Such techniques include rotation and animation and may include the ability to overlay raster images of material properties onto an image. Textural and pattern mapping adds realistic effects. Some packages include already-described properties in menus (e.g., wood grain, stripes, marble texture, bumps) and some allow you to define your own through graphic libraries. Scaling (changing the size of an object without changing its location or orientation) and clipping (removing parts of a graphic image outside specific boundaries) add to realism. So does compositing, the technique of adding graphic elements, such as a picture of a rocket superimposed on a satellite image of a planet.

Many sophisticated graphics and image processing packages perform these functions. As yet, however, it's difficult to find one package that provides a thorough combination of image processing, data analysis, 3-D rendering and animation. But a few are available.

New packages concentrate on solving the human side of the problem: the human interface. Says Craig Mundie, vice president of research and development for Alliant Computer, "I call visualization 'graphics grown up.' With visualization, computers will become a utility, like telephones. We aren't there yet, because computers haven't achieved uniform ease of use. A visual interface is the key to achieving this."

With graphic techniques so complex, scientists who use computer-graphic analysis often are skilled programmers. Now, menu-driven, windows-oriented packages are being spawned, as are proprietary 4GLs

designed to relieve scientists of the need to program at the system level.

The Fourth Dimension

Precision Visuals' Prawel points out that scientific data isn't simply 3-D. It can have an infinite number of dimensions, depending on the parameters you're examining. He uses the example of engineers studying air quality. They look at parameters including temperature, time of day, time of year and air pressure.

Integrated packages that address visualization from input (e.g., image or signal processing) through analysis to rendering and display should allow you to look at more than three dimensions at one time. This could be done by a variety of techniques, including 2-D simulation, 3-D modeling, plotting, draping raster images over plots on a 3-D image, and so on. Animation allows for greater understanding of the time dimension. If, for instance, you're studying snow pack at certain elevations over a year, you can animate that snow-pack visual and watch the snow's depth rise and fall at various elevations over time.

> . . . it's difficult to find one package that provides a thorough combination of image processing, data analysis, 3-D rendering and animation.

Interactivity

You might conclude that scientists simply want to represent data they've collected. To scientists and researchers, however, the what-if factor provides answers to many complex questions. If you have 12 parameters acting on an environment, for instance, and you change one of those parameters (e.g., the amount of carbon monoxide in the air), the overall picture changes. By work-

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Graphics Standards

Graphics workstation performance commonly is described in vectors and polygons per second. Computational power sometimes is described in Mflops and mips. This doesn't tell you much. Because there are no standards for image transfer or board addressing, there are no standards for graphics performance measurement.

Because each vendor delineates size, attributes and orientation of vectors and polygons differently, comparisons are relatively meaningless. Randi Rost, a principal engineer in Digital's Workstations Engineering Group, says, "Every vendor tells you something like, 'We do 100,000 vectors per second.' Vendors don't tell you how long the vectors are, whether they're interpolated color, constant color, randomly oriented, horizontal or vertical." It's like describing room dimensions in feet without specifying that a foot is 12 inches.

Rost is Digital's representative to an increasingly important benchmarking group, the Graphics Performance Characterization (GPC) committee, which is sponsored by several graphics hardware vendors and administered by the National Computer Graphics Association (NCGA), based in Fairfax, Virginia.

GPC, founded in 1986 by Ken Anderson, publisher of *The Anderson Report*, now is developing the GPC Picture-Level Benchmark, a standard way to measure the speed at which a picture is displayed on the screen. SimGraphics Engineering Corporation is developing the software, which shows models being shaded, rotated and transformed in three dimensions. In April, at NCGA '89 in Philadelphia, the group exhibited early versions of the software, which showed a model of a HIND 24 helicopter moving "toward you" on the screen, rotor spinning and missiles firing.

The work is based in part on efforts by the Bay Area chapter of the Association for Computing Machinery to define primitive-level standards that provide a common format for measuring vector performance. A full implementation of the Picture-Level Benchmark software should be complete by August 1989, according to NCGA officials. When available, the software should run on any vendor's equipment. This will reduce the necessity for vendors to write software drivers for customers attempting to determine system performance using a particular application.

Two more advanced benchmarking levels are being investigated: system- and application-level standards. At the system level, tests would measure image manipulation, such as how fast a figure can be rotated by 15 degrees.

"The idea of reporting system-level functionality," says Digital's Rost, "is to time some feedback on elapsed clock time for the attributes you've called. You might care about vector performance but not about smooth-shaded [Gouraud-shaded] graphics. You might care about depth-cue vectors, antialiased vectors or testing the color."

The most sophisticated tier is the application level, for which a test suite will incorporate widely accepted software programs. According to NCGA, the software will perform a set of typical functions on public-domain images.

ing with interactive packages, you can update the image when you manipulate parameters.

Currently, you must change these parameters to solve your problem. However, Alliant's Mundie forecasts that, in two or three years, supercomputers will be able to change the parameters for you. He provides this example:

You design an engine with a library of parts from CAD/CAM software. Then, you tell the computer to perform a dynamic thermal analysis of the engine as it moves and color-code the parts. A piston overheats and glows red. Up to this point, this is now possible.

In the future, you'll be able to point to the piston on the screen and tell the computer, "It's too hot; alter the parameters until this no longer overheats." At that point, the computer does the calculations and the red glow subsides.

It takes powerful computers to handle the complexity of visualization. This brings meaning to Digital's IVE announcement. Terry Shannon, director of the Digital Advisory Service at International Data Corporation of Framingham, Massachusetts, says, "Now, when you think about visualization, you think more about Cray, Convex and Pixar. Digital thus far hasn't been regarded as a formidable contender in the image processing and visualization arena."

> WITH GRAPHIC techniques so complex, scientists who use computer-graphic analysis often are skilled programmers.

Shannon predicts that this will change. He forecasts an announcement of Digital 20- and 30-mip uniprocessors, equipped with vector coprocessors, by the end of the year. These powerful computers will handle the numerically intensive work of processing images. He also expects that Digital's VAXstation 3520 and 3540 will come equipped with vector coprocessors by the end of this summer and that Digital will release a midrange 7- to 40-mip VAX 6400, similarly equipped with facilities to speed graphical work.

"Digital currently is working on an entirely new class of 3-D workstation: a high-resolution machine that will blow the VAXstation 8000 out of the water. After Digital has the platform, it will have what it needs to do serious graphics imaging and be a contender in this arena," adds Shannon.

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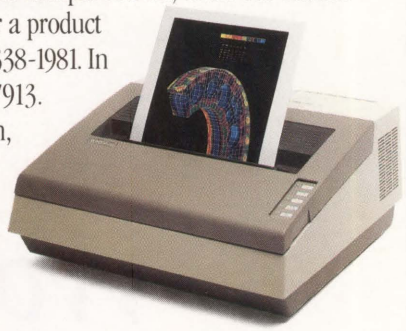

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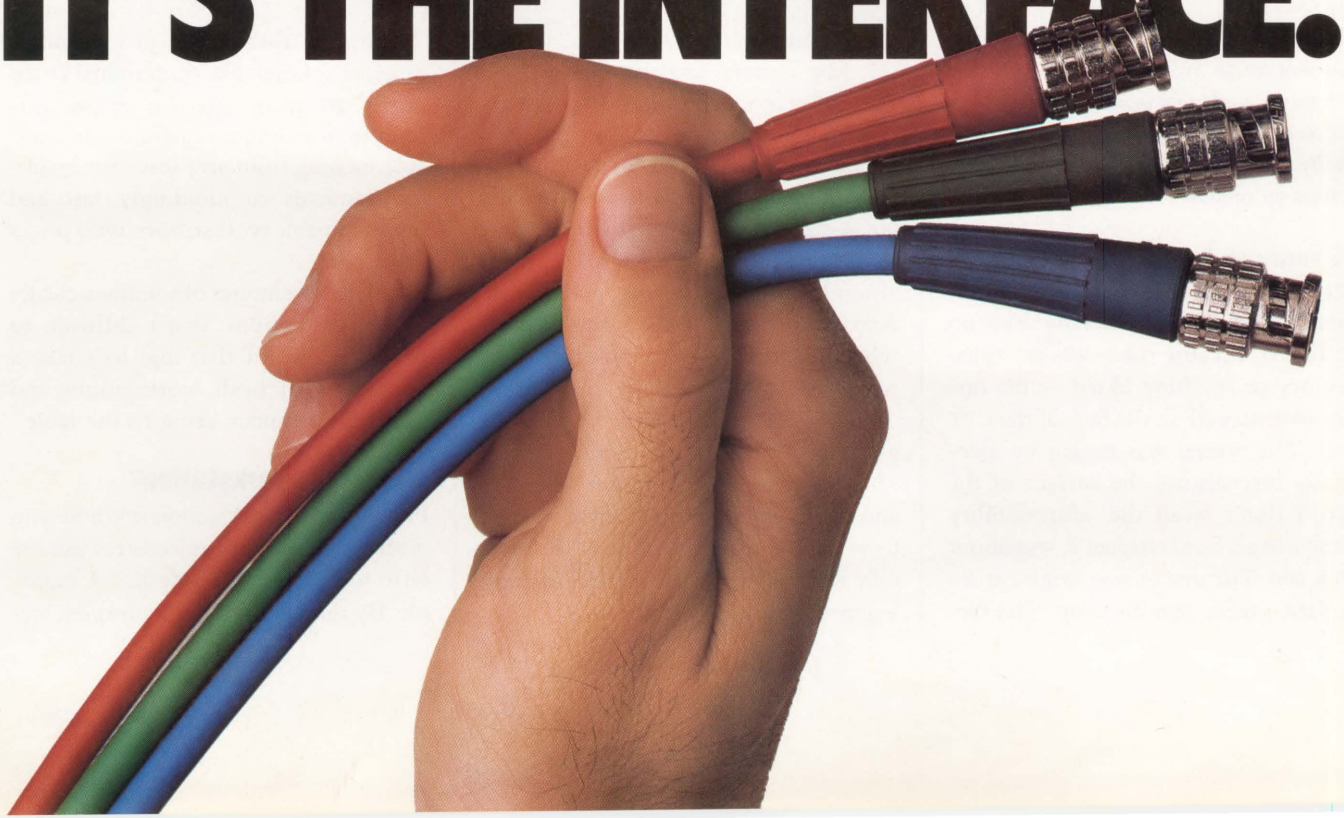


Workstations And Graphics Terminals: ROOM FOR BOTH?

A look at what workstations and graphics terminals bring to the table.

BY PHILIP A. NAECKER

Editor's note: This is the first in a series of occasional articles by Technology Editor Philip A. Naecker analyzing technical developments that have a major impact on the DEC community. Look for future articles in the new Technology column.

THE FIRST CRT TERMINAL I ever used, in 1971, was a flat-screen Tektronix storage-tube device. It literally drew on the screen, because there was no video memory or anything like it — the images were stored on the face of the CRT itself. The screen was erased by electrically discharging the surface of the CRT. I don't recall the addressability of the image, but I suspect it was about 400 x 600. The image was bright green on dark green, one bit deep. The terminal cost about $10,000.

My current favorite display is a 1,024 x 860 monochrome 11-MB VAXstation that's about three years old. I'm about to purchase a color DECstation 3100. With eight bit planes and incredible X-server performance, the DECstation will have a discounted cost of around $15,000, including peripherals. And the *DEC PROFESSIONAL* Lab is scheduled to review a number of X terminals.

The Lab has seen a number of graphics terminals in recent months. These range in price from $500 to $3,500, and their functionality spans the range from just above that of a VT320 text-only terminal to something approaching a general-purpose workstation.

Today, there isn't just a single graphics solution like the terminal I used nearly 20 years ago. An entire continuum of graphics capabilities is available, ranging from very low-cost graphics terminals to blindingly fast and highly capable workstations with prices to match.

This continuum of solutions creates a fog of options that's difficult to penetrate. To lift that fog, let's take a look at what both workstations and graphics terminals bring to the table.

What's A Workstation?

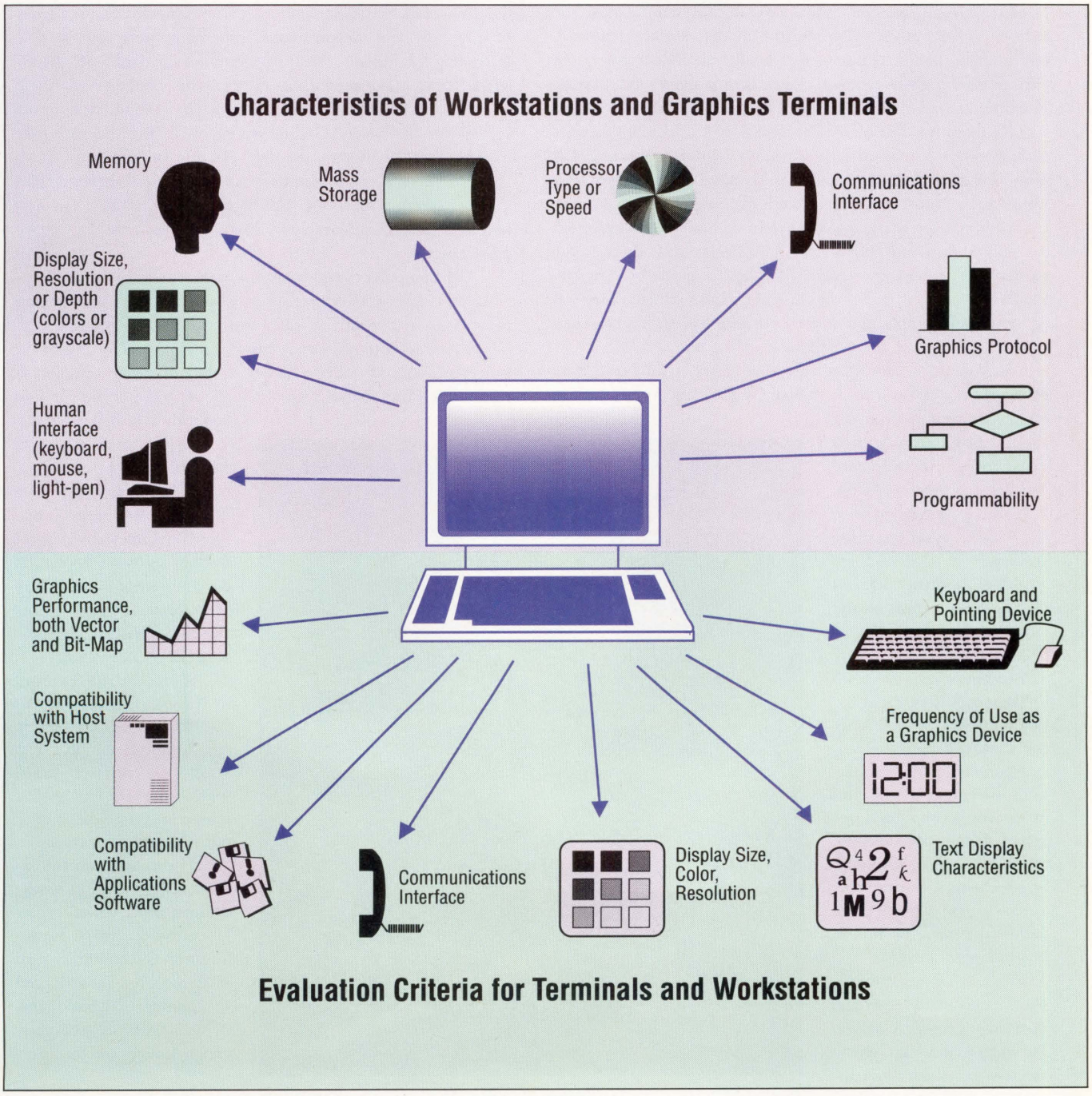
Put simply, a workstation is where you work. Furniture manufacturers use the term to describe your desk, for example. By that definition, the simplest ter-

minal is also a workstation. To be useful, however, the term must be refined.

There are a number of dimensions to the terminal/workstation product space. The top half of the diagram on this page shows some of the characteristics we could use. Some of these characteristics don't differentiate between workstations and graphics terminals. For example, you can get a mouse for a VTxxx terminal, and there are devices generally accepted to be workstations with displays smaller than those on devices generally accepted to be terminals.

Memory probably isn't a good determiner, either. Tektronix sells terminals that have about the same memory as some VAXstations, which are clearly workstations. Mass storage doesn't differentiate between workstations and terminals, because there are diskless workstations.

Processor speed is almost impossible to measure, at least in any relevant way. Many processors on both workstations and terminals are specially optimized for writing data into video RAM, and there's no reasonable measure of an instruction to compare among them. Application-based performance, such as how long it takes to draw a display, depends too much on other



CAD/CAM Workstations

The nine-year-old graphics-oriented workstation market was elevated to new heights in early 1987 when Prime Computer and Silicon Graphics jointly announced a RISC-based superworkstation built around an R2010 processor from Mips Computer Systems Inc. The term superworkstation was created to convey the concept of supercomputer performance brought to the single user's desktop.

The parallel UNIX machine offered up to 16 million colors, 24-color bit planes, four user-accessible system planes, the industry's first 24-bit Z-buffer (for hidden surface removal), multimode graphics windows that could run concurrently, and primitives for high-level design objects such as splines and surfaces. The price started at about $75,000 and soared well above $100,000.

Competition was defined at a new level of computing, and superworkstations carved a niche in scientific and engineering sites with advanced CAD/CAM needs. Since then, the relatively new superworkstation class often is overlooked as sales and publicity lag in comparison to the lower-priced systems at the workstation low end, with strong entries from Sun, Digital and others. In the wake of the proposed purchase of Apollo Computer by Hewlett-Packard, which will merge Apollo's high-end with HP's low-end product lines, competition in the workstation arena has heated to a price/performance boiling point.

Technological advancements and price reductions have developed as rapidly at the high end. Graphics superworkstations are penetrating engineering and scientific sites with a variety of high-performance visualization requirements:

1. Molecular modeling, such as X-ray crystalographic analysis.
2. Visual simulation in areas such as flight simulation and radar display.
3. Medical imaging.
4. Econometrics.
5. Geophysical design.
6. Animation for the science and motion picture fields.
7. Manufacturing simulation, including many elements of computer-integrated manufacturing (CIM) and robotics programming.
8. Mechanical computer-aided engineering from design and detail to modeling and stress analysis.
9. Fluid dynamics.
10. Circuit-board layout and mask- and gate-array design.
11. Industrial design, which includes geometric and concept modeling, as well as image generation.

Besides Prime and Silicon Graphics, competitors in personal CAD/CAM stations include scores of Digital-compatible array processors (available for every bus; graphics supercomputer vendors Alliant, Convex and Ardent; high-end workstation manufacturers Apollo, Evans & Sutherland and Tektronix; and one-year-old newcomer Stellar Computer. Significantly, Stellar's CEO is Bill Poduska, founder of Prime and Apollo.

Standards, particularly UNIX and the X Window System, are the name of the game in graphics superworkstations. Stellar's series of graphics and departmental supercomputers supports X (including X terminals), the PHIGS graphics standard, OSF's Motif and UNIX V3.0. The networking protocols include Ethernet, TCP/IP and NFS. Additionally, the departmental computers support several familiar VAX/VMS conventions, including the VMS user interface, EDT, FORTRAN for VMS V4.0 and DECnet.

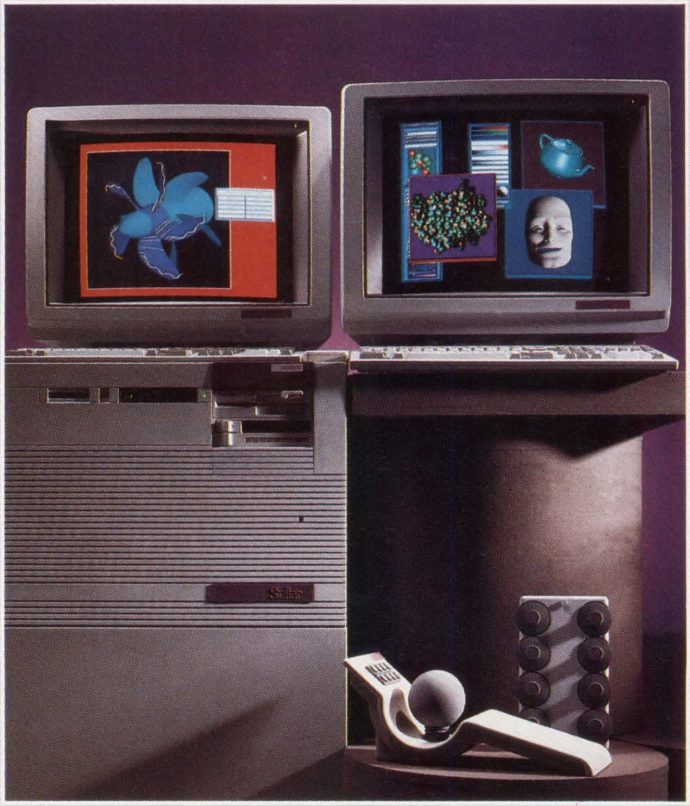
The Stellar systems exemplify the potential power of graphics systems entering the 1990s. The high-end 2500 models can sustain 35 mips and a peak rate of 100 Mflops. They're in the $100,000 price range.

The computers implement an architecture based on Synchronous Pipeline Multiprocessors, which includes a multistream processor, a vector floating-point processor (80 Mflops), a rendering processor (with real-time texture mapping) and up to four I/O processors, all in parallel. The key to the performance figures is the system's high bandwidth (4 GB per second, 512 bits) and an application visualization environment that supports 32,000 x 32,000 pixels.

Stellar's graphics line (the GS1000/2000 series) is optimized for interactive visualization software tools. Its departmental line (the DS1000/2000 series) is designed for distributed, networked environments.

Along with the increases in processing power in CAD/CAM graphics, prices are dropping rapidly. The $113,000 entry-level 2000s, with twice the processing power, are priced the same as the 1000s were a year ago.

Though underpublicized, today's graphics workstations aren't without their glory. In a few years, the application of computers such as Stellar's have contributed to significant advancements in such fields as aerospace, geophysiology and medicine.



Two users with high-resolution graphics displays simultaneously can use the same application on Stellar's GS2000.

—Evan Birkhead

characteristics, such as the communications interface.

At one time it looked as if the existence of an Ethernet interface was one definition of a workstation. However, you now can run LAT emulation on a PC running a terminal emulator. C.Itoh is about to introduce a VT3xx-class terminal with an Ethernet interface. Many of the so-called X terminals have Ethernet interfaces, and some of them have RS-232 interfaces as well.

BUT AT LEAST one characteristic offers hope of differentiating workstations from terminals: programmability.

As to the graphics protocol used by the box on your desk, it's hard to see how that matters. Although the term workstation is considered to be synonymous with the use of the X protocol, that's a rather chauvinist view. Sun Microsystems machines running NeWS certainly are workstations.

But at least one characteristic offers hope of differentiating workstations from terminals: programmability. An X terminal clearly isn't programmable, at least not at the user level, nor is the most sophisticated graphics terminal. If a device is programmable, sits on your desk and has a display and a communications interface to the rest of the network, it's probably a workstation.

There are, however, other programmable devices that aren't workstations. A PC that has no communications connection to the rest of the network clearly isn't a workstation — it's a PC. A PC that has a terminal line but that can't transfer files or do anything besides log in as a terminal is still just a PC. So another attribute of a workstation is that it must have peer-to-peer communica-

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$$$ The Economic Angle

At its foundation, the decision to choose between a graphics terminal and a workstation is economic. It isn't about which features are nice or make it easier to use or even about which device performs better. The decision is based on dollars and cents, and the key factors in such a decision are the cost and efficiency of the people using the device.

The cost component is easy. Most organizations can assign a burdened cost to each worker (including overhead such as benefits, office space, and so on). A typical software professional has a burdened cost somewhere in the neighborhood of $75,000 per year. There's relatively little you can do about changing the cost component. Even adding or subtracting computer resources will make only a marginal difference.

On the other hand, the efficiency component is where you can have an impact on overall productivity economics via hardware and software choices. For example, an efficiency boost of just 10 percent will result in a savings sufficient to justify the purchase of $20,000 worth of hardware, based on a three-year payback and including such things as maintenance. (Of course, many organizations are tight on capital, and for them this economic analysis may fall flat.)

But how do you achieve a 10 percent performance improvement? If a user does only one thing using the terminal/workstation, then you need to achieve the performance improvement doing that one thing. For example, if one device is faster than another, that might be enough to justify any difference in price. But it would have to be a lot more than 10 percent faster, because generally only a fraction of a user's time is spent waiting for output from a graphics device.

However, a user rarely does just one thing. A recent study of engineers, for example, showed that a typical engineer spends less than 20 percent of his time actually doing engineering. The rest of the time is spent on the phone, writing memos, preparing project budgets and performing other management tasks. There are similar statistics for other kinds of information users.

So, the way to improve efficiency and productivity isn't by helping professionals do their primary jobs better. The way to improve productivity is by helping professionals spend less time on their secondary tasks. And that's where a workstation, with its windowing capabilities, can make the difference.

tions with the rest of the network.

We all apply a number of measures when we choose between terminals and workstations. The lower half of the diagram on page 49 shows some parameters that could sway you toward either a graphics terminal or a workstation. Consider, for example, engineers who spend nearly all of their time using one particular program that works best on a certain graphics terminal.

One of my clients has dozens of users in this category. They use their terminals just for running a surveying and coordinate geometry system. They want a low-cost, high-performance device that does this one thing and does it exceptionally well.

Another client has a small number of simple statistics and graphics programs that are used regularly, but infrequently, by a number of users. They don't need great graphics, just graphics. And they don't need it very often, because they spend most of their time using simple text-based applications on the VAX.

The decision also can go the other way. For example, if the application requires repeatable and reliable response time, a workstation has major advantages, because it isn't affected by other activities on a host computer.

And, although there are bit-mapped graphics terminals, most graphics terminals primarily are vector-oriented and aren't designed for the display of scanned grayscale images and similar memory-eating applications. Bit-mapped applications (including most iconic and windowed interfaces) are the wave of the future for human interfaces. Thus, bit-mapped capability can be a major factor when choosing between terminals and workstations.

Host-software compatibility also is a major issue. In the VAX world, this factor often is ignored, because any software that runs on a VAX host will run essentially unchanged on a VAX workstation.

The same isn't true of many non-VAX workstation alternatives. Because the workstation processor isn't compatible with the host processor, using a workstation instead of a terminal-plus-host may require porting the application.

There are many other examples of this single-dimension analysis of graphics devices, and that's why so many graphics terminals still are developed and sold. When a user has a relatively narrow focus on what's required, then graphics terminals generally have a price and compatibility advantage over workstations.

In these cases, the users don't care about the other attributes that differentiate a workstation from a graphics terminal. They don't care about multiple windows, a local processor or an icon-and-mouse interface (see Sidebar, "The Economic Angle").

Decisions, Decisions

If your purchasing decision is single-dimensional, you can stick to that overriding concern and your decision will be sound. But if you can't justify a decision on a single dimension, perhaps you should broaden your view of what your users need to make their job more productive. Workstation proponents make this argument, and there is sound reasoning behind it.

For starters, any good workstation provides multiple windows. Most workstation users have one or more windows available for tasks such as electronic mail, file manipulation and spreadsheets. Unlike working on a ter-

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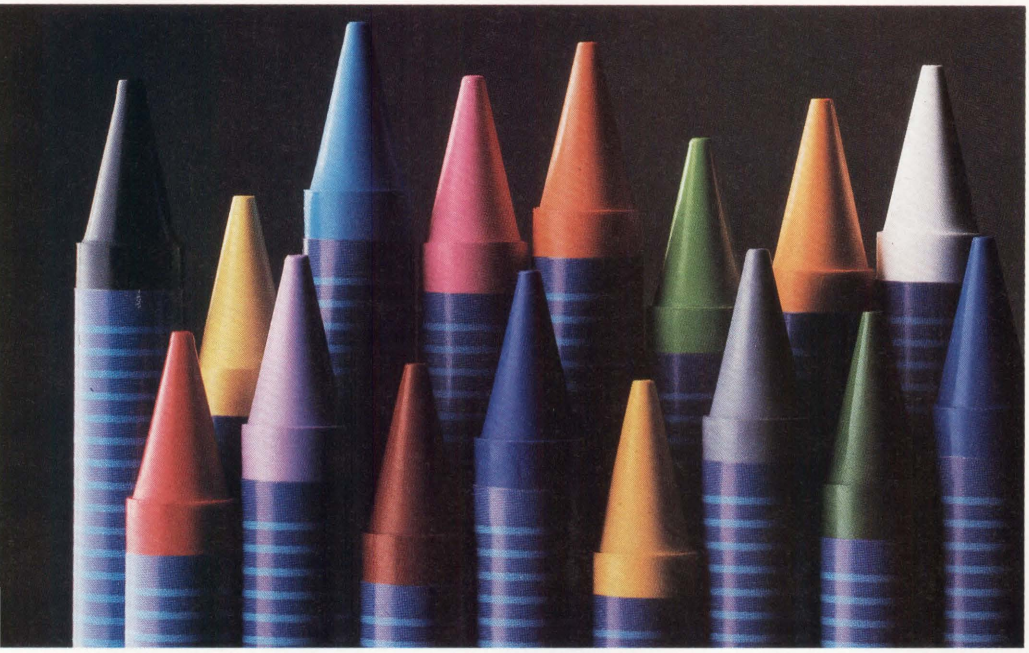

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minal, you don't have to interrupt what you're doing to use these windows. You simply click on another window, do the task and return to your previous task.

. . . graphics terminals generally stay within one or two families of graphics protocols.

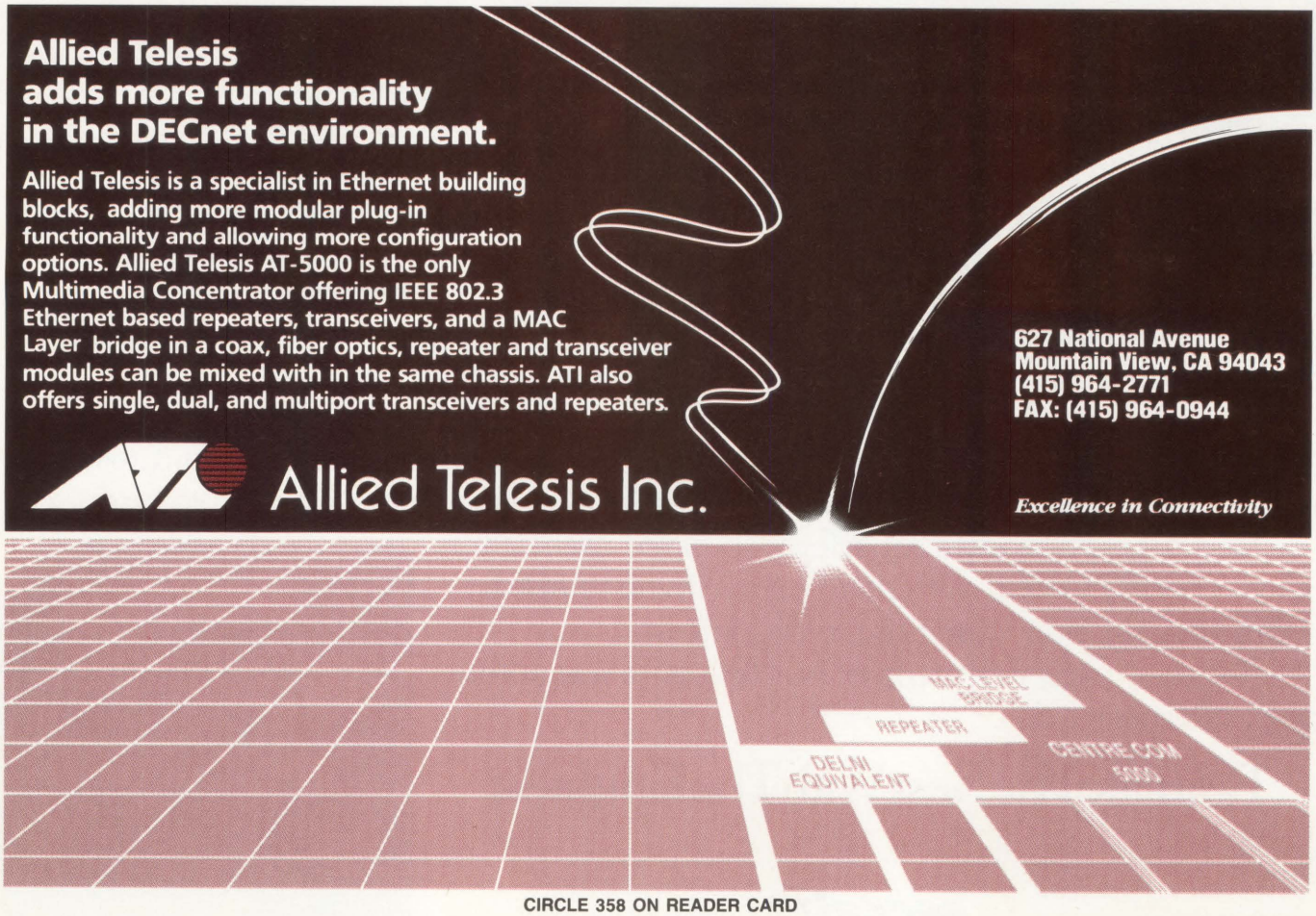
This improves productivity in two ways: It takes less time to switch tasks, and less time means that there's less chance of losing your train of thought.

A more subtle advantage is the access to the network resources that a windowing workstation, especially an X workstation, provides. Workstations sometimes are described as windows to the network. That access to network resources can boost productivity by helping you use the most effective resource for a particular task. If a certain tool, compiler or hardware peripheral is available on another node in the network, a workstation user can take advantage of it more easily than a terminal or PC user.

"But what about graphics performance?" you ask. "Can't a graphics terminal display certain kinds of graphics faster and cheaper than a workstation?" In specific cases, that might be true. I don't doubt that the Tektronix emulation performance of my MicroVAX II-based workstation is slower than the performance of even a modestly price graphics terminal. However, even if we ignore the fact that I get many other benefits from my workstation, there are other factors to consider.

Many graphics terminals are gated by the speed of their communications port. A graphics terminal connected over an RS-232 port might run as fast as 19.2k baud. (Some do, and some don't. Buyer beware!) Or, if you're lucky, you can have a VAX multiplexer or terminal server that supports 38.4k baud and a terminal that also goes that fast. But this is much slower than the virtual communication path of a local workstation. If the graphics application is on the same node as your workstation display, there's no communications delay. Even if the application program is on another node, the communication path is likely to be Ethernet. Thus, you get data at Ethernet speeds as opposed to RS-232 asynchronous speeds.

Further, graphics terminals generally stay within one or two families of graphics protocols. For example, newer Tektronix terminals generally are backward-compatible with older Tektronix terminals, and many manufacturers make graphics terminals with



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Tektronix emulation or Tektronix plus ReGIS capability. But if you need two different graphics terminal types, you probably need two terminals.

However, a workstation can be modified to emulate many graphics protocols. Right now, my DECwindows workstation emulates a Tektronix 4010 (actually a DEC VT340, which in turn emulates a Tektronix 4010). But there's no reason why a sufficiently enterprising software developer couldn't create any number of emulators for execution on the entire range of X workstations and terminals. In fact, on a workstation, any number of terminal emulators could be run simultaneously. For example, you might run a Tektronix 4105 emulator in one window and an IBM 5080 emulation in another.

A number of very good graphics terminal emulators are PC-based. These solutions may be right for you if you need a PC on your desk anyway.

Good software emulation of complex graphics protocols isn't easy, but it can be done. And it can be done with reasonable performance and good price/performance when compared to a hardware (terminal) solution. At first, you might doubt that. After all, a graphics terminal has hardware optimized for graphics operations and protocols. It's hard to see how a general-purpose processor like that on a typical workstation should be able to keep up.

But general-purpose microprocessors have become very fast and cost-effective. A tremendous amount of engineering goes into producing a general-purpose microprocessor used in a workstation (Intel 386, Motorola 680xx, Mips R3000, CVAX). That level of engineering simply can't be invested in a relatively low-cost chipset like that in a graphics terminal. The same is true for the investment in the production methods and the cost advantages of the very-high-volume production runs for today's commodity microprocessors.

Someone's Listening

According to Dataquest of San Jose, California, the workstation market is growing at the rate of 53 percent per year. Much of that growth comes from people who previously purchased graphics terminals.

These trends have resulted in tremendous downward pressure on the traditional text- and graphics-terminal markets, a fact that hasn't been lost on terminal manufacturers. To respond, they've redirected their new product efforts and repositioned their existing products.

Tetronix, for example, has merged its Graphics Terminals Division with the Graphics Workstations Division to form a new Interactive Technologies Division. Tek is marketing a number of powerful new graphics and workstation products, such as high-resolution, high-quality color monitors, digital and video interfaces for both input and output of video images, and a family of graphics workstations and Ethernet-based terminals.

C.Itoh is taking a different approach. It offers cost-effective terminals that compete head-on with Digital's VT3xx offerings and intends to provide Ethernet/LAT support soon. It's responding to the downward pressure on graphics terminals by offering much cheaper, faster and more capable graphics terminals, rather than by stepping out

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of the market. However, C.Itoh is aware that pressure from workstations will continue to shrink the market for those devices.

Other firms, such as Visual Technology, Network Computing Devices, Esprit, GraphOn, Mips Computer Systems, Human Designed Systems and Acer, have introduced X terminals — devices that connect to host computers but act like single-minded workstations. These devices aren't general-purpose computers: They can't be programmed, and they can't do multitasking. However, they provide for a relatively low-cost display of the bit-mapped graphics that make up most of an X workstation's display.

TRADITIONAL graphics terminals with RS-232 interfaces won't go away overnight.

There are two different approaches for these devices. Some connect via Ethernet, using either the TCP/IP or DECnet protocols, and provide an X bit-map service. Others connect over serial lines (RS-232) using either a terminal port on the host or a terminal server. X terminals that connect over RS-232 lines, such as those from GraphOn, allow users who have a fast modem to dial in to a host from a remote location. The differences are more than philosophical, because potentially big differences exist between the two in price, performance, availability (uptime) and connectability.

DEC is expected to introduce a similar device this year. The DEC device has been referred to as an Etherterm, implying that it will connect on the Ethernet and talk DECnet or another transport protocol (perhaps LAT). But it's conceivable that DEC's X terminal will use an RS-232 transport with much of the terminal's intelligence resident on the host.

Traditional graphics terminals with RS-232 interfaces won't go away overnight. Too many good applications use them, and there are too many RS-232 ports around to hook into. But as power users create pressure for more flexible computing interfaces, graphics terminals will slowly but surely move closer to the capability and appearance of a diskless workstation.

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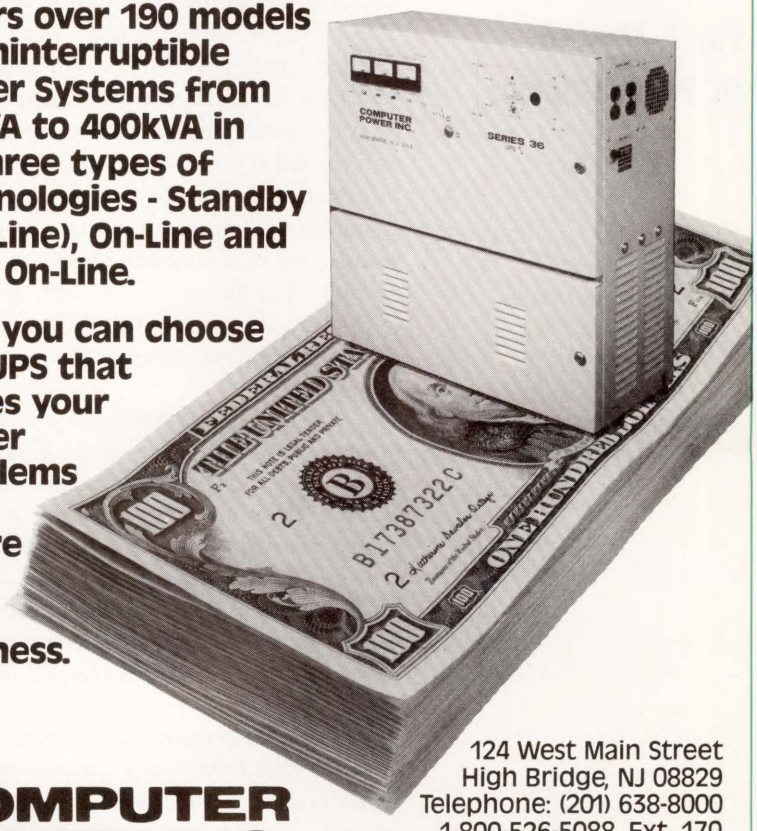

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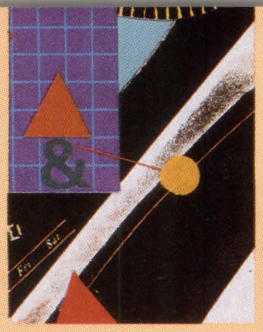

HARDWARE

PCLAN/SERVER 2000

By David W. Bynon

An Effective Solution From DEC For A Myriad Of PC Problems.

There's no doubt that the PC has done more for business and government than any other class of computing. This is evident by the number of PCs sold. Still, though PCs help us to be more productive personally, they can be unproductive to the organization they serve.

A simple case in point: Most PCs in business and government are standalone devices or have limited asynchronous connections to a host computer. Therefore, information created at the PC isn't available to others. Information is one of the most expensive resources an organization has. So, it's no wonder we hear so much about LANs, connectivity and file servers. PC users are trying to gain the advantage of their bigger brethren: a shared pool (centralized or decentralized) of information.

Many computer hardware and software manufacturers have studied the problems of standalone PCs. The typical solution is to use another PC with server software to provide shared disk and printer services. Some go a step further and allow the resources of each PC to be accessed by other network nodes. The problem is that most PC servers and LANs have a common weak link: the PC operating system.

Current PC operating systems, such as MS-DOS and OS/2, aren't capable platforms when it comes to high-speed communications, security, multiuser file systems and high-capacity storage. A true multiuser operating system, such as UNIX or VMS, is needed.

Two years ago, DEC announced its first PC integration product. We know it as VMS Services for MS-DOS and the PC File System (PCFS). VMS Services for MS-DOS received rave reviews for the services it provided and its ease of use. However, version 1.x provided mediocre performance at best.

PC Solution

At the end of 1988, DEC announced two revised products as one: VMS Services for MS-DOS version 2.1 and the MicroVAX 2000. Together they're the PCLAN/Server 2000.

This product is important for two reasons. First, it's DEC's first serious attempt to battle it out with the likes of 3Com, Novell and Sun. More important, the PCLAN/Server 2000 represents a splendid entry-level deal for DEC's customers. There are a lot of standard features in this ready-to-go package (see Figure).

The PCLAN/Server's list price is $18,800, about $10,000 less than the components and licenses configured separately. You must purchase Ethernet adapters (Network Integration Packages) separately.

DEC's PCLAN/Server is a true plug-and-play system. Setup is as simple as connecting the three system boxes (MicroVAX 2000, TK50 and RD54); loading VMS, DECnet and VMS Services for MS-DOS via the TK50 tape drive; and registering each PC connected to the LAN. My installation took about a day to complete

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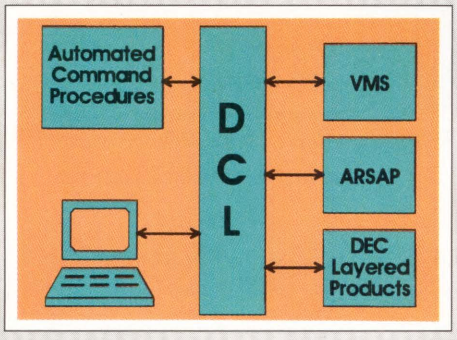

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▲There is no system accounting interface that is more automated than ARSAP's DCL. This feature alone sets ARSAP years ahead of those products with menu-driven interfaces. Menus are repetitive, tedious and can hinder productivity. With ARSAP's uniquely flexible design, you can run either interactively—or automatically!

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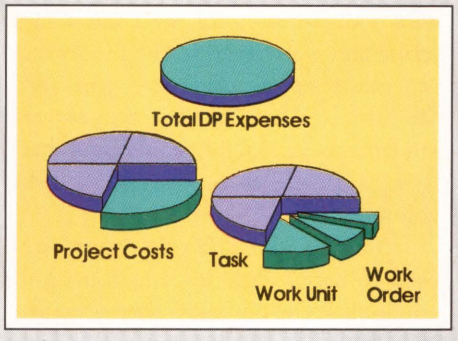
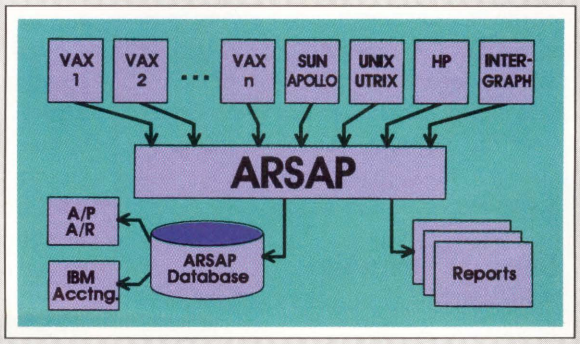


Accurate, detailed project accounting.

▲Project accounting with ARSAP is more automated, flexible and accurate than you thought possible. You can use project codes up to 96 characters and five custom groupings to track project charges. Custom-fit ARSAP, using five-level, user-definable prompting and automated defaults for all or parts of a project code.

Only ARSAP includes features for printer forms charging, Intergraph plot charges, selective image surcharging and consistent disk charges even when samples are missing.



If there's a more automated system accounting product than ARSAP, it's still on the drawing board. Call for more information on:

- ☐ User Chargeback
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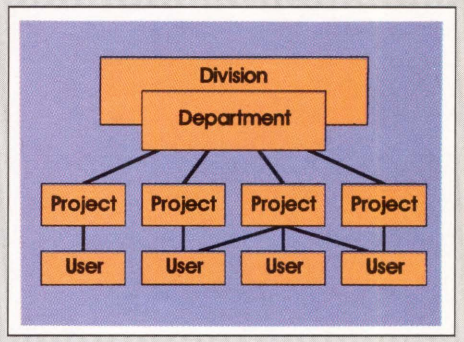
Track your entire organization *automatically.*

▼ARSAP's automated accounting capability extends to nine organizational levels. You can track their usage and generate reports with the detail amount automatically tailored to each management level.



ARSAP can handle any situation—whether a company division contains five or 5,000 users; users belong to one department or several; a project consists of one or multiple users; or users from several departments are working on the same project.

ARSAP is never obsolete.

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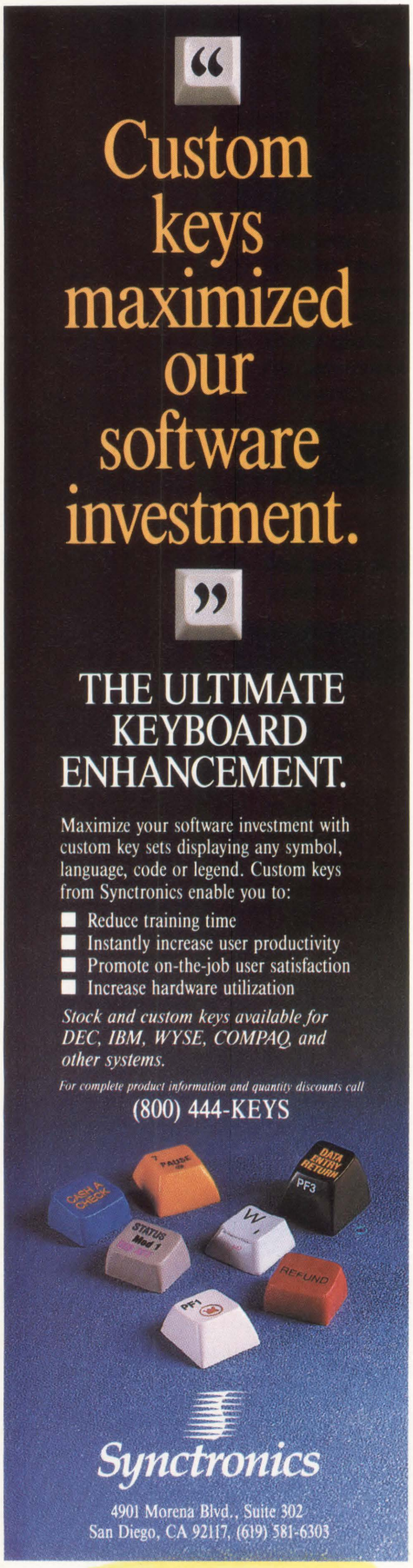

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and included registering and configuring two Tandy 4000s.

Service To The Crew

VMS Services for MS-DOS V2.1 is a robust integration package. It offers virtual disk services, VMS file services, security for DOS files, printer services and more. The LAN manager must become familiar with all of these functions.

Two server images are provided with VMS Services for MS-DOS: a file server and a disk server. The file server provides access to native VMS print and file resources, whereas the disk server implements virtual (i.e., something that looks like it's there but isn't) disk volumes.

It seems odd that two servers are used to access disk information until you look at the functions they provide. The disk server implements a DOS formatted volume on the PCLAN/Server's storage device. After it's created, the DOS volume acts like a local PC disk. The PC assigned to the virtual disk can boot from it, the virtual disk provides local hard-disk performance, and access to the virtual disk is private, i.e., it can be protected from other PC users. The file server, on the other hand, provides shared access to files for PC users, Mac users, VMS, ULTRIX-32 and other systems connected to the network.

With the connectivity capabilities of the PCLAN/Server, I'm curious as to why DEC didn't include an LAVc license. When connected as a member of a LAVc or a mixed VAXcluster, the PCLAN/Server nets the PC user complete access to storage and print resources of a VAX/VMS computer center.

Using Is Believing

Although robust, the PCLAN/Server and PCSA V2.1 are simple to use. After the PCLAN/Server and PCs are configured, the PC user rarely notices that many or all of his disk and print services are provided by another computer.

To set up the PCLAN/Server, the server administrator (system manager) uses two utilities: PCSA Administration and PCSA Manager. The PCSA Administration Utility, which is menu driven, is used to establish file and print services and to register workstation users.

Each workstation must be registered by the file server for VMS file and print services and by the disk server for remote boot services. After this has been accomplished, the PC user can remote boot from the server (if using a DEPCA Ethernet controller) and access file server resources.

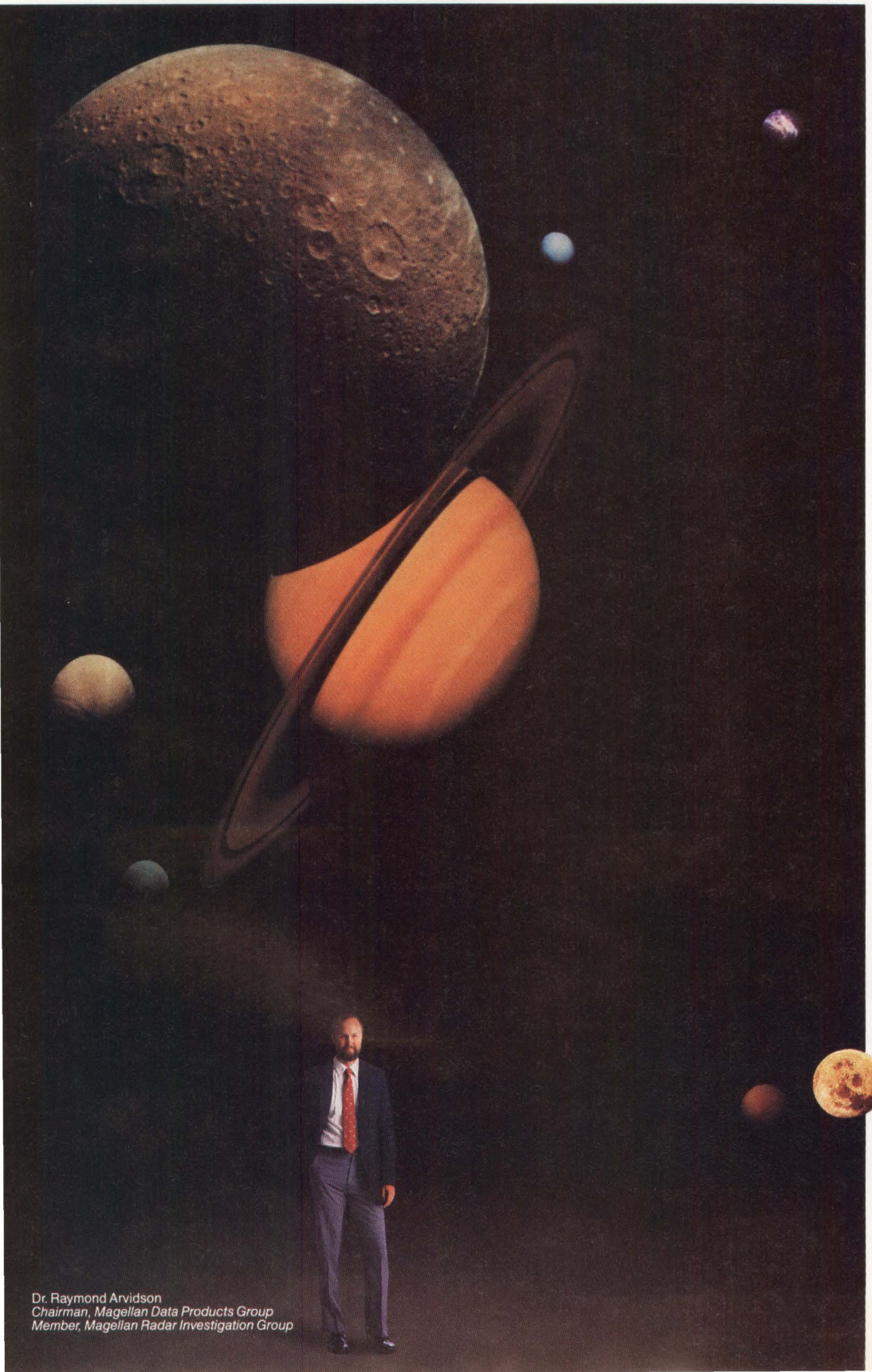
Typically, the server administrator establishes a personal service for each PC user, client system services for each type of PC and multiple application and common services. Each service can be public or private. A service is controlled as a VAX/VMS account, so all VMS security features apply. To use a file service, the PC user issues a PCSA NET

FIGURE.

MicroVAX 2000
- 4-MB memory - RD54 disk drive (154 MB) - TK50 cartridge tape - RX33 floppy-disk drive - Ethernet adapter - Four asynchronous serial ports - VT320 terminal
Server Software
- VMS - DECnet - VMS Services for MS-DOS version 2.1
PC Software (for 16 users)
- PCSA - DECnet-DOS - MS-Windows - MS-NET - PCmail - DOS Utilities

The PCLAN/Server 2000 package boasts an array of standard features.

Before System 1032, 24 years and 1 trillion bits of interplanetary data were lost in space.



Dr. Raymond Arvidson
Chairman, Magellan Data Products Group
Member, Magellan Radar Investigation Group

When the recently launched Magellan space probe reaches Venus in the summer of 1990 to map the planet's surface, it will collect more than 1 trillion bits of data. That's more information than gathered from all the previous planetary probes combined.

According to Dr. Raymond Arvidson of Washington University in St. Louis, the successful use of this new data all gets down to System 1032 from CompuServe Data Technologies.

"Our System 1032 database is the only one in the world that does what it does," said Professor Arvidson.

As Arvidson discovered, System 1032 4GL/RDBMS software readily handles his record-breaking amounts of data at record-breaking speeds. Smoothly. Easily.

Along with the team from the Department of Earth and Planetary Sciences, Arvidson uses System 1032 to catalog and access vast amounts of digital data from past and present missions. Currently, the database includes information about 150,000 images and 500,000 photoproducts.

Before System 1032, 24 years of data weren't cataloged or readily accessible. So trying to find a particular image could not only take weeks, it might not be found at all.

Using System 1032's browse capability, the database can be easily searched and data quickly displayed. For example, a data search that might have taken 40 hours before System 1032, can now be done in just seconds.

If your large, sophisticated RDBMS application leaves you lost in space, here's how to find the answer: Think Big. Think Fast. Think System 1032 from CompuServe Data Technologies.

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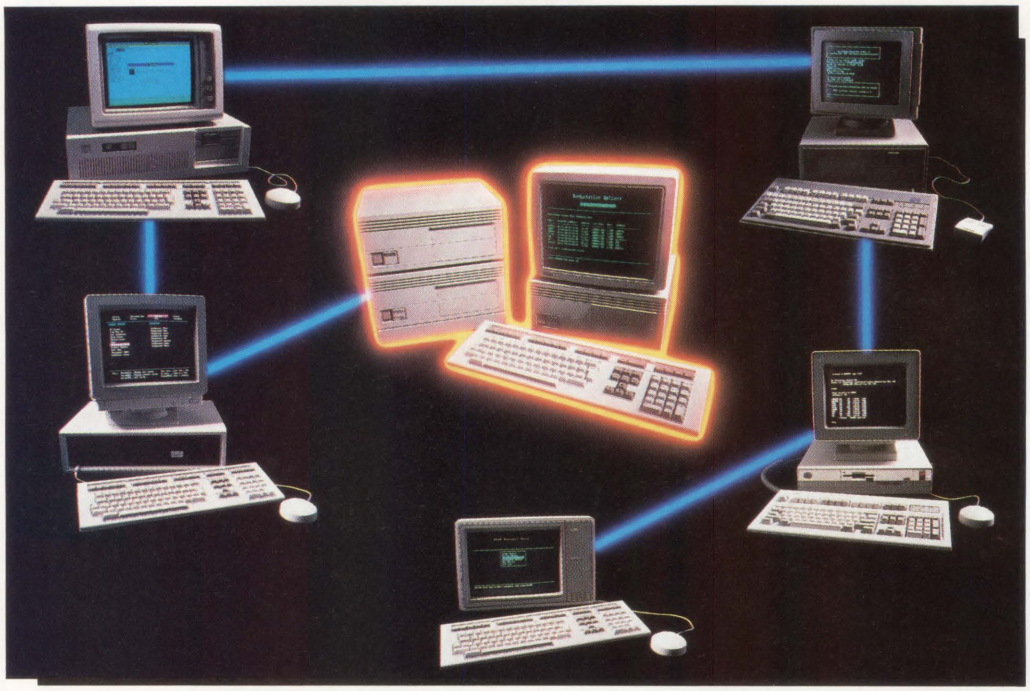

DEC's PCLAN/Server makes PC users part of the mainstream of information.

USE or LOGIN command. For most users, the MS-DOS commands used to connect to file and disk server resources can be put in the PC's AUTOEXEC.BAT (startup) file. If the remote boot option is used, the server administrator can access the key disks (remote boot disk) to update AUTOEXEC.BAT files as services are added or removed.

The PCSA Manager Utility, which is command line driven, is used to manage advanced and seldom-used functions of the file and disk servers. As with the PCSA Administration Utility, you can add and delete file and print services with the PCSA Manager Utility. You also can change service characteristics, grant and deny user access or stop server access. With the PCSA Manager Utility, you have complete control of the file and disk servers and the resources offered to the PC users.

The PCSA Manager Utility also is used to create and mount virtual disk volumes. Virtual disks can be created as 360-KB or 1.2-MB remote boot disks or 5-, 10-, 20- and 32-MB shared disks. VMS maintains the virtual MS-DOS disks as a single file and can't access the MS-DOS data. To the PC user, the virtual disks (after they're mounted) appear to be a local hard disk. In my setup, I found the performance of the virtual disks to be almost indistinguishable from a local 40-MB ST506 hard disk. Access to VMS files via the file server, however, was noticeably slower.

DEC supplies several beneficial utilities for PC workstation users. The most useful utilities are BACKUP, which lets the user back up to and from network disks; BACKLIST, which lists the contents of a backup; DECNET, which front-ends NCP and other DECnet-DOS utilities with a menu; and PCmail, which facilitates electronic mail between PC workstations and VMS users.

Control And Security

As a system manager, I welcome the PCLAN/Server for two simple reasons: It offers a central point of control, and, it offers data security. For anyone who has had the displeasure of managing numerous standalone PCs, the PCLAN/Server will provide relief. There's no more running from office to office installing software and backing up hard disks, and there's a lot less worrying about information security.

With the PCLAN/Server, new software can be made available immediately to everyone by installing it once, instead of on every PC. This is an incredible time saver. Backups are made simple, too. The TK50 tape drive saves files for all PC clients on TK50 cartridges. You can forget about buying PC floppies by the case, because you won't need them for PC backups.

THE PCLAN/SERVER IS an effective solution for a myriad of PC problems. It makes PC users part of the mainstream of information, while taking away a burden of the systems manager. Those are big solutions for such a small box.

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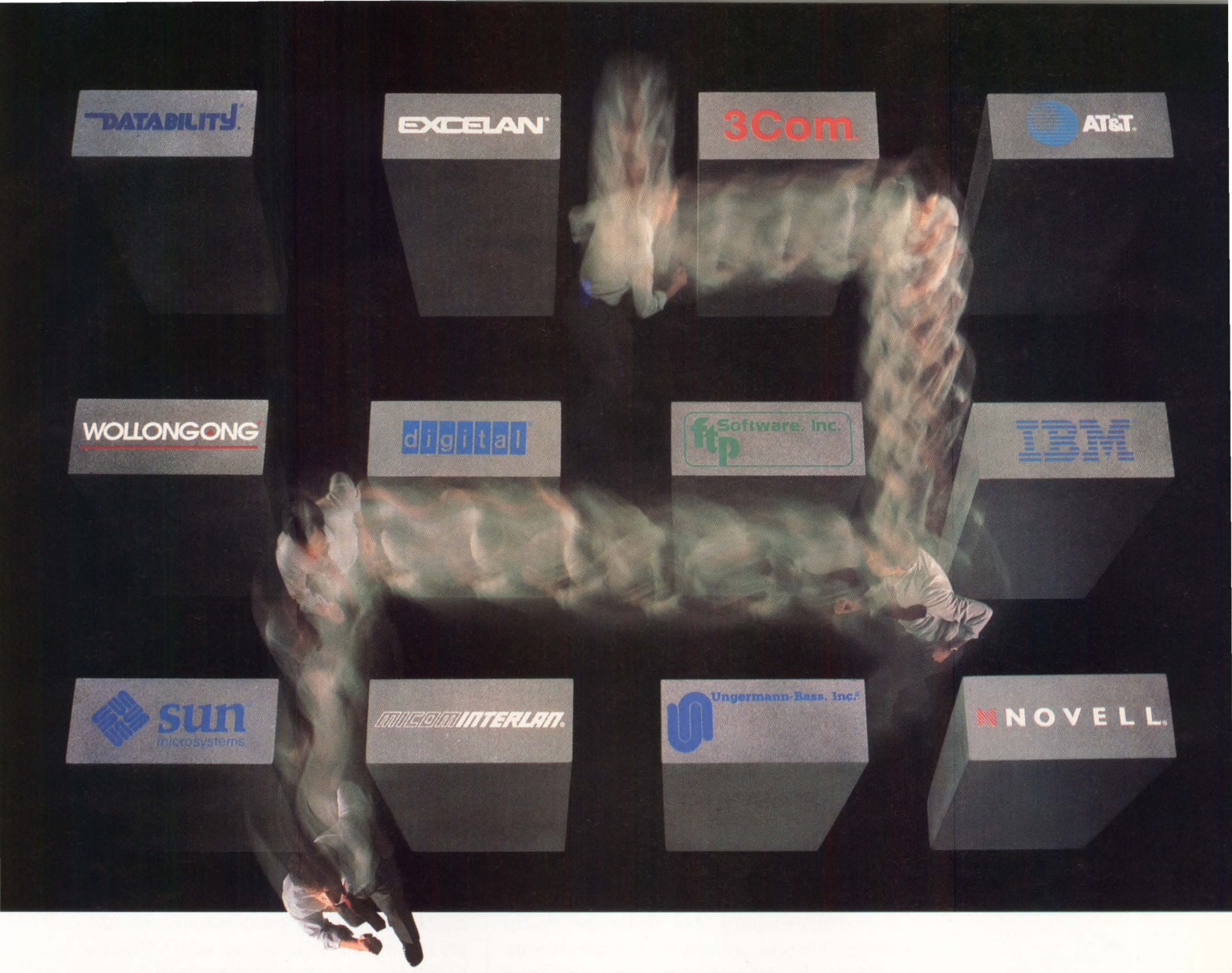

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Reflection 4 PLUS for $349* emulates the VT241 terminal with 16-color ReGIS graphics. **Reflection 2 PLUS** for $249* emulates the VT320. Network server pricing is available.

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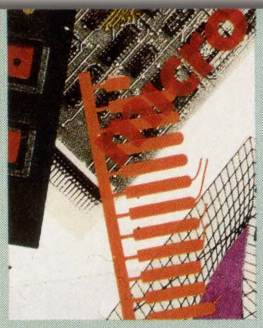


SOFTWARE

CASE: DEC'S VIEW

Part 2: Current Products And Plans For The Future.

By Geoffroy T. Roach

Editor's note: Part 1 of this series, published in May, focused on DEC's CASE strategy. Part 2 features an in-depth look at products in the CASE environment and a glimpse at DEC's CASE future.

The first major component of DEC's CASE strategy is the availability of tools for all phases of the software life cycle. This includes not only analysis, design and coding but also project management, documentation, communication and other tasks (see Figure 1).

DEC's VAX Software Project Manager is a graphics-oriented tool that's specifically designed to plan, estimate and control software projects. It includes resource requirements estimation using the COCOMO model and provides scheduling and tracking using PERT, GANTT and CPM, while supporting multiuser access.

To implement many of the popular design methodologies available, DEC provides, through its Cooperative Marketing Program (CMP), analysis and design tools. These tools include:

1. Excelerator, from Index Technology.
2. Software Through Pictures, from Interactive Development Environments.
3. Teamwork, from Cadre Technologies.

All are integrated with the DEC CASE tools.

CASE Tools

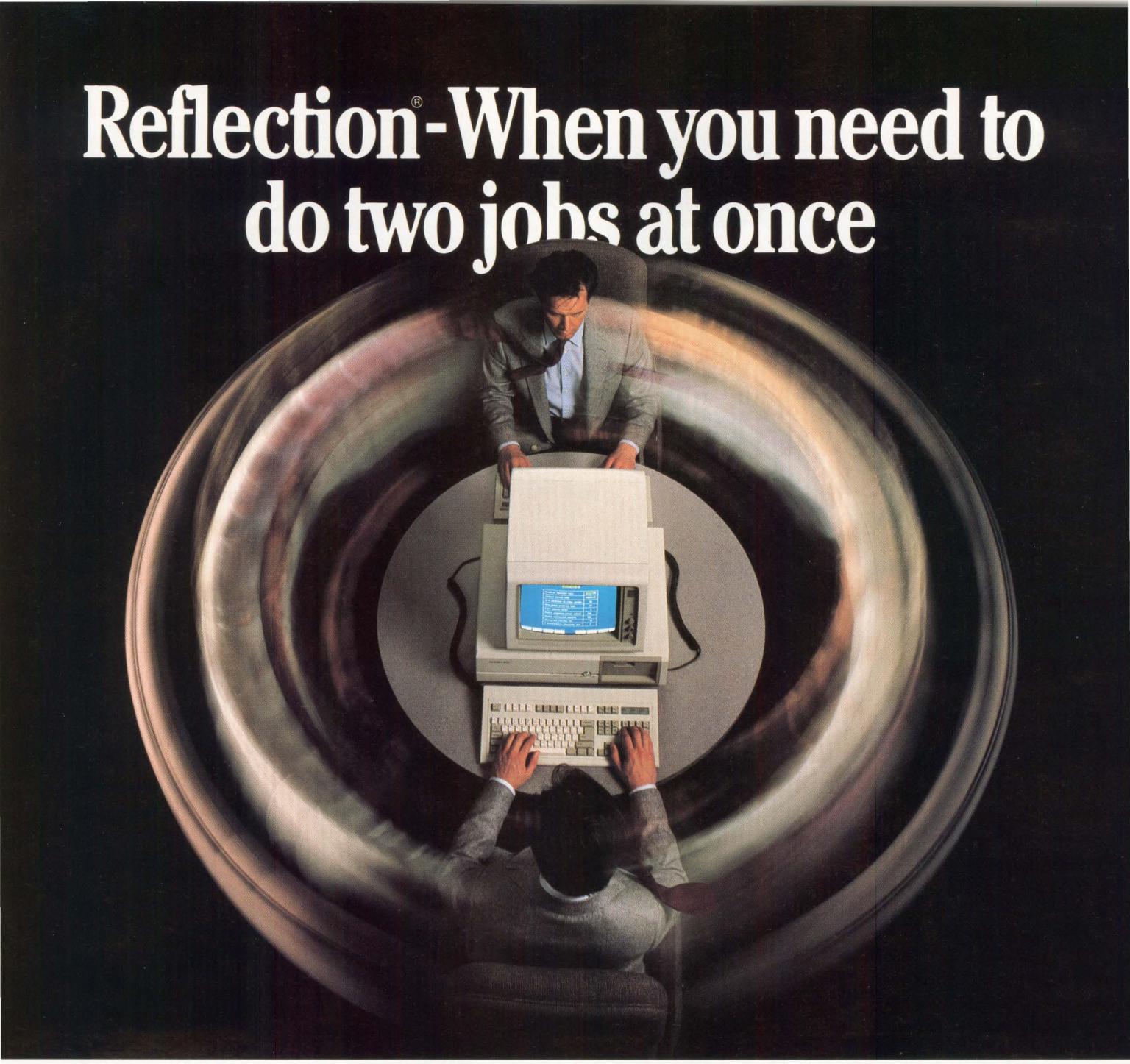
In the Information Systems (IS) world, DEC provides a solution for the design and implementation of business systems in the marketplace. For instance, DEC provides capabilities that cross the bridge between detail systems design and code generation in the VAX COBOL Generator. Designed to generate error-free COBOL code from an icon-based graphic design on the programmer's screen, the VAX COBOL Generator can be used to create entire applications.

For systems that can be developed using a 4GL or for those instances in which significant prototyping needs to be done, DEC provides a number of tools from its own offerings and from participants in CMP. VAX RALLY, DEC's 4GL, is integrated with CDD/Plus, VAX/Rdb and VAX TEAMDATA and is complemented by products from Cognos, Signal Technology, Information Builders and Cullinet.

For those who'd like to take advantage of the DEC software-engineering environment and use the VMS platform to develop applications for IBM mainframes, DEC has worked with Netron. DEC and Netron allow system developers to design, code and test systems on a VAX computer, with IBM mainframes running MVS, CICS, DB2 or IBM PCs as the target environment. Netron/CAP can be used in conjunction with DEC's tools to create a networked, team-oriented development environment that isn't found using PC-based code generators.

The VAX Language Sensitive Editor (LSE) is an editor that has knowledge of the syntax in DEC's programming languages. It provides context-sensitive help and is integrated with DEC compilers, debuggers and other tools. By

Reflection®-When you need to do two jobs at once



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Only Reflection gives you the power to perform simultaneous PC and host operations. For instance, let Reflection monitor your VAX Mail in background while you run other applications on your PC. Reflection will inform you of new mail and leave you with enough memory to run another DOS application in the meantime.

Pulling double duty is only one of the virtues that made Reflection the winner of the *1989 Digital Review Target Award.* A programmable script language gives you the flexibility to automate tedious tasks.

Reflection's high-speed file transfer works with a wide range of computers and includes easily-uploaded VAX and UNIX file transfer software at no extra charge. The **PLUS** option offers support for all popular networks and a sophisticated PC file backup and restore capability.

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Reflection 4 PLUS offers accurate VT241 emulation, plus 16-color ReGIS graphics, for $349.* For VT320 emulation only, choose **Reflection 2 PLUS** at $249.* Quantity discounts are available.

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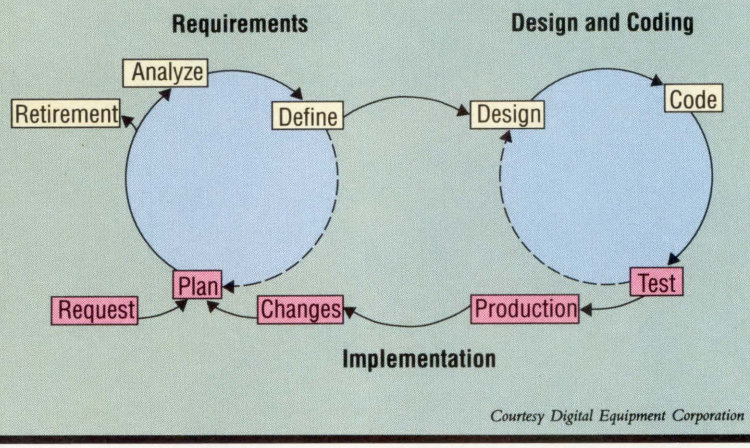
FIGURE 1.



Software development.

reducing the amount of time spent in coding and maintaining programs, it can help address the creation and maintenance of code.

The VAX Source Code Analyzer (SCA) allows interactive inquiries about program structure, including cross-reference information, calling structure and where and how often different program elements are used. This enables new team members to understand program structure and helps to ensure consistent modifications. SCA also addresses many of the problems surrounding system maintenance. LSE and SCA are part of the VAXset programming environment under VMS.

DEC offers a number of programming languages in VMS and UNIX. These languages operate in DEC's Common Language Environment. This allows a program written in any language to make calls to programs written in any other supported language and to use common consistent system services. Programmers can reuse components of systems, thereby increasing productivity and encouraging consistency.

Programming languages offered by DEC are supported by a common tool environment: One set of tools supports all DEC's languages. After a developer masters the tools for one language, he can use them equally well with all languages. DEC has languages that support development of software for many target environments, including VMS and UNIX systems, as well as real-time systems based on the VAXELN environment.

Under the UNIX programming environment, several tools contribute to writing better software. These include a choice of window-based editors, a dx notepad and a window-based version of emacs: xedit. For static analysis, there are the UNIX tools, cxref, lint and ctrace.

CDD/Plus is at the center of DEC's CASE for Information Systems (CASE/IS) solution. Besides being a distributed, active data repository, it also has been built to be a completely open dictionary environment. With the development and publication of a standard interface, CDD/Plus is seen as the core for system development using not only DEC software tools but also tools from independent software vendors. By integrating the DEC compilers, code generators, 4GLs and other CASE tools with products developed by others, an environment is created to design, develop, test and implement systems.

CDD/Plus is integrated tightly with VAX Rdb/VMS and the DECtp environment. In fact, the DEC CASE environment is one of the major advantages in developing data-management and transaction-processing applications in the VMS environment.

In the VMS environment, the VAX Performance and Coverage Analyzer (PCA) collects and analyzes performance and test information. It can highlight performance bottlenecks and provide coverage analysis to indicate what code in a program actually has been tested.

The VAX DEC/Test Manager (DTM) organizes and runs tests and then analyzes test results. It also helps ensure that a system meets design goals and that improvements don't introduce additional errors. Testing and profiling can be done at the same time by DTM running PCA on an application. PCA and DTM are a part of VAXset.

In the UNIX environment, performance measurement and testing is supported with the UNIX tools profil, cflow, perfmon and grep.

The VAX Code Management System (CMS) is an automated file librarian that tracks revisions to source code, documentation, test files, documents and other project-related files. The VAX Module Management System (MMS), which is integrated with CMS and CDD/Plus, uses a script to automatically build systems and documentation using the latest versions of components.

Six of the VMS CASE tools have been packaged under the name VAXset. These tools are LSE, SCA, DTM, PCA, CMS and MMS.

For UNIX systems, librarian functions are supported with sccs. Automated system and documentation building is handled by the UNIX utility make.

Under VMS, DEC's VAX Document handles composition and output of large documents with text and graphics. It uses a markup language to specify formats that include standard forms, such as DOD Standard Formats, and supports

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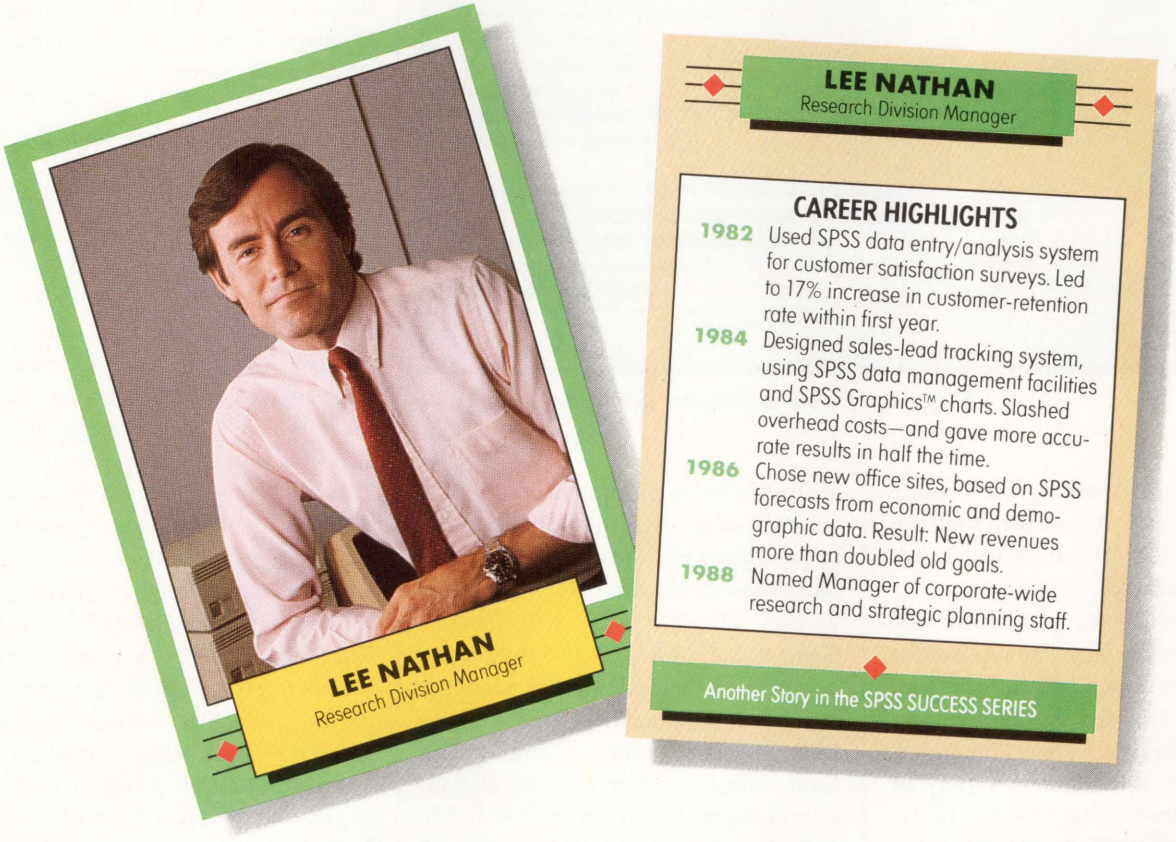

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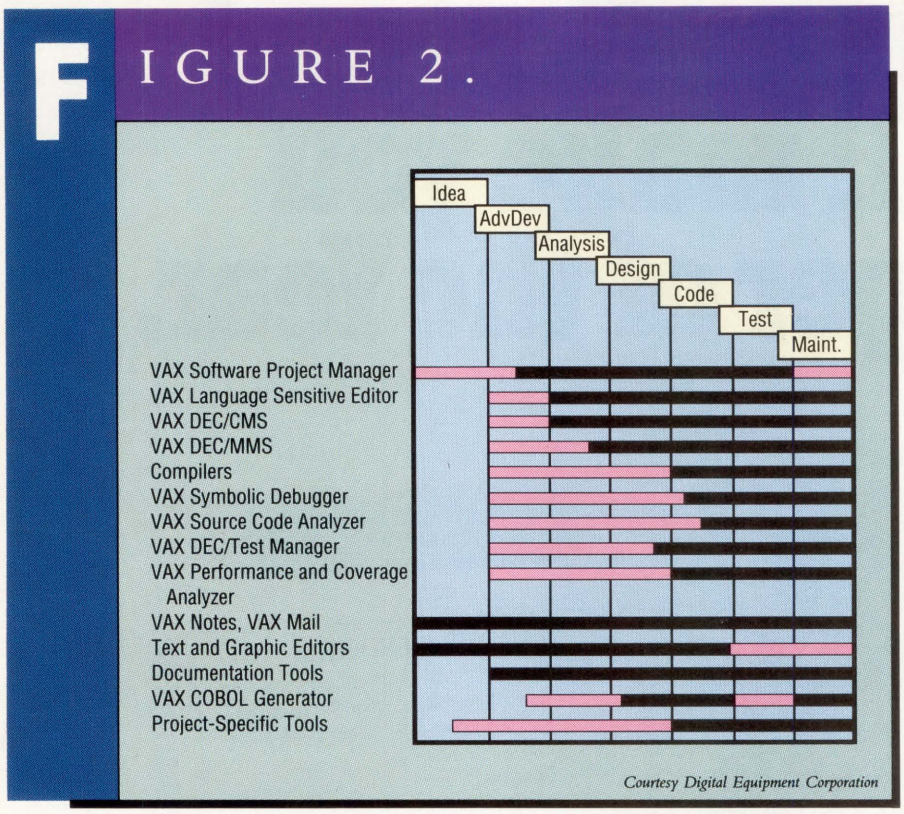


Mapping of tools to software development life cycle.

multiple authors working on a single document. WYSIWYG-oriented tools are available from CMP participants Interleaf and Datalogics.

DEC's DECwrite is available for VMS and UNIX. This is a powerful WYSIWYG compound-document tool that features text and graphics editing capabilities and page layout functions. It can import and export a variety of formats for interfacing to other tools.

These are coupled with tools that provide communication for team-oriented environments. Tools to support these requirements include VAX Mail and VAX Notes.

A mapping of some of these tools to the software development life cycle is shown in Figure 2.

Integration

The second key element in DEC's CASE strategy is creating and integrating CASE environments. DEC has taken a number of approaches to enhance the integration not only of its own software products but also those of third parties. The Core Integration mechanisms are provided by VAXset, CDD/Plus, the VAX COBOL Generator, VAX RALLY and Rdb/VMS.

Many of the third-party products mentioned above are integrated with the DEC products. Some examples are Cadre's Teamwork and its use of VAX Document and CMS, as well as Index Technology's Excelerator and Signal Technology's Smartstar and their use of CDD/Plus. An instance of this integration can be shown in that a change to a data item in CDD/Plus or to source code in CMS automatically can trigger a system build in MMS.

DEC has worked to develop standards in the integrated project-supported environment (IPSE) area. Three primary benefits to using an IPSE for software development are improved configuration-management capability, a stable development foundation with the flexibility to integrate new tools and customize work flow, and a consistent user interface to all tools. DEC has integrated VAXset, the VAX Software Project Manager, the VAX/Ada Compiler, Interactive Software Development's Software Through Pictures, Interleaf's Technical Publishing Software and Atherton Technology's Project Software through the Atherton software backplane.

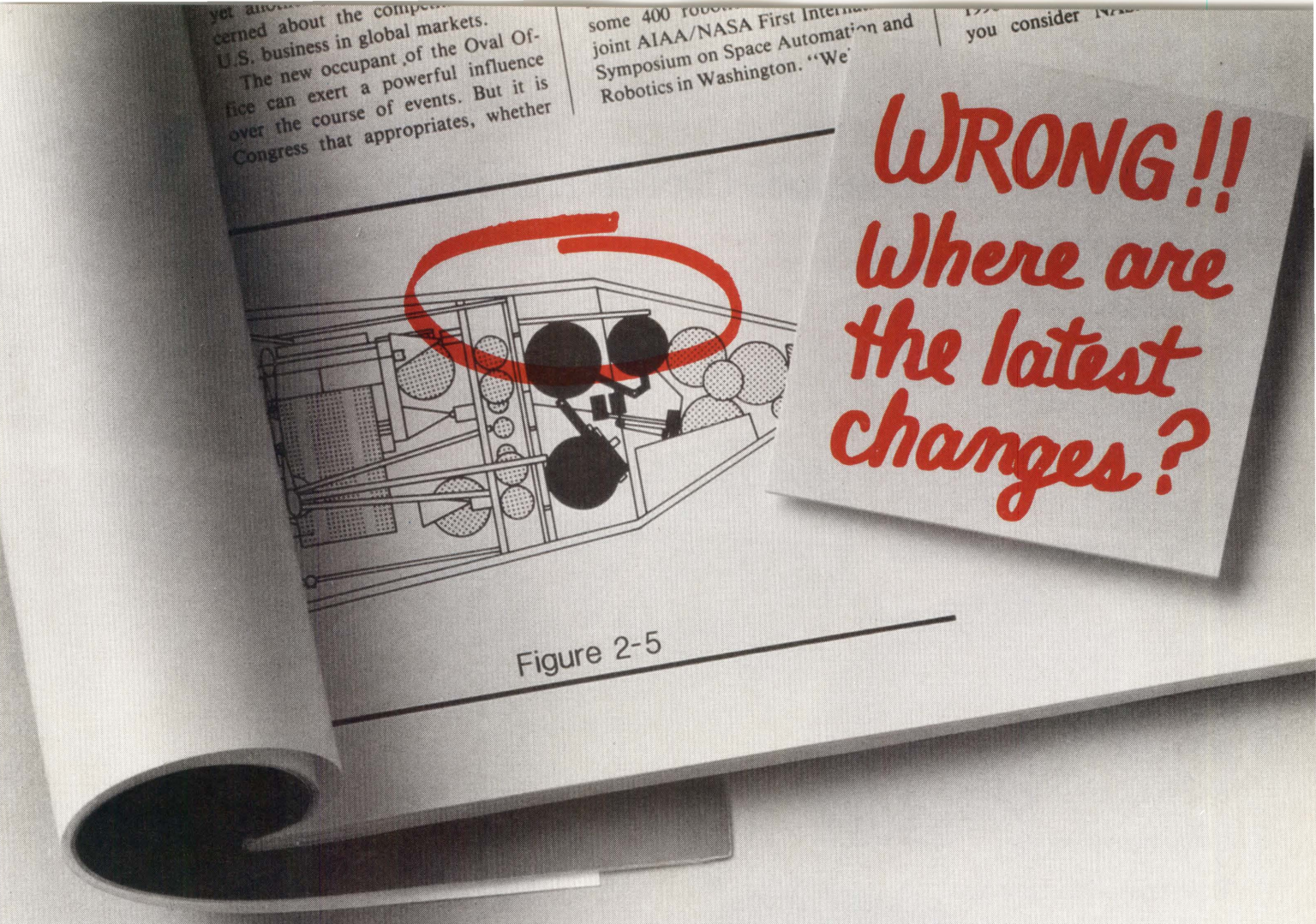
DEC's Ada programming support environment (APSE) fulfills the CASE needs of the Ada customer. The Ada development environment consists of the same tools used with any other VMS language. These tools include DEC/CMS, DEC/Test Manager, SCA, LSE, PCA, VAX Document, VAX Software Project Manager, VAX Notes and the VAX Debugger.

There have been several enhancements to DEC's CASE tools to support Ada programming specifically. For example, VAX LSE has Ada language templates that are useful to those learning the Ada language. SCA supports static analysis of Ada programs and provides cross referencing, keeping in mind Ada language idiosyncrasies. VAX Document provides many styles of documents for the user, including DOD-Std-2167A requirements.

The VAX Debugger was enhanced with the first release of VAX Ada in 1985. The enhancements were designed to support debugging of Ada programs, paying particular attention to Ada-specific programming characteristics.

DEC's XD/Ada program, developed in conjunction with System Designers Ltd., will support embedded systems based on the 1750A and 68000 series microprocessors. This provides an environment that includes compatibility with VAX/Ada and the use of VAXset, providing a programming and debugging environment on the VAX host for these microprocessors.

Expert systems have two places in the CASE environment. The first is on the implementation side of a system. Rather than implement in a 3GL or 4GL, it may be an option to develop a par-



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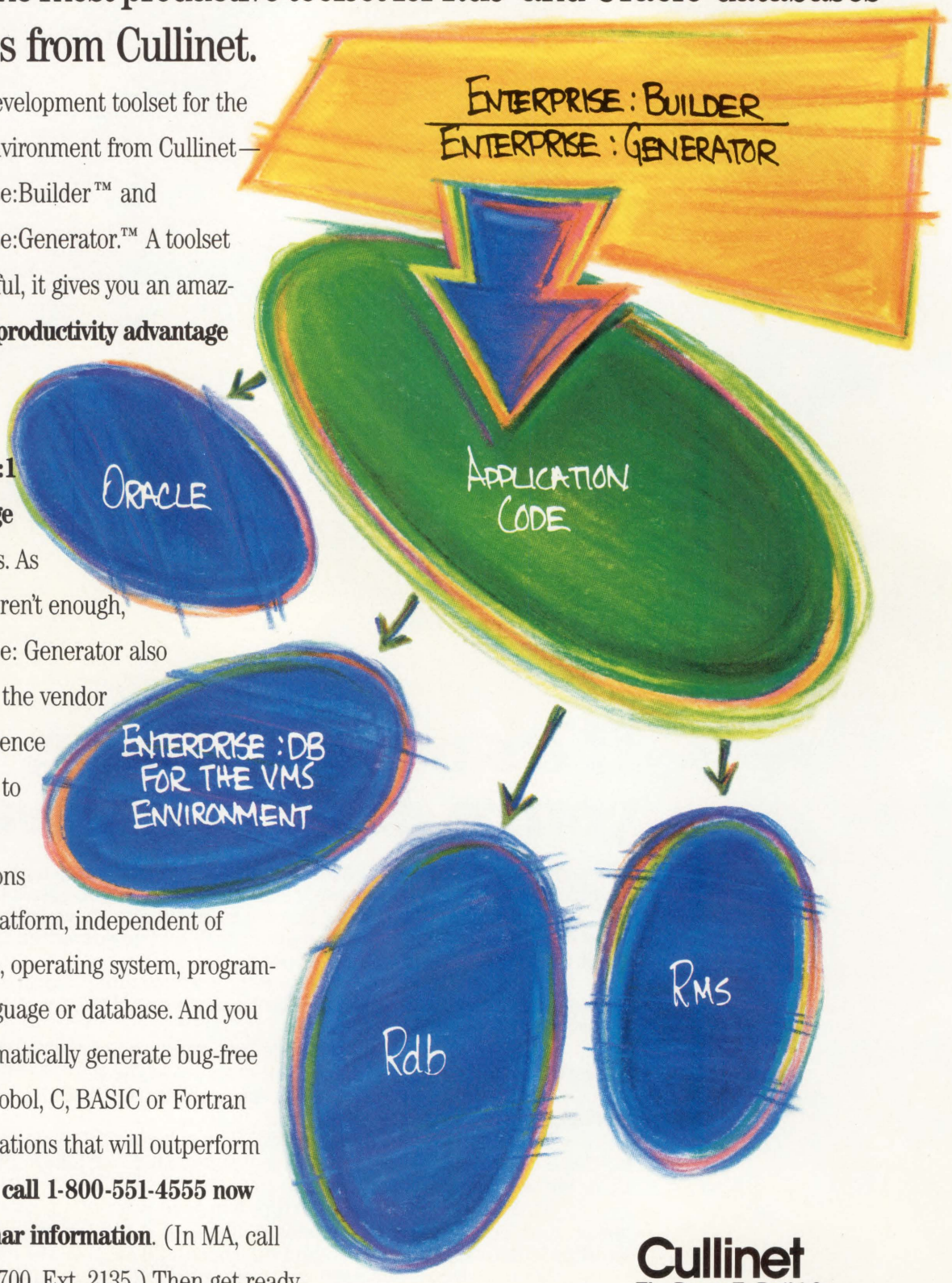

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ticular part of a system with an expert system shell. Expert system shells, such as VAX Decision Expert, are geared toward applications in which diagnostics play a significant role. VAX Decision Expert also can be used in conjunction with other VAX languages, so that a combination of technologies can be applied. VAX languages, such as VAX LISP, also can be used to implement expert systems.

The second use of expert systems in CASE is to embed intelligence in the CASE tools. At DEC, several prototypes of intelligent CASE systems have been built, and these systems currently are being studied. The prototypes cover such areas as integrating VAXset with an intelligent relational database and application generator. Work is under way to understand how to integrate data repositories, IPSEs and expert systems.

WHAT'S IN STORE for the future for CASE at DEC? Several trends have emerged. With the recent release of DECwindows and applications that use this windowing system, the work toward creating a more integrated software-engineering environment has begun. Making the tools easier to use and fit a wider range of applications and target environments is key. New technologies, such as object-oriented design and programming with such products as C++ and Trellis, will begin to impact CASE at DEC. While DEC's CDD/Plus and the efforts performed in conjunction with Atherton are good initial offerings in CASE integration and repositories, work will continue to strengthen this area.

DEC has used and promoted software engineering and software development successfully over the last decade. The next decade will see many changes in the ways that software is developed and maintained. *—Geoffroy T. Roach is a Digital Equipment Corporation marketing executive in the CASE/IS program, Corporate Systems Group, Marlborough, Massachusetts.*

Assistance for this article was provided by Michael Kendall, Engineering Systems Group, and Shirley Ann Stern, Corporate Systems Group, Digital Equipment Corporation.

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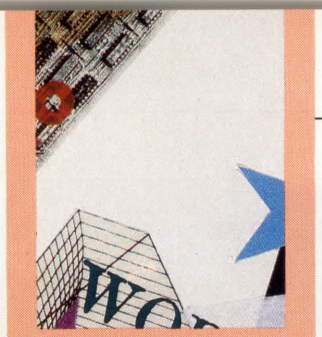

UPDATE

DEC PRO ON-LINE

By Eric Schoeniger

ARIS/BB Provides A Text-Retrieval System For Accessing Back Issues Of *DEC PROFESSIONAL*.

DEC PROFESSIONAL is a valuable reference tool, an in-depth source of technical information and solutions for DEC computing problems. It offers the experience and expertise of our technical editors, in-depth analysis of market trends and industry issues, and current product information.

Soon, you'll be able to access every back issue of *DEC PROFESSIONAL* on-line. Every current subscriber can use the ARIS/BB text-retrieval system to access these back issues. This makes hundreds of articles just a keystroke away when you need answers fast. And, like ARIS/BB, our Automated Reader Information Service bulletin board, this new reader service is free.

Although diagrams published in the magazine won't be available on-line, the text will appear in its complete, original form. This means you'll have a comprehensive DEC computing library. Text from 1988 issues to the present will be available next month, and text from prior years will be available in the future. Watch ARIS/BB for notification of when issues come on-line.

"The ARIS/BB text-retrieval system will make nearly 10 years of DEC computing knowledge available to every subscriber — information unavailable from any other source," says Linda DiBiasio, executive editor of Professional Press.

Eventually, all Professional Press publications will be available to their respective subscribers. These include *DEC PROFESSIONAL*; *VAX PROFESSIONAL*, the technical software journal that focuses on VAX/VMS systems; *HP PROFESSIONAL*, a solutions-oriented magazine for users of Hewlett-Packard computers; and *MIDRANGE SYSTEMS*, a biweekly news publication covering the IBM Systems/3X and AS/400 markets.

The articles are made available through a customized version of CC Search, a text-retrieval software package from CC Software Inc., Rockville, Maryland.

On-Line Read

To access the keyword search, log in to ARIS/BB. To log in, you'll need your subscription number from your mailing label. Set your terminal to seven data bits, one stop bit and space parity, or eight data bits, one stop bit and no parity, and dial one of the ARIS/BB numbers listed on page 18. You also should use VT100 emulation.

From the ARIS/BB main menu, choose the text-retrieval option. From here, you can perform searches. On the command line, key in a word for a subject of interest, for example, UNIX. The text-retrieval system finds all occurrences, or matches, of that word in every issue of the magazine and lists them by article in the File screen. The File screen lists how many matches are found for each article in which the match appears (see Figure 1).

You can use your Up and Down arrow keys to select an article that interests you. The

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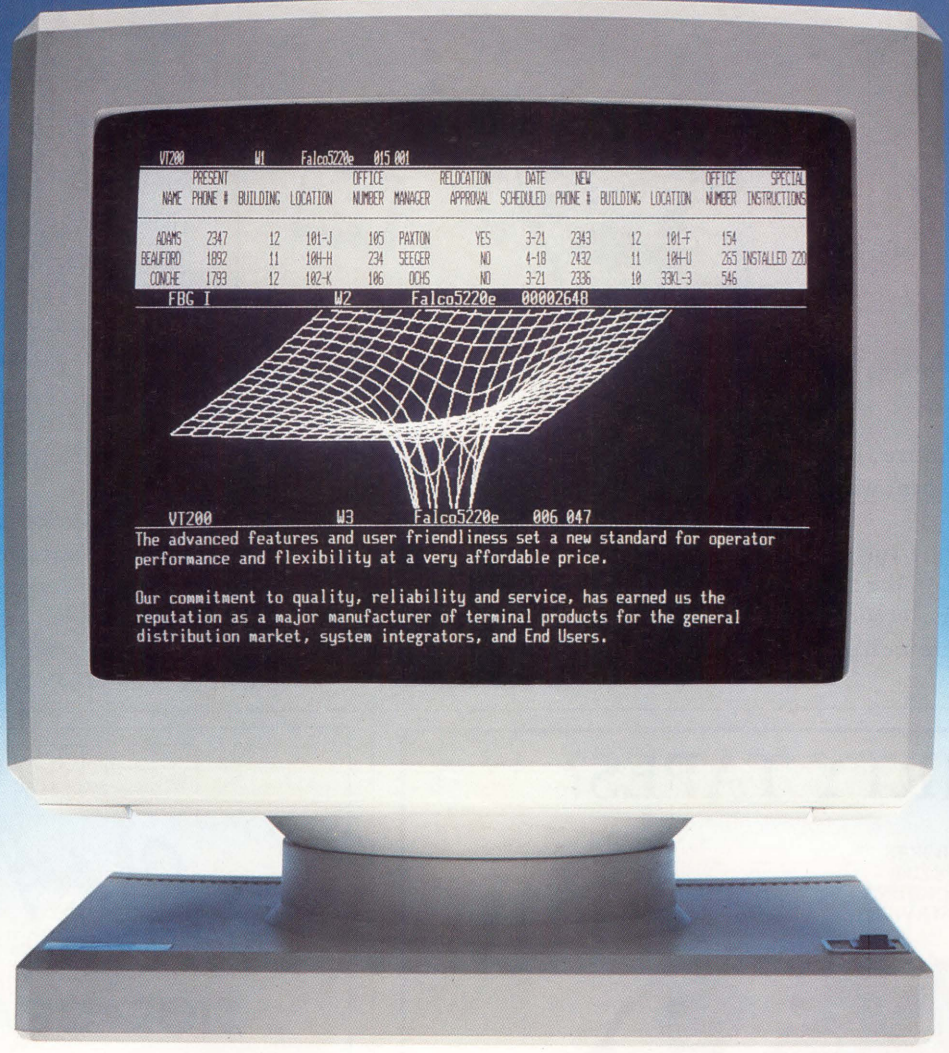

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article you choose will appear highlighted. From here, you have several options:

1. Press the Right arrow key, and the Text screen displays the article you've chosen at the first occurrence of the match. The matches are highlighted (see Figure 2).

2. Entering READ will take you to the beginning of that article. You then can browse through the article for the information you need.

3. You can use the FILTER command to narrow your search. Say, as in our example, that you searched for UNIX. The File screen displays the articles in which

To access the keyword search, log in to ARIS/BB . . .

UNIX appears. Now, type FILTER VMS. The File screen will display only the articles in which both UNIX and VMS appear.

Up and Down arrow keys allow you to move through the text line by line. Next Screen and Prev Screen move through the text accordingly.

Search Selections

From the Text screen, the Left arrow key returns you to the File screen for the list of articles. To search for a new word, press the Left arrow key again, then type CLEAR. Then key in the new word to

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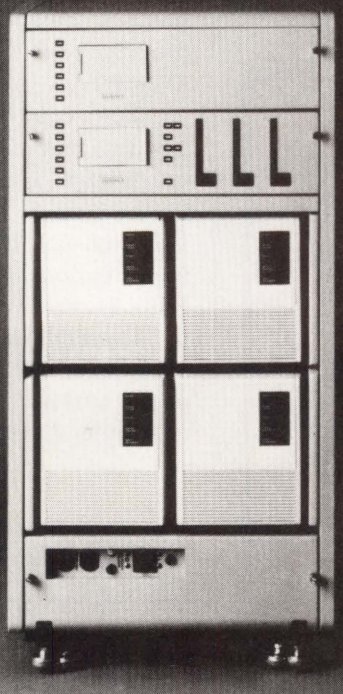

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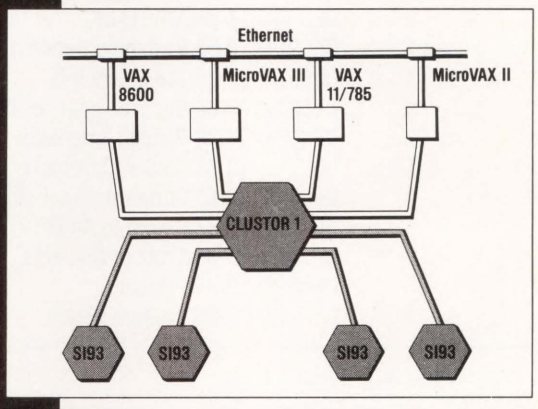

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be searched. If you don't CLEAR the first search, the results of the next search or any successive searches are combined. The File screen will list the combined total number of matches for the words searched.

In the Text screen, LOCATE lets you search for other words. For example, type LOCATE VMS. The text will scroll to the first occurrence of VMS. VMS will be located on your screen at the top line; however, it won't be highlighted.

The NEAR command is part of the search string. Type UNIX NEAR: VMS and the search will look for UNIX and VMS appearing within 10 words of each other, not counting noise words. Noise words are those not recognized in the search, such as *and, but, for, with.*

The text-retrieval system also supports wild-card searches. For example, program* will search for program, pro-

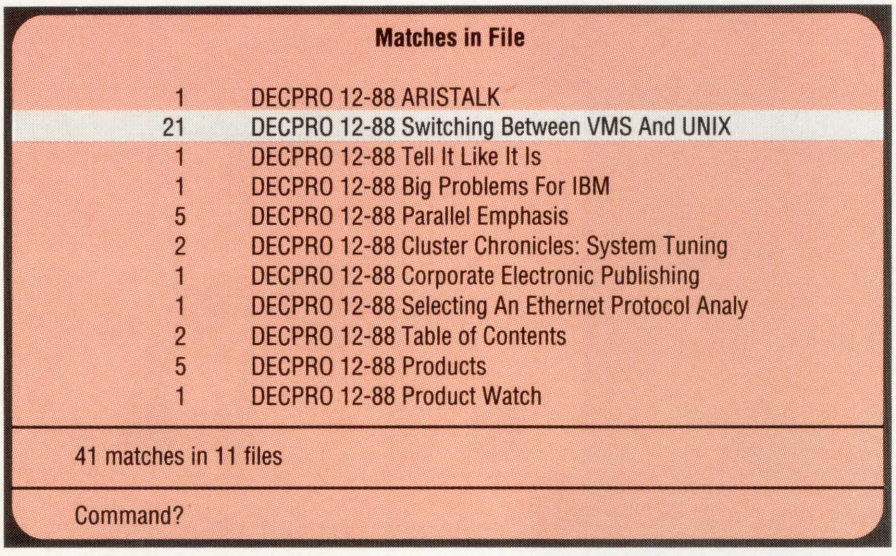

Figure 1: The File screen displays articles where the matches occur. Use the Right arrow key to go to the first occurrence of the match in the article you choose.

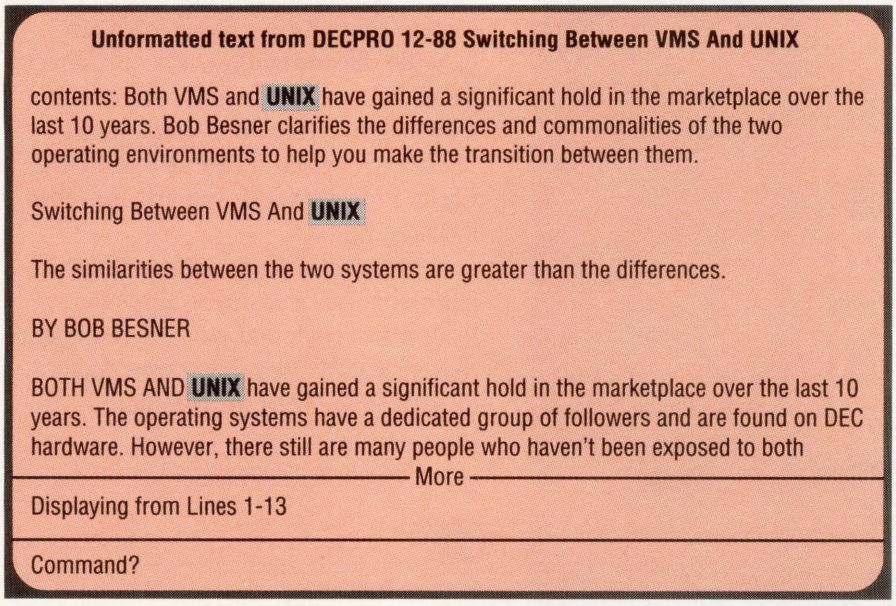

Figure 2: The Text screen displays the highlighted match. You can move through the text by line (Up and Down arrow keys) or by screen (Next Screen/Prev Screen).

> In the Text screen, LOCATE lets you search for other words.

grammable, programmed, programmer, programming, and so on. You can search for partial words by using at least two letters, for example, pr*.

Type HELP from any screen to access on-line help. This includes a list of commands and a chart of numeric keypad definitions. Press CRTL-Z to quit HELP.

Typing EXIT from any screen returns you to the ARIS/BB main menu.

Programs that appear in *DEC PROFESSIONAL* are available on-line. To access them, enter the download section of ARIS/BB and review the index of program names. When you find the program you want, download it using KERMIT.

For a copy of an article, including any diagrams, screens or programs, you can order the issue in which it appears, if that issue is available. Order back issues on-line by choosing the back issues option in ARIS/BB. Or contact Karol Hughes at (215) 542-7008.

Contact Anne Schrauger at (215) 542-7008 for more information on how to use ARIS/BB or the ARIS/BB on-line text-retrieval system. ■

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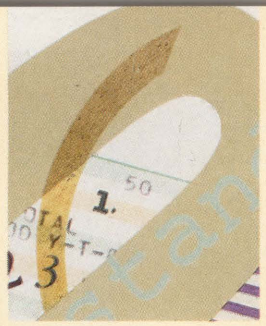


MEASUREMENT

WHERE HAS THE CPU GONE?

By Betty Steele Walker

Observing CPU Usage And Fluctuation.

How well-distributed are the workload and resource demands on your CPU? As a system manager, I'm constantly concerned with CPU use. But in an interactive environment, I found it difficult to measure CPU usage accurately.

I developed a DCL routine called CPU_USE.COM that allows me to observe the CPU usage and fluctuation over a 24-hour period (see Figure 1). It pulls information from a monitor collection file and produces a histogram, or plot, that breaks down the CPU activity into modes. An hour of information prints on each page. I submit the following MONITOR command to run on my batch queue for a 24-hour period:

```
MONITOR ALL_CLASSES/ALL/RECORD=MON_CPU.SMP/
  NODISPLAY/INTERVAL=60
```

This monitor session collects system information every 60 seconds. I collect all classes so I can refer to the collection file if I need more detail for a particular time period. The MON_CPU.SMP file consumes from 5,000 to 15,000 blocks of disk storage space, depending on your system activity. After the data has been collected, I submit CPU_USE.COM to batch:

```
SUBMIT/PARAM=MON_CPU.SMP CPU_USE
```

CPU_USE.DOC

This creates two new files: MODE_USE.SMP and CPU_USE.RPT. MODE_USE is a display file of the CPU states that's stripped from the MON_CPU file. It uses 4,000 to 5,000 blocks. From this MODE_USE file, the routine creates a 500-block CPU_USE.RPT report that shows how the workload is distributed on your CPU for the 24-hour period (see Figure 2, p. 157). CPU_USE.RPT reports interrupt stack (I), kernel (K), executive (E) and supervisor (S) modes on the left side of the print line. User (U) mode prints on the right side of the report. Idle time is represented by the blank spaces in the center. Another mode, PDP-11 compatibility, isn't printed on this report. The date and time of each one-minute interval prints on the far left side. The totals at the far right of each line are the summary percentages for the time spent in each mode for that interval.

What It Means

Let's look at what each mode represents and what the report can show you about your CPU activity. It's difficult to tell you what's excessive for your system in some of these areas. You can judge if an area is a problem by monitoring your system on a regular basis and then forming your own opinions on good or bad performance. If you decide that a certain time interval is producing poor results, compare it to a good time interval and see what differences are present in your CPU states.

Interrupt Stack — The interrupt stack represents CPU interrupts from peripheral devices. An excessive interrupt stack time, greater than 15 percent, could mean you have a buffered I/O bottleneck. Terminal and printer controllers, such as DZ11 ports and LP11 series printers, send character interrupts to the CPU. In a VAXcluster, remote service activity, such as locking, also registers here.

To check buffered I/O activity further, run the MONITOR PROCESSES/TOPBIO command against your MON_CPU.SMP file to see which processes generated the most buffered I/O during that time. If you have a VAXcluster, issue the MONITOR DLOCK and MONITOR SCS commands to observe the lock manager activity and internode traffic. You also might want to do a SHOW DEVICE/SERVED to see any MSCP activity.

Kernel — Kernel mode time greater than 25 percent could indicate excessive system activity and should be investigated further. High page fault rate or high inswap rate when running the MONITOR IO command could indicate a memory limitation. Local locking also can cause high kernel mode activity. The MONITOR LOCK/DLOCK command should show any problems in this area. File I/O and image activation also accumulate in kernel mode. MONITOR FCP and MONITOR IO can help isolate extensive file usage and direct I/O activity. A high demand zero fault rate during MONITOR PAGE indicates heavy image activation.

If you use DECnet, be sure to run MONITOR DECNET and observe any excessive packet rates occurring on your network. Defragmenting your disk can help alleviate high kernel mode. Efficient file handling and less image activation through careful application design also can help in this area.

Executive — Excessive or inefficient use of RMS will raise your executive mode activity. Any database product you have also will inflate your executive mode rate. Be sure your file I/O access, especially with indexed files, is designed properly for their use. RMS/ANALYZE can help you determine if bucket sizes, fill factor, data compression or other factors need to be revised.

Supervisor — DCL operations accumulate in supervisor mode. Extensive activity here could mean routines currently in DCL should be rewritten into more efficient program code.

User — Most of your user-written code executes in this area. If this is high, it would show that your CPU is being used efficiently for the workload being executed. If user mode remains high for extended periods, you might want to look at shifting some of the intensive workload to another time of day when the CPU is less busy.

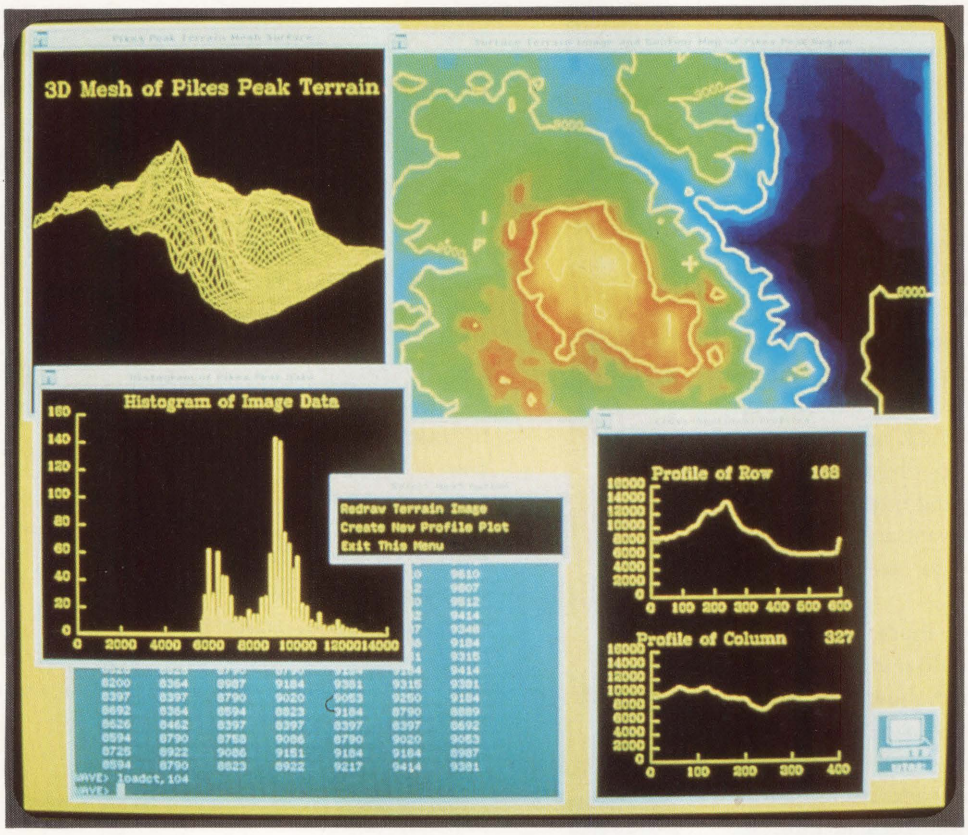
Idle — If your report shows high idle time, it could indicate that no CPU bottleneck exists and that your system can handle your workload easily. If your report shows extended periods of high idle time in one area and little or no idle time in others, try to shift your workload and balance the resource demand on your CPU. Also, other overburdened resources could be causing the CPU to be underused. Use the MONITOR STATES command to determine if some processes are being blocked from using the CPU. Poor response time while the CPU is idle could indicate that processes are awaiting I/O completions on slow peripheral devices.

Continued on page 157.

FIGURE 1.

```
$! CPU_USE.COM
$! MONITOR REPORTING FROM MON_CPU.SMP DATA COLLECTED
$! MODE
$MONITOR MODE/DISPLAY=MODE_USE.SMP/INPUT='P1
$SET NOVERIFY
$ NUM = 0
$ TOTAL = 0
$ OTIME = 99
$ OPEN/READ INPUTF MODE_USE.SMP
$ OPEN/WRITE REPORT CPU_USE.RPT
$ PRT_FILE[0,132] := ""
$ FF := <FF>
$ GOTO MODE_LOOP
$HEADING:
$ WRITE REPORT FF
$ PRT_FILE[50,60] := "SYSTEM MODES"
$ WRITE REPORT PRT_FILE
$ WRITE REPORT ""
$ PRT_FILE[0,132] := ""
$ PRT_FILE[1,4] := "DATE"
$ PRT_FILE[9,4] := "TIME"
$ PRT_FILE[40,60] := "--- M --- O --- D --- E --- S---"
$ PRT_FILE[115,17] := "I  K  E  S  U  I"
$ WRITE REPORT PRT_FILE
$ PRT_FILE[0,132] := ""
$ GOTO NEWTIM
.
.
.
```

Precision Visuals Inc.'s PV-WAVE Is A Software System For Data Acquisition And Visualization.



New WAVE

Turning large data sets into useful graphic images is a daily necessity for many engineers, scientists and analysts. A large number of scientific and research applications require considerable programming effort — time that these individuals could spend doing more important things.

The Workstation Analysis and Visualization Environment (PV-WAVE), from Precision Visuals Inc. of Boulder, Colorado, is a data analysis and visualization system designed to relieve the complex task of boiling down large amounts of data into meaningful forms.

PV-WAVE is a set of language statements and procedures that can be used interactively or combined into programs. It can accept data sets of any size and format and translate the data into charts, contour maps, plots and images. PV-WAVE is robust enough to develop large applications that include windowing, traditional graphics and animation. Much of the complex programming, however, is done for you. PV-WAVE pro-

DAVID B. MILLER

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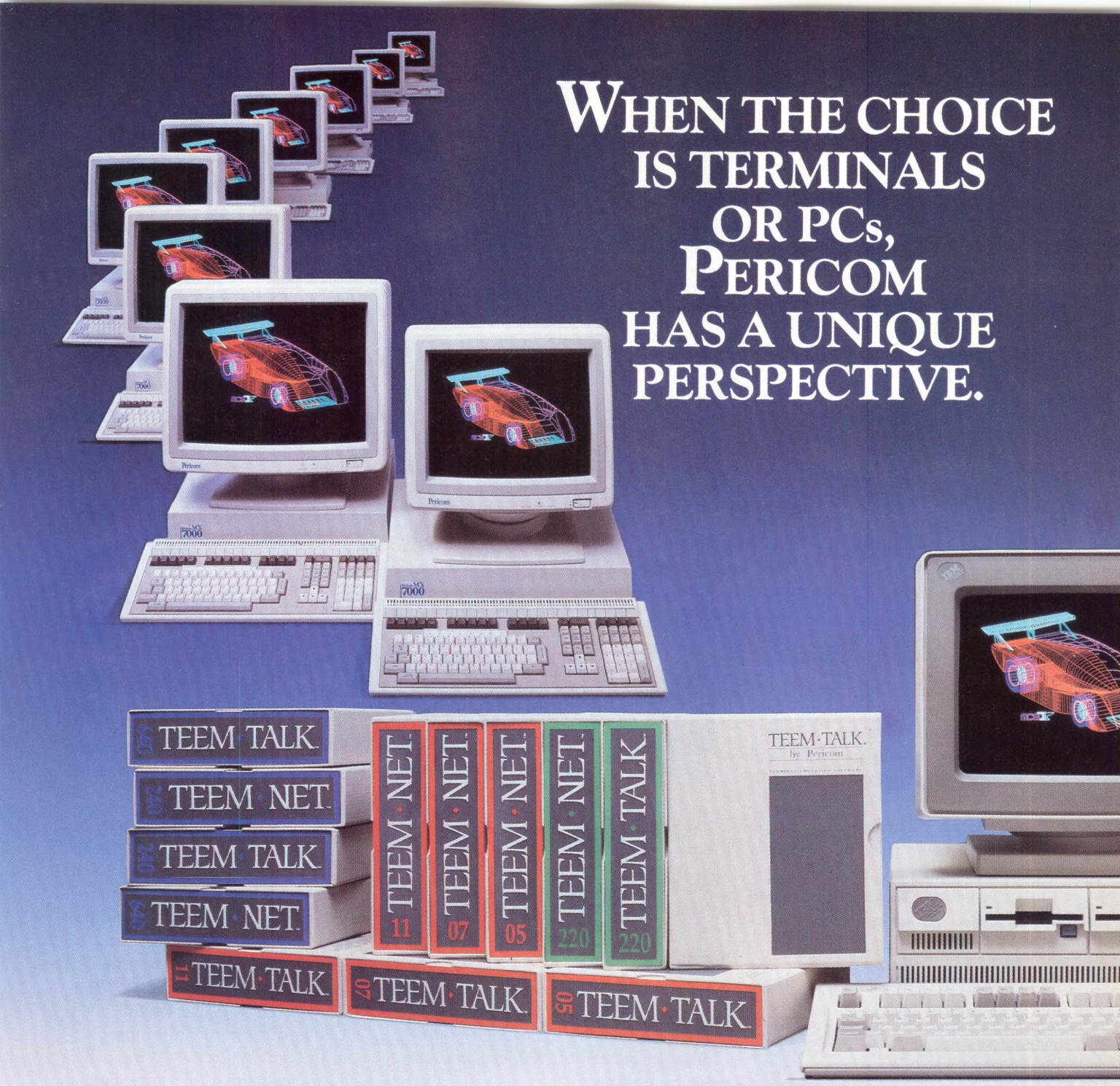

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cedures and statements can accomplish what you want to do without requiring you to write the procedure.

We looked at PV-WAVE version 1.1 running on our VAXstation 2000. PV-WAVE also can be used with a VT-240, VT-340, Tektronix or compatible terminal connected to a VAX.

Riding The WAVE

A command procedure WVINSTALL.COM must be copied to your disk and executed. WVINSTALL.COM copies the remaining PV-WAVE files to your disk, then asks you some questions about your hardcopy and graphics devices on your system. Permanent installations require a software key to allow access to PV-WAVE. A set of tests is included to enable you to review the installation before allowing PV-WAVE's general use.

After you know the language, you can execute PV-WAVE statements interactively from the command line. You also can group statements into command files and procedures to run as a program. I'll discuss typical analysis tasks and show the appropriate PV-WAVE statements.

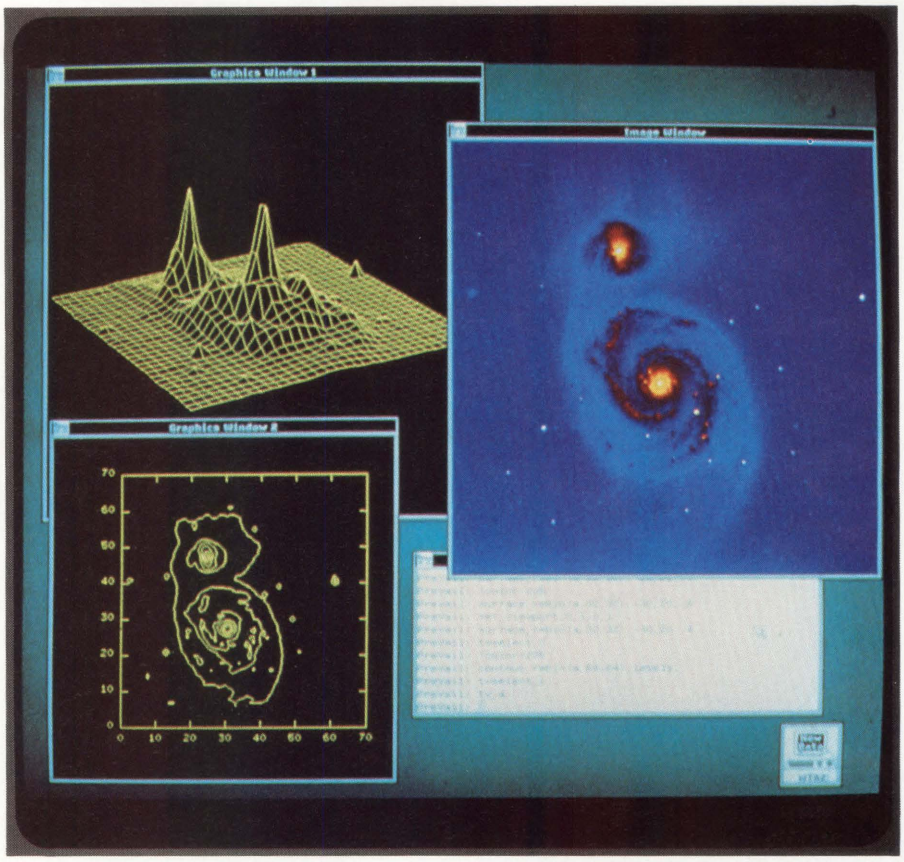
Getting data into the system can be the most difficult task. PV-WAVE can accept data written in any format supported by VMS. Sequential, Relative and Indexed files are supported. For example, the PV-WAVE sequence:

```
A = FLTARR(10,500)
OPENR, 1, 'WAVE$DIR:SAMPLE.DAT'
READF, 1, A
CLOSE, 1
```

will cause PV-WAVE to read a formatted data file consisting of 10 columns and 500 rows of floating-point numbers into the array A. Statements exist to open files for writing or updating, to read data from the keyboard and to read and write unformatted FORTRAN data.

Built-In Functions

One handy function is ASSOC. It associates an array structure with the contents of a file. For example, given the file INPUT.DAT, containing records that



This example displays the PV-Wave command window at the bottom right of the screen.

are 30 x 40 floating-point arrays, the statements:

```
OPENR, 1, 'INPUT.DAT'
SAMPLE = ASSOC(1, FLTARR(30, 40))
A = SAMPLE(4)
PLOT, SAMPLE(0)
```

will do the following:

1. Open INPUT.DAT for reading.
2. Associate a 30 x 40 floating-point array structure variable, SAMPLE, with the file on unit one.
3. Assign the data contained in the fifth record of INPUT.DAT to the variable A. A is also a 30 x 40 floating-point array.
4. Generate a scatter plot of the data contained in the first record of INPUT.DAT.

You can write data to files using the ASSOC function as easily as you can read it. For example, the statement:

```
SAMPLE(5) = Q
```

writes the contents of the array Q into the sixth record of INPUT.DAT.

Although you need to know the format of the data being read into the program, PV-WAVE's statements make it easy to tailor your application to the data you have. This is helpful if data existed before PV-WAVE arrived at your site. You needn't follow any special PV-WAVE formats to make your data useful.

After data is read into your application, you can employ PV-WAVE's analysis and data reduction procedures. For example, the statement:

```
TRANSPOSE(A)
```

transposes the array you input in the above PV-WAVE sequence. Other array-manipulation routines include HISTOGRAM(A), which returns a longword vector of the density function of the array A, and MEDIAN(A, width), which returns the median of each element of the array A within the 1- or 2-D neighborhood of the element as

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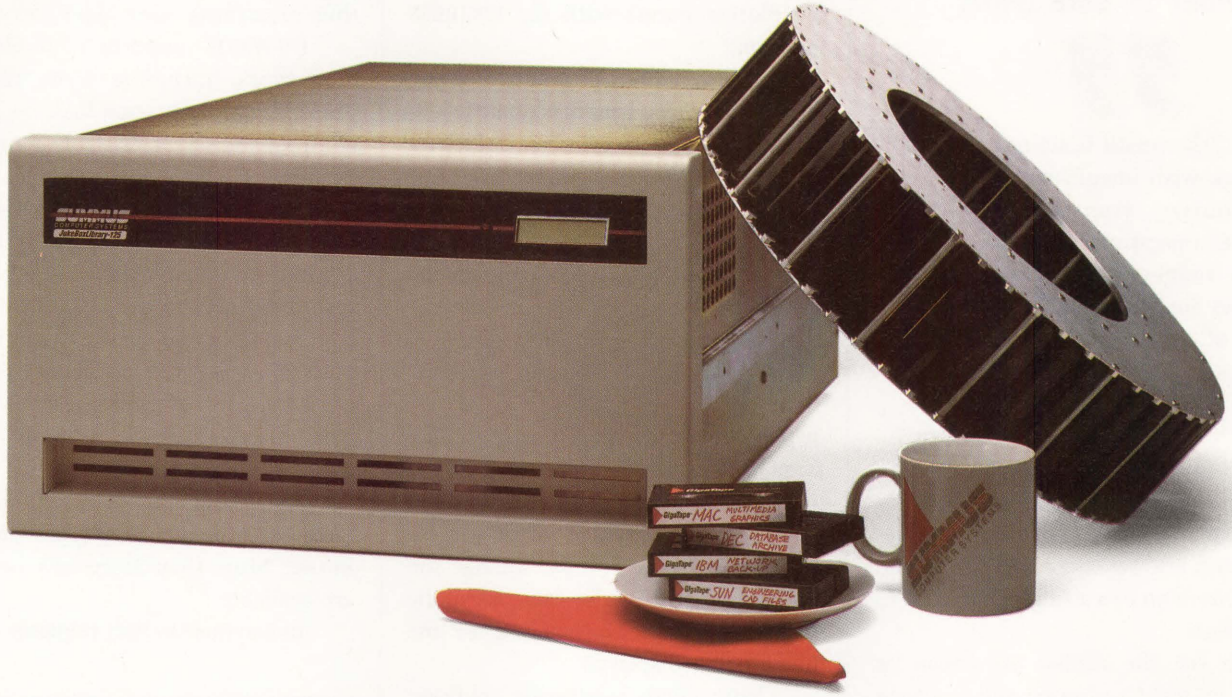

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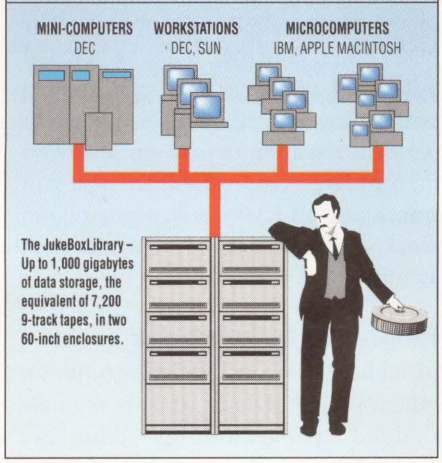

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specified by the width value.

The list of mathematical functions includes all the Transcendentals (SIN, COS, and so on), as well as the gamma, Bessel and exponential integral functions. Other math functions allow you to work with imaginary numbers and do Fourier Transformations and Boolean operations.

> ***PV-WAVE supports a number of data types . . .***

A number of string processing routines are available. For example, the result of:

```
STRMID('PV-WAVE IS POWERFUL',4,3)
```

is 'AVE' (position indexes start at zero). Other string functions allow EBCDIC-to-ASCII and ASCII-to-EBCDIC conversion, strip leading or trailing blanks, and the conversion of a string's characters to uppercase.

To see the results on screen or paper, PV-WAVE's plotting and graphing functions can be used. See Figure 1 for a sample of PV-WAVE's capabilities. Using the array A, the statement:

```
CONTOUR, A
```

will draw a contour plot of the 2-D array A. Parameters can be sent to the CONTOUR routine to specify contour levels, a maximum data value to consider from the array, and the increment between levels.

The SURFACE procedure draws the surface of a 2-D array with hidden lines removed. You can specify the surface's aspect ratio and whether or not a skirt is drawn around the image.

General routines, such as PLOT, draw graphs of vectors. OPLOT plots vector data without erasing the image of a prior plot. Given a closed region, the POLYFILL routine fills the enclosed region with lines that you can angle and draw as you like.

You can alter the appearance of a plot to your preference. You can change linestyles and scatterplot symbols and adjust axes and tick marks. You also can generate multiple windows on a screen and scale coordinates so that the plot fits properly within a window. In addition, you can draw regression lines through the plotted points with the REGRESS function.

You can redirect output to files and devices. PV-WAVE supports QMS/Talaris and LN03+ laser printers, Hewlett-Packard HP-GL plotters and PostScript laser printers.

Image processing routines are also part of PV-WAVE. For example, the sequence:

```
TV, A
```

displays the image data contained in the array A. The lower left corner of the image is coordinate (0,0). Images are written to the screen from bottom to top, left to right. You can change the drawing order. You also can control the starting position and scaling of the image being displayed.

Other image processing routines, such as TVOUT and TVPLOT, allow you to write text and draw vectors on the image display. TVPOLY, similar to the POLYFILL routine, fills a closed polygonal region with a pattern you create. Routines also are provided to perform zooming operations, load and manipulate color tables, perform smoothing and edge enhancement and work with graphics input devices such as mice.

Programming Language

In addition to these built-in routines, other PV-WAVE statements make it a full-fledged programming language resembling BASIC or FORTRAN. These statements include IF...THEN...ELSE, CALL, CASE and the looping constructs FOR, WHILE and REPEAT...UNTIL.

Program files and procedures are written similar to other programming languages. PV-WAVE compiles the statements into executable code rather than interpreting them line by line. As with other programming languages, procedures can be called from other routines. You can place procedures peculiar to your site in a library to be included later with other programs. You can link external images written in other languages with PV-WAVE procedures, thus preserving your older software.

PV-WAVE supports a number of data types, including byte, floating point, double-precision floating point, complex and string. Variable names can be from one to 15 characters long. Variables used during a PV-WAVE session retain their value for the length of the session. They can be saved in a file and restored when needed.

A number of special system variables allow you to control the PV-WAVE environment. For example, !PSYM controls the symbols used to do plots. !LINETYPE controls plotted line styles — solid, dotted, dashed or combination. !TERM sets the type of graphics terminal in use. More than 35 system variables are available.

In response to user requests, Preci-

PV-WAVE Version 1.1

PLATFORMS: VAX/VMS systems with VT-240, VT-340, Tektronix and compatible terminals, as well as all DEC workstations

PRICE: From $3,350 for the VAXstation 2000 to $24,000 for the VAX 8830

PRECISION VISUALS INC.

HEADQUARTERS:
6260 Lookout Rd.
Boulder, CO 80301
(303) 530-9000

FOUNDED: 1980

PRODUCT LINE: Software engineering tools and services

OWNERSHIP: Private

BRANCHES: Two international

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sion Visuals has included numerous user-written routines in a User Library. Precision Visuals encourages PV-WAVE users to submit programs.

Documentation includes an *Overview* that takes you through PV-WAVE's basics, a *User's Guide* that describes PV-WAVE's routines, statements and syntax in detail, and a desktop reference with chapters devoted to such topics as image processing, file I/O and PostScript graphics.

PV-WAVE provides a robust interactive/programming language for data analysis and visualization. The large number of built-in graphics, analysis and imaging routines removes much of the programming burden from the user. Programming most often is required to get your data into PV-WAVE, but after that, PV-WAVE routines can be called to grind, chop, slice and dice your data and display the results quickly and easily.

Anyone needing a powerful yet easy-to-use system for analyzing and visualizing large data sets should take a look at PV-WAVE. ■

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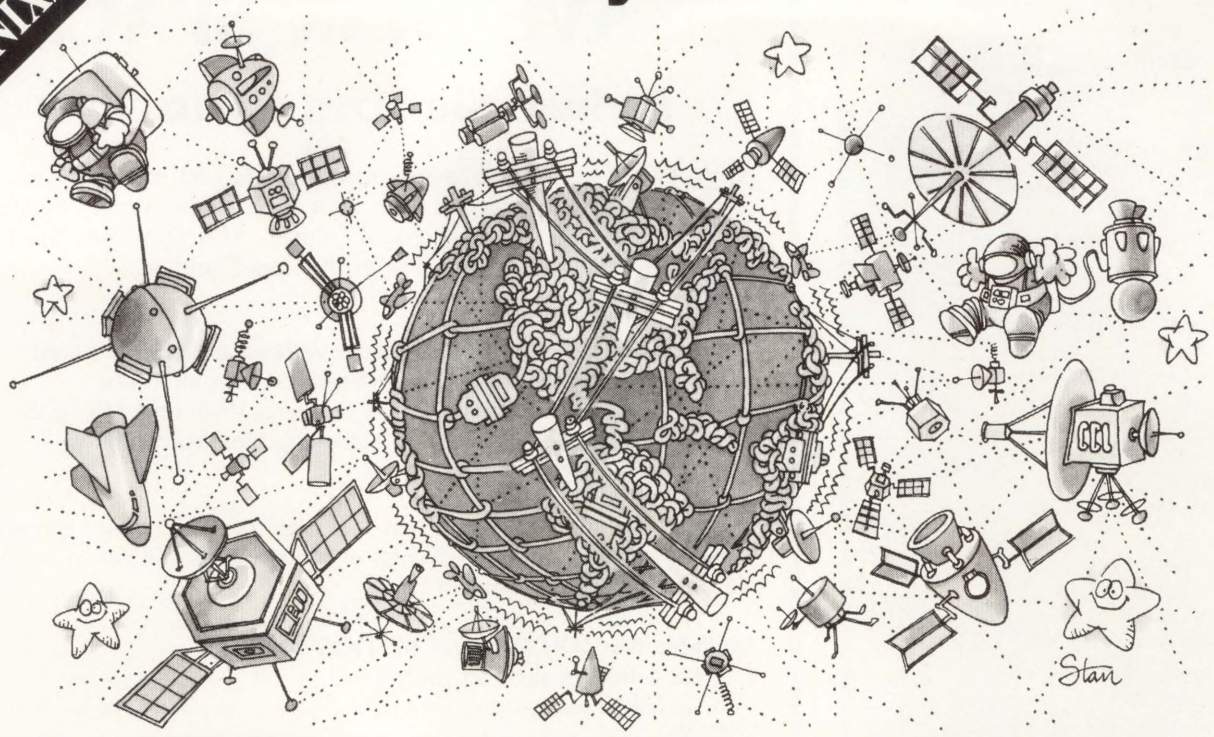

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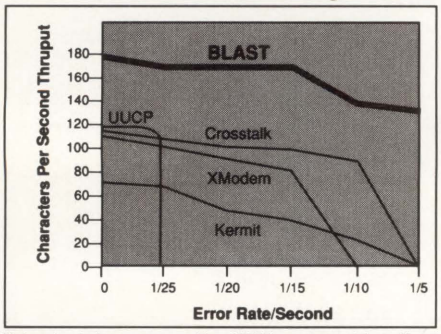

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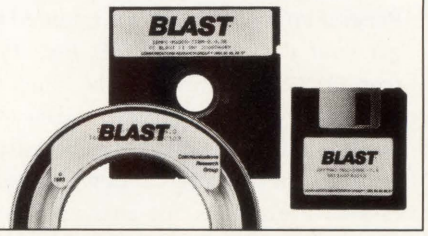

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CIS Graphics Inc.'s Dimension 6 Graphics Ball Uses Infrared Optical Sensors.

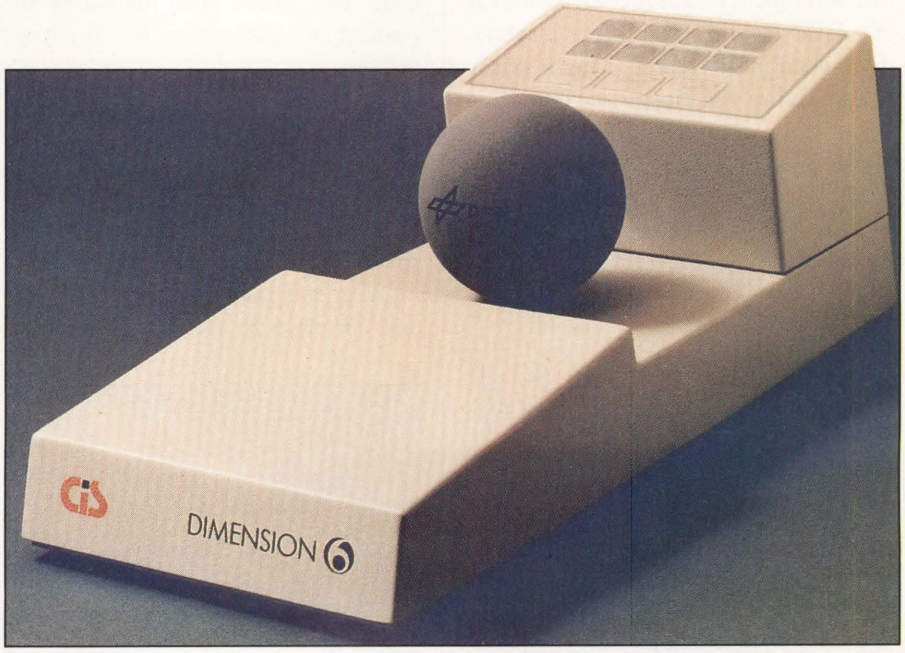
A NEW DIMENSION

EVAN BIRKHEAD

The number of potential markets for a peripheral input device as versatile as CIS Graphics Inc.'s Dimension 6 force/torque graphics ball is staggering. Using highly sophisticated customized software, it's applicable for screen object manipulation in such areas as engineering design, molecular modeling, stress analysis, architecture, robotics, animation and simulation.

The West Germany-based company entered the U.S. market a year ago and already has established several patents that cover a variety of designs in the device. The most intriguing is its use of infrared optics, which converts light-intensity alterations into digital measurements for forces and torques. This increases the ball's response sensitivity over older methods, such as Strain Gauge technology, which consists of a mechanical response to pressure exerted on the device.

I tested the Dimension 6 on a Silicon Graphics Iris 4D/120 GTX, its entry-level UNIX workstation that features two 16-MHz processors and the capability of sustaining 20 mips of scalar performance. It sports two 380-MB



The torqueball replaces the mouse for 3-D screen object manipulation.

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DP LABS
TESTING CENTER

drives and a floating-point rate of 2 Mflops. For 3-D workstations, the interface is no different: Dimension 6 plugs into the mouse port. It will run identically on a VAXstation 8000, a high-end VAXstation 3xxx and a Sun or HP workstation.

Easy As X-Y-Z

The name Dimension 6 comes from the six directions of movement the device supports. For each of the three axes (X, Y and Z), it provides one translational movement (along the axis) and one rotational movement (around the axis). The workstation immediately reads and displays packets sent from the Dimension 6 whenever you move it.

There are three basic components to the device: the control ball, function keys and platform. The function keys include eight user-programmable buttons for commonly performed operations and three master switches that set the software for translational or rotational displays or for dominant displays. Dominant means that whichever axis is being pushed the most is the one that's displayed. Combinations of these buttons can set your system to any of six possible operating modes.

The board set is located in the base. Inside the ball are six position-sensitive LEDs that measure light intensity and, using a software matrix, calculate the change in force and torque that corresponds to the change in light. Three measure horizontal movements, and three measure vertical movements. The light passes through a ring in the ball socket that spins with hand movements, allowing the light to shine through thin slits. The board then measures the positive or negative force by the change in light.

My initial tendency was to rotate the ball rather than apply pressure to it. It also took a while to realize that the 3-D axes I perceived on the screen correlated precisely to the axes on the sphere in my hand. The most confusing aspect is that the up and down Y axis correlates to the north-south axis on the ball. You push down to move down the screen, but my inclination was to pull toward myself.

Moving the ball toward and away from you affects the screen's Z axis. Pulling toward you enlarges images as they appear closer. Pushing away makes them smaller. You have to picture yourself above the workstation, rather than looking into it, or picture the ball as sitting inside your monitor.

> ***"The name Dimension 6 comes from the six directions of movement the device supports."***

Software Protocols

There are four software protocols selectable by dip switches located beneath the base. These include:

1. Standard ASCII (Voltage) protocol — This continuously sends ASCII data or voltages from the sensors within the ball.
2. Standard ASCII protocol — This sends computed forces and torques in an ASCII string.
3. Standard binary protocol — This is where one 12-byte block of binary data is sent on request.
4. Knobbox (dialbox) emulation — This sends data only when the ball is outside a defined zero position.

First determine which protocol your host system uses, then set the dip switches to the desired setting. This is described in the 14-page *User's Manual*, which overviews baud settings and other installation procedures, patents and technical specs. It also provides maintenance and repair information.

THE TECHNOLOGY BEHIND this device is remarkable. If you're in an environment that requires the manipulation of sophisticated graphics objects, you'll appreciate the power of the Dimension 6 and have fun learning to use it. ■

Dimension 6

PLATFORMS: RS-232-based 3-D graphics workstations

PRICE: $3,300 for the device and cabling

CIS GRAPHICS INC.

HEADQUARTERS:
285 Littleton Rd., Ste. 3
Westford, MA 01886
(508) 692-9599

FOUNDED: 1974

PRODUCT LINE: Aerospace and engineering graphics products

OWNERSHIP: CIS Graphik, GmbH, Dusseldorf, West Germany

REVENUES: Approximately $20 million (1988)

BRANCHES: Four West German and one Swiss

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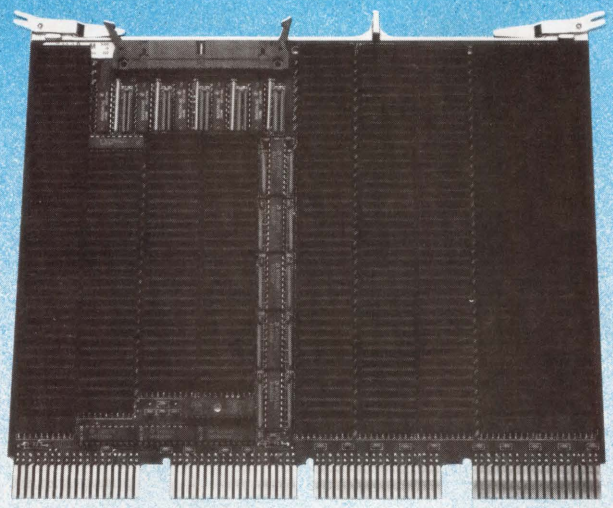

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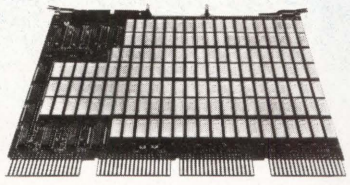

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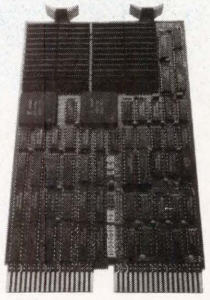

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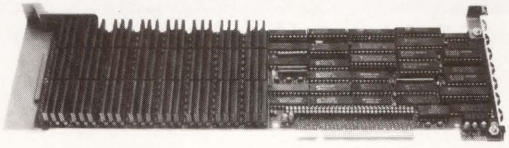

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CIRCLE 216 ON READER CARD

Digital Serves Up ScriptPrinter, A PostScript-Compatible LN03

Printing With PostScript

Digital's ScriptPrinter features software versatility.

Digital's ScriptPrinter, a PostScript-compatible laser printer, is a basic LN03R. As such, it's part of Digital's LN03 family, which has a deservedly excellent reputation.

The most interesting part of the ScriptPrinter is its translator. The desktop printer is designed primarily for PostScript text and bit-mapped graphics, but it also has a host-based systems package that translates SIXEL, ReGIS, ANSI or Tektronix 4010/4014 graphics-formatted files into PostScript files.

PostScript is a page-description language, now popular on Macs and IBM PCs, that tells the printer how images will appear on printed pages. With it, the ScriptPrinter can print digitized photographs, graphics and text on the same page and can perform such functions as sizing and rotating.

The PC-compatible printer accommodates 9,600 baud, operates at 8 ppm, has 2 MB of on-board memory and features a resolution of 300 x 300 dpi. Digital now is selling Adobe's Typifies

EVAN BIRKHEAD

DEC PROFESSIONAL DP LABS TESTING CENTER

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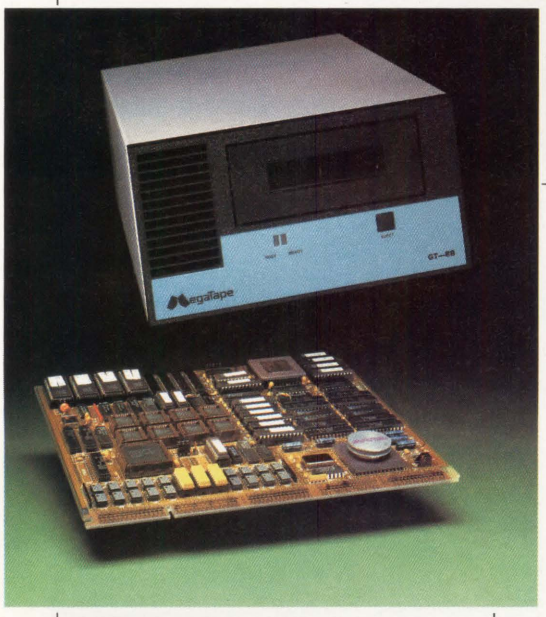

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CIRCLE 403 ON READER CARD

Pack 1 with this printer, which adds 14 VMS PostScript fonts to the 29 already supported.

The ScriptPrinter I tested ran Version 2 ScriptPrinter Software, which lets multiple VAXs share the printer via a DECserver port. This version also offers more support for its ANSI translator, particularly layup and setup/form qualifiers. Layup lets you shrink multiple copies onto a single page. Setup/form qualifiers lets you store page header or specify paper types in your print queues.

Running Translations

The ScriptPrinter was tested on SAURON::, a VAXstation 2000 node on our LAVc, but it just as easily could have been set up as an option on the printer list for the entire cluster.

From the $ prompt, a typical command to perform Tektronix translation looks like:

```
print/queue=script/param=
  (data_type=tek4014)
  tek_filename
```

From here, hit space, then the directory and PostScript filename:

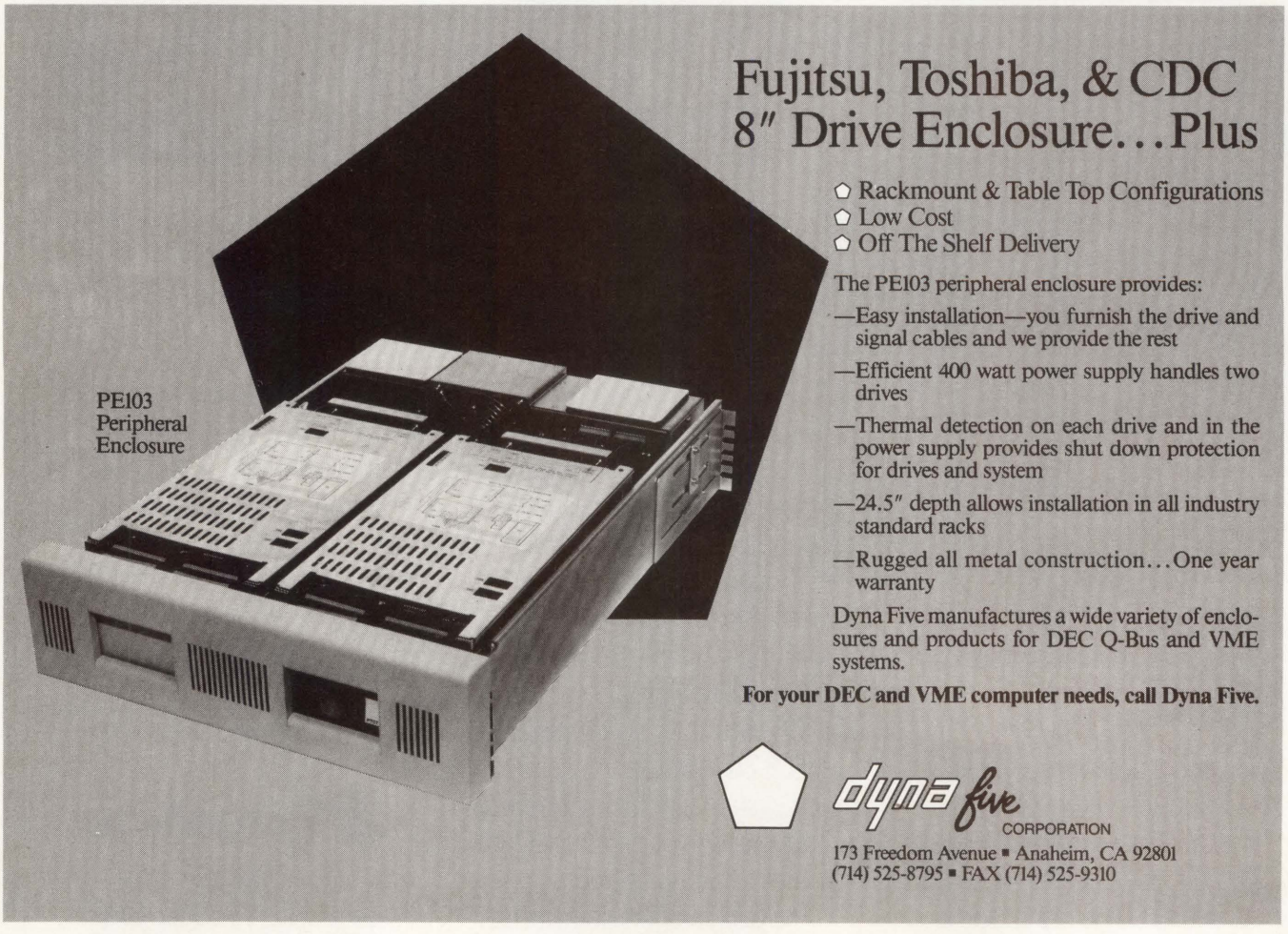
```
[directory]mass11_gp.ps
```

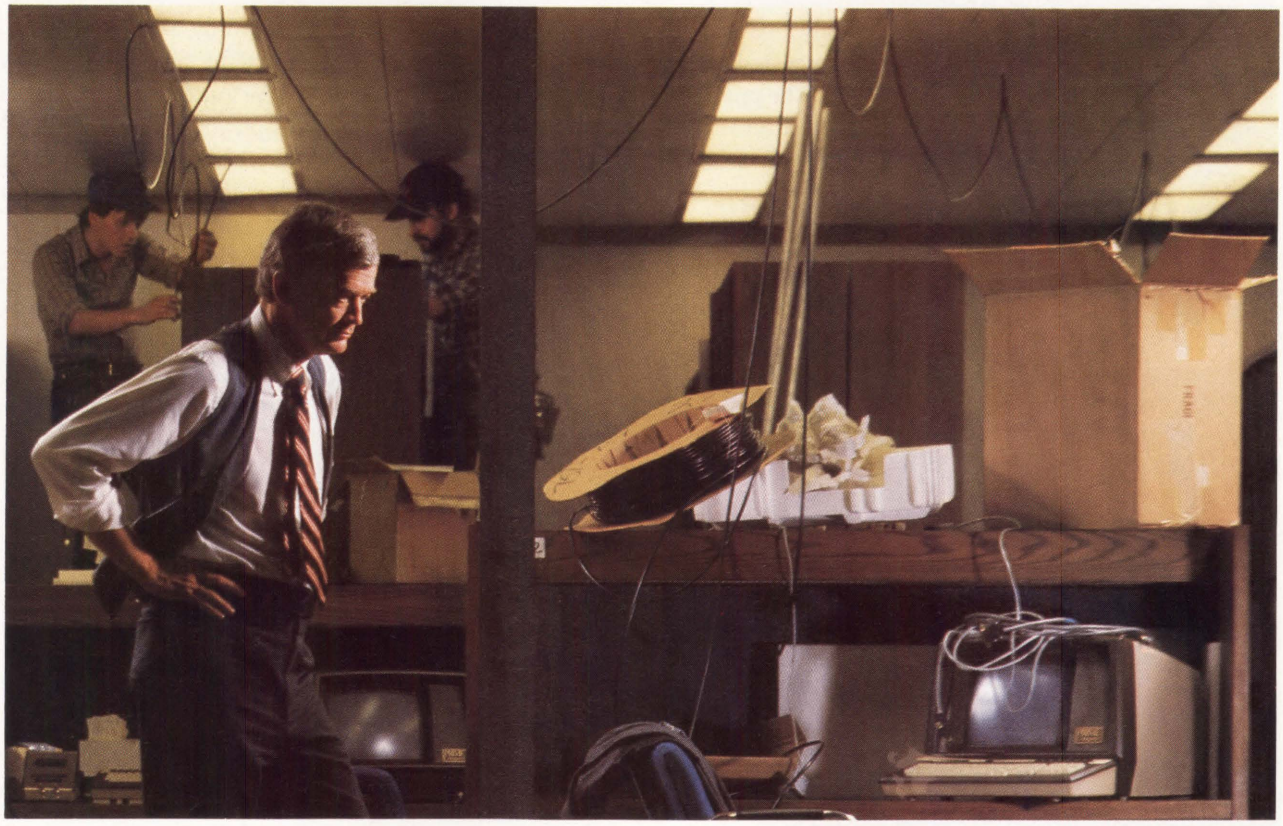
When I used this method, all documents and graphs, including Tektronix, ReGIS and ASCII files, printed perfectly. You don't have to concern yourself with file type.

Installation

The ScriptPrinter is about 15 inches high, 21 inches wide and 24 inches deep. It only processes 8½- x 11-inch paper or transparencies, but it can be set up for special labels. Relatively few buttons or connectors (just the plug and the RS-232 line jack) appear on the printer. It's designed to be operated and controlled from a terminal. LED indicators on the front panel provide a printer status report. They include symbols for such things as character display, paper jam, controller error, call field service, add paper, and replace toner cartridge and cleaning pad.

Toner is loaded through a door on the left side. The paper output mechanism is on top of the printer and





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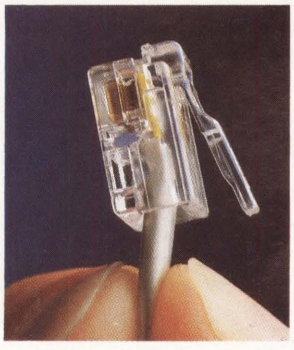

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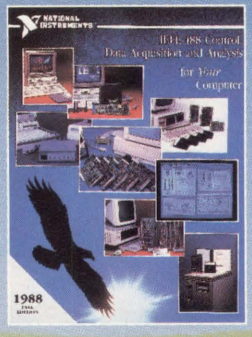

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easily lifts to clear paper jams and for general housekeeping.

The printer connects to the VAX via a serial cable. The software, which arrived on a 1,600-bpi TK50 streaming tape, is installed with a standard VMSINSTAL. It sets up the appropriate queue characteristics for you. You need only know the name you create for your print queue. The procedure takes care of everything else.

You can establish separate queues for each type of data the printer will receive. For example, you could set up a queue called SCRPST to handle PostScript data, another called SCRTEK to handle Tektronix 4014 data, and another called SCRASC to handle ASCII files. You'd then use the appropriate queue name whenever you sent one of these types of data to the printer.

As a system default, the printer sends lead and trail pages through the printer. A sample trailer follows:

```
END OF JOB
SAURON::USER
JOB 450
MASS11_GP
```

These also list statistics for priority, queue, device type, and time and date. You may feel that this wastes two sheets of paper, in which case you should set it for blank pages that can be reused.

Documentation

Six manuals come with the printer. Two are large loose-leaf binders: the *PostScript Translator's Reference Manual*, which you need only if you're on a network with a variety of complex graphics-generation sources; and the *Version 2 ScriptPrinter Software Installation Guide*, which I used only as a reference.

More useful for installation and startup are the four smaller booklets: the *LN03R ScriptPrinter Operator Guide*, which describes general maintenance procedures such as adding toner; the *LN03R ScriptPrinter Installation Guide*, which was invaluable during software setup; the *LN03R ScriptPrinter Programmer's Supplement*, which tells how to access and alter system parameters and printer software; and the handy *PostScript Quick Reference Guide*, which lists standard PostScript operators, LN03-specific PostScript operators and fonts.

> ***ScriptPrinter should prove a competitive product for Digital because it provides software versatility that's sorely needed in many VAX publishing shops.***

THE SCRIPTPRINTER SHOULD prove a competitive product for Digital because it provides software versatility that's sorely needed in many VAX publishing shops. With PostScript compatibility, the printer will run in multivendor environments, too. ■

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More speed.
For instance, the maximum data transfer rate on the C.Itoh Tigers is 38.4 kilobaud. On the DECs, it's only 19.2. Add the Ethernet option, not available on DEC's terminals, and your communication is at network speed of 10 MB/sec with LAT or TCP/IP protocols.

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The CIT344 gives you up to 16 colors for each window from a palette of 262,144—64 *times* as many as DEC. And it offers 16 foreground and 16 background color text attributes you won't find on the VT340.

And more.
Tigers can also run two sessions at once, and dynamically size and position the windows anywhere on the screen. They have pop-up menus for easy setup using keyboard or mouse.

Feature	CIT344	VT340	CIT334	VT330
Drawing Speed (Regis)	2x	1x	2x	1x
Pages of Memory	6	3	6	3
Dynamic Windows	Yes	No	Yes	No
Pop-Up Menus	Yes	No	Yes	No
Colors Per Session	16/262K	16/4K	—	—
Color Text Attributes	Yes	No	—	—
Screen Refresh Rate	70 Hz.	60 Hz.	70 Hz.	60 Hz.
Overscan/ Borderscan	Yes	No	Yes	No
Ethernet Interface	Option	No	Option	No
RGB Interface	Option	No	—	—

A standard Apple Desktop Bus lets you use any ADB device for terminal cursor control, so you can choose from a mouse, keyboard or tablet. The Tigers also have a faster refresh rate—70 Hz as opposed to 60—so they're flicker-free, making them easier on the eyes.

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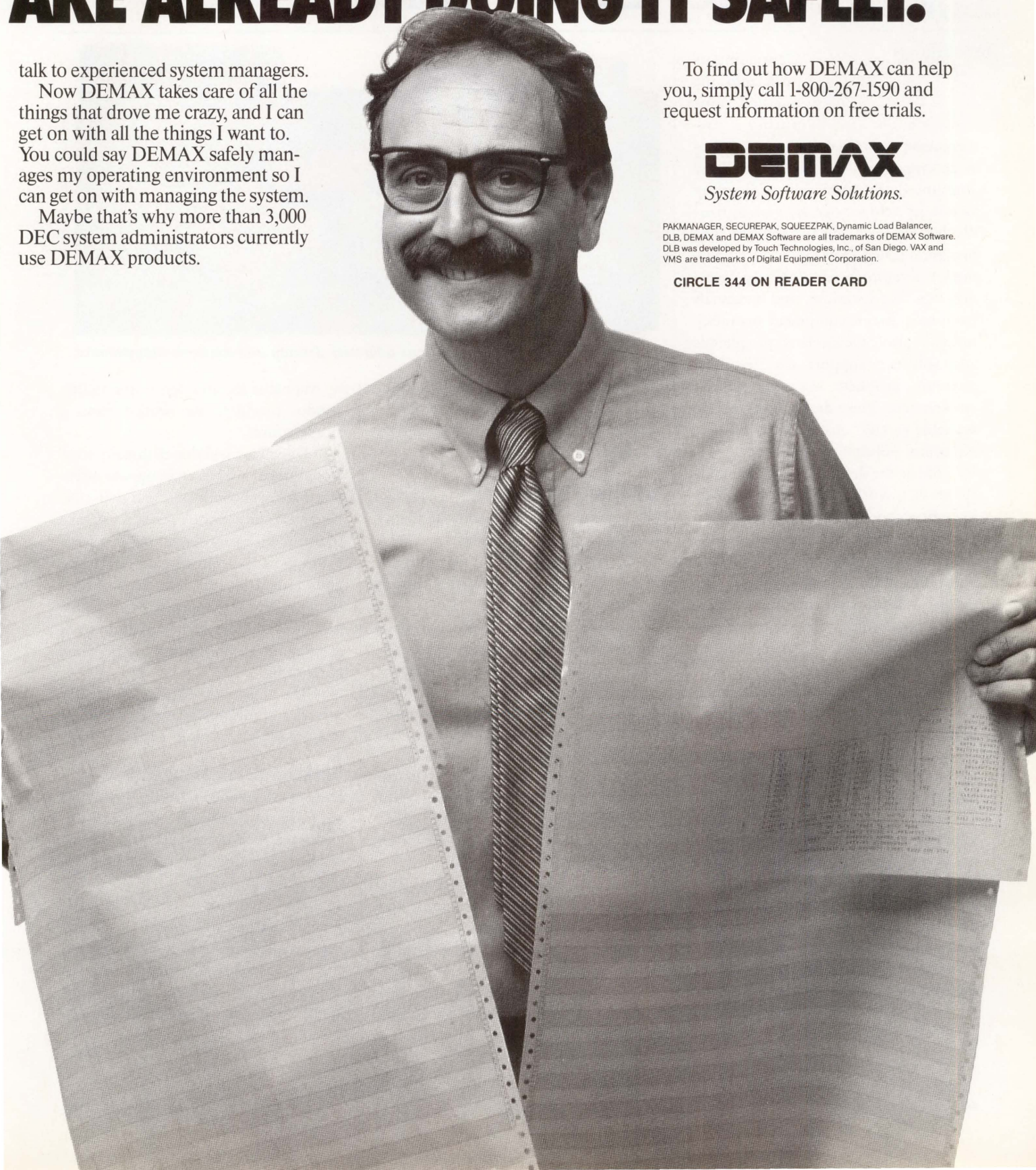

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CIRCLE 344 ON READER CARD

FIELD SERVICE

Ron Levine

DEC Targets The Low End

Continuing its push into the low-end computing environment and enhancing its enterprise-wide support philosophy, DEC recently announced the formation of a group within its field service division to handle desktop servicing and support. The program, called Desktop Service Solutions, is a comprehensive offering covering PCs, workstations and terminals from most major equipment manufacturers. It also covers related peripherals and software support for the most common products in a networking environment. These desktop services are available to DEC customers who meet minimum volume requirements.

Today, the desktop environment includes PCs, workstations and terminals in both standalone and network configurations. The 1989 installed base is estimated at 80 million units. It probably will reach more than 110 million units by 1992. It's estimated that about 17 percent of these units are now part of networks. That's expected to increase to more than 50 percent by 1992.

According to DEC's Leigh Webber, marketing manager, U.S. Field Service, Digital was aided by a number of focus groups in researching the desktop services arena before embarking on this endeavor. More than 200 DP managers were interviewed, and they gave their views on current desktop environment needs in the service/support area. Future plans regarding equipment purchases, connectivity and control of the complete desktop computing function within their companies also were depicted. Participants were asked what they saw as their biggest problems, what problems might arise and where they thought there was room for improvement in current service offerings from DEC and its competitors.

Courtesy Digital Equipment Corporation

Desktop Service Solutions addresses desktop and network maintenance.

What Digital Learned

Main points that came out of the 19 focus-group sessions were:

1. There's plenty of room for improvement in current service/support offerings.
2. More than 50,000 DEC accounts have multivendor desktop hardware and software products running on Digital systems.
3. Many others have desktop multivendor products running on non-DEC systems and as standalone units.
4. MIS now typically supports 100 to 150 users (up from a previous average of 16) without an increase in staff or funding. This growth is a result of the influx of desktop machines.
5. Because of the variety of equipment, help is needed in applications and operating system support.
6. Assistance is needed in networking design and support.
7. Training to support this new environment is a drain on many customers.
8. Maintenance and repair for multivendor products are needed from a single source.

Digital learned that customers want a comprehensive service/support offering that covers both DEC and non-DEC hardware and software products, is easy to use and is easily accessible. The service/support also must be cost-effective and modular in approach, i.e., customized per site requirements. Users also want full support as they migrate from standalone environments to network computing.

The Desktop Service Solutions service and support offering announced last month is a result of these findings.

Desktop Service/Support

DEC has developed a family of service/support options for the desktop customer. Its desktop service solutions can be segmented into four main offerings (see Figure):

1. Start-Up Service — Under this program, users have the option of obtaining installation support or a staging service. Installation support provides full system configuration and checkout at the customer's desk. It includes all

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CIRCLE 338 ON READER CARD

FIGURE.

Item	When Available In U.S.
Start-Up Service	Now
Direct Access Advisory Service	Early Fall
Maintenance Service	Now
Desktop Integration Services	Early Fall
Service offerings will be phased in internationally during the next year.	

Desktop Service Solutions availability schedule.

hardware and operating system (OS) components connected and tested as a total functioning system. Training and system orientation are included.

The staging service option offers basically the same service/support as above, except that the system is preassembled at a staging area. Then, after configuration and checkout, it is disassembled and reinstalled at the customer's desk as a fully tested system.

Both service options are available during normal business hours with a maximum two-day response time to customers who have a desktop maintenance agreement with Digital. Both are charged on a fixed-fee basis. The staging service costs a little more than the installation service option.

2. Direct Access Advisory Service — This is basically a telephone support service covering the customer's entire desktop environment. With one toll-free telephone call, the customer receives complete single-user or networked desktop support. Remote access capability for both also are provided. The desktop services support group at DEC's Atlanta Customer Service Center (CSC) handles hardware, OS and networked applications support on DEC and non-DEC products.

Experts and specialists in the desktop computing environment are available five days per week between 8:00 a.m. and 8:00 p.m. (EST). The service can be customized to allow MIS, users or both to place calls to the CSC. This service is available on a fixed-fee basis to users with a minimum of 500 desktop units.

3. Maintenance Service — This is the basic fix-it field service offering. DEC offers two levels of repair services: on-site and service-center repair. Both DEC and non-DEC products are serviced. Coverage is available between 9:00 a.m. and 5:00 p.m. five days per week on a next-day-response basis. Pricing is fixed-fee and includes parts and labor. Customers must meet a 500-unit threshold requirement either on-site or in a campus-type environment.

With the on-site option, Digital services the unit at the customer's desk or office. Under the service-center option, Digital uses a central depot concept. The customer must bring the unit to a designated location for repairs. The depot is set up on the customer's premises.

Pricing for this basic maintenance service is extremely competitive. DEC has established families of product types with associated fixed monthly charges. For example, a 286-based unit has one fixed service price without regard to vendor or manufacturer. Quantity discounts and discounts for maintenance-sharing tasks are available.

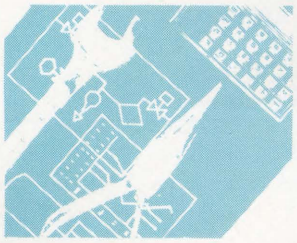
4. Desktop Integration Services — This support package is designed to aid the

Parse Announces DEC Diagnostics Rentals

Parse Inc. announced a quarterly diagnostics rental plan for Digital Equipment Corporation and Data General computer systems to aid both the self-maintainer and the independent-maintenance industry. DEC diagnostic packages for the MicroVAX II, VAXstation 3000 series, all VAX 11/700 machines and the VAX 8600 line, as well as all of the Data General MV series, are available as of July 2. DEC 8000 and 6000 BI-bus series diagnostics will be available in the fall.

Diagnostics can be rented from Parse on a non-restrictive basis. Parse's President Ray Ball says the Parse license agreement allows for multiple-site use of the diagnostics and sets no limits on the number of CPUs on which they may be run. "Programs like this take the risk out of going after new lines for the TPM. No large up-front money is required; therefore, cash flow is protected. TPMs can just rent while they test a market," states Ball.

The program requires an initial six-month rental commitment and a security deposit equal to three months' rent. The customer can cancel at any time after the initial period and use the security deposit to pay for the last quarter. The customer can convert from rental to purchase at any time by paying the listed price (rental payments don't accrue toward purchase as in a lease agreement). Quantity discounts are available, and combined rentals and purchases count toward these discounts. Rental prices range from $144 per quarter for the Parse 3000 (VAXstation) to $1,296 per quarter for a Parse 8600 package (VAX 86xx series). A combined Micro Kit, including VAXstation 3000 and MicroVAX II diagnostics, is available for $252 a quarter. UNIBUS Kits (for VAX 11/700 and 8600 series machines) are available for $1,728 a quarter.



SERVICE PROFILE: KCS COMPUTER SERVICES INC.

Editor's note: Service Profiles supply specific information about the activities of a particular field-service company.

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PARTS INVENTORY: More than $1 million (average)

TECHNICIAN TRAINING: OEM and in-house

KCS Computer Services Inc. provides depot repair, media maintenance, remote troubleshooting/diagnostics assistance and complete reconditioning services for most major brands of tape and hard-disk drives. Services are on either a contract or per-job basis. Units may be carried or mailed in. A pickup and delivery program is available in some instances.

KCS has 50 employees, of which 25 are technicians. The company claims to repair up to 1,200 tape drives and 600 disk drives per month. KCS says it would like to align itself with a number of manufacturers to provide product end-of-life (EOL) repair in addition to the services it now provides to OEMs, VARs, TPMs, dealers and users.

The company maintains a parts inventory for the products it services. Replacement may be by new or used parts or on an exchange basis. Average turnaround time for repairs is 10 days. Purchased and in-house written diagnostics are used by technicians who are OEM and in-house trained.

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customer in transforming standalone systems into a networking environment. It's available for Digital and selected non-Digital platforms. With this support agreement in place, DEC assumes responsibility for the total operational network environment. After a customer decides on the equipment and software to be used in his network, DEC will help set up the network and get it working. This includes the installation and configuration of the network OS and network application programs and familiarizing the user with the applications.

Desktop Service Solutions has been set up as a dedicated service and sales group within DEC's field service division. A specialized unit in the Atlanta CSC is the hub of desktop service support. All advisory support operates through the Atlanta center, but local maintenance service and support is provided by dedicated desktop services groups in each of Digital's nine U.S. geographical service areas.

Logical Extension

Manufacturers, retailers and independent maintenance providers offer many of the same desktop services available from Digital's programs. But, according to customers of these services, there's room for improvement. Desktop hardware, software and networks are integrated entities. When problems arise, it isn't easy to isolate them as hardware-, software- or network-driven.

DEC customers say that despite the many service providers that have entered the desktop services field, it's still hard to find one-stop, comprehensive support for system problems. A service vendor capable of providing total system support will find a waiting market with tremendous growth potential. DEC may be uniquely qualified to enter and dominate that market segment.

Digital, with its large array of products, expertise in working with mixed-vendor equipment and vast experience in the networking business, can claim that providing network services at the desktop level is a logical exten-

sion of its service business. DEC has been providing multivendor servicing since 1983 and today supports more than 1,000 non-DEC products from more than 200 vendors. For more than 15 years, it has been installing, designing and supporting networks of all types — more than 4,000 LANs to date.

DEC owns and supports the largest non-defense network in the world. Its internal network consists of more than 35,000 nodes worldwide. Digital's experience, expertise and service technology may be what MIS and users have been looking for in their search for comprehensive service/support and assistance in the migration of the desktop from a standalone to a networking environment.

With the addition of DEC's service offering, a customer can get "desktop to data center" service and support for the full system — hardware, software and network.

Will O'Brien, DEC's corporate strategic marketing manager for field service, points out that three years ago it looked like niche market service environments would be the wave of the future. Now, that philosophy has been replaced with one of across-the-board computing. There is a belief that support requirements will be similar across all industries. For example, data communications or transaction processing environments need the same type of service/support, irrespective of the industry using that DP environment. "We've committed to this new philosophy and are going full-tilt in that direction," states O'Brien.

Parsing Group Votes To Join NCSN

The Parsing Group, a coalition of independent computer maintenance vendors, ended its latest session in Avila Beach, California, in May, with a vote to seek membership in the National Computer Service Network (NCSN) as a group member within that organization. The new entity is to be called the Independent Maintenance Suppliers (IMS).

The NCSN's overture to the Parsing Group to join with it in a united front met with the unanimous support of those attending the meeting. This was the third gathering of the group over the past year. Members include national and international third-party maintenance vendors such as Control Data Engineering Services, General Electric Computer Service and Granada Computer Services, as well as small regional service vendors such as SMS Computer Inc.

Representatives of service firms from as far away as New Zealand and The Netherlands, as well as Europe, Canada and the United States, formed the Parsing Group more than a year ago in order to discuss such common problems as dealing with computer manufacturers, obtaining parts, documentation, training and to enhance the image of the independent maintenance industry. The group is proposing to the NCSN that two board of director positions be opened to the new IMS membership and that the NCSN consider identifying itself as a truly international organization. They're also requesting that the NCSN assign action committees to promote special areas of interest to the independent maintenance industry. The NCSN now consists of about 300 members of mostly small independent maintenance companies. The Parsing Group has about 35 members.

Parse Inc. created the group as a means of communicating with its customer base. Parse manufactures and sells DEC and Data General diagnostic packages to independent maintenance vendors.

In the past, we've seen Digital endeavor into the desktop marketplace, only to eventually pull out. DEC has been unable to match its successes in midrange computing with comparable successes in the high-growth area of low-end computing. Its too early to speculate whether this latest service/support venture will survive.

If DEC's entry into the desktop services arena is serious, DEC may have its first major success in the low-end market. Digital's corporate support philosophy of being the service provider across the customer's entire enterprise, combined with its background in networking and connectivity, multivendor system experience and technical service know-how, could enable DEC to be the dominating vendor in the desktop networking services industry. ■

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National Computer Service Network (NCSN)
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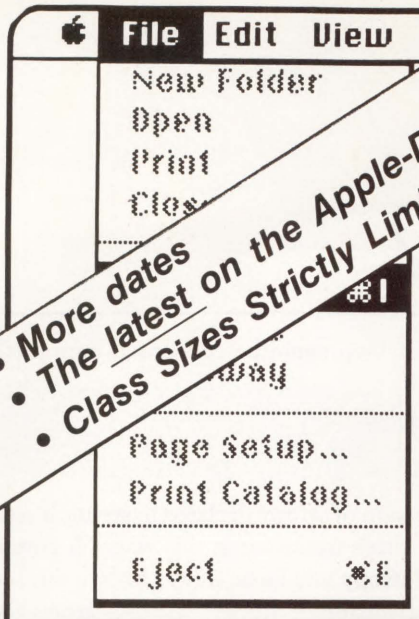

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LET'S C NOW

Rex Jaeschke

Pointers, Part 2

Editor's note: This is the second of a three-part series that covers pointers. In this installment, Mr. Jaeschke revisits the **strcpy** *library function and covers functions that return pointers and pointer arithmetic.*

The commonly used library function **strcpy** is trivial to implement using pointers. For example:

```
#include <stdio.h>

main()
{
        char str[30];
        void strcpy(char *, char *);

        strcpy(str, "The C Programming Language");
        printf("str = >%s<\n", str);
}

void strcpy(char *pdest, char *psource)
{
        while ((*pdest = *psource) != '\0') {
                ++psource;
                ++pdest;
        }
}
```

The output produced is:

```
str = >The C Programming Language<
```

strcpy copies one **char** array (including the trailing '\ 0') to another **char** array, and it expects its arguments to be pointers to the destination and source arrays, respectively.

Therefore, the formal arguments are declared correspondingly. In this example, we manipulate the pointers and the objects they point to, so in one case the * operator is required and in the other it isn't. ***pdest = *psource** causes one **char** to be copied from the address to which **psource** points to the address to which **pdest** points.

A more common way of writing the **while** loop is:

```
while ((*pdest++ = *psource++) != '\0') {
```

Because all the work is done in evaluating the controlling expression, a null statement is needed. As shown in an earlier example, this loop could be condensed even further:

```
while (*pdest++ = *psource++) {
        ;
```

The library version of **strcpy** declared in **string.h** returns a value. However, that's irrelevant at this stage. A complete implementation of **strcpy** will be be shown later in this series.

Let's look at a version of **strcpy** that uses arrays rather than pointers:

```
void strcpy(char dest[], char source[])
{
        unsigned i = 0;

        while ((dest[i] = source[i]) != '\0')
                ++i;
}
```

For programmers new to pointers, this version makes more sense. However, it requires the creation of the temporary variable **i** and its initialization. The variable **i** must be incremented separately, as neither **dest[i++] = source[i]** nor **dest[i] = source[i++]** guarantees the correct result. (Bear in mind that C, like most languages, makes no promises about the order of evaluation of expressions such as these.)

Note that in the context of formal argument lists, pointer and array notation can be interchanged freely. For example, the following function definitions are equivalent:

```
void strcpy(char dest[], char source[])     { /* ... */ }
void strcpy(char dest[], char *source)      { /* ... */ }
void strcpy(char *dest, char source[])      { /* ... */ }
void strcpy(char *dest, char *source)       { /* ... */ }
```

The manner in which **dest** and **source** are declared has no bearing on whether or not these identifiers can be used with pointer or array notation in the function body. However, it's common practice to use either all pointer notation or all array notation.

Functions Returning Pointers

Functions can return objects of any type except arrays, and because a pointer is an object, it can be returned. Earlier, we stated that the library routine **strcpy** returns a value. A complete implementation of **strcpy** follows:

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```
#include <stdio.h>
main()
{
        char str[30];
        char *strcpy(char *, char *);

        printf("return value = >%s<\n", strcpy(str, "abc"));
        printf("str = >%s<\n", str);
}

char *strcpy(char *pdest, char *psource)
{
        char *pcopy = pdest;

        while ((*pdest++ = *psource++) != '\0')
                ;

        return (pcopy);
}
```

The output produced is:

```
return value = >abc<
str = >abc<
```

We must declare that **strcpy** returns a pointer to **char** in the function prototype and the function definition. We know that the **printf** edit mask **%s** expects an argument to be a null-terminated array of **char**. However, because such arrays are passed by address, a pointer to a null-terminated string is really what's expected. And because **strcpy** returns such an object, the return value can be used directly to display the string to which it points.

That **strcpy** returns the address of its first argument is purely a matter of convenience. If we wish to embed a call to **strcpy** within an expression, we can do so as shown. If, however, we wish simply to call **strcpy** using an expression statement, that too is possible. Many of the **str**xxx and **mem**xxx library routines declared in **string.h** have this capability.

The following example contains a function called **stoupper** that accepts a pointer to a null-terminated string and converts each lowercase letter in that string to its uppercase equivalent:

```
#include <stdio.h>
#include <ctype.h>

main()
{
        char *ptext = "ABCdefghij!@#$%wxyz";
        char *stoupper(char *);

        printf("  Original version: >%s<\n", ptext);
        printf("Upper case version: >%s<\n", stoupper(ptext));
}

char *stoupper(char *pc)
{
        char *pcopy = pc;

        while ((*pc = toupper(*pc)) != '\0')
                pc++;

        return (pcopy);
}
```

The output produced is:

```
Original version: >ABCdefghij!@#$%wxyz<
Upper case version: >ABCDEFGHIJ!@#$%WXYZ<
```

A lowercase version **stolower** can be written by simply calling **tolower** instead of **toupper**. Neither **stoupper** nor **stolower** is part of the standard C library.

The following declaration is worthy of comment:

```
char *ptext = "ABCdefghij!@#$%wxyz";
```

ptext is being declared as an automatic object that can point to a **char**. And because **ptext** is a scalar, its initializer list may contain only one expression. That expression is a string literal.

We've seen on numerous occasions that when the compiler comes across a string literal used in an expression, it allocates space for it and adds a terminated **'\0'**. The type of that expression is an array of *n* **char** (where *n* is the number of **char**s in the array, including the **'\0'**) and the value of the expression is a pointer to the first **char** in the array. Therefore, **ptext** is being initialized with the address of the letter A. The string is *not* being copied to **ptext**, as you might first believe, because C doesn't support string assignment.

The library function **strchr** locates the first occurrence of a given character in a given string. The prototype for this function is:

```
char *strchr(char *pstring, int chr);
```

An implementation of this function might look something like the following. (Note that, by definition, the null character terminating the string *is* considered part of the string, i.e., you can search a string looking for the terminating **'\0'**. However, the same result also can be achieved via **strlen** and some pointer arithmetic.)

```
char *strchr(char *pstring, int chr)
{
        while (*pstring != '\0') {
                if (*pstring == chr)
                        return (pstring);

                ++pstring;
        }

        return (0);
}
```

```
#include <stdio.h>
main()
{
        char *pc;

        pc = strchr("ABCDEF", 'C');
        if (pc == 0)
                printf("Character C not found\n");
        else
                printf("Trailing substring is >%s<\n", pc);

        if ((pc = strchr("ABCDEF", 'X')) == 0)
                printf("Character X not found\n");
        else
                printf("Trailing substring is >%s<\n", pc);
}
```

The output produced is:

```
Trailing substring is >CDEF<
Character X not found
```

The only aspect introduced here is the use of 0 in pointer comparisons and as a pointer return value. In other words, we're mixing pointers and integers, something you generally should avoid. The reason is simple: C guarantees that it will never store an object or function at an address of 0. Therefore, we have a value that can be given to a pointer, so it can take on a special meaning. In this example, a pointer value of zero is returned if the character being searched for doesn't exist. Likewise, the library function **strstr** returns this special null pointer if a substring can't be found in another string. ANSI C permits the value 0 to be assigned and/or compared with pointer expressions without using a cast. This is the only integral value that you can use with pointers in a portable fashion.

Numerous standard library routines use the null pointer in this way. Consequently, the null pointer has been given the special name **NULL**. This macro is defined in numerous standard headers, although traditionally it usually was defined only in **stdio.h**.

You're urged strongly to use the name **NULL** instead of 0 in pointer expressions, because that's **NULL**'s purpose, and its meaning is well-understood and obvious. The specific definition of **NULL** isn't given by ANSI C. All the standard requires is that **NULL** expand to an implementation-defined null pointer constant. Specifically, the standard states, "An integral constant expression with the value 0, or such an expression cast to type **void ***, is called a null pointer constant. If a null pointer constant is assigned to or compared for equality to a pointer, the constant is converted to a pointer of that type. Such a pointer, called a null pointer, is guaranteed to compare unequal to a pointer to any object or function."

NULL could be defined as **0** or **0L** or perhaps something else. On some implementations, different pointer types can have different sizes, and you must take care that **NULL** can be used with all of them. The null pointer constant needn't be represented by all-bits-zero.

Pointer Arithmetic

Pointers may be involved in limited arithmetic operations (we've already seen pointers being used with the **++** and **--** operators). Given the similarity between **++i** and **i = i + 1**, we might expect that we can add arbitrary integral expressions to or subtract them from pointer expressions, and that is the case. For example, the following code is an implementation of the library function **strrchr**, which searches a string for a given character. **strrchr** is almost identical to **strchr**, except that **strrchr** searches from the end of the string backward.

```
#include <stdio.h>
#include <string.h>

char *strrchr(char *pstring, int chr)
{
        char *pc;

        pc = pstring + strlen(pstring) - 1;
        while (pc >= pstring) {
                if (*pc == chr)
                        return (pc);

                --pc;
        }
        return (NULL);
}

main()
{
        char *pc;

        pc = strrchr("CBCDCF", 'C');
        if (pc == NULL)
                printf("Character C not found\n");
        else
                printf("Trailing substring is >%s<\n", pc);

        if ((pc = strrchr("ABCDEF", 'X')) == NULL)
                printf("Character X not found\n");
        else
                printf("Trailing substring is >%s<\n", pc);
}
```

The output produced is:

```
Trailing substring is >CF<
Character X not found
```

The statement:

```
pc = pstring + strlen(pstring) - 1;
```

makes **pc** point to the **char** immediately preceding the trailing **'\ 0'**. In the case of a null string, **pc** points to the **char** before the start of the string. However, in this case, **pc** would be less than **pstring**, the loop would never be entered, and

NULL would be returned as required.

Another arithmetic operation can be performed on pointers: one pointer can be subtracted from another. However, the pointers have to point to the same type of object for this to be syntactically correct. Also, to be strictly portable, both pointers must point into elements in the same array. Otherwise, the result usually is meaningless. For example:

```
#include <stdio.h>

main()
{
        double d[25];
        double *pd1 = &d[5];
        double *pd2 = &d[22];
        double e;

        long int diff;

        diff = pd2 - pd1;
        printf("pd2 - pd1 = %ld\n", diff);

        diff = pd1 - pd2;
        printf("pd1 - pd2 = %ld\n", diff);

        diff = pd2 - &e;        /* ??? */
        printf("pd2 - &e  = %ld\n", diff);
}
```

The output produced is:

```
pd2 - pd1 = 17
pd1 - pd2 = -17
pd2 - &e  = -3
```

As we can see, the difference between two pointers is *n* objects, not *n* bytes. That is, the difference between the two addresses is scaled by the size of the object being pointed to (as is the case with all pointer arithmetic). Therefore, the first result is as expected: 17 **double** objects separate these two addresses. However, 17 is neither the inclusive nor the exclusive number of objects separating **d[5]** and **d[22]**. Depending on what you want the pointer subtraction to mean, you may need to add or subtract one from the result.

If a pointer with a larger value is subtracted from one with a smaller value, a negative result is produced. Therefore, the difference provides both magnitude and direction information.

In the third case, a (probably) useless result is obtained, because we have no control over where **e** is allocated in memory, and we don't know what lies between it and any other object we've allocated.

We've gone to the trouble of creating a temporary variable of type **long int**. This is because the type of the difference between two pointers is implementation-defined. ANSI C calls this type **ptrdiff_t**, and in many respects it's just like **size_t**, the type of the **sizeof** operator. By definition, **ptrdiff_t** is a signed integral type capable of storing the difference between two pointers. The only candidates realistically available for this type are **int** and **long int**. Therefore, the example stores the difference in the largest of these and displays it using the **%ld** mask. This is the only guaranteed way to make the program portable.

All other arithmetic operations are syntactically illegal when applied to pointers. However, as with numerous other aspects of C, there's a back door through which you can perform other operations. For example, for certain programs you may wish to know the base address of a particular segment of memory. On VAX/VMS, each address belongs to a memory page, while on MS-DOS, each belongs to a paragraph. Perhaps you wish to find out what that page (or paragraph) base address is. For example:

```
/* locate the page base address of a variable */

#include <stdio.h>

main()
{
        double d;
        unsigned long int u;

        printf("              &d = %0lx\n", &d);
        u = (unsigned long int) &d;
        u &= ~511;
        printf("page base address = %0lx\n", u);
}
```

The output is:

```
              &d = 374c0fce
page base address = 374c0e00
```

By masking off the nine low-order bits, the 512-byte page base address is determined. Similarly, the % modulus operator can be used to determine the offset within a page. After we've cast the pointer to an integral type, we can perform any arithmetic operation on it that makes sense. This is quite implementation-defined because it relies on the implementation having an integral type large enough to hold a pointer representation. It also requires us to know what that integral type is and whether or not it's signed or unsigned. You also must be careful when casting pointers to and from integer types on word architectures, because the behavior may be different than that on byte machines.

In Part 3 we look at the relationship between arrays and pointers. We also introduce arrays of pointers, handling command-line arguments and the ANSI C addition, void pointers. Finally, some common pointer errors are demonstrated.

Readers are encouraged to submit C-related comments and suggestions to Rex Jaeschke, 2051 Swans Neck Way, Reston, Virginia 22091 or via the uucp address uunet!aussie!rex.

—Rex Jaeschke is an independent consultant, author and lecturer. He is the C language editor of DEC PROFESSIONAL *and our representative on the ANSI C Standards Committee.*

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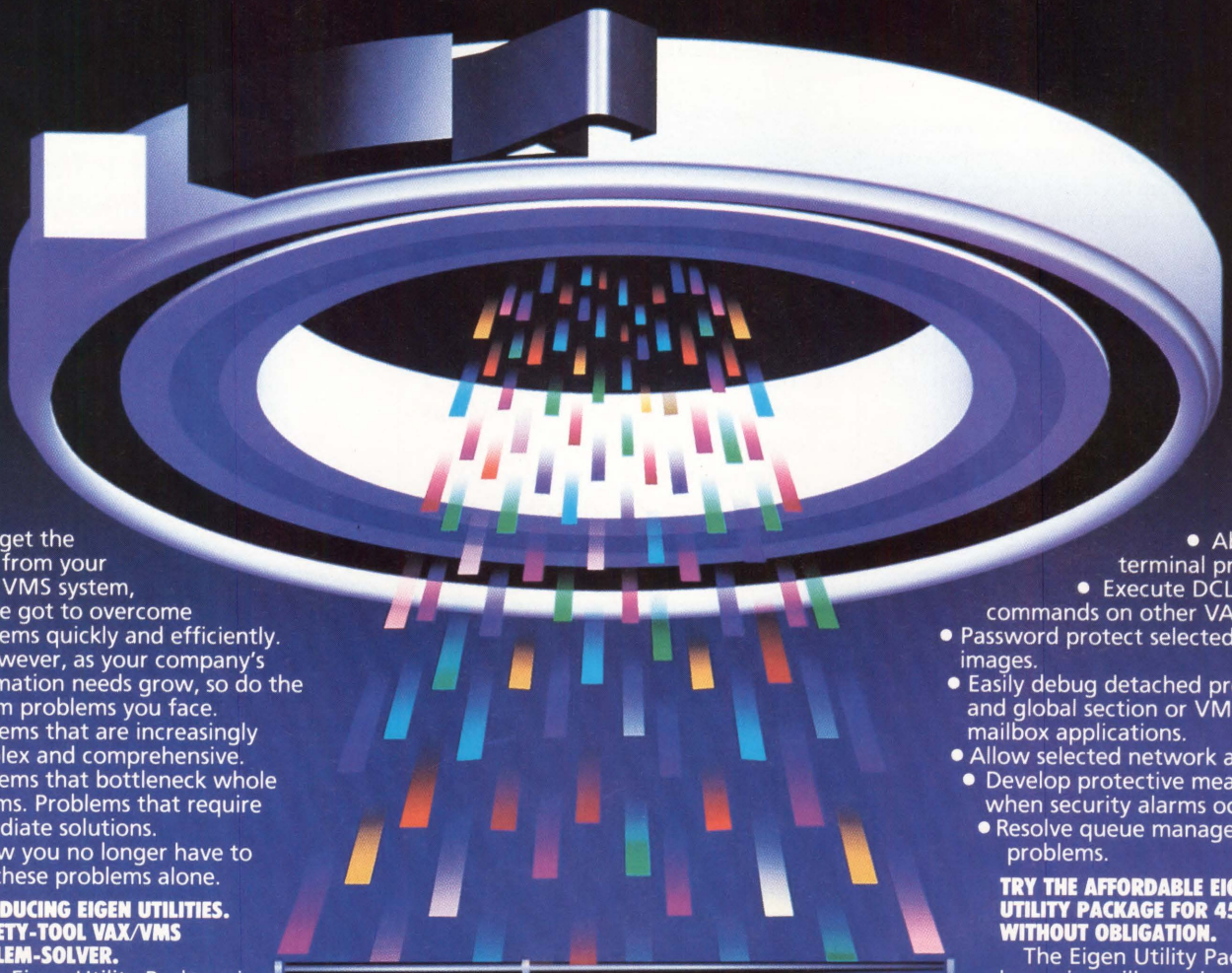

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Don't Quote Me

Everyone has a pet peeve. Mine is excessive use of quotation marks in DCL.

By excessive I mean placing quotation marks around DCL symbols in locations where their use is superfluous or forcing substitutions with the apostrophe (') when such substitution is unnecessary.

For a definitive discussion on the topic, refer to DEC's *DCL Concepts* manual. Here's a brief rundown on quotation mark rules in DCL.

Assignment Use

Symbols are assigned by using =, ==, := and :==. The = and := assign local symbols, while == and :== assign global symbols.

When you use = or == to assign a string value to a symbol, you must enclose the value being assigned in quotation marks:

```
$ COMMAND1 = "WRITE SYS$OUTPUT"
$ SHOW SYMBOL COMMAND1
  COMMAND1 = "WRITE SYS$OUTPUT"
```

If you forget the quotation marks, you get:

```
$ COMMAND1 = WRITE SYS$OUTPUT
%DCL-W-UNDSYM, undefined symbol -
 check validity and spelling
  \WRITE\
```

That's because DCL thinks the word WRITE is another symbol. After all, you didn't enclose the phrase in quotation marks, which is how the = determines if the value is a string.

If you need to include quotation marks in the symbol, you have to enclose the quotation marks within quotation marks:

```
$ TEXT1 = "Drive, he said."
$ WRITE SYS$OUTPUT TEXT1
Drive, he said.

$ TEXT2 = """Drive, "" he said."
$ WRITE SYS$OUTPUT TEXT2
"Drive, " he said.
```

Note that in the above examples there are no quotation marks or apostrophes around the symbols TEXT1 or TEXT2. That's because WRITE is a command that can accept a symbol as a command parameter.

You can omit the quotation marks if you use := or :==, the special string assignment operators:

```
$ COMMAND2 := write  sys$output
$ SHOW SYMBOL COMMAND2
  COMMAND2 = WRITE SYS$OUTPUT
$ TEXT1 := Drive, he said.
$ WRITE SYS$OUTPUT TEXT1
DRIVE, HE SAID.
```

In addition to assigning a string to a symbol, the := also converts the string to uppercase, compresses multiple spaces and tabs into single spaces and trims any trailing spaces.

If you don't want DCL to do any conversions, enclose the string in quotation marks:

```
$ TEXT1 := "Drive, he said."
$ WRITE SYS$OUTPUT TEXT1
Drive, he said.
```

To include quotation marks in the symbol:

```
$ TEXT1 := """Drive, "" he said."
$ WRITE SYS$OUTPUT TEXT1
"Drive, " he said.
```

> ***WRITE isn't the only command that can deal with symbols without excessive quotation marks and apostrophes.***

Watch what happens when we incorrectly place the quotation marks:

```
$ TEXT1 := "Drive, " he said.
$ WRITE SYS$OUTPUT TEXT1
Drive, HE SAID.
```

In this case, DCL preserves "Drive ,", because it was enclosed in quotation marks, but converts the "he said", which wasn't in quotation marks, to uppercase.

In the above example, we could have formatted the WRITE commands as:

```
$ WRITE SYS$OUTPUT "''TEXT1'"
```

But why bother? WRITE can handle symbols by itself.

More Than Write

WRITE isn't the only command that can deal with symbols without excessive quotation marks and apostrophes. DEPOSIT, EXAMINE and IF automatically evaluate symbols contained in their command lines. DEPOSIT and EXAMINE are a trifle obscure for the

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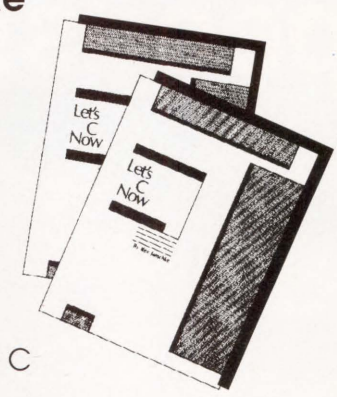

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CIRCLE 165 ON READER CARD

FIGURE.

```
.
.
.
$ GOS DB
$ GOS CW
$ IF W THEN GOT HW
$! Grab center square , if available.
$ IF P5 .NES. P THEN GOT W
$ P5 = 0
.
.
.
$ W = 0
$ ! Check horizontally:
$ IF P1+P2+P3 .EQS. WP THEN W=1
$ IF P4+P5+P6 .EQS. WP THEN W=1
$ IF P7+P8+P9 .EQS. WP THEN W=1
$ IF W THEN RET
.
.
.
```

typical DCL user, so let's look at IF:

```
$ VAL = 1
$ TEXT = "TRUE"
$ IF VAL .EQ. 1 THEN
  WRITE SYS$OUTPUT TEXT
TRUE
```

IF could tell that VAL was a symbol, and WRITE could handle the symbol TEXT with no problem.

Symbols are legal arguments to lexical functions, as well:

```
$ FILE := LOGIN.COM
$ TYPE := UIC
$ VAL = F$FILE(FILE,TYPE)
$ WRITE SYS$OUTPUT VAL
[GROUP,USER]
```

Not a quotation mark or an apostrophe in sight. You could have entered:

```
$ VAL = F$FILE("''FILE'","''TYPE'")
```

In a command procedure with SET VERIFY turned on, the line would appear as:

```
$ VAL = F$FILE("LOGIN.COM","UIC")
```

as the procedure executed. This is OK for debugging purposes, but for the sake of efficiency and proper coding technique, you should eliminate the excess baggage in the final version of the file.

An Extreme Example

TICTACTOE.DOC is a DCL version of Tic-Tac-Toe (see Figure). It's also an example of DCL code pared down to an absolute minimum. Command names have been shortened as much as possible, symbol and label names have been kept to minimal size and comments are practically non-existent.

The original source for this game is about twice as large. The Figure shows the production version, stripped down for speed. Note that there are very few quotation marks or apostrophes in the file. They're used in symbol definitions and as the prompting text for the INQUIRE command, which doesn't accept symbols.

TIRED OF THE bozo in the adjoining cubicle with the Sun workstation? Those UNIX greps, yaccs and awks got you down? Show your colors with an "I Love DCL" sticker.

For your own DCL sticker or a listing of all FidoNet public bulletin board systems in the U.S. that feature message areas with DEC-related topics (VAX, PDP-11 and Rainbow), send a self-addressed, stamped envelope to BBS List and/or DCL Sticker, Kevin G. Barkes Consulting Services, 4107 Overlook Street, Library, Pennsylvania 15129.

The list is also available on-line from my SYS$OUTPUT bulletin board system: (412) 854-0511, 1,200/2,400 baud, 8 bits, 1 stop bit, no parity. If you're active on FidoNet, ask your local sysop to file request DECBBS.LST from 1:129/38.

—Kevin G. Barkes is an independent consultant in VAX systems software, management, tuning and training based in Library, Pennsylvania.

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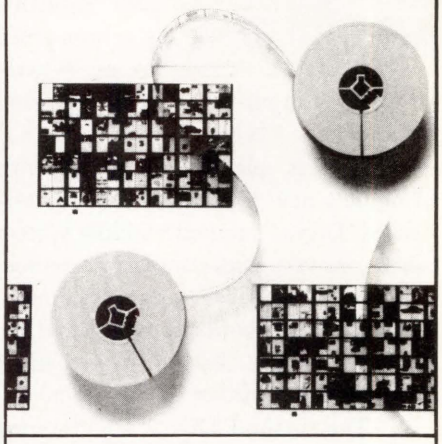

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REMOTVIEW.DOC

WORKSTATIONS

David W. Bynon

Getting Started With DECwindows, Part 2

For the last few months, I've been glued to my VAXstation with an ear-to-ear grin, exploring possibilities. DECwindows fascinates me.

Yet, as pleased as I am with Digital's new interface, I'm also confused. Digital's touted window system lacks one very important feature: remote task execution. The masters of connectivity and networking overlooked, or didn't release, a click-on-it method of starting applications on remote nodes.

The method Digital suggests for starting a remote application is inconvenient at best. As per the DECwindows *User's Guide*, to display remote applications on your workstation, you must log in to the remote system, issue a SET DISPLAY command and run the application.

Digital's suggested method isn't consistent with its FileView application. FileView is the DECwindows user's primary command interface to the workstation. FileView has a list of pull-down menus that are used to manage files, run applications and access DCL. It seems only reasonable that you should be able to start a FileView process on a remote node by clicking on a menu option.

FileView Fixer

As it turns out, the solution to this inconvenience is simple. By adding a new verb (menu choice) to FileView and using the DECnet task-to-task communication facility, a command procedure can be invoked on a remote node to start a program for you.

Through the FileView Customize menu, FileView verbs and menus may be added, modified or removed. To create a new verb, such as Remote VUE, you select Verbs and Menus from the Customize menu, select a menu from the Menu Names box, then enter a new verb name in the Verb Name box. The new verb name must be associated with a DCL command. In most cases, the verb executes a DCL command procedure. By convention, these verb procedures are maintained in the DECwindows directory SYS$COMMON:[VUE$LIBRARY].

In the simplest form of DECnet task-to-task communication, a command such as $ TYPE VENUS::"TASK=VUE" can be used to execute a procedure. In our example, a procedure called VUE.COM is executed on node VENUS. The DCL OPEN command, or a file open command from a VMS language, also can be used to invoke a remote task.

Programs

The programs I whipped up to start FileView on a remote node are called VUE$REMOTE_VIEW and STARTVIEW (see Figures 1 and 2). VUE$REMOTE_VIEW is the procedure executed by my new FileView verb (which I call Remote VUE), and STARTVIEW defines the name of its X Server and runs FileView.

To avoid having to hard-code node and access control information into these programs, information had to be

FIGURE 1.

```
$!-----------------------------------------
$! RemoteView V1.0
$!
$! Procedure to start a FileView process
$! on another node using the DECnet
$! task-to-task communication facility.
$!
$! By David W. Bynon, January 1989
$!
$! File name: VUE$LIBRARY:VUE$REMOTE_VIEW
$! Protection: W:RE
$!-----------------------------------------
$!
$! Trap errors
$!
$ SET NOON
$ ON WARNING THEN GOTO VIEW_ERROR
$!
$! Suppress DCL task output window
$!
$ VUE$SUPPRESS_OUTPUT_POPUP
$!
$! Prompt for a node name
$!
$ VUE$INQUIRE_SYMBOL "NODE Node:"
$ VUE$READ NODE
$!
$! Get local node and user information
$! for StartView
$!
$ LOCAL_NODE = F$GETSYI("NODENAME")
$ USER = F$GETJPI("","USERNAME")
$!
$! Invoke the StartView procedure
$!
$ TASK_NAME = -
  "''NODE'""''USER'"":::""TASK=STARTVIEW"""
$ OPEN/WRITE SYS$NET 'TASK_NAME'
$!
$! Pass StartView our node name
$!
$ WRITE SYS$NET "''LOCAL_NODE'"
$ CLOSE SYS$NET
$!
$! Were finished, StartView
$! should be running...
$!
$ VUE$EXIT_COMMAND_LOOP
$ STOP
$VIEW_ERROR:
$ VUE$SET_ERROR_STATUS
$ EXIT
```

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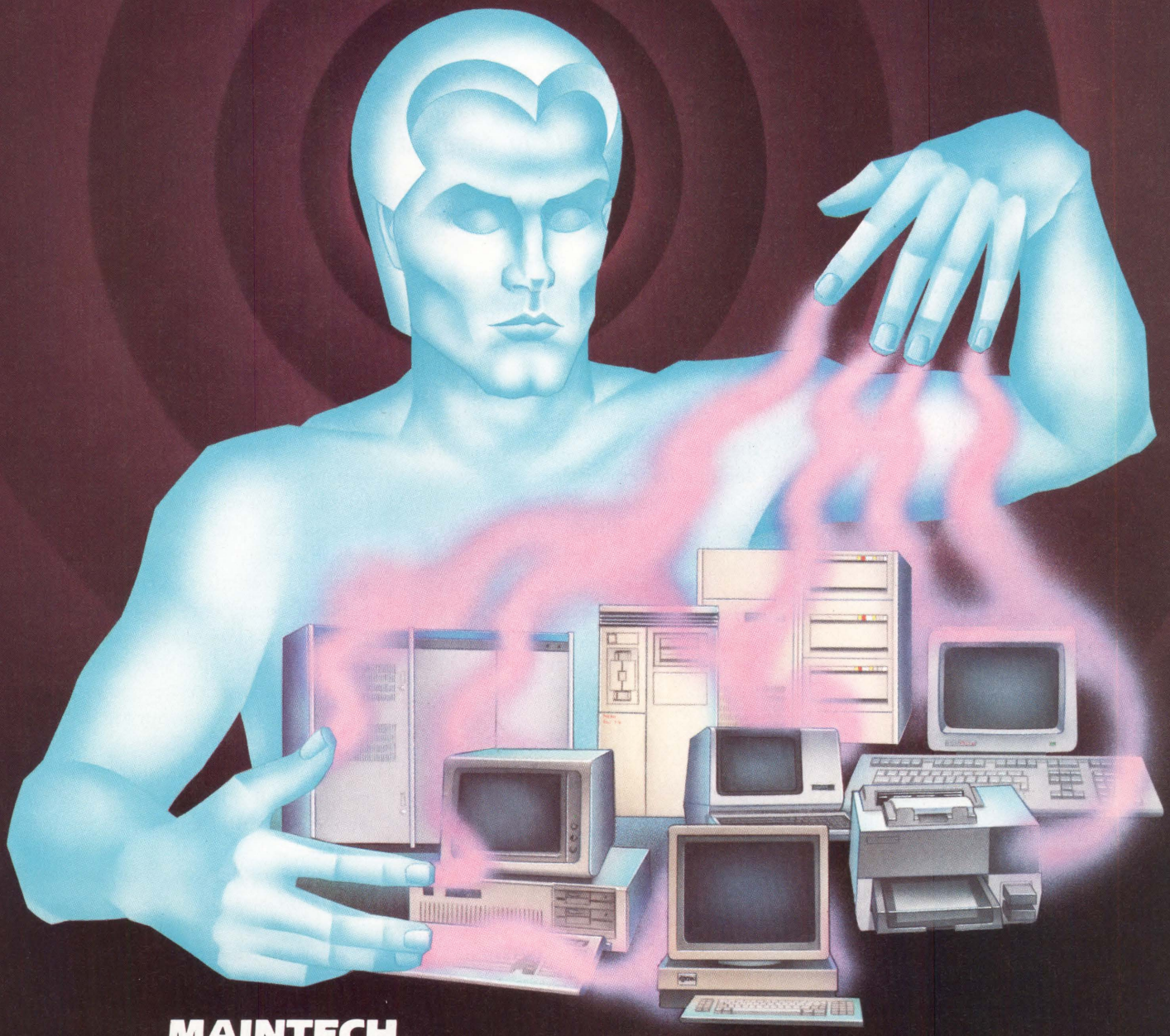

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CIRCLE 120 ON READER CARD

passed from the user to VUE$REMOTE_VIEW to STARTVIEW on the remote node. Getting information from the user to a verb procedure is facilitated through FileView Task Messages. The Task Messages are built-in FileView-to-DCL interface commands, which are implemented via DCL symbols. For example, in a DCL subprocess created by FileView, the commands:

```
$ VUE$INQUIRE "NODE Node:"
$ VUE$READ NODE
```

would pop open a dialog box requesting a node name. The user's input would be stored in a symbol called NODE.

To pass information from the FileView verb procedure to the remote node, the task-to-task link itself can be used. By using the DCL OPEN command to invoke the remote procedure, the network link can be written to and read from as a file-oriented device. The remote procedure, as one of its first tasks, must open the network link for read access. After the necessary information has been passed between the two procedures and the X Server display has been assigned, the network link can be closed. At this point, the function of the Remote VUE verb is complete.

The STARTVIEW procedure has several important functions. First, it must get the name of the node that started it, i.e., the X Server's name. Next, the process name is changed to something meaningful. By default, it would have a network process name (NETnnn). Next, display output is reassigned to the X Server using the SET DISPLAY command. The final step is to run FileView. If the STARTVIEW procedure succeeds, a FileView window is opened within a couple of seconds on your workstation. It's slick!

If the STARTVIEW procedure succeeds, a FileView window is opened within a couple of seconds on your workstation.

There are several circumstances that cause the STARTVIEW procedure to fail. The most common problem is VMS log in/access control. To use STARTVIEW, you must have proxy access to the node on which you're trying to start the VUE process. Or, you must supply log in information. My example programs assume you have proxy access. The second point of failure is if STARTVIEW.COM can't be found. You must make this procedure known to the system by defining it as a known DECnet object using NCP or put a copy in your log in directory on the remote node.

Philip A. Naecker, our technology editor, says that he uses a version of the public domain program TELL to start remote tasks in DECwindows (see "TELL," by Philip A. Naecker, *VAX PROFESSIONAL*, June 1987).

WE NOW NEED a program that can provide a menu of available DECwindows applications on remote nodes. This could possibly be done in the same fashion as Digital's Distributed Logical Name Service. Any volunteers? ■

FIGURE 2.

```
$!-------------------------------------------
$! StartView V1.0
$!
$! This is a remote task started by
$! VUE$REMOTE_VIEW.COM.  StartView
$! reads a node name from SYS$NET,
$! which is then used as the X display
$! server.
$!
$! By David W. Bynon, January 1989
$!
$! File name: SYS$LOGIN:STARTVIEW.COM
$!-------------------------------------------
$ SET NOON
$ ON WARNING THEN GOTO ERROR
$!
$! Open the network link for read access
$!
$ OPEN/READ NET_LINK SYS$NET
$!
$! Read the node name of the node which
$! invoked us.
$!
$ READ NET_LINK DISP_NODE
$!
$! Get the users name to use in the
$! new process name.
$!
$ USER = F$GETJPI("","USERNAME")
$ USER = F$EXTRACT(0,F$LOCATE(" ",USER),USER)
$!
$! Change our process name
$!
$ SET PROC/NAME = "VUE@''DISP_NODE'::''USER'"
$!
$! Set our display to the new X Server
$!
$ SET DISPLAY/CREATE/NODE='DISP_NODE' -
  /TRANSPORT=DECNET
$!
$! The network link is no longer
$! needed...close it.
$!
$ CLOSE NET_LINK
$!
$! Start the FileView
$!
$ MCR VUE$MASTER
$!
$! When the user stops FileView,
$! deassign the display device.
$!
$ SET DISPLAY/NOPERMANENT
$ERROR:
$ STOP
```

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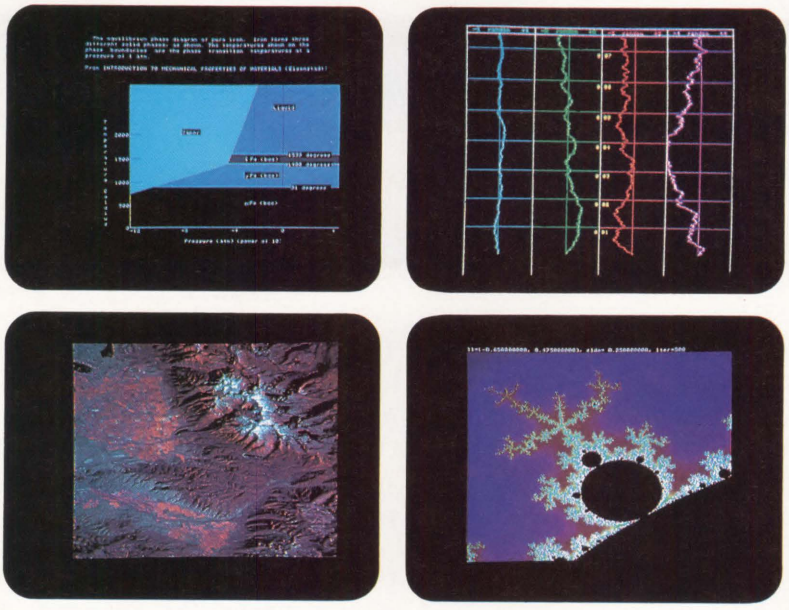

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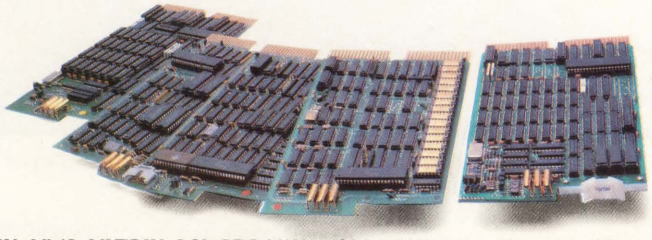

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File Handling: UNIX Versus VMS

ULTRIX

Philip E. Bourne, Ph.D.

Editor's note: We continue our introduction to UNIX for VMS users with a discussion of UNIX file handling. The use of files and the internal mechanisms by which UNIX manages them differ significantly from the corresponding VMS features.

If you've ever witnessed the party trick of filling a triangular stack of champagne glasses, in which the performer relies only on adhesion, surface tension and a steady hand to fill every glass, then you're on your way to understanding the UNIX file hierarchy.

Just as every glass can be filled from the top glass, so every UNIX directory can be accessed from the root directory — the top of the directory hierarchy, denoted by /.

The VMS analogy is a separate stack of glasses for each physical disk. This presents a problem to the VMS user: To fill a certain glass, you have to know with which stack to start. Unlike the VMS user, the UNIX user needn't be concerned with knowing which physical disk a file resides on. UNIX answers that question internally. The major implication of this difference between the operating systems is illustrated in Figure 1.

The UNIX **find** command searches every directory on every physical disk, from the root directory down the directory hierarchy, for references to the file **myfile**. It displays the location of any entries found. This is an elegant and simple mechanism for finding a file in a large disk farm.

The VMS user is faced with the more finger-intensive task of issuing a command for each disk to be searched. This can be simplified by the use of logical names and common roots, but it remains cumbersome. Why can a UNIX user address any file on the system without regard for which physical device it's located on?

Each physical disk attached to a UNIX system is divided into one or more partitions. This division is described in a file called **/etc/disktab**, an abbreviation for disk table. **/etc/disktab** is an absolute file definition. It's defined explicitly from the root directory. Because the root directory is denoted by /, the definition begins with /. The VMS analogy is DUA0:[ETC]DISKTAB., an absolute file specification from the top-level directory of device DUA0:.

The other major way of defining a file is relative to the current directory:

FIGURE 1.

```
        VMS                                  UNIX
example: $ DIR DUA0:[*...]MYFILE.EXT         % find / -name myfile -print
        $ DIR DUA1:[*...]MYFILE.EXT
        $ DIR DUA2:[*...]MYFILE.EXT
        ...
```

VMS versus UNIX file search.

FIGURE 2.

```
# @(#)disktab      6.2
                   (ULTRIX) 9/23/88
#
#       disktab   from 4.5  4.2 BSD 83/07/30
# Disk geometry and partition layout tables.
# Key:
#       ty        type of disk
#       ns        #sectors/track
#       nt        #tracks/cylinder
#       nc        #cylinders/disk
#       p[a-h]    partition sizes in sectors
#       b[a-h]    partition block sizes in bytes
#       f[a-h]    partition fragment sizes in bytes
#
rd53|RD53|DEC RD53 Winchester:\
        :ty=winchester:ns#17:nt#8:nc#1024:\
        :pa#15884:ba#8192:fa#1024:\
        :pb#33440:bb#4096:fb#1024:\
        :pc#138672:bc#8192:fc#1024:\
        :pe#50714:be#8192:fe#1024:\
        :pf#87958:bf#8192:ff#1024:\
        :ph#122788:bh#8192:fh#1024:\
        :pg#89348:bg#8192:fg#1024:
```

A sample ULTRIX* disktab *entry.

FIGURE 3.

```
                VMS
                $ SHOW DEVICE/MOUNTED
                Device   Device    Error   Volume        Free    Trans   Mnt
                Name     Status    Count   Label         Blocks  Count   Cnt
                DLA0:    Mounted   0       SYS$SCRATCH   8790    1       1
                DUA0:    Mounted   0       SYS$CUMBG1    4200    137     1
                DUA2:    Mounted   0       USR$DISK1     1544    2       1
                DUA3:    Mounted   0       USR$CUMBG1    13179   5       1
                UNIX
example: % df
                Filesystem Total   kbytes  kbytes  %
                           kbytes  used    free    used  Mounted on
                /dev/ra0a   7415   5348    1326    80%   /
                /dev/ra0g  41639   28211   9265    75%   /usr
```

***File systems displayed with* df.**

a relative file definition. For example, consider **../myfile.dat**, versus the VMS file construct [-]MYFILE.DAT — the file **myfile.dat** in the directory above the current directory.

A sample entry from the **/etc/disktab** file found on an ULTRIX version 3.0 system is shown in Figure 2. **/etc/disktab** is an example of a UNIX look-up table. Different look-up tables are used by a number of UNIX commands, each having a similar format. The file **/etc/disktab** is used by the system administrator when formatting a new disk with the command **newfs** (new filesystem). As in other look-up tables, # at the beginning of a line signifies a comment line, otherwise it separates a variable name from a value; \ indicates that the command continues on the next line; **:** separates fields; and | separates different names for the same entry.

Each type of disk is represented by an entry such as the one shown for an RD53. The **newfs** command includes the argument **rd53**, **RD53** or **"DEC RD53 Winchester"** to point to the appropriate entry in the look-up table. That entry contains the parameters that define the format of the disk.

Looking at **/etc/disktab** and knowing that a sector is 512 bytes and that the RD53 has a capacity of 71 MB, simple arithmetic establishes that the disk can be divided into several alternative combinations of partitions, e.g., as a single **pc** partition or as the two partitions **pa** and **pg**. You also can see that a different **block size** can be assigned the **pb** partition.

VMS block sizes are always 512 bytes, with the space allocated to a file determined by the **cluster size** (default 3). As a file is written, it increases in size by three-block increments. Varying **block sizes** (and for some disks, **fragment sizes**) offer the opportunity for more efficient I/O. Such variations are useful in situations in which a partition is likely to contain a preponderance of small or large files. For a normal mix of small and large files, the default values are sufficient.

A file system is mounted into each partition. The UNIX file system is analogous to a VMS physical disk. For example, first, file systems are mounted as part of the boot sequence and can be mounted or dismounted by the system administrator at any time. Second, complete and incremental backups are performed on UNIX file systems. The maximum size of a file system is governed by the size of the partition. Prior to setting up file systems, you must consider which file systems to mount in which partitions on the basis of the expected maximum size of the file system.

The file systems that are available on a UNIX system are determined with

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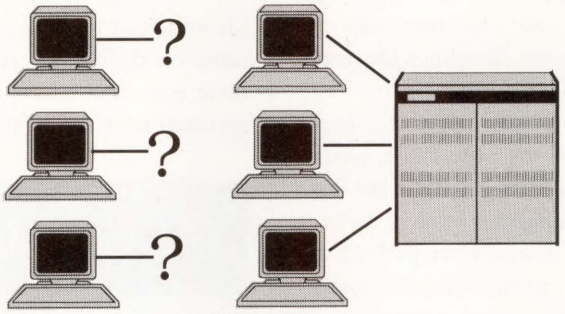

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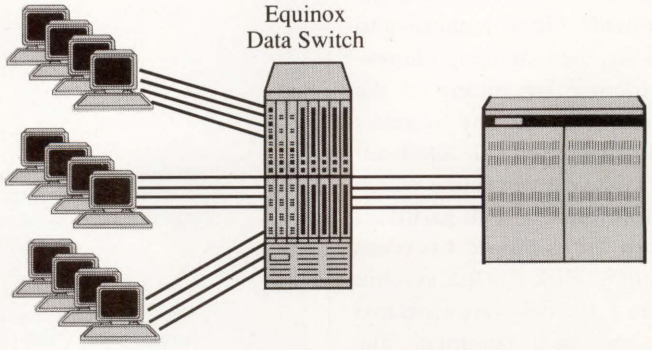

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FIGURE 4.

```
# Contents of /etc/fstab
#
/dev/ra0a:/:rw:1:1:ufs::
/dev/ra0g:/usr:rw:1:2:ufs::
/dev/ra1a:/src:rw:1:1:ufs::
/dev/ra1g:/mnt:rw:1:2:ufs::
```

Sample ULTRIX **fstab** *file.*

the command **df** (disk free). Compare the VMS command SHOW DEVICE/MOUNTED. Figure 3, which is for the RD53 described above, shows two file systems, **/** and **/usr**, which are mounted in the **a** and **g** partitions, respectively, of the device **ra0**. The partitions are represented by the filenames **/dev/ra0a** and **/dev/ra0g**.

/ is not only the top of the directory hierarchy, it's also a file system located in the **a** partition of the **ra0** disk. When a UNIX system is booted, the root file system is mounted as part of the boot sequence, because this file system contains the operating system kernel (the file **/vmunix** in ULTRIX), which is loaded into memory (compare the VMS file SYSBOOT.EXE).

The system first is brought to single-user mode (compare the VMS command SETLOGINS/INTERACTIVE = 0), at which point only the root file system is mounted. Upon continuing to multiuser mode, the remaining file systems are mounted by means of the **mount** command. **mount** searches another look-up table, the file **/etc/fstab** (file system table), to determine which file system to mount in each partition. The **/etc/fstab** file in Figure 4 is taken from a dual RD53 disk ULTRIX system.

In Figure 4, the fields are separated by colons, and each comment line begins with #. The important fields are **/dev/ra0g**, the **g** partition of the **ra0** disk (or **/dev/ra1a**, the **a** partition of the **ra1** disk); **/usr**, the file system name; **rw**, file system access — read and write in this example (compare the VMS command MOUNT/[NO]WRITE); and **ufs**, a file system mounted on a local disk.

The alternative is **nfs**, signifying Network File System (NFS), a protocol that permits remote file systems to be accessed as though they were mounted on a local disk, when in fact access to these remote file systems is made across an Ethernet network.

Addressing Files

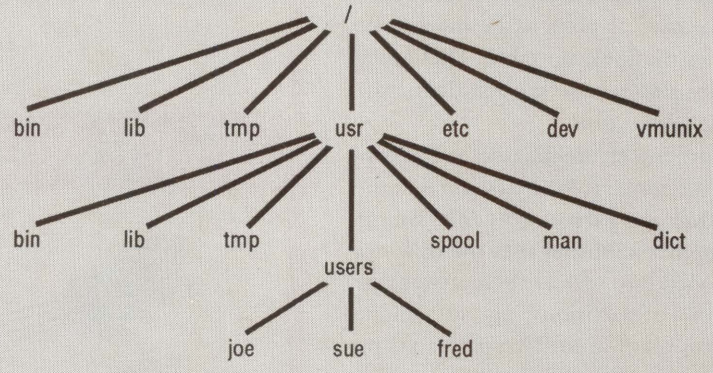
Because each file system has a directory entry in the root directory, it's directly accessible from that directory. Figure 5 illustrates this hierarchy and shows the organization of system and user files for the same RD53 disk.

Although files can be on different file systems mounted in different partitions on different disks, this arrangement is transparent to the user. Files are accessed relative to the root or relative to the current directory. This makes the addressing of files straightforward, as the examples in Figure 6 show. The examples give us the opportunity to introduce UNIX file-naming conventions and the use of wildcards.

The similarity between VMS and UNIX filenames is immediately obvious. For the most part, there's no reason why the VMS user learning UNIX shouldn't adhere to VMS file-naming conventions — with the following provisos:

1. There are no version numbers in UNIX filenames, because UNIX only retains the most recent version of a file. This is good news for system administrators managing disk space and bad news for novice UNIX users. Unless you're sure of yourself, make a copy of any important file before issuing a command.

FIGURE 5.



Definitions *	
/	root file system (DUAO:[SYSO.] or SYS$SYSROOT)
/bin	executable system files (SYS$SYSTEM)
/lib	system libraries (SYS$LIBRARY)
/tmp	scratch directory (SYS$SCRATCH)
/etc	restricted data and programs (SYS$SYSTEM and SYS$MANAGER)
/dev	special files for physical devices (SYS$SYSTEM)
/vmunix	UNIX kernel (DUAO:[SYSEXE]SYSBOOT.EXE)
/usr/bin	less-used executable system files (SYS$SYSTEM)
/usr/lib	less-used system libraries (SYS$LIBRARY)
/usr/tmp	less-used scratch directory (SYS$SCRATCH)
/usr/spool	spool directory (SYS$SYSTEM)
/usr/man	on-line documentation (SYS$HELP)
/usr/dict	dictionaries
/usr/users/...	user directories (DUA1:[USER1])

* Closest VMS analogy is shown in parentheses

The UNIX directory hierarchy.

2. Because UNIX is case sensitive, the file **myfile.dat** is different from the file **MYFILE.DAT**.

3. The period in a UNIX filename is another character, not a formal delimiter between a filename and a file extension. File extensions, or file types. as they're referred to in UNIX parlance, are used only to aid in the recognition of files. They have no formal meaning. The filename **myfile.c** can be used to denote a C source-code file. However, to compile that code, the complete file specification **cc myfile.c** must be given. **cc myfile**, a valid VMS command, returns a "file not found" error in UNIX.

The examples in Figure 6 use the UNIX **ls** command to perform directory and file look-ups. **ls /bin/cat** uses an absolute file definition to return information on the UNIX **cat** program, which displays files. **ls bin** either returns information on the file **bin** or, as in the example, the contents of the **bin** directory.

ls ../myfile.dat uses a relative file definition to return information about the file **myfile.dat**, located one directory level above the current directory. **ls ~user1**, a command syntax unique to the C shell, uses ~, a special character, or metacharacter, to provide a listing of the files in the home directory of the UNIX user with the log in name **user1**.

ls . and **ls *** have distinct meanings. The period signifies the current directory. Thus, **ls .** lists files in the current directory. **ls *** lists files in the current directory and files in the next level down the directory hierarchy.

ls *.* lists all files with a period somewhere in the filename. **ls *.c** lists all files that terminate in **.c**. It has nothing to do with files of the file type **c**.

ls aa?.com lists all files that begin with **aa**, are followed by any single alphanumeric character (compare the % VMS wildcard) and end in **.com**.

The last three examples in Figure 6 illustrate how UNIX expands on the VMS wildcard scheme: **ls ../../name[xyz]** lists files two levels above the current level in the directory hierarchy with the filenames **namex**, **namey** or **namez**; **ls name[a-z]** lists files **namea** through **namez**; and **ls name.{o,f}**, unique to the C shell, is a Boolean *and*, i.e., it returns any files **name.o** and **name.f**.

File Structure

An original design goal imposed by UNIX developers was, "keep things simple." Although the novice user may think that this goal hasn't been met, few would deny the simplicity of UNIX file structure. Compare the output of the VMS and UNIX commands used to describe the characteristics of a file in Figure 7.

In Figure 7, a single line describes most of the information available for the file **testfile.dat.** It's obvious, when compared to the record structure assigned to a VMS file, that the UNIX file has little

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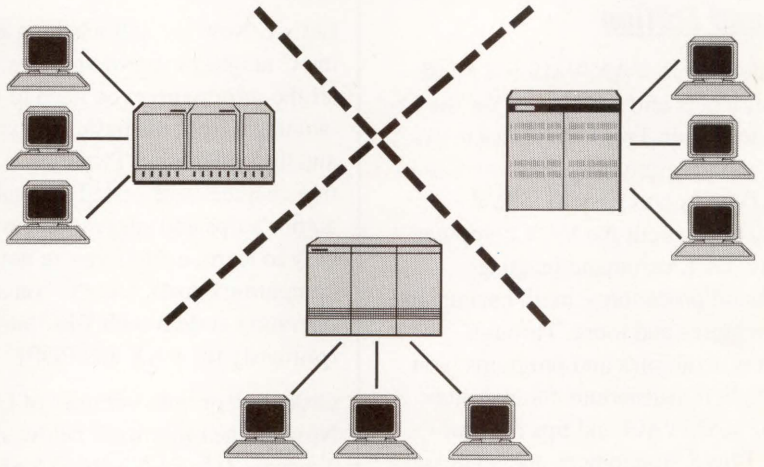

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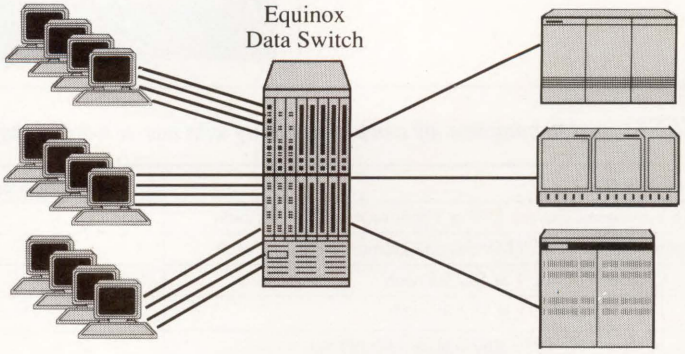

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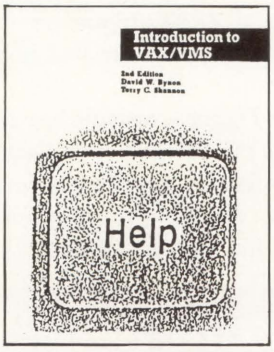

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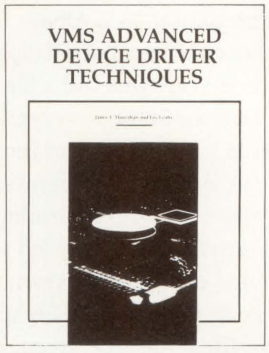

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structure. A UNIX file is simply a string of bytes with a block size defined by the partition block size. No record structure is imposed, and each program decides how to handle non-alphanumeric characters, e.g., the newline character, signifying a carriage return/line feed or a tab. With such a simple structure, it's easy to pass data among commands and other programs.

Input to a file is terminated with a <CTRL>-D, which closes the file. Under certain circumstances, a terminal session also may be terminated with <CTRL>-D. In other words, input from the terminal is treated no differently than input to a program from a file. In a terminal session, the program is the shell, which parses each input line as it's entered.

Much of what there is to know about a UNIX file can be learned from the last line in Figure 7. Let's look at each field in turn:

1. **4248** is the inode number (compare the VMS file identifier) by which UNIX keeps track of all files internally, including the characteristics explained here and the physical location of the file on the disk. Like the VMS file identifier, the inode number isn't used directly by the average user.
2. In **-rwxr-xr--**, the file type is the first character and the file protection is the next nine characters.

The two most common file types are the ordinary file, denoted here by **-** , and the directory pointer file (compare the VMS .DIR file), denoted by **d**. A third file type is the device-special file. **/dev/ra0g**, introduced above, is an example of a device-special file. UNIX diehards like to frighten would-be users by telling them that devices and files are indistinguishable.

This concept is alien to the VMS user, but with practice it will become evident that addressing devices as files is a simplification. For example, to copy a file to a magnetic tape could be as simple as copying the file to the device-special file that represents the tape drive. Different files are used to represent different characteristics of the tape drive, e.g., tape density.

For now, it's enough to know that device-special files are kept in the directory **/dev** and are of two types, represented by the file types **b** and **c** for block and character, respectively. As the names suggest, character devices process data one character at a time, whereas block devices group characters before processing.

rwxr-xr-- describes the protection assigned to the file. There are three levels of protection (read, write and execute) for three classes of users (owner, group and world). Compare this to VMS, which has four levels of protection for

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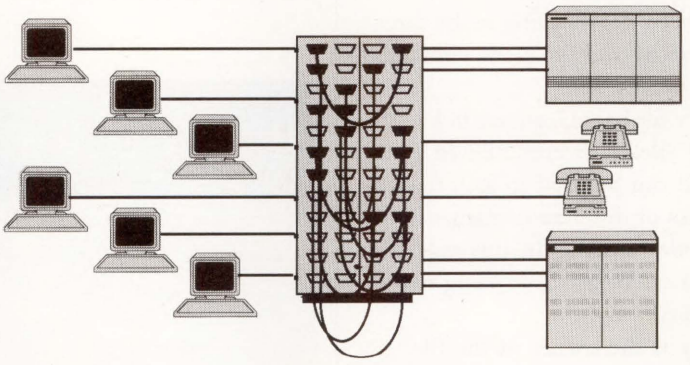

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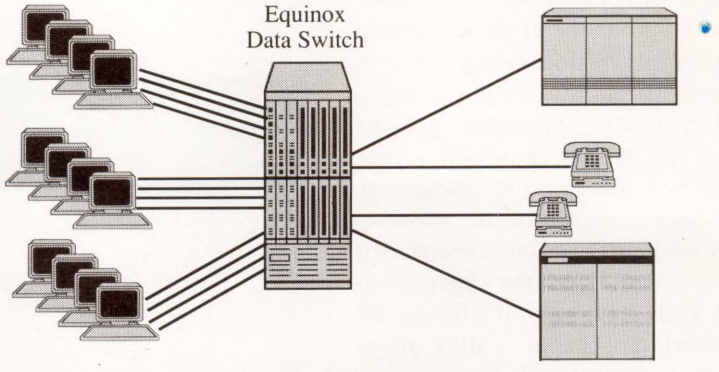

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four classes of users. UNIX doesn't have a separate class of protection assigned to the system.

The superuser, log in name root (compare the VMS username SYSTEM), has access to all files. UNIX has no delete access; write implies delete. Hence, **rwxr-xr--** implies the owner has read, write and execute access (**rwx**); the group has read and execute access (**r-x**); and all other users have read-only access (**r--**).

3. **1** is the link count, the number of links possessed by the file. It's referred to as a link because it's the only connection between the filename in the directory hierarchy and the inode contained in the directory file.

Every file has at least one link to the directory file. However, the **ln** (link) command can be used to assign additional links or different filenames to the same inode number. In this way, the same data can be accessed using two or more filenames.

4. **danny** is the owner of the file.

5. **staff** is the name of the group assigned to the file. UNIX doesn't support a concept similar to the VMS Access Control List (ACL), which gives different levels of file access to different classes of users. Rather, a user can belong to multiple groups and gain access to a file via the group ownership and group protection settings. A VMS user belongs only to a single group.

The UNIX command **groups** returns the groups to which a user belongs by accessing the file **/etc/group**, which keeps a record of this information. Changing the group ownership of a file is achieved with the **chgrp** command. Only the owner of a file (or the superuser) can change a file's group ownership. Further, only the superuser can change the groups to which a user belongs.

6. **1000** is the size of the file in bytes or the number of characters (compare VMS, where file sizes are given in blocks of 512 bytes).

7. **10 Aug 12:20** is the date the file was last modified. UNIX also maintains the time the file was last read or executed and the time the inode was last changed, e.g., by changing the file protection. Compare this to VMS, in which a backup and expiration date are maintained but there's no way of telling when the file was last read or executed.

8. **testfile.dat** is the name of the file.

THIS DISCUSSION MAY leave VMS users uneasy, because at first glance it appears to reflect the obsession of UNIX developers to get away from any mention of devices such as DUA0: or MUA0:. However, when you begin to use files and directories, the elegance and simplicity of the UNIX directory hierarchy and file structure will become manifest.

Information regarding kinks and hints that would be useful to VMS users grappling with UNIX can be sent via e-mail to SYSTEM@CUMBG.BITNET or pbourne@cunixc.cc.columbia.edu.

—Philip E. Bourne, Ph.D., is senior associate at the Howard Hughes Medical Institute at Columbia University and the author of UNIX for VMS Users *, soon to be published by Digital Press.*

FIGURE 6.

```
          VMS                                   UNIX
example:  $ DIR DUA0:[SYS0.SYSEXE]TYPE.EXE      % ls /bin/cat
example:  $ DIR [.BIN]                          % ls bin
example:  $ DIR [-]MYFILE.DAT                   % ls ../myfile.dat
example:  -                                     % ls ~user1

example:  $ DIR *                               % ls .
example:  -                                     % ls *
example:  -                                     % ls *.*
example:  $ DIR *.C                             % ls *.c
example:  $ DIR AA%.COM                         % ls aa?.com
example:  -                                     % ls ../../name[xyz]
example:  -                                     % ls name[a-z]
example:  -                                     % ls name.(o,f)
```

Addressing UNIX files.

FIGURE 7.

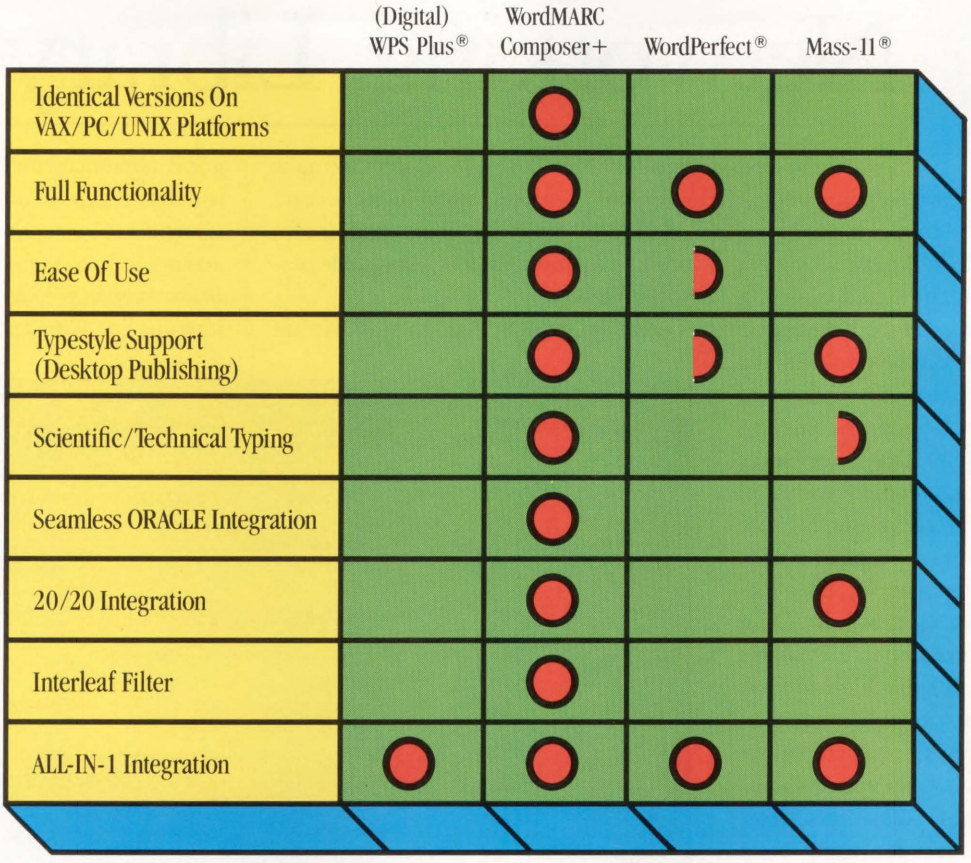
```
          VMS
example: $ DIRECTORY/FULL TESTFILE.DAT

          Directory DUA3:[DANNY]
          TESTFILE.DAT;1      File ID:  (11044,9,0)
          Size:    1/3        Owner:    [STAFF,DANNY]
          Created:  20-FEB-1988 13:15   Revised:  20-FEB-1988 13:15 (1)
          Expires:   <None specified>   Backup:    <No backup recorded>
          File organization:  Sequential
          File attributes:    Allocation: 3, Extend: 0, Global buffer count: 0, No version limit
          Record format:      Variable length, maximum 4 bytes
          Record attributes:  Carriage return carriage control
          Journaling enabled: None
          File protection:    System:RWED, Owner:RWED, Group:R,   World:R
          Access Cntrl List:  (IDENTIFIER=%X80010003,ACCESS=READ+WRITE+EXECUTE+DELETE+CONTROL)
                              (IDENTIFIER=%X80010000,ACCESS=READ+WRITE+EXECUTE)
          Total of 1 file, 1/3 blocks.

          UNIX
          % ls -lgi testfile.dat
          4248  -rwxr-xr--  1  danny   staff     1000 10 Aug  12:20 testfile.dat
```

VMS versus UNIX file characteristics.

THE WORD IS OUT.



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NETWORKING

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Building Your Networking Library

I'm often asked where I get information on networks. I get it from reading documentation, using products, writing code and staring at microfiche until the wee hours of the morning. Some topics can be learned easily through books and documentation. Others require the brute force method of learning: Get dirty and do it!

This article presents my favorite sources of networking information. They'll help you learn about networking and will prove to those doubting few that, yes, documentation is available for most subjects. It's just hard to find.

One of my favorite places to get information is a bookstore chain in the San Jose, California, area called Computer Literacy. These folks carry practically every title you can think of in books for the computing community. If they don't have a book, they're very helpful in locating it. However, expect to pay list price. On the brighter side, they offer corporate accounts, accept major credit cards and deliver anywhere overnight.

Another source of technical books is Taylor's Technical Books in Dallas. With more than 4,500 titles, it's a technical-book junky's delight. This store, too, offers corporate accounts, accepts major credit cards and delivers anywhere overnight.

The Figure divides books into categories to make it easy to find particular titles on particular subjects. These are books that I own and have read.

The following categories correspond to the categories in the Figure.

General Networking — These books are useful in helping to learn the basics of networking. The bible of networking is *Computer Networks*, now in its second edition. A very technical and useful book, it's a must for any respectable network library.

TCP/IP — Both books in this list are good references for TCP/IP, although I usually recommend the *Handbook of Computer Communications*, because it's arranged better for network people. *Internetworking With TCP/IP* is good for learning TCP/IP and is replete with

Title	Author	ISBN Number	Publisher/Date
General Networking			
Computer Networks	Andrew Tannenbaum	0-13-162959-X	Prentice Hall,1988
Technical Aspects of Data Communication	John McNamara	1-55558-007-6	Digital Equipment Corp.,1977
New Concepts and Architectures	Bill Hancock	0-89435-270-9	Essential Resources Inc.,1989
The Dow Jones-Irwin Handbook of Telecommunications	James H. Green	0-87094-661-7	Dow Jones-Irwin,1986
Data Communications and Teleprocessing Systems	Trevor Housley	0-13-197435-1	Prentice Hall,1979,1987
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TCP/IP			
Internetworking With TCP/IP	Douglas Comer	0-13-470154-2	Prentice Hall,1988
Handbook of Computer Communications, Volume 3 — Department of Defense (DoD) Protocol Standards	William Stallings	0-02-948072-8	Macmillan,1988
DECnet			
Advanced Device Driver Techniques	Jamie Hanrahan Lee Leahy	0-9614729-5-2	Professional Press,1988
VAX/VMS Internals & Data Structures (Version 4.4)	Lawrence J. Kenah Ruth E. Goldenberg Simon F. Bate	1-55558-008-4	Digital Equipment Corporation,1984
Open Systems Interconnect (OSI)			
Standards for Open Systems Interconnection	Keith Knightson Terry Knowles John Larmouth	0-07-035119-8	McGraw HIll,1988
Computer Networks	Andrew Tannenbaum	0-13-162959-X	Prentice Hall,1988
Handbook of Computer Communications Volume 1 — The Open Systems Interconnection (OSI) Model and OSI-Related Standards	William Stallings	0-02-948071-X	Macmillan,1987
General LANs			
Designing & Implementing Local Area Networks	Dimitris N. Chorafas	0-07-Y66233-9	McGraw Hill,1984,1986
The Practical Guide to Local Area Networks	Rowland Archer	0-07-881190-2	McGraw Hill,1986
Local Area Networks in Large Organizations	Thomas Madron	0-8104-6205-2	Hayden,1984
Local Area Networks, The Second Generation	Thomas Madron	0-471-85989-3	Wiley,1988

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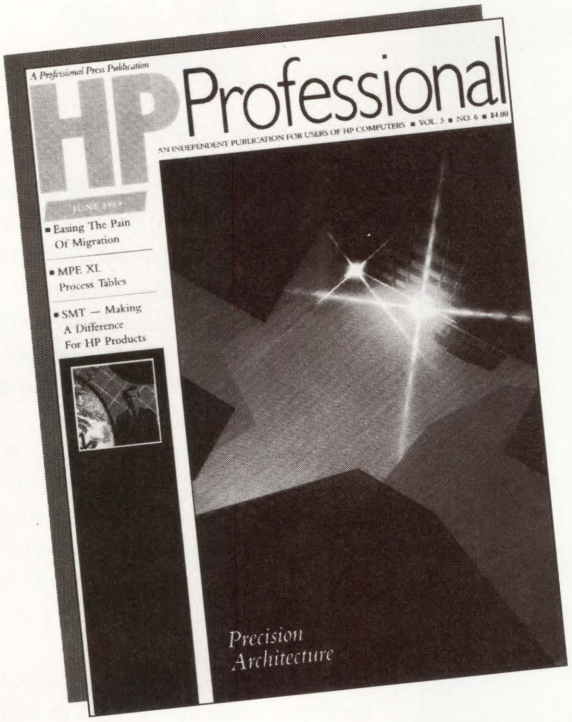

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Local Area Networking with Microcomputers	Stevanne Lehrman	0-89303-640-4	Brady,1986
Local Area Network Design	Andrew Hopper Steven Temple Robin Williamson	0-201-13797-6	Addison-Wesley,1986
Handbook of Computer Communications Volume 2 — Local Network Standards	William Stallings	0-02-948070-1	Macmillan,1987
MAP and TOP Advanced Manufacturing Communications	John Dwyer Adrian Ioannou	0-470-20991-7	Wiley,1988
Ethernet/802.3 LANs			
Designing & Implementing Ethernet Networks	Bill Hancock	0-89435-252-0	Essential Resources Inc.,1988
Keeping the Link, Ethernet Installation & Management	Martin Nemzow	0-07-046302-6	McGraw Hill,1988
Broadband Network Technology	Edward Cooper	0-13-083379-7	Prentice Hall,1986
Personal Computer Networking (PC/PS/Mac)			
Communications & Networking For the IBM PC	Larry E. Jordan Bruce Churchill	0-89303-385-5	Brady,1983
Networking IBM PCs (2nd Edition)	Michael Durr	0-88022-271-9	Que Corp.,1987
PC LAN Primer	The Waite Group	0-672-22448-8	Waite Group,1986
The Well-Connected Macintosh: An Overview of Desktop Communications	Tony Bove Cheryl Rhodes	0-15-695666-7	Harcourt Brace Jovanovich Inc., 1987
Inside NETBIOS	J. Scott Haugdahl	0-939405-01-6	Architecture Technology Corp.,1986
Network Performance and Management			
Communications Network Management	Kornel Terplan	0-13-153065-8	Prentice Hall,1987
Performance Analysis of Local Computer Networks	Joseph Hammond Peter J.P. O'Reilly	0-201-11530-1	Addison-Wesley, 1986
Design and Analysis of Computer Communications Networks	Vijay Ahuja	0-07-Y66161-8	McGraw Hill,1985
A Computer and Communications Network Performance Analysis Primer	B.W. Stuck	0-13-163981-1	Prentice Hall,1984
Electronic Mail			
E-Mail	Stephen A. Caswell	0-89006-303-6	Gage Educational Publishers,1988
The Complete MCI Mail Handbook	Stephen Manes	0-553-34587-7	Bantam,1988
Electronic Mail and Message Systems Technical and Policy Perspectives	Robert E. Kahn Albert Vezza Alexander D. Roth	AFIPS document	
Miscellaneous			
SNA: IBM's Networking Solution	James Martin Kathleen Chapman	0-13-815143-1	Prentice Hall,1987
Optical Fiber Systems: Technology, Design & Applications	Charles K. Kao	0-07-033277-0	McGraw Hill,1982
Technician's Guide to Fiber Optics	Donald Sterling Jr.	0-8273-2612-2	Delmar Publishers,1987
Protecting Information on Local Area Networks	James A. Schweitzer	0-409-90138-5	Butterworth,1988
Packet Switching Tomorrow's Communications Today	Roy D. Rosner	0-534-97965-3	Lifetime Learning Publications,1982
Internetworking Computer Systems	John McConnell	0-13-473976-0	Prentice Hall,1988
Networks for the 1990s	Ray Reardon	0-470-21026-5	Online,1988
Data Communications for Programmers	Michael Purser	0-201-12918-3	Addison-Wesley,1986
Inside SAA, IBM's Strategic Architecture	J. Scott Haugdahl	0-939405-03-2	Architecture Technology Corp.,1987
Introduction to the X Window System	Oliver Jones	0-13-499997-5	Prentice Hall,1988
X Window System, C Library and Protocol Reference	Robert W. Scheifler James Gettys Ron Newman	1-55558-012-2	MIT and Digital Equipment Corp., 1988

technical information in a readable form.

DECnet — There's no thorough, documented reference on DECnet, although at least one is in progress. None of the suggested books contains an in-depth technical analysis of DECnet. But they do provide in-depth information into parts of DECnet as implemented on the VAX/VMS architecture.

A new subject to many, and an important subject for all networks, OSI is here to stay.

The Digital Network Architecture functional specifications (available from the Software Documentation Directory) are of use to networking people, but don't expect to learn much if you aren't already familiar with DECnet.

Open Systems Interconnect (OSI) — A new subject to many, and an important subject for all networks, OSI is here to stay. Because many networking vendors promise customers the miracle of OSI in their lifetimes, it's a smart idea to learn OSI as soon as possible.

General LANs — There seem to be more books on LANs than any other network subject, but many of them are overviews of LAN technologies. If you're looking for such information, try this list.

Ethernet/802.3 LANs — I put the Ethernet/802.3 LAN books in a separate category because many DEC sites have Ethernet/802.3 and because specific texts are available. Most of these books are fairly current and provide good information on the technology.

Although *Broadband Network Technology* doesn't address Ethernet specifically, it explains the concepts of

broadband very well and is must reading for information on broadband Ethernet/802.3 networks.

Personal Computer Networking (PC/PS/Mac) — Although most PC/PS and Mac networks use the same network hardware technologies as most other LAN architectures, these books go into more depth on the subject of microcomputer networks and products to assist in such endeavors.

Network Performance and Management — Don't tackle this group of books unless you love statistics and esoterica. These books aren't for the weak of heart, but after you wade through them, you may find some enlightenment.

Electronic Mail — Although electronic mail is a popular subject these days, finding information on how e-mail works and locating information on subjects such as X.400 is difficult and time consuming. Try these volumes.

Miscellaneous — These books don't fit in a well-defined category, but they're good to have around for reference or light reading before bed. ■

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THE MAC CONNECTION

Al Cini

GatorBox: An Intelligent Network Gateway

Featuring a 10-MHz Motorola 68000 CPU chip and 1 MB of dynamic RAM, the GatorBox intelligent network bridge, from Cayman Systems of Cambridge, Massachusetts, packs more raw computing power than some of the PCs, workstations and servers that use it. Designed to stand vertically on a table or desktop, the GatorBox is about the same shape and size as a pack of duplicator bond paper.

On the front of the GatorBox, you'll find nothing more than a couple of function status lights and the vendor's logo. The back of the unit presents three network ports: a circular-8 serial port, a circular-8 LocalTalk (Apple's twisted-pair LAN) network port and your choice of either a BNC (ThinWire) or DB-15 (ThickWire) Ethernet connector.

The GatorBox operates in total silence (vents in the top and bottom of its case cool the unit chimney-style, without a fan). And, while standing unobtrusively alongside your Mac, the GatorBox does some remarkable things over your Ethernet/LocalTalk network.

Triple Threat

A GatorBox can be configured to perform three network functions: it can act as a gateway between AppleTalk and TCP/IP communications protocols; it can function as an AppleTalk network bridge between a LocalTalk and an Ethernet network; and it can deliver UNIX-style Network File Services (NFS) to a Mac client running Apple's AppleShare workstation software. Before discussing these functions, let's review a few networking basics.

Hundreds of corporations, universities and U.S. government installations are networked using a family of communications protocols developed almost 20 years ago to promote the interconnection of multivendor computer devices. Transmission Control Protocol/Internet Protocol (TCP/IP) today supports several common services on a wide variety of computer platforms. These include Telnet, which allows a user at a TCP/IP workstation "client" to log onto a TCP/IP computer "server" over the network, and NFS, which enables a workstation client user to access the disk files of a networked NFS server system as though it were a locally connected hard disk.

> ***". . . the GatorBox does some remarkable things over your Ethernet/LocalTalk network."***

During the last several years, communications protocols similar in function to TCP/IP have been developed by a number of vendors, including products such as DEC's DECnet and Apple's AppleTalk. A specific service available through AppleTalk is AppleShare. Like NFS, AppleShare allows a networked Mac client system to access the disk files resident in a server computer — either a dedicated Mac running AppleShare server software or a VAX/VMS system running AlisaShare or PacerShare — as though it were a locally connected disk.

With just a general familiarity with the underlying network technology, it's easy to understand where a GatorBox fits into the TCP/IP and AppleTalk networking worlds.

The GatorBox In Action

Using a public-domain standard called MacIP, a Mac in a TCP/IP network equipped with the client ends of applications such as Telnet and NFS will wrap its TCP/IP communications packets within Apple's Datagram Delivery Protocol (DDP) packets before issuing them over its LocalTalk LAN wiring. A GatorBox connected to the same LocalTalk LAN and configured as a TCP/IP gateway will peel away the AppleTalk datagram packet information, exposing the TCP/IP packet within.

If the TCP/IP packet is addressed to a TCP/IP network device outside the LocalTalk network, the GatorBox will forward the packet as a User Datagram Protocol (UDP) packet through its Ethernet interface. In this case, the communications protocols and device addressing scheme between the client and the server are TCP/IP. With a little low-level packet translation, the GatorBox simply routes the TCP/IP packets between the LocalTalk and Ethernet wiring media. This permits a Mac user to take advantage of any Telnet or NFS services that might be available on the TCP/IP network.

Similarly, in an AppleTalk-only internetwork consisting of LocalTalk and Ethernet wiring, a GatorBox can be configured as an AppleTalk bridge and will forward packets between Ethernet- and LocalTalk-connected AppleTalk clients and servers. The communications protocol exchanged between the clients

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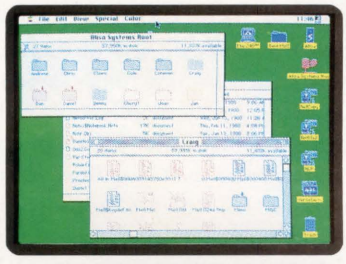

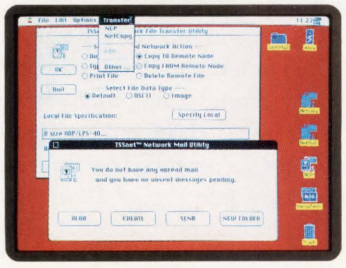

For more details, call or write to Alisa, the originators of Mac-to-VAX connectivity software.

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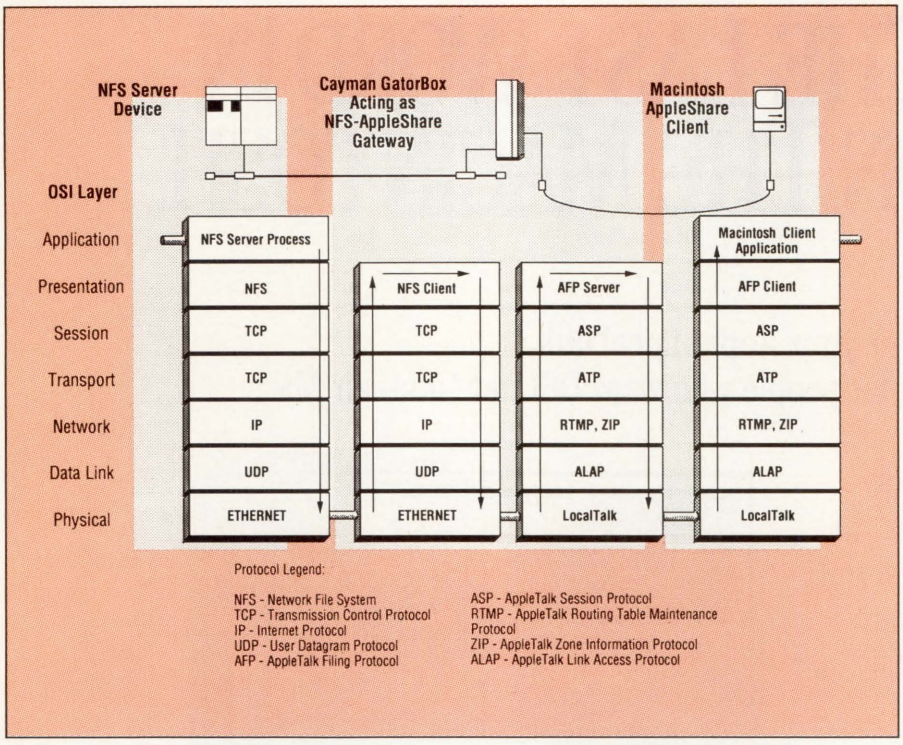


Figure 1: Using the seven-layer OSI network model as a frame of reference, the GatorBox simultaneously appears as a "client" to an NFS server (left center column) and as a "server" to an AppleShare (AFP) client (right center column).

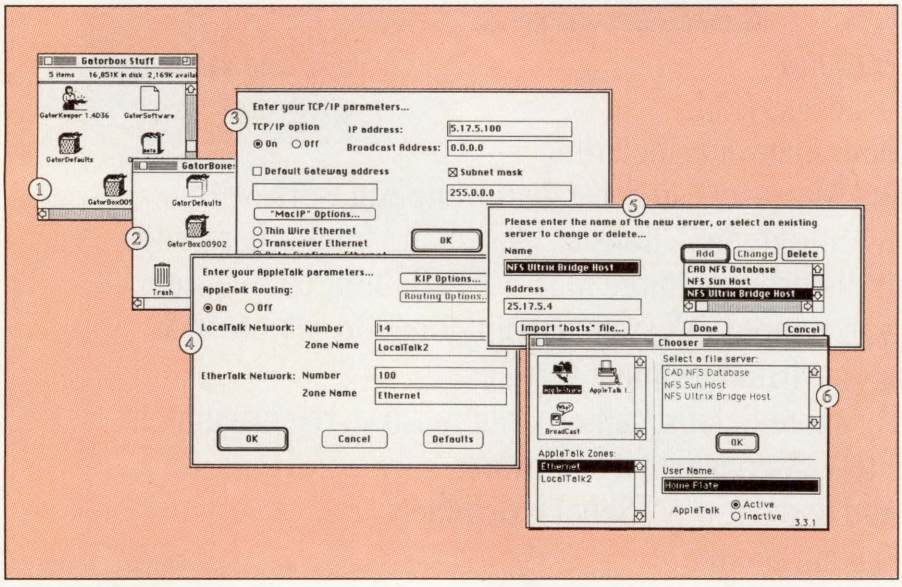


Figure 2: The steps of GatorBox configuration. Vendor-supplied GatorKeeper Mac application (1) offers icons for each networked GatorBox (2) on its desktop. The GatorBox then can be configured in a TCP/IP (3) and an AppleTalk (4) Network to allow NFS file servers in the TCP/IP network (5) to appear as AppleShare servers to Mac users on the AppleTalk network (6).

and servers in this scenario is AppleTalk. The GatorBox simply routes AppleTalk-addressed packets from/to LocalTalk devices and to/from Ethernet devices.

The current version of the GatorBox's internal software supports the Kinetics Internet Protocol (KIP), in which two GatorBoxes (or a GatorBox and a Kinetics FastPath) can cooperate to use a TCP/IP virtual circuit as a tunnel through which AppleTalk packets can be passed. This feature potentially can enable a Mac in Florida to speak AppleTalk with a Mac in California by way of a TCP/IP network in between. Used in pairs, future versions of the GatorBox's software will support a similar remote bridging scheme using the devices' serial ports and standard asynchronous lines between them, like the Hayes InterBridge.

Things become a bit more interesting in a hybrid network consisting of TCP/IP and AppleTalk nodes. This is where the GatorBox is perhaps most useful. Configured as an NFS server access gateway, the GatorBox simultaneously looks like an NFS client to an NFS server and like an AppleShare server to an AppleShare client. This makes it possible for a Mac running unmodified Apple-supplied AppleShare software to see an NFS server in the TCP/IP network as though it were an AppleShare server (see Figure 1).

Educating GatorBox

A GatorBox can't do any of this until its owner teaches it how. The GatorBox comes with a Mac application called GatorKeeper that's used to teach, control and activate the GatorBoxes in the network. A file called GatorSoftware, supplied with GatorKeeper, contains the GatorBox's operating software.

The version of GatorKeeper we tested was still under development. We had to overcome a few bugs, but the user interface is clean and straightforward. GatorKeeper presents you with its own desktop (see Figure 2), including icons corresponding to the GatorBoxes

in your network. To define or change a GatorBox's configuration parameters, you simply double-click the corresponding icon using the mouse. Alternatively, the GatorBox Defaults icon can be dragged with the mouse over a GatorBox icon to set its parameters to standard settings appropriate in your network.

GatorKeeper leads you through a series of configuration dialogs. GatorBox configuration requires some technical knowledge of TCP/IP and/or AppleTalk network addressing. (GatorBox functions are optional. If you don't want the TCP/IP bridging function, for example, you can turn it off and forget about it). Further, it isn't a plug-and-play device. Before you run GatorKeeper, you'll want to familiarize yourself with the technical aspects of the network environment in which you intend to use it.

After a GatorBox configuration database has been created on a Mac using GatorKeeper, the network parameters and the GatorSoftware program file must be downloaded into the GatorBox, using GatorKeeper's Restart GatorBoxes function. The downloading process takes about two minutes and can be monitored in GatorKeeper's status window (see Figure 3).

Unfortunately, the GatorBox's dynamic RAM can't survive a power failure. On power-up, a GatorBox needs to be downloaded to function. For this purpose, either a Mac running the GatorKeeper software must be kept online at all times, which is very inconvenient, or, if a UNIX system is available, it can download the configuration data-

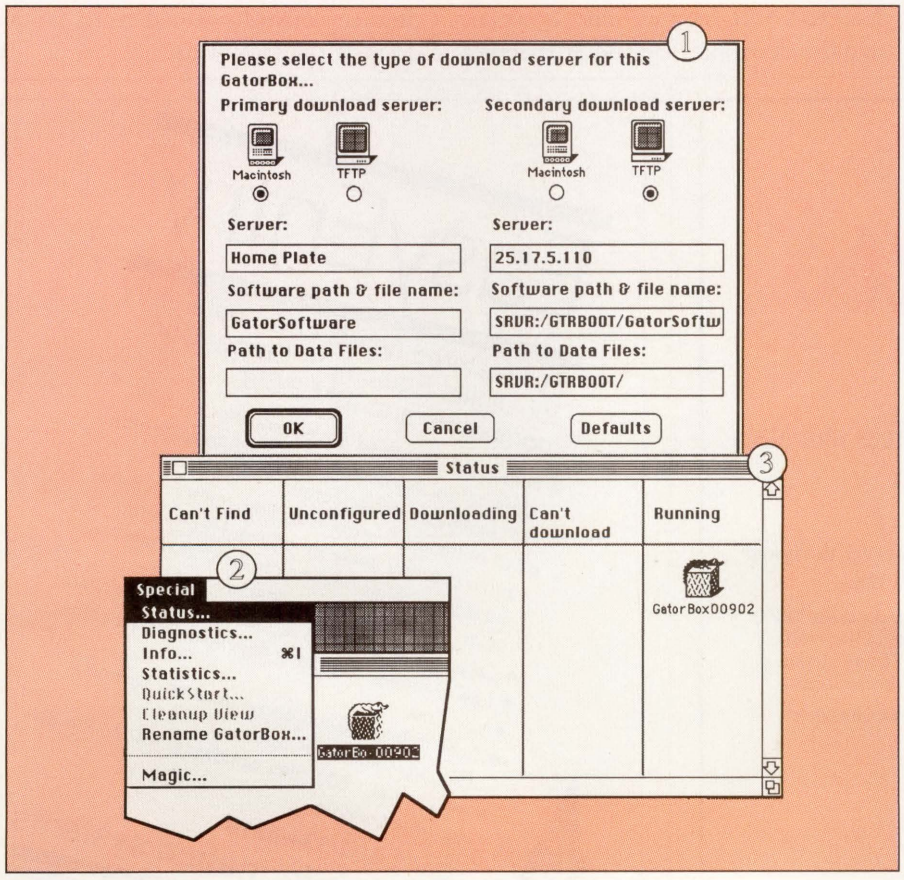
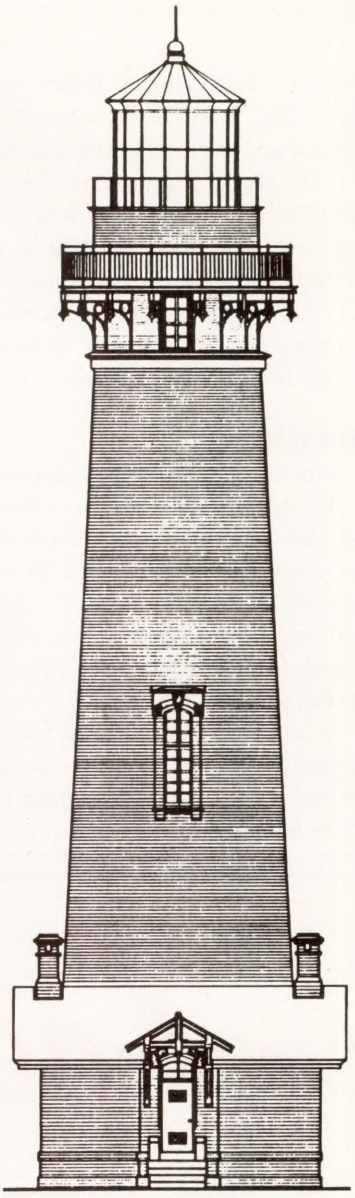


Figure 3: On power-up, GatorBox configuration information and operating software are "downloaded" from a designated Mac or TCP/IP TFTP "host" (1). A GatorBox can be observed through the GatorKeeper Mac application (2), which reports device status and diagnostic information through windows (3).



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base and GatorBox software using Trivial File Transfer Protocol (TFTP), which is preferable. GatorKeeper allows you to teach your GatorBox the name/address of a primary and secondary download server system in your network. The GatorBox will remember this information and on power-up automatically will ask the designated devices for the files it needs.

Packaging

In general, the GatorBox manual is nicely organized and easy to follow. It includes enough technical detail to let you configure the GatorBox in all its network modes. The manual's Quick-Start guide, however, isn't detailed enough to show a new user how to get a GatorBox on-line.

The GatorBox comes with an AppleShare workstation installer diskette and a diskette containing NCSA Telnet Macintosh client software.

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USED SIMPLY AS AN AppleTalk bridge between a LocalTalk and an Ethernet network, the GatorBox isn't as cost effective as similar alternatives from other vendors. The GatorBox's high-level NFS bridging capability, however, and the electronic mail and print server functions planned by Cayman for a future release of GatorSoftware can really pay off in a hybrid AppleTalk-TCP/IP network. Organizations with Macs on their desktops and NFS servers in their networks should take a serious look at the GatorBox. ■

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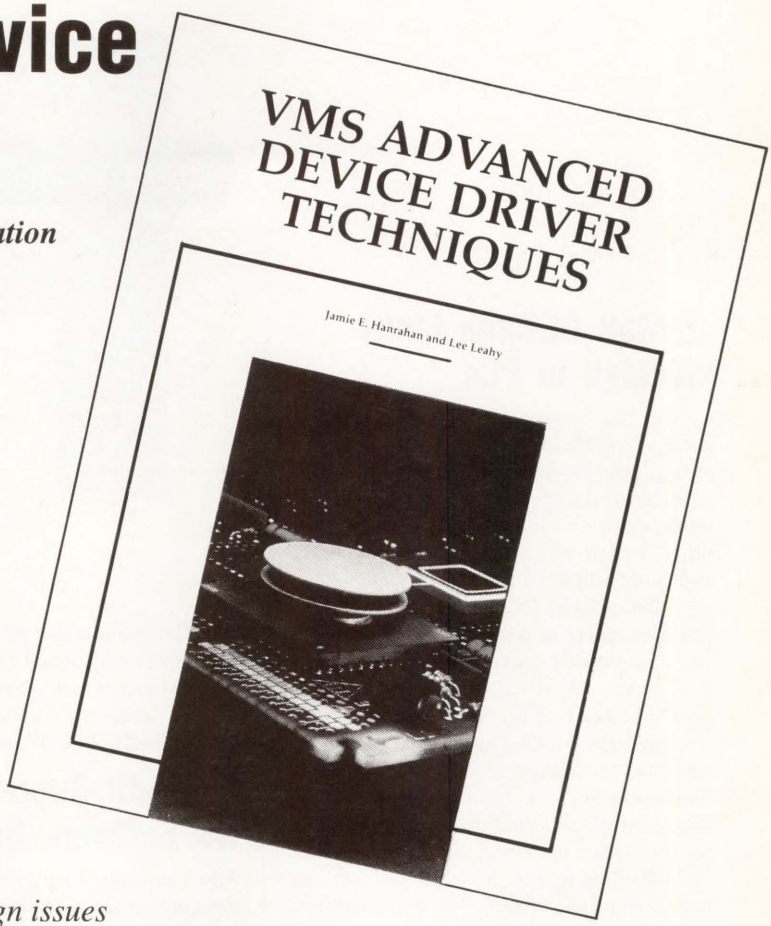

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cc:Mail DEClink Links VAXMail to PCs

cc:Mail Inc. announced cc:Mail DEClink, a gateway to DEC e-mail systems. Like other cc:Mail gateways, the DEC gateway product schedules and automatically establishes communication links. It exchanges messages with other cc:Mail post offices on the same LAN and with bridged LANs.

The cc:Mail DEClink gateway allows text messages to be communicated seamlessly and transparently between VAXMail and any Mac or any MS-DOS- or OS/2-based PC on the cc:Mail LAN. ALL-IN-1 users can send and receive files and text messages to and from cc:Mail users. The software accommodates network environments of thousands of users. cc:Mail DEClink users can connect to the same networks and use existing cc:Mail components, including post offices, user directories, mailing lists and gateways, without modifications.

cc:Mail DEClink is priced from about $2,500 to about $3,000 per network.
To find out more, contact Monty Swiryn, cc:Mail Inc., 385 Sherman Ave., Palo Alto, CA 94306; (415) 321-0430.

Circle 441 on reader card

CA-SuperImage/VAX Uses DECwindows Interface

Computer Associates International Inc. announced CA-SuperImage/VAX, a graphics editing and drawing system for the VAX/VMS environment. CA-SuperImage/-VAX provides an interactive medium for creating and enhancing presentation graphics through the DECwindows interface.

CA-SuperImage/VAX enables graphics artists and application developers to create illustrations through freehand drawing, digitilization of objects, import of graphics images, industry-based clip-art symbols, or high-quality backdrops. It provides flexible editing capabilities and supports features such as object mirroring, step-and-repeat functions, grid snapping, and object and point editing. It supports the VAX 2xxx, 3xxx and GPX workstations and more that 300 graphics output devices, including terminals, plotters, laser printers and film recorders.

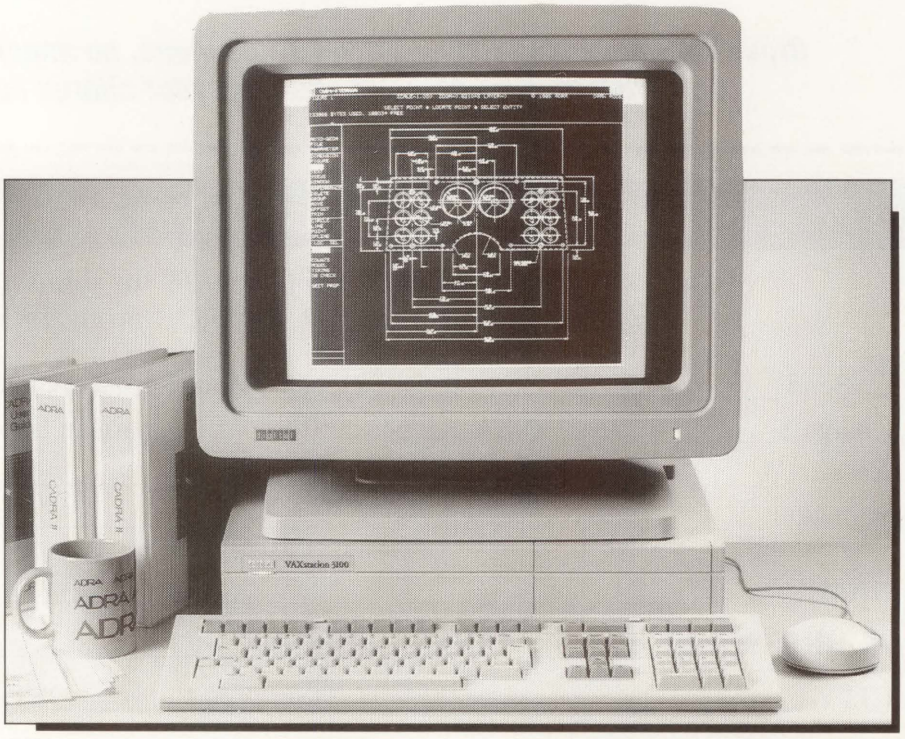
The product is priced at $2,800.
To learn more, contact Susan D'Elia, Computer Associates Int'l Inc., 711 Stewart Ave., Garden City, NY 11530; (516) 227-3300.

Circle 442 on reader card

Cadra-III Supports NC Software Options

Adra Systems Inc. announced Cadra-III design/drafting software. Cadra-III supersedes Cadra-II version 6.0. It enhances and extends Cadra's mechanical design and drafting capabilities, supports many numerical control (NC) software options and allows engineers to design in 3-D using Adra's 3-D modeling module.

The software is available with Adra's response-optimized 3000-Plus workstation and Acclaim! PC/CAD system. It also runs on industry-standard platforms from DEC, Sun, Apollo and Tektronix, as well as on 80386-based workstations. It features multiple independently scalable views; drawing annotation; multiple dimensioning standards, including ANSI, ISO, DIN, BSI and JIS; and bidirectional compatibility with other CAD/CAM systems using IGES, DXF and direct data translators. It can be configured with an optional 3-D modeling module. Complementary Cadra-NC software includes packages for 2- through 5-axis NC programming, postprocessing and NC toolpath verification.
To learn more, contact Kathy Riccardi, Adra



Adra Systems Inc.'s Cadra-III design/drafting software.

Digital Products

■ DEC enhanced its portfolio of network services. DEC's Local Area Interconnect Service (LAIS) includes improved support for customers' local configurations of cable plant and interconnect hardware. An on-line database maintains an inventory of customers' cable plants and the interconnect hardware that makes up the network transport system.

DEC's reduced-cost, enhanced Wide Area Interconnect Service (WAIS) includes an alarm that monitors circuit characteristics. The alarm provides DEC's centralized network specialists automatic notification of failed or degraded circuits on the WAN.

LAIS is priced at $300 per month. WAIS is priced at $289 per month for each wide area link.

■ DEC introduced DECforms software, a set of development tools and run-time services that help application developers create fixed-format user interfaces. DECforms is the VMS implementation of the proposed ANSI/ISO standard for a Form Interface Management System (FIMS). It supports VT-series terminals and compatible PC and workstation terminal emulators.

DECforms incorporates VAX FMS and VAX TDMS software while adding many features and tools. These include a flexible Forms Development Environment for creating forms, a Panel Editor that lets you create graphic form elements in an interactive WYSIWYG fashion, Independent Form Description Language (IFDL), and an IFDL translator.

The price for a DECforms license for customers without VAX FMS or VAX TDMS licenses ranges from $1,285 for a VAXstation to $22,620 for a VAX 6220.

■ DEC announced the inclusion of the Rdb Runtime license with the VMS operating system. Rdb Runtime software lets you run applications based on Rdb at sites not requiring a full development license. Those using VMS V4.7 or later automatically will receive an Rdb Runtime license.

The change in Rdb licensing will make it economical for DEC customers to distribute their internally developed applications throughout their organizations. The licensing also will benefit ISVs that layer their front-end tools and applications on Rdb/VMS.

■ DEC enhanced several tools that support the DEC CASE environment.

1. VAX CDD/Plus V4.1 adds support for the VAX COBOL Generator and VAX DBMS to help programmers track the development of complex applications.
2. VAX COBOL Generator V1.3 features enhanced integration with VAX CDD/Plus and Rdb/VMS. This integration increases programming consistency, reduces redundant effort and speeds the development of data processing applications.
3. VAX Notes V2 supports a DECwindows-based user interface. It also supports CDA.
4. VAX OPS5 V3 provides a DECwindows-based environment that runs on standalone VAXstations or in client/server mode.

For more information, contact your local DEC sales office or call 1-800-DIGITAL.

Systems Inc., 59 Technology Dr., Lowell, MA 01851; (508) 937-3700.

Circle 436 on reader card

Quantum PM Monitors VAX Performance

Computer Information Systems Inc. announced Quantum PM version 2.0. Quantum PM is VAX performance-monitoring software that operates on single CPUs, in VAXclusters and in DECnet networks running all versions of VMS.

Quantum PM collects statistics directly from VMS, including all SYSGEN parameters and more that 150 dynamic and configuration statistics. User-defined statistics can be included in the collection, as well as configuration, CPU, I/O, memory and disk statistics. The set of data to be collected and the frequency of the collection is defined by the user. The disk data collection function can collect disk utilization and fragmentation statistics from any disks available on the local node. The information can be stored in a single collection file or optionally maintained on a one-file-per-disk basis. A collection also can run from multiple nodes, and multiple collections can be run simultaneously.

To learn more, contact R. Stephen Lilly, Computer Information Systems Inc., 165 Bay State Dr., Braintree, MA 02184; (617) 848-7515.

Circle 443 on reader card

Peritek Announces VCW-Q For Q-bus

Peritek Corporation announced the VCW-Q, a Q-bus-compatible color display controller. It supports medium resolution (640 x 512) requirements, providing one or two independent channels. The VCW-Q is available in a variety of configurations, including 4- and 8-bit graphics with or without color alphanumeric overlay and 8-bit graphics with 8-bit alpha. Depending on the VCW model, one or two graphics cursors are available.

A high-performance Advanced CRT Controller (ACRTC) supplies 23 on-board graphics primitives and flexible timing parameter control. Raw drawing speed is in excess of 2 million logical pixels per second. The alpha channel has 8k words (two pages) of display memory. The VCW-Q is contained on a single dual-height Q-bus board. It's compatible with the full line of Q-bus-based DEC computers, from the LSI-11/23 through the MicroVAX 3600. Support is available for VMS, ULTRIX and RT/RSX/TSX.

Pricing for the VCW-Q begins at $1,700.

Learn more by contacting Peritek Corp., 5550 Redwood Rd., Oakland, CA 94619; (415) 531-6500.

Circle 449 on reader card

Adaptor Makes PC/AT Compatible With Q-bus

Bit 3 Computer Corporation announced an IBM PC/AT-to-Q-bus Adaptor that makes the PC/AT appear as a bus master processor on the Q-bus. Because the Adaptor makes the PC/AT compatible with the Q-bus, you have the full resources of the PC/AT to use as a bus master in PDP/LSI and MicroVAX Q-bus applications.

Random access read/writes are transferred from the PC/AT to the Q-bus for memory and I/O cycles. Interrupts are supported, and MicroVAX VMS software support is available. The Adaptor consists of two printed circuit cards. One fits inside the PC/AT, the other fits inside a Q-bus card

cage. The PC/AT can be used as the bus master or as one of several bus masters in a multiprocessor Q-bus application. Both byte and word transfers are supported. Parity is provided on address, control and data. Cables to 25 feet and Long Line Driver Modules that permit cable lengths to 300 feet are available.

The Adaptor is priced at $2,495.

Find out more by contacting Philip M. Vukovic, Bit 3 Computer Corp., 8120 Penn Ave. S., Minneapolis, MN 55431; (612) 881-9674.

Circle 438 on reader card

SPX/SI Connects VAX To SPX Network

Network Equipment Technologies Inc. announced the SPX/SI Software Interface. It connects VAX/VMS hosts to an SPX network, providing asynchronous terminal-to-host connectivity for LANs and WANs.

The SPX/SI installs on any VAX/VMS processor and shares the host's standard Ethernet controller. The SPX/SI enhances Network Equipments' data networking capabilities. The framework for those capabilities is the SPX/Series 2000 family of networking multiplexers. Network Equipment's SPX protocol is designed for use over both Ethernet and leased lines to connect delay-sensitive asynchronous terminals to remote hosts. The SPX/SI provides LAT functionality, such as multiple sessions, printer spooling and host selection. It offers flow control and signalling capability, enabling multivendor host support. The interface provides up to 256 host connections into the SPX network.

The SPX/SI Software Interface is priced from $1,295 to $3,995, depending on configuration.

For more information, contact Network Equipment Technologies Inc., 800 Saginaw Dr., Redwood City, CA 94063; (415) 366-4400.

Circle 480 on reader card

DB-Mach2 Released As Standalone Engine

National Information Systems Inc. announced its RDBMS, DB-Mach2, as a standalone database engine. Until now, it was bundled with the Accent R 4GL.

DB-Mach2 was designed based on a hybrid of the relational data model that enables it to seamlessly support RMS files, arrays, multiple record types, unlimited views and other high-performance features within the open database architecture of Accent R. DB-Mach2 processes data management functions via interactive commands, stored command procedures, the 4GL and the Host Language Interface (HLI). Table definitions are stored within the Accent R database library, so they're accessible from any database server supported by Accent R. Therefore, DB-Mach2 supports applications that are difficult to develop with traditional SQL-only relational database products.

DB-Mach2 is priced between $1,320 on the VAXstation 3100 and $43,360 on the VAX 6360. Accent R and HLI are available separately.

Find out more by contacting Dave Wagner, National Information Systems Inc., 1190 Saratoga Ave., San Jose, CA 95129; (408) 985-7100.

Circle 481 on reader card

MasterDisk/SDI Connects To DSA Controllers

American Digital Systems Inc. announced the MasterDisk/SDI series of disk-drive storage

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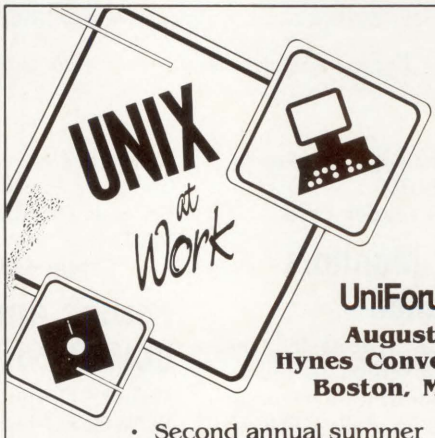

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With WINDOW you can create sessions on demand for as many applications as you want to work with. And quickly switch from program to program with a single keystroke.

With WINDOW the power and utility of the DEC VAX/VMS system is magnified. And for the first time, the terminal can do what you do—several things at once.

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Now that's productivity!

More windows. More power. And Macros.

WINDOW lets you leave one session and jump to another. Then jump back. In an instant. WINDOW keeps track of the activity in each session and refreshes your screen to the most up-to-date display for that job.

In the WINDOW environment, you can capture screens from several different programs. Collect, combine, edit it all in one place. Or print it to a file for later viewing.

On top of that, you have macro capability too. So you can shrink those long, complex or repetitive sequences to a single defined keystroke.

The whole process is easy, swift, and natural.

Until you've worked with WINDOW, you won't imagine the productivity that lurks within your terminal. Or the beautiful view away from the sprawl of terminal clutter.

Do more work, more kinds of work, and do it faster. Find out more about the new visions your present terminal can have by giving us a call at

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CIRCLE 104 ON READER CARD

*note: WINDOW also works in the ALL-IN-1 environment. WINDOW is a trademark of Clyde, Inc., dba Clyde Digital Systems. All other brand and product names are trademarks or registered trademarks of their respective companies. © 1989 Clyde, Inc.

Remember how computers remembered? Mercury delay lines? Punched cards with 90 columns and round holes? Hand-wired magnetic cores? In case your memory needs refreshing, The Computer Museum would like to share its memories with you.

The Computer Museum Memory Poster
We have created a limited edition, 20″x32″ poster of the picture shown below. Printed in full-color, it includes an identification key to help you recall the memories you've forgotten. To get your poster, along with an information kit on museum membership, exhibits and activities, send a tax-deductible contribution of $25 or more to:
Memory Poster, The Computer Museum,
300 Congress Street, Museum Wharf,
Boston, MA 02210.
Please allow six weeks for delivery.

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Located on Museum Wharf
300 Congress Street, Boston, MA 02210
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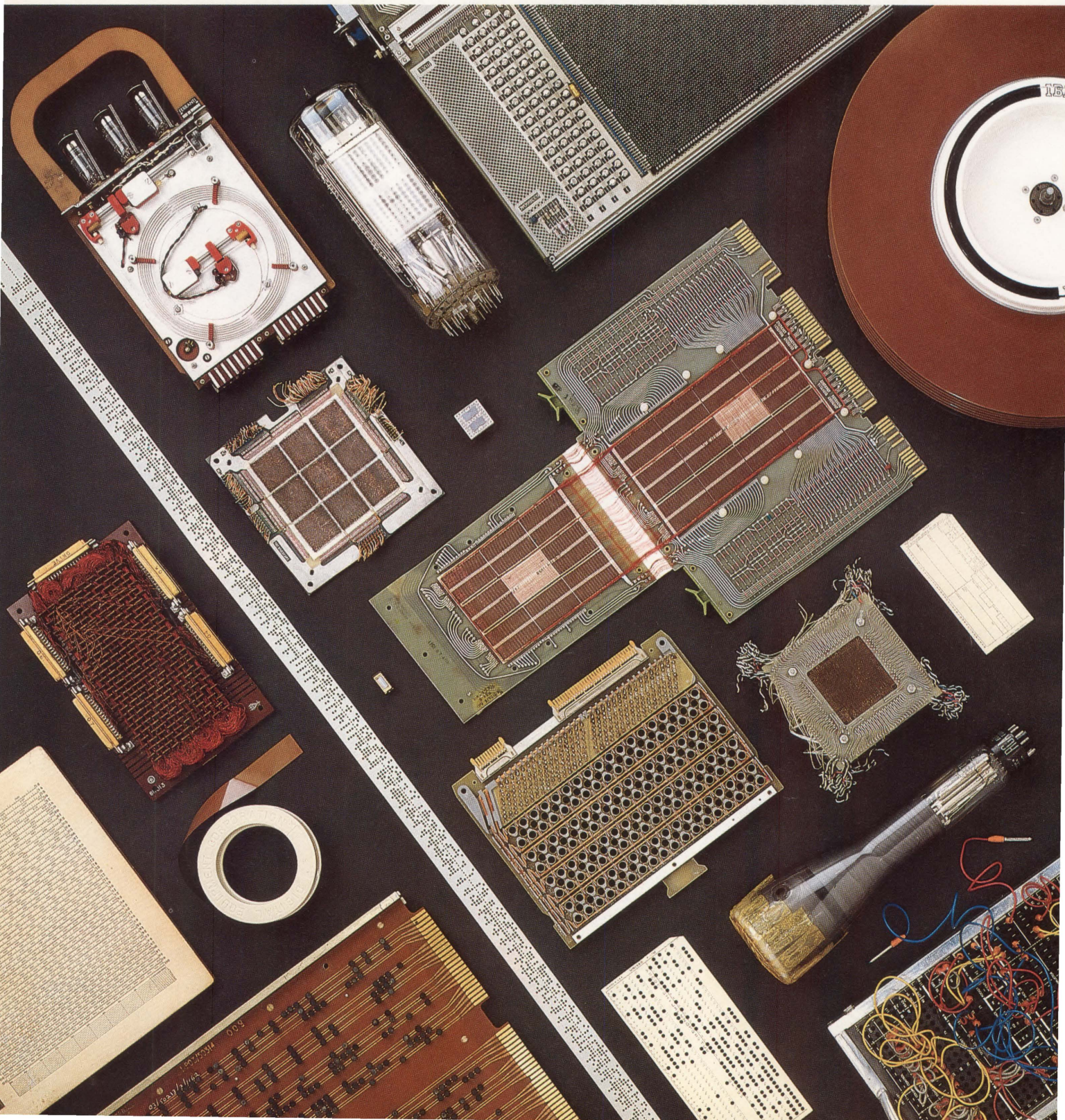
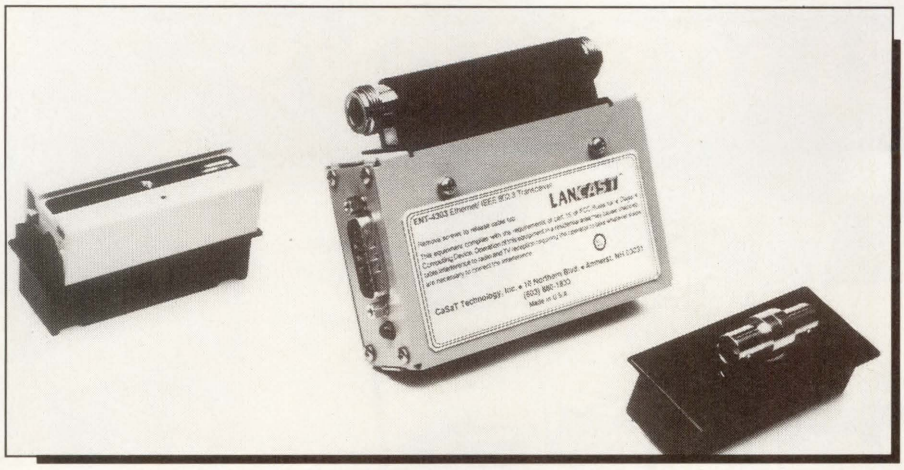
Special thanks to this publication, Scitex America Corp. (color separations), Grafik Communications, Ltd. (design), David Sharpe Studio (photography) and VM Software, Inc. (poster).





CaSaT Technology Inc.'s Model ENT-4303 transceiver.

systems. The series is compatible with all VAXs, including the VAX 8xxx series and VAXclusters, and emulates DEC's Standard Drive Interface (SDI).

MasterDisk/SDI connects to any of DEC's DSA controllers. It uses industry-standard ESDI and SMD drives, providing the high-performance capabilities of these drives while emulating an RA-series drive. It features an average seek time of 14 ms and an average access time of 22.3 ms, about 40 percent faster than standard RA drives. More than 10 GB of storage fit into a single 40-inch rack, requiring 22 cubic feet of space.

Prices range from $14,140 for a 137-MB system to $285,600 for a 16.6-GB single-cabinet system. System prices include drive, interface board, cables, cabinet, diagnostics, documentation, installation toolkit, a two-year warranty and unlimited technical support.

For more information, contact Roberta G. Shoaf-Enge, American Digital Systems Inc., 75 Union Ave., Sudbury, MA 01776; (508) 443-7711.

Circle 437 on reader card

ENT-4303 Improves Network Operation

CaSaT Technology Inc. announced an IEEE 802.3 Ethernet transceiver. The Model ENT-4303 transceiver is the first of the company's LANCAST products, a line of collision-avoidance circuits that provide improved network operation. The transceiver is fully compliant with the IEEE 802.3 medium attachment unit (MAU) specification. It's supplied with a choice of three different industry-standard cable taps for use with a variety of network cabling schemes.

The Model ENT-4303 transceiver is packaged in a metal enclosure. It meets FCC Class A requirements and is UL listed. CaSaT will introduce a line of products that will service media-related applications.

The Model ENT-4303 transceiver is priced at $265.

For more information, contact CaSaT Technology Inc., 10 Northern Blvd., Amherst, MA 03031; (803) 880-1833.

Circle 440 on reader card

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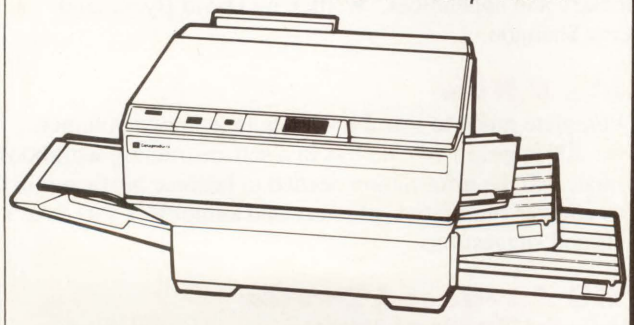

Standard with 3 megabytes of memory, both an RS-232 and a Centronics interface, 34 resident fonts, 750 page capacity,* 11" by 17" paper handling capacity and a one year warranty, the **LZR 2655LN** is the most cost effective laser available to the DEC market.

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VAX Professional – The Technical Journal for VMS Systems

This paid-subscription, bimonthly publication is the only technical journal dedicated solely to users of VAX/VMS. Subscriptions include access to an on-line bulletin board, programming models and program down-loads, systems information and practical articles on software applications.

DEC Professional

DEC Professional is the only magazine serving DEC computing professionals. And it's the only publication of any kind offering DEC computing professionals solutions-oriented editorial, hard-hitting commentary, the on-line bulletin board, ARIS/BB, and fact-filled product reviews that help simplify the jobs of the 95,000+ subscribers who receive the magazine free of charge.

MIDRANGE Systems – The Independent Newspaper for IBM Multiuser Computing

The only high-quality, full-color tabloid serving IBM System/3X and AS/400 users, it's the free biweekly news source for 35,000 computing pros who use and buy IBM midrange equipment. MIDRANGE Systems provides timely information on industry news and trends, new products, hardware and software, plus how-to features and more.

Introduction to VAX/VMS, Second Edition

This self-teaching text explains and illustrates how to use VAX/VMS systems. Easy to learn for the computing novice ... an excellent reference for VAX/VMS pros. Covers the basics and teaches systems and programming as well, plus glossary and appendices. Written by David Bynon and Terry Shannon.

Let's C Now

A complete guide to learning C language in two volumes. Over 300 pages in 26 chapters in a self-instructing workbook format. All the information needed to become proficient in C. Plus chapter summaries, glossary and author Rex Jaeschke's hints and suggestions.

VMS Advanced Device Driver Techniques

A manual of step-by-step instructions on how to design, implement and debug device drivers for the VMS Version 5 operating system from two recognized experts in the field, Lee Leahy and Jamie Hanrahan. Covers simple VMS device drivers, full duplex and state machine-based drivers and VAX BI drivers, as well as advanced debugging strategies and techniques.

For More Information

Call (215) 542-7008 ■ FAX (215) 628-2845
or Write:
Professional Press
921 Bethlehem Pike ■ Spring House, PA ■ 19477

SAS Institute Enhances The SAS System

SAS Institute Inc. announced the SAS System version 6. Written in C, it implements the SAS System's Multivendor Architecture (MVA) strategy, an engineering design philosophy that makes the software a vendor-independent system. Three new components round out the PC product line.

SAS/ETS software is an econometric and time series analysis tool for forecasting, planning and financial modeling. It includes procedures for time series analysis, linear and non-linear systems simulation and loan amortization. SAS/QC software offers tools for statistical quality control and experimental design applications. It includes procedures for generating Shewhart, cumulative sum and moving average control charts. SAS/OR software is an operations research, project management and decision support tool. It handles general assignment problems and performs critical path analysis and linear programming.

The first-year license fee for SAS/ETS, SAS/OR or SAS/QC ranges from $395 for one workstation to $7,500 for 500 workstations.

Obtain more information by contacting Hilary Yeo, SAS Institute Inc., Box 8000, SAS Circle, Cary, NC 27511; (919) 467-8000.

Circle 450 on reader card

1st-Class Announces Fusion For The VAX

1st-Class Expert Systems Inc. announced 1st-Class Fusion for the VAX. This VMS version brings the expert system development capabilities of 1st-Class Fusion to the engineering workstation environment. It's well-suited for factories that depend heavily on the VAX architecture and that want to build and deliver systems to run on the factory floor.

The VAX version makes it easy to distribute centrally maintained knowledge bases and thus spread the benefits of expert systems throughout the manufacturing environment. 1st-Class Fusion is available on the VAX as well as on IBM PC, XT, AT and compatible PCs.

1st-Class Fusion is priced from $5,500. It includes free updates for registered users and toll-free telephone support.

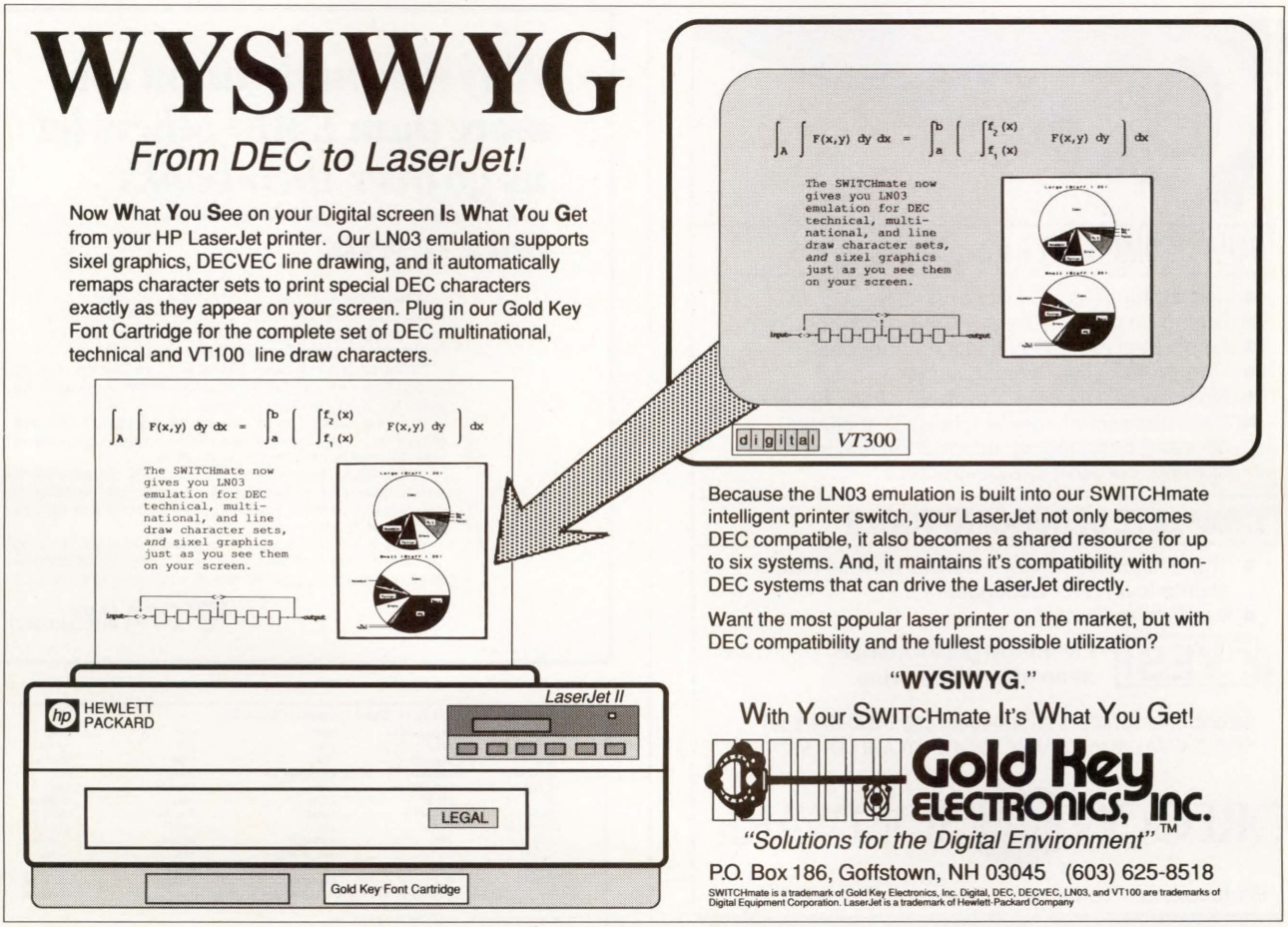
To find out more, contact Amy Metzenbaum, 1st-Class Expert Systems Inc., 526 Boston Post Rd., 150 E., Wayland, MA 01778; (508) 358-7722.

Circle 446 on reader card

DASnet Allows Transfer Among E-Mail Services

DA Systems Inc. announced a service that lets DASnet Service subscribers send binary or ASCII text files to users of e-mail systems linked by the DASnet Service. Subscribers can send files to users of ATT Mail, BIX, CONNECT, DASnet hosts, Dialcom hosts, Easylink, EIES, GeoMail hosts, INET, MCI Mail, The Meta Network, NWI, OnTyme, DASnet Accounts, PeaceNet/EcoNet hosts, Portal, The Source, Telemail hosts, TWICS, UNISON, UUCP, The WELL, Internet Domains, and organizations whose e-mail systems are linked via the DASnet Service.

On some systems, the service uses the host's file transfer mechanisms, user interface and security features. You receive a file in the same fashion as a file sent by another user within the system. Outgoing files add



CIRCLE 260 ON READER CARD

an intersystem code and address. On other systems, senders and recipients use a DA Systems software package that runs on their PCs prior to sending or after receiving a file. Subscribers can send files regardless of the DASnet file transfer implementation at the destination.

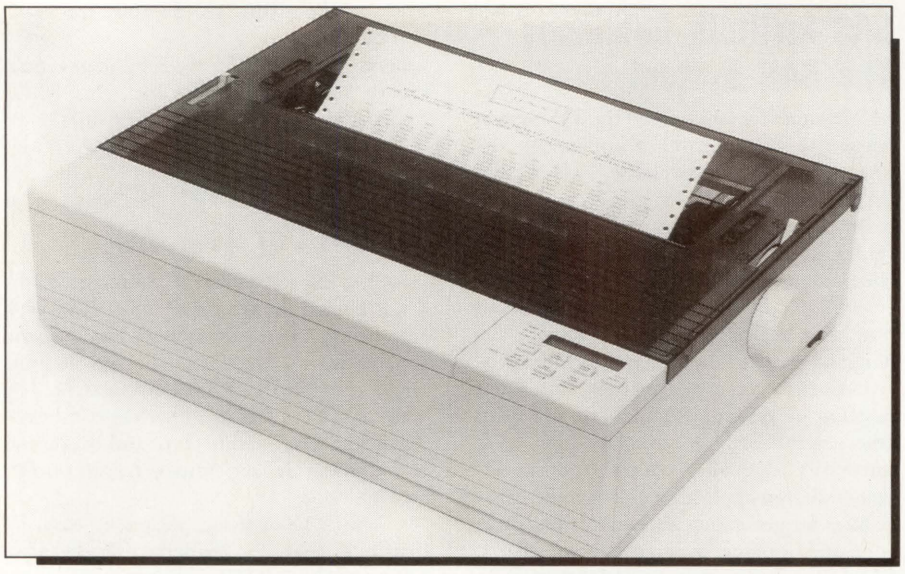
For complete details, contact Anna B. Lange, DA Systems Inc., 1503 E. Campbell Ave., Campbell, CA 95008; (408) 559-7434.

Circle 445 on reader card

CI-5000 Features Four Print Speeds

C.Itoh Electronics Inc. announced the ProWriter CI-5000 dot-matrix printer, which features four print speeds and three printer emulations. The ProWriter CI-5000 is the first of C.Itoh's 18-wire printers that compliments the 9- and 24-wire mono and color printers.

Compatible with the IBM ProPrinter XL, Epson FX-286e and DEC LA210/LA75/LA50 dot-matrix printers, the ProWriter CI-5000 prints in draft mode at 540 cps and 450 cps at 12 and 10 cpi respectively; 225 cps at 110 cpi in memo mode; 10 cps at 10 cpi in NLQ mode; and 73 cps at 10 cpi in LQ mode. Its 18-wire, high-resolution printhead, four speeds and 16-inch, 231-column carriage handle multipart forms, high-volume data processing, business graphics and bar codes. It lets you store and recall up to three task-specific printer setups for special printing jobs.



C.Itoh Electronics Inc.'s ProWriter CI-5000 dot-matrix printer.

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Find out more by contacting Marc Liebesman, C.Itoh Electronics Inc., 2505 McCabe Way, Irvine, CA 92714; (714) 660-1421.

Circle 439 on reader card

TEEM.NET Provides Terminal Emulation

Pericom Inc. announced TEEM.NET, providing Ethernet capabilities to its emulation software. Designed to let a single PC on a network function in the same way as a dedicated graphics or alphanumeric terminal over an Ethernet connection to a host, TEEM.NET emulates terminals from DEC, Tektronix, Retrographics and Data General.

TEEM.NET products support three networking protocols that allow IBM PCs or compatibles to participate in network communications: DECnet-DOS CTERM, DECnet-DOS LAT and TCP/IP. It lets you operate the PC as a terminal over an RS-232 interface. EGA, VGA and high-resolution versions of TEEM.NET include DEC VT220 and VT240 ReGIS; Tektronix 4105, 4207 and 4111; Retrographics VT640; and Data General D200. Site licenses tailored to a specific number of users are recommended for larger networks and can be installed on the PC file server.

Prices range from $249 for TEEM.NET 220 to $1,495 for TEEM.NET 11.

To find out more, contact Pericom Inc., 9 Princess Rd., Ste. D, Lawrenceville, NJ 08648; (609) 895-0404.

Circle 448 on reader card

LC1000/2000 Provide Filtered Power

IEPS Electronic Inc. announced a pair of power-line conditioners for use with PC LANs, minicomputers and peripheral devices such as laser printers. The LC1000 and LC2000 provide filtered power for equipment or clusters of equipment requiring 1,000 and 2,000 VA, respectively.

The LC1000/2000 feature a static shielded transformer design for isolation and protection against power-line noise. They're for use in applications in which electrical noise or current spikes might interfere with operation or corrupt data. They provide four isolation power outlets. Workstations, peripherals and file servers derive line power directly from the LC1000/2000, which remove hazardous voltage transients. An optional feature allows protection for telephone or data devices using RJ-11 connectors.

The LC1000 costs $600, the LC2000, $900. The telephone line/modem protection option costs $65.

For more information, contact IEPS Electronic Inc., 11391 Meadowglen, Ste. F, Houston, TX 77082; (713) 558-0010.

Circle 447 on reader card

Controllers Feature Fiber Optic Links

The Logical Company announced two fiber optic controllers for use in VAXs and PDP-11s. The BCU-1000 is a UNIBUS-compatible controller for use on the VAX and PDP-11. The BCQ-1000 is a Q-bus-compatible controller for use on the MicroVAX and MicroPDP-11. The products are designed to repeat, extend and convert the host's bus.

The BCU-1000 and BCQ-1000 can be

VAX Systems Managers

PC-VAX LINK USES ONLY 10K RAM

PC Users Access VAX Power

MAXLink™ is the new LAN software package for PC users operating on DEC VAX/VMS over Ethernet.

- **Centralize PC applications on the VAX** where multiple PC users can access and run their programs.
- **Excessive PC memory requirements are eliminated.** MAXLink uses less than 10K RAM memory! Other network packages typically require 100K or more on the PC.
- **Excessive VAX machine loading is cut by 80 percent.**

Print server, disk server, and backup/restore utility **now available.**

Call John Kelly
(313) 356-8811
Digital Area Networks™

VAX is a registered trademark of Digital Equipment Corp.

CIRCLE 316 ON READER CARD

used as bus repeaters to expand the drive capability of a computer's bus and ensure reliable operation. They provide additional drive capability comparable to the computer's drive capability. They also extend the computer bus beyond the typical 50-foot limit to let peripheral equipment be placed 1 km away. They allow the UNIBUS and Q-bus to be interconnected, thus providing them with a method to communicate with one another. A UNIBUS computer can control and transfer information between the UNIBUS and Q-bus. A Q-bus computer can control and transfer information between the Q-bus and UNIBUS.

The products cost $1,295 each.

For complete information, contact Les Wellington, The Logical Co., P.O. Box 549, Cottage Grove, OR 97424; (503) 942-3610.

Circle 452 on reader card

3100 SIMM MODULES NOW AVAILABLE!

YOU CAN PAY MORE FROM DEC or YOU BUY the SAME PERFORMANCE from SEE FIRST for LESS $$$$.

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Also ask for pricing on our complete line of memory & RAM DISK products.

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*THE 3100 WORK STATIONS ARE A TRADE MARK OF DIGITAL EQUIPMENT CORP.

CIRCLE 240 ON READER CARD

Symbolics Enhances Animation Software

Symbolics Graphics Division announced Symbolics Animation and Paint Software version 4.1. A new system, S-Convert, has been added. It allows menu-based conversion of images to and from Scitex CT2T, Scitex Handshake and Truevision type 2. This version also offers enhancements to many other systems.

The Color System separately can store a small icon on disk. S-Colorize features a menu-based interface for image colorization and for generation of fractal images. S-Compositor features an interface for image compositing. S-Dynamics allows field animation without double rendering overhead. S-Geometry includes binary files for bodies, which results in a speed increase when reading and writing complex objects. S-Paint features improved organization and readability of the user interface. S-Record supports the Abekas A60 video disk recorder. S-Render offers field rendering, which allows the creation of original-sized images with alternate lines skipped.

Obtain additional information by contacting Don Miskowich, Symbolics Graphics Division, 1401 Westwood Blvd., Los Angeles, CA 90024; (213) 478-0681.

Circle 451 on reader card

Ergodic Announces MDS32 Version 2

Ergodic Systems Inc. announced MDS32 version 2, a menu-design tool for VAX/VMS. MDS32 lets you integrate applications programs, DCL and menus without repeated process spawns and image activations or programming.

A new feature, password protection, restricts access to sensitive menus and choices. Use of a one-way open encryption guarantees security even if a user can examine the application's source files. MDS32 V2 extends definable function-key support to gold keys. This permits MDS32 environments to emulate existing applications conventions more closely. Function-key associations are dynamic and can be permanent or temporary at any level. Also, a menu interface to the VMS Mail Utility presents you with pop-down menus of your file folders and messages that allow you to read, send, print, file and delete mail messages.

Primary license prices range from $245 for VAXstations to $2,245 for VAX 88xx-series machines.

To find out more, contact Steve Duff, Ergodic Systems Inc., 23666-A Birtcher, El Toro, CA 92630; (714) 380-9719.

Circle 464 on reader card

The idea behind our 8mm tape backup system's display panel.

The whole reason for putting instrumentation in cars is to help you avoid unpleasant surprises.

Well, that's exactly why we gave the new CTS-8000 8mm tape backup system a built-in status display. It lets you catch problems before they happen—not after.

A digital readout tells you how many megabytes of unused storage remain on a tape. When you put in a cartridge, you'll know for sure that you've got enough tape to finish the job.

The CTS-8000 also tells you the ECC error correction rate. By watching it for a minute or two, you can determine if the tape is in good enough condition to properly record your data. If the tape is unacceptable, you'll know before you leave at night—not when you return in the morning.

Still another first on the CTS-8000 is multi-host capability. It can back up data from as many as three hosts.

It's also TMSCP compatible and works with all your applications without any modifications.

And thanks to TTI's long line option, you can place the CTS-8000 up to 80 feet away from the host.

Don't settle for unattended backup with less than full instrumentation. For complete information on the CTS-8000, call (714) 744-1030. Or write Transitional Technology, Inc., 1411 N. Batavia, Suite 203, Orange, CA 92667.

TTi
TRANSITIONAL TECHNOLOGY, INC.

In Europe, call 0865 741345. Or write Transitional Technology, Suite 2, Kennett House, 108/110 London Road, Headington, Oxford OX3 9AW.

CTS-8000 is a registered trademark of Transitional Technology, Inc. TMSCP is a registered trademark of Digital Equipment Corporation.

CIRCLE 261 ON READER CARD

Tektronix Expands Printer Capabilities

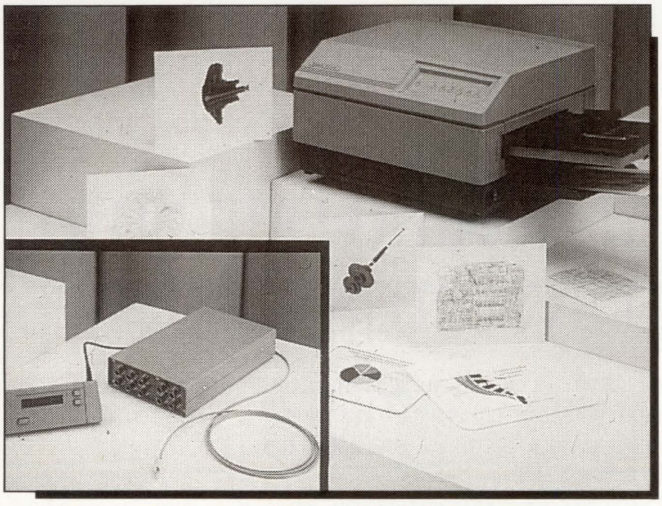
Tektronix Inc. announced enhanced color capabilities for its Color Screen Printer (Model 4693RBG), a 300-dpi thermal wax transfer printer designed for popular workstations and graphics terminals. The product is a self-calibrating screen printer that features a compact fiber optic cable architecture. The system offers a remote personal print control device, giving you control of the printer's key functions from your workstation or terminal.

You have a choice of two 4,096-color palettes. The color palette includes light color choices that closely match display colors. Two modes have been added. The 125-color mode reduces line breakup and provides better line image quality for detailed drawings and schematics as well as CAD software packages that rely heavily on dark colors. The 27-color mode eliminates dithering and is suitable for schematics, wireframes, 2-D images and architectural drawings.

The Color Screen Printer is priced from $7,400.

Find out more by contacting Tektronix Inc., Wilsonville Industrial Park, P.O. Box 1000, Wilsonville, OR 97070; (800) 835-6100.

Circle 415 on reader card



Tektronix Inc.'s Color Screen Printer.

CEB Functions As Bridge/Router

RAD Data Communications announced the Composite Ethernet Bridge (CEB), a hybrid internetworking product that functions as both a local and remote bridge/router. CEB lets you connect LANs locally and remotely to form a WAN that combines LAN/WAN functions conventionally found in three separate devices: local bridges, remote bridges and routers.

CEB features two IEEE 802.3 AUI interfaces for local connections, a serial link interface for up to four remote connections, alternate routing and load balancing and sharing. CEB automatically and continuously checks and adapts to conditions or events in the WAN. From the serial interface, CEB supports coax cable, twisted pair, fiber optic cable, modem, microwave and high-speed digital phone networks. Data rates supported range from 4.8 Kbps to 2.048 Mbps.

The product costs from $6,950 to $12,445.

For complete details, contact RAD Data Communications, 151 W. Passaic St., Rochelle Park, NJ 07662; (201) 587-8822.

Circle 482 on reader card

DiskView Provides Performance Information

Innovative Computer Technologies announced DiskView version 1.1. DiskView provides system managers and users with a detailed window into the I/O activity of single or multiple devices in a VAX/VMS environment. DiskView displays I/O bottlenecks and disk load imbalance.

DiskView offers a large base of performance information during software benchtesting by providing I/O displays that show detail for presentation purposes. This includes real-time displays of file/disk activity by process, device and/or file and the ability to record, playback, sort and summarize collected data. DiskView provides statistics such as read/write rates, global buffer hit/miss rates and fragmentation counts per file. Enhancements in DiskView V1.1 include additional qualifiers for more flexible report formatting, new displays detailing physical device I/O and compatibility with VAX/VMS V5.0.

Learn more by contacting Innovative Computer Technologies, 2861 Sherwood Heights Dr., Unit 32, Oakville, ON L6J 7K1; (416) 829-2020.

Circle 478 on reader card

KEA Systems Unveils ZSTEM 240 For UNIX

KEA Systems Ltd. announced ZSTEM 240 for UNIX. ZSTEM 240 for UNIX gives an 80x86-based machine running UNIX the capability of emulating a VT241 color graphics terminal. The emulator allows a PC to display VT340 ReGIS, Tektronix and Sixel graphics as well as VT220 text.

ZSTEM 240 can be run in conjunction with mainframe/mini applications that have been ported to the UNIX desktop environment. Its pseudo teletype support allows applications to output VT241, VT220, VT100 or 4014 escape sequences to the PC console with ZSTEM taking care of the PC graphics display. This allows software developers to port VAX applications using ReGIS, Tektronix or Sixel graphics to the desktop UNIX system's PC console.

Learn more by contacting Danielle Galbraith, KEA Systems Ltd., 2150 W. Broadway, Ste. 412, Vancouver, BC V6K 4L9; (604) 732-7411.

Circle 466 on reader card

P-Graf 2 Workstations Are For Molecular Modeling

Chemical Design Inc. announced molecular modeling workstations based on the VAXstation 3100. P-Graf 2 workstations run Chemical Design's Chem-X software and are available in a variety of configurations.

P-Graf 2 systems offer computational performance combined with 1,024- x 864-pixel color graphics running DECwindows. Systems can be configured to include a 3-D graphics terminal. P-Graf 2 workstations run an average of about three times faster than MicroVAX II-based systems for a range of typical modeling applications. For tasks that involve considerable disk access, such as searching databases, performance is even higher.

Prices range from $11,500 for a diskless system configured for addition to an existing Chem-X system to $57,000 for a standalone P-Graf 2 system with 8 MB of memory, a 19-inch color monitor, a 912-MB disk, a tape drive, a tailored VMS environment and Chem-X software.

To find out more, contact Chemical Design Inc., 200 Rt. 17 S., Ste. 120, Mahwah, NJ 07430; (201) 529-3323.

Circle 477 on reader card

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△ XENIX ◈ EXCELAN ◈ OS/2 ◈ EXCELAN ◈ DOS ◈ EXCELAN ◈ UNIX ◈ EXCELAN ◈ VMS ◈ EXCELAN ◈ MAC ◈ EXCELAN ◈ XENIX ◈ EXCELAN ◈ OS/2 ◈ EXCELAN ◈ DOS ◈ EXCELAN ▽

△ DOS ◈ EXCELAN ◈ UNIX ◈ EXCELAN ◈ VMS ◈ EXCELAN ◈ MAC ◈ EXCELAN ◈ XENIX ◈ EXCELAN ◈ OS/2 ◈ EXCELAN ◈ DOS ◈ EXCELAN ◈ UNIX ◈ EXCELAN ◈ VMS ◈ EXCELAN ◈ MAC ▽

GUESS WHO WROTE THE BOOK ON TCP/IP NETWORKING WITH VMS.

No other company has more TCP/IP solutions for networking of VAX/VMS environments than Excelan, not even DEC.

In fact, not only does Excelan offer more TCP/IP solutions than anyone else, but all of them are fully compatible with VMS versions 4.4 through to 5.0.

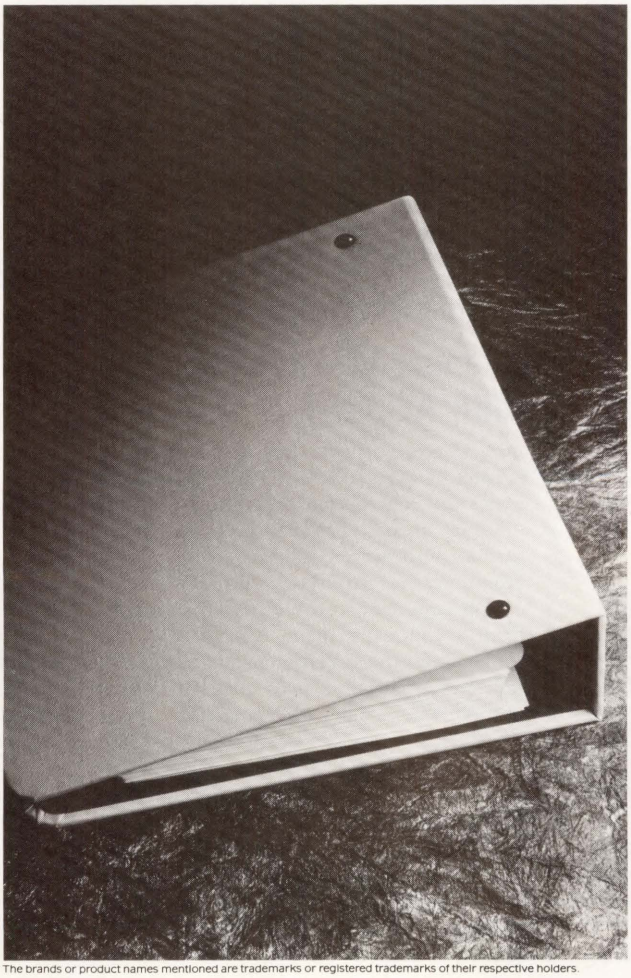
OUR CONNECTIVITY SOLUTIONS.

At Excelan, we take two approaches to DEC connectivity, both of which support TCP/IP on Ethernet.

LAN Service™ for VMS is our front-end processor solution. Users may off-load network protocols and with standard networking applications expedite high speed file transfers, even entire directory trees. They can also log into remote host systems and exchange electronic mail.

Excelan's MultiNet is our hardware independent, TCP/IP implementation, which allows users to run multiple network media and protocol stacks, including all DEC Ethernet adapters.

Both LAN Service for VMS and MultiNet also support third party programming through QIO, or Berkeley Sockets, as well as the standard networking applications.



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DISTRIBUTED POWER.

In addition Excelan's LAN Service NFS is the optimum TCP/IP VMS Server implementation of Sun's Network File System (NFS). It applies VAX power to distributed applications through an NFS environment, giving users unlimited file space, not to mention full connectivity across the network environment.

All of which goes to prove our point. No one has more solutions or experience in networking DEC environments on Ethernet via TCP/IP than Excelan, the company that networks networks.

If you would like more information on how Excelan can network VAX's to just about anything, go by the book, call 1-800-243-8526. Or write to us at 2180 Fortune Dr., San Jose, CA 95131.

◂EXCELAN▸
WE NETWORK NETWORKS.

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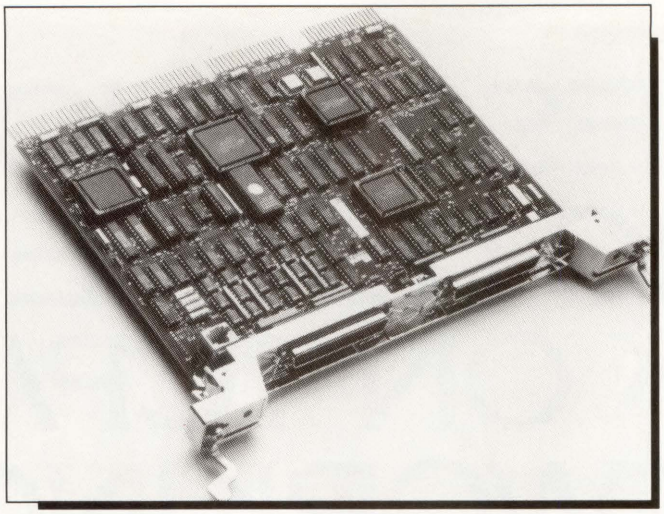
CIRCLE 333 ON READER CARD



Dilog's SQ3723A SCSI Host Adapter.

SCSI Adapters Allow Choice of Cabling

Dilog announced two SCSI host adapter boards that provide a switch-selectable choice of single-ended or differential cabling to MicroVAX IIIs. The SQ3726A Disk Host Adapter provides a SCSI for attaching up to seven disk drives to a MicroVAX III. The SQ3723A Tape Host Adapter provides a SCSI for connecting up to four tape drives or tape emulation devices to a MicroVAX III.

Both quad-height controller boards provide the SCSI differential cabling option. It lets you extend cable lengths to 80 feet versus the maximum 18 feet in the single-ended mode. You simply set each adapter for the desired cabling at the time of board installation. The host adapters also have connect/disconnect logic that automates bus transfer rate and mode selection.

The SQ3726A SCSI Disk Host Adapter and the SQ3723A SCSI Tape Host Adapter are priced at $2,000.

For more information, contact Judie Dutton, Dilog, 1555 S. Sinclair St., Anaheim, CA 92806; (714) 937-5700.

Circle 463 on reader card

K-Share Lets AppleShare Clients Use Sun Or DEC

Excelan Inc. announced K-Share, a full implementation of the AppleTalk Filing Protocol (AFP) for Sun UNIX or VAX ULTRIX operating systems. It allows Macs and other AppleShare client systems to use Sun or VAX computers as AppleShare servers.

K-Share lets Mac workgroups take advantage of the large disk capacities and file backup facilities of powerful computers such as UNIX-based Sun workstations or ULTRIX-based VAXs. K-Share features access from Macs to NFS volumes residing on any computer on the same network as the Sun or VAX. Sun's NFS protocol is a file storage method that lets you exchange information on a network of dissimilar computers. A VAX equipped with Excelan's LAN Service NFS can access NFS volumes from Macs and workgroups through K-Share software. K-Share includes K-Spool printer-management software. It lets UNIX users benefit from the PostScript standard for page formatting and font description and lets Mac users benefit from UNIX-based print spooling.

K-Share is priced at $795.

Learn more by contacting Peter Troop, Excelan Inc., 2180 Fortune Dr., San Jose, CA 95131; (408) 434-2300.

Circle 465 on reader card

Queman V4.0 Works With ALL-IN-1

Data Center Software announced Queman version 4.0. Queman is a utility that automates the control and processing of print (output) queues, batch queues and print forms. Full-screen displays constantly monitor queue activity and allow any queue or job command to be executed instantly from a command menu. Queman's User Table allows the system manager to decentralize the management of queues to users without sacrificing VMS security.

Queman now can be used in conjunction with ALL-IN-1, Mass-11 and many other word processing and office automation products. A display option allows monitoring of queues based on user-defined status values such as stopped, stalled, paused or queues with jobs pending. Queman automatically can create, modify and delete queues as desired. The Mass Maintenance facility allows queues to be used as models for duplication.

To obtain additional information, contact Data Center Software, 70 Herrick St., Beverly, MA 01915; (508) 922-5500.

Circle 467 on reader card

Polygraf Simulates Complex Polymers

Molecular Simulations Inc. announced Polygraf, integrated molecular modeling and simulation software developed for the polymer industry. Polygraf combines computation chemistry and 3-D graphics to simulate the behavior of complex polymer molecules. It reduces the need to perform multiple trial-and-error laboratory experiments typically required to develop new substances.

Polygraf uses a range of molecular mechanics capabilities, specialized builders for small molecules and polymers, energy minimization, conformational searching, animation of dynamic trajectories, analysis of structural features, calculation of physical properties and constant stress dynamics. This enables chemists to build interactively complex new substances (of up to 20,000 atoms) and subject them to various stresses, such as heat or pressure, on the computer.

Obtain more information by contacting Heidi Marie Youngkin, Molecular Simulations Inc., 199 S. Los Robles Ave., Ste. 540, Pasadena, CA 91101; (818) 793-3600.

Circle 479 on reader card

Signum Introduces The RGB200 Analog Interface

Signum Inc. announced the RGB200, a true-color acquisition and display capability for its IS200 Image Processing System. The RGB200 is a universal multichannel analog interface with three independent input channels, each with an 8-bit D/A converter, programmable gain and offset plus loadable look-up tables.

The RGB200 was designed to take advantage of the 4- x 16-bit video bus architecture of the IS200. An on-board programmable cross-port switch determines the coupling of each input and output channel to individually specified 8-bit segments of the video bus. The RGB200 has an optional real-time conversion feature that provides for the coding and decoding of 24-bit RGB data to 16- or 8-bit YIQ or HSV formats. The IS200 subsystem consists of a family of high-performance modules interconnected by a software reconfigurable video bus network.

To learn more, contact Ernest Henrichon, Signum Inc., 600 W. Cummings Park, Ste., 5500, Woburn, MA 01801; (617) 933-4780.

Circle 483 on reader card

Over 250 TV and radio stations depend on WSI for prompt, accurate weather data.

WSI SUPERsat™

WSI depends on the ACS 4030.

"With the ACS 4030 we have a low-cost, reliable Ethernet bridge that guarantees we can maintain the on-time service our customers expect."

Paul Bayer, Ph.D.
Director of Computer Services, WSI

WSI is the world's leading private supplier of on-demand weather information and graphics. WSI relies on the ACS 4030 as the critical link that allows satellite data to flow continuously from a remote Ethernet to applications processors at WSI headquarters.

WSI saved money by choosing the ACS 4030. Bayer checked into other remote bridges but chose the ACS 4030. "It had all the features we needed and was priced considerably less than the others."

With the ACS 4030, remote LANs function as a single network. Explains Bayer, "Now that we transparently connect all of our Ethernets, operations are a lot easier for WSI's programmers and system managers." The ACS 4030 fits into WSI's existing system with no need for additional expensive equipment.

The ACS 4030 is simple to install. It learns and filters addresses automatically and maintains high throughput between LANs. And you can connect ACS 4030s with multiple ports to level the traffic load and provide redundant links.

If you want the benefits of linking your remote Ethernets, choose a bridge with proven reliability. ACC has been meeting the network needs of companies like WSI for over 12 years. To find out how the ACS 4030 can make your computing resources more efficient and save you money, *call ACC today.*

Advanced Computer Communications
720 Santa Barbara Street
Santa Barbara, CA 93101
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ACC®
The Interconnectivity Source

CIRCLE 184 ON READER CARD

Sybase RDBMS Provides Data Security

Sybase Inc. announced a commercial RDBMS designed to meet the National Computer Security Center's (NCSC) B1- and B2-level security for multilevel data. The Secure SQL Server is available on VAX computers running ULTRIX. It's based on the standard Sybase SQL Server, an RDBMS for on-line applications, and implements the uniform assurance approach to security. With uniform assurance, the DBMS labels data and mediates access to the data.

According to NCSC guidelines, products evaluated at the B level enforce mandatory and discretionary access control. Mandatory access control is the ability to control users based on assigned security labels. Discretionary access control is the ability to limit access based on user identity. The Secure SQL Server combines the benefits of an SQL-based RDBMS with the ability to store data of multiple security classifications in a single database.

The Secure SQL Server is priced from $20,000 to $200,000, depending on CPU. For complete details, contact Rich Scheffer, Sybase Inc., 6475 Christie Ave., Emeryville, CA 94608; (415) 596-3500.

Circle 468 on reader card

WIN/NFS Release 1.3 Supports XDR/RPC

The Wollongong Group Inc. announced WIN/NFS release 1.3 for VMS. Release 1.3 is compatible with VMS versions 4.7 and 5.0. It supports the XDR/RPC programmer library interfaces specified by Sun Microsystems, the developer of NFS. It also provides access to VAX/VMS printers from remote PC-NFS hosts, support of VMS DISKQUOTA thresholding and several enhancements to the data- and file-handling options.

The Printer Server in release 1.3 provides access to printers on VAX/VMS systems from a PC-NFS requestor on a PC. Enhancements have been made to the data-handling algorithms to more fully support different data formats among Wollongong's VMS-based WIN/NFS implementation and common UNIX-flavored versions of NFS. Release 1.3 includes support for records that exceed the usual UNIX block length and improved facilities for sharing data among VMS and non-VMS users.

WIN/NFS for VMS is priced between $1,000 and $9,000, depending on VAX processor class.

For more information, contact The Wollongong Group Inc., 1129 San Antonio Rd., Palo Alto, CA 94303; (415) 962-7200.

Circle 472 on reader card

Intouch Features VMS V5.0 Compatibility

Touch Technologies Inc. announced Intouch version 2.1 for VAX/VMS. Intouch is a software-development environment that offers the benefits and features of Database/4GL packages without their resource- and time-intensive characteristics.

Intouch provides an environment in which you can design, run and test software under direct control through the use of a CRT. Intouch is well-suited for scientific and real-time programming environments. It

5.4 Gigabytes of Unattended Backup

HIGHEST CAPACITY
HIGHEST DATA RATE
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GIGASTORE™, by Digi-Data, is a complete line of high capacity tape drives. Employing videocassette tape, GIGASTORE features three models offering capacities of 2.5, 3.7 or 5.4 Gigabytes of formatted data, on a single tape.

Systems are available for DEC VAX™ and MicroVAX™, the IBM PC/XT/AT™ and compatibles as well as 386 machines. A Novell LAN compatible system is also available. And Digi-Data's product line includes 1600 and 6250 bpi 9-track tape drives and systems.

Digi-Data is an organization with a 27 year history of manufacturing quality tape drives.

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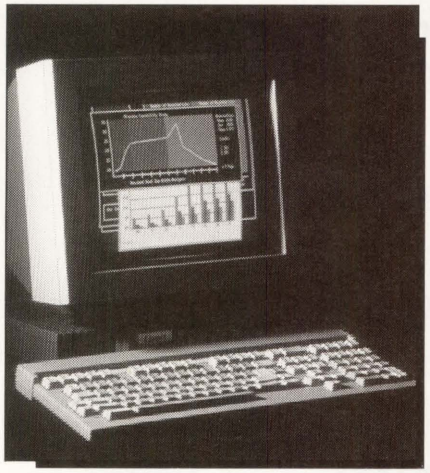
CIRCLE 199 ON READER CARD

provides a debugging system, quick response, database management facilities and a powerful, logical language. It includes VMS V5.0 compatibility, an Ingres interface, pop-up menus and multiwindow capabilities.
More information can be obtained by contacting Debbie Robinson, Touch Technologies Inc. 9990 Mesa Rim Rd., Ste. 220, San Diego, CA 92121; (619) 455-7404.

Circle 457 on reader card



Esprit Systems Inc.'s PICTerm CBG color terminal.

PICTerm Displays Text Or Graphics

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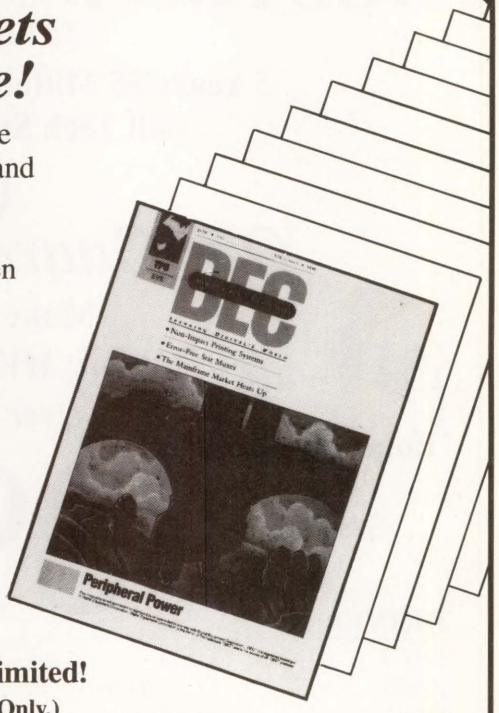

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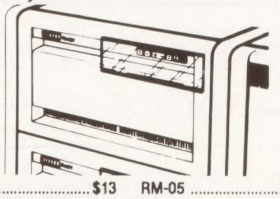

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Continued from page 79.

IT'S GOOD PRACTICE to review CPU usage on a regular basis. You might want to run a random day monitor on a monthly or quarterly basis. This will give you history information to use as a comparison for future system performance measures and potential CPU bottlenecks.

A clear understanding of your CPU use is a critical part of VMS performance monitoring. But CPU usage is only one part of measuring your system's efficiency. Be sure to do a complete evaluation of all your system resources before reaching any final conclusions on your CPU's level of performance and use. — *Betty Steele Walker, formerly Betty Steele Adukoski, is a free-lance writer in Cape Coral, Florida.*

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FIGURE 2.

SYSTEM MODES

DATE	TIME	--- M --- O --- D --- E --- S---	I	K	E	S	U
2-JUN	09:00:03	IIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKEEEEEEEEEEEEE	UUUUUUUUUUUUUUUUUUUUUUUU	17	17	13	0	24
2-JUN	09:01:04	IIIIIIIIIIIIIIIKKKKKKKKKKKEEEES	UUUUUUUUUUUUU	14	12	4	1	13
2-JUN	09:02:04	IIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEESSSS	UUUUUUUUUUUUUUUU	12	21	11	4	16
2-JUN	09:03:05	IIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEES	UUUUUUUUUUUUUUUU	14	22	10	1	17
2-JUN	09:04:07	IIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEEEES	UUUUUUUUUUUUUUUUU	15	19	11	1	18
2-JUN	09:05:08	IIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEES	UUUUUUUUUUUUUUUUUU	14	25	15	1	19
2-JUN	09:06:09	IIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEES	UUUUUUUUUUUUUUUUU	16	26	11	1	18
2-JUN	09:07:10	IIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKEEEEEEEEE	UUUUUUUUUU	15	17	10	0	11
2-JUN	09:08:11	IIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEEEEEESSS	UUUUUUUUUUUU	10	26	19	3	13
2-JUN	09:09:12	IIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEE	UUUUUUUUUUUUU	13	19	16	0	14
2-JUN	09:10:13	IIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEEEES	UUUUUUUUUUUUU	15	24	18	1	14
2-JUN	09:11:14	IIIIIIIIIKKKKKKKKKKKKKKKKEEEEEEEEEEEE	UUUUUUUUUUUU	9	18	15	0	13
2-JUN	09:12:15	IIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKEEEEEEEEEEEEEE	UUUUUUUUUUUUU	21	18	16	0	14
2-JUN	09:13:15	IIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEEEE	UUUUUUUUUU	17	21	18	0	10
2-JUN	09:14:16	IIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEEE	UUUUUUUUUUUU	16	23	17	0	14
2-JUN	09:15:18	IIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEES	UUUUUUUUUUU	13	23	15	1	12
2-JUN	09:16:19	IIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEES	UUUUUUUUUUUUU	14	19	16	1	15
2-JUN	09:17:20	IIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKKKKKEEEEEEEEEEES	UUUUUUUUUUUUU	18	25	13	1	14
2-JUN	09:18:21	IIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEEEES	UUUUUUUUU	13	19	16	1	9
2-JUN	09:19:22	IIIIIIIIIIIKKKKKKKKKKKKKKKKEEEEEEEEES	UUUUUUUUUU	12	18	11	1	10
2-JUN	09:20:24	IIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEEEEEESSS	UUUUUUUUUUU	11	20	13	3	12
.								
.								
.								
2-JUN	10:00:14	IIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKEEEEEEEESSSSS	UUUUUUUUUUU	19	17	8	5	12
2-JUN	10:01:15	IIIIIIIIIIIIIIIIIKKKKKKKKEEEE	UUUUUUUUUUUUUU	17	9	4	0	15
2-JUN	10:02:17	IIIIIIIIIIIIIIIIIIKKKKKKKKKKKKEEEES	UUUUUUUUUUUUUUUUU	20	14	4	1	18
2-JUN	10:03:18	IIIIIIIIIIIIIIIIIIKKKKKKKKKKKKEEEESS	UUUUUUUUUUUUUUUUUUUU	18	13	5	2	24
2-JUN	10:04:20	IIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKEEEES	UUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	17	17	5	1	33
2-JUN	10:05:22	IIIIIIIIIIIIIIIIIKKKKKKKKKKKKKEEEES	UUUUUUUUUUUUUUUU	17	14	4	1	17
2-JUN	10:06:24	IIIIIIIIIIIIIIIIIIIKKKKKKKEEE	UUUUUUUUUUUUUUUUUUUUUU	20	8	3	0	25
2-JUN	10:07:25	IIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKEEEEEES	UUUUUUUUUUUUUU	18	21	6	1	15
2-JUN	10:08:27	IIIIIIIIIIIIIKKKKKKKKKKKKKEEEEES	UUUUUUUUUUUU	14	14	5	1	13
2-JUN	10:09:29	IIIIIIIIIIKKKKKE	UUUUUUU	10	5	1	0	7
2-JUN	10:10:30	IIIIIIIIIIKKKE	UUUUUUUU	11	3	1	0	8
2-JUN	10:11:31	IIIIIIIIIIKKKKKKKKKKKEEEEES	UUUUUUUUU	11	13	5	1	9
2-JUN	10:12:32	IIIIIIIIIIIIIKKKKKKKKKKKKKKKEEEEE	UUUUUUUUUUUUUUU	15	17	5	0	17
2-JUN	10:13:33	IIIIIIIIIIIIIIIKKKKKKKKKKKKKKKEEEEES	UUUUUUUUUUUUUUUU	17	17	5	1	18
2-JUN	10:14:34	IIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKEEEES	UUUUUUUUUUU	21	14	4	1	12
2-JUN	10:15:35	IIIIIIIIIIIIIIIKKKKKKKKKKEEEE	UUUUUUUUUUUUUUU	16	11	4	0	17
2-JUN	10:16:36	IIIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKEEEEE	UUUUUUUUUUUUUUUUUUUUUU	24	12	5	0	25
2-JUN	10:17:37	IIIIIIIIIIIIIIIIIIIIIIKKKKKKKKKKKKKKKKKKKEEEEEEEESSSSSS	UUUUUUUUUUUUUUUUUUUUUU	20	22	9	6	24
.								
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The New Age Of Invention

When a person can't stand a situation, he can make an attempt to change it. He can move to avoid unpleasant neighbors or find a new job to relieve boredom.

The inventor who can't tolerate a condition because it causes him physical or mental pain can try to resolve that condition. Inventions such as dish and clothes washers, vacuum cleaners, frost-free freezers, car washes, factory robotics and computers came from this motivation. The history of invention is the history of mankind.

Electronic computing stemmed from a need to add and subtract. What makes a computer different from many inventions is that the computer turned from a number cruncher into a tool with which other inventions can be created.

These inventions include spreadsheets, database managers and word processors. Each has supplanted less effective inventions, such as the typewriter or one of those weird old billing machines.

As far as the world of invention is concerned, the computer is the great expediter. If software programs are considered inventions, then we're seeing more inventions per month than we saw per year just a decade ago. This is the new age of invention.

In the old days, only a few inventions made their creators wealthy. For example, few games of any consequence came about, and most weren't "invented" as much as they "evolved." But with a company such as Nintendo earning $2 billion per year in game machine and game sales, you realize how times have changed. Computer-related invention is the road to riches.

The Perfect Vehicle?

Computers are the perfect vehicle for the creative mind. Children constantly invent. It's no coincidence, therefore, that they love computers. But do computers limit invention in some peculiar way?

Most inventions of the, "Gee, I wish I had thought of that" genre were thought of during idle play. Many inventions are conceptualized during unorganized, aimless doodling. Leroy Grumman, the inventor of the backward folding aircraft wing used on old aircraft carrier planes, found the "idea light bulb" over his head while playing with an eraser and paper clip. The invention that resulted was a carrier plane that was invaluable during World War II.

What may be lost with this computerized invention technique is the fluke invention, the serendipitous unearthing. Numerous discoveries happened with no pre-existing search. Many great inventions were developed from "errors."

For example, saccharin resulted when a chemist forgot to wash his hands before eating. He'd been slaving over a Bunsen burner all morning and was probably hungry and hurried. When he munched into his sandwich, it tasted sweet. This concerned him. So he frantically reviewed the chemicals he'd been working with. Whatever chemicals he'd accumulated on his hands were the basis for the sugar substitute. After he determined that the combination wasn't lethal, the result was saccharin.

This kind of sloppy work can't be tolerated in a computerized environment. You can't compile some sloppy code and stumble onto the game of ZORK accidentally. You aren't likely to hear someone say, "Look, Henry, I just put some random numbers in the machine, and I've accidentally cloned VMS!"

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Unfortunately, the big dough for today's inventor is in computer technology. You see so many computers used as tools for inventors that you have to wonder if the old-fashioned inventor ever will be heard from again. With computer-aided design, neural nets, idea processors, database links and other massive assistance from machines, it seems unlikely that we'll ever again see the likes of a pure creator such as Thomas Edison.

In recent years, we've seen the decline of the great old-fashioned invention centers such as Bell Labs and RCA's David Sarnoff Research Lab. It's no coincidence that young turks are becoming multimillionaires selling cheap software invented at home. It's a new world. ■

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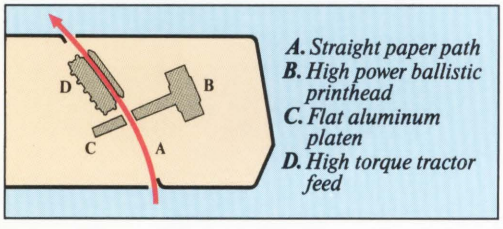

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