STORAGE

MEGARAM-VX

- Taking Apart The DECstation™ 2100 And 3100 Workstations
- Field Service Overseas — Insights On The International Market
- A VMS™ User's First UNIX™ Terminal Session

OCTOBER ■ 1989

DEC Professional

An Independent Magazine from Professional Press

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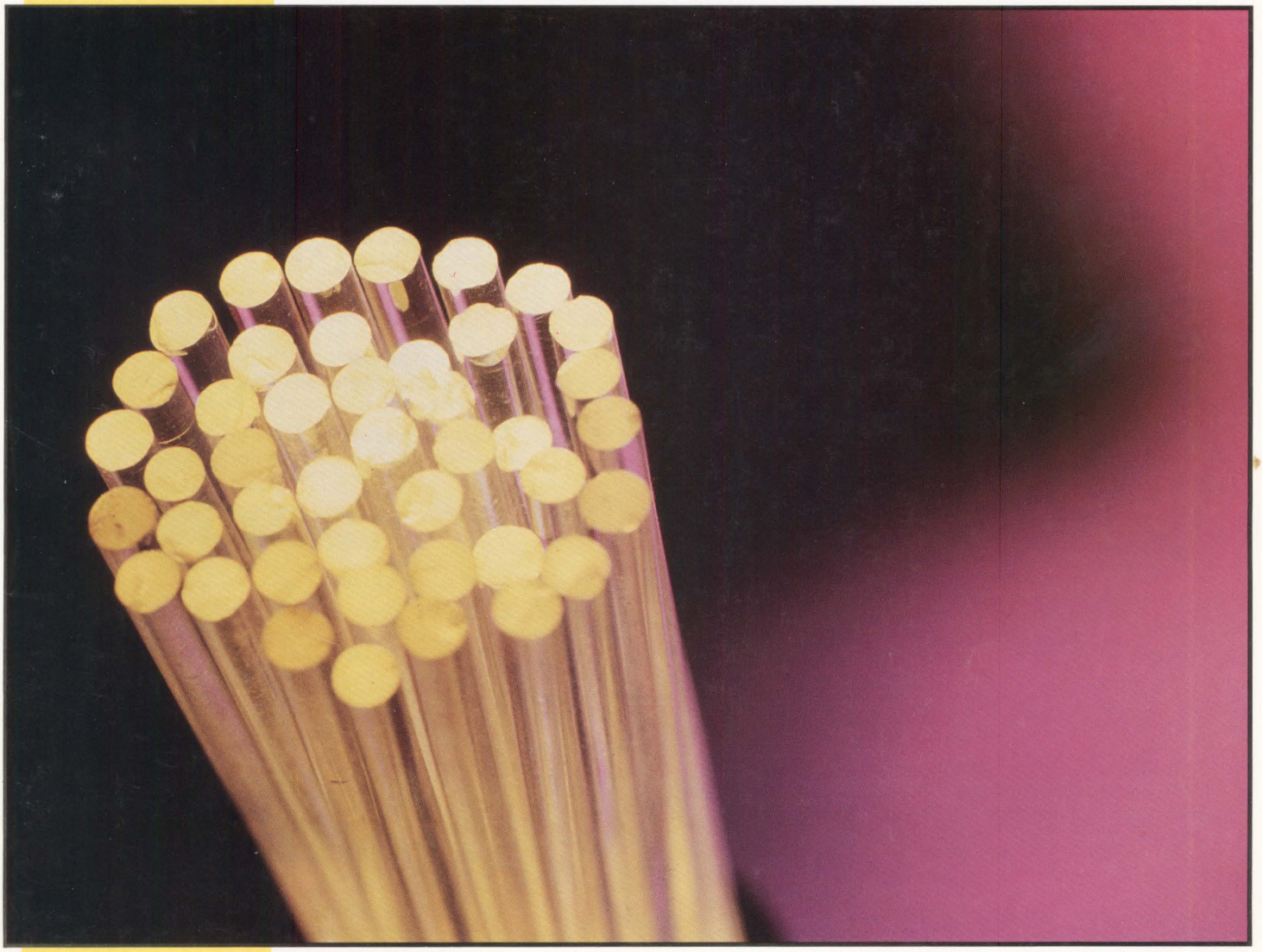

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Features	VISTA	DECserver-300	Emulex P-4000
16-port Product	NEW	NEW	OLD
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Expandable	128 ports	No	32 ports
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CIRCLE 107 ON READER CARD

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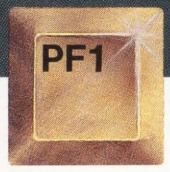

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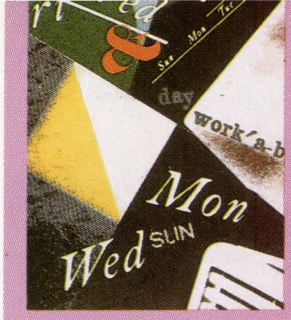

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KEA Systems Ltd.'s PowerStation 240 DEC terminal emulator and communications program offers a painless transition from terminal to personal computer. It consists of emulation software and a replacement VT220-style (LK201) keyboard that connects to an IBM or compatible PC.

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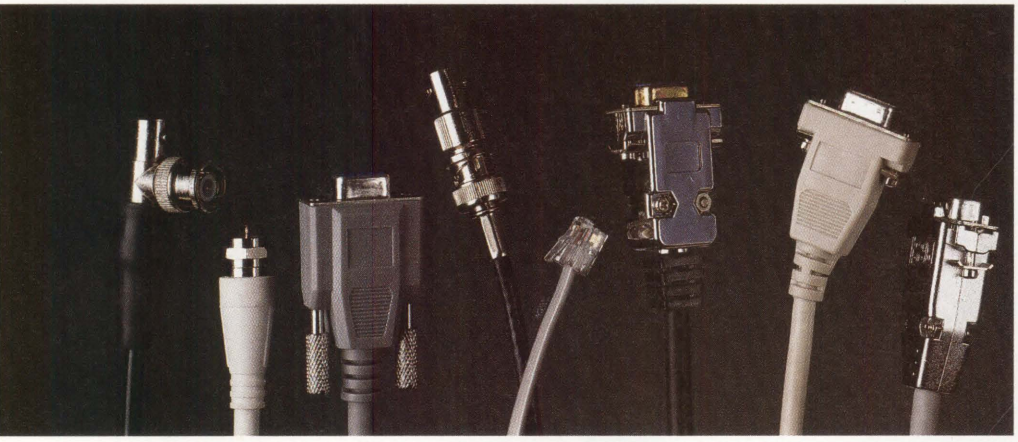

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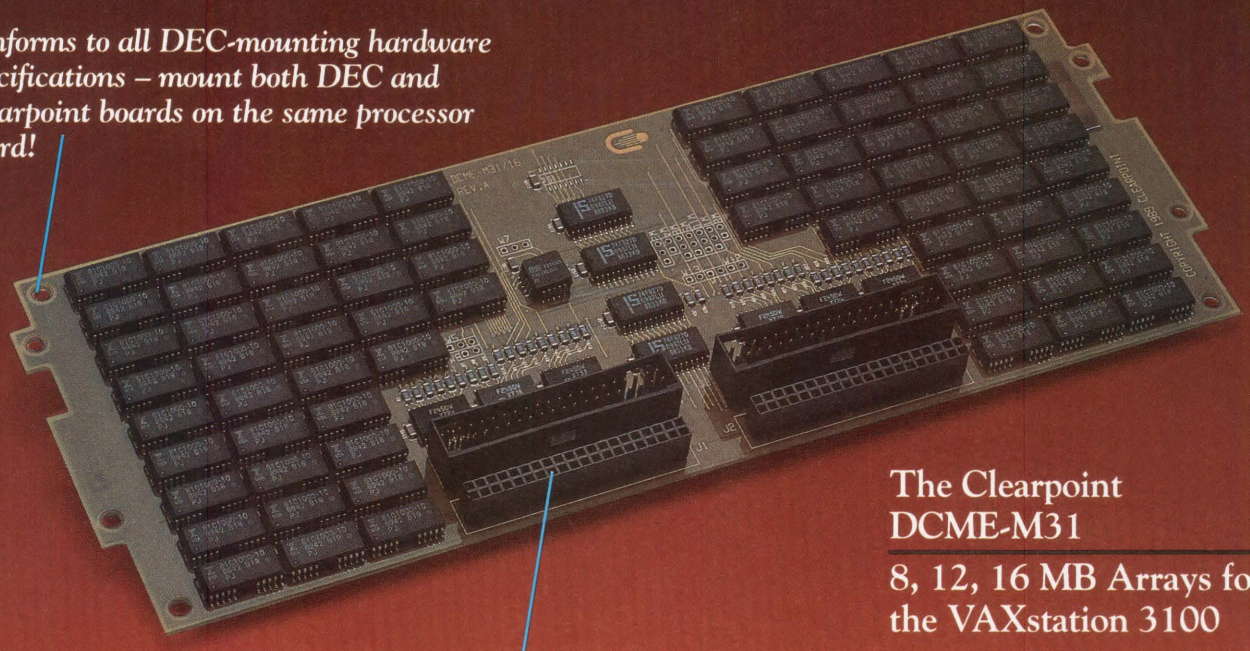

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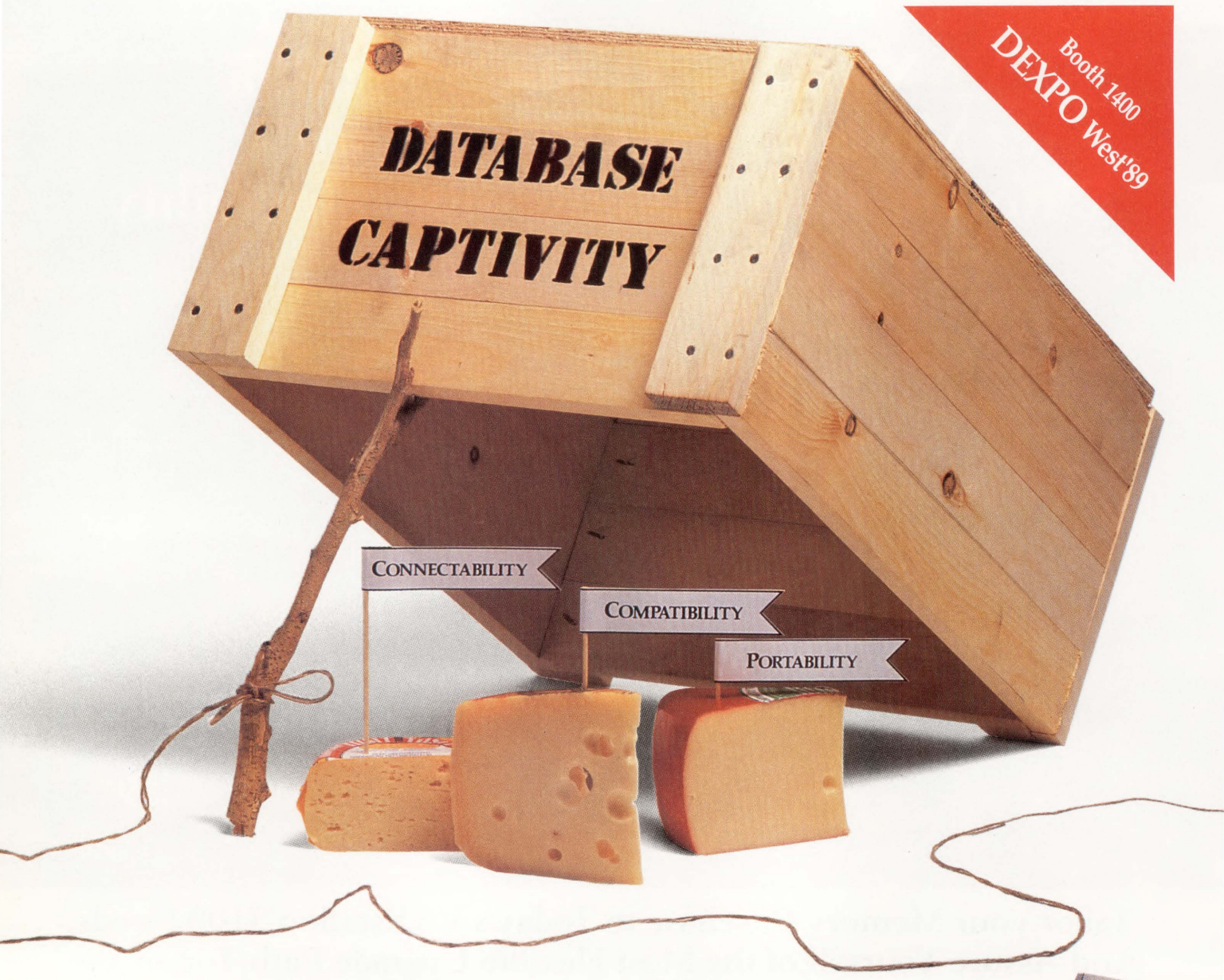

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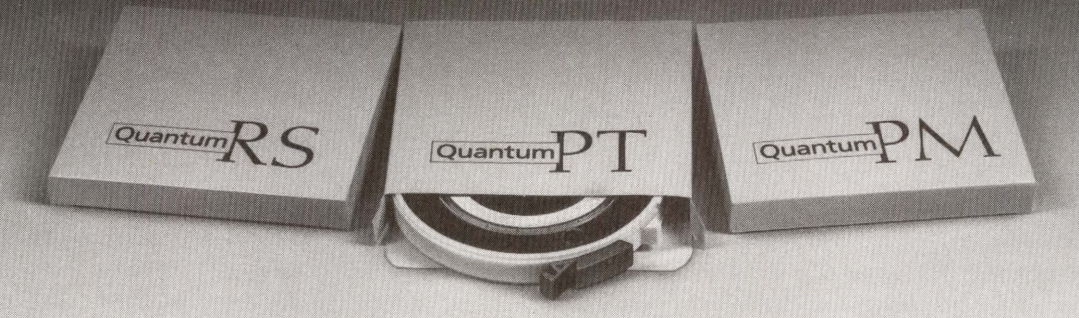

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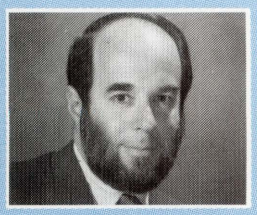

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Carl B. Marbach

Intertwined

You don't realize how connected you are to a place until you move to a new location. Trying to untangle yourself from where you were isn't easy. This thought is the result of Professional Press' recent move to its new headquarters.

Moving our first computer years ago was simple compared to today's multitentacled Hydra, which has connections everywhere. The PDP-11 only had terminal lines attached to a DH-11. Our current system isn't just a computer, it's a network: a seven-node VAXcluster with Ethernet gateways to AppleTalk, PC networks and remote locations. Terminal servers provide capabilities to every area of our publications, and printers are no longer slaves to the computer room. They've been moved as far away as we need and connect to the Ethernet instead of a parallel port.

Did you ever try to remove a vine at its root only to discover it was impossible to dislodge, having snaked in and around whatever it was attached to? Our system was that way — attached to everything. Disconnecting was one thing, but setting it up at our new headquarters could have been a nightmare. Fortunately, our MIS department did an outstanding job in planning and executing our move. The computers worked without a hitch. An article in next month's issue will cover the details of moving our VAXcluster and non-DEC systems.

The concept of a computer network has its counterpart in the DEC marketplace. No one user or company stands alone. Even DEC needs support from the user community and third parties supplying the products and services that it doesn't. Unfortunately, DEC hasn't accepted that it needs help.

Companies that fail to rally a vibrant third-party market easily can decline. Wang, Data General and Prime are examples of this.

The PC market, on the other hand, is the dominant model of how third parties can make a market. And IBM's midrange strategy is based on "business partners" that will help IBM move into new and existing businesses. By its own admission, IBM expects two-thirds of all AS/400s (the midrange) to be sold by these business partners.

Meanwhile, DEC has been closing the doors to the market that surrounds it. This occurred first with the proprietary BI bus to which no one could attach and more recently with the closing and licensing of its LAT software protocol. We note with interest that not one company using LAT has signed a licensing agreement at press time. DEC should have learned with the Rainbow that a closed architecture isn't the wave of the future.

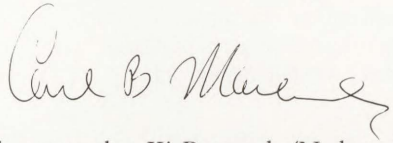
Where is the hoped-for software for DECwindows? Why haven't Lotus or Aldus produced software for a platform that looks like it eats Macintoshes for breakfast? Could some of these third-party vendors be frightened at what DEC might be like to work with? Many vendors have had unpleasant experiences with DEC. That stigma is hard to erase and there's no evidence that DEC is trying.

But opportunity abounds! The DEC market is entering, or in the middle of, a slowdown, a dip or a recession, and the market could use help. It's time for DEC to rethink its position and invite vendors to form business partnerships to serve the market, not DEC. When you provide a better solution, people flock to your door.

In the mid-80s you could say, "Digital has it now," but you never could say, "Digital has it all." If Digital is to provide a better solution — for "Digital to get it back" — the company will require a fuller, more robust solution than it alone can provide. There's too much software and too many connections, and computing needs are too disparate for any one company to provide the total solution for the enterprise. Computing for the '90s will require cooperative processing unlike any we've ever seen.

For the market to deliver what the user community needs and what DEC wants, there will have to be an attraction that can pull the limited efforts of many companies into the DEC market. The Macintosh, PC, UNIX and IBM markets are powerful competitors drawing the fertile third party toward them. DEC has to sweeten the pot, not sour it with lawsuits and unsignable license agreements.

One solution is for DEC to provide real business partnerships, including cooperative advertising, sales referrals, lucrative OEM agreements, new channels, an aggressive sales force, open architectures and a genuine effort to work with, rather than against, third parties. It makes sense for all of us to work toward integrating the enterprise with a total solution, even if the solution isn't all DEC.



Editor's note: Digital reports that Ki Research (Nashua, NH), which offers a LAT-compatible product for UNIX computers, is among the first LAT licensees.

The New Leader

Today VAX and VAX cluster users are looking to Micro Technology for the dynamic solutions they need to solve their networking and storage problems. As the new leader of VAX enhancement products, we have worked hard to respond to the needs of this constantly changing marketplace with the most efficient solutions possible.

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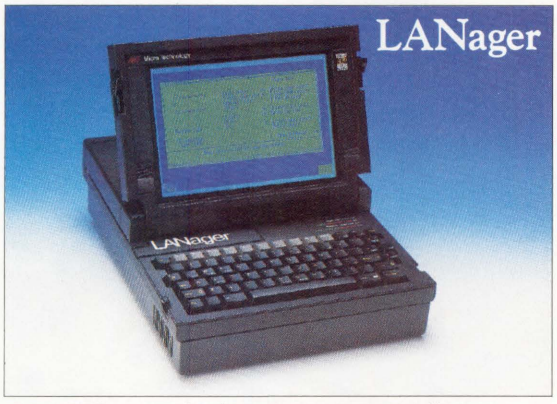

◆ Solutions for keeping your rapidly expanding network under control with our LANager network analysis and monitoring system for Ethernet. The LANager trouble shoots network problems quickly and monitors the performance in real time.

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But we didn't get to be the largest independent supplier of DEC compatible storage simply by serving more than 30,000 customer sites with some of the best-priced, best-performing products in the business.

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A lot of people talk about value. We've built a business on it. Today we follow the same simple rule we started with: **First we make a better product. Then we stand behind it.**

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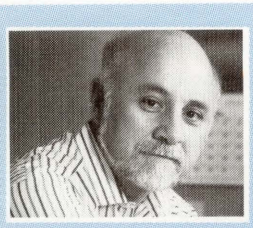

EDITORIAL

Dave Mallery

Ebb And Flow

DEC is afflicted with a strange disease. It comes on about every three years and usually lasts about six months. Many people regularly make fortunes in the market, because they understand the cycle of the disease and have the guts to get in and out at the right times.

The first symptom is that the market gets confused. New products come rushing out and smart buyers (who aren't under split-second hardware deadlines) stop buying. This is exactly what happened when the prices of VAX 6000 machines started to be redefined every 90 days. Add to that the raw mips of the new ULTRIX machines, and you have the early symptoms.

After the smart buyers stop buying, panic starts. The Wall Street analysts predict doom and gloom for the next quarter. DEC continues bravely forward, building and announcing. The DEC-related market panics, usually because its venture-capital people only believe analysts. DEC, with billions in cash, continues purposefully forward, building and announcing. By this time, everything is in a hole.

Finally, DEC gets its product line back in shape. The purchase orders start flowing. Order returns.

The analysts recognize that DEC is back to normal and issue their blessings once more. There's peace in the valley. The stock rises and a few experienced people laugh all the way to the bank. If you were waiting to buy a 6000, you can buy with the relative confidence that you won't be on the carpet next month explaining why you bought the wrong machine.

The funny thing is that this scenario happens with total regularity. It's too bad analysts can't see beyond a 90-day time frame.

DIANA WALKER/TIME MAGAZINE

It took Logicraft to get two *other* giants talking to each other.

It was a global concern. DEC and IBM were engaged in a cold war. A war whose only real casualties were businesses desperately looking for a way to improve relations between their Digital terminals and IBM PC-compatible software. So they turned to Logicraft for the answer.

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LETTERS

LESS TALK, MORE TYPE

Troy Frericks' letter (June 1989, p. 16) makes false assumptions and analogies in promoting voice over keyboard input.

Spoken English is different from written English. The speaking rate of 200 words per minute to which Frericks refers is for conversational English, which includes a great deal of redundancy, hesitation and corrections. (Read transcripts of speeches, hearings or telephone conversations to get an idea.) Conversation seldom is used for precise communication.

Desktop publishing has added the complex choices of typography, layout, organization and non-verbal inclusions such as diagrams and photographs to the once-simple task of linearizing thought into print. It has separated spoken and written language even further.

Computer interaction tends to rely on a high-density, high-accuracy, non-redundant grammar. Learning to type requires little effort, but learning to type meaningful things often requires a lifetime's effort.

Even if voice recognition were available and cheap, without an artificial spoken grammar and additional language elements for typographical purposes, its practicality would be limited. For computer input, I'll stick to a keyboard.

William D.A. Geary
Deer Park, New York

MORE ON TRENDS

In "Trend Analysis — A Waste Of Time" (May 1989), John C. Dvorak's assertion that trend analysis is pointless and that we merely should follow industry leaders is ludicrous. In many cases, trendsetters fail at subsequent endeavors, while the trend they started continues without them. Two classic examples in the PC industry involve Jack Tramiel of Commodore Business Machines and Steve Jobs of Apple Computer.

Tramiel made the Commodore 64 the most popular computer in the world. He then went to Atari, where he developed the critically acclaimed Atari-ST and fell on his face. Steve Jobs was the driving force behind the Apple II. He left Apple to create the Next Computer. Billed as the next generation of PC, the Next system has failed to generate sales. Clearly, playing follow the leader isn't always the best policy.

Finally, Dvorak's analogy between pop music and computers is nonsense. The computer industry constantly is being improved with technological breakthroughs, making yesterday's machines obsolete. In the music industry, technical advances don't make preceding music sound bad.

Michael D. McGovern
Warrendale, Pennsylvania

Please address letters to the editor to *DEC PROFESSIONAL*, 101 Witmer Rd., P.O. Box 218, Horsham, PA 19044 - 0218. Letters should include the writer's full name, address and daytime telephone number. Letters may be edited for purposes of clarity or space. You can also fax letters to us at (215) 957-1050.

NO SMALL OPPORTUNITY

I agree 100 percent with Dave Mallery's editorial "Missed Opportunities" (August 1989). It's really too bad that DEC insists that it can't deal with small customers. What if a small customer decides it needs a state-of-the-art system but the distributor doesn't have one?

If DEC doesn't watch out, many small customers may feel more comfortable with Big Blue or HP. Are you listening, DEC?

Louis Lange
Boston

IN SEARCH OF E-MAIL

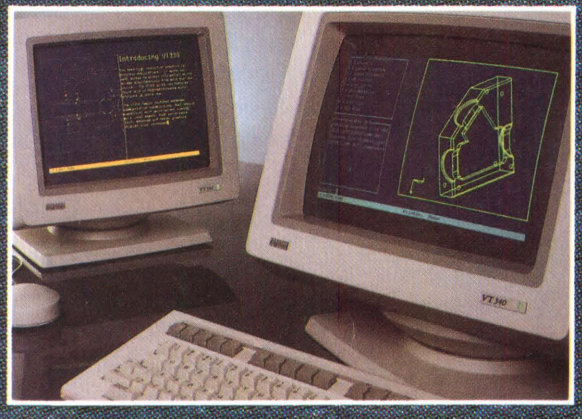
Thank you for keeping up the quality of your publication in the face of computer "fashion" magazines. I find your analyses and editorials intelligent and useful.

I'm interested in electronic mail and would like to find *E-Mail*, by Stephen A. Caswell, as mentioned in Bill Hancock's "Building Your Networking Library" (July 1989). I haven't been able to locate Gage Educational Publishers to order the book.

Mark Grimes, Ph.D.
San Francisco

Editor's note: E-Mail, by Stephen A. Caswell, is published and distributed in the U.S. by Artech House. At the time the article was published, the book was distributed in Canada by Gage Educational Publishers. It now is distributed in Canada by Carswell Legal Publishers.

The Competition is Good.
Our VS-230E is Excellent.
Feature Richness sheds new Light on DEC Compatibility.
Simply, THE BEST VALUE!



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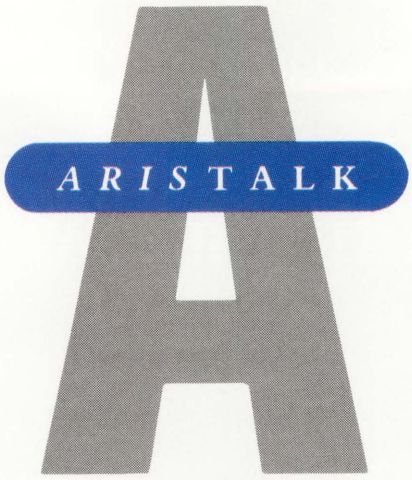

RSX TO VAX/VMS

QUERY:

Paul A. Lucero *(SIG 31/MESS 48)*: Can I use VMS backup to read tapes that were used or written by the BRU utility of RSX? We're migrating files from our PDP-11/44 by copying the files directly from DU0: and DU1: to DUA0: and DUA1:. Do I need to do this, or can I connect the DU0: and DU1: ports to the VAX without doing massive copy commands? I don't have the means to do a test, because our PDP constantly is running and using those disks for data acquisition.

REPLIES:

Andrew Duggan *(SIG 31/MESS 49)*: From what I've read, VMS backup can't read BRU tapes. You can connect your disks to your VAX (I assume they're RA8x drives). VMS can read and write RSX disks (ODS-1). You'll want to have backups, but you can do it. After the drives are on the VAX, you can use VMS backup to back up the data. If you connect the drives to the VAX, the unit numbers mustn't conflict with the drives already on the same controller. If you already have a DUA0: and DUA1:, change the unit select plugs on the drives to other numbers (DUA2: and DUA3: are easiest). You'll want to convert the disk up to ODS-2, so you'll have a lot of shuffling to do.

Barton F. Bruce *(SIG 31/MESS 50)*: The easiest transitions from RSX to VMS or vice versa often are done over time. If you have DECnet on Ethernet, this is trivial. Your files can exist on either machine, and programs on either machine can access them within reason. You can migrate applications one by one.

Another trick is to use the dual ports on your disk drives. A cable from each machine goes into each drive. Note that simultaneous access isn't possible, but any disk can be mounted on either machine. RSX doesn't understand ODS-2 disks, so you can't use your regular VMS disks easily under RSX, but RSX's ODS-1 disks (or ones INI'd for ODS-1 on the VAX — see INI/STRUcture=...) can be used on either system. If you have an RA60 that you use occasionally, both systems can share the drive, and VMS can use it for ODS-2 packs.

Even if the A/B button isn't pushed in to allow access from a port, the drive number still is visible to the controller connected to that non-enabled port. Any controller (e.g., UDA50) mustn't see the same drive number twice on two different cables.

To coexist with a VAX, you shouldn't be limited to unit numbers of simply 0-3. M+ SYSGEN limits you to four UCBs being generated per controller, and because there's no functionality, such as CON SET PORT DU3: /PHYS_UNIT_NUMB=7, you're stuck with four numbers, generally 0-3.

If you need more, it's simple to fix. Extract module SGNMAS from SYSGEN.CLB, and there are two places you'll have to edit. One is an explicit limit of possible unit numbers of (4x controllers). The second is a limit of four units for each controller. These tests aren't near each other. This is a big command file. Keep a copy of the original .CLB, stuff the fixed module back into a new copy of the .CLB and do a component mode SYSGEN to rebuild DUDRV. I often build for 0-17. Each UCG generated means that much less primary pool, so do what you need.

Can VMS read BRU tapes? There have

How To Use ARIS/BB

Subscribers to *DEC PROFESSIONAL* can call up our on-line bulletin board and log into ARIS/BB, our **A**utomated **R**eader **I**nformation **S**ervice. In ARIS/BB, you can download programs from this publication, communicate with our editors, request a change of address, find additional information about advertisers, order books and back issues, check the guidelines for submitting articles, take a peek at our editorial calendar for the year and communicate with other VAX users.

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. Set your terminal emulation to VT100 and dial:

- (215) 957-1000 - Pennsylvania
- (818) 577-9100 - Southern California
- (415) 873-2135 - Northern California

New! ■ **(617) 863-5010 – Massachusetts**

Baud rates: 300, 1,200 or 2,400.

The ARIS/BB symbol appears at the beginning of each article when the program is downloadable. *VAX PROFESSIONAL* programs are available to subscribers of *VAX PROFESSIONAL* only. For subscription information, contact Karol Hughes at (215) 957-1500, 9 a.m. - 5 p.m. EST. Use these recommendations at your own risk. Professional Press is not liable for any damages to your system that might be caused by the hardware, software, programs or procedures discussed here.

XMODEM and KERMIT are available.

SIG Identification

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

26 ..... CPUs
31 ..... Migration Issues
101 ..... Miscellaneous

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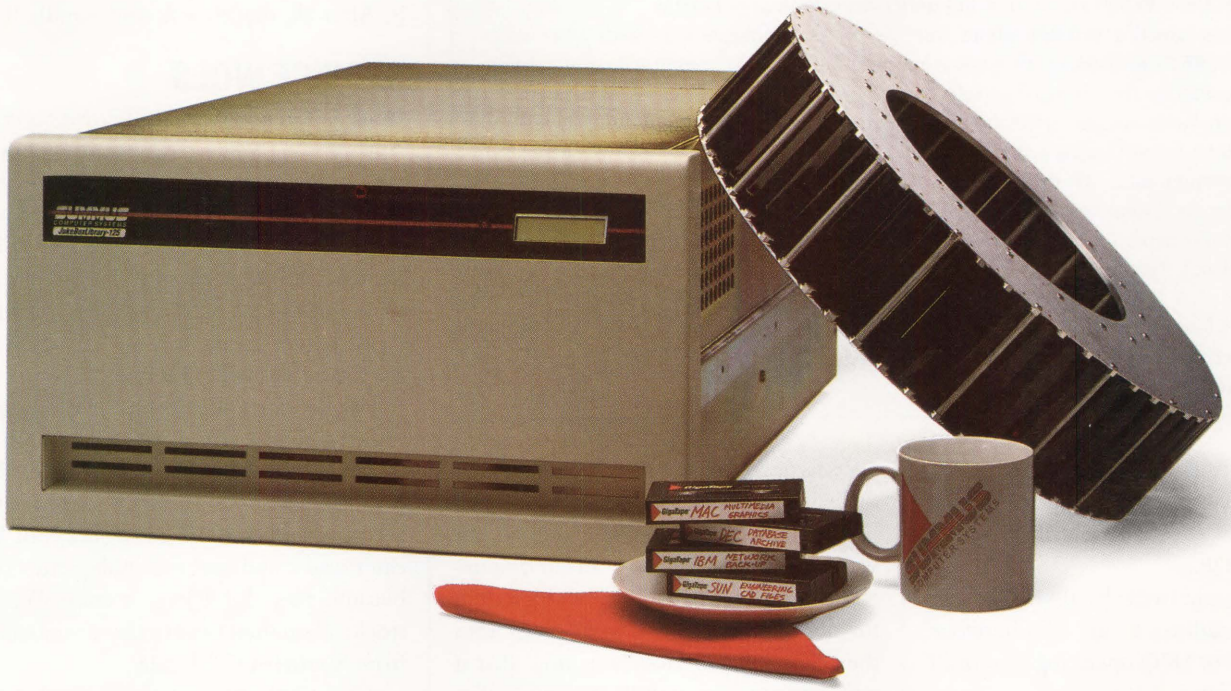

▶ Really hungry? Satisfy your system's big appetite for high-performance data storage with the new, fat-free 125 to 1,000-gigabyte **JukeBoxLibrary**™ helical-scan tape subsystem from SUMMUS.

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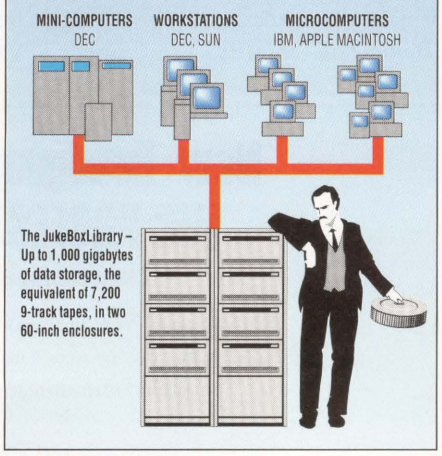

▶ Not quite so hungry? There's more on the menu. Our **GigaTape** 8mm drives can be configured from 2.3 gigabytes up. Or choose from our new rewritable magneto-optical **LightDisk**™ or a smorgasbord of fast, reliable disk drives in our **GigaBox,**™ with 170 megabytes to 20 gigabytes on-line.

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[Report From Dr. R.]

RISCY VAX

Editor's note: Dr. R. contributes timely information about upcoming Digital products and strategies. Look for his insights on ARIS/BB and in ARISTALK.

- A next-generation "RISCy VAX" based on a 64-bit version of Mips Computer Systems' RISC architecture is very likely to emerge in the early 1990s. Lending credence to this claim is the fact that only two midrange VAX processors (CMOS III at 10 VUPS and CMOS IV at 25 VUPS) and two high-end VAX processors (Aquarius II at 50 VUPS and the GaAs-based Centaurus at 150 VUPS) are funded and under development at Digital.
- Digital has issued a warning about the use of disk defragmenters with VMS V5.2. Apparently, V5.2 incorporates file system modifications that have caused at least one defrag package to corrupt files. (Digital appears to be developing its own defrag, anyway.)
- Expect an R3000-based DECstation before the year's end. And with the advent of ULTRIX SMP support before year's end, expect three- and four-processor DECsystem 5830 and 5840 configurations. By mid-1990 (if not before), Digital should have a 50- to 60-VUPS ULTRIX server system based on Mips Computer Systems' R6000 chipset.
- Aquarius still seems to be on-track for a November 1 launch. However, the vector facility may be delayed. Not that it matters — the FORTRAN 6.0 vectorizing compiler isn't ready yet, either.
- OZIX is a forthcoming operating system for on-line transaction processor (OLTP) servers, not the successor to Mica. OZIX is being developed at the much-vaunted DECwest facility in Bellevue, Washington.

been such tools on DECUS VMS SIG tapes. Try [VAX000] or [vax000.tools]. There used to be something called VAXBRURDR.

Some people swear by RMS Convert and related utilities to get files between RSX and other DEC operating systems. I haven't tried it.

UNWISE UPGRADE?

QUERY:

Abe Suleiman *(SIG 26/MESS 54)*: Can I upgrade the VAX 8200 to an 8350? I'm hoping it will be cheaper than getting a MicroVAX 3xxx and additional software licenses. I read that the 8350 provides 2.3 VUPs versus 1.0 VUPs for the 8200. Is this true?

REPLIES:

Robert G. Schaffrath *(SIG 26/MESS 57)*: You can upgrade a VAX 8200 to an 8350, but I don't advise it! The price is outrageous and the performance (even under VMS V5.0) is unimpressive when compared to a MicroVAX 3xxx. Another division in my company spent $35,000 to upgrade its VAX 8200 to an 8350 and was very disappointed. Now, the division expects its new VAX 6310 to provide the performance expected.

If you're short on cash, you might want to do the upgrade yourself by purchasing a used KA-820 CPU board. It sells for about $10,000. It simply plugs into the BI backplane. However, note that if you are running a VMS version earlier than 5.0, ASMP was licensed separately, so you won't be able to start the CPU. Under V5.0, it starts automatically.

Brett Bump *(SIG 26/MESS 61)*: I agree with Robert: Don't upgrade to an 8350. Our college decided to purchase the "more powerful" 8350. At the time, VMS 4.6 was in beta, so we were running V4.5. I was disappointed that the machine couldn't beat my desktop PC in number crunching. If V5.0 gives the 8350 an honest 2.5 VUPs, it's closer to my 4-VUPs PC, but I wouldn't call that much of an improvement. I'd leave the wide-bussed 8200 as it is. After all, my PC will only handle me.

SERVICE WOES

Bruce A. Grembowski *(SIG 101/MESS 555)*: Apparently, the service DEC provides on the East Coast is superior to what we get on the West Coast. My site is in San Jose, in the heart of Silicon Valley, yet DEC field service often doesn't have a replacement RA-80 disk drive, UDA-50 controller or power supply for our PDP-11/44s. It's frustrating when I know the problem is with the controller but have to wait for the DEC field service rep to call the office to have his boss walk him through the diagnostics. I tell him that the ERRLOG seems to indicate the controller, but he can't read it and tries everything else first, because they don't have a controller in stock. Then they have to ship a controller from Southern California.

One DEC rep we had knew what he was doing. None of the other reps seems to know anything about PDPs (and I'm not so sure they know too much about VAXs, either).

INTRODUCING THE TERMINAL SERVER YOU THOUGHT DEC WAS GOING TO ANNOUNCE.

16-Port DECserver Due This Summer; Uses LAT, TCP/IP

By Kimberly Patch

MAYNARD, Mass. — DEC is slated to announce this summer a 16-port terminal server that supports both LAT and TCP/IP, according to sources.

The introduction of the DECserver 300 [illegible]

The MAXserver 1000 Series.

You thought DEC™ was going to deliver both LAT™ and TCP/IP in the same 16-port box. And you thought it was going to be priced very affordably.

Well, DEC didn't do it. But Xyplex,® the leader in multi-protocol communication servers, did. Introducing the MAXserver™ 1000 Series. It's got every feature you were hoping for. Including LAT and TCP/IP, and a great price. Plus it's got a lot of other features DEC never even dared to offer:

- An incredibly compact package that's ⅓ the size of the DECserver™ 300.
- A network connection that can tell whether it's thickwire or ThinWire™ and adjust automatically.
- A self-loading version that's host-independent so your VAX™ works less.
- All with Xyplex's 3-year warranty, the best in the industry.

And in case you want just LAT after all, we've still got DEC beat. The MAXserver 1000 Series includes a LAT-only version. For hundreds of dollars less than DEC. And with the ability to grow into TCP/IP later.

So if you want the industry's best 16-port terminal server, forget DEC. The real news is at Xyplex. To learn more, call our toll-free number today. Or write Xyplex, Inc., 330 Codman Hill Road, Boxborough, MA 01719.

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PRODUCT WATCH

Applying X To C

Saber Software's Saber-C Debugging Environment Supports X Development

In the old days (circa 1985), software engineers debugged their programs by scrolling through code line-by-line, looking for typos and miscues. Browsers and other cross-referenced compilers helped, but the process remained tedious and time-consuming.

Saber-C V2.1, from Saber Software Inc. of Cambridge, Massachusetts, is a software tool that overlays C programs (particularly applications under development) and lets you interactively examine the code and data structures to prototype, test, maintain and debug them. The LISPlike program highlights errors or syntax and semantics that don't conform to the properties of the C programming language. It then prompts you as to what and where the problem is.

This allows the application designer the freedom to test conditional lines of code to see if they conform to C guidelines or work within the functions specified by the program. After the complete program has been debugged and tested, it can be compiled with any C compiler.

Matt Landau, a software engineer at BBN Software in Cambridge, Massachusetts, has used Saber-C to debug several hundred thousand lines of software. "It's our preferred code-development environment for new software," claims Landau.

Saber-C consists of a C interpreter, a source-language debugger and a comprehensive program checker beneath a single user interface. Its linker incrementally can reload modified files while the program checker automatically finds static and run-time errors. The product seems more like a CASE system than a debugging tool.

When an error is discovered by Saber-C, it's reported to the user via a window, and its location within the code is specified. Lines or subsections can be isolated, then checked and tested. The file then can be reloaded at a rate of 18,000 lines per minute. The program is integrated with ULTRIX compilers and utilities with a command language based on existing tools.

Saber-C can do the same in an X environment. Through extensions to Saber-C's error-detection facilities, the software informs a software engineer whether his X application conforms to the X.11 programming interface. The program implements its own X-based multiple-window user interface.

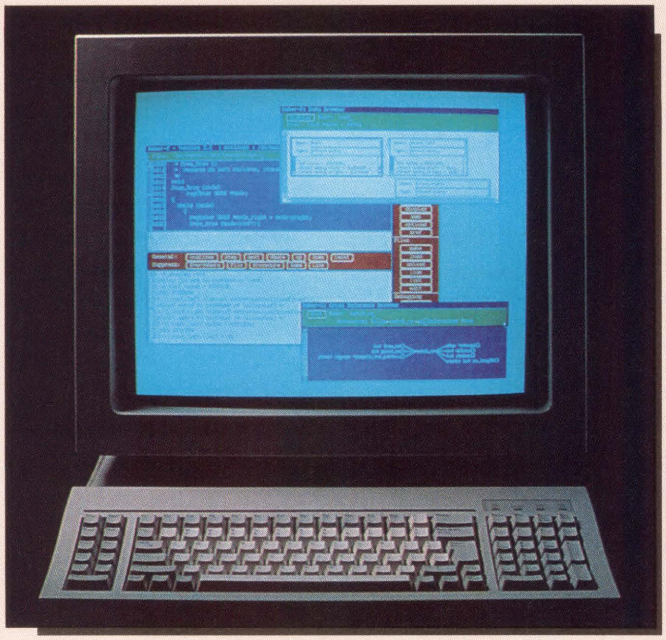
Saber reports that integration with X was the number one request in a recent customer survey. Few tools are available to assist programmers in the development and testing of their X applications. In fact, DEC used the tool during its DECwindows development. And although the program is intended for use on windowing workstations, it can be used with standard ASCII terminals. The program is available on DEC's RISC-based DECstations, including the DECstation 2100.

Saber-C is priced at $2,495 on Sun workstations, DECstations and VAXs, with discounts for multiple purchases.

For more information, contact Saber Software Inc., 185 Alewife Brook Pkwy., Cambridge, MA 02138; (617) 876-7636.

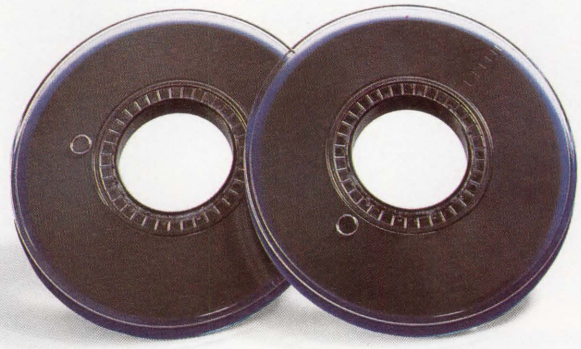
Circle 491 on reader card

—Evan Birkhead

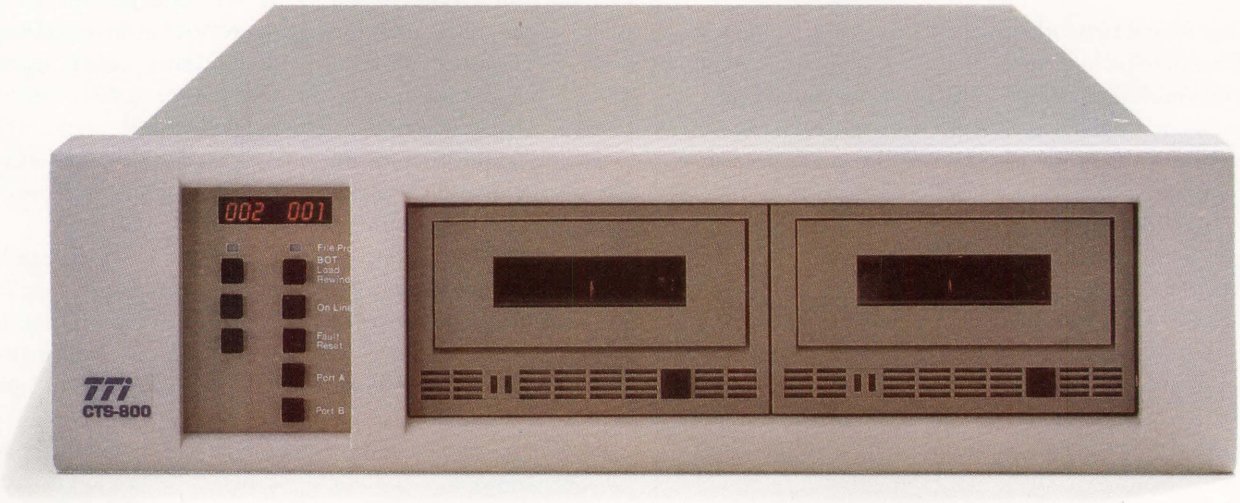


Saber-C V2.1 lets you edit C code residing on different devices.

Backing up a VAXcluster can be reel slow.



Or real fast.



You decide.

You can stick with your TA-79 and back up at a snail's pace.

Or you can switch to TTI's CTS-800 Series and accelerate the entire backup process.

You can stand around all day (or night) loading reels—15 reels in all—to back up 2.2GB on your VAXcluster.

Or you can insert just one 8mm cartridge in a CTS-800 Series drive and let it back up those 2.2GB of data completely unattended.

Need really high capacity? Up to four tape drives can be connected to a single port on your HSC40/50/70 controller. So with a fully loaded HSC5X-CA card, you can back up 32GB overnight... completely unattended. That's real efficiency.

And upgrading to a high performance TTI backup subsystem is really easy. The CTS-800 is a plug and play swap with TA drives and 100% HSC compatible too.

TTI's CTS-800 Series Tape Subsystems. It's the VAXcluster backup subsystem with un-reel performance.

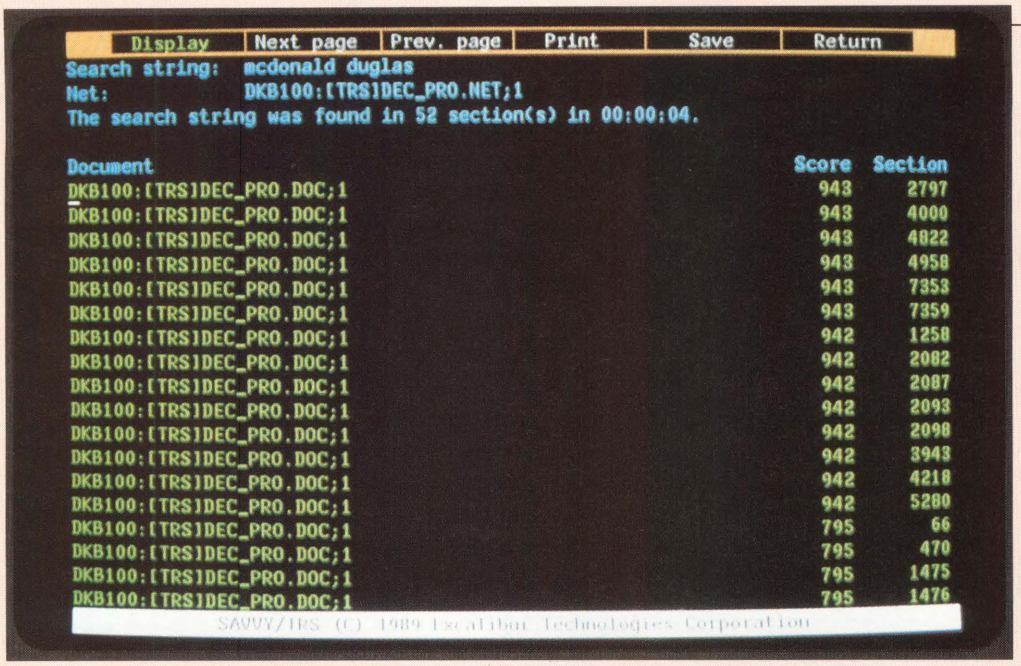
For more information, call the leader in unattended backup systems, TTI, at 714-744-1030.

Or write to: Transitional Technology, Inc., 1411 N. Batavia, Suite 203, Orange, CA 92667.

TTi
TRANSITIONAL TECHNOLOGY, INC.

European Sales Office. Transitional Technology, Suite 2, Kennett House, 108/110 London Road, Headington, Oxford OX3 9AW. Phone: 0865 741345.

CIRCLE 261 ON READER CARD



A Savvy/TRS query generates this list of possible text selections.

The Search For Text And Image

Excalibur Technologies' Savvy Neural Network Speeds Text And Image Retrieval

The Savvy neural network from Excalibur Technologies Corporation of Albuquerque, New Mexico, which is used to search and retrieve information from databases, is a pattern-recognition system. This process involves the interaction of data along one layer — the layer between the user's query and the database.

The neural network program builds a pattern-recognition database and can learn new patterns from search queries. Unfamiliar data queries are interpreted by indexing them to candidate patterns in the database that they most closely resemble. The Savvy program then provides you with an educated guess, a list of numerically sorted database headings from which you can select.

Founded in 1980, the Savvy technology initially was used as the basis for a natural programming language. Eventually, it was integrated into a signal-recognition system (Savvy/SRS), which identifies digitized signals in chemical-analysis applications. Today there are two other neural networking products from Excalibur: the Savvy/TRS text-retrieval system and the Savvy/VRS visual-recognition system. The products are packaged as callable C software modules.

An integrated text and vision system called PixTex can input, store and retrieve scanned documents that contain text and graphics. Using neural-networking technology, PixTex retrieves and displays up to 4 GB of the documents it stores as compressed 50-KB monochrome images.

Savvy/TRS is a VAX/VMS-based text-retrieval application that mixes Boolean logic with the ability to match character patterns. Character patterns are determined from the ASCII codes. After new patterns are used to retrieve data, the pattern is stored and serves as an index into the database. Then a second-level non-neural search homes in on the probable selection.

By using ASCII software standards, Savvy/TRS calls up clean information without character-transformation errors and broken word strings. A menu system is provided for using Savvy/TRS as a standalone text-search system. With no inverted indexes, key word tables or expert system rules to construct, Excalibur claims that Savvy/TRS can run the day it's installed. The system includes performance monitors and tuning parameters, and it automatically corrects misspelled words.

Savvy/TRS, priced from $12,000 to $44,000 depending on VAX configuration size, can access any ASCII file across a network or cluster.

Savvy/VRS is an image-recognition system for VMS and DEC's 386-based workstations. It can recognize shapes and textures of input scanned images and then respond to user queries about the image.

The Savvy/VRS program, which is priced at $45,000 for a development system, builds its inspection system using input video images rather than text, but otherwise uses the same neural-networking principles of Savvy/TRS. A device driver that interfaces to image processing hardware is included.

In addition to the basic license fees, there are also fees for additional users, technical instruction and software maintenance.

Functions of Savvy/VRS include:

1. vrs_configure, which configures VRS to driver addresses.
2. vrs_learn, which teaches the images pattern to the neural network.
3. vrs_autorec, which matches a frame to the neural network.
4. vrs_finder, which searches a frame for specific objects.

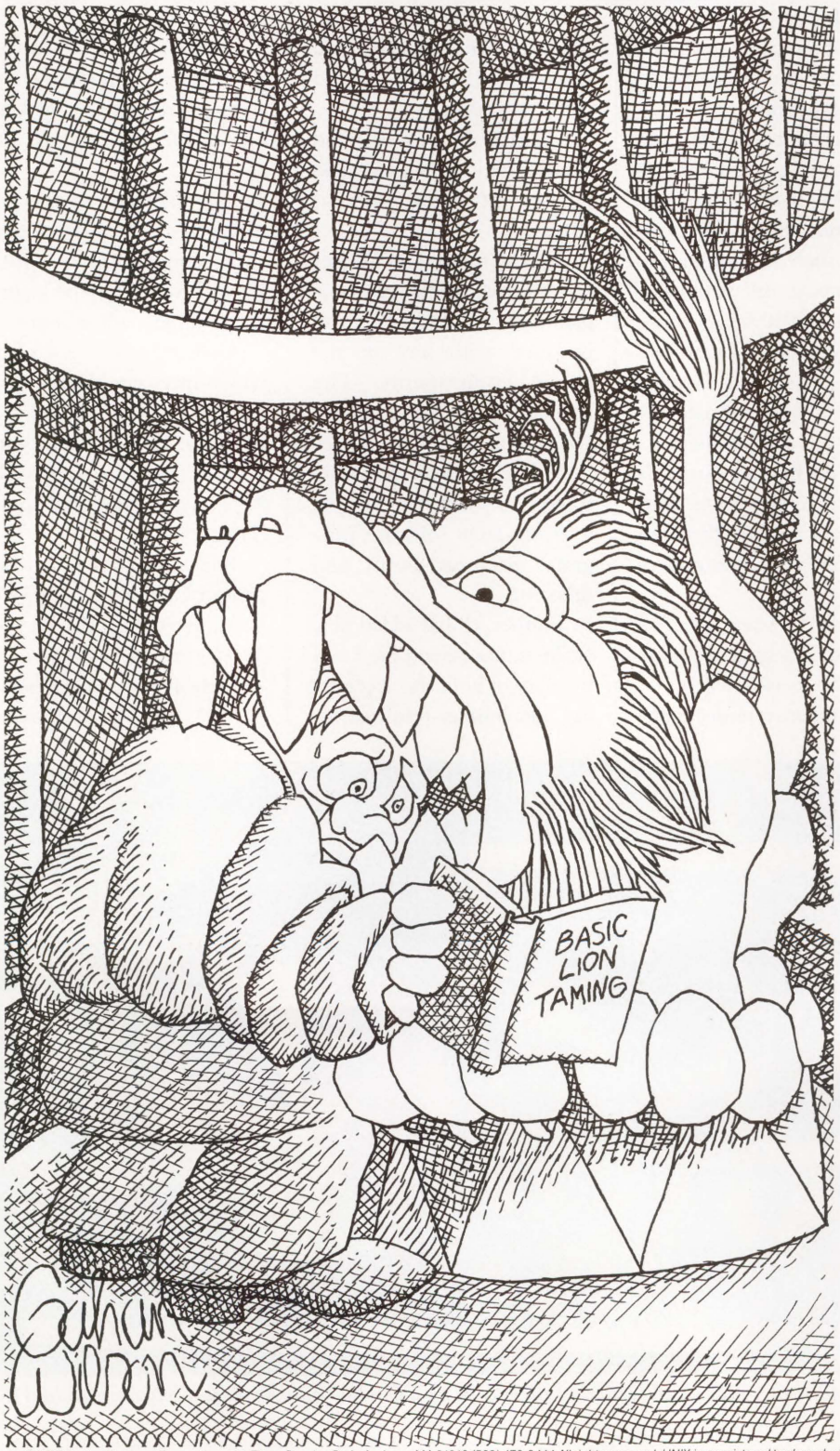
Through a relationship with Nikkei Information System Company of Japan, Excalibur is developing an advanced programming and application-development environment called Threaded Interpreted C Object Language (TICOL), which will integrate neural networks, natural language interfaces, object languages and expert systems.

For more information, contact Excalibur Technologies Corp., 2300 Buena Vista Dr. S.E., Albuquerque, NM 87106; (505) 764-0081.

Circle 492 on reader card

—Evan Birkhead

WHEN FACED WITH LEARNING A NEW TEXT EDITOR, YOU CAN PROBABLY THINK OF SOMETHING ELSE YOU'D RATHER DO.



Most people would do just about anything to avoid learning a new text editor.

Fortunately, there's EDT+. EDT+ from Boston Business Computing is a full-featured text editor based on VAX EDT. EDT+ let's you move from VMS to UNIX or MS-DOS without the expense or hassle of retraining.

EDT+ supports all the familiar EDT features like line and keypad mode commands, disaster recovery, command macros, user-defined keys and initialization files. It also offers important improvements over the old standby, including TPU/EVE features like SHELL and LEARN and 132-column support—all with the speed expected of a truly contemporary product. You will benefit immediately, as you optimize newer technology and eliminate a drain on your VAX resources.

No Train No Pain

And as the leader in DEC compatible software, we'll fully support your move from VMS to the not so familiar world of UNIX or MS-DOS. Call (508) 470-0444. Before you do anything drastic.

EDT+

Take the bite out of going from VMS to UNIX or MS-DOS.

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The DEC Compatible Software Company

CIRCLE 297 ON READER CARD

World Class Meets 20/20

Collier-Jackson's World Class Series Software Adds 20/20 Integration

Collier-Jackson of Tampa, Florida, through an alliance with Access Technology Inc. of Natick, Massachusetts, has extended its World Class Series of cross-industry accounting and human-resource software for VAX/VMS.

The CJ/Advanced General Ledger System can link with Access' 20/20 spreadsheet for the VAX. In addition to letting users read data stored in 20/20 files, this integration allows Collier-Jackson users to analyze data displayed in 20/20's color graphics utility. Collier-Jackson plans to integrate its human-resource software with 20/20, as well.

The General Ledger is designed to help businesses monitor and control their financial operations, providing facilities for budgeting, forecasting, allocating and reporting. The system's flexibility allows it to compare figures against set benchmarks. For example, you can pit projections against results or measure forecasts against revised budgets. The system includes the full range of standard reports, which are tailored and generated online by the user.

By supporting multiple accounting periods and fiscal years, the General Ledger lets you review budgeting histories. Charts of accounts can be set up for separate companies. Each company can have a unique organization, chart of accounts and accounting cycle.

In addition to the Advanced General Ledger, CJ offers four other integratable software modules devoted to accounting management:

1. CJ/Accounts Payable controls costs by governing transactions among multiple banks and companies with features such as vendor inquiry support, calculations of discounts and 1099 reporting.
2. CJ/Accounts Receivable consists of several inquiry capabilities and format options for 30, 60 or 90 days.
3. CJ/Purchasing controls your procurement cycle from order placement through evaluation of vendor performance.
4. CJ/Fixed Assets can be tailored to suit your accounting and tax personnel.

CJ's human-resource management packages are:

1. CJ/Payroll, a module that includes benefits tracking, tax updates and reporting and adjustable pay cycles.
2. CJ/Personnel, which maintains information such as skills inventories by jobs, organizational levels, job applicant information and medical records.
3. CJ/EFA (Employee Fund Administration), which tracks investment plans such as 401(k)s.

The CJ/Report Writer and CJ/Execulink are complementary systems that can be used with any of the above components. The Report Writer lets you select which information is reported. Execulink is a PC-based utility that transfers data into MS-DOS software programs such as Lotus and dBase III.

Further, CJ has added new facilities that extend the functionality of both the accounting and human-resource series. PC Time Entry lets outside departments using PCs (or field office employees) enter their hours and attendance information onto the host Payroll system. A package called Position Control matches corporate titles to job applicants and furnishes information (reporting hierarchy, skills, salary, and so on) on all positions in the company.

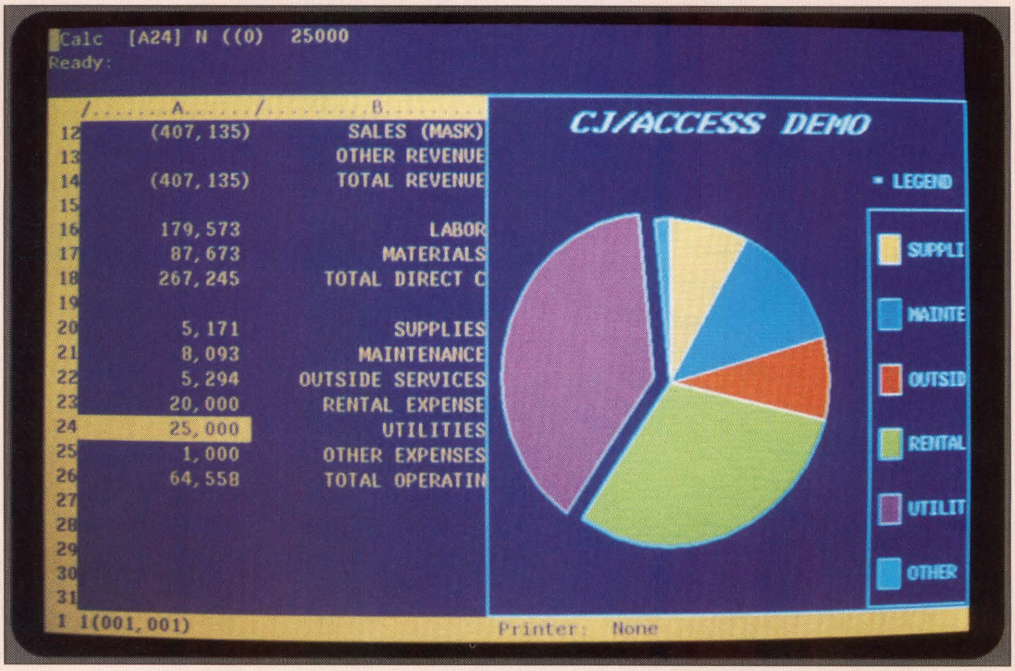
The Fixed Assets module has been enhanced with bar-code compatibility, which allows inventory to be logged in using bar-code scanners.

Collier-Jackson is a Digital Cooperative Market Program (CMP) participant and has a similar agreement with Hewlett-Packard for its HP 3000 series of financial applications.

For more information, contact Collier-Jackson, 3707 W. Cherry St., Tampa, FL 33607; (813) 872-9990.

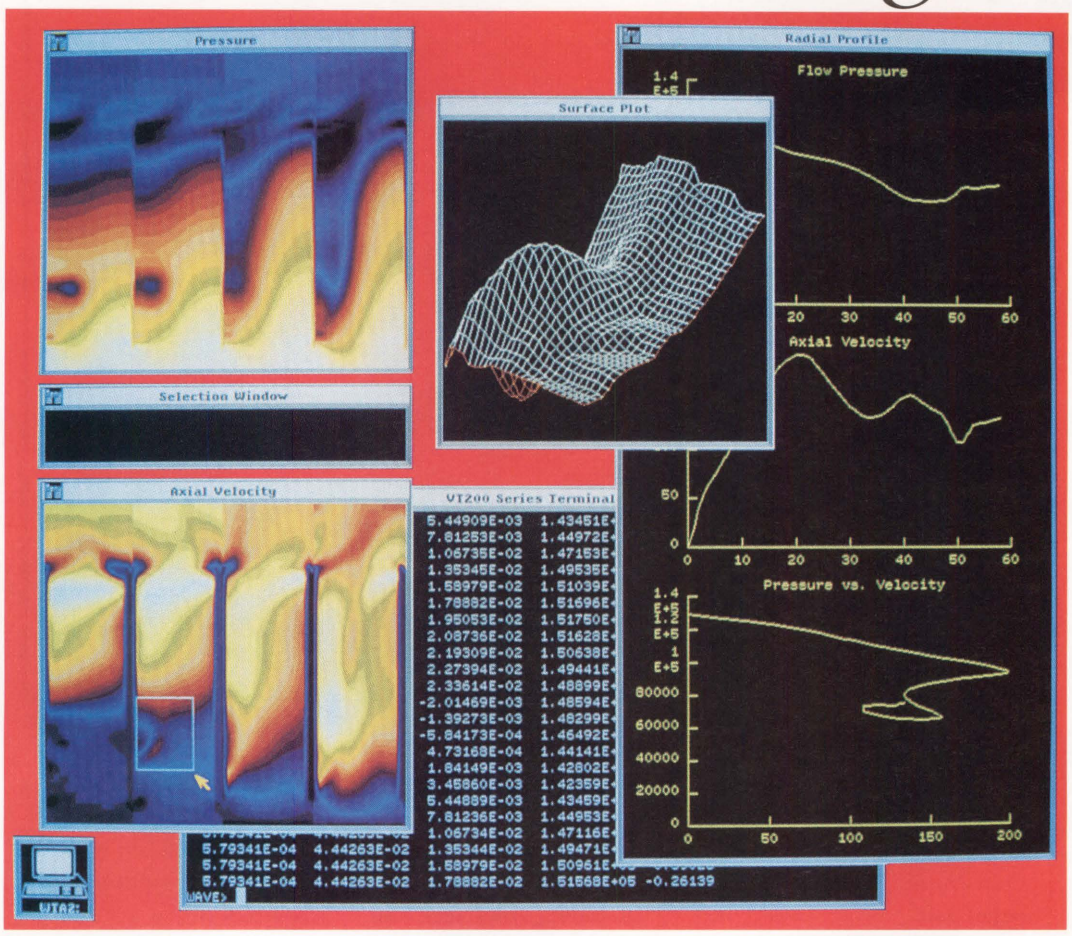
Circle 490 on reader card

—Evan Birkhead



Collier-Jackson's Advanced General Ledger calls up a window from an Access 20/20 spreadsheet file.

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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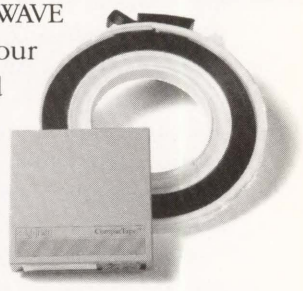

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CIRCLE 172 ON READER CARD

EasyLink VAXmail

Western Union's OfficeAccess Provides Worldwide VAXmail Services

If your VAX site is like many, VAXmail is its lifeblood. Nothing is better to beat the telephone-tag blues.

But VAXmail is great only as long as your messages don't need to be sent outside your site's boundaries. If you need to communicate with a VAX site not your own, you must use other means. If you have access to other sites via modem, you still can use VAXmail. But who wants to go through the dial-up hassle just to read and send mail?

Western Union Corporation of Upper Saddle River, New Jersey, makes remote mail access easier with OfficeAccess. OfficeAccess takes advantage of Western Union's EasyLink worldwide electronic network to let VAX users send and receive mail to and from remote sites as easily as they do within their local site.

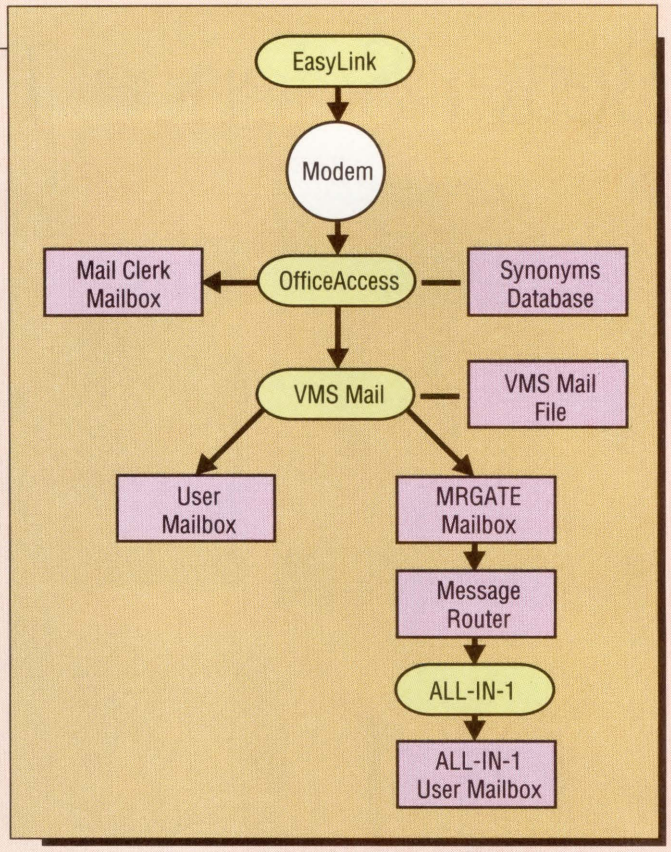
OfficeAccess acts as an interface between VMS Mail and EasyLink. EasyLink addresses are defined as VMS Mail names. Sending VMS Mail to an EasyLink address simply requires that you know the name of the desired destination EasyLink mailbox address. An acceptance message is return mailed to inform you of successful mail transfer. Rejection messages are sent in the event of problems.

Systemwide and user-specific directories of mail recipients can be maintained. OfficeAccess addresses consist of a name of your choice and its corresponding EasyLink address. Comments can be included in the OfficeAccess address definition. In addition to the VMS Mail facility, mail can be sent through ALL-IN-1's mail subsystem.

Before users can send mail, the system manager defines the dial-out host ports to be used for OfficeAccess communications. Information for each EasyLink account also must be set up in an OfficeAccess database. This information includes the account's EasyLink identification, EasyLink access phone number, username, password, the dial-out ports to be used by OfficeAccess and the name of a user on your system to which incoming mail will be routed if OfficeAccess can't locate the target user.

A number of ports can be designated as dial-out ports. OfficeAccess will try each port in succession until one is available. The system manager can define a cycle time that OfficeAccess will wait before checking for more outgoing mail. If new outgoing mail is detected, the OfficeAccess driver dials out to EasyLink and sends the messages. For urgent requests, users can have OfficeAccess send messages immediately.

At the same time OfficeAccess sends messages, it checks for incoming messages. If no new messages are sent within a specified time period, OfficeAccess automatically will check for incoming mail. This time interval can be controlled by the system manager in the same manner as the outgoing-message cycle time.



Route of incoming OfficeAccess messages.

Incoming messages are distributed with VMS Mail to VMS users at the target site. If OfficeAccess can't find the user to which mail is sent, the message is deposited in the account of the person assigned as the target site's mail clerk.

As installed, OfficeAccess lets any user send and receive EasyLink messages. The system manager can limit the number of users who can access OfficeAccess. Users also can be restricted in their ability to define destination addresses.

Messages can be sent in a variety of forms. In addition to the standard EasyLink mailbox, messages can be sent to a telex terminal (whether or not it's a Western Union telex terminal). Worldwide telex service is available. Mailgrams, telegrams and cablegrams can be sent. Another option is priority letters that are printed and delivered by Western Union.

For target sites that don't have EasyLink or a telex terminal, a fax option lets you send messages to any Group III fax machine.

OfficeAccess runs on any VAX running VMS V4.2 or later. MicroVAXs running MicroVMS V4.2 to 4.7 are also supported. Average memory use for the OfficeAccess driver is 500 KB. Installation requires 300 KB of disk space.

For more information, contact Western Union Corp., 1 Lake St., Upper Saddle River, NJ 07458; (201) 818-5000.

Circle 472 on reader card

—David B. Miller

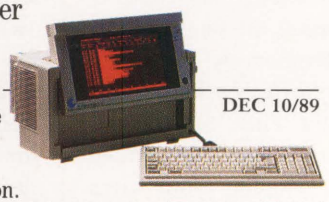
Even with a protocol analyzer, you have a limited view of your LAN.

If you're responsible for managing or maintaining a LAN, you need a tool that will do more than just fix a problem after it occurs. That's where Spider's Monitor and Analyzer come in. They provide continuous monitoring and sophisticated analysis capabilities for Ethernet and IEEE 802.3 networks—so you can manage your LAN, not just react to it. They provide you with the information essential for proactively managing your network, including event alarms, packet filtering, protocol decodes and more—presented in an easy to interpret and use format.

To learn more about how SpiderMonitor and SpiderAnalyzer can help you better manage your network call **1-800-447-7807,** or simply send in the coupon.

Protocol Analyzers vs. SpiderMonitor & SpiderAnalyzer

Features	Protocol Analyzer	SpiderMonitor 220	SpiderAnalyzer 320
Continuous monitoring in simultaneous modes		•	•
Per station statistics		•	•
Event detection alarms		•	•
Security monitoring		•	•
Performance monitoring		•	•
Trend analysis		•	•
Traffic simulation	•	•	•
Data filtering	•	•	•
Low level decodes	•	•	•
High level decodes	•		•
User-definable decodes	•		•
Price	$18–30,000	$8–14,000	$10–17,000



DEC 10/89

Yes, I want to learn more about the SpiderMonitor and SpiderAnalyzer.

☐ Send more information.
☐ Send more information and a demo disk ☐ 5¼″ ☐ 3½″
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SPIDER SYSTEMS

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CIRCLE 247 ON READER CARD

Finding A First-Class Expert

Create Your Own Expert System With 1st-Class Expert Systems' 1st-Class Fusion

Do you remember ELIZA, the psychotherapist who gave advice to students at MIT in the mid 1960s? If you do, then you'll recall that ELIZA wasn't human, but a computer program designed to simulate intelligent behavior. ELIZA was an early attempt at AI. More than 20 years later, the quest for machine intelligence and true expert systems continues.

One company working in this area, 1st-Class Expert Systems Inc. of Wayland, Massachusetts, has developed 1st-Class Fusion. 1st-Class Fusion is software that lets you build an expert system using your VAX or IBM PC or compatible.

1st-Class Fusion lets you develop your own Knowledge Base Modules (KBM), or advisors, in six steps. This is accomplished by working in and moving through six menu-driven screens:

1. Files — With the Files screen, options include creating a new file (knowledge base), getting an existing file or exiting to DOS temporarily. The Files screen lists many knowledge base files. These files serve as sample advisors and models for developing your own knowledge bases. Examples include a simple diagnosis to determine the type of aphasia present from clinical findings and a circuit board troubleshooter advisor.

2. Definitions — The Definitions screen is where you define your knowledge base. This is similar to setting up a spreadsheet template as in Lotus 1-2-3 or defining a database as in Ashton-Tate's dBase. A knowledge base has four main elements: Results, Factors, Values and Text.

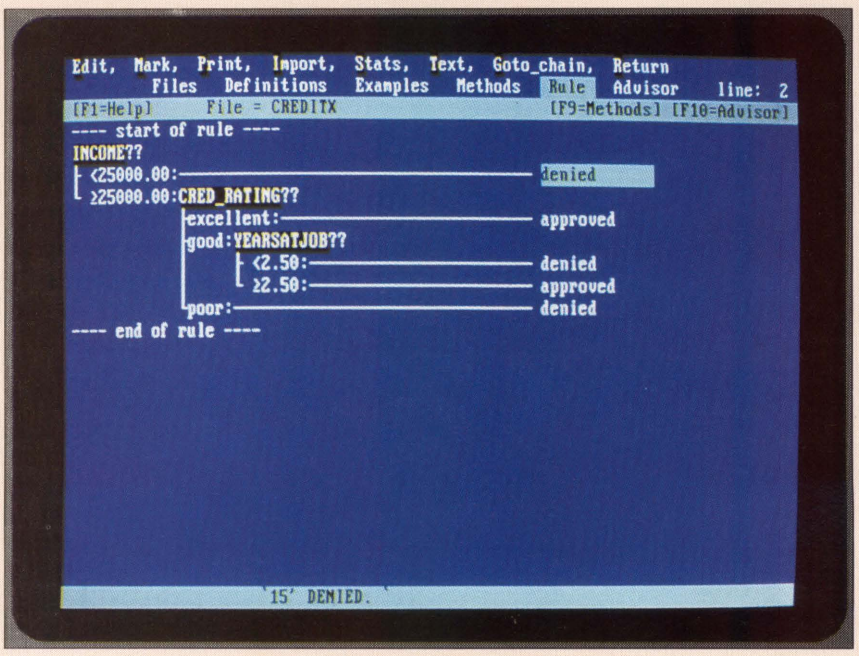
3. Examples — The Examples screen is where you "teach" 1st-Class Fusion to be an expert by giving it examples of how an expert thinks. An example is a set of values (one for each factor and result) that describes how an expert would make a decision under similar conditions.

4. Methods — The Methods screen lets you select among six Methods, or techniques, for building a rule for the knowledge base: Optimize (this eliminates factors that don't affect the result); Left-Right (this lets you establish the sequence of questions); Progression (this builds a simple sequence of factors); Exhaustive (this builds a complete rule covering all cases); Customize (this allows manual building of a rule tree on Rule screen); and Match (this matches answers to examples rather than using a rule).

5. Rule — The Rule screen converts the entered definitions and examples into a visual rule called a rule tree. The rule tree is displayed as a standard inverted search tree with nodes and branches that show the sequence of questions the knowledge base will ask the user. The rule tree may be used to test run the advisor to check its logic at every decision point.

6. Advisor — The Advisor screen shows exactly what the user sees. Following the rule that was developed, the Advisor screen presents a series of questions (corresponding to factors) to the user. The rule determines the result based on the specific combination of user answers. The Advisor screen then offers this result to the user as advice.

1st-Class Fusion adds a source-code generator for C and PASCAL. This eliminates the need for programmers to do the coding. It also has built-in links to dBase III files and larger knowledge bases. This lets PC users use dBase III in their applications.



Ist Class Expert Systems' 1st-Class Fusion lets you build expert systems of any size by chaining knowledge bases.

1st-Class Fusion development and run-time programs cost from $1,495 for the IBM PC and compatibles and from $5,500 for the MicroVAX II, VAX 8200 and 8250.

For more information, contact 1st-Class Expert Systems Inc., 526 Boston Post Rd., Ste. 150 E., Wayland, MA 01778; (508) 358-7722.

Circle 468 on reader card

—George T. Frueh

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!

But what does that get you?

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.

KEA

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Telephone: 604-732-7411 Fax: 604-732-0715

CIRCLE 119 ON READER CARD

Terminals Go ASIC

Wyse Technology's WY-370 And WY-185 Terminals Are Latest In '90s Series

Wyse Technology of San Jose, California, has added two newcomers to its "Terminals of the '90s" series: the WY-370 high-performance color terminal and the WY-185 DEC VT320-compatible monochrome display terminal. Both terminals incorporate Application Specific Integrated Circuit (ASIC) technology. This increases product performance and improves reliability by reducing the number of components on-board.

The WY-370 color terminal features a 14-inch diagonal non-glare CRT and a low-profile, two-position tilt keyboard. The terminal is 13.5 inches high, 14 inches wide and 14.5 inches deep. It supports ASCII, ANSI and Tektronix 4010/4014 graphics. It has 64 background and 64 foreground colors in alphanumeric mode, and it supports dual sessioning.

The WY-370 provides emulations of WY-370 Native, DEC VT320/220/100/52, Intecolor 220, Wyse WY-350, TeleVideo 950, Esprit III and ADDS A2.

Fonts and character sets include 128-character U.S. ASCII, DEC Multinational and ISO 8859-1. Up to 512 unique characters can be programmed and displayed simultaneously.

The 80 x 26 character-cell screen is refreshed at a 60-Hz rate and displays alphanumeric characters within a 16 x 20 character cell. Screen formats are 26/52 lines by 80/132/161 columns with up to three pages of display memory. The WY-370 supports double-high and/or double-wide characters.

In the Tektronix 4010/4014 mode, graphics resolution is 640 x 480 pixels with a 1:1 square pixel aspect ratio. Screen formats with graphics are 80 columns by 36 rows or 128 columns by 60 rows.

WY-370 keyboard memory consists of two independent, non-volatile, 512-byte user-definable function key buffers.

Choice of layout includes VT320 ANSI (105 keys), Enhanced PC (102/103 keys) and Wyse ASCII (101 keys).

The WY-370 can operate in full/half duplex, block or monitor (debug) mode.

Two female DB-25 connectors are provided on the back for serial communication. One can be used for RS-232/RS-422 communications up to 76.8 Kbaud, and the other for RS-232 up to 38.4 Kbaud. A cartridge interface for optional communication ports and/or personality cartridges is provided.

The WY-370 includes windowed set-up menus and help messages and the WyseWorks personal productivity tools (calculator, datebook and alarm).

An 8-MHz 68000 microprocessor accessing 64 KB of high-speed static CMOS RAM forms the brain of the WY-370. Also included is 16 KB of lithium battery-backed RAM.

The WY-370 color terminal is priced at $1,249.

The WY-185 works in DEC VT220 and VT320 applications and supports double-high and/or double-wide characters. The 14-inch CRT is available in paper-white, amber or green phosphors. The terminal is 12.5 inches high, 13.4 inches wide and 12.2 inches deep.

Alphanumeric characters can be displayed in 80 columns using a 15 x 12 or 10 x 20 character cell, or 132 columns using a 9 x 12 or 9 x 20 character cell. Screen formats can be 25 lines by 80/132 columns with two pages of screen memory.

The WY-185 can operate in half/full duplex, local or monitor mode and is compatible with RS-232, DEC MMJ and RJ-11. It uses an 11-MHz 8032 microcontroller accessing 24 KB of high-speed static CMOS RAM. Also included is 8 KB of lithium battery-backed RAM.

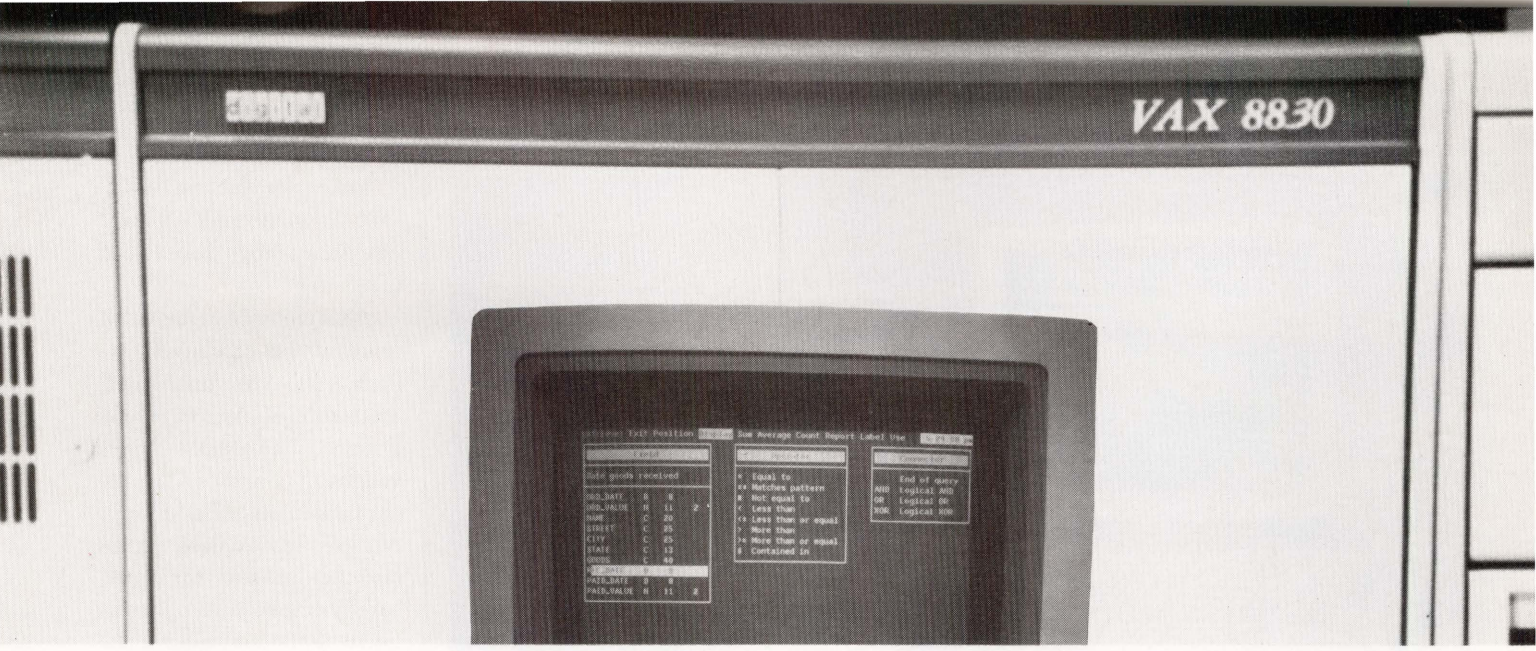
The WY-185 monochrome terminal is priced at $499.

For more information, contact Wyse Technology, 3571 N. First St., San Jose, CA 95134; (408) 473-1200.

Circle 421 on reader card

—George T. Frueh

Wyse Technology's WY-370 color terminal, which incorporates ASIC technology, supports ASCII, ANSI and Tektronix graphics.



Now dBASE users have someplace to grow.

When PC users need more power, now they can have it. Recital ™ is the first RDBMS and 4GL for VAX systems that's totally upward-compatible with Ashton-Tate's dBASE.™ It's also compatible with Clipper™ and FoxBASE.™ So you can move applications and associated data directly from PC to VAX/VMS.™ Maintain and modify your applications using the same familiar syntax and commands. No retraining and no reprogramming. Recital runs on UNIX systems, too.

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CORPORATION

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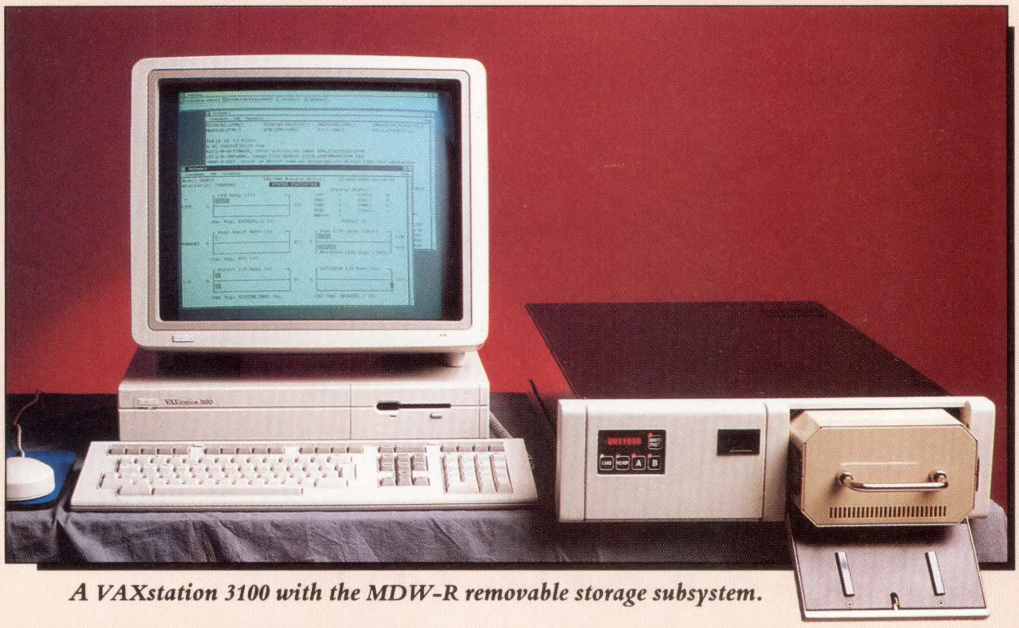

A VAXstation 3100 with the MDW-R removable storage subsystem.

MT's Expanding Storage Menu

Micro Technology Introduces Several New Tape, Fixed And Removable Storage Subsystems

Micro Technology Inc. (MT) of Anaheim, California, has added several new members to its family of storage devices for DEC and other computer workstations. The systems range from tape storage subsystems to fixed and removable storage subsystems, some of which include tabletop and pedestal versions.

The MDW-F/MDS-F series includes fixed storage subsystems for DEC and Sun workstations. The MDW-F is designed to be compatible with all DEC and Sun computers that use a SCSI interface, and the MDS-F is for Sun workstations and file servers using a VME interface. The SCSI interface allows equipment to interface to a wide variety of host systems.

"The number of large VAX sites importing VAX and Sun workstations is significant," says Steve Hamerslag, Micro Technology's president and CEO. "I believe that over 50 percent of DEC's large VAX sites now have one or more workstations. To not offer a compatible product in this area would be ignoring a significant shift in the market toward high-performance workstations networked together."

The configurations include a tabletop version that can house two 1.2-GB storage devices and one 8mm tape and a pedestal version that can house four 1.2-GB devices and one 8mm tape. Partial performance characteristics for the subsystems include a 16-ms average seek time and a 2.5-MB-per-second data-transfer rate.

Prices for the MDW-F/MDS-F storage subsystems range from $8,000 to $30,000.

On the tape side, the MTU-100 and MTQ-100 are nine-track DEC-compatible tape subsystems. The MTU-100 is for UNIBUS-based systems; the MTQ-100 is for Q-bus-based systems.

Both subsystems use the Micro Technology M-100 tape transport, which features dual densities of 1,600/6,250 bpi and tape speed of 100 ips. The MTU-100 and MTQ-100 are TMSCP-compatible with the MU driver and can be upgraded to be HSC-compatible with the addition of Micro Technology's MA-90 HSC adapter interface.

The MTU-100 is priced at $28,000, and the MTQ-100 is $24,000.

The MDW-R/MDS-R series are removable storage subsystems for the UNIX workstation market. The MDW-R series is designed for use with the DECstation 3100, VAXstation 3100 and other SCSI-based platforms. The MDS-R is a VME-based removable storage subsystem and initially is targeted at Sun and Solbourne workstations.

Prices for the MDW-R/MDS-R removable storage subsystems range from $9,500 to $37,500.

Also removable is the MDM series, a high-capacity 5 1/4-inch, 600-MB formatted, SMD-compatible storage subsystem. The MDM series weighs 16 pounds when fully encased in its shock-mount canister. It's available as an end-user product for DEC-based computers using traditional SMD controller technology.

Partial performance characteristics for the MDM series include a 2.5-MB-per-second data-transfer rate, 16-ms average seek time, 8.3-ms average rotational latency and 8.3-GB maximum capacity per footprint.

Prices for the MDM series range from $26,000 to $182,000.

Micro Technology also has added two features to its existing MA-24 HSC-compatible 8mm tape backup system. The first allows the MA-24 to execute faster file mark searches, allowing the tape subsystem to search for data at a rate of 10 times the read speed.

The second is an intelligent front panel that displays all tape activity for the master and slave units. It displays such information as the STI unit number, current error rate, the remaining tape in megabytes and the current SCSI command in progress for each drive. The MA-24 with new features is priced at $30,000.

For more information, contact Micro Technology Inc., 5065 E. Hunter Ave., Anaheim, CA 92807; (800) 999-9MTI.

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Many managers are looking to fiber networks to provide for their future networking needs. And vendors now push customers to install fiber optic cable.

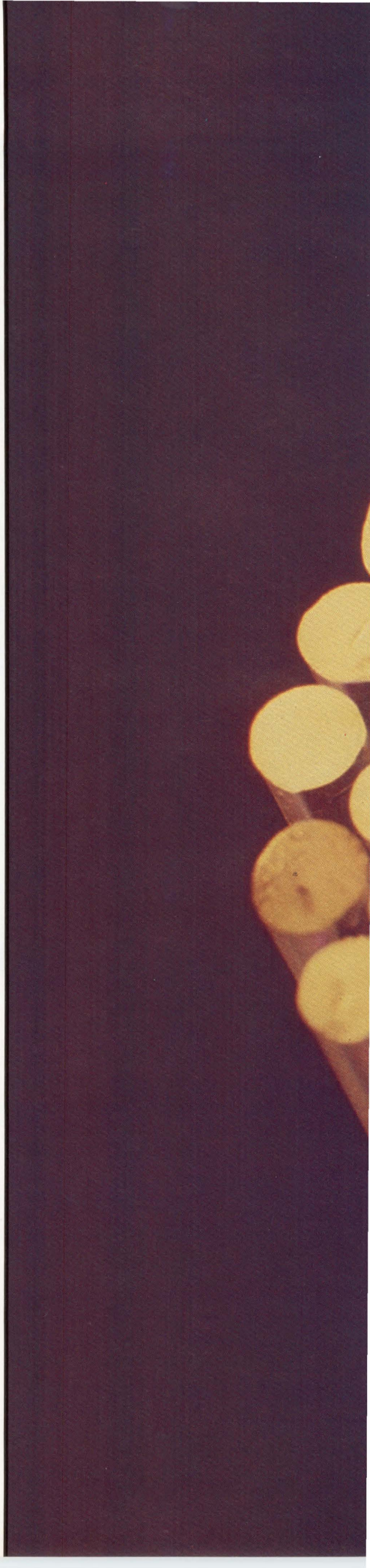
What are the myths and realities of fiber for today's networks? And how should you prepare for a fiber network, such as Fiber Distributed Data Interface (FDDI), tomorrow?

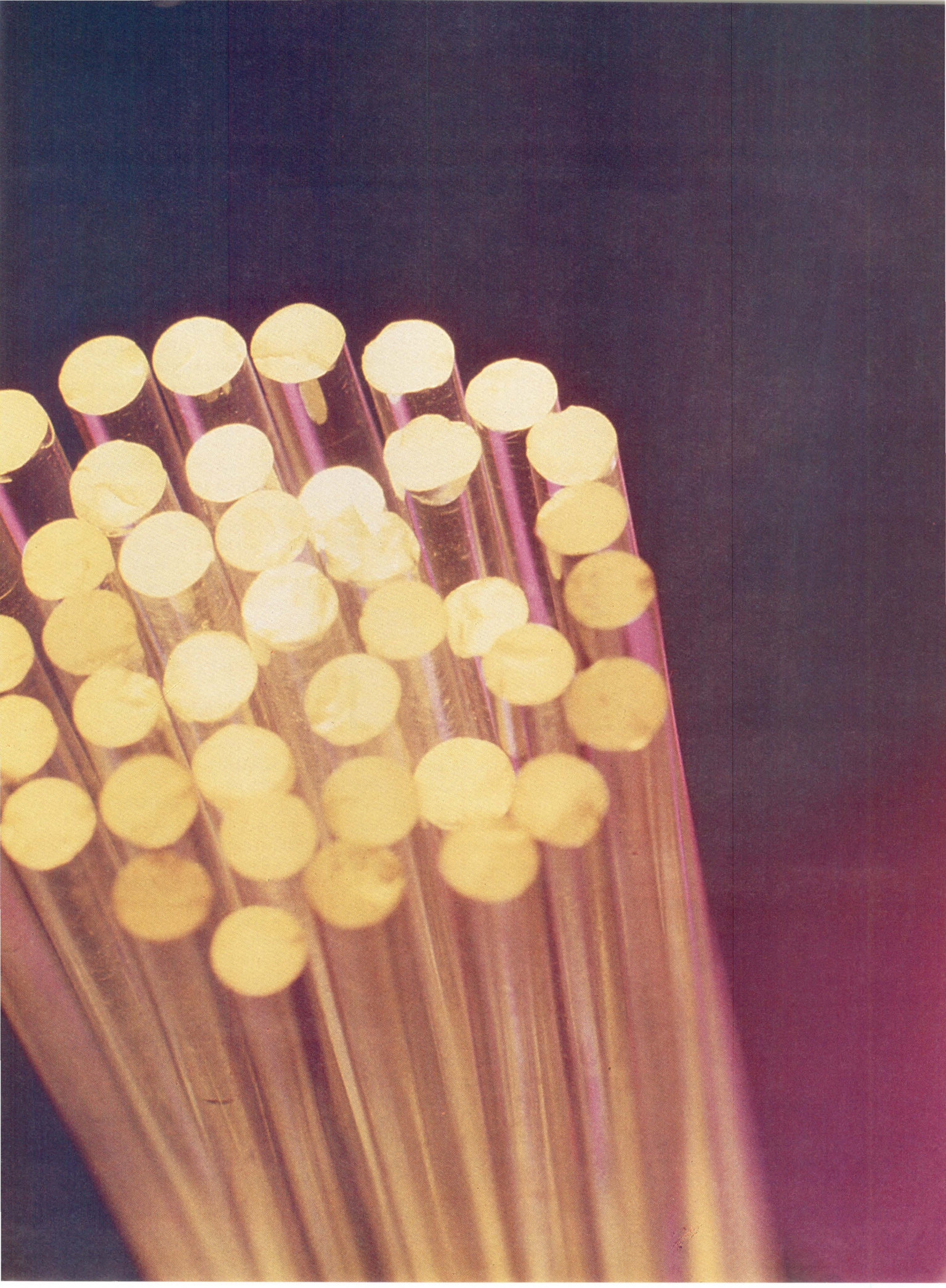
Fact Check

First, let's get the facts straight:

1. There's nothing wrong with a copper-wire network. Copper isn't inferior or slow.
2. Most LAN cable speeds outclass anything most communications controllers

BY BILL HANCOCK





Token Ring Model

Fiber Distributed Data Interface (FDDI) is based on a token ring model. To better understand FDDI, let's review how a token ring network operates.

Each station wishing to access the network is connected to the token ring network and is granted access when a data element called a token is available. A token is present on the network when the network is idle. A sending station grabs the token and modifies a bit in the token that changes the token from a token bit pattern to a start-of-frame (SOF) bit pattern.

The sending node then appends the network frame information to the SOF and sends the data on the wire. The frame is sent from node to node. Each node inspects the address destination field to ensure that the frame being passed isn't destined for itself. If it isn't, the node forwards the message to the next station in the path.

When the message reaches the remote station delineated in the address destination field, the message is examined, and up to two actions can take place. Many token ring networks have an "address recognized" field that's used by the destination node to inform the sending node that the destination saw the message and recognized the message as being for itself. Another field in the frame, "data copied," is used by the receiver to inform the sender that the frame was copied into the destination. This is a useful feature, because it allows the sending station to identify one of three conditions:

1. The destination address isn't active (there are no modifications to the frame sent).
2. The destination node is active but was unable to copy the frame into the node (lack of buffers, and so on).
3. The frame was copied properly into the destination node.

After the destination has taken its action on the frame, the frame is passed to the next station and eventually makes its way back to the originating station. That station sees the frame marked as having been read by the receiving station. The message is deleted and a new token is generated by the sender to show that the network is available for use by the next node in the ring that has data to send. In this manner, only one station at a time can transmit data. The amount of transmitted data varies among token ring network types but may be from 20 bytes to 4 KB, depending on the token ring architecture used.

can generate in terms of data. Most cables can handle more data than single or multiple controllers can create.

3. At the same time system or network managers are given fiber communications technologies, they're also provided with twisted-pair communications technologies at 10 Mbps or better. To provide compatibility with existing equipment, many fiber technologies have the same speed rating as equivalent copper technologies.

In the short term, fiber doesn't necessarily provide the speed boost some claim it does. Fiber can handle much greater speeds than copper, but for now most vendors seem content to provide the same rated speeds of copper networks over fiber media.

Some applications, such as imaging systems, may benefit from fiber connectivity, but in general, the copper connection isn't used fully. In fact, most 10-Mbps Ethernet/802.3 networks average less than 10 percent of potential load. It'll be a while before communication controller technologies become cost-effective enough to uproot existing networking techniques that provide network speeds of 4 Mbps or greater constant capacity on the cable.

A raging argument in favor of fiber is that it helps diskless workstations communicate faster. But diskless systems, such as LAVc nodes, diskless PCs and diskless NFS systems, suffer from a range of problems. These include the type of network protocol being used, network parameter tuning, activity levels and available CPU/network resources on primary access systems, and queuing delay.

You can almost always clear up network performance problems on token ring and Ethernet/802.3 networks without resorting to faster network cable access. A large number of diskless workstation networks aren't configured properly, and many are misused or badly configured for the application at hand.

Finding The Fiber Fit

Fiber fits as a backbone network or in areas in which speed is an issue. Some networks today could benefit from use of higher-speed fiber as a backbone. These networks would include those with a few hundred nodes that have connection devices to the fiber network that allow connection to such technologies as FDDI.

There are few such networks today. But with corporate networks growing at an astronomical rate, high-speed backbones will be necessary within five years for large companies and 10 years for smaller-sized firms. The need for a very high-speed data "bus" will be apparent with such advances as voice-annotated documents; large data repositories; integrated retrieval systems; graphical system access methods; and other data- and compute-intensive systems, all fully distributed.

Five years from now, most shops will not need fiber connection to the desktop. However, in the next five years you'll probably need fiber for backbone interconnection.

Why a fiber backbone? The standard reasons include the following:

1. High speed — This is obvious, but what if the controllers can't keep up?

2. Noise immunity — This is and isn't obvious, because optical communications can have noise.

3. Security — This is a misconception. Fiber can be non-intrusively tapped by new connection hardware coming to the market soon.

4. Ease of upgrade — This isn't obvious, but it's true. The fiber remains, but the signal-generating equipment and attachments can be upgraded to a new speed without changing the fiber.

5. Electrically isolated environment — This is obvious.

A more important reason to use a fiber backbone has to do with the rapid

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interconnection of networks and the conversion from one network technology to another. Now that various shops have gone Ethernet/802.3-happy or token ring-happy, there's the problem of tying everything into a useful, cohesive network. There are also the problems of speed matching among network types, protocol matching among data-link protocols (let OSI handle the upper-layer goodies), medium (cable) differences and data generation/reception techniques.

To provide for rapid interconnection, the interconnecting network should be faster than the networks it interconnects or the direct systems connected to it. Further, the network should encompass the needs of data-link encapsulation and forwarding among dissimilar LAN types (such as 802.3 to 802.5 connections); reliable connectivity; expansion (it should be able to handle many nodes or network connections); and connection of many systems over a wide geographical area. The *local* in local area network is supposed to mean a network that's 1 to 2km in length. If you connect LANs in offices throughout a geographic region, you'll need high-speed connections among LANs within 50 to 100km.

This connectivity is handled with T1 leased lines among dedicated LAN bridges or specialized LAN protocol routers. In the near future, however, this connectivity won't provide the capabilities required for the access of data on remote network segments. Here's a good opportunity for networking technology that provides:

1. High-speed interconnectivity among nodes and networks farther apart than 1km but closer than 100km.
2. Many nodes or networks (250 or more connections).
3. Reliability (a backup or fail-safe).
4. Dissimilar network connectivity.
5. Incorporation into OSI physical and data-link layers.
6. A variety of interconnect capabilities.

FDDI, from the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X3T9.5, answers this need. In the early 1980s, ANSI saw the need for a network that would provide these services, eventually to the desktop.

A Token Ring Gesture

The token ring concept takes a turn for the better in FDDI. In the token ring world, three variations are popular:

1. IBM's Token Ring with source routing.
2. IEEE 802.5 token ring network.
3. Cambridge "slotted" ring network.

IBM's Token Ring and the 802.5 token ring work similar to the techniques described in the box "Token Ring Model," on page 38 but are slightly different in implementation. The Cambridge ring concept uses multiple tokens on a ring at the same time and allows more than one message to be in progress from a host system to a destination or destinations at the same time. In all three cases, a token is used to identify the availability of the network to sending nodes.

THE TRUTH IS THAT BOTH token ring and Ethernet/802.3 networks have strengths and weaknesses.

An argument made in favor of token rings is that the networks are deterministic. In a deterministic network, the network analyst can determine when a network packet will hit a destination after being generated from a source. This is possible because the network has quantifiable values that can be used to compute the stages of packet creation and delivery and the amount of time before a particular station could create a packet. This networking technology lends itself to applications in which absolute timing of network activity is required to provide adequate network support, such as chemical reaction control networks and factory control. The argument is that, because they are deterministic, token ring networks provide better throughput.

The truth is that both token ring and Ethernet/802.3 networks have strengths and weaknesses. Which network you should use depends on your needs. Although a token ring network is deterministic at the cable level, it's impossible, especially on a multiprotocol, multitasking system, to determine when a process on the system will generate a packet for the network controller. Because this is a statistical function, it defuses the argument of determinism.

Thus, although the cable is deterministic, token ring networks are referred to as node-based, because their performance is highly dependent on the number of

Figure 1.

FDDI Code	Bit Encoding
0	11110
1	01001
2	10100
3	10101
4	01010
5	01011
6	01110
7	01111
8	10010
9	10011
A	10110
B	10111
C	11010
D	11011
E	11100
F	11101
S (set)	11001
R (reset)	00111
Q (quiet)	00000
I (idle)	11111
H (halt)	00100
T (terminate)	01101
J (start 1)	11000
K (start 2)	10001

FDDI group codes.

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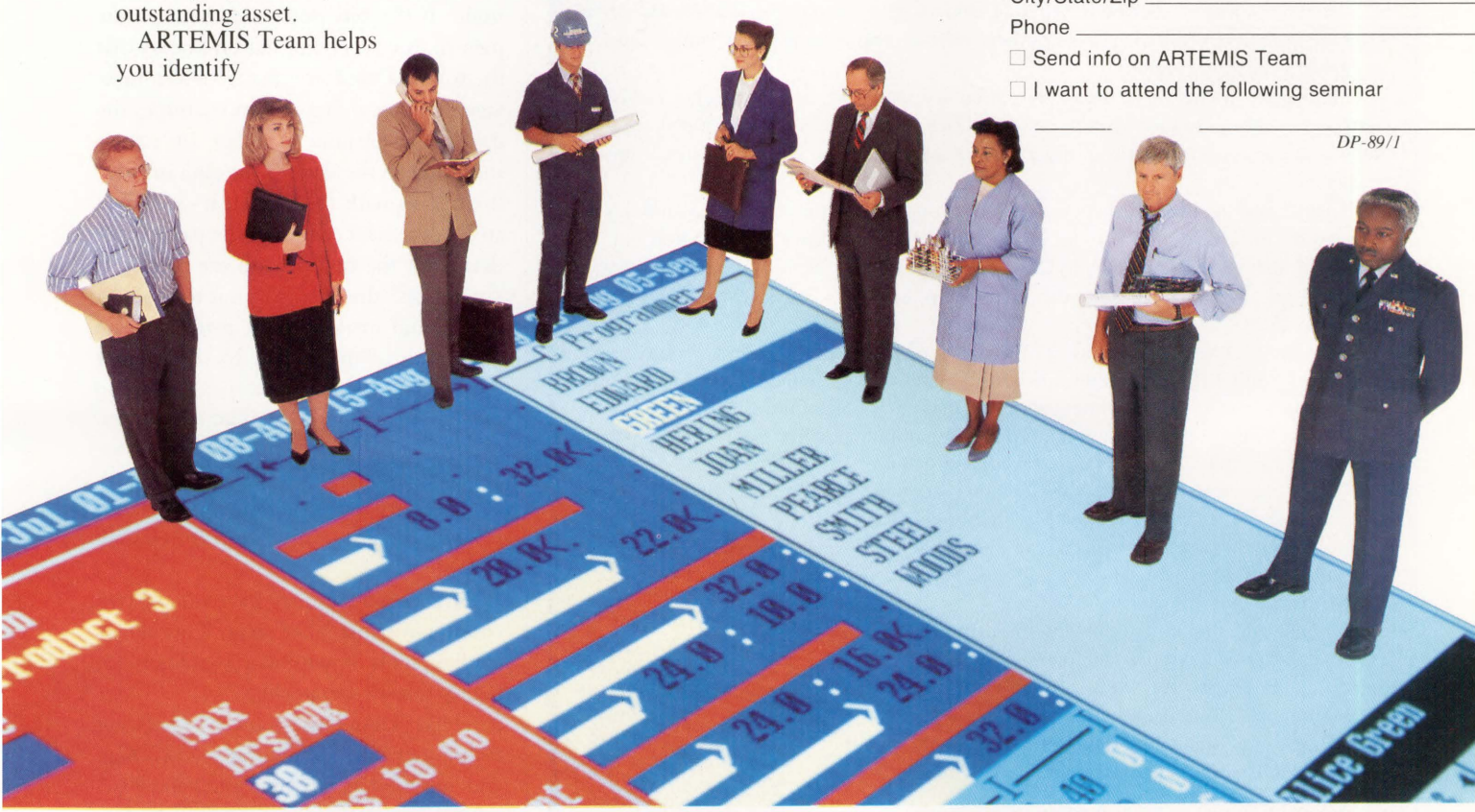

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Digital: High In Fiber

Digital has made a greater commitment to fiber optic networking than any other major computer manufacturer. Now that the proposed Fiber Distributed Data Interface (FDDI) standard in the ANSI X3T9.5 Committee is emerging as a reality, Digital can claim to be one of its strongest lobbyists and developers. Likewise, Digital is working closely with its third party to ensure that it has a head start when the imminent fiber explosion occurs.

Digital's initiative in the area isn't without motive. Many analysts project a $200 million market surrounding FDDI over the next four years.

Digital's strategies suggest that it believes that FDDI networks ultimately will be used as the backbone interconnect for Ethernet 802.3 LANs. The 100-Mbps performance levels will help absorb the strain that new applications and compute engines put on existing 10-Mbps Ethernets. Digital plans to support all types of FDDI configurations (e.g., bus and star topologies) and the wiring and attachment devices (e.g., concentrators, bridges and routers) that will accompany the advent of FDDI.

Although Digital sees a role for FDDI in wide area networking, its most prominent use will be as a backbone for intrabuilding and interbuilding communications in *Fortune* 1000, university, hospital, financial and government campuses. The company anticipates that the prevalent physical topology will be the hierarchical star. Fiber backbones with wiring concentrators and bridges in the tree topology will connect to existing horizontal LANs.

Lee Cooper of Digital's Networks and Communications division says that the U.S. will follow the lead of Digital's European installations, where the era of FDDI has already dawned. Cooper reports that fiber isn't just being installed as long-distance networks but is supplanting existing corporate Ethernet backbones. "FDDI has the bandwidth to support high-performance LANs and different buses," says Cooper. "It's already being used with the new diskless [distributed] workstations overseas. We'll be able to learn from experience."

Digital is relying heavily on its development and marketing relationship with many third-party vendors of fiber optic Ethernet devices. Fibercomm Corporation and Artel Communications Corporation, among others, will figure prominently in Digital's blueprint to adjust to the new medium.

Third-party talents could make the difference in many sales for Digital. Raycom Systems Inc., for example, offers a multiport fiber optic ring that can support up to 500 stations at 2km station-to-station distances and an overall ring path that extends up to 100km.

Digital has sought out partners with products that will help push its bread-and-butter fiber products, which include servers, routers and bridges. Digital will rely most on its marketing and technology pact with Chipcom Corporation. Chipcom produces a variety of fiber optic Ethernet products that have many of DEC's largest customers already migrating to FDDI.

Chipcom's ORnet system consists of an eight- or 14-port fiber optic star coupler and transceiver that's used in combination with Digital's LAN Bridges. The couplers can connect up to 1,024 nodes without using repeaters. Any port of the star can connect to another star or transceiver using ring or hierarchical topologies. Through 802.3 repeaters, the ORnet can connect to baseband, broadband or Ethernet LAN segments.

The ORnet also supports PCs with an adapter card that uses an Ethernet controller from Western Digital Inc. to put PCs and PS/2s on the fiber optic coupler. The system can drive a variety of network operating systems, including Xenix, Sun's PC-NFS and Novell's Advanced NetWare.

For Digital, the PC tie-in is significant. By connecting to any desktop device, it will provide the Ethernet functionality necessary for DEC's Networking the Enterprise strategy on fiber optic systems, as well. Digital intends eventually to provide complete multivendor support with its fiber Ethernet.

—Evan Birkhead

nodes on the network, not necessarily the amount of data. Networks such as Ethernet are called statistical, because when a station wishes to send data, there's a statistical average that allows that the network will be available to anyone who wishes to send a message to another system. There could be thousands of systems, but if no one is using the network, it's 100 percent available.

Uncovering FDDI

What does this have to do with FDDI? FDDI is a token ring and, technically, deterministic. The difference is that FDDI doesn't act like a classic token ring network, because tokens on FDDI react differently than those on most token ring networks. Further, there's more accommodation for statistical network interconnections than on classic token ring architectures.

FDDI uses a token passing scheme similar to token ring networks. The difference is that the token is a series of specially defined bits sent from node to node. If the bits don't match a specific pattern, the receiving station knows that the token is used and that it's a data message. The receiving station examines the data to determine whether or not it should keep the data. If the data isn't for the station with the packet, it's regenerated to the next station in the path. If the data is for the station with the packet, it "snapshots" the data, passes it to the host system and marks the bit pattern at the beginning of the packet to signify that the message has been received and read into the receiving node. The token then is passed to the next node and eventually to the sending station.

There are serious differences between FDDI and token ring architectures such as 802.5:

1. FDDI networks may have one or two counter-rotating fiber rings. This allows configuration of redundant topologies for highly reliable networks.
2. FDDI doesn't use standard encoding techniques like Manchester encoding, which is used in Ethernet/802.3 and 802.5 token rings. FDDI uses a group encoding technique that allows four bits to be

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encoded in five bauds (4B/5B). In Manchester encoding, each bit to be sent requires at least two signal transitions or bauds. This means that a 16-Mbps token ring network would require a signaling rate of 32 MHz. Ethernet/802.3 running at 10 Mbps would require 20 MHz.

Using Manchester encoding on FDDI would mean that the fiber used would require more than 200 MHz to provide the FDDI-rated speed of 100 Mbps. Through group encoding, FDDI runs at a rate of 125 MHz and provides a data rate of 100 Mbps. With this scheme, FDDI provides high-speed capability over less-than-optimal media and provides data symmetry that allows for easier architecture of analog capture circuitry for receiving nodes. The FDDI group codes are shown in Figure 1 on page 40.

3. FDDI doesn't use bit definitions for various fields. All FDDI fields are defined by at least four bits and may be defined by a byte of information. As a result, the fields easily can be modified or replaced by the nodes on the network as the frames and token travel throughout the rings.

4. An optional technique in token ring networks that's a feature on FDDI is early token release (ETR). ETR places a token on the network before the generated frame has had the chance to circulate throughout the network.

5. On 802.5-type token rings, stations can implement a priority scheme whereby token ring nodes can reserve a token for access — access control field (AC). This scheme wouldn't work properly in the FDDI environment. FDDI nodes usually send a token at the end of a data transfer, which means that reservation techniques don't work. This is referred to as "new token after send," which is different from 802.5's "new token after receive."

6. There's an explicit maximum data size of 4,500 bytes per frame on FDDI. On 802.5, there's no explicit data-frame size. Specification of an explicit frame size prevents a node from monopolizing the cable.

7. Tokens on FDDI aren't modified to a start-of-frame (SOF) as on other token ring networks. Tokens are absorbed and regenerated after a message has been sent.

8. FDDI implements a capacity allocation capability that lets the network provide critical service to certain types of transactions and priority-oriented service to other traffic types. This is implemented through a service called the Timed Token Protocol (TTP). The protocol separates traffic types into synchronous and asynchronous.

For example, disk access data is synchronous traffic, while virtual terminal data is asynchronous data. By measuring token arrival and departure times and following specific rules of the TTP, a node can compute how many of each frame type can be sent and the next time such transmissions will be available to the node. In this manner, nodes on FDDI balance data throughput and provide a pseudo-priority scheme for various types of data.

9. FDDI supports a distributed recovery capability in case of ring failure. The ring could be cut, and between physical and FDDI frame components, nodes on the

network automatically would isolate the fault and actively reconfigure the network to provide maximum availability.

10. On token ring networks, one clock on the network is responsible for providing clocking signals for all nodes on the cable. The main clock node also provides an elastic buffer capability that slides to compensate for speed differentials on the network (jitter). In a 100-Mbps environment, this clocking mechanism is impractical. At 4 Mbps, the bit time is 250ns, compared to a 10ns per bit time at 100 Mbps. As a result, each FDDI node provides its own clock (hence a distributed clocking scheme) and corrects for timing jitter via its own internal elastic buffer.

FDDI's network frame is configured to handle the needs of a high-availability, speedy network. The frame is shown in Figure 2 and provides for a variety of network functions.

Configuration

Configuring FDDI isn't easy. The primary purposes for FDDI, according to the original scope of the project, are to provide high-speed networking for:

1. A network to connect workstations to file servers.
2. A network to connect peripherals to systems.
3. A backbone network between other networks.

To provide for these situations, an FDDI interface controller is an obvious need. But because the product is new, prices for such devices are prohibitive. Some controllers cost between $8,000 and $10,000, but with ASIC technologies and volume, prices will drop.

When considering implementation of FDDI, you must follow some rules. First, there's the problem of the physical cable plant. FDDI uses either 62.5/125 or 85/125 micron multimode fiber. Alternatives of 50/125um and 100/140um also are specified. Smaller fibers allow higher speeds but cause greater connector loss. Further, the fiber must be attenuated for light transmission at the 1,300nm wavelength (as opposed to products such as Digital's LAN Bridge 100, which can work in the 850nm range).

Because most fiber plants transmit at 850nm, 1,300nm or 1,550nm, finding compliant fiber usually isn't a problem. In networks less than 1km long, 850nm is usually adequate. However, as performance needs increase, the 850nm light source becomes inadequate. Light transmission above 1,550nm usually requires a sophisticated and expensive light source, such as a laser system. Fiber runs may be no longer than 2km between stations and no longer than 100km per FDDI ring (two rings are allowed). Each ring consists of two fibers. Five hundred nodes are allowed on FDDI.

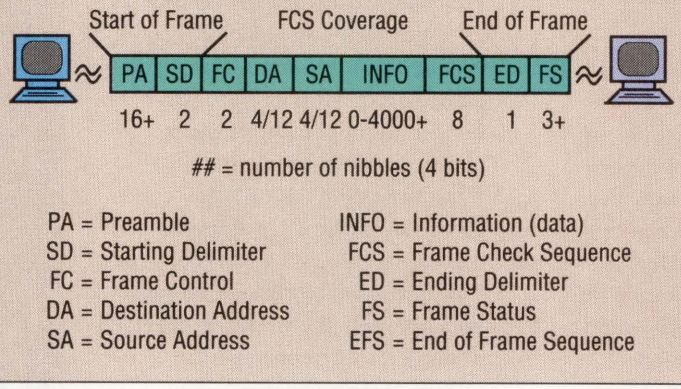
There are two types of nodes within FDDI: Class A and Class B (see Figure 3). Class A nodes are connected to two rings and can reconfigure the network between the primary and secondary rings to form a valid network in case of failure. Class B nodes only connect to the primary and can be isolated from the network in some failures. Of these nodes, some will be equipped with bypass connections, which allow light-source continuation even if the node connection has failed, and help ensure network uptime.

In most wiring configurations with FDDI, the network designer configures a main backbone to be set up as Class A nodes for reliability. The length of the backbone is determined by how distributed a network is.

In a building environment, the backbone may be located in a single room with all segments connecting to it or located vertically throughout telephone closets. There may be other variations, but in all of these cases, the backbone FDDI is contained within the building.

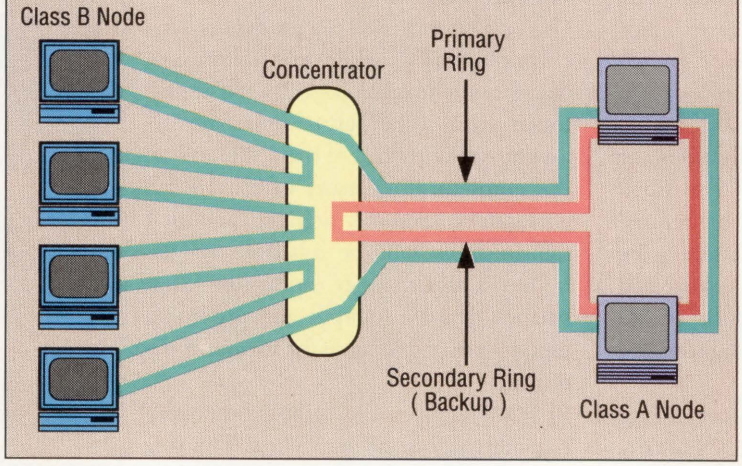
In a campus environment, the backbone could be in a single room in a single building but most likely would run from building to building in the campus. In this configuration, each building could have a main network con-

Figure 2.



FDDI frame format.

Figure 3.

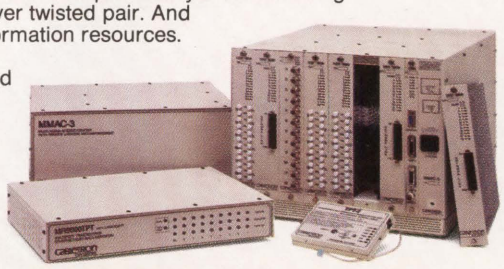


FDDI general topology.

Ethernet Over Twisted Pair.

WITHOUT THE ABILITY TO EASILY MONITOR AND CONTROL NETWORK EVENTS...

Without comprehensive network management *and* control capabilities you're not taking full advantage of the benefits of running Ethernet over twisted pair. And you could even be risking your company's vital information resources. Only Cabletrons' solution provides an integrated three-tiered management and control scheme called LANVIEW™. It allows you to easily monitor network events from a single remote workstation to identify bottlenecks and marginal communications links. But unlike other so-called management systems, LANVIEW™ not only alerts you to potential problems, but also gives you the control functions you need to take corrective action quickly.



LANVIEW™ allows you to enable or disable individual ports and reroute network traffic around the problem *before* it affects performance. It also provides automatic redundancy and complete physical layer diagnostics to assure network reliability. So if you're considering a twisted pair solution, make sure you protect your investment. Check out Cabletron's Multi Media Access center with LANVIEW™ and see how easy *and affordable* it can be to manage Ethernet networks over a variety of media including unshielded twisted pair cabling, IBM data cabling, coaxial cabling and fiber optic cabling.

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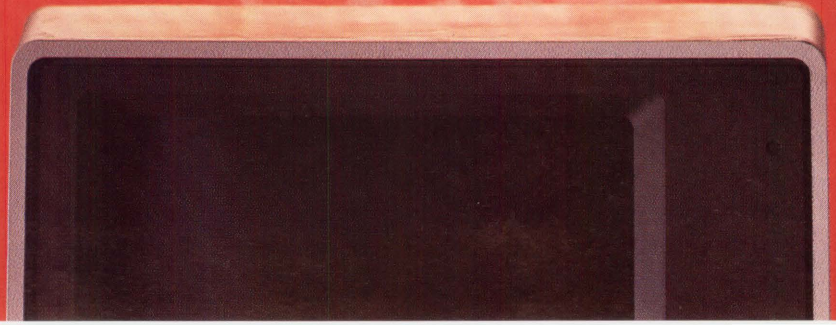
CIRCLE 289 ON READER CARD

THE RESULTS COULD BE TERMINAL.



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trol closet, so there would be only one tap on the network backbone in each building. The backbone network may vary in size and number of taps depending on network location.

After FDDI has been used as the network backbone, it also may appear as a backbone within a building that's connected to the main backbone FDDI. In this example, there are two FDDI network levels: the main backbone and a separate FDDI per building. This can be expanded to an FDDI on a floor and then connected to the building hub, which is connected to the main backbone in a campus environment. In this configuration, the fiber is run to the machines on the network and other networks may or may not be bridged onto the FDDI.

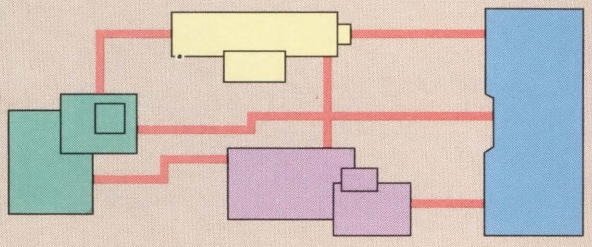
Fiber Matters

Many vendors have developed fiber-count configuration rules that allow customers to install fiber required for FDDI connectivity now and in the future (see Figure 4). Each FDDI requires a minimum of two fibers, and Class A nodes require at least four fibers.

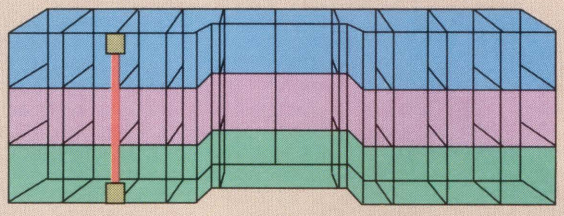
Although the selected fiber for FDDI is either 62.5/125 or 85/125, there's a jacket around the fiber to keep the fiber safe and meet local electrical and cabling codes. Typically, fiber is enclosed in a jacket "buffer" that separates the fiber from external contact and protects it from damage. Buffers can be standard dielectric, foam or, in the case of fibers that are submerged in liquid, gel-pack.

Buffers for indoor FDDI should be of the "tight" variety to allow maximum protection. Buffers for locations in which fiber expands and contracts (usually outdoors) should be loose. A loose buffer expands and contracts independently of the fiber.

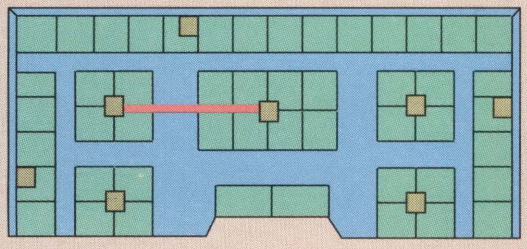
Figure 4.



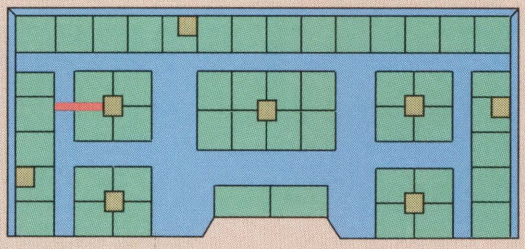
Campus network interconnecting other buildings/networks:
- 24-pair fibers (48 fibers) in an aerial sheath. This usually would be armored as well as configured for indoor/outdoor use.



Vertical run within a building (e.g., in telephone closets, floor to floor):
- 12-pair fibers (24 fibers) in a tight-buffer cable certified for air plenum use within the building.



Horizontal floor run for connection between closets on a floor:
- 4-pair fibers (8 fibers) in a tight-buffer cable certified for air plenum use within the building.



Horizontal run from a local closet to an office:
- 2-pair fibers (4 fibers) in a tight-buffer cable certified for air plenum use within the building.

Fiber-count recommendations.

Jacket material is determined by local fire and electrical codes, as well as where the cable is being placed in the structure. Some materials give off noxious fumes when burned and aren't allowed where there's a return air plenum. Also, each jacket type is inserted with a variety of stiffeners that give the cable rigidity and strength when pulled or suspended. How many and the type of stiffeners used (some have aluminum rods inserted in the jacket) vary from vendor to vendor.

After time, suspended fibers can develop microfractures or strain fractures. Fiber used on networks such as FDDI is made of glass but has very high tensile strength. However, if a crack develops on the surface of the fiber, it may result in optical dispersion or breakage.

Another problem is bend radius. Although fiber is much more flexible than copper cable and can be bent in much smaller radii, microbends may appear in fiber that has been bent too tightly. Microbends can cause light path disruption and increase loss on the cable.

Because uninterrupted fiber runs are impossible in most fiber plants, splices are required for many networks. Each splice introduces a signal loss (anywhere from .2 db to 1.1 db per splice). Connectors and cable length also introduce loss problems. Items that cause loss are charged against the cable power budget to ensure that the connections and splices to the cable won't override the ability of the light source to deliver a signal to the destination. Fiber at 850nm usually allows 3.0 - 4.0 db maximum attenuation per kilometer. Fiber at 1,300nm allows only 1.0 - 2.0 db maximum attenuation per kilometer.

BECAUSE UNINTERRUPTED fiber runs are impossible in most fiber plants, splices are required for many networks.

To connect a node to a fiber network, the network must have a fiber coupler (tap) attached to it. These couplers typically require that the cable be cut and terminated properly with approved connectors (typically ST fiber terminators). Splices are straightforward and reasonable to implement. They can be achieved by scoring and breaking the fiber, then connecting the ends with epoxy. You also can use a fusion splicer, by which an electrical arc connects the ends of two fibers.

Termination of cable requires that the ends be cut and polished before insertion into a terminating hood. Polishing is begun with a hand tool and completed with a polishing machine. This allows a smooth end without imperfections that will pass the light source to the optical receiver in the destination transceiver or repeater. This polishing effort can take 40 minutes per fiber, which helps account for the cost of fiber installation. Improper polishing and connection of the termination points on a fiber render the fiber useless for connection purposes and at minimum result in poor network performance. Termination is required for proper testing of the fiber (this can be performed with an optical time domain reflectometer), which is necessary to ensure proper installation.

FDDI ISN'T CHEAP. Because Ethernet controllers range from $250 (for PCs) to about $4,000, FDDI isn't cost-competitive with Ethernet and other LAN technologies. Although fiber isn't terribly expensive to purchase and pull, its unique problems increase the cost per connection to FDDI.

FDDI is an important new technology. It provides a high-speed, redundant cabling environment for fast, highly available networks. It's costly, however, and won't be cost-effective at the desktop for some time. In the meantime, it serves as useful backbone network technology or system internal interconnect technology. As networks evolve, FDDI will be a central focus for LANs and should be a part of any well-conceived network scheme. —*Bill Hancock, networking editor, is author of* Network Concepts and Architectures, *published by Essential Resources Inc. of New York City. He also serves on the DECUS Board of Directors.*

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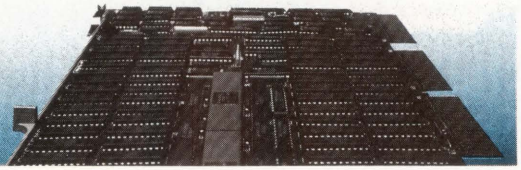

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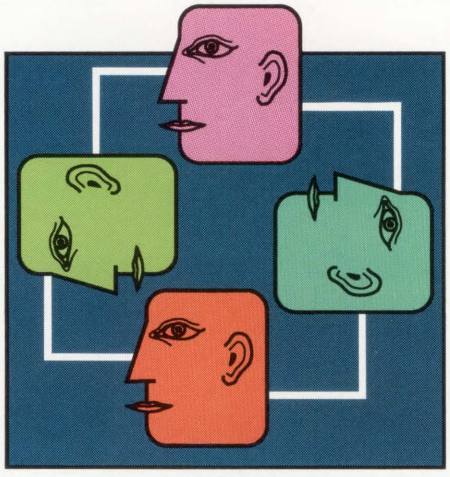
CIRCLE 344 ON READER CARD

The Network's Eyes & Ears

DEC and its third party have many approaches to monitoring and analyzing activity on networks. BY EVAN BIRKHEAD

DIGITAL'S ENTERPRISE MANAGEMENT ARCHITECTURE (EMA) is the DECnet/Ethernet answer to IBM's SNA/NetView and AT&T's Universal Network Management Architecture (UNMA). Each strategy combines a set of proprietary networking products that purports to help systems managers govern their multivendor, multiprotocol networks. This includes connectivity hardware as well as software that monitors traffic to help managers see — and hear — what goes on inside their networks.

The basic component of EMA is DECnet/OSI, Digital's Ethernet-based software that's compliant with the International Standards Organization's (ISO) Open Systems Interconnect (OSI) specification. Digital has adhered to roughly this same networking philosophy since 1975, when it announced its Digital Network Architecture, which outlines protocols, interfaces and communications facilities for letting non-Digital operating



systems play within DECnet. By design, Ethernet is compatible with several network operating systems, including those from Sun Microsystems, Hewlett-Packard and Novell.

By opening itself to these outside environments, Digital severely complicated the task of monitoring and managing its DECnet-backboned network. The complexity is compounded in enterprise networks, which often consist of LANs connected by bridges, routers and gateways, which are far more error-prone than LAN connections.

To compensate for this complexity, Digital has sought third-party partners more readily in networking than in other areas. The third party has helped tremendously in making EMA the most comprehensive of networking architectures by building interfaces from its network-management products to Digital's.

Networking, Digital Style

Digital has identified four areas of networking as the glue for the EMA framework:

1. Connectivity, or the ability to move data from one platform (or network node) to another, such as the X.25 interface and ISDN.
2. Interoperability, the exchange of data among platforms, manifested by PCSA, DECnet/SNA and VAX File Tranfer,

Access and Management (FTAM).

3. Distributed applications, which implies the ability to access any software applications from anywhere on the network.

4. Network management, which is a set of products that enables the network manager to control, direct and support the entire enterprise network.

The network-management products from Digital and most of the third party comply with OSI standards for managing five functional areas: configuration management, fault management, performance management, security management and accounting management.

OSI Management

Each OSI-defined area requires a degree of on-line network monitoring. Digital provides software in each area, but in most instances, third-party monitoring and management packages have far greater functionality, offering a seemingly infinite set of capabilities. Digital's monitors look similar to most of the third-party packages, but some of these packages fill gaping holes in Digital's product line. Many network-monitoring products in the Ethernet world have taken their cues from packages designed for PC LANs, such as Microsoft's LAN Manager.

Configuration management usually is accomplished by a network topology, a diagram that shows all of the devices in a network, accompanied by statistics about the devices and traffic passing through them.

Fault management is the art of preventing and correcting problems. This often is done by users setting thresholds for statistics that trigger a screen alarm — a change in color or a warning message. A sample set of fault-management rules is shown in Figure 1. Many third parties offer packages that even resolve basic problems such as node jabbering or bridge reconfigurations.

Performance management, like fault management, is based on statistics gathering. By comparing statistics such as the level of traffic on each node, a manager can analyze where his performance is poor or where to add more power or storage.

Security management is the control of access to a network by unauthorized users, an important issue in the era of open systems.

Accounting management includes facilities that track the cost of adding equipment to the network.

OSI also has established a draft of management protocols, but they're too early in the development stage to be considered standards yet.

Ethernet Monitoring

At the lowest level, Ethernet is capable of little network management. Its Link Management function, as specified by IEEE 802.3, is responsible for line collisions; it listens for a free transmission medium before beginning transmission. Collisions are managed by stopping packet transmission and waiting a designated time before sending the next packet.

DECnet adds a few advanced management capabilities, such as the ability to recognize when links are down and to automatically reroute traffic. DECnet includes software called the Network Control Program (NCP), a management utility provided for every node in the network.

Digital provides sophisticated network-monitoring software in a variety of areas. NMCC/DECnet Monitor is the fundamental tool. This system displays all of the traffic data, error statistics and status information node by node on a map that shows the layout of the network. The user can define performance thresholds. The system identifies problems when the thresholds are reached.

The system updates line costs when new connections are added. The central kernel collects data over the network using user-defined real-time event logging and intermittent polling. Four reports can be generated that measure configuration, traffic, errors and availability.

NMCC/VAX Ethernim is a VMS LAN-management tool that recognizes DECnet and non-DECnet connections. The topology display shows such infor-

Figure 1.

```
RULE CPU_BOTTLENECK_WARNING
: This rule logs a message to a log file whenever the CPU becomes more than 95% busy
: or develops a significant computable queue. The message identifies the date, time
: and CPU statistics.

    CONDITION
        CPU_BUSY_PCT>95 OR PROCESSES_COM>3
    ACTION
        LOG_PERF_EVENT CPU is {CPU_BUSY_PCT}% busy at {DATE} {TIME}
        LOG_PERF_EVENT Computable queue is {PROCESSES_COM}

END RULE CPU_BOTTLENECK_WARNING

RULE DISK_SPACE_WARNING
: This rule sends an OPCOM message as soon as the free block count on a disk
: dips below 20000 blocks. Once the message is sent, the rule "rests"
: for a period of time to allow time to correct the situation manually.

    CONDITION
        DEVICE_FREE_BLOCKS<20000
    ACTION
        OPCOM/TO=DISKS WARNING: Disk space down to {DEVICE_FREE_BLOCKS} on {DEVICE}
        DISABLE/INTERVALS=4 DISK_SPACE_WARNING

END RULE DISK_SPACE_WARNING

RULE DISK_SPACE_ACTION, OCCURRENCE=2 OUT OF 4

: This rule takes action if the free block count on a disk persistently stays below 10000 or
: repeatedly dips below 10000. PURGE_DISK performs a purge based on the disk name and
: the severity of the shortage. This rule also enables the warning rule in case it is disabled.

    CONDITION
        DEVICE_FREE_BLOCKS<10000
    ACTION
        PROCEDURE/FILE=$1$DUA2:[SYS_MGR]PURGE_DISK {DEVICE} {DEVICE_FREE_BLOCKS}
        ENABLE DISK_SPACE_WARNING

END RULE DISK_SPACE_ACTION
```

Courtesy Computer Information Systems Inc.

This rule set for Computer Information Systems' RoboMon defines one rule to monitor CPU usage and two to monitor disk space.

mation as nodename, type of Ethernet port, transceiver type and DECnet address or segment-specific information such as cable type or descriptive text.

Other Digital monitors include the LAN Traffic Monitor, which graphically presents statistics of information from a variety of Ethernet protocol types, including LAT, TCP/IP, DECnet and XNS; the Terminal Server Manager, which observes activity on all terminal servers in a DECnet, including response times and faults; and the Remote System Manager, which lets a system manager watch his DECnetted VMS and ULTRIX systems.

The Live Wire

Do these packages help network managers run their systems better? In most cases, network managers would be dead without them. Problems that crop up on an Ethernet run the gamut from ridiculously simple oversights and errors to infuriatingly invisible malfunctions.

An informal survey of networking administrators using Excelan's LANalyzer Ethernet monitor reveals that network problems increase as you go deeper into the seven layers of the OSI protocol (see Figure 2). According to the survey, 60 percent of all problems occur in the two lower levels, the Data-Link and Physical layers. These layers are associated with the 802.3 specification for the Ethernet cable. The Data-Link layer controls access to the wire, and the Physical layer protocol is associated with the cable.

Most problems in the five higher layers are caused by user error, while most problems in the two lower layers are caused by physical problems with the equipment.

Troubleshooting

In a third-party package, you should look for software that gives you a clear, concise view of your network with information that lets you look inside network nodes and connections and rapidly analyze problems and trouble spots.

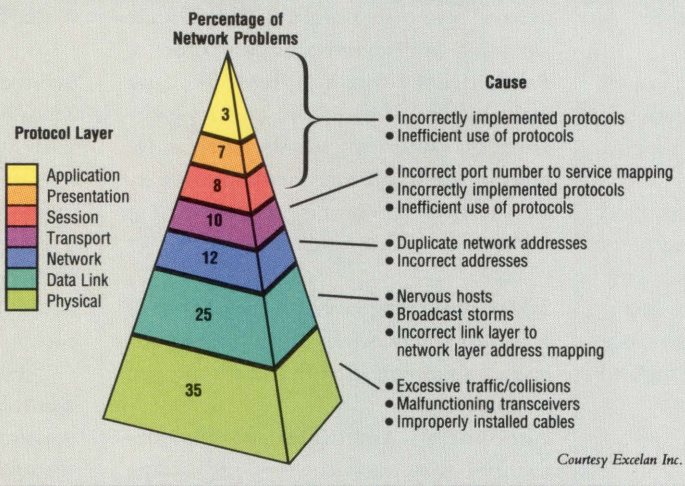
Your options in the market are broad, and the competition is cutthroat. You probably won't have a problem getting vendors to lower prices. If cost is an issue, bear in mind that network-monitor solutions range from hundred-thousand-dollar software packages to the CaSaT Ethernet Port Monitor, a $95 hardware monitor the size of a cable tap that indicates data transmission and reception and collision signals.

Some products, such as Cabletron's LANview, are full-blown, comprehensive network monitors that track outside LANs based on other hardware and run over a variety of cable types (see Figure 3). Network General's Sniffer, for example, supports all seven layers of the ISO model.

Network-monitoring software features functions that seemed futuristic a few years ago:

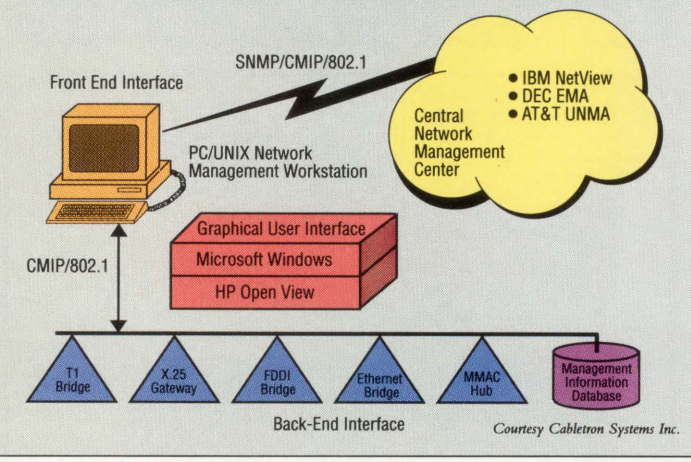
- Software can pinpoint your trouble spot and display it in a network topology.
- You can home in on one node in a network diagram and call up a window with detailed information on that node.
- Software automatically can adjust to nodes added to the network. Some analyzers let you pretend to add new loads to predict the influence on the system.
- DECwindows and other advances in user-interface design mean that you needn't be confused by your screen. It can be organized, concise and color-coded.
- Many packages interpret and decode network protocols.
- Any statistic can be monitored, down to collisions that occur in the initial bytes of a packet.
- Virtually any statistic can appear as a label, including inventory numbers.

Figure 2.



Examining network problems at each layer of the OSI model reveals that the percentage of problems is greater at the lower layers.

Figure 3.



A comprehensive LAN-management system acts as a central management point for the major types of networks.

Looking at color video printers? Be sure you see Toyo. Yes, other leading video printers offer the same big B-size output, the same 300 dpi resolution, and the same wide range of beautiful colors. But when most people compare, they choose Toyo.

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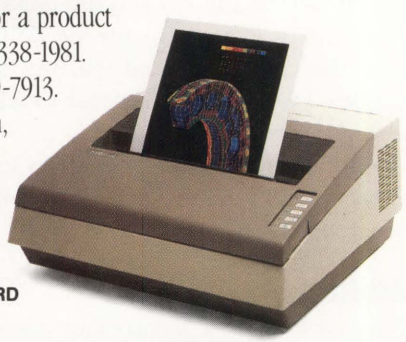

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Monitors In The 1990s

There are four components of the model for the impending Fiber Distributed Data Interface (FDDI) standard, which will emerge from an ANSI committee as a standard protocol for fiber optic networks. The only component not yet agreed on and currently holding the standard back is the Station Management (SMT) section, which covers monitoring, management and configuration of fiber networks and connections. This component is critical, not only because of its importance to the FDDI standard but also because it contains technology that will define the way in which large LANs will control their data in the 1990s.

With a little help from the standards committees — and Digital has a seat on many of them — multivendor software sharing will be a reality in the next decade. Digital's third-party partnerships will be pivotal, as will the quality of programs produced by third parties for IBM, HP and Sun. After all, a network is only as strong as its weakest link.

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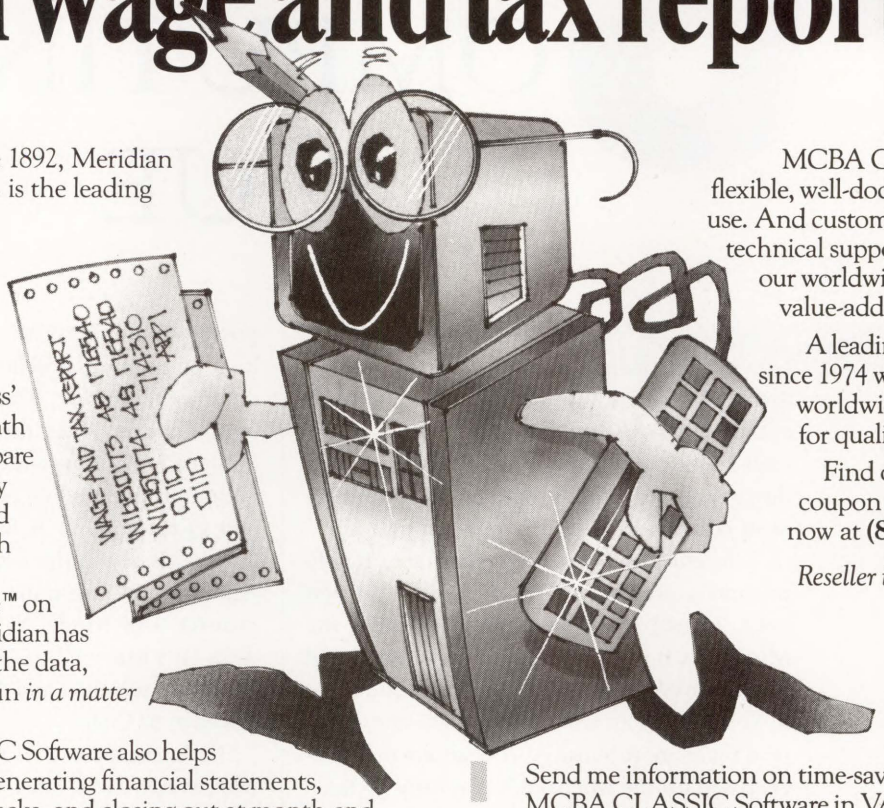

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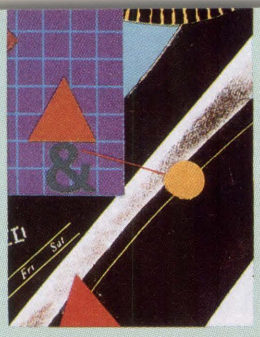

HARDWARE

COMPUTING VALUE

By David W. Bynon

Getting The Most Computing Bang For Your Buck.

Choosing a computer system is more difficult than ever. When was the last time you looked at the MicroVAX lineup? What about the new 6000 series? And when was the last time you thought about computing value — getting the most computing bang for your buck?

The current MicroVAX offering certainly presents a problem when deciding what you need. Digital offers the MicroVAX 2000, the MicroVAX II in Q2/Q3/Q4/Q5/Q6 flavors, and the MicroVAX 3000 series, which includes the 3100, 3300, 3400, 3500, 3600, 3800 and 3900. And there are too many VAXstations and servers based on the MicroVAX platforms to list.

With so many systems and options from which to choose, how do you pick the best value? You'll find the best value when you know what you need, what you want, what you can live with and, most important, what's available. To find the best computing value, you have to do your homework!

For example, at the bottom end, for a three- to four-user system, you might choose a MicroVAX 2000 or MicroVAX II. Their performance ratings are almost the same, but their prices are worlds apart (see Figure 1).

For less money at the low end, you get more computer with the MicroVAX 2000 if you don't want much expansion capability. Can you live with the MicroVAX 2000's limited expansion capability, or do you need the Q-bus system and its wealth of third-party offerings?

It would be a mistake if you needed the power of a MicroVAX II or 2000 but didn't look at a more capable system to see how it compared in price. The MicroVAX 3100 is a good example. Like the MicroVAX 2000, the 3100 has limited expansion capabilities. For this reason, its price is low compared to an equivalent Q-bus system. A fully loaded MicroVAX 3100 costs about the same as a MicroVAX II. And you get a lot more for your dollar: a MicroVAX 3100 Model 20 with 8 MB, two RZ23 disks (105 MB total), a TK50, four async ports, a console terminal and 10-user VMS license is priced at $23,460.

Let's compare the MicroVAX II and the MicroVAX 3300. The MicroVAX 3300 has a median performance increase of 2 1/2 to three times the MicroVAX II. Both configurations use the Q-bus and support the same peripheral devices. A MicroVAX II in a Q3 configuration has 12 Q-bus slots, and the MicroVAX 3300 has six. However, because of the single-board design of the MicroVAX 3300, the basic configuration requires fewer slots. There are plenty of open slots for most expansion needs. Figure 2 shows the comparison.

LAVc Or Single System?

Are local area VAXclusters (LAVc) and network servers a good value? Maybe. LAVcs solve very important problems. An LAVc provides incremental growth and a degree of resource redundancy. But is it best to configure an LAVc from the outset? Let's look at the cost of building a system to service 20 concurrent office automation users.

When Digital announced the MicroVAX 3300 and 3400, it also announced the DSSI bus.

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DSSI allows two MicroVAX CPUs to share up to five RFxx disk devices. For this reason, we'll use this feature in our example LAVc.

The dual-host MicroVAX 3400 is one of Digital's preconfigured systems. It's a packaged MicroVAX 3400 cluster with 20 MB of memory per CPU, a single RF71 400-MB disk, a TK70 tape and licenses. Each CPU is licensed for one to 10 users. Figure 3 shows the configuration and cost of the hardware.

For a single-system configuration, 20 users in an office environment are handled easily by a MicroVAX 3500 or 3600. DECservers would be used to connect users and printers to the system. Figure 4 shows an appropriate configuration and its price.

Although the hardware cost and capability of these two systems are about equal, the software cost and manageability aren't. The single software license cost for application software products for the MicroVAX 3600 is much less than the same licenses for the two LAVc nodes. Further, the 3600 is easier to manage and set up. On the other hand, the 3400 LAVc provides a higher degree of reliability with two CPUs.

The conventional wisdom is that it's better to buy a single system to handle your initial needs. As your requirements increase, you can expand to a cluster system. The value is the cost of software and system management effort, not the cost of hardware.

There are times when conventional wisdom doesn't provide the best solution. For example, I was recently asked to provide an upgrade path for a client. The client was experiencing a problem with the load of SAS programmers on a production system. By removing the four full-time SAS programmers, I determined that the 8350 could handle twice as many concurrent Mass-11 users (the primary application on this system).

I made two proposals. One was a MicroVAX 3400, and the other was an LAVc of VAXstation 3100s. The cost analysis of the two configurations including software and hardware maintenance differed by only a few dollars. The difference was the software. However, unlike multiuser software, the cost of the workstation software in a cluster configuration was much less. The computing value in this situation was found by playing out several configuration scenarios.

Standalone PC Or PC Server?

Many organizations are committed to or require the widespread use of PCs. Computing value with PCs is found when a server is implemented for the purposes of communication, shared storage and management.

Several computer and communication companies, such as Digital and 3Com, believe that the diskless PC is the way of the future. This is primarily because of cost and because many PC users don't manage their own information. Network servers solve these and other problems, and they're cost-effective.

The demand on a microcomputer today is much greater than it was in the past. The advent of user interfaces such as Microsoft Windows, the X Window System and the Macintosh interface requires a more capable CPU.

For a professional workstation, it's impractical to look at systems with CPUs less capable than the Intel 80386, Motorola 86020 or Digital 78032. A true 32-bit machine with a high memory capacity is almost imperative.

Networking puts an additional demand on a microcomputer. If you've ever put an original IBM PC or XT system in a network you'll know what I'm talking about: The dog turns into a slug.

Let's assume that the system we'll configure is a group of 80386 systems. For the sake of being average, let's use the Tandy 4000 (i.e., DECstation 316) as our guinea pig. Figure 5 shows what 16 fully configured Tandy 4000s would cost.

The bottom-line cost of Figure 5 is for 16 machines that can't communicate. Their only means of sharing information is by "sneakernet", that is, physically running disks around, which isn't a pretty

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FIGURES 1-6.

System	Memory	Disk	Tape	VMS License	Approx. Cost
MicroVAX 2000	6 MB	RD54	TK50	1-4	$16,116
MicroVAX II	5 MB	RD54	TK50	1-4	$25,145

Figure 1: Although the performance ratings for these MicroVAXs are similar, their prices are quite different.

System	Memory	Disk	Tape	VMS License	Approx. Cost
MicroVAX II	9 MB	RD54 (2)	TK70	1-8	$45,065
MicroVAX 3300	12 MB	RF30 (2)	TK70	1-10	$46,450

Figure 2: The MicroVAX 3300 provides 2 1/2 to 3 times the median performance of the MicroVAX II.

System	Memory	Disk	Tape	VMS License	Approx. Cost
Dual-Host 3400	2 x 20 MB	RF71	TK70	2 x 1-10	$91,000
DECserver 200 (3)					$11,400
DESTA (3)					$825
			Hardware Total:		$103,225
			Cost Per User:		$ 5,161

Figure 3: The dual-host MicroVAX 3400 is one of Digital's preconfigured systems.

System	Memory	Disk	Tape	VMS License	Approx. Cost
MicroVAX 3600	32 MB	RA82	TK70	1-20	$104,600
DECserver 200 (3)					$11,400
DESTA (4)					$1,100
ThinWire Cable					$ 250
			Hardware Total:		$117,350
			Cost Per User:		$ 5,867

Figure 4: A MicroVAX 3500 or 3600 easily can handle 20 users in an office environment.

System	Memory	Disk	Tape	Monitor	Approx. Cost
Tandy 4000 (16)	2 MB	20 MB	40 MB	CGA/EGA/Color	$ 5,676
				Total for 16 Units:	$90,816

Figure 5: The only way these Tandy 4000s can communicate is by "sneakernet."

System	Memory	Disk	Tape	Monitor	Approx. Cost
PCLAN/Server 3100	4 MB	RZ32 (3)	TK50	VT320	$15,500
Tandy 4000 (16)	2 MB	DEPCA		CGA/EGA/Color	$75,568
				Total:	$91,068
				Cost Per Workstation:	$5,692

Figure 6: The PCLAN/Server 3100 offers a common storage source, PC-to-PC and PC-to-the-organization communications, and a single point of management.

way to conduct business.

The alternative is a network server such as Digital's PCLAN/Server 3100. The PCLAN/Server provides a common storage source, PC-to-PC and PC-to-the-organization communications, and a single point of management for up to 48 PCs. The price for these features is only about $250 more. Compare Figure 6 with Figure 5.

Best of all, the price of the PCLAN/Server is for hardware and software. Each PCLAN/Server comes with a one-to two-user VMS license, DECnet, VMS Services for MS-DOS and 16 DECnet/PCSA Client licenses.

MicroVAX Or VAX?

I've been asked a lot lately, "Should I buy a MicroVAX 3000 or a VAX 6000?" This is difficult to answer if a needs analysis hasn't been done. Although the MicroVAX 3800/3900 has about the same mips rating as the VAX 6000 Model 210, the I/O bandwidth and expansion capability of the two systems are worlds apart.

The limiting factor of any Q-bus computer is the 3.3-MB-per-second bus. Digital has taken steps to relieve the Q-bus limitation by localizing as many I/O functions (such as memory) as possible and providing on-board Ethernet adapters and on-board disk controllers. This doesn't change the fact that a MicroVAX is a small minicomputer.

If your computing task isn't I/O-intensive, you can't ignore the fact that a MicroVAX 3800/3900 can take on the small VAX 8000 and 6000 with ease. A MicroVAX 3900 configured with 64 MB of memory and RA90s will handle 60 to 70 ALL-IN-1 users with confidence. The starting price for a 3900 is $120,200. To manage the same number of ALL-IN-1 users on a large VAX would require a VAX 8500 or larger. The price starts at about $250,000. Which system provides the better value?

VAX Or RISC?

The battle between VAX/VMS systems and RISC/UNIX systems is another issue to address. It's difficult to ignore the

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price/performance difference. A DECsystem 5400 configured with 32 MB of memory, two RA90s, a TK70, a TU81, a DSSI adapter, an Ethernet adapter and a 64-user ULTRIX license costs about the same as a MicroVAX 3900 configured the same. But the DECsystem 5400 has about four times the raw CPU horsepower. Is it worth it? It is if you need the processing speed. It isn't if you need to preserve your investment in VMS.

As a DEC user, you're most likely to have success with a RISC system if you have third-party applications that run under UNIX. For example, relational database giants Oracle and Ingres run under both platforms. The key to your value with these systems is the software, because the hardware is a great value.

SHOPPING FOR COMPUTER VALUE is easy if you understand what you're paying for. Don't buy more slots than you need, don't pay for an expandable system if you don't plan to expand it, be willing to pay a little more for an integrated system that's easy to manage, and look at the total cost of a system, including hardware, software and maintenance.
—David W. Bynon, Workstations Editor, is author of a comprehensive guide to ALL-IN-1 to be published later this year by Professional Press.

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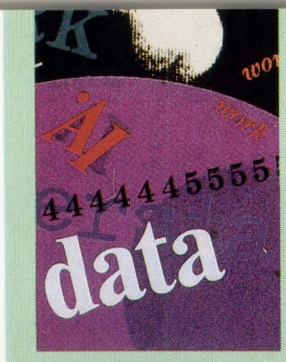

SECURITY

FREEZE, SYSTEM MANAGER!

By Christina L. Sidrow

Part 2: Apprehending A Computer-Crime Suspect.

Editor's note: This is Part 2 of a two-part series on security violations. Part 1 explored computer crime and ways to protect yourself and your company in the event of a system break-in.

Patrol officers are trained in the techniques of observation. Without the ability to observe an individual's unusual activity, no suspect could ever be arrested.

Detecting a criminal is the first step to apprehending him. To apprehend suspects of computer crimes, you must learn techniques for patrolling your computer system and observing unusual or suspicious activity.

Before you can observe unusual activity on your computer system, you must know what usual activity is. Because this differs from one computer to the next, the person responsible for user activity must be able to identify what's usual for that computer. On a VAX, a system manager can establish a set of commands to gather information about user activity. If these commands are executed on a regular basis, they can help to define normal user activity. The output from the commands should have a date and timestamp and should be stored away from the computer system.

Under VAX/VMS, a simple command such as:

```
SHOW USER/OUTPUT=NOW.LIS
```

can provide a lot of information if executed regularly. The output allows you to show which users typically access the computer at given times and what terminal connections they typically use. It already has a date and timestamp. This can be done for the system's use with the command:

```
SHOW SYSTEM/OUTPUT=SYSNOW.LIS
```

If you have a network, monitor user access regularly. A program on the DECUS library tape called Finger System: Network and Local Server can be used to get a snapshot of not only usernames but also of the programs that each user is using at the time.

The patrol officer has another method for determining suspicious activity: an alarm. This alerts the officer to a particular area for investigation. Under VAX/VMS, you can set alarms to warn of certain user activity. On your VAX, you may decide that some files are so sensitive that you want to be aware of any access to them. You would use the Access Control List (ACL) method of alarming the files. There are many variations of the SET ACL command, for example:

```
SET ACL/ACL=(ALARM=SECURITY,
   ACCESS=READ+FAILURE)
   SYSUAF.DAT
```

After you've set the ACL, arm it (i.e., turn it on). This is done with the command:

```
SET AUDIT/ALARM/ENABLE=ACL
```

For a full explanation of the SET ACL command, consult your VAX/VMS documentation.

Some system activity areas to monitor are typical I/O and CPU use. The MONITOR utility can help with regular checking and daily analysis of the ACCOUNTING file, and

You also can graph data such as I/O or CPU use to spot-check your system's use quickly.

ACCOUNTNG.DAT can help detect any unusual activity.

You also can graph data such as I/O or CPU use to spot-check your system's use quickly. You should be able to produce documents to substantiate your definition of normal activity for a court, if needed. Third-party vendors offer software to watch most users' activities.

Your patrol should detect break-ins in progress and previous break-ins. Under VAX/VMS, the ACCOUNTING utility is helpful in examining user activity, especially if you've used the IMAGE qualifier. It's a good habit to turn the accounting feature ON in your site-specific startup procedure. It's even better if you add the IMAGE qualifier at that time. For example:

```
$ SET ACCOUNTING/
ENABLE=IMAGE
```

Observing A Break-In

The next step is to know what to do after identifying suspicious activity. This is called crisis management, or a contingency plan, and your company should have a management-approved policy regarding it. The following points should be contained in any plan:

1. The name, title and phone number of the first person to contact after you've determined that a break-in has occurred.
2. A method for qualifying the extent of the break-in and damage. This might consist of third-party software aids, prewritten command procedures or simply a list of commands to perform during or after a break-in.
3. If you're on a network, decide now whether you should disconnect your

When you can show that a user's activity is suspicious, you can investigate. Your suspicious circumstances now become your probable cause for the investigation.

computer in the event of a break-in. Also decide how you'll alert your user community.

4. Emergency action taken by the system manager will affect current users. Decide whether you'll execute your contingency plan on a system with users still logged in or if you should stop all use immediately. You also must address "crowd control," or, more likely, "rumor control." Have a preset message that you can send to users that won't alarm them but that will make them follow your directions promptly.

5. Like any crime scene under investigation, you need a plan for controlling and preserving evidence. This should conform to local authorities' methods.

6. Have a list of steps you should take to recover from the break-in and restore your system in a timely manner.

Suspicious Circumstances

Suspicious circumstances is a phrase often used by police. An officer can articulate what activity is abnormal for a particular area and why. When you identify abnormal user or system activity, be prepared to document why that activity is abnormal and how you observed it. If you're performing a regular patrol, you'll be able to compare the usual activities with your observations to demonstrate the difference.

When you can show that a user's activity is suspicious, you can investigate. Your suspicious circumstances now become your probable cause for the investigation.

An officer uses the power of observation to formulate the necessary probable cause to stop a suspect. In a computer environment, however, companies may not have to articulate probable cause to investigate a user.

Users may waive privacy by being allowed access to the computer. This will have to be tested in the courts as more computer-crime cases enter the legal system. As a system manager, you always should substantiate probable cause for an investigation.

After you launch an investigation, every output or file that demonstrates the existence of unusual activity could be valuable evidence. You'll have to document how and when the evidence was obtained and from what computer, directory or file. If you witnessed the break-in, your ready-made procedures to take various snapshots of the system and the suspect's activity would be necessary evidence.

If you're uncovering signs of a past break-in from selected files such as accounting summaries, they're your evidence. After a break-in, much evidence can be retained by doing a full backup of your system and all data. This way, areas can be examined later that weren't obvious at first. Consult your local authorities for their rules of chain of evidence (proper control of evidence) before final approval on any policies or procedures.

What Crime?

The ability to identify a crime is the key to accurate evidence and fact collection. Every crime has one or more elements. You must prove the existence of these elements to substantiate the crime. This requires the system manager to know the state and federal laws and be aware of what kind of files or output would be helpful in preparing the evidence.

For example, if you implement regular procedures to monitor users on your system and save the output of those procedures, you may have enough evidence to prove the elements necessary in a crime. In California, it's a crime to access a computer system intentionally without permission. This crime isn't hard to prove if the system manager and the company have established procedures and an environment as outlined above.

The system manager needs a strict means of controlling access to AUTHORIZE to add user accounts. When user accounts are altered, a new document of valid accounts should be produced. This list and procedure should show only the user accounts that have permission to access the computer. If you notice an invalid username on your system, you can use the ACCOUNTING utility to find any use of the image AUTHORIZE, which would have created the invalid account. That information would lead you to the account that created the invalid username. It may be a privileged account that was used without permission or broken into. It also may be a valid account that could use AUTHORIZE without permission.

This evidence proves that the account was created and logged into intentionally. The VAX/VMS utilities will help you show what happened. Your policies and procedures and knowledge of the computer system will help you show why the events are legal or illegal.

When investigating a crime, bear in mind that in many states damages also are measured in time lost by you and your staff while performing the investigation and in income lost as a result of the break-in.

The Report

A police report must use facts and evidence to support the accusation that an individual has committed a crime. The only facts necessary are those directly related to proving that a crime occurred.

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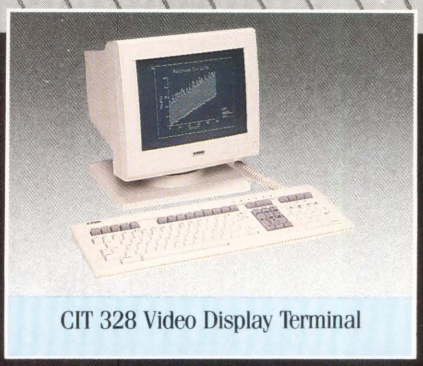

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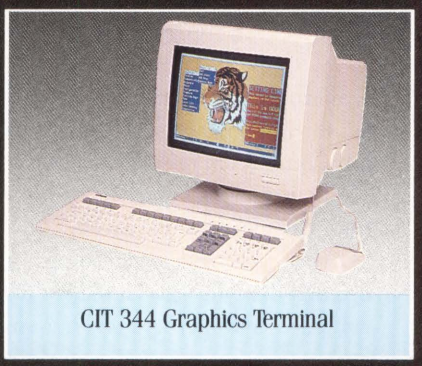

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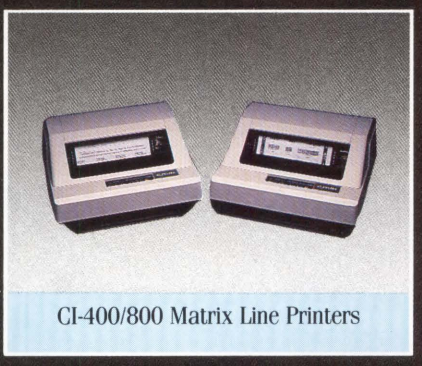

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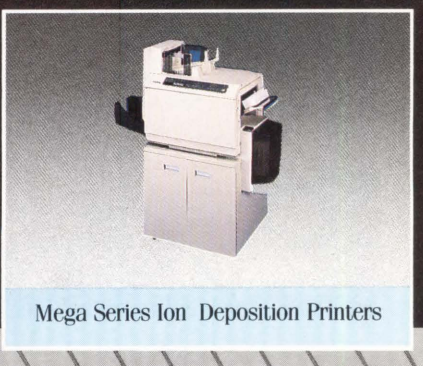

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After you and your company have decided that you have sufficient facts and evidence and perhaps even a suspect, report the crime to your local authorities.

To illustrate the importance of evidence, let's compare burglary to petty theft. In the California Penal Code, a burglary charge can be made against a suspect only if the element of intent can be proved along with the other elements. For example, it might be easy to prove that a suspect entered a store and removed an item from the store without paying for it.

However, to charge the suspect with burglary instead of petty theft, you also must prove that he entered the store with the intent to take the item. Evidence that would help you prove this might be an aid for concealing merchandise. The report must contain all elements of the crime as well as evidence to prove that each element was present.

After you and your company have decided that you have sufficient facts and evidence and perhaps even a suspect, report the crime to your local authorities. Depending on their expertise, they may or may not be able to write the report that must be submitted to a district attorney. The final part of your contingency plan should be how to handle the reporting of the incident. In some cases, you may want a computer security expert to write the report and follow it through the legal system.

AN INCREASING NUMBER of computer-crime cases are being tried. Thus, a new case law is being established that impacts the way companies do business with computers. The daily routine of computer personnel is being affected, as well as company policy and procedures. The ability to protect yourself from computer crime and apprehend a computer criminal will become increasingly valuable. *—C.L. Sidrow and Associates, a technical consulting firm based in San Dimas, California, publishes the newsletter "Computers and the Law" for data processing managers and VAX/VMS system managers. Sidrow is a VAX system manager and a Los Angeles County Deputy Sheriff.*

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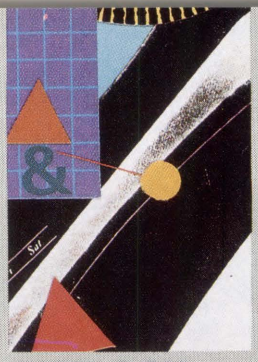

OUTLOOK

THE NEURAL CONNECTION

By Klaus K. Obermeier, Ph.D.

Massive Parallelism And Adaptability Set Neural Networks Apart From Current Computing Technologies.

Neural network technology, according to optimistic predictions, will claim half the total revenues of the robotics and computer markets by the year 2000. Neural computing, also called connectionism, has significant potential to succeed in areas in which conventional computing and AI techniques have failed, such as perceptual pattern recognition and learning. What sets neural networks apart from current computing technologies is their massive parallelism and their adaptability.

Neural networks have gone from great promise in the 1940s through attacks in the 1960s to legitimate revival in the 1980s. Leading-edge developments are undertaken at universities and high-tech companies, then farmed out to start-ups. New interest in neural networks is the result of advances in mathematics, neurology and neurobiology. Consequently, neural networks are studied under two theoretical aspects:

1. Efficiency of neural-based electronic architecture.
2. Understanding of biological functions of neural networks.

When neural networks were acknowledged openly in 1986, they were expected to fill the void of intelligent processing that AI had made obvious. Not only were most expert systems incomplete, but they also couldn't handle fuzzy or faulty information. Moreover, expert systems were expensive to build and maintain. Neural networks were attractive because they worked on poor data and performed better with every piece of new data without requiring knowledge engineers.

The Brain Stem

The idea behind neural networks stems from models developed to explain what little is known about the human brain, in particular the behavior of neurons and their synapses. The value of these theoretical models lies in the mathematical provability of their information processing capabilities, not in how closely they resemble human brain processes.

When comparing the information processing capabilities of a human and of a computer, the biggest enigma related to performance is the difference in the speed of the processors. Whereas the operations of conventional computers are measured in nanoseconds, neurons operate in milliseconds but perform complex operations without fail. Most cognitive processes take no longer than a few hundred milliseconds. Although individual neurons in the human brain compute operations at a rate as slow as a single instruction of a digital computer, the brain performs its processing feat through massive parallelism, with 10 billion neurons and more than 1,000 times that many interconnections.

To simulate massive parallelism, the neural network approach for computer simulation consists of setting up a network of processing elements, the electronic analogy to neurons (see Figure 1). Each processing element has a number of inputs, a small set of possible states and an output that's the function of the inputs. Each input to the processing element has a confidence value, which ordinarily ranges from 1 to -1.

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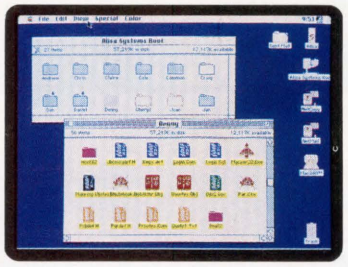

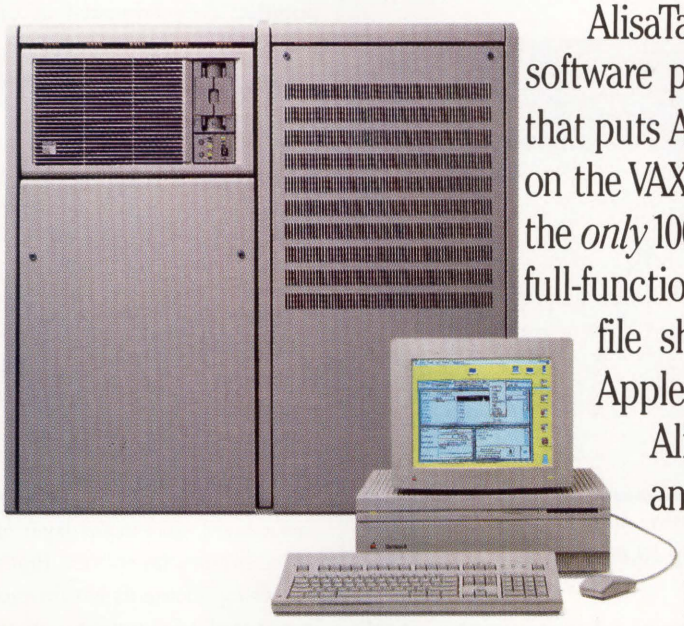

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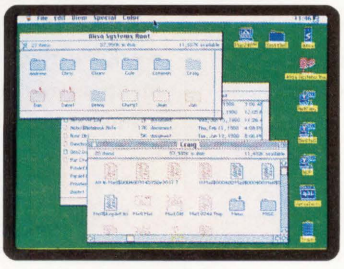

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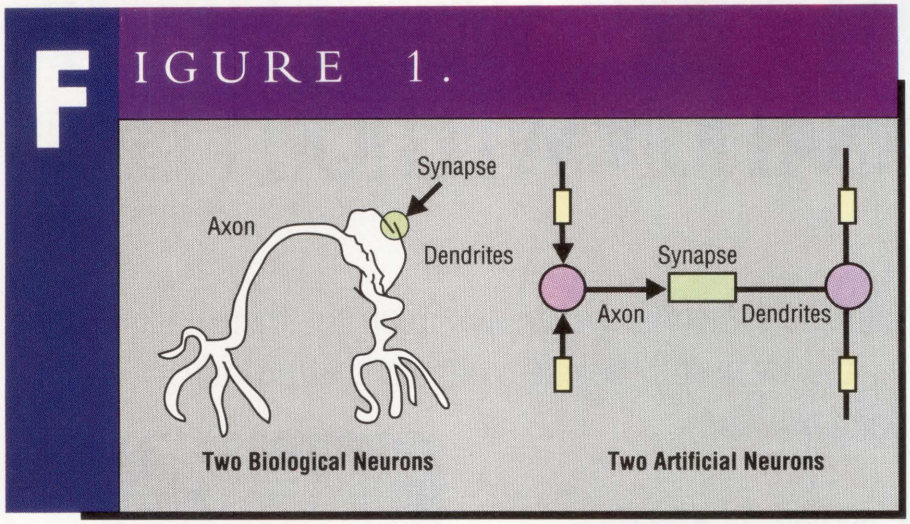
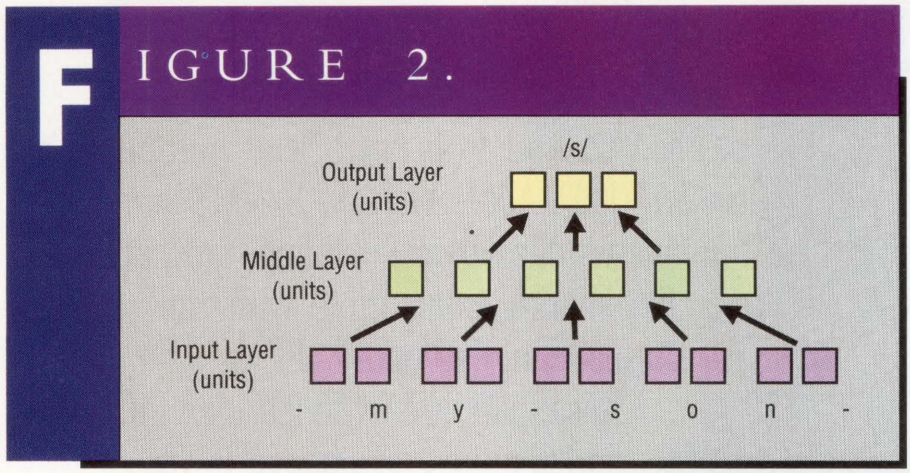


The neural network metaphor.



NETtalk- an example of a hierarchical network using about 200 input units, 80 hidden units and 26 output units. Nearly 20,000 weights are specified.

When a processing element is activated, it evaluates its inputs and weighs them according to their respective confidence value. If certain conditions are met, the computing unit generates an output value used as input by other processing elements. Only the confidence values of the inputs can be changed during "learning," the phase when new data is introduced to the network and the weights on the processing elements are adjusted. Programming a neural network is simply adjusting weights, sometimes manually, sometimes automatically. Consequently, algorithms are used to accommodate the manipulations of the weights that activate individual processing units.

To achieve adaptability, the neural network approach employs three strategies:

1. Supervised learning
2. Unsupervised learning
3. Self-supervised learning.

Supervised learning requires an external monitor that tells the network if the output is correct. If an error occurs, the monitor simply adjusts the weights on the connections until the desired output is obtained. Unsupervised learning consists of algorithms that determine how the input data should be processed without outside intervention. Self-supervised learning takes place without an external monitor. The network is equipped with a feedback device that allows for error detection and weight modification.

While conventional computing requires programming, neurocomputing requires the training of the networks. At first, neurocomputing seems easier and less expensive than conventional computing in regard to the required resources to run applications. But it becomes obvious that the training of large neural networks may require an exorbitant amount of time and that the development of neural network algorithms (dozens are available) may take as long as conventional algorithms.

Network Layers

When neural networks first became popular, they consisted of one or two layers. Having at the most an input and an output layer, the network was limited in what could be represented. Adding a third layer allowed the system to form an internal representation of the problem. Single-layer networks restricted the representation to what was in the input configuration. Multilayered, hierarchical networks are more powerful, because they generate their own internal representation in the so-called hidden units. Hierarchical networks are used for applications such as speech and character recognition.

A hierarchical network consists of an input layer, an output layer and one or more hidden layers (see Figure 2). The processing elements within each layer are connected via weights. As mentioned earlier, the weighted sum of the inputs determines the output function. The setup of the middle layers is crucial to the network's ability to respond to novel input. If the number of processing elements in the middle layer is too large, it will replicate the elements from the input layer, causing problems similar to those encountered in single-layer networks. If the number of processing elements in the middle layer is too small, many iterations are required during training, and recall accuracy may be impeded.

In the sample application of NETtalk in Figure 2, the task of the network is

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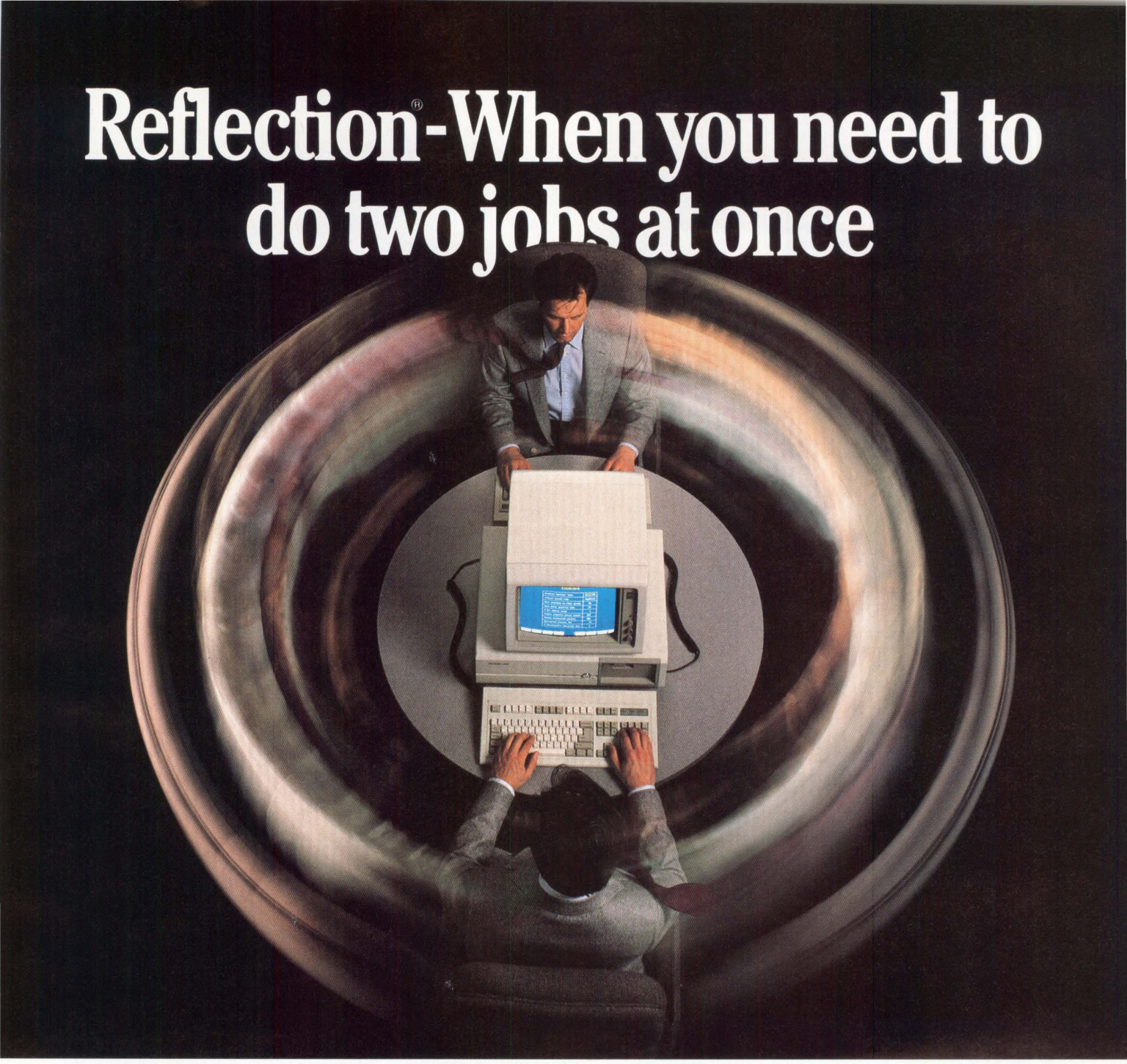

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Neural Nets And VAX

Neural networks are used and produced in the form of neurocomputers (hardware that models the parallelism of neurons) or netware (software that emulates neurons and their interconnections on conventional serial computers). Neurocomputers have been configured on the device (chip), subsystem (board) and complete system level. General-purpose neurocomputers are available as coprocessors to computers. The neural network is accessed just like a subroutine that can be called if needed. In this form, neurocomputers fit into the infrastructure of current computer technology.

Neural network tools often are configured for specific applications that are licensed. An important aspect of netware is that it can be simulated on conventional computers.

In the DEC/VAX environment, two well-known implementations are James Anderson's "brain state in a box" at Brown University, Providence, Rhode Island, and Terrence Sejnowski and associates' NETtalk at Johns Hopkins University, Baltimore. "Brain state in a box" research focuses on the psychological realism of human problem-solving capabilities when filling in missing information. Anderson's contention is that humans make deductions and inferences not based on the laws established by classical logic (for which you need computers), but based on analogical and probabilistic reasoning. His research shows that not only can a network learn partial information, integrate it with other information and even reconstruct missing information, but that it also can recover from failure. This supports evidence from studies on memory disorders and aphasias. The teaching process takes about five minutes of CPU time on a VAX 11/780.

NETtalk is a system that performs text-to-speech conversion. The network is presented with one five-sound sequence at a time. The system learns to pronounce the middle sound using the surrounding sounds as contextual clues for correct pronunciation. Connected to a speech synthesizer, NETtalk pronounces new words that aren't in the initial training set with 95 percent accuracy.

VAXs are integrated widely into the neural network infrastructure. For example, TRW's Mark III acts as a coprocessor to any VAX.

Still, VAX performance is less favorable than that of supercomputers and massively parallel machines. While the number of interconnects on a VAX goes up to 2 MB per second for a room-sized configuration, the Cray X-MP shows about 50 MB per second and Thinking Machines Corporation's Connection Machine about 13 MB per second. In the near term, the use of conventional computing platforms, especially larger VAXs, is a viable solution for experimentation and prototyping.

to learn the correct pronunciation of English sounds. NETtalk, developed by Terrence Sejnowski of Johns Hopkins University, Baltimore, and Charles Rosenberg of Princeton University, Princeton, New Jersey, is a system that performs text-to-speech conversion. The network is presented with one five-sound sequence at a time, learning the correct pronunciation of the middle sound. After setting the weights in the network, the first pattern, a five-sound sequence for the speech-recognition application, is presented to the input layer and then propagated through the middle and output layers. The result from the output layer then is compared with the desired result. If necessary, the weights in the consecutive layers are adjusted. Upon completion of this process, the next pattern can be introduced.

Applications

Massive parallelism gives neural networks a high degree of the following:

1. Fault tolerance — the ability to recover gracefully from processor failure.
2. Associative recall — the ability to retrieve information instantaneously based on content.
3. Graceful degradation — the ability to guess if there's no exact match for the requested information.

Consequently, neural networks very likely will outperform conventional computers, including parallel processors, in tasks involving incomplete data sets or

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FIGURE 3.

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Storage Improvement	Dynamic RAM (1-16 MB)	Wafer and Analog Devices	Optical Storage
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Trends in neurocomputing.

fuzzy or contradictory data.

These properties make neural networks attractive for applications in the military (e.g., sonar pattern recognition, visual identification and classification of enemy aircraft) and industry (e.g., object recognition for robots, automatic process control and radiograph interpretation).

More specifically, neural network applications fall into three classes:

1. Sensor processing
2. Control systems
3. Knowledge processing.

Sensor processing applications include image processing and compression, character recognition and continuous speech recognition. Sensor pattern recognition applications use neural networks to recognize underwater targets by sonar. Handwritten character classification programs such as Nestor's NestorWriter can determine rules for recognizing characters based on common features, e.g., curvature and orientation. Thus, the system recognizes characters it hasn't seen before. Industrial applications of this technology range from processing checks to reading Japanese characters.

In speech synthesis, NETtalk provides an impressive demonstration of the potential of this new technology. This program learns to read English text aloud without the benefit of preprogrammed linguistic rules. In contrast, conventional programming techniques, including AI programming, have serious problems with this task.

Control systems include robotics, autonomous vehicles, adaptive routing and switching. One of the oldest control applications is used to eliminate echoes in telephone lines. It's also used to cut down on data transmission errors in telephone modems.

Knowledge processing tasks include expert systems, predictive modeling, and information storage and retrieval of large databases. In one expert system application, a neural net was trained on the functional relationships between symptoms, diagnoses and treatments. Testing the behavior of the network showed that it responded with 100 percent accuracy to non-equivocal cases, weighed the evidence in equivocal cases and fell back on known relationships if unknown cases were presented. The neural network was configured in a fraction of the time it would take a knowledge engineer to build an expert system.

THE FUTURE OF neural networks, apart from theoretical advances, depends on technologies that support their speed and storage requirements (see Figure 3). Speed will be improved in the short term by the development of the digital processing chip, in the midterm by gallium arsenide chips and in the long term by optical computing devices. Storage capacities will be increased in the short term by dynamic RAM with up to 16 MB, in the midterm by wafer and analog devices and in the long term by optical storage.

Neural network technology is still in an embryonic state, and with a handful of commercial companies specializing in the first commercial netware (that is, neural network software) products, caution is necessary. Regardless of the revenues neural networks may generate in the future, neural network research will help usher in a new age of computer technology. *—Klaus K. Obermeier, Ph.D., is projects manager of the Intelligent Systems Group at Battelle in Columbus, Ohio, and author of* Natural Language Technologies in Artificial Intelligence, *to be published this fall by Wiley and Sons, New York.*

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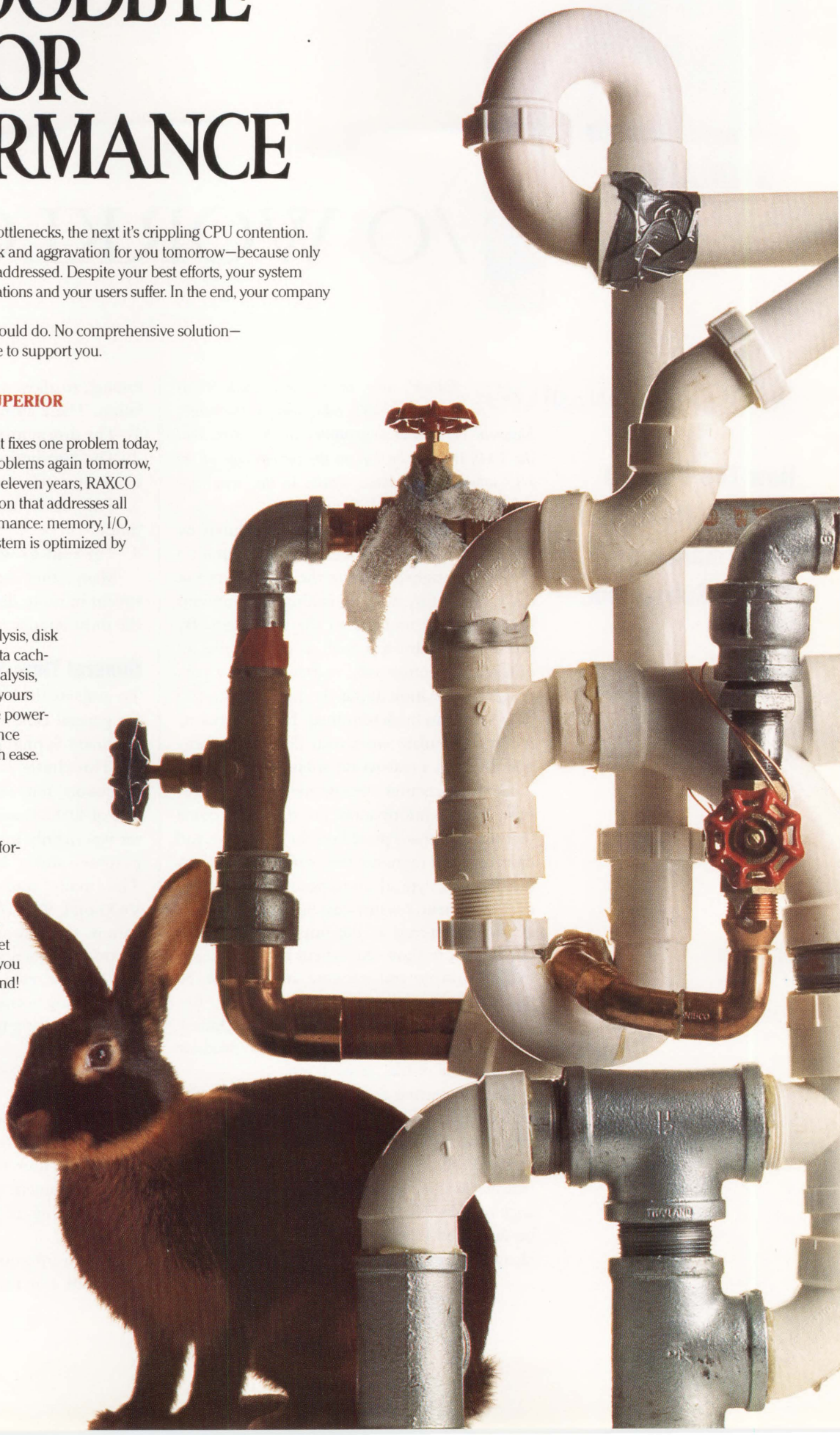

STORAGE

I/O WORKLOADS

By Kenneth H. Bates

How The VMS I/O Stream Affects The Performance Of The I/O Subsystem.

Editor's note: In this third article in his series on I/O subsystem performance, Kenneth H. Bates concentrates on the effects that the VMS I/O stream has on the performance of the I/O subsystem. Previous articles in this series appeared in the April and August issues.

I/O performance typically is measured by saturation testing and benchmarks. Saturation testing is designed to stress the controllers and disks, and it functions by issuing a continuous stream of I/O requests to the subsystem. By modifying parameters such as the number of outstanding commands, request size and seek range, information about the limits of the I/O subsystem can be determined. Benchmarks attempt to emulate workloads that may be encountered in a real-world environment.

Both procedures exercise the system and return valuable information, but it can be argued that the load that's placed on the controller and disks may not represent the workloads encountered under typical conditions and may not even represent a worst-case scenario. Because it's in the interest of the implementer of the benchmark to show the system in its best light, many hardware and software shortcuts can be taken that normal applications can't use. Beyond this, the validity of applying benchmark data to a real-world environment can produce questionable results, as we'll see.

Before starting a program to enhance the performance of the I/O subsystem, you must know the characteristics of the I/O stream associated with a particular workload to allow a realistic evaluation of the associated performance metrics. Although an I/O stream only can be described fully by actual trace data, several characteristics of this stream are descriptive enough to allow accurate modeling and simulation. These characteristics include:

1. The distribution of request sizes.
2. The distribution of seek distances between successive QIO packets to the same disk.
3. The distribution of interrequest arrival times.
4. The read-to-write ratio.

Many other characteristics describe the I/O stream in more detail, but the above items are the most important.

General Time-Sharing Workload

To evaluate the VMS I/O stream, a cluster used for general time-sharing purposes in Digital's Colorado Springs office was selected for analysis. This cluster consisted of five VAX 11/785 processors, four HSC70 controllers and a mixture of 40 RA81 and RA82 disk drives. The cluster was mainly used for general administrative purposes and a light engineering workload. The main applications run were MAIL, VAXnotes, VTX, DECalc, word processors and various text editors. The total number of users on this cluster varied but averaged from 100 to 125. The main activity on the cluster took place during normal business hours. In essence, this cluster was a typical VMS interactive time-sharing cluster.

The VMS I/O stream was collected by capturing every QIO packet issued by the cluster over a continuous two-week period. During this time, more than 23 million packets were sent to the four HSC70 controllers. Of these, about 78 percent were READ commands, and the remaining 22 percent were WRITE commands.

The distribution of request sizes illustrated in Figure 1 is revealing. The I/O activity is

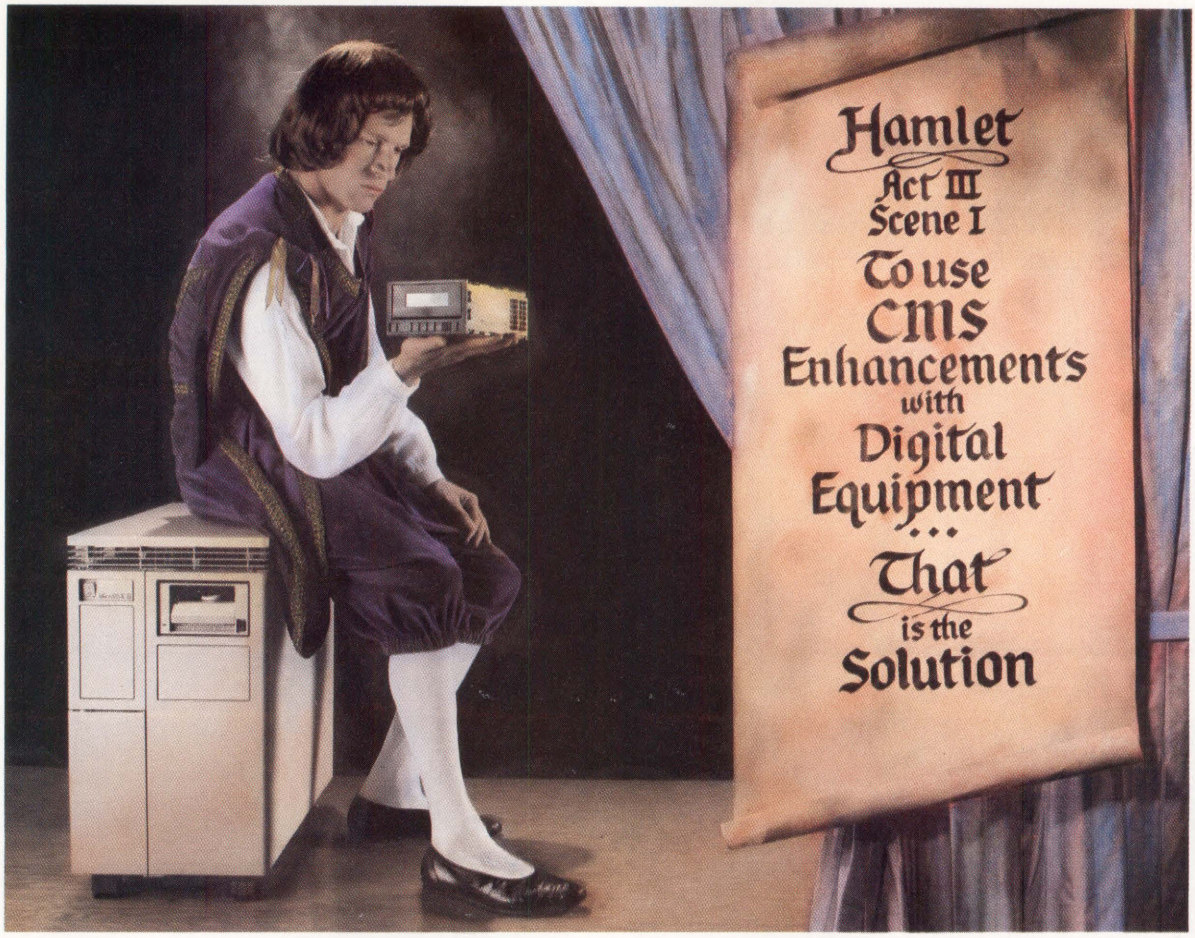

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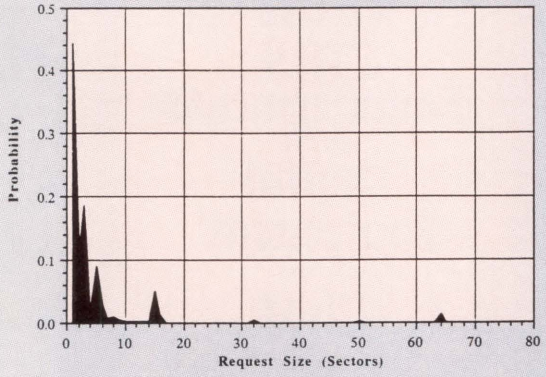
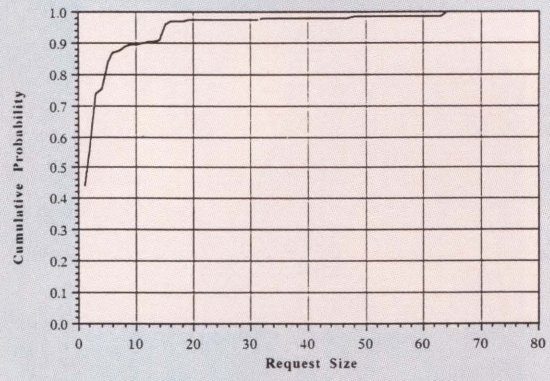
FIGURE 1.



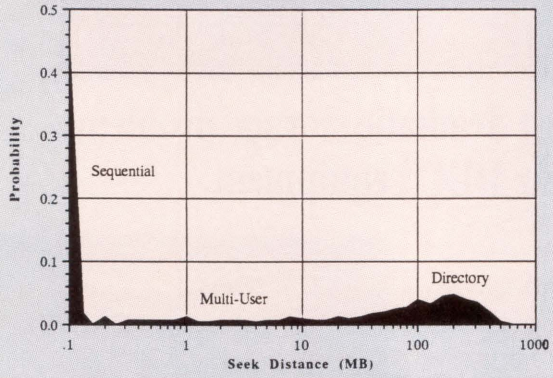
Request size distribution.

FIGURE 2.



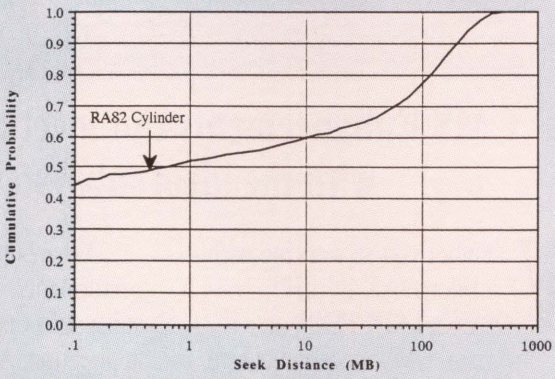
Cumulative request size probability.

FIGURE 3.



Seek distance distribution.

FIGURE 4.



Cumulative seek distance probability.

dominated by small request sizes, with nearly three-quarters of the requests being three sectors or fewer in length. The cluster size of the VMS disks on this system was three. There's a small amount of activity at the 15 sector transfer size, with peaks of activity at sizes of 32, 48, 64 and 96 sectors. The RMS blocking size for this disk was 16 sectors.

The effect of the small request sizes is illustrated dramatically in Figure 2, which shows the cumulative probability distribution (ogive). Ninety percent of the transfers are 12 sectors or fewer in length, with 95 percent being fewer than 16 sectors long. We can conclude from these graphs that this workload is characterized by fairly small transfer sizes and that there's little or no need for disks with very high data-transfer rates.

The next distribution, seen in Figure 3, is of seek distances. To allow comparisons of different disk types, this distance is shown in megabytes. A value of 1,000,000 was used as the number of bytes in a megabyte, rather than 1,024 times 1,024. The horizontal scale is non-linear (logarithmic), in order to spread out the lower seek distances. Another VMS characteristic is apparent in Figure 3. Most of the seek distances are 0.1 MB or less in length. There's some activity around the 50- to 400-MB range, but this is totally overshadowed by the small seeks.

Figure 3 can be broken into three areas that are a result of VMS activity. The first portion is that of sequential access or seeks that will have a very high locality of reference. This is because of the natural tendency for applications to sequentially access a file and the fact that when VMS updates a directory it will read the entry it has just written to ensure that it's correct.

The second portion is the uniform distribution beginning at about 0.2 MB. This is caused by the effect of multiple users on a disk (or multiple data files). As files that are distributed over the surface of the disk are accessed, the disk heads tend to move randomly over the surface.

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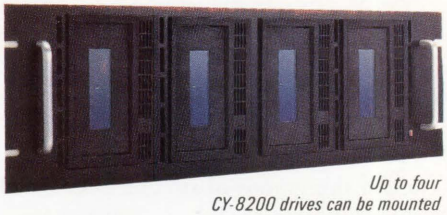

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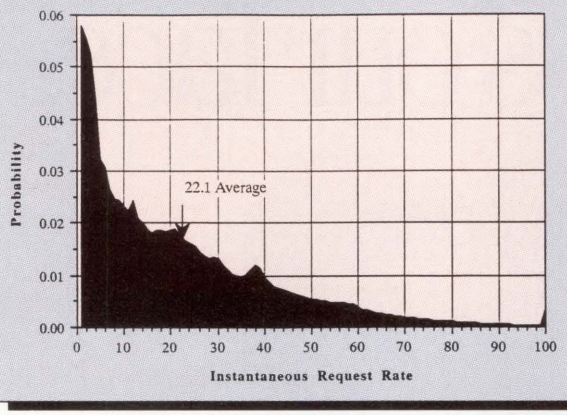
FIGURE 5.



Request rate distribution.

FIGURE 6.

	Request Size	Seek Distance	Request Rate
Range	1 - 127	0 - 623	1 - 200
Mean	4.71	63.54	22.15
Median	2	1.96	17
Mode	1	0 to 1	1
Variance	91.2	3690.57	18.23

Time-sharing summary statistics.

The final portion of the graph is due to directory accesses. As users log in, run programs and create and delete files, VMS must access the directory INDEXF.SYS. Because this is usually located in the center of the disk, the tendency will be to have a component of the seeks be strictly because of directory accesses. The shape of this curve is partially because of the logarithmic scale of the graph, but a distinctive point also can be seen on a linear scale.

The ogive in Figure 4 reveals the tendency toward small seeks. There's a 50 percent probability that a given request will result in a seek of 0.5 MB or less. With an RA82 disk drive containing a total of 0.47 MB per cylinder, it's easy to see that no seeking will take place 50 percent of the time.

Although the published figures for average seek times are based on the 33 percent of full capacity distance, seeks under this workload are much less. With the 33 percent point of an RA82 being 207 MB, Figure 4 shows that nearly 90 percent of the seeks are less than that. In other words, 90 percent of the seeks are less than what's published as the average seek distance!

Figure 5 illustrates the distribution of the request rates as seen by all the HSC70 controllers on this cluster and typifies a real-world VMS system. With multiple users on the system, requests will arrive at unpredictable times. This can be viewed as a classic example of a Poisson process. In this case, the average request rate (as might be seen by SPM or VPA) was 22.1 requests per second. There are instances in which the rate is quite low (only 1 per second), and sometimes it can be quite high (more than 100 per second). The average rate was 22.1 per second from all hosts to all disks. Although the ogive isn't shown, 90 percent of the I/O requests arrived at a rate of 50 requests per second or fewer.

It's important to understand this variable request rate. Although a disk drive easily can handle 22 requests per second, it can't handle rates of more than 100 per second. Because of this, some requests must wait, because the disk is busy servicing preceding requests. As a result, their response times rise. The effects of this "queuing" will become apparent in a future article on configuring the I/O subsystem for maximum performance. It is one of the major differences seen when comparing performance on a real system against that produced by benchmarks.

When modeling the overall system, one of the measures of a workload is the I/O appetite of the processors. To normalize the various processors manufactured by Digital, a VAX 11/780 is considered to be one VAX Unit Processor (VUP). Because an 11/785 is about 1.5 VUPs, this cluster would have a total processing power of 7.5 VUPs. Ninety percent of the I/O activity requires 6.8 requests per second per available VUP. The actual use of the processors wasn't measured during the experiment, so the amount of I/O activity per used VUP wasn't determined.

The statistics for the previous distributions are illustrated in Figure 6 and confirm several facts that were visually obvious from the preceding graphs. The tendency toward low transfer sizes is apparent by observing the low mean in this figure. The fact that the mode of the request size is one sector while the median is only two makes clear that the low request sizes are the predominant transfer mode of VMS.

Examination of the seek range column confirms the high locality of reference. As expected from the graphs, the mode of the data being between 0 and 1 indicates a high probability of little or no disk arm motion. The mean seek distance of 63.5 MB is also only 10 percent of the size of an RA82, which indicates that seek time won't be the dominant performance factor.

In the request-rate column, as you might expect for a real workload, the close conformance between the mean and variance suggests a Poisson distribution. Although the average rate was 22.1 requests per second, a peak of 200 per second was reached.

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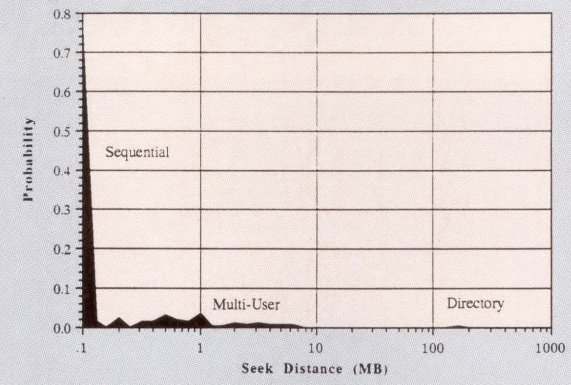
FIGURE 7.

Request size distribution.

FIGURE 8.



Seek distance distribution.

To see how a benchmark compares with real systems, the next experiment was to measure the infamous Debit/Credit benchmark running at five transactions per second (tps).

The system tested consisted of a single VAX 8650 processor with 68 MB of main memory. One HSC50 served as the I/O controller, with two RA81 disks for the system files and six RA81 disks containing the files used by the database.

The driving system consisted of a separate VAX 8650 processor, which contained a Remote Terminal Emulator (RTE) and was responsible for driving the 8650 under test (any I/O from the driving 8650 was excluded from the analysis). Five hundred users were simulated, the driving system providing the test system with the equivalent of 500 users entering data from separate terminals.

The capture of the I/O data didn't begin until all 500 users had logged in and operations had been under way for at least five minutes. This way, startup transients weren't included in the analysis. By the same token, the data capture was terminated well before the workload simulator was stopped.

The data collection ran for slightly under one hour, resulting in about 176,000 QIO packets. Because this simulation consisted of repetitive tasks with no periodic execution of different programs, the allocated time was sufficient to capture the I/O profile representative of this workload. Of these requests, 33 percent were READ requests, and 67 percent were WRITE requests.

Figure 7 illustrates the distribution of request sizes for the Debit/Credit workload and shows that nearly 90 percent of the requests are for one sector. Although this is characteristic of a specific software package, this graph highlights the fallacy of using benchmarks. No swapping, paging or image activation is taking place, all of which use much higher byte counts. Dependence on the results of this benchmark can be grounds for a rude awakening when a real system is run, as shown by the differences between Figures 7 and 1.

The distribution of seek distance is shown in Figure 8. This curve also differs considerably from the time-sharing curve. Although the basic components still exist, the sequential access far outweighs all others. The "multiuser" component only covers the users accessing the Debit/Credit database, because no other users are on the system. Consequently, seeks only occur over the data files, and the directory activity is small and barely discernable.

It should be obvious from Figure 8 how unrealistic benchmark results are. In this case, all 500 users are performing useful work; they're working 100 percent of the time. If your system doesn't conform to this idealistic picture, consider the differences between Figures 8 and 3 as an example of seek differences.

The request rate for Debit/Credit in Figure 9 shows considerable variation from that of the time-sharing workload. Instead of the Poisson distribution as in the time-sharing case, the Debit/Credit appears to conform to a normal distribution. This is because the Debit/Credit is an artificially driven workload, and the request arrival rates are therefore more predictable than random. This can cause problems interpreting the results, because the behavior of the drive queues will be much different from that caused by the more realistic rates in Figure 5. The periodic spikes at intervals of nine requests per second are unexplained but probably are because of the nature of the testing software. This is another reason to avoid benchmarks.

Typical VMS

To determine what the typical VMS system does, data was captured for many VMS systems. This capture was performed internally at Digital and at customer sites. Although it's probably a mistake to generalize too much, several characteristics appear to be typical of VMS when on an interactive system:

1. Small request sizes — VMS I/O is dominated by small request sizes. The size occurring most often is 512 bytes,

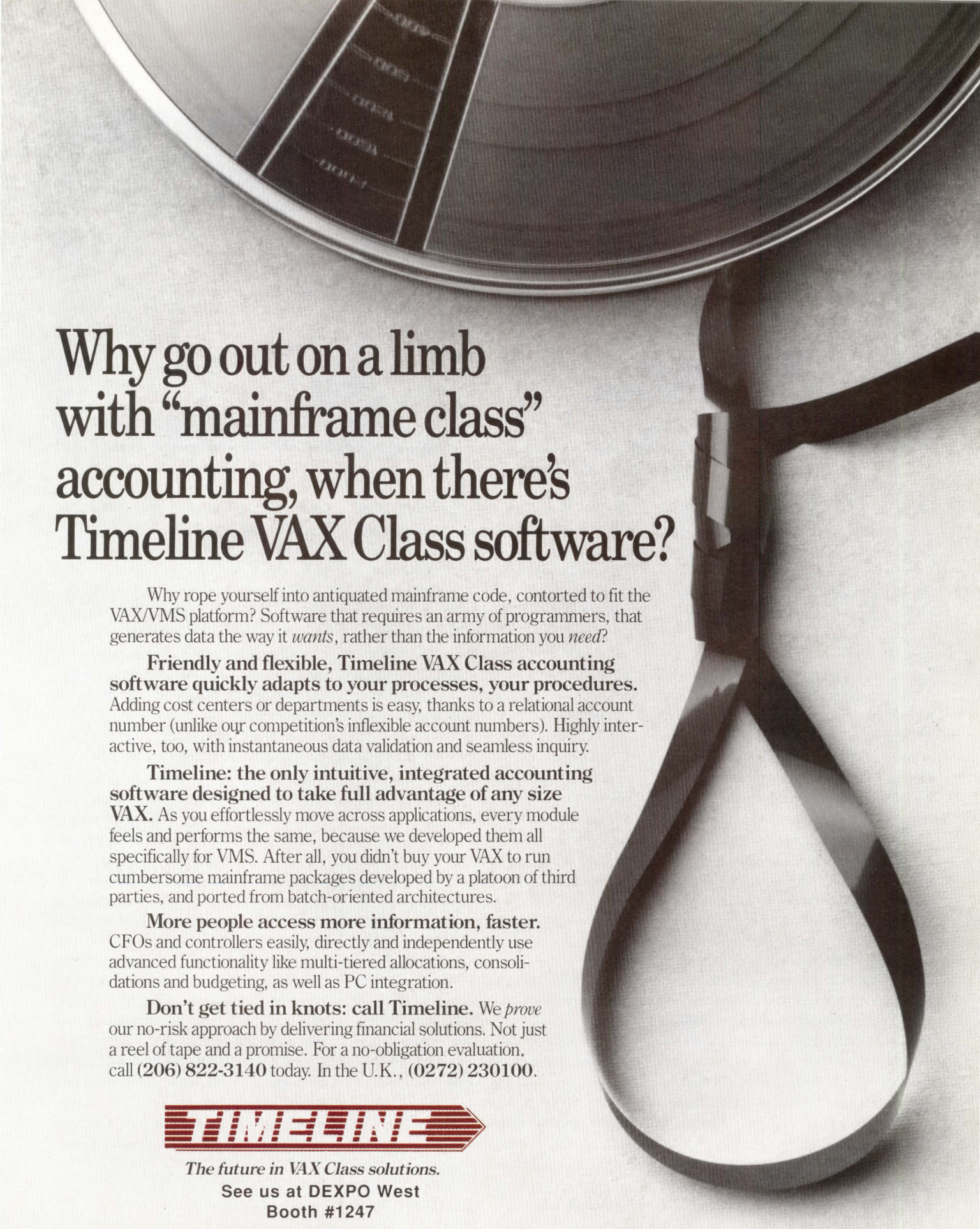


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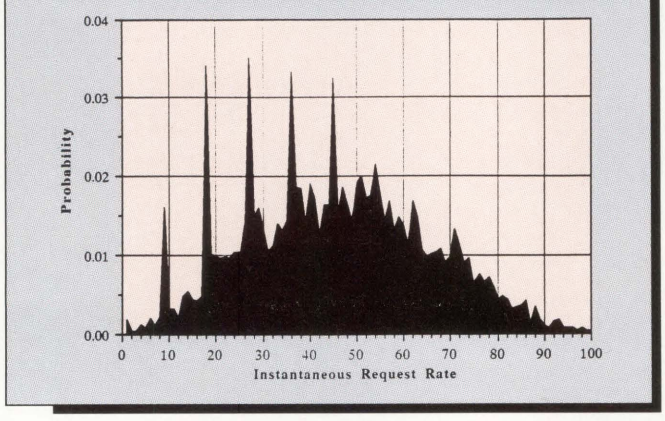
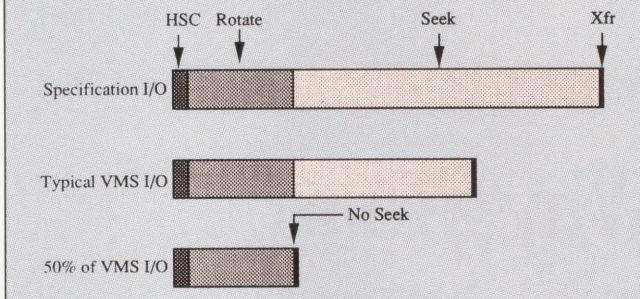
FIGURE 9.



Request rate distribution.

FIGURE 10.



Response time components.

while the average size is 4 KB. Ninety percent of all transfers are less than 8 KB, dramatically illustrating how small most VMS transfers are. As a result, the data transfer rate of a drive contributes very little to the overall response time.

2. Small seek distances — On the average, VMS has very short seek distances. Although most disk specifications quote the average seek times of a disk at 33 percent of total capacity, the average VMS seek is considerably less. On the average, a QIO from VMS will result in a seek of less than 10 percent of the capacity of the disk. Fifty percent of all QIO requests issued by VMS result in no seek.

This fact reveals startling information. If a disk drive had an average seek time of zero (beyond the speed of any disk drive in existence), for 50 percent of the requests there would be no performance increase!

Taking this one step further, most disks rotate at 3,600 rpms, while the RA70 rotates at 4,000 rpms. Because of this and the 50 percent on-cylinder figure, half the time the RA70 drive will be the fastest drive for VMS. The only thing faster than an RA70 would be an electronic disk.

3. Read/Write ratios — On the average, a VMS I/O stream consists of 70 to 80 percent READ requests and only 20 to 30 percent WRITE requests. Because of this, significant performance advantages can be gained by shadowing. Remember that certain disks have a larger number of WRITE requests, such as those used for paging and swapping, and won't gain any performance benefit from shadowing.

4. Request rates — VMS conforms to Amdahl's law, which implies that the I/O appetite of a processor will increase in proportion to the power of the processor. On the average, a typical VMS system will issue between 10 and 15 requests per second per VUP. The average request size is 4 KB, translating to about 40 to 60 KB per second per VUP. The peak rate will be about 2.5 times the average rate, so you can expect from 25 to 40 requests per second per VUP peak.

VMS tends to issue requests in bursts, exactly as you'd expect in a real-world environment. Because of this, queuing can occur at the drive, causing response times to rise and performance to degrade well below what the drive theoretically is capable of. This is most noticeable on hot spindles, which are ideal candidates for an electronic disk.

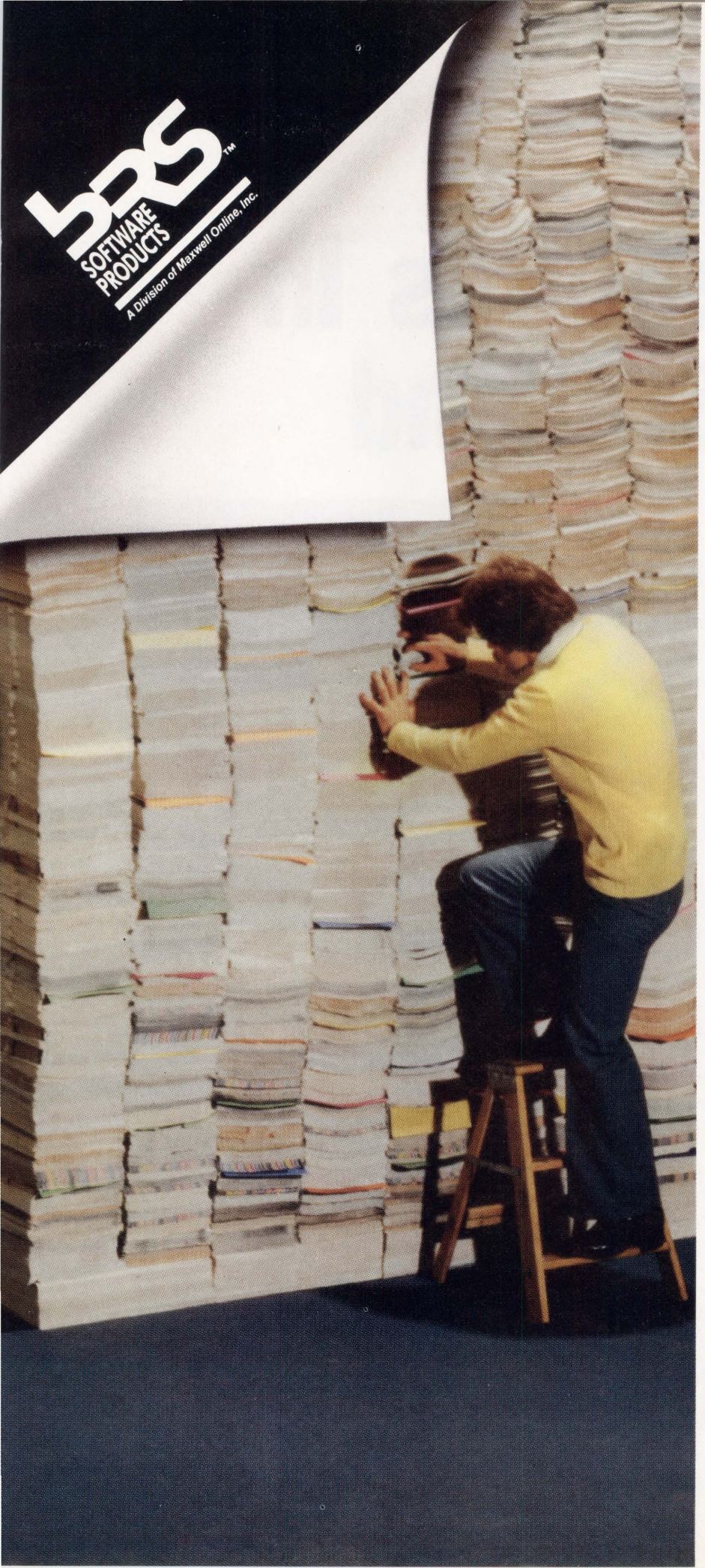
If possible, you should avoid saturation workloads and benchmarks when evaluating the performance of the I/O subsystem. Although the information they provide is accurate, it's difficult if not impossible to relate this information to a real-life VMS system.

This is illustrated in Figure 10. The top bar graph shows the components of response time for a single-sector transfer based on the published specifications for an RA82 disk drive. You might assume that seek time is the most important factor.

The second graph shows what can be expected under a typical time-sharing environment and illustrates that although seek time is still the dominant factor, the rotation speed assumes a much more significant degree of importance than you might expect.

The third graph dramatically illustrates the typical case of 50 percent of all requests being on-cylinder, highlighting the fact that rotation time alone will make the difference. This characteristic of VMS makes the RA70, at 4,000 rpms, the fastest drive in 50 percent of all I/O.

All this is a clear case for understanding your application before attempting to evaluate the performance of the I/O subsystem. Only when the characteristics of your system are well understood should you evaluate different disk drives to see how they'll maximize performance. How to accomplish this by measuring disk specifications objectively and accurately on your system will be discussed in the next article. *—Kenneth H. Bates is a consulting software engineer for Digital Equipment Corp. in Colorado Springs, Colorado, and a member of the I/O Performance Group.*



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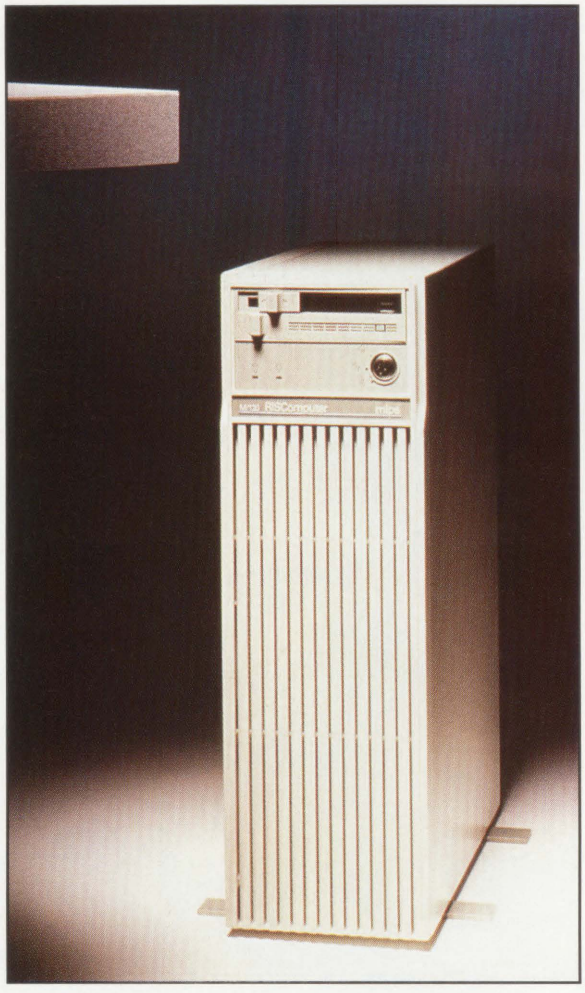


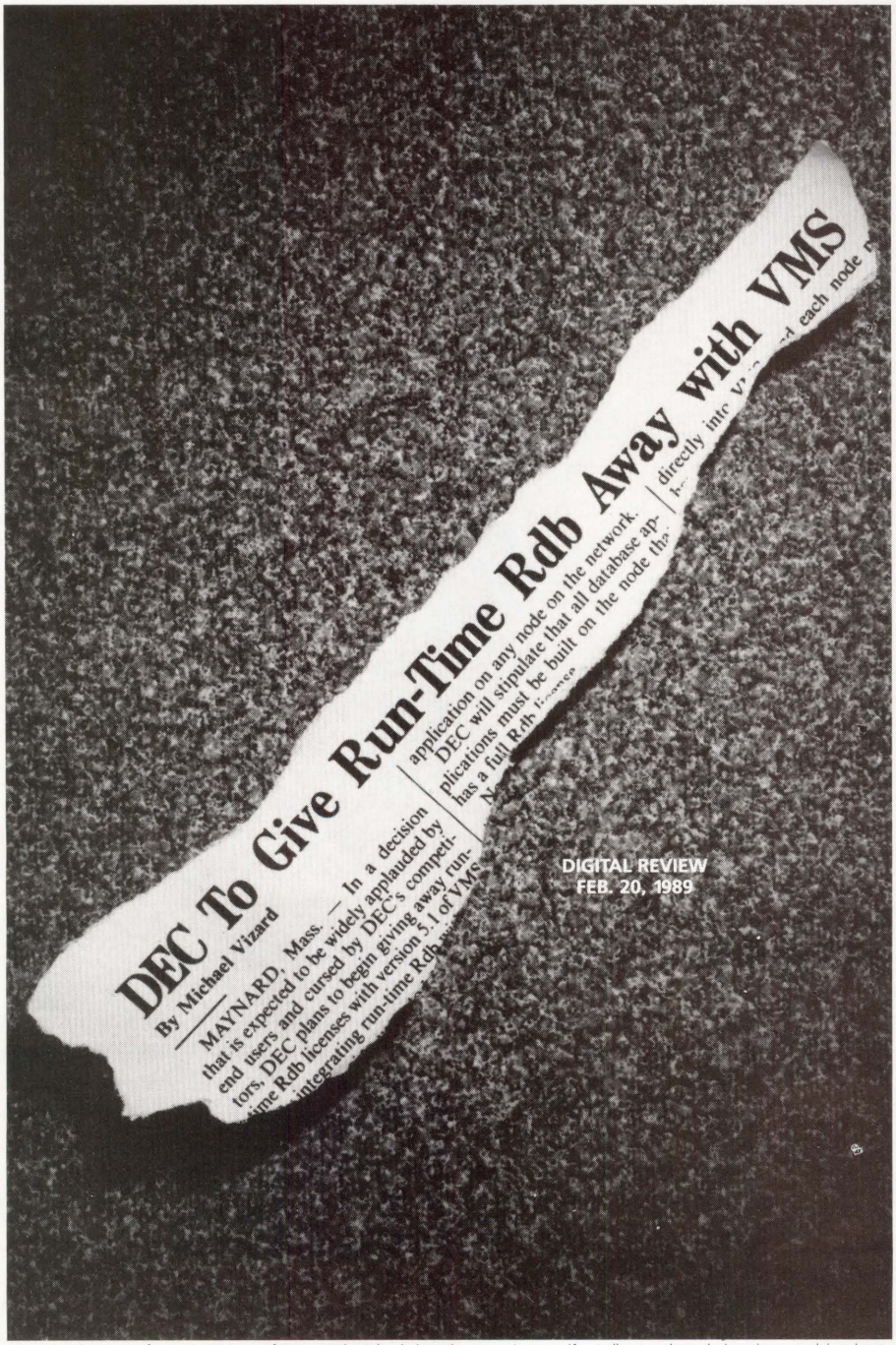
PHILIP A. NAECKER

Everyone knows the cliche: "These benchmarks are approximate measures only. Your mileage may vary." But the allure of high-performance Reduced Instruction Set Computers (RISC) is sometimes strong enough to confuse even a normally clear-thinking individual. Take me, for instance.

The M/120 RISComputer, from Mips Computer Systems Inc. of Sunnyvale, California, is a lightning-fast machine. Based on the R2000 chipset from Mips running at a 60ns clock cycle, this machine is a close cousin to the DECstation 3100. The M/120 has been around for about a year, and its performance figures have been reported widely.

The Mips machine is well-engineered and has all the bells and whistles you'd expect from a high-performance engine (see Figure 1). The R2000 processor and R2010 floating-point coprocessor are supported by instruction and data caches (64 KB each) and separate memory and

Rdb and FOCUS 4GL: One is free, the other pays for itself.



Now that runtime Rdb is free*, you need an application development system to make it work. FOCUS 4GL is the perfect complement to Rdb because FOCUS pays for itself in a fraction of the time of any other VAX application development product. Whether you need a transaction system to create and maintain Rdb data, or a decision support system with reporting, graphics, statistics, and spreadsheet, only FOCUS gives you a complete solution for all your Rdb applications.

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FOCUS comes with a complete development toolset ready to work with Rdb. In addition to code generators and user-oriented screen and window painters, the FOCUS data management language lets you complete your application without having to rely on COBOL, C, or other 3GLs. And since FOCUS for VAX was designed for your VAX system, it is DSRI-compliant and works with ALL-IN-1, CDD/Plus, DECwindows and CIT products.

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FOCUS gives you access to all structures permitting you to load your Rdb tables directly from RMS or DBMS files as well as any other database on your VAX or IBM mainframe. And of course, all FOCUS applications are portable between VAX and IBM mainframe, UNIX workstations, HP, Wang, and PC. Your users can even have access to all IBM mainframe databases like IMS and DB2 without ever leaving the VAX.

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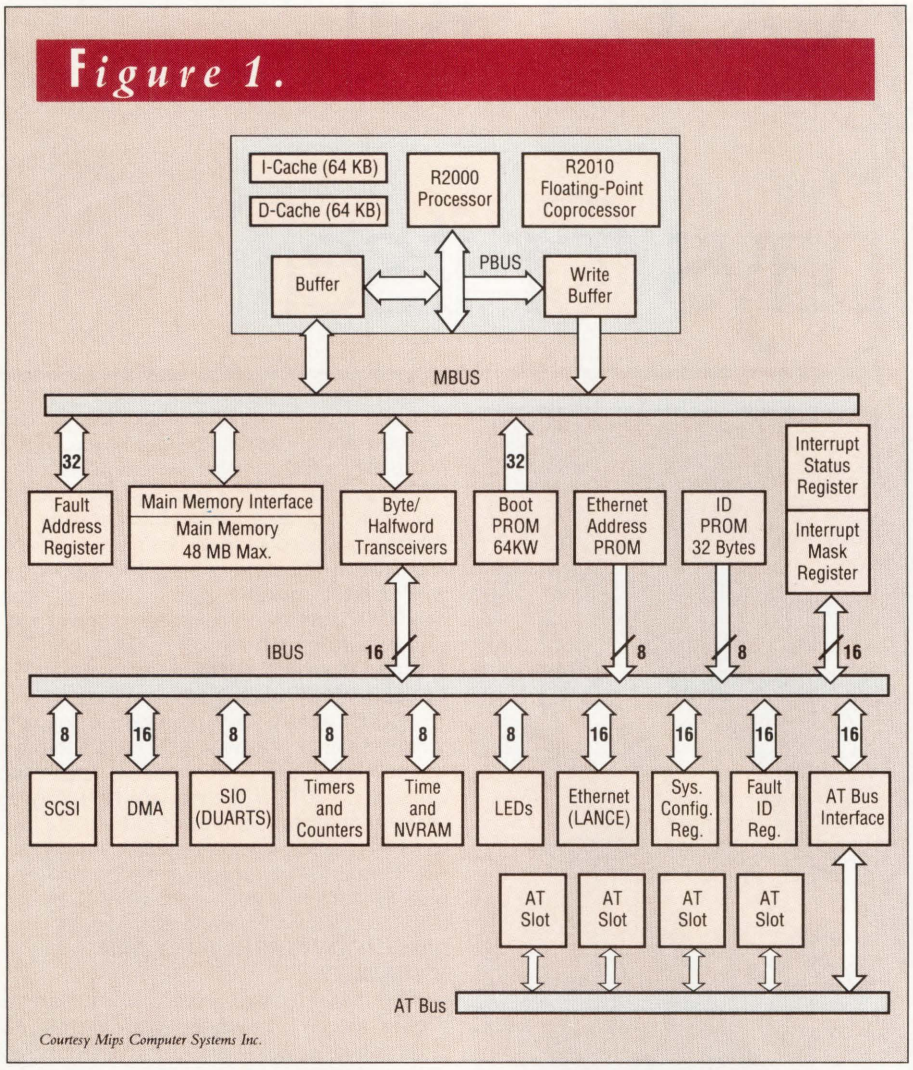
For more information on FOCUS for Rdb, write Information Builders, Inc., 1250 Broadway, N.Y., N.Y. 10001. Or call (212) 736-4433, Ext. 3700.

*Rdb runtime only license is packaged with VMS.
Media documentation and services are sold separately.

digital™ Cooperative Marketing Program

FOCUS Information Builders, Inc.

CIRCLE 235 ON READER CARD



The organization of the M/120 and the major programmable elements within the system.

I/O buses. The system I tested had 16 MB of main memory, a 380-MB SCSI disk with 16ms average access time and a 1/4-inch cartridge tape drive. The machine came up beautifully the first time and every time since. The hardware and operating system have run flawlessly. It took 30 minutes to get the machine running and another 15 to get the Ethernet hooked up and TCP talking to my MicroVAX II running VMS.

The M/120 runs RISC/OS (also called UMIPS), Mips' variant of System V with some BSD extensions. The operating system is good, with all of the tools and shell scripts you'd expect from a major vendor. The documentation is also good, perhaps even a little better than that of most UNIX boxes. In addition to the OS, our system came with networking software (NFS, TCP and UUCP all standard) and the C and FORTRAN compilers.

If you read about RISC computing, you soon realize that the compiler technology is an essential ingredient in getting useful work done with high performance. Among other things, RISC performance depends on keeping the instruction pipeline full, and this is accomplished by the compiler. The code generator portion of the compiler reorders instructions so that those that take more than one cycle will have time to complete before their data is needed.

Almost all R2000 instructions take only one cycle to complete. However, several instructions have delay times before their data becomes valid. Thus, that pipeline stage is available to handle the next operation, but the data from the previous operation isn't yet available for the next stage in the pipeline.

Another important factor in keeping the pipeline full is the instruction and data caches. That's because the processor is so fast that it needs data at speeds faster than typical memory cycle times.

The compilers in a Mips environment are more tightly integrated than you'd expect if you're accustomed to VMS. As in many environments more modern than VMS, the compilers share the code generator, and the linker is more tightly integrated with the compilers than in a VMS environment.

The compilers have four levels of optimization. The lowest level, Level 0, generates essentially non-optimized code. But even this level is more optimized than most VMS-compiled codes, because the R2000 arithmetic instructions work only on registers, unlike the complex-instruction-set VAX, which has operands that support both registers and addresses. Thus, R2000 code uses a classic load-store approach in which data values are loaded into registers before they can be operated on by other instructions.

The next level of compiler optimization, Level 1, uses limited-scope optimization techniques such as factoring common subexpressions. Level 2 uses global optimization within the scope of a single module. Level 3 is a universal optimization operating on the symbol table and object code files from Level 2 optimization.

Modeling With Mips

I got into computing by way of large scientific simulations, so it was natural that the first application I tried was a large finite element model. The first try to build the program on my MicroVAX II failed, because the VAX linker requires virtual page count (VIRTUALPAGECNT) as large as the fully demand-zero paged image. A quick reboot fixed that, and that night the program ran on an unloaded machine. The statistics and job

accounting information are shown in Figure 2.

Note that the image is nearly 40,000 pages (20 MB). The system was about 83 percent efficient in doing this job (the rest probably going to page fault processing and page fault waits).

I next copied the FORTRAN source and data file to the M/120 and fired off a compilation. It failed with a complaint about an error in an internal FORTRAN library. Several simple programs worked fine, but on the large code the compiler dumped core and died.

> ***"The operating system is good, with all of the tools and shell scripts you'd expect from a major vendor."***

A few weeks later I got the newest version of the operating system and the compiler. The installation of the software used a shell script that worked much like the VMSINSTAL procedure, and in 30 minutes I was running the newest versions. The compilation finished without errors in a fraction of the time it took on my MicroVAX II.

I started the run, and the first phase of the model (data initialization) completed about 15 times as fast as on the MicroVAX II (20 mVUPS). I expected some paging in the guts of the code, so I figured that the factor of 15 up front would put us around 12 mVUPS for the whole model.

When the run completed, however, the performance statistics were as shown in Figure 3. The statistics the UMIPS time command returned are also shown.

A little arithmetic shows that performance relative to the MicroVAX II is only around 7.7 mVUPS, nothing like the 12 to 14 mVUPS reported by others in various benchmarks. However, some parts of the program were more than 15 times faster, while others were only four times faster. This looked interesting, so I investigated a bit more.

The results were the same on both machines. That told me that the two machines were implementing the same algorithm and that they had the same precision in their arithmetic operations. If the precision were different, you'd expect slight differences in the result because of numerical dispersion in the model.

Although the results were OK, I suspected that performance problems were related to the compiler, so I tried using a higher level of optimization — Level 3. In a program such as this, you wouldn't normally expect any improvement in the code generated by universal optimization. But it was hard to judge in my case, because the compilation never finished. After 90 minutes of compute, I decided that it probably would never come back and killed the compilation.

I next used a Profiler tool under UMIPS. Similar to DEC's Performance and Coverage Analyzer, the Profiler told me which modules and lines of code were receiving the most CPU time. The

M/120 RISComputer

OPERATING SYSTEM: RISC/OS

PRICE: Base system from $30,000 to $35,000, depending on configuration

MIPS COMPUTER SYSTEMS INC.

HEADQUARTERS:
928 Arques Ave.
Sunnyvale, CA 94086
(408) 720-1700

PRODUCT LINE: A full line of binary-compatible, single-architecture RISC-UNIX-based systems

FOUNDED: 1984

OWNERSHIP: Private

BRANCHES: 17 U.S., 10 international

CIRCLE 433 ON READER CARD

Figure 2.

Phase	Elapsed Time (hr:min:sec)
Problem Setup	3:35
Generate Stiffness Matrix	14:53
Matrix Decomposition	3:12:22
Matrix Back Substitution	12:10
Process Results	7:36
Total	3:50:36

Buffered I/O Count	551	Peak Working Set Size	1863
Direct I/O Count	11331	Peak Page File Size	39759
Page Faults	1645661	Mounted Volumes	0
Charged CPU Time	0 03:13:06.12	Elapsed Time	0 03:51:03.12

Benchmark and accounting information results from running a finite element analysis modeling program on the MicroVAX II.

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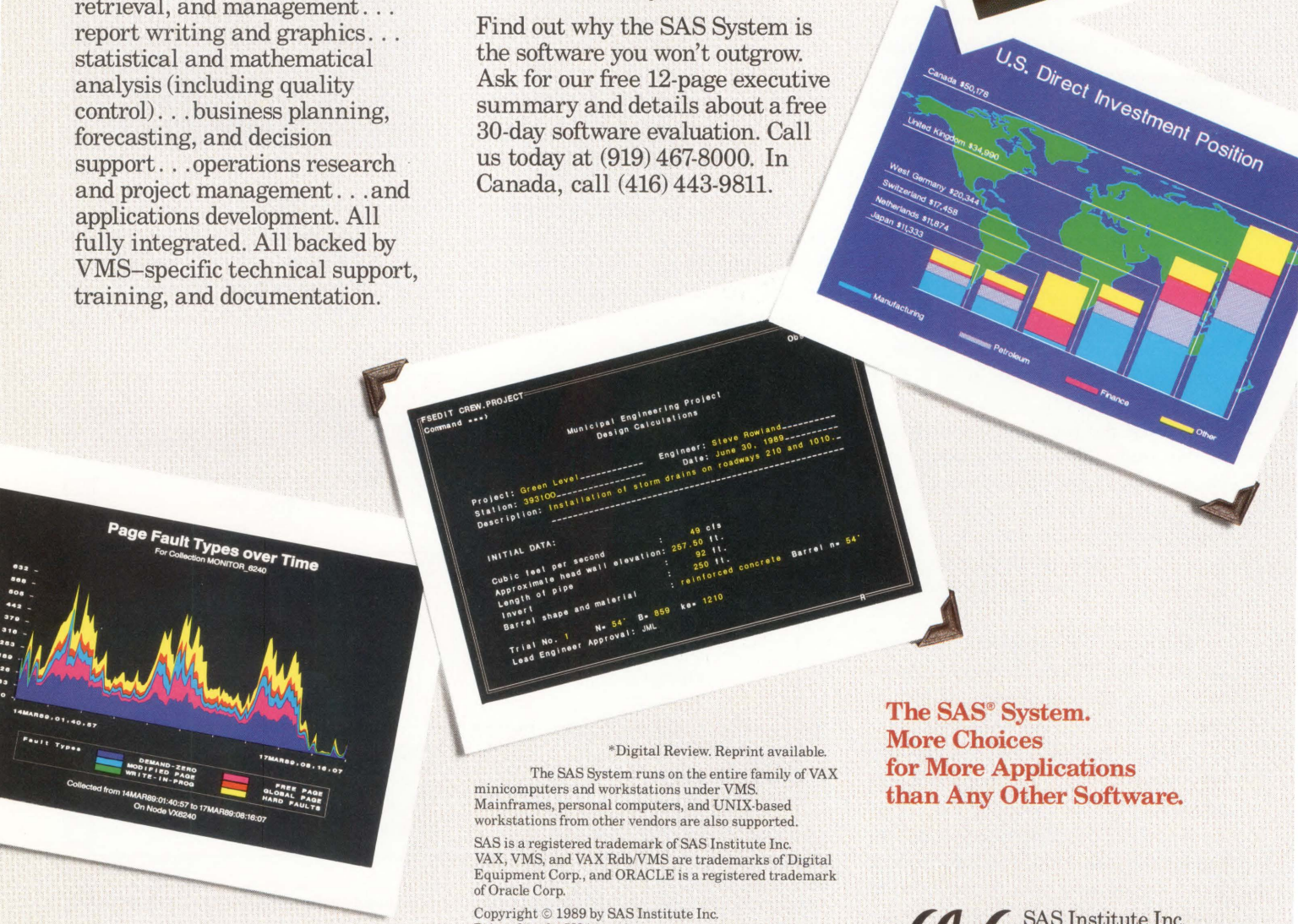

*Digital Review. Reprint available.

The SAS System runs on the entire family of VAX minicomputers and workstations under VMS. Mainframes, personal computers, and UNIX-based workstations from other vendors are also supported.

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Figure 3.

Phase	Elapsed Time (hr:min:sec)	Factor
Problem Setup	0:14	15.3
Generate Stiffness Matrix	3:49	3.9
Matrix Decomposition	24:08	8.0
Matrix Back Substitution	1:00	12.1
Process Results	0:35	13.0
Total	29:46	7.7
real	30:21.9	
user	24:51.0	
sys	34.7	

Results from running the program described in Figure 2 on the Mips M/120 RISComputer.

majority of the time was spent in the matrix decomposition and back substitution routine, which wasn't a big surprise. At least it proved that the problem wasn't a result of some screwy FORTRAN intrinsic or other aberration.

I then checked the code generated by the Mips compiler. The code looked good, with very few nop instructions inserted to keep the instruction pipeline full. Apparently, the optimizer could keep the pipeline full with just instruction reordering. The code where most of the work is being done is simple. There are few subexpressions to be factored out, and the most complex line of code has three additions and two multiplications.

The Theory

I'm still investigating, but here's my working hypothesis: The data cache (see Figure 1) is very important to the M/120. It ensures that data load operations aren't slowed by the relatively poor performance of the memory subsystem. The memory subsystem on the M/120 uses 100ns DRAMs, so you can expect overall performance around 120ns, which is about twice the cycle time of the processor.

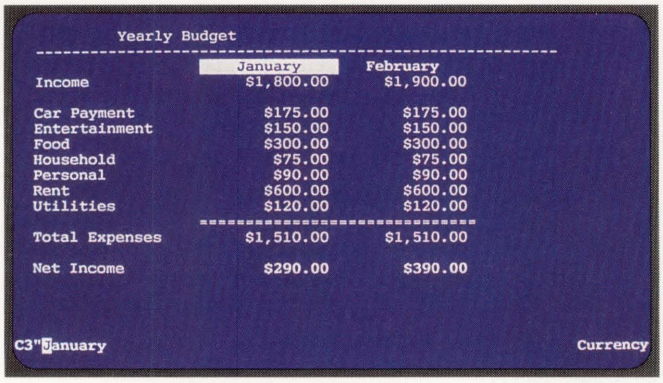
The model I ran, like many real-world applications, processes vast quantities of memory. It sets up arrays of 2,225,000 elements of double-precision floating-point numbers. The interesting parameter isn't so much the number of elements as the fact that each element is touched only a few times and in a scattered fashion. A data element is loaded from memory into a register, and a copy is kept in cache. That element might be used only once or twice before it must be flushed from cache to main memory. On a smaller memory configuration, it may need to be flushed to backing store on disk.

Thus, the tendency is for all 18 MB of data to be processed in a way that causes the data cache to be essentially useless. I proved that I'm not taking a paging performance hit by increasing the memory on the system to 48 MB and observing only very minor gains in total throughput. In fact, the MicroVAX II I'm comparing to has only 11 MB, so any paging hit would probably be worse on that platform than on the M/120.

If my hypothesis is correct, I'd expect performance for this application on the M/120 to be essentially a direct factor of the speed of main memory (about 120ns). Although there was some I/O and paging, it doesn't appear that I/O bandwidth is a factor affecting performance.

Next on my list is a benchmark of Mips machines, VAXs and several popular workstations running a large database application.

WordPerfect Corp.'s PlanPerfect, A Spreadsheet Package For VAX/VMS, Offers Ease Of Use As Well As Advanced Features.



Yearly Budget

	January	February
Income	$1,800.00	$1,900.00
Car Payment	$175.00	$175.00
Entertainment	$150.00	$150.00
Food	$300.00	$300.00
Household	$75.00	$75.00
Personal	$90.00	$90.00
Rent	$600.00	$600.00
Utilities	$120.00	$120.00
Total Expenses	$1,510.00	$1,510.00
Net Income	$290.00	$390.00

C3"January Currency

Figure 1: A sample yearly budget worksheet.

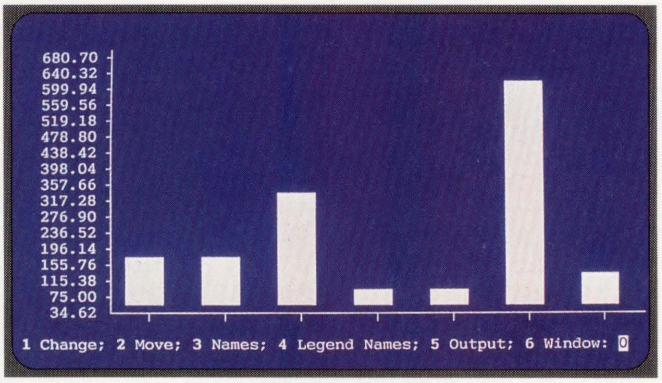


Figure 2: A graph created from selected portions of a worksheet.

THE PLAN: Perfect Spreadsheets

WordPerfect Corporation of Orem, Utah, producer of the WordPerfect PC word processing program, recently introduced a VAX version of its spreadsheet, PlanPerfect V3.0. We tested PlanPerfect on LABDOG::, our MicroVAX II.

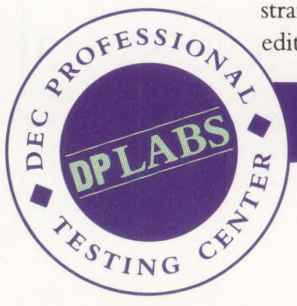
PlanPerfect uses VMSINSTAL for an easy and familiar installation procedure. It makes extensive use of function keys and two-key combinations familiar to users of WordPerfect but substitutes PF1, PF2 and PF3 combinations for the familiar CTRL, ALT or SHIFT combinations.

PlanPerfect takes advantage of the Soft Character option available in the VMS SET TERM utility. This allows it to draw straight lines when you tell it to open an editing window or create a graph. Make sure you have your terminal mode in the appropriate setup-screen display — VT200 mode — if you want to take advantage of the VT200 function-key layout. A template for VT200/VT300-series terminals is provided.

PlanPerfect comes with a 444-page manual that includes a detailed reference guide and a learning section. I especially liked the tutorial. The learning section ends with a chapter that uses 10 sample applications to illustrate several sophisticated features of PlanPerfect.

Perfect Provisions

The PlanPerfect worksheet has 256 columns labeled A to IJ and 8,192 rows labeled 1 to 8,192. You start PlanPerfect by



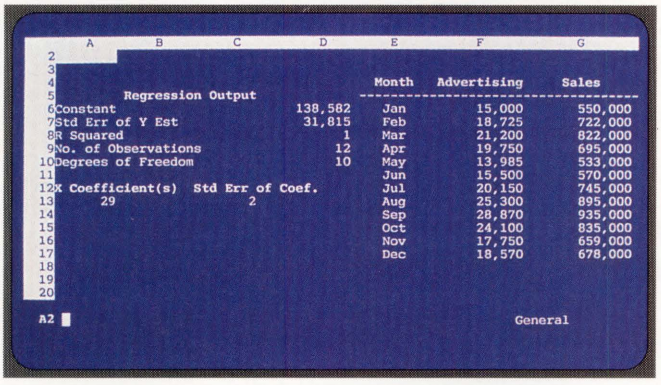
BARRY SOBEL

typing PL at the $ prompt and are shown a "window" into the worksheet. Rows 1 to 19 are labeled at the left of your screen and columns A to H are labeled across the top. A cell address is made up of the column letter followed by the row number.

can be accomplished easily by using BLOCK (PF3,F10) and GO TO (PF3,F19) commands followed by executing the function. While in a worksheet, you can press HELP (F9) at any time to get information about any key or function.

the worksheet as labels for the x-axis.

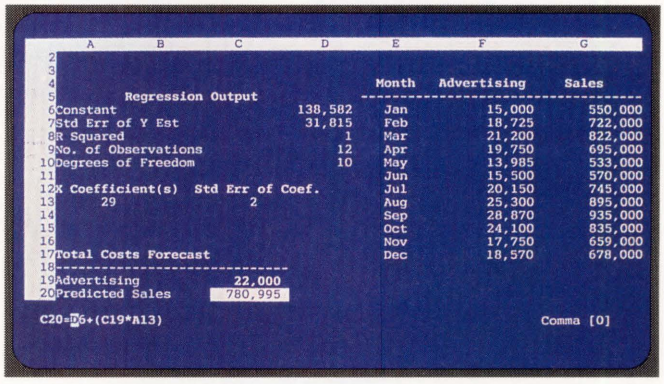
PlanPerfect lends itself to defining a worksheet that uses text more than numerical data. EDIT (F12) works on a previously defined block and opens a window in which you can enter text to



	A	B	C	D	E	F	G
2							
3							
4					Month	Advertising	Sales
5		Regression Output					
6	Constant			138,582	Jan	15,000	550,000
7	Std Err of Y Est			31,815	Feb	18,725	722,000
8	R Squared			1	Mar	21,200	822,000
9	No. of Observations			12	Apr	19,750	695,000
10	Degrees of Freedom			10	May	13,985	533,000
11					Jun	15,500	570,000
12	X Coefficient(s)	Std Err of Coef.			Jul	20,150	745,000
13	29	2			Aug	25,300	895,000
14					Sep	28,870	935,000
15					Oct	24,100	835,000
16					Nov	17,750	659,000
17					Dec	18,570	678,000
18							
19							
20							

A2 General

Figure 3: A regression table created by PlanPerfect.



	A	B	C	D	E	F	G
2							
3							
4					Month	Advertising	Sales
5		Regression Output					
6	Constant			138,582	Jan	15,000	550,000
7	Std Err of Y Est			31,815	Feb	18,725	722,000
8	R Squared			1	Mar	21,200	822,000
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12	X Coefficient(s)	Std Err of Coef.			Jul	20,150	745,000
13	29	2			Aug	25,300	895,000
14					Sep	28,870	935,000
15					Oct	24,100	835,000
16					Nov	17,750	659,000
17	Total Costs Forecast				Dec	18,570	678,000
18	----------						
19	Advertising	22,000					
20	Predicted Sales	780,995					

C20=[W6]+(C19*A13) Comma [0]

Figure 4: A worksheet using regression to predict monthly sales.

The bottom four lines on the screen display information. At the lower left, the first line displays messages in reverse video as reminders that certain features are on. For example, it displays Calc if the worksheet needs to be recalculated. The second line on the left shows the current cell address and contents. The last two lines display feature menus or system messages. The bottom right displays the format of the cell, e.g., General if the cell is formatted to that type.

You don't have to refer to the cell address — PlanPerfect lets you NAME (PF2,F12) a cell. Subsequently, you can use that name in a formula and the contents of that named cell will be used to calculate the result. LIST NAMES (PF1,F12) opens a window that shows currently defined names in the spreadsheet and the cell address they reference.

Building A Budget

The first example in the tutorial is a home budget. You start by entering simple data and formulas and naturally progress to more sophisticated formatting techniques, such as adding headers, displaying figures as currency, turning borders off/on, modifying column width and centering data or headers.

Operations on entire columns, rows or any other worksheet section of your choice

After entering HELP, you can press a key to get information about that key or enter a letter to display a list of features beginning with that letter. LIST FILES (F11) displays the name of the PlanPerfect default directory. Press return to see a list of subdirectory and worksheet files in that directory. Or, you can enter another directory. Standard DCL wildcards are accepted for file selection. From a menu appearing on the bottom of your screen you can change directory, retrieve, delete, rename, print or copy a file, import a DCL text file or look at a file.

Easy Graphs

PlanPerfect easily allows you to create graphs of the data in your spreadsheet. The default graph type is a bar graph. Stacked bar, scatter and hi-lo graphs are available.

Often, you'll want to graph one line or segment of data. For example, after highlighting the January budget expenses from the sample worksheet, you get a bar graph (see Figures 1 and 2). The odd-looking number scale on the left is derived from the data in the individual worksheet. If you want a more usual y-scale, select 1 Change from a menu at the bottom of the graph and choose Auto Ranging to reselect the values manually. Choosing 3 Names allows you to extract names from

help clarify sections of the worksheet.

A built-in application of this is EDIT HELP (PF3,F9), which allows you to enter help text for a cell to aid an unsophisticated user in entering correct data. A bank or savings and loan might make use of this and the LOCK (PF3,F13) feature, which prevents changing contents of a cell until unlocked. For example, a model of expected savings-plan results or a car-loan payment plan can be created, letting customers modify selected cells, such as in-

terest rate, total loan, or monthly deduction/payment before meeting with the banker.

Built-In Functions

For sophisticated scientific and business users, PlanPerfect has a wealth of built-in functions including Standard Deviation, Present and Future Value, SYD and DDB depreciation methods and basic TRIG functions. For example, the payment function (PMT) works by entering PMT followed by a parameter list enclosed in parentheses and separated by commas:

```
PMT (Rate,Present Value,Periods,
Future Value)
```

To find the amount needed to invest per month to earn $5,000 at the end of three years at an interest rate of 10.5 percent, enter (dividing the interest rate by 12 months):

```
PMT(10.5%/12,0,36,5000)
```

This would return $118.76.

Let's Regress

Linear Regression is a statistical tool that uses past data to make a best estimate of future results. For example, suppose you want to establish a relationship between monthly sales revenues and the amount spent on advertising for the month. To use this function in PlanPerfect, do the following:

1. Reserve an area for PlanPerfect to insert the regression table. This is a table of data that determines the relative validity of the prediction and supplies the data to plug into the regression formula that will determine the predicted value.
2. Press TABLES(PF1,F11) and select Regression (4) from the menu. Enter the block of Y or dependent values. In this case, enter g6:g17, because the monthly sales figures are dependent on the advertising data that you enter as the block of X (independent) values (f7:f17). PlanPerfect asks you to enter the cell address for the upper left corner of the regression table; enter A5. Figure 3 is generated on the screen in the space you've reserved for it.
3. Reserve an area on the worksheet to display your monthly advertising cost figure (the independent variable), and calculate the Predicted Sales result using the regression formula Y=Constant+(X*X Coefficient). Using this worksheet, enter the formula D6+(C19*A13) in cell C19 (see Figure 4).

> ***"For sophisticated scientific and business users, PlanPerfect has a wealth of built-in functions ..."***

Entering 22,000 in cell C19 will result in 780,995 being put into C20 after you press RECALCULATE (F17). If you had NAMED (PF2,F12) the cells in the formula, you could have referenced by NAME in the regression formula. PlanPerfect allows for multiple regression. Up to 24 independent variables can be used to calculate the dependent value.

PLANPERFECT HAS MANY other capabilities. Mailing lists can be created, and labels can be copied, blocked and sent to a printer. Temporary and permanent links among worksheets can be established.

PlanPerfect is a well-thought-out and well-documented spreadsheet package for VAX/VMS. It's easy for beginners to use and has enough advanced features to keep jaded Lotus 1-2-3 users interested.

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Cambridge, MA 02142
(617) 577-8500
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Slow VAX™? A Simple Diagnosis

"An Oversimplified Guide to Diagnosing VAX Performance Problems"

by Craig Jensen

(Expert VAX Managers: Do not read this first section.)

(Overworked VAX Managers who don't have time to read all this: skip to the end where I tell you how to get a free program to figure this stuff out for you.)

— C.J.

The purpose of your VAX is to do some sort of useful work for your organization.

There are three main resources the VAX uses to do work: CPU, memory and input/output (I/O). I/O can be further subdivided into direct (disk) I/O and buffered (terminal or printer) I/O. To assist our oversimplification, we'll omit buffered I/O and just concern ourselves with CPU, memory and disk. If your VAX is suffering from a terminal case of terminal I/O, this guide won't do you a bit of good. Sorry.

While the system is in use, type this command:

```
$ MONITOR SYSTEM
```

You will see five bar graphs on the screen, updated every few seconds. The first of these is marked "CPU" and says "CPU Busy" across the top. The length of the bar on this graph shows what percentage of your CPU is being used. Don't get too excited if the graph shows the CPU to be 100% utilized. You *want* your CPU to be 100% utilized. Less than 100% means you're wasting some VAX CPU time (and a CPU is a terrible thing to waste). It's when *more* than 100% is needed that you have a CPU capacity problem. But the graph only goes up to 100%. Look to the right, under "Process States." One entry is marked "COM" and indicates how many processes are computable (could run if the CPU was available) but waiting for the CPU. A value of zero here is perfect; one is fine, but two or more means a shortage of CPU capacity. The higher the number, the more CPU capacity you need to add.

The second bar graph is marked "MEMORY" and headed "Page Fault Rate." Again, you want memory to be 100% utilized, but that is not what this graph shows. It shows how many page faults are occurring per second. Small numbers (under 100) are fine; big numbers (thousands) are very bad. These numbers basically indicate the number of pages (program disk blocks) brought into memory from disk each second (an oversimplification, but it will serve). Excessive page faulting means you don't have enough memory to run all the programs you are running at the same time.

The third bar graph is marked "I/O" and headed "Direct I/O Rate." This graph shows how many (not a percentage) disk I/Os are performed each second. Oversimplifying yet again, you can expect to get a maximum of 20 I/Os per second from RD series disks and 60 per second from RA, RF and RZ series disks. At more than half these rated capacities, your disks are working hard, but not inefficiently. Digital Storage Architecture™ (DSA) disks contain enough intelligence to perform well at high I/O rates. But you probably have more than one disk on your VAX, so you need more information. Type this command:

```
$ MONITOR DISK
```

This will show you the I/O rates for each disk connected to the VAX. Watch the average rate for a while to see what your data rates are, on average. If a disk is running at or near its rated capacity, you should get another disk to rearrange the workload so that disk is not overloaded.

Now type this command:

```
$ MONITOR IO
```

The top row of this display tells you how many disk I/Os your system is doing. The fourth row tells you the "Split Transfer Rate," which is how many I/Os could not be satisfied with a single disk read or write — they required multiple transfers. Split transfers are the result of fragmentation. A file is fragmented into two or more pieces and your I/O transfer spans fragments. Presto! The I/O for that transfer takes twice as much time and effort as a non-split transfer — at least.

If the split transfer rate is zero, you are fine (and most likely you are already a DISKEEPER® customer). If it is anything *but* zero, you have a fragmentation problem serious enough to hurt performance. Dividing the average Split Transfer Rate by the average Direct I/O Rate gives you the percentage of performance impact. Unfortunately, this too, is an oversimplification. The percentage is only accurate if split transfers result in only one extra I/O per transfer. If fragmentation is bad enough to cause two or more extra I/Os per transfer, the performance impact is much worse than that indicated by this percentage.

What To Do About Fragmentation

Buy **DISKEEPER/*Plus*™** customized online defragmenter, of course. Then you won't have to give fragmentation another thought — ever. Just install **DISKEEPER/*Plus***, start it up, and forget it. That's it.

This may seem too good to be true or unbelievable to you, so we offer a 100% money-back guarantee of satisfaction. The ultra-cautious (good for you, U.C!) can get a free demo to try out before buying. For those stick-in-the-muds who wouldn't believe it if they saw it with their own eyes, there is backup and restore. This is the classic (read "old") solution to fragmentation. Backup the disk to tape (unless you have a spare disk drive lying around unused, in which case what are you reading *this* for?), reinitialize the disk, pray there are no unrecoverable tape errors, and restore your data files from tape to the disk. Semi-Presto! Fragmentation is gone and it only cost you a few hours time watching tapes spin with the disk out of service and unavailable to users. Of course, if you have *two* disks to backup and restore, it is not as much fun the second time. And doing it every week, as your diagnosis will probably indicate is needed, can become very tedious indeed.

There are other solutions:

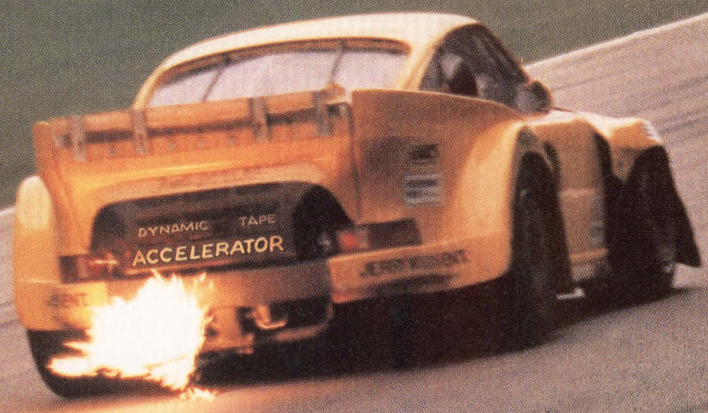
1. Buy a spare disk for backup and restore and don't let anyone ever use it for anything else (RA82 $18,180; RA90 $25,840).
2. Buy a 6250 BPI tape drive so you can backup and restore in a little over an hour instead of 4 to 6 hours (TU81E $35,104; TU79 $64,796).
3. Buy a TA series tape drive and hang it on the HSC so backup and restore can be done without eating up the CPU (TA81 $37,466; TA79 $70,550).

There's just one catch: none of these "solutions" frees *you* from having to do the work. You still have to stand around (after hours) and do backup and restore. Forget it! Get **DISKEEPER/*Plus*** and let *it* do all the work. It's a lot cheaper than buying more hardware, too.

Free Fragmentation Analysis Utility™

Now, for those of you who skipped the diagnosis guide, above, and those who are too overloaded to put it to use, we have written a program to do it for you. Call Executive Software right now at 1-800-VAX-HELP extension 2320 and ask for our free Fragmentation Analysis Utility. Then you'll know.

Accelerate Your Tapes To *STREAMING* Speeds!



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Your wish has just come true...

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San Diego, CA 92121

(619) 455-7404 • FAX: (619) 455-7413

CIRCLE 165 ON READER CARD

System Industries' MegaRam-VX Solid-State Disk Subsystem Provides DEC Disk Emulation At Memory Speeds.

MegaRam-VX connects to a UNIBUS or Q-bus. MegaRam-SDI, shown here, connects directly to an HSC40/50/70 or KDB50.

MEGARAM-PAGE!

Although rotating, magnetic disks improve in performance constantly, only performance approaching memory speeds can meet the needs of some applications. Solid-state disks provide a solution to performance-starved applications and systems. Although expensive, given the cost of memory, those who can pay the price can benefit from solid-state disk technology.

The acquisition of Imperial Technology — a leading manufacturer of solid-state disks for the IBM market — by System Industries (SI) of Milpitas, California, gave SI a foothold in the memory disk market. Solid-state disks now are beginning to show up at VAX sites.

We tested SI's MegaRam-VX, installed on our MicroVAX II.

The MegaRam-VX is a solid-state disk subsystem that emulates Digital's RA80- or RD52-class disk systems. It can be installed in UNIBUS and Q-bus systems. It's MSCP-compatible and can be used with your existing applications and with Digital disk diagnostics.

Our MegaRam was rack-mountable. The Internal Memory Bus (IMB) of the chassis holds from one to eight memory modules of 8, 12 or 32 MB each. Our unit was equipped with one 32-MB module. Expansion chassis can be daisy-chained to the first unit to bring a MegaRam system up to 512 MB.

Up to four controllers can be contained in a MegaRam system. UNIBUS and Q-bus host controllers, as well as an optional High Speed Interface (HSI) and Disk Backup Unit Interface (DBUI), can be mixed within the same system.

Our Q-bus controller was installed in our MicroVAX II. Controllers also can be installed in the MegaRam's chassis. Because internal controllers use slots in the

DAVID B. MILLER

Figure.

Disk Type	Average Access Time (milliseconds)	Average Transfer Rate (KB/sec.)	Average Controller/VMS Overhead (milliseconds)
MegaRam-VX	0.0*	1,139.14	2.1
Imprimis Wren	27.3	538.43	0.6

*Fewer than 2 microseconds

Comparative benchmark results between MegaRam-VX and Imprimis Wren system disk.

MegaRam's backplane, an expansion chassis might be required to hold additional memory modules.

Installing the Q-bus controller required setting the bus request/grant priority level, the device address and other options. Parameters are set with pencil switches and jumpers.

Because four controllers can be used in a MegaRam system, each controller must be assigned a unique priority level: S, 2, 1 or 0. For each operation cycle, a "bus master," the controller with the highest priority level that also has an outstanding bus request, is granted access to the IMB for one operation cycle. A System (S) level controller must perform bus arbitration control, memory refreshing, ECC initialization and bus clock generation. Our controller was the only one on the system, so it was assigned the "S" priority level.

Two switch packs are used to set the device address if you need an address other than the default. Remaining switch-selectable options determine the type of operating system running (VMS or RSX-11M+), the type of Digital controller and drive to emulate (RQDX3/RD52 or KDA50/RA80) and the device unit number.

Other than connecting the cables from the controller, nothing has to be done to the memory module chassis. Adding memory modules requires that switches be set to ensure contiguous memory addresses.

Solid-state disks are useful in applications that require high-speed disk access. OLTP is one example. The MegaRam makes an excellent paging and swapping disk. All paging and swapping activity takes place at memory rather than at magnetic disk speed.

The MegaRam unit helped get our review of SAS/CPE (see "Peaking Performance," August 1989) off the ground. We were running SAS and SAS/CPE on our MicroVAX and getting less-than-optimal performance because of MicroVAX II limitations. We used the MegaRam to hold a large secondary page file, and performance improved noticeably.

Using Workstations Editor David W. Bynon's benchmark utility (see "Disk Benchmark," October 1988), we ran tests on the MegaRam and on our system disk, an Imprimis Wren drive. Five trials of the benchmark were run for each disk. The average of the trials for each disk is shown in the Figure.

With no heads to move and no platters to rotate, you'd expect the MegaRam's performance to be superior to a conventional rotating disk. The MegaRam's performance didn't disappoint us.

The documentation we used was published by Imperial Technology. SI hadn't yet produced its own documentation when we received our MegaRam. A printing error in one of the switch-setting tables provided a suitable challenge for the SI engineers who installed the unit at DP Labs.

The necessary information is in the documentation, but finding it sometimes presents a problem. The text seems geared toward experienced installers who don't need detailed steps to get a MegaRam up and running.

System Industries intends to revise, expand and clarify the documentation.

Exercising Your Options

Battery backup, a high-speed interface and disk backup are options you can add to your MegaRam.

The optional battery is housed in the MegaRam chassis. Cables run from the back of the chassis to the controller card. The battery can sustain the memory modules from four to 200 minutes, depending on the number of memory modules in the chassis and the amount of battery backup you purchase. An external battery backup unit can be added to increase the time the unit can run without AC power.

Extreme caution is required if you move the controller card to another slot in your backplane. Make sure the battery backup cables are disconnected from the back of the MegaRam unit. Even though there's no power going through the backplane when the MicroVAX is turned off, current is flowing from the MegaRam's battery to the controller card.

The HSI controller provides a direct memory access port. It allows high-speed data transfers of up to 12 MB to and from the memory modules. Devices such as analog-to-digital converters can be attached to the port supplied on the HSI. A single external device can access up to eight HSI controller ports. On fully configured systems, the device would have access to up to 4 GB of solid-state disk.

A disk-backup option is available. The Disk Backup Unit (DBU) interfaces to the

Imprimis Technology Inc.
12501 Whitewater Dr.
Minnetonka, MN 55343
(612) 936-6271
CIRCLE 469 ON READER CARD

Maxtor Corp.
211 River Oaks Pkwy.
San Jose, CA 95134
(408) 432-1700
CIRCLE 470 ON READER CARD

SAS Institute Inc.
SAS Cir., Box 8000
Cary, NC 27512
(919) 467-8000
CIRCLE 504 ON READER CARD

MegaRam-VX

PLATFORMS: All UNIBUS and Q-bus systems

PRICE: $32,850 for a 32-MB system with battery backup; $73,850 for a 128-MB system with battery backup; $287,850 for a 512-MB system with battery backup. Other configurations available

SYSTEM INDUSTRIES

HEADQUARTERS:
560 Cottonwood Dr.
Milpitas, CA 95035
(408) 432-1212

PRODUCT LINE: Disk and tape subsystems, proprietary clustering solutions and workstation products for DEC computers

FOUNDED: 1968

REVENUES: $138 million (1988)

OWNERSHIP: Public

BRANCHES: Dublin, Ireland

CIRCLE 414 ON READER CARD

memory chassis via the DBUI controller.

A number of Maxtor drives, including 700-MB (560-MB formatted capacity) units are used for the backup option. Upon power failure, the battery unit and disk backup unit work together to back up an entire MegaRam system automatically in minutes. Restores from the magnetic disk to the MegaRam can be done automatically when power returns. A manual override is available so that a backup can be performed any time. The DBU is housed in a separate cabinet with its own battery backup system.

NOT MANY SITES will buy a MegaRam as a luxury item. But sites that run intensive applications requiring high-speed data access might find a solid-state disk such as the MegaRam to be a real money-saver in the long run.

In addition to selling them separately, SI packages MegaRam units as part of its Tiered Storage Performance Pac offering — data storage subsystems that combine solid-state and Winchester disk technology. Combining the best of both worlds should go a long way to meet the needs of customers whose applications can't afford to slow down.

KEA Systems Ltd.'s PowerStation 240 DEC Terminal Emulator And Communications Program Offers A Painless Transition From Terminal To Personal Computer.

From VT To PC

BARRY SOBEL

The PowerStation 240, from KEA Systems Ltd. of Vancouver, British Columbia, is a DEC terminal emulator and communications program. It consists of ZSTEM 240 emulation software and a replacement VT220-style (LK201) keyboard, the PS200, that connects to an IBM or compatible PC.

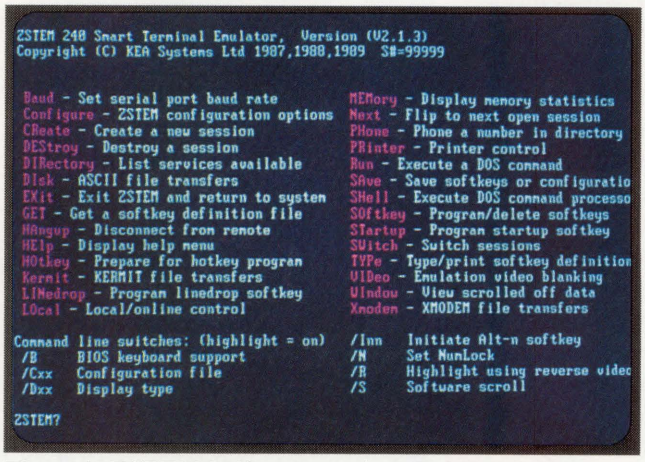
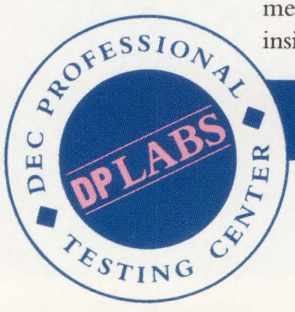


Figure 1: ZSTEM 240's command-mode HELP screen displays the top-level commands.

To use the Power Station keyboard on my AT&T PC (Model 6312 WGS), I had to obtain an upgrade kit from KEA. The kit contains an adapter cable that allows the standard 5-pin DIN keyboard connector to connect to AT&T's DB-9-type keyboard port and a replacement for the standard ROM chip located inside the keyboard. It took 20 minutes to disassemble the keyboard, and I needed a screwdriver to pry the original ROM from its socket.

I later received a pre-release version of a new PowerStation keyboard called the PS205. It comes with an easily accessible eight-position DIP switch located under



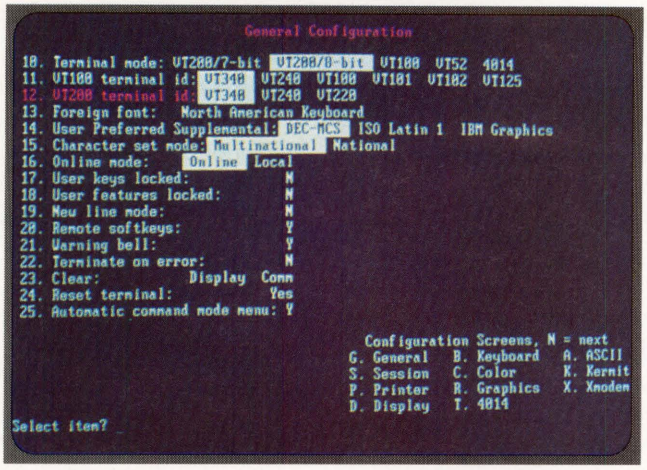


Figure 2: This G:General Configuration screen is an example of ZSTEM 240's configuration screens.

the keyboard. You can set the switch to conform to the type of PC you're using, including the AT&T. You still need the cable adapter for the AT&T, but you don't have to change the ROM. It worked flawlessly. The PS205 features FCC class A approval, as does the current PS200. An adapter is also available for PS/2 machines. General availability is scheduled for later this year.

KEA's ZSTEM 240 V2.1.3 is a versatile, easy-to-use, feature-rich terminal emulation package. It includes full VT340-compatible Sixel processing and four-plane 16-color bitmap, including ReGIS graphics, 4010/4014 emulation and true 132-column mode. ZSTEM 240 provides complete VT340 character-set support in text or ReGIS mode. It also supports a choice of three supplemental character sets, including DEC-MCS, ISO Latin-1 (compatible with the VT340 ISO character set) and IBM Graphics.

The PowerStation keyboard felt like home with its familiar VT220 keys and labeling. The PC functions are labeled on the front of the keys. The PowerStation keyboard operates in VT200 and DOS mode. To run ZSTEM, you must be in VT200 mode. If you have a PC or XT or compatible, you must change modes by pressing CTRL-Hold Screen, which toggles between modes. You can check what mode you're in by pressing the Lock key twice. If the LED indicator is red, you're in VT200 mode. If the indicator is green, you're in DOS mode. If you have an AT or PS/2 or compatible, the mode change is automatic.

Getting Started

Installation for ZSTEM 240 is menu-driven and allows generous options in configuring ZSTEM to your environment. After it's installed, you can tailor your setup to work best with your PC and target host systems.

To bring up ZSTEM 240, type ZSTEM240 at the DOS prompt. ZSTEM lets you specify Startup Switches to compensate for incompatibilities of your system. For example, entering ZSTEM /B at startup causes ZSTEM to use BIOS keyboard handling rather than its own internal method. You may find this necessary if ZSTEM interferes with certain RAM-resident programs. Other switches control such things as how bold is displayed.

The first screen to appear is the title/copyright screen. On the bottom left appears Online..., indicating that you're in ZSTEM emulation mode. You can enter your Hayes Smartmodem command sequence to access the remote system or enter command mode by pressing ALT-Z. If you see the HELP screen with the ZSTEM? command prompt in the lower-left corner of your screen, you're in command mode (see Figure 1).

From the main command menu (which is the same as the HELP screen) you can select the CONFIGURE option, which lets you go through seven detailed configuration screens: G:General, S:Session, D:Display, B:Keyboard, C:Color Palette, R:Graphics and T:4014.

You can set such things as terminal mode and terminal ID in the General Configuration screen, which is similar to the General Setup screen on a VT220/240 (see Figure 2). Configure your communications parameters (baud rate, data bits, parity, and so on) in the Session screen. This lets you create up to four open sessions at once with the ZSTEM CREATE command and SWITCH among them. If you're using the program for remote communications from your PC's communications port through a Hayes-compatible modem, you can enter commands either in ZSTEM's emulation mode or in command mode using the PHONE command. You can use this command to dial any number or call a number from a previously established directory.

ZSTEM 240 supports other communications protocols by including various communications drivers. These include DEC's LAT protocol, NetBIOS for compatible network cards, PCS/1 for the Bridge/3Com PCS/1 TCP/IP card, Net1 for use with Excelan and others, and RAF for Datability Software Systems' RAF software to connect to a networked VAX.

Recently, KEA Systems released an option for users of ZSTEM terminal-emulator products called ZLAT. It's an MS-DOS interpretation of DEC's LAT protocol and allows communication over an Ethernet/LAT network to a VAX host. It requires DOS 3.3 or later, ZSTEM 240 or ZSTEM 220 V3.2.4 or later and a 3Com EtherLink 3C501 or InterLan N15010 Ethernet board installed in your PC.

PowerStation 240

PLATFORMS: IBM PC or compatible with 360 KB memory, disk drive and MS-DOS V2.0 or later, serial port or internal modem and CGA, Hercules, EGA or VGA video display adapter and compatible monitor. The program works on PC/XT, AT, PS/2 or 80386-based systems

PRICE: Single-user license, $435. Separate ZSTEM 240 V2.1.3 software, $295

KEA SYSTEMS LTD.

HEADQUARTERS:
2150 W. Broadway, Ste. 412
Vancouver, BC V6K 4L9
(604) 732-7411

FOUNDED: 1975

PRODUCT LINE: Terminal emulation products

OWNERSHIP: Private

CIRCLE 459 ON READER CARD

Figure 3: Invoking the softkey command puts you in this editing screen.

ZSTEM supports many special video display adapters in addition to the standard values selectable in CONFIGURATION screen D. These include Automatic, CGA-like, EGA-like, VGA-like and EGAmate.

Support is included for text and graphics printers, plotters and pointing devices, including Epson MX and LQ, IBM Graphics, Hewlett- Packard's LaserJet, various HP plotters, DEC's LN03, the Microsoft Mouse and Summagraphics' BitPad. Use the Printer and Graphics CONFIGURATION screens for your choices.

ZSTEM 240 supports XMODEM, KERMIT and ASCII for file transfer to and from a host system. Three associated CONFIGURE screens set up the parameters in advance. The *Users Manual*'s explanation of these protocols is complete and easy to understand. After you've configured ZSTEM 240, you can SAVE the executable image to any filename you specify, although the *Manual* recommends that you don't overwrite the supplied version, ZSTEM240.EXE. You can SAVE your present configuration to a file and subsequently run ZSTEM with the /C switch to test that configuration. For example, if you SAVE the configuration to myfile, entering ZSTEM240/C:myfile starts ZSTEM with the SAVEd configuration.

Softkeys

ZSTEM lets you program almost any key as a softkey, i.e., it lets you equate a key with a programmed string of text (see Figure 3). It's done in a way that's similar to programming with the LEARN command in the EVE interface to VAX TPU.

You can program "keyless" softkeys as you would the actual keys. For example, using the PHONE command, you can define a string composed of a Hayes command and create a phone directory keyed by any name you wish. Type PHONE JOE at the ZSTEM? command prompt and ZSTEM dials JOE's number through your modem. This saves time and keystrokes when accessing many systems, and you can avoid memorizing phone numbers.

ZSTEM 240 generates characters not provided on your keyboard through the ALT key in combination with another key. This is particularly useful when programming a softkey if you want to execute a command but not enter it into the softkey program. For example, ALT-T ends the softkey program and returns you to command mode.

You can program any of the ALT control sequences to activate when signaled by the host system. For example, you can program ALT-B to execute a KERMIT transfer after it receives the valid escape sequence, indicating that the host KERMIT is ready to SEND.

If you always perform certain tasks after ZSTEM comes up, such as dialing in and logging onto a system or setting up special configurations, you can program the keyless STARTUP softkey. Then, ZSTEM automatically performs those tasks each time it comes up.

> ***"ZSTEM lets you program almost any key as a softkey..."***

Using files supplied with ZSTEM after loading ZSTEM on to your office PC, you can set up a remote ZSTEM operation from your home PC. You then can transfer files among PCs and set up remote DOS access. Password control is provided. You don't need the PowerStation keyboard to use ZSTEM, although it's easier if you're used to DEC's layout. ZSTEM has many configuration options if you'd rather not replace your PC keyboard.

ZSTEM 240 is a comprehensive DEC terminal-emulation package. The *Users Manual* is complete and well-organized and includes an alphabetical command reference as well as numerous softkey examples and elaborate descriptions of CONFIGURATION options. The PowerStation makes the transition from your VT to your PC painless.

Companies Mentioned In This Article

AT&T
550 Madison Ave.
New York, NY 10022
(212) 605-5500
CIRCLE 497 ON READER CARD

Datability Software Systems Inc.
322 8th Ave., 11th Fl.
New York, NY 10001
(212) 807-7800
CIRCLE 417 ON READER CARD

Epson America Inc.
23530 Hawthorne Blvd.
Torrance, CA 90505
(213) 373-9511
CIRCLE 418 ON READER CARD

Excelan Inc.
2180 Fortune Dr.
San Jose, CA 95131
(408) 434-2300
CIRCLE 419 ON READER CARD

Hayes Microcomputer Products Inc.
P.O. Box 105203
Atlanta, GA 30348
(404) 449-8791
CIRCLE 454 ON READER CARD

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Boxborough, MA 01719
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CIRCLE 441 ON READER CARD

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Redmond, WA 98073
(206) 882-8080
CIRCLE 410 ON READER CARD

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Seymour, CT 06483
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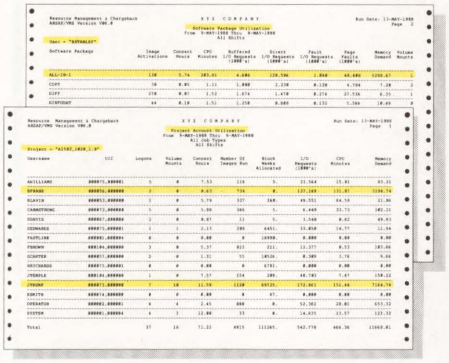

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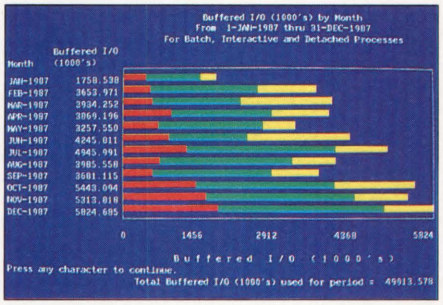

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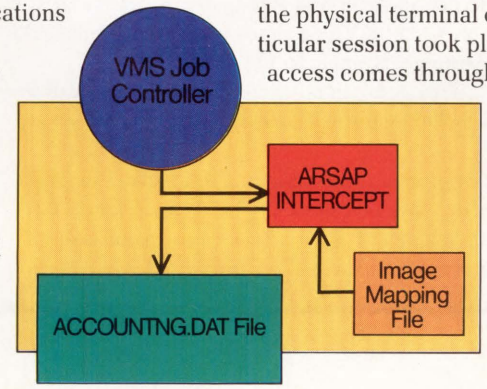

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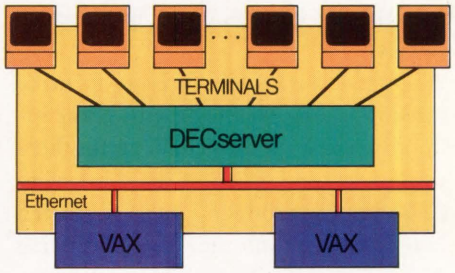

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CIRCLE 113 ON READER CARD

DIGITAL WATCH

Evan Birkhead

Granting LATitude

In the wake of Digital's raucous VAX- and RISC- processor upgrades, the company quietly announced, on July 13, a program to license its recently patented Local Area Transport (LAT) protocol to all comers, including software vendors and competing manufacturers of terminal servers. LAT is Digital's method of connecting terminal-service users on networks to VAX servers.

Digital made this long-anticipated move for three reasons:

1. Industrywide standards are good for business (particularly when the standards initially are proprietary), because they increase the community of prospective buyers.
2. Digital saw the opportunity to make inroads among its third-party competition by making it more difficult for them to push systems. Each of the third-party LAT-device producers we contacted complained about the "steep" pricing schedule and the "extreme" royalty program. They rationalized that the licensing program underscores that Digital has fallen far behind the competition in the server area.
3. Digital saw the chance to make more money. By licensing LAT to the LAT-compatible community, the company will profit from every sale of a LAT port.

Tough Terms

Several companies had developed and were shipping their own version of the protocol. An unofficial count reveals that, for different reasons and to varying degrees, the software had been "reverse engineered" by Able Computer Communications, Datability Software Systems, Emulex, Infotron Systems, Kea Systems, Meridian Technology and Polygon. These companies theoretically were eligible to receive LAT licenses, but at press time none had been granted. Each company was holding discussions with Digital, however, and those we talked to reported that the fine print in the licensing agreement was tough to commit to.

"If I agreed to [Digital's] terms, I could have a license right now," claimed one executive who asked to remain anonymous. "But the terms are flexible. The delay is the negotiations."

Datability had endured hot-and-cold relations with Digital over its reverse-engineered LAT implementation and now can choose to license Digital's or go with its own. "We expect to be one of the first licensees," says Datability President Ron Howard, adding that relations with Digital currently are quite friendly. But Datability will continue to market its

DEC Answers The Call

Digital's heavy activity in the area of Computer Integrated Telephony (CIT) has important ramifications for the future. The telephone is expected to play an even greater role in computer networks as fax machines and voice recognition systems become more advanced and more widely implemented.

Two major agreements, one with AT&T and one with Northern Telecom, are spearheading Digital's efforts in this area. Northern Telecom's Integrated Services Digital Network Applications Protocol (ISDN/AP) software links the company's Meridian SL-1 Private Branch Exchange (PBX) with VAXs. The surprising joint-development agreement with UNIX rival AT&T is to design and manufacture a PBX-to-VAX application interface based on Digital's CIT platform and AT&T's Adjunct Switch Application Interface (ASAI).

The CIT platform involves two fundamental software components that reside on the VAX. These are the VMS CIT applications interface, which provides programmers with a library of VMS routines for building applications around telephones connected to PBXs; and the VMS CIT Server, which connects to PBXs through a synchronous link and DECnet and can communicate with the applications interface. The Server allows the transfer of request and status information on the telephones. For example, the Server supports communications between the VAX and the Meridian SL-1.

The CIT platform currently includes the AT&T and Northern Telecom ventures among several third-party software applications, including:

- A Focus/CIT interface that allows users of Information Builders' Focus fourth-generation language to develop VAX-based applications that incorporate CIT technology.
- Applications from Alexandria, VA-based National Political Resources Inc.'s TeleTech system that provide management and automation of telephone calls with menu-based software that runs on VAXs or VAXstations, plus a Toolkit that adds services and other enhancements to existing CIT applications.

All of the applications are based on communications standards from CCITT and ANSI and span industries including financial, chemical, utilities, university and healthcare.

"The only missing piece is voice services, in terms of our strategic vision of the network," says Lois Levick, who directs Digital's CIT efforts. "We need the voice piece, and it will depend on partnerships. AT&T is the major player in that area."

proprietary LAT implementation.

"We'll make application for the license fairly quickly," explains Greg Ferguson, senior vice president at Xyplex, "but we'll keep looking for other ways around it." Xyplex was preparing to introduce a LAT-compatible 16-port terminal card for $1,995 at the time of Digital's LAT-licensing announcement.

"[The royalties] won't affect our sales," says Jon Asahina, product marketing manager at Emulex. "But we're still undecided as to whether we'll license DEC's LAT."

In many cases, the customer's budget may bear the biggest burden. "Customers who were going to buy Xyplex will continue to buy Xyplex," explains Ferguson. "It's just unfortunate that DEC's customers and our customers will suffer."

Driver's License

Digital has categorized its licensing policy into three areas:

1. A one-time $10,000 host license for writing LAT drivers to other operating systems or platforms.
2. A one-time $10,000 license for single-port servers that would be used for writing PC terminal-emulation packages.
3. A multiport license for LAT terminal servers that's free when purchased with one of the other two packages but costs $10,000 when purchased alone. Digital will collect a $15 royalty per port sold on the multiport license.

License purchasers will get the LAT protocol spec, source code and documentation with sample implementations. "The idea is to make this efficient environment available to everyone," says Lee Cooper, Digital's terminal networks manager. "LAT is the most dominant connectivity protocol going, and it's growing in the LAN space. We believe it will be the terminal connection choice for some time to come."

That said, Cooper made it evident that Digital won't enter the TCP/IP market for the time being, an area in which much of its third-party competition has profited substantially.

Industry Watch

Call Of Apollo — The NCS Remote Procedure Call (RPC) from HP's Apollo division is the foundation of a distributed-application facility that Digital is co-designing with HP. The current implementation isn't OSI-compatible, and Digital reports that it will have to change RPC components to better support OSI/DECnet.

The RISC-Based VAX — Sources within Digital confirm that the company has developed a version of VMS that can run on a large-scale RISC architecture. Although the product isn't expected to be released or acknowledged during the next calendar year, it could prove a key strategic development. The inability to run an operating system with the full functionality and security of VMS is one of the primary drawbacks of the current Mips Computer Systems' processor-based ULTRIX machines.

OSF's Underlying Motif — The Open Software Foundation of Cambridge, Massachusetts, has made its OSF/Motif operating environment available after just one year in development. The Graphical User Interface, based on IBM's AIX operating system, also implements HP's window manager, Microsoft's Presentation Manager and Digital's user-interface language and toolkit based on extensions to the X Window System.

Motif lets you select objects, perform actions and adjust system parameters without using syntax. It's an icon-based series of windows that pull down on-screen menus selectable with mouse clicks.

The system, which purports to be a standards-based open system based on current technology, implements this common user interface across unlike platforms. According to David Tory, president of OSF, the technology is "independent of constituent self-interest or vendor partiality."

Aquarius Update — Don't confuse the vector-processors-for-VAXs scheme that Digital announced in July with the Aquarius mainframe (VAX 9000) expected shortly. The built-in vector accelerator on Aquarius will run 125 Mflops peak, far superior to the first VAX architecture-compatible vector boards for the VAX 6000 Model 400 that Digital will ship late this year. The two vector strategies were devised by different groups within Digital, but both rely on proprietary designs.

Wait State — Digital introduced an upgraded 286 machine during the same week that IBM came out with a new PS/2 based on a 486. How long will the computer industry wait before Digital introduces a 486-based machine?

Since then, Intel has introduced the 82350 chip set, which implements the 32-bit Extended Industry Standard Architecture (EISA) Personal Computer bus. The set includes the 82357 Integrated System Peripheral (ISP) and the 82358 EISA Bus Controller (EBC). It extends the capabilities of the 386 and 486 to this I/O expansion bus.

No Layoffs, But... — The conventional wisdom for the past few years has been that Digital could stand to trim some staff. However, President Ken Olsen has admirably stood by one cardinal rule since founding the company: no layoffs.

He has compensated in the lean years with salary and hiring freezes, both of which have been in effect during 1989. He has also been a wizard at shuttling employees among departments, staffing the areas where the R&D focus lies, another tactic that was used this year.

But declining revenues have forced Olsen's hand. Late in August, the *Boston Globe* reported that a memo indicated that nine internal departments were to cut 25 percent of their personnel by July 1991. This was to occur through attrition or transfer.

A Star Is Born — The merger of Stellar and Ardent will be completed by the middle of this month. The new company, called Stardent, is a 50/50 split between East and West Coast companies that shared the lead in the graphics supercomputing and visualization markets. The product lines, which consist of large RISC workstations and parallel vector processors, will be merged by 1991, according to the companies. Both companies manufacture machines based on UNIX V.3.

Companies Mentioned In This Article

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Xyplex Inc.
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Boxborough, MA 01719
(508) 264-9900
CIRCLE 467 ON READER CARD

With Digital's LAT licensing policy now established, the LAT terminal-server market shapes up as one of the industry's most cutthroat. Digital accompanied the LAT program with the debut of the 16-port DECserver 300, which has twice the performance and line density of the DECserver 200 but is rivaled by new offerings from Datability and Xyplex, among others. The async-only Ethernet box, which uses LAT as the connection, costs about $275 per port. ■

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ULTRIX

A VMS User's First UNIX Terminal Session

Philip E. Bourne, Ph.D.

You can make only one first impression, so it has to be good. UNIX system administrators and new UNIX users should take this advice. UNIX system administrators should provide VMS users new to UNIX with an environment that eases the transition. VMS users should know how to customize the UNIX terminal session to suit their needs.

When you log into a VMS system, you're assigned a process with a unique process identifier. Associated with the process is a set of resource limits and privileges defined by the system administrator in the file SYS$SYSTEM:SYSUAF.DAT. The files SYS$MANAGER:SYLOGIN.COM and LOGIN.COM also are executed, providing system- and user-defined logical names and symbols, respectively. Figure 1 illustrates the analogous UNIX log in sequence.

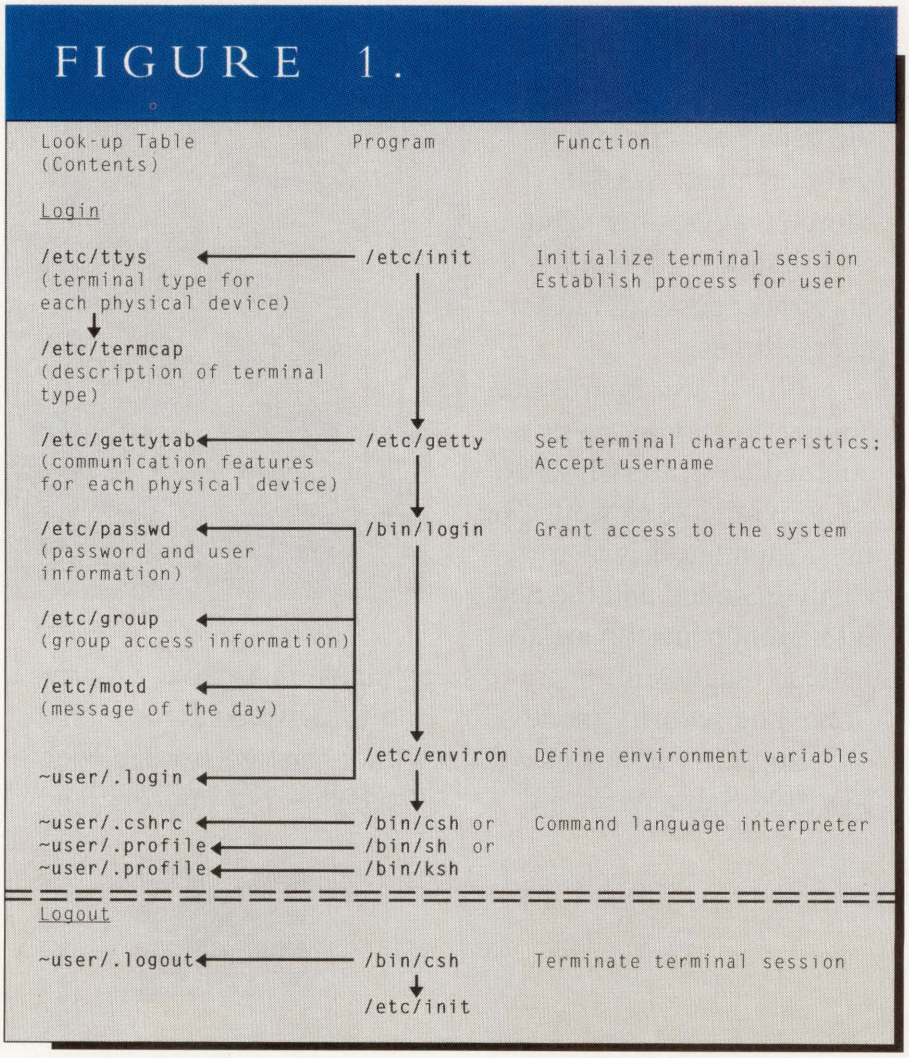
At first this sequence appears long, but the execution of these programs is transparent to the user. The programs are listed to highlight UNIX's modularity, which lets the programs and their associated look-up tables function cooperatively. None of these programs or look-up tables assigns privileges to the user. Unlike VMS, UNIX takes an all-or-nothing approach to user privileges. The system administrator (whose log in name is always root) has all privileges, whereas all other users have the same limited set of privileges and resource limits.

At the start of a UNIX terminal session, a new UNIX user's first concern is to have his terminal communicate with the UNIX host. That is, what's the UNIX equivalent of the VMS command SET TERMINAL? In ULTRIX's case the answer can be found in the file **/etc/ttys**. **/etc/ttys** maps each physical terminal device to a set of communication parameters and a terminal type. Figure 2 shows a typical entry from **/etc/ttys**.

UNIX terminal devices are named tty, followed by single hexidecimal digits for the controller and port, respectively. Therefore, in Figure 2 tty00 is port 0 on controller 0 (compare the VMS terminal device TTA0:). In Figure 3 tty00 is mapped to the entry std.9600 in the file **/etc/gettytab**.

std.9600 is a simple entry defining only the baud rate and parity. Entries can be more complex. A modem entry can include responses to the break key. If it does, after a connection is established you can strike the break key one or more times to change the baud rate of the physical device to match the incoming modem. UNIX

FIGURE 1.



UNIX log in/log out sequence.

has nothing as sophisticated as the VMS command SET TERMINAL/PERM/AUTOBAUD, which causes the terminal device to adjust automatically to the speed of the terminal.

/etc/ttys also contains an entry, vt100, for device tty00. vt100 is a terminal type that matches an entry in the file **/etc/termcap**. Figure 4 illustrates the terminal characteristics assigned to the entry vt100. It's unlikely that the system administrator will ever need to modify this entry. The worst-case situation is the need to design an entry for an unclassified terminal type. Fortunately, the ULTRIX version of **/etc/termcap** contains entries for all Digital terminals and many common third-party terminal types.

If the system administrator has entered the correct terminal type in **/etc/ttys**, the UNIX user may need to do little to get the terminal to respond satisfactorily. But what if different terminal types are likely to be connected to the same computer port (e.g., modem lines)? You then may need to resort to the commands **tset** and **stty**. **tset** modifies the I/O characteristics, and **stty** modifies the keyboard characteristics. In these cases the terminal device is mapped to a generic entry in **/etc/termcap** called, for example, dialup. Setting specific terminal features is achieved with **tset** and **stty** (see Figure 5).

The first example defines the delete key and the kill-line keys. Other keys also may be defined like this (compare the VMS command DEFINE/KEY). The second more cumbersome example for **tset** defines the terminal as a VT100 if the connection is made via the network.

With the terminal and keyboard responding as desired, it's necessary to tell the operating system more about the terminal type, because the terminal type is used by many programs, including the editor. VMS uses the command SET TERMINAL/DEVICE_TYPE to define a terminal type. UNIX uses the environment variable TERM.

Environment Variables

In Figure 1, the program **/etc/environ** defines environment variables at log in time. Environment variables are analo-

gous to entries in the VMS logical name tables. However, there isn't the flexibility exhibited by VMS in defining different classes of logical names for systems, groups, processes and users. Environment variables are defined only for the user. The UNIX command **printenv** (compare the VMS command SHOW LOGICAL) displays the environment variables in effect, and the command **setenv** (compare the VMS command DEFINE) defines them.

Figure 6 illustrates environment variables from an ULTRIX terminal session; comments following a # describe the role of each environment variable. For example, the environment variable PATH specifies the directories, delimited by colons, that are to be searched to resolve requests for commands and programs. It's a common UNIX practice to include your directories in the path, as shown for user fred. The most commonly searched directories should be placed first in the PATH list.

The two examples of **setenv** define environment variables, first for an X terminal server and second for a VT300-series terminal. Environment variables can be defined during or, more often, at the beginning of the terminal session by including them in the hidden file **.login** (compare the VMS file LOGIN.COM), which is executed as part of the log in procedure. Figure 7 shows a sample **.login** file.

Environment variables such as those defined in Figure 7 are global, i.e., they're defined for the whole terminal session and are independent of the shell (command interpreter). UNIX permits a further level of customization for each shell.

FIGURE 2.

```
# name  getty                 type   status       comments
#
  tty00 "/etc/getty std.9600"  vt100  on nomodem   # direct connect tty
```

Sample** /etc/ttys **entry.

FIGURE 3.

```
# sp = baud rate
# pd = no parity on output
#
2|std.9600|9600-baud
        :sp#9600:pd:
```

Sample** /etc/gettytab **entry.

FIGURE 4.

```
d0|vt100|vt100-am|dec vt100:\
        :cr=^M:do=^J:nl=^J:bl=^G:co#80:li#24:cl=50\E[;H\E[2J:\
        :le=^H:bs:am:cm=5\E[%i%d;%dH:nd=2\E[C:up=2\E[A:\
        :ce=3\E[K:cd=50\E[J:so=2\E[7m:se=2\E[m:us=2\E[4m:ue=2\E[m:\
        :md=2\E[1m:mr=2\E[7m:mb=2\E[5m:me=2\E[m:is=\E[1;24r\E[24;1H:\
        :rf=/usr/lib/tabset/vt100:\
        :rs=\E>\E[?3l\E[?4l\E[?5l\E[?7h\E[?8h:ks=\E[?1h\E=:ke=\E[?1l\E>:\
        :ku=\EOA:kd=\EOB:kr=\EOC:kl=\EOD:kb=^H:\
        :ho=\E[H:k1=\EOP:k2=\EOQ:k3=\EOR:k4=\EOS:ta=^I:pt:sr=5\EM:vt#3:xn:\
                :sc=\E7:rc=\E8:cs=\E[%i%d;%dr:
```

Sample** /etc/termcap **entry.

FIGURE 5.

```
example: % stty crt erase <delete> kill ^U

example: % tset - -Q -m network:vt100
```

***Examples of** stty **and** tset.*

C Shell Customization

UNIX uses the hidden file **.cshrc** to define features unique to the C shell. **.cshrc** is executed for each process forked by the C shell, i.e., for most commands, but excluding those commands processed by the shell. The file **.cshrc** usually contains **set** and **alias** commands (see Figure 8). **set** defines features unique to the C shell, and **alias** provides shorthand notations for command strings (compare VMS symbol definitions).

Some C shell variables have the same names as environment variables, but in lowercase. For example, **path** has the same function as **PATH**, but for the C shell only. If you switch to a different shell, a different set of directories to resolve command requests can be specified.

You can review which shell variables and aliases have been defined by giving the **set** and **alias** commands without arguments.

Before leaving **.cshrc**, let's consider what happens when you make changes to this file during a terminal session — a leading cause of frustration to the novice UNIX user.

The VMS user making a change to LOGIN.COM would have the command

FIGURE 6.

```
example: % printenv
        HOME=/mnt/fred                  # Parent directory
        SHELL=/bin/csh                  # C shell as default
        TERM=vt300                      # Terminal type
        USER=fred                       # Login name
        PATH=/usr/ucb:/bin:.:/mnt/fred/bin:     # Directories to search
             /usr/bin:/usr/local:/usr/new:/etc  #    for commands
        EDITOR=/usr/ucb/vi              # Default editor
        MAIL=/usr/spool/mail/fred       # Place to store mail messages
        EXINIT=set ai aw ic sw=4 redraw # Predefine editing features
             wm=4|map g G|map v ~~~~

example: % setenv DISPLAY xterm1:0      # Define X-terminal server

example: % setenv TERM vt300            # Set terminal to vt300
```

Environment variables.

FIGURE 7.

```
stty dec new cr0                        # Compare VMS SET TERMINAL
tset -I -Q                              # Compare VMS SET TERMINAL
umask 027                               # Compare VMS SET PROT/DEFAULT
setenv EDITOR '/usr/ucb/vi'             # Define default editor
setenv MAIL /usr/spool/mail/$USER       # Define directory for mail
setenv SHELL /bin/csh                   # Define default shell
setenv EXINIT 'set ai aw ic sw=4 \      # Define editing characteristics
      redraw wm=4|map g G|map v ~~~~'
```

Sample .login file.

FIGURE 8.

```
set noclobber                   # Prevent unwanted redirection
set autologout=30               # Automatic logout after 30 minutes
set prompt="next?"              # Compare VMS command SET PROMPT
set cdpath=( $HOME/sys /usr/sys /usr/spool )  #
set path=(/usr/ucb /bin  $HOME/bin /usr/bin\  # C shell version of PATH
        /usr/local /usr/new /etc .)
set history = 100               # Save last 100 commands for recall
set savehist=50                 # Save last 50 commands for next session
set mail=$MAIL                  # Set to environment variable
biff y                          # Compare VMS SET BROADCAST/MAIL
alias h history                 # Compare VMS command RECALL
alias rm 'rm -i'                # DELETE :== DELETE/CONFIRM
alias mv 'mv -i'                # RENAME :== RENAME/CONFIRM
```

Sample .cshrc file.

interpreter execute the file by preceding the file name with @. In UNIX it's sufficient to give the file name, provided the file has a protection that renders it executable. The shell forks a process to execute the command, and the commands defined in **.cshrc** take effect for that process. However, when that process dies, so do any definitions that were made — the changes made to **.cshrc** haven't been applied to the parent process.

The command **source**, part of the C shell, circumvents this problem. Issuing the command **source .cshrc** forces the parent process to execute the commands in **.cshrc**. Thus, they're in effect for the parent process. It isn't necessary to log out and in again to have them take effect for the parent shell process.

Log Out Sequence

What you must do to end a terminal session depends on the shell in use. The Bourne shell uses the command **exit**; the C shell uses CTRL-D or **logout**, depending on whether or not the shell variable **ignoreeof** is set. In the C shell, if the file **.logout** is found in your parent directory, its contents will be executed. Finally, control passes to the **/etc/init** program to end the terminal session gracefully.

After reading this, VMS users may feel their worst fears about UNIX are true: It's complex and unfriendly. But if the system administrator has done his job, you should have a usable environment. Part of the ULTRIX procedure for adding a new user copies hidden files similar to those discussed here from the directory **/usr/skel** to your parent directory so that you have working templates with which to start. You also should stay with one shell in the beginning. The C shell is more versatile than the Bourne shell and usually is preferred.

System administrators should make sure:

1. The hidden files in **/usr/skel** are modified to reflect sitewide needs.
2. **/etc/ttys** has the correct terminal types for each terminal device.
3. **/etc/termcap** contains entries for each terminal type.
4. **/etc/passwd** makes the appropriate shell the default at log in time.

Information regarding hints and kinks useful to VMS users grappling with UNIX is appreciated. Send it via e-mail to SYSTEM@CUMBG.BITNET or pbourne-@cunixc.cc.columbia.edu. — *Philip E. Bourne, Ph.D., is a senior associate of the Howard Hughes Medical Institute and the author of* UNIX for VMS Users, *published by Digital Press.*

FIELD SERVICE

Ron Levine

International Insights

Many VAX sites have data processing operations scattered throughout the world. Because of the impending 1992 European liberalization developments, under which most of Europe will drop trade barriers, many firms plan to ship higher volumes of high-tech products to Europe in the next few years.

Many system managers are familiar with the major U.S. vendors offering overseas service (e.g., Control Data Corporation, Sorbus Inc. and Digital). We'll look at a number of alternative vendors for the overseas market. We'll also focus on a new parts bank operation recently set up to service high-tech companies with a large European user base. As 1992 nears, expect other vendors to target this potentially lucrative area.

Field Service Overseas

Granada Computer Services International Ltd. is the largest TPM in Europe (it's number one in the U.K.). With 20 percent of the European independent maintenance business, the size of Granada's field engineering force rivals that of most equipment manufacturers on the continent. Only IBM tops Granada's more than 3,000 FEs. Granada offers its services to users in almost all of the European Economic Community (EEC) countries and has smaller operations in Canada and the U.S.

According to Alan Penny, research and development director, Granada is a true multivendor maintainer. It handles maintenance under one contract. Hardware often is repaired on-site, with an emphasis on getting the customer up and running quickly.

Granada provides field maintenance, disaster recovery services, brokering (buying and selling used equipment) and depot repair on computers and peripherals.

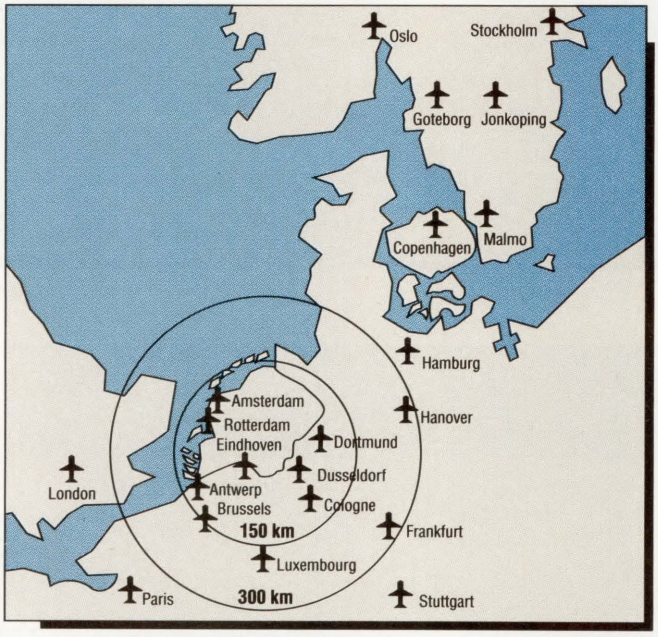


Figure: American companies can use Logistic Support Europe (LSE) to serve their European customers. Located in Eindhoven, the Netherlands, the 50 to 70 million inhabitants and 170,000 enterprises within a 150-mile radius make it one of the most densely populated areas in the world.

Bell & Howell, another major TPM, offers a full field-service menu for users of DEC equipment in Australia and New Zealand. From centers at Auckland, Wellington and Christchurch, Australia, Bell & Howell provides independent maintenance service around the clock on most major brands of computers and peripherals. As with Granada, you need only one maintenance contract for all your service needs. If the hardware problem can't be rectified on-site, Bell & Howell's maintenance centers are equipped to test, repair and modify your hardware.

Bell & Howell Ltd., in Lower Hutt, New Zealand, provides the same services for that country's users. According to David Brown, general manager of the New Zealand office, Bell & Howell is DEC's number one competitor in this part of the world. Services offered include field maintenance (on a time-and-materials or contract basis), upgrades, installation/removal and DEC network configuring.

Olivetti is another major TPM player worldwide. Perhaps not as well known as its competitors in the DEC market (because of its various names in different countries), it's one of the largest independent maintenance suppliers in Italy, the U.K., Scandinavia and other areas. Albino Cooreia De Andrade, TPM development manager, states that Oliservice is the main field service arm of Olivetti. A division called Radial provides DEC service for the Olivetti group of companies.

Services offered include single-source TPM service, fourth-party repairs, hardware support and selected software assistance, and physical network support.

Thijssen Field Service, based in the Netherlands, provides a full slate of DEC and DEC-compatible product maintenance for companies operating in Hol-

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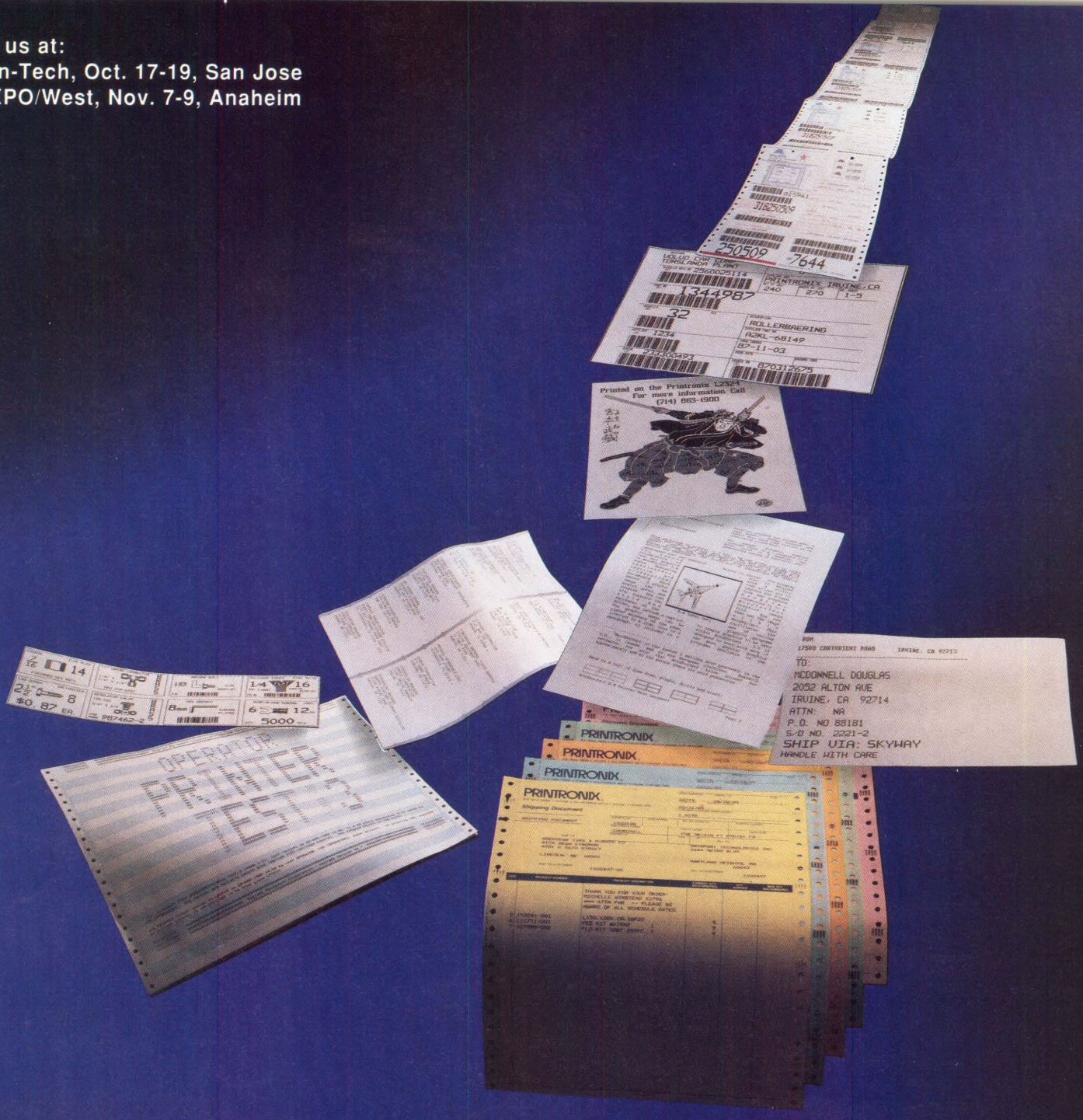

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Thijssen Field Service has at least one of every DEC system it maintains at its main office in Veenendaal, Holland. Systems are used for a variety of functions, including testing, training and media conversion.

land and Belgium. Some parts of Germany and France also are within Thijssen's field service operating realm. Albert Thomassen, managing director of Thijssen, states, "If there's a DEC CPU on the system, Thijssen will support the entire system or network. Not only is the hardware supported but so is the complete line of DEC software."

Thijssen Field Service offers site maintenance for the complete line of DEC products from the PDP to the MicroVAX to the 8550. Other services include depot repair, hardware and software training, new and used equipment sales and spares purchases. Service agreements are on a time-and-materials or contract basis, with two- , four-, eight-, 16-hour or next-day response times. Service is provided seven days per week, 24 hours per day. Thijssen guarantees its customers system access for 95 to 99 percent of the contract hours.

Spare parts are stocked for all equipment covered in any contract and are brought directly from the central warehouse to your location. Thomassen says that the company has at least one of every system it maintains at its main office in Veenendaal, Holland. The systems are used for testing, training, backup service, converting media and running applications.

American Depot Repair

Board and component repair services are offered to self-maintainers and other DEC equipment users by Granada Computer Services and Thijssen Field Service. But an American company, Douglas Computer International (DCI), headquartered in Salt Lake City, is making a major push toward capturing the DEC European depot repair business.

In January, Douglas opened a facility in England (Douglas U.K.) to service Europe and Japan. Douglas in Salt Lake City handles accounts in Australia, South Africa and other overseas nations. It supports self-maintainers and TPMs (including Granada and Olivetti) with emergency parts, head/disk assembly (HDA) repair, DEC training and technical support for selected hardware and software products.

According to Mike Clark, DCI's director of marketing, more than 45 percent of the company's business next year is projected to come from its European customer base. More than 60 percent of its business will come from this base in three to five years. Not surprisingly, Douglas is making major investments in its European operation, including stocking parts for a number of TPMs to launch them into the newer Digital technologies (6000- and 8000-series maintenance).

DCI President Craig Hunter says that the self-maintainer in Europe is looking for a one-stop shop offering first-class training, diagnostics, board repair and hardware/software support.

Logistics

Until recently, parts banks and related support operations run by Federal Express, SonicAir and Emery Worldwide dominated the independent warehouse and distribution channels market. Their inventory management and control functions, along with stocking and transporting capabilities at carrier facilities, were used by American and European companies. But in April another player surfaced in the European arena: Logistic Support Europe (LSE).

American high-tech companies making such products as computers, printers, terminals, medical equipment and control instrumentation can use LSE logistic service and support capabilities (known as a parts bank) to serve their European customer base. It's located in Eindhoven, the Netherlands, whose 50 to 70 million inhabitants and 170,000 enterprises within a 150-mile radius make it one of the most densely populated areas in the world.

A parts bank is a method for storing and delivering critical, time-sensitive parts. Parts banks are independent warehouses and distribution channels that act as extensions to your own facility. This logistics system also may provide such services as repair and training in conjunction with your own service department.

LSE's parts bank offers services in four major categories:

1. Logistic support — This includes warehousing, customs handling and documentation, a bonded facility, inventory control, materials management, physical distribution and, on request, physical inventory control.

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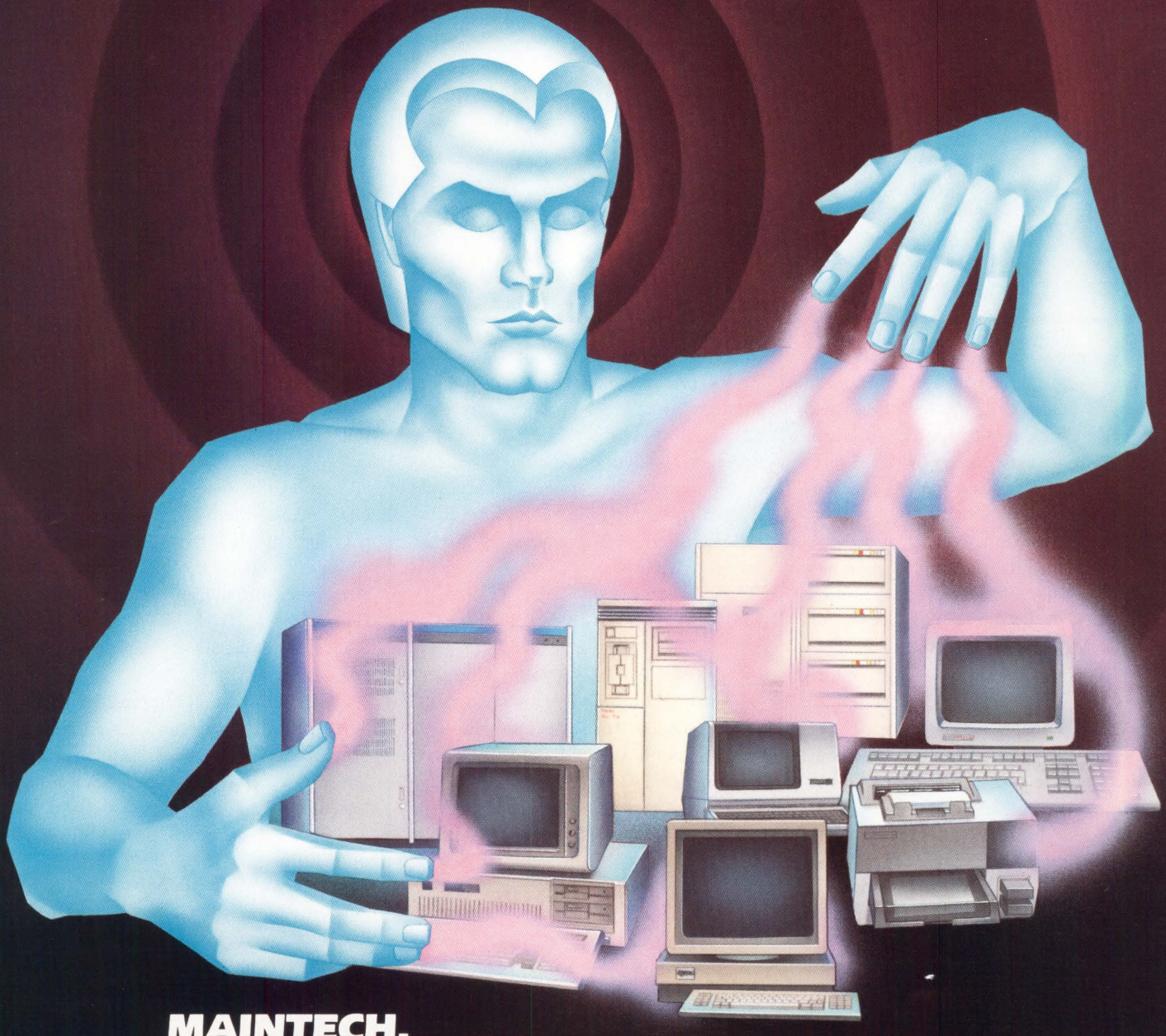

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Mergers, Shakeouts And Rumors

■ Over the last few months, Bell Atlantic Corporation has merged its fourth-party companies into one division called Bell Atlantic Fourth-Party Services. ESS, Camerx, CPX and Dynservice Network, all previous Bell Atlantic acquisitions, make up the new division. Another Bell Atlantic service company, Sorbus, isn't included in the reorganization.

■ Decision Data Services Inc. (DDSI), a major player in the IBM maintenance market, acquired the maintenance division of Iverson Inc., moving it into the DEC market. Earlier this year, DDSI acquired FDR Field Service Company and its subsidiary DSI Computer Services Inc. DDSI was formed last year by the merger of the service operations of Decision Industries Corporation and Momentum Technologies Inc.

■ In August, McDonnell Douglas announced plans to pull out of the computer field service business (and the computer business in general). A management buyout offer is reported to be on the table.

■ An unconfirmed rumor has it that Control Data Corporation is taking offers for its Third Party Engineering Services Division, or at least parts of it. Also heard on the street is that TRW would like to sell its Customer Service Division. A TRW source denies that the company is soliciting a sale.

2. Technical support — LSE clients are given the option of having technical services performed by LSE personnel trained by the client company. This technical support may consist of repair services, assembly, quality control and testing.

3. Marketing support — This provides for rental of offices, secretarial timesharing, telephone, fax/telex, printing, translation and liaison between governmental institutions and LSE clients.

4. Financial support — This includes invoicing, C.O.D. services, accounting and commercial banking assistance.

Parts bank benefits are numerous. Most important may be that consolidation of shipments to Europe reduces total transportation costs. And while the parts are stored in a bonded warehouse, no import duties or value added tax (VAT) have to be paid until the product is sold. LSE states that customers can achieve cost savings as high as 65 percent by using its operation.

LSE claims that products in stock can be delivered anywhere in Western Europe within 24 hours, enabling you to offer your customers a high standard of service. High-tech repairs can be performed by LSE qualified technicians, eliminating the need to return products to the U.S. for repair. This lets you avoid paying import duties twice. Assembling products at LSE also reduces expenses, because import duty costs on components are less than on finished products.

No capital investment is required from clients using LSE's services, so financial risk is minimal. You pay only for the services you use.

Looking At LSE

LSE creates a custom package of services for each client selected from various options. LSE is an officially recognized customs agent and operates using a bonded warehouse with preprogrammed document checking. Clients don't have to pay import duties and taxes during the period of storage. LSE offers direct assistance to its American clients in gaining export licenses for strategic goods from the U.S. via the Export Department in Washington.

Inbound products from the U.S. (i.e., those going to the LSE warehouse) are deposited by the carrier of your choice. LSE receives and stores your merchandise and advises you about receipt/storage and inventory, in accordance with arrangements made between LSE and your company.

Outbound products (i.e., those going from the LSE warehouse to your customers) are shipped per your or your agent's specifications. Appropriate customs documents, prepared by LSE, accompany your shipment. Invoicing also may be done through LSE.

Products are shipped from the LSE warehouse by air cargo and road transport. Because the company doesn't have its own vehicles, the best transport option is selected on a case-by-case basis. Many deliveries from LSE are guaranteed door-to-door within 12 hours. If a repairable item has to be returned to LSE or another repair shop, it's picked up when the replacement part is delivered.

Dutch customs authorities have simplified the administrative procedures that enable the transportation of goods across EEC borders. An extensive system of bonded warehouses and administrative customs regulations has been developed in the Netherlands to aid the flow of international goods. LSE claims that customs laws there are designed to assist shippers, and the movement of freight is recognized as the fastest in Europe.

Frank Timmerman, president and CEO of LSE, summarizes the major benefits his company offers:

1. Knowledge of the complex customs regulations and transportation systems in Europe.
2. Service 24 hours per day, seven days per week.
3. Warehousing and shipping service.
4. Repair, assembly and testing options.
5. Financial benefits of bonded warehousing (i.e., no taxes or import duties levied during storage).
6. Express air and road services throughout Europe.
7. Convenient location to Eindhoven Airport, the Netherlands. From this location, air service is available to London, Manchester and Birmingham, England; Paris; Hamburg and Frankfurt, West Germany; and Amsterdam and Rotterdam, the Netherlands.

THE IMPENDING 1992 European liberalization process will make many American companies consider exporting more high-tech products to Europe. For these firms, service and shipping in this region will be of foremost importance.

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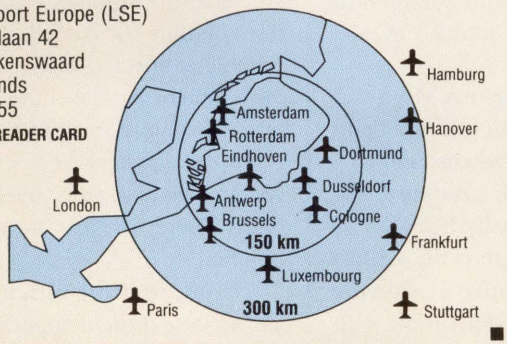

UNIX

The Magic Of Mach, Part 1

Elaine L. Appleton

Editor's note: Developers of the Mach operating system focused their efforts on four features: interprocess communication, virtual memory management, networking and parallel process support. In Part 1 of a two-part series, UNIX Editor Elaine L. Appleton introduces Mach and discusses interprocess communication and virtual memory management.

In 1984, developers at Carnegie-Mellon University (CMU), Pittsburgh, began to carve out an operating system designed for hardware independence across all sizes of machines from PCs to supercomputers. Called Mach, the operating system originally was intended to solve many of the problems UNIX was intended to solve: shared information across networks, portability of programs and data and performance through improved memory-management processes.

Although Mach and UNIX were born out of similar needs, they differ because of history. Mach developers had 20 years of technological advances and many experiences with which to work since AT&T began UNIX gestation.

Recently, a few commercial releases of Mach have appeared, although they're not widespread. BBN Advanced Computers Inc. has employed the operating system on its parallel-processing Butterfly computer, and Encore Computer's Multimax bears the mark of Mach.

Also, Next Inc. shone its publicity beam on the operating system and brought it out of its academic breeding ground when it released it along with UNIX on the Next computer.

Most important to DEC users, however, is the Cambridge, Massachusetts-based Open Software Foundation's (OSF) plan for Mach. At a recent DEC symposium, OSF Research and Development Manager Ira Goldstein announced OSF's Ten Commandments. Among them was, "Thou shalt be independent of hardware." Goldstein's address included strong hints that OSF is planning to incorporate Mach's hardware-independent virtual memory-management scheme into OSF/1.

> ***"CMU developers hope that Mach will become the next common platform upon which other operating systems and languages can reside..."***

The OSF Influence

"OSF is our ULTRIX strategy." These words from Digital spokesperson Peter Kobs mean that programmers with an interest in ULTRIX should watch what OSF will implement in the first release of its enhanced AIX operating system, OSF/1. DEC has promised that ULTRIX will comply 100 percent with OSF/1, although it will add its own ingredients to the stew of OSF/1 specs. Also important is the announcement by Mt. Xinu, a Mach distributor, that it will release a commercial version of Mach for the VAX in January 1990, along with commercial releases for the Sun 3, the IBM RT PC and possibly Apple's Mac II.

CMU developers hope that Mach will become the next common platform upon which other operating systems and languages can reside — the same goal that UNIX developers originally held.

Currently, Mach supports the 4.3BSD "Berkeley UNIX" interface, allowing Mach users to employ UNIX tools with which they are already familiar.

CMU computer scientists have tried to work the same magic with Mach that was attempted with UNIX, i.e., to achieve true hardware independence. The magic failed with UNIX, as is apparent from the UNIX International/OSF wars and from the fact that some 200 versions of UNIX exist, all keyed to different processors. Despite the success of UNIX, these versions suffer from the methodology with which they were created. As new services are added to UNIX, the UNIX kernel grows larger and more unwieldy. A single programmer has a difficult time trying to know the entire operating system. Thus, UNIX becomes more difficult to maintain.

Along with 20 years of technological advances, Mach developers could look back at 20 years of problems uncovered by UNIX code writers. The CMU scientists decided that the most effective way to achieve hardware independence and maintainability was to keep the Mach kernel small. Mach is modular: services are added to modules called by abstractions within the kernel. Only a single module is affected as services are added to it, rather than the entire operating system. In contrast, new UNIX services can adversely affect code elsewhere in the system, because the operating system exists more or less as one complex bundle.

Despite its many versions, this bundle allows for excellent application portabil-

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ity across single-processor computers, and in some instances, across multiple-processor machines as well. When CMU developers first began working on Mach, in an unusual move they made it run first on multiprocessors and then ported it to single-processor machines; it's designed for efficiency in multiple-processor environments. As microprocessors become cheaper and the cost of developing and maintaining software rises, multiprocessors should overtake uniprocessors in popularity, believes Alan Tobey, spokesperson for Mt. Xinu. DEC has announced that ULTRIX will be supported on symmetric multiprocessors (SMP) by the end of the year. VMS and SMP are already partners.

Mach conjurers focused their sorcery on four features that are metaphors for today's computing. The CMU scientists (and assistants, which have included DEC, OSF and such companies as Mt. Xinu) consider interprocess communication, virtual memory management, networking support and parallel process support the targets for their computing spells.

Interprocess Communication

UNIX and Mach processes differ somewhat in definition and methodology, despite the fact that Mach was written in C in the UNIX environment.

The UNIX operating system considers a process to be a program in a state of execution. Therefore, the process can consist of several assignments, or missions. It spawns new processes in a hierarchical fashion, using the fork system call to create child processes from parent processes. Processes have many ways of communicating with one another, including pipes (one-way passages), messages, semaphores, sockets, streams and so on. Because UNIX was initially designed for uniprocessor machines, and is still most commonly found on single-processor computers, UNIX is most often employed so that processes execute sequentially, says Dan Julian, a CMU graduate student researching Mach. Julian works with CMU Associate Professor Richard Rashid, a top Mach researcher.

Mach proponents argue that in a multiprocessing environment, sequential processing is inefficient. Although numerous companies have developed extensions to UNIX that allow it to run in multiprocessing environments — allowing the operating system to run in a parallel rather than sequential fashion — it's not commonly used this way. According to Julian, because Mach was intended from the start for multiprocessing environments, Mach's small number of kernel abstractions allow it to run in a standard fashion on multiprocessing devices.

The difference is one of standardization. Julian says, "There is no common standard [for UNIX multiprocessing extensions]; there is no good integration of these extensions. Mach provides a richer set of facilities to allow multiple collaborating processes, be they separate tasks or threads within a single task."

A task is an execution environment, the basic unit of resource allocation. It includes a paged virtual address space and protected access to system resources such as processors, port capabilities and system memory. The Mach kernel manages and protects message queues, called ports, which are simplex communication channels.

A thread is the basic unit of execution and contains the minimal processing state associated with a computation: a program counter, a stack pointer and a set of registers. It executes in virtual memory and works within a single task. A task may be multithreaded, broken into smaller parts for greater efficiency. (Think of a task with a single thread as you would a UNIX process.) Multithreading was designed specifically for multiprocessing environments, but also works well in single-processor architectures.

Rather than using pipes to communicate among tasks like UNIX processes, Mach primarily employs messages. Messages are ordered collections of typed data consisting of a fixed message header and a variable-size body. The bodies may contain in-line data, pointers to data and capabilities for ports.

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Interprocess communication in Mach extends the idea of UNIX shared memory, says Tobey: "It extends this idea so that both threads within a process [task] and cooperative processes can share and access the same memory space." The result could be greater performance: Next Inc.'s CEO Steve Jobs says that Mach's interprocess communication mechanism runs seven to 10 times faster than regular UNIX. Mt. Xinu says it's too early for true performance testing.

Virtual Memory Management

Mach virtual memory management is implemented as a set of abstractions, or primitives, within the kernel, allowing for a high degree of machine independence. In contrast, UNIX memory-management implementation, although it exists in the kernel, must be customized for the hardware on which it runs.

UNIX virtual memory lets the operating system break a large process into portions that are loaded into main memory and portions that sit on disk until the

operating system pulls them into main memory — simple paging support. Programs larger than main-memory space can be run in this way. Additionally, portions of many processes can run concurrently in main memory.

Mach extends this idea but removes, as much as possible, the machine dependence of UNIX memory management, greatly extending portability. It does this by separating machine-dependent and machine-independent code. The machine-independent code contains all necessary code for maintaining virtual memory. According to CMU's Richard Rashid, Mach virtual memory includes only one machine-dependent code module and header file.

A Mach address space is associated with each task. The task's threads must execute within this space, which consists of an ordered collection of memory regions, a region being a continuous range of addresses. The only restrictions on location of memory regions are that they fall within the virtual address space defined by the hardware. According to the CMU developers, this scheme provides for a virtual address space of up to 4 GB on an IBM RT PC and up to 2 GB on a VAX. Mach restricts regions to alignment on system page boundaries.

Like UNIX, Mach works with a parent/child syntax. As a child task is spawned, it inherits the restrictions and allowances of the parent. Thus, the child receives the ability to share, by reading and/or writing, the parent's address space. It's possible to restrict inheritances and assign protections.

Mach effectively combines message-oriented interprocess communication and virtual memory management in a complex but efficient process that has brought it to the attention of OSF. In its search for portable, high-performance components of a UNIX-based operating system, OSF won't restrict itself to traditional UNIX techniques.

In Part 2, we'll continue our analysis of the four Mach operating system features by examining networking and parallel process support. We'll also discuss the X Window System interface.

Author's note: The following sources provided technical information for this article:

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NETWORKING

Bill Hancock

Phase V Migration: Method Or Madness?

Editor's note: In Part 2 of a two-part series, Networking Editor Bill Hancock explores steps you can take to prepare for migration to Phase V DECnet. He looks at applications, addressing, domains and routers and offers practical advice for the transition to Phase V.

In Phase V DECnet, network management gets a needed boost by using a variety of new tools that allow better control of the network. A management model introduces the concepts of directors and entities. A director is the management software used by the network manager, such as Network Command Language (NCL). Directors then tell entities what to do through the Common Management Information Protocol (CMIP). An entity is any manageable component on the network, e.g., clearinghouses and objects.

Applications And Addressing

Applications destined to work in the Phase V environment may need work. If nodes in the Phase IV and Phase V network follow the node naming and numbering conventions in the standard Phase IV network, there will be little problem getting programs up and running. For a true OSI call interface, however, most likely you'll have to recode in the future. Because Phase V allows nodenames to be a maximum of 512 characters, while Phase IV allowed only six characters, there could be incompatibility problems. If your application is hard-coded for six character names, there will be problems. A potential aid is the fact that Distributed Name Service (DNS) allows aliases to map between Phase V names and Phase IV names.

In a full-tilt Phase V applications environment, the programmer may specify connection information in the connect request that wasn't allowed on Phase IV connections. Such features as session entity connection and transport class are incompatible with Phase IV connection functions but are still desirable. Take care to understand which code entity is connecting to which node. If Phase IV nodes will be supported for some time, stick to Phase IV rules for now to provide compatibility.

> ***A management model introduces the concepts of directors and entities.***

Phase V addressing is also different from Phase IV. Under Phase IV, a 16-bit address was used to identify in which area and in which node ID within the area a node was located. In Phase V, there will be a minimum individual node address of 6 bytes (48 bits) with an additional prefix 2-byte value for area and a 1-byte trailer for selector byte. Because of this addressing method, you can create very large networks. Within an area, a single node would have a minimum of a 9-byte address as compared to a maximum 2-byte address under Phase IV.

Although greater numbers of address bits allow a large number of areas and greater individual node addresses allow many more nodes per area, the selector byte following the node address bytes is of special note. By using the selector byte, an automatic configuration capability is possible in a Phase V network. The selector byte identifies the user of the network service (routing, a specific transport layer, and so on). By using the selector byte, an end node automatically finds the nearest router and configures itself to be within the area of the router.

Other information such as nodename and ID can be added without manual intervention. New end nodes automatically are known to the network without network manager assistance. Routers still must be configured manually, but on a properly configured network there should be few of these.

Domains

One problem in Phase V occurs when multiple areas are configured as a domain and the domain is connected to other domains in the world. When a packet transitions from one domain to another, up to 10 addressing bytes may be added to the address of a packet. This happens because each domain requires information on such things as an authority and format identifier and the initial domain from which the packet came. Thus, interconnected domains must have a unique ID per domain, and that means there has to be a domain ID registration authority.

In the U.S., ANSI will be the registration authority. Digital probably will help customers that will require a domain ID navigate through the required registration facility. Digital will ship DECnet/OSI with the same default ID, so be careful when connecting domains.

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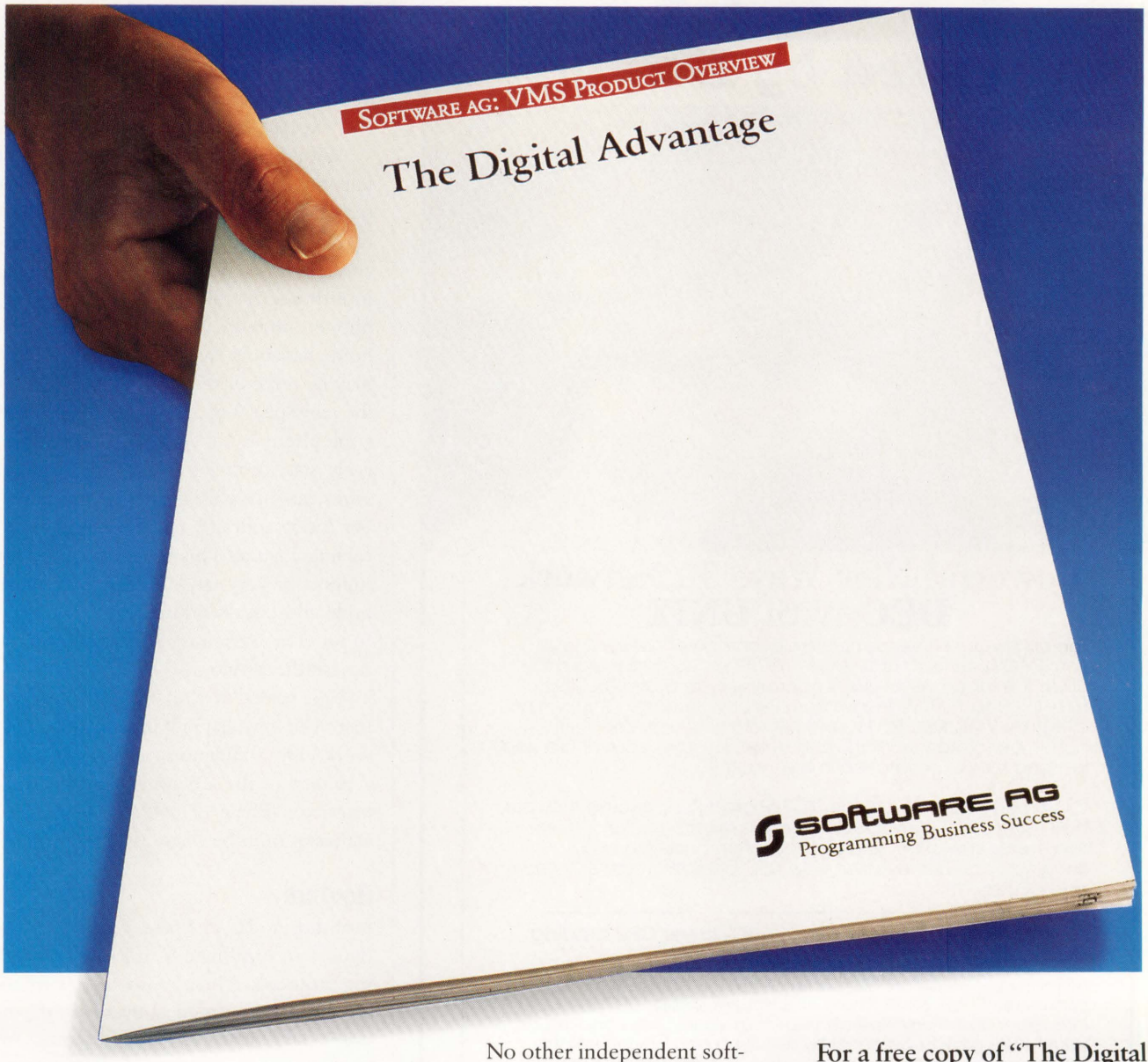

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will hook up to other domains in the world. There are similar examples now. For local networks to hook up to the Internet, an ID is required to keep node numbers from being duplicated on the network and causing chaos. The issue of domain networking address is no different, except the network could be huge.

With ISDN, it's probable that different telephone connections will have different addresses in the near future. Thus, each extension off the same trunk becomes a new node address. To illustrate, most homes in the U.S. have one or two phone numbers, which means that each home has about two pairs of wires. There may be three or more extension jacks off the same pair, but all extensions have the same phone number. In the near future, each extension off the same pair of wires may have a different phone number (node address), but there will be no cabling change. This creates the need for support of very large ranges of network node addresses worldwide and the need to provide explicit identification of entities on the network.

End nodes in the Phase V environment can exist happily in a Phase IV network. The stipulations are that all level-1 routers in the area must run the same protocols (Phase IV or Phase V), and all addresses must be Phase IV-compliant.

Routers

Routing nodes in Phase V can be configured to run Phase V or Phase IV routing protocols. These protocols are different and may confuse some nodes if you don't take care in configuration. All level-1 routers in an area must run the same set of routing protocols. Because Phase V routers can run Phase IV routing stacks, new Phase V routers can be added and Phase IV routers converted without major disruption of the network. After all routers are converted to Phase V, the network can be converted to a full Phase V routing environment by network manager-initiated commands.

For level-2 DECnet networks, a Phase V router can run different routing stacks at level 1 or level 2. This means that a Phase V router could run Phase IV rout-

ing stacks in a Phase IV local area and Phase V routing stacks between itself and an adjacent Phase V router. This lets transition among areas be independent of local area node type transitions.

You can handle the Phase V router transition in two ways: Do it all at once, or coordinate specified disconnect time among network areas to convert routers. It's a good idea to get all end nodes up on Phase V first, and then move the routers into the Phase V environment. After all nodes are Phase V, ensure that the namespace is set up and connected properly and then convert, simultaneously, all routers from Phase IV routing to Phase V routing. This will take only a few minutes for most networks. The larger the network, the longer the process and the more coordination required.

It takes time to set up the namespace properly. The process is similar to setting up a relational database for the first time. Information about each node in a clearinghouse must be collected and identified. Objects, nodename, aliases, addresses, circuit configurations, cluster IDs, cluster types, routers, router types, version numbers, operating systems and other items must be coordinated and set up correctly for the namespace to be efficient and function properly. Also, future growth and potential network changes must be considered for a good transition to a DNS environment.

Some applications in a pure Phase V environment will break. Most noticeable will be applications that use the Phase IV Network Information and Control Exchange (NICE) protocol to interface to the network management layers of Phase IV. In Phase V, NICE has been replaced by multiple entities that require programs that used NICE under Phase IV to recode for CMIP. Identify applications early that will die because of protocol incompatibilities.

How fast your site must migrate to a full-bore Phase V environment depends on what other networking problems must be solved. If the network is pure DECnet connections, transition may take as long as needed. If you need OSI connections to other network nodes from other vendors, transition to Phase V may be essential, and this means an accelerated timetable. When the transition occurs, there will be a philosophical difference in how updates and other changes happen. Standardized methods change slowly, even if a problem has been identified.

Taking Precautions

In the Phase V transition, there will be the occasional "undocumented feature." If you have a critical networking application, low and slow should be your motto. Make the transition carefully and with a lot of testing.

The OSI protocol suite is complex and compute-bound. This means that there will be situations in which Phase IV degraded your system and the degradation was expected and tolerable. But overhead on OSI protocols, regardless of the Digital implementation, is greater than the equivalent modules of protocols under Phase IV DECnet. This means that OSI packets for the same user data take longer to create, are at times substantially larger than Phase IV packets, and that the level of complexity is unmatched in previous versions of DECnet. In Phase V, it says DECnet on the label and looks like DECnet to the user, but the engine is different and requires education and understanding. It also requires a lot of CPU power.

This is the beginning of the Great Network Experiment. Theoretically, OSI has been the answer to all networking needs. Now it will be put to the test. There will be stops and starts and problems. In the grander scheme, OSI is the right idea and the right path. However, caution never hurt anyone. Take time migrating to Phase V and don't hurry to implement a networking method simply because it exists. Prudence and planning go a long way in preventing a network migration catastrophe. ■

WORKSTATIONS

Taking Apart The DECstation 2100 And 3100

David W. Bynon

In the last few months we've witnessed a flurry of workstation announcements by Digital, Sun and Hewlett-Packard. Now, the war among the three workstation giants has settled a bit.

With offers of more processing power for fewer dollars, it's easy to catch the need-more-power bug. The super-mips-per-dollar offers from DEC and Sun, with their RISC workstations, make it difficult to choose between VMS compatibility and the ultimate power trip: speed.

While terminology may have changed during the last 30 years, Ken Olsen's vision hasn't. "From the beginning we have believed that computers should be tools that can be used by people who need information to do their jobs," he said. A key part of Olsen's vision is interactive computers that can be placed or distributed wherever they're needed.

You can look at Digital's offerings during the past decade and make a blanket statement that its computing strategy is VAX and networking. Digital's success and our love affair with the VAX and DECnet have convinced Digital and its customers that its computing strategy is the right one.

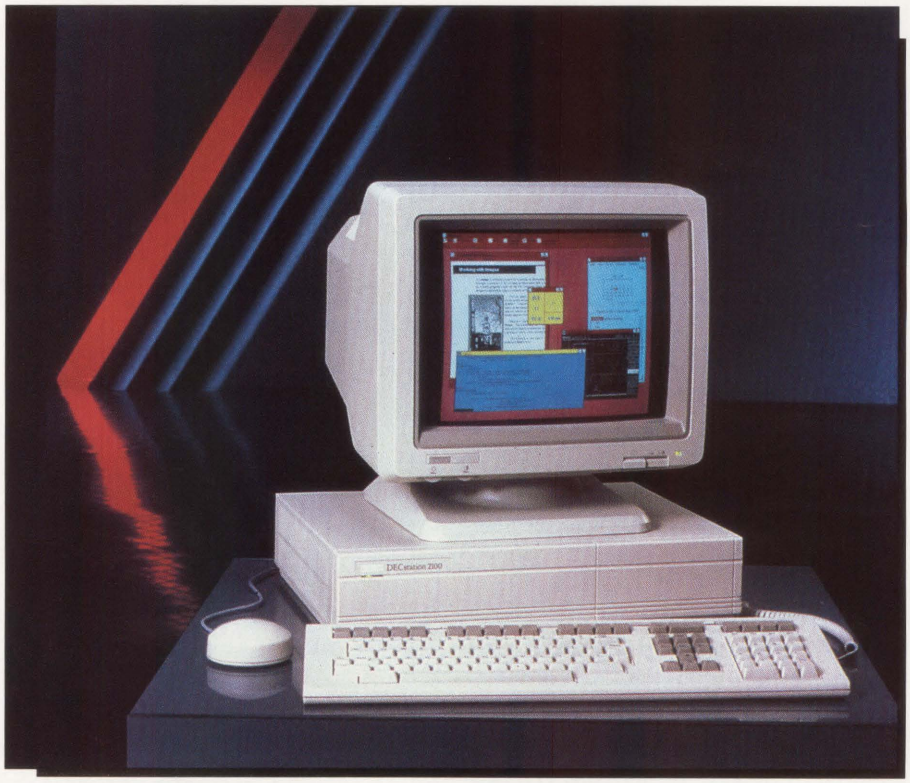
So why is the king of proprietary computer architecture using a foreign CPU in its workstations? Does this fit into the Digital computing strategy? Was the VAX really Digital's strategy or was it just its technology emphasis until a better technology was developed?

To fully understand, you must look at the design, function and purpose of the DECstation 2100 and 3100 and at how these workstations fit into the traditional Digital computing environment.

The DECstation 2100 and 3100 are virtually identical. They're designed around the Mips Computer Systems' R2000 CPU, R2010 FPU and the R2020 Write Buffers (i.e., memory controller) chip. The basic difference between the 2100 and 3100 systems is the system clock rate. The 3100 operates at 16.67 Mhz, while the 2100 has been slowed to 12.5 Mhz.

The Mips R2000 CPU has a unique design. The chip consists of two tightly coupled processing units in a single package. One processing unit is a 32-bit RISC processor, and the other is a system control coprocessor (CP0). The R2000 can operate with up to four tightly coupled coprocessors. In fact, the R2010 floating-point unit is the first external coprocessor (CP1). The two remaining coprocessor interfaces aren't used on the 2100 or 3100. It's reasonable to assume, however, that DEC will use this capability to develop multiprocessor RISC workstations with two or three R2000 CPUs in the near future.

The DECstations are single-board systems with two internal bus structures. One, a high-speed memory interconnect, interfaces the Mips chips with system memory, a disk buffer, a network buffer and a miscellaneous interface. The other is implemented via a control and status register (CSR) connected to the miscellaneous interface. The CSR is a simple 16-bit read/write register that contains the status of all workstation options (e.g., RTC, serial line interface and video controller) and controls the illumination of



The DECstation 2100 consistently outperforms Sun's entry-level SPARCstation 1.

LEDs. The CSR and system I/O options are buffered by the miscellaneous interface.

DECstation Memory

A great deal of the DECstations' performance is attributable to the Mips R2020 Write Buffers chip and how these systems interface with memory and DMA devices. The R2020 relieves the CPU of writing data from the data cache to main memory. The basic function of the R2020 is to capture data and addresses associated with a CPU output operation and to write that data to main memory.

Because the Mips R2020 Write Buffer can buffer high-speed write activity from the CPU, the processor appears to write to main memory without stalling. Until the Write Buffer fills, successive memory writes complete in six cycles. The peak memory write bandwidth is about 11.1 MB per second.

The memory system is optimized for minimum read latency. It can sustain a five-cycle read, permitting a peak read bandwidth of about 13.3 MB per second.

System memory is provided by double-sided, surface-mount, single in-line memory modules (SIMMs). The memory supports byte (8-bit), half-word (16-bit) and word (32-bit) operations, but there's no DMA-to-I/O device support. The operating system is required to copy data between device I/O data buffers and main memory. System memory support is 8 MB minimum, expandable in 4-MB increments to 24 MB.

The lack of DMA-to-I/O device support improves workstation performance for two reasons:

1. By making all I/O devices multiplex their I/O operations to a dedicated buffer, the operating system can coordinate I/O activity better. This is important in systems that are primarily compute-intensive.
2. By making the operating system copy data between the I/O data buffers and the user's memory data area, the caches never need to be flushed.

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Peripheral Interfaces

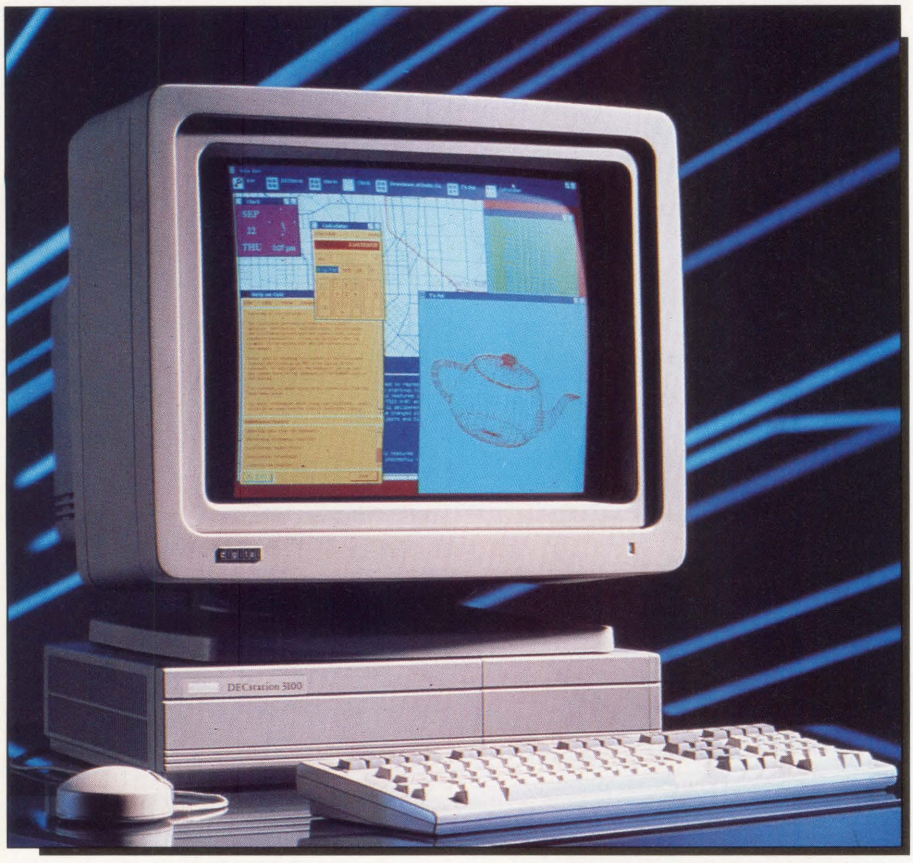
Data storage devices are interfaced with the DECstations via SCSI. The SCSI interface is a small daughterboard based on a gate array device called the SCSI Integrated Interconnect (SII). The SII implements and manages a standard SCSI interface that operates independently of the processor.

The processor monitors SII operations through the Control and Status Register. Processor-to-SII I/O occurs through a 128-KB buffer, to which the SII has DMA access. This SCSI buffer is connected directly to the High-Speed Memory Interconnect. The SII can sustain an effective read/write bandwidth of 2.8/2.4 MB per second. The interface is single-ended and supports a cable length of up to six meters. One to seven standard SCSI devices can be supported.

The Ethernet LAN interface is based on Digital's Local Area Network Controller for Ethernet (LANCE) chip. This interface was first introduced in the VAXmate PC but now is used in many applications. The LANCE is a microprogrammed device that implements a 10-Mbit-per-second link-level Ethernet protocol interface.

After it's programmed, the LANCE operates independently of the host processor. Like the SII, the LANCE interfaces with the processor through a buffer connected to the High Speed Memory Interconnect. The buffer is 64 KB and receives operating parameters and transfers and receives network packets. The effective processor-to-buffer bandwidth is 3.3 MB per second for writes and 4.8 MB per second for reads.

Like the VAXstation 2000 and 3100, the DECstation 2100 and 3100 have a four-line



The DECstation 3100 operates at 16.67 Mhz.

data communications interface that's compatible with Digital's "DZ" interface. Even though the four general-purpose serial lines are independent, two of the lines are dedicated to the keyboard and mouse. The two remaining ports are available via six-pin modular jacks for printers, modems or whatever. The ports support data rates between 50 and 9,600 bps.

The DECstation 2100 and 3100 are pure Digital. Most of the technology used to build these systems was hijacked from the VAXstation 2000 and 3100. This is good, because many components are interchangeable between these systems, which will help keep prices down.

Digital wanted the DECstations to blend in with the VAXstations, not overshadow them. They have a superior CPU capability, yet their functional capability as workstations is no better than the VAXstation 3100. In fact, to get high-performance 2-D and 3-D graphics, you have to look to the VAXstation 3520 or 3540.

Operating System Wars

For many potential DECstation buyers, the biggest controversy isn't about the power differential but the ULTRIX operating system. That the DECstations don't run VMS is a major stumbling block for many would-be purchasers.

However, this shouldn't be such a problem. The level of interoperability between VAX/VMS and ULTRIX workstations (VAX or RISC) is superb for two reasons: DECwindows and VMS/ULTRIX Connection software.

DECwindows lets ULTRIX and VMS workstation users access applications supported by host systems on the LAN, and VMS/ULTRIX Connection software adds NFS server functions and TCP/IP to the VMS environment. With VMS/ULTRIX Connection software running on a VAX/VMS system on the LAN, ULTRIX workstations can remote boot and transparently access both VMS and ULTRIX file systems.

Further, if you're a programmer, engineer or scientist, ULTRIX has a better set of program-development tools than VMS, such as Make, SCCS and the C compiler. Code-management tools and compilers are additional layered software products under VMS.

ULTRIX isn't a proprietary environment. It's Digital's entry in the "me too" open system platform category. ULTRIX is based on Berkeley Software Distribution (BSD) 4.2 with BSD 4.3 enhancements. It's compatible with hundreds of software programs written for the BSD environment and complies with the IEEE POSIX 1003.1 standard. Most applications written with the Portable C Compiler (PCC) run under ULTRIX.

Digital claims that its strategy with ULTRIX is to track the standards established by OSF and remain 100 percent OSF compliant. In the long run, this effort may force VMS out of existence, although that day is a few years down the road.

In terms of migration and compatibility, Digital traditionally has kept the customer's best interest in mind. There's no reason to believe that will change with the RISC-based workstations. In the next year, we should see a string of product announcements that will bring ULTRIX and VMS systems closer.

THE DECSTATION 2100, starting at $7,950, and the DECstation 3100, starting at $11,900, are bargains. They go head to head with recent Sun announcements.

Digital is on top of the price/performance game. The DECstation 2100 consistently outperforms Sun's entry-level SPARCstation 1 and is priced $1,000 less than the Sun workstation. On a higher scale, the DECstation 3100 outperforms the $59,500 HP 9000 Model 835 and performs on par with the $29,900 Sun SPARCstation 300.

With Digital's commitment to compatible systems and connectivity, the DECstation 2100 and 3100 are definitely worth the RISC. ■

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LET'S C NOW

Rex Jaeschke

VAX C V3 And The ANSI Standard, Part 1

Editor's note: In Part 1 of a two-part series, C Editor Rex Jaeschke discusses the most interesting new features provided in V3 of DEC's VAX C compiler.

After parallel VAXs were announced, the pressure was on to provide supporting development machinery. The parallel FORTRAN compiler and debugger were the first to ship. With C's increasing popularity within DEC and its customer base, support for C came next.

To produce "compiler-assisted loop decomposition," as it's called, a new compiler option /PARALLEL was added.

The idea behind parallel programming is to identify and isolate operations that can be done in parallel, i.e., asynchronously to each other. While it's preferable that the compiler do all the work, it's sometimes necessary or desirable that the programmer provide explicit assistance. When a task begins, the number of processors available is determined, and individual pieces of work are parcelled out to each available processor. (Each parallel process is sometimes called a thread.)

Ideally, the elapsed time for all threads to execute isn't greater than that needed to execute the same work in one serial thread. However, it can take longer if the overhead of establishing and managing the threads exceeds the savings parallel processing produces. While execution time may be significantly reduced, the size of the source code is always larger, sometimes very much so.

Consider the following simple program compiled with and without the /PARALLEL option:

```
main()
{
        void f(void);
        f();
}
```

The only difference in the generated code (/LIST/MACHINE) is that the parallel version contains the following instruction:

```
jsb     FOR$PAR_INIT
```

This routine performs the necessary initialization for spawning parallel threads. (As you can see by its FOR$ prefix, it's the same routine used by the parallel FORTRAN compiler.) Because this call adds code to your program and increases execution time, you shouldn't use /PARALLEL unless you need it. (It's also one reason you can't reliably call **main** recursively.) When most people move up to a parallel environment, they often want to exploit parallelism from existing programs that never were designed with parallelism in mind. For example:

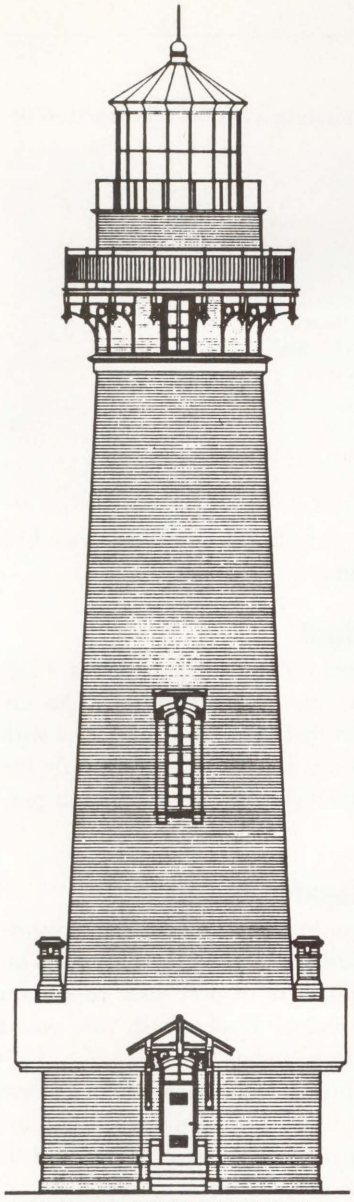
```
void f(int a, int *pi)
{
        int i[1000];
        int j;
                for (j = 0; j < 1000; ++j) {
                        i[j] += a;
                        pi[j] += a;

%CC-I-ADDRDEPENDENCE, Potential dependence
created by use of variable "pi" within the
expression that inhibited decomposition at loop
control variable "j".

        }
}
```

The compiler can make no assumptions as to where **pi** points, because there's no way to promise that a pointer isn't aliased to some other object. In this case, I suspect it always should be completely safe, because **pi** can never be pointing (reliably) into the array **i**, because **i** is a local, automatic array. As a result, the loop isn't decomposed. However, if the code is rewritten as follows, one of the loops can be decomposed:

```
for (j = 0; j < 1000; ++j)
       i[j] += a;

for (j = 0; j < 1000; ++j)
      pi[j] += a;

%C-I-ADDRDEPENDENCE, Potential dependence
created by use of variable "pi" within the
expression that inhibited decomposition at loop
control variable "j".

+---------------------------------+
|      Loop Decomposition Summary |
+---------------------------------+

For function "f" loops at the following lines
were decomposed: xx
```

When the /PARALLEL option is used, the .LIS file contains a report identifying which loops were decomposed, as shown.

Loops containing function calls also cause problems, because the compiler doesn't know whether asynchronous execution



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of the same function will be safe. For example:

```
void g(int a, int *pi)
{
        int f(void);
        int i[1000];
        int j;

        for (j = 0; j < 1000; ++j)
                i[j] = f();

%CC-I-NOTSAFECALL, Function "f" inhibited loop
decomposition at loop control variable "j".

}
```

This can be resolved by the programmer promising that the call is safe by using a **#pragma** directive as follows:

```
#pragma safe_call(f)

        for (j = 0; j < 1000; ++j)
                i[j] = f();
```

Inlining Functions

The compiler now can recognize that certain functions can be brought inline instead of generating a call instruction. Such functions must be contained in the same source file as the functions that call them. The criterion seems to be code size. If a function is larger than a certain size, it's never inlined. If smaller, it's in *every* place that it's called. If you call a function 10 times separately (not in a loop with 10 iterations), the code is duplicated 10 times. Watch out for "quiet" code explosion. However, the resulting code is faster, because the overhead of the function call is eliminated.

According to the VAX C developers, the number of times a function is called also is used in determining if code should be duplicated inline.

Inlining is the default, and you can switch it off by using /OPT=NOINLINE or, more drastically, /NOOPT.

The bad news is that on two occasions inlining has resulted in incorrect code generation for my programs. There always will be bugs, but these were disconcerting, because my test cases were very simple.

If a **static** function is inlined and its address isn't taken, there's no need to generate code for a standalone version of that function. It can't be called from outside its parent source file. However, whether an **extern** function is inlined or not, a copy of that function is kept in case the linker needs it.

Builtin Instructions

Quite a few VAX instructions are now directly available from C by using the new intrinsic, or builtin, functions. These include the ability to read and write any of the general-purpose register set and the PSW, as well as PROBER and PROBEW instructions.

An example of directly generating a MOVC3 instruction is:

```
#include <stdio.h>

#pragma builtins

main()
{
        static char name[30];

     printf("name contains: >%s<n",name);
     _MOVC3(10, "More Text", name);

/* movc3  #10,21(ap),(r6) */

        printf("name contains: >%s<n",name);
}
```

Builtins aren't enabled by default. To use them, you first must specify **#pragma builtins**.

Saving Preprocessor Output

Many preprocessors permit their output to be saved in a .I file, and VAX C now provides this capability. It still provides the same output in the .LIS file, but that output is interspersed with the original source code, whereas the .I file contains only the preprocessor output. The /PREPROCESS_ONLY option performs this task.

Non-Portable Warning Suppression

In previous releases it was disconcerting to get portability warning messages when the standard headers were processed. This was misleading, because if you were to port your code, you wouldn't take DEC's (non-portable) headers with you; you'd use the target's version of **stdio.h**, and so forth.

The problem was that the preprocessor knew nothing about standard versus non-standard headers. It treated them all as user-supplied headers. Now, a **#pragma** directive is provided to disable such messages. Look at **stdio.h** for an example.

As a result of this welcome change, the warning messages resulting from using /STANDARD=PORTABLE are all relevant, so there are no more excuses for not using this option.

Prior to V3 there were significant problems in the area of assignment-compatibility checking in prototypes. Pointers were treated as unsigned integers and therefore were treated as being compatible with arithmetic types.

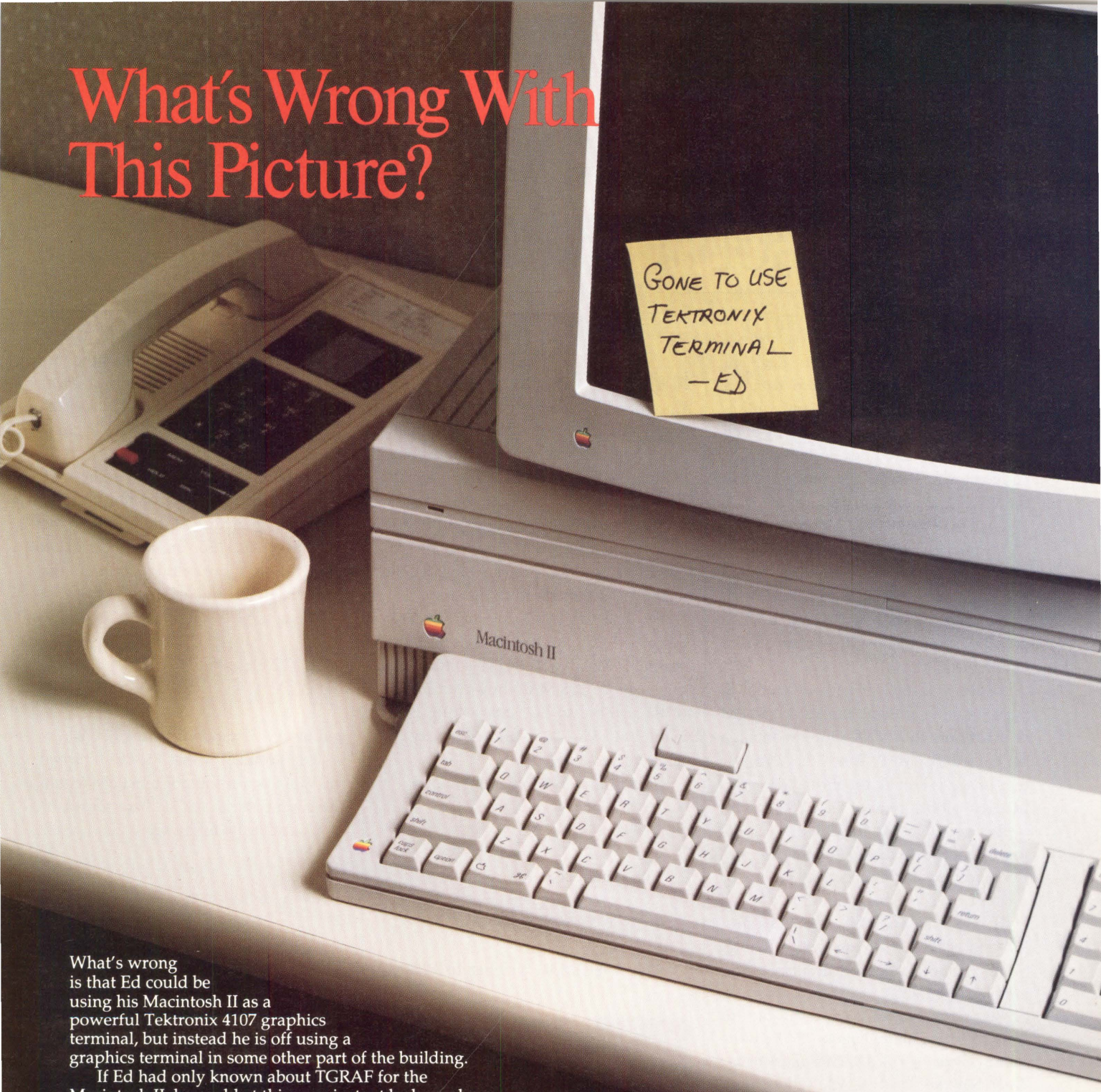
Also, mixing void and non-void pointers produced a compatibility warning that was incorrect. A **void** pointer is compatible with all pointers. Both problems have been fixed.

In Part 2, we continue our look at the VAX C compiler V3 and focus on its level of ANSI conformance.

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's DEC PROFESSIONAL*'s representative on the ANSI C Standards Committee and the U.S. international representative for ISO, as well as editor of* The Journal of C Language Translation*, a quarterly publication aimed at C implementers.*

What's Wrong With This Picture?



What's wrong is that Ed could be using his Macintosh II as a powerful Tektronix 4107 graphics terminal, but instead he is off using a graphics terminal in some other part of the building.

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Grafpoint, a leader in Tektronix terminal emulation, now has a powerful 4107 software emulator for the Macintosh II. TGRAF for the Macintosh is a comprehensive emulator that supports all the display features of a Tektronix 4107 terminal in both asynchronous (RS-232-C) and networking communication environments.

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DCL DIALOGUE

Raiders Of The Global Symbols

Kevin G. Barkes

Although DCL can return a great deal of system data via calls to its lexical functions, some information can't be obtained easily by such straightforward methods. Sometimes it's convenient to look at a specific location in the VAX's memory and perform the DCL equivalent of BASIC's PEEK command.

Fortunately, DCL provides this capability through the EXAMINE command and the F$FAO lexical function. The trick is knowing where to look in memory to get this data and how to extract it in a usable form.

Unless you inadvertently deleted it in a space-saving crusade, the SYS$SYSTEM directory on your VAX should contain a file named SYS.MAP. When the VMS system image is linked, the virtual addresses of each global symbol in SYS.OBJ are written to SYS.MAP. In addition to a listing of addresses, the file contains cross-references to all entities that set up or reference each global symbol.

If you aren't a VMS internals guru, looking at SYS.MAP can be frustrating. Some symbol names are familiar, others are indecipherable.

"Rosetta Stones" are available to translate these hieroglyphics. Perhaps the best is *Version 4.4, VAX/VMS Internals and Data Structures* and its V5.0 addendum, available from Digital Press. These hefty tomes provide keen insight into the operation of VMS and have an extensive listing of SYS.MAP's global symbols and their meanings.

For a fictional approach to VMS innards, see "The Hitchhiker's Guide To VMS" by internals wizard Bruce Ellis in *VAX PROFESSIONAL, DEC PROFESSIONAL*'s sister magazine. This new series, which began in the June 1989 issue, provides a user-friendly overture to VMS' dark secrets.

In English, Please

Consider this scenario: You're writing a system management-related command procedure and need to know the amount of available memory on the free-page list. You could direct the output of the SHOW MEMORY command to a disk file, read it back in and extract the required value. You prefer to extract the information directly from memory.

By studying SYS.MAP and the VMS internals book, you discover the global symbol SCH$GL_FREECNT contains this information. SYS.MAP shows the address of the symbol to be %X80004018. (This is for VMS V5.1-1 — addresses vary for different versions.)

You issue the command:

```
$EXAMINE/DECIMAL %X80004018
```

The system responds with:

```
80004018:  0000004535
```

The /DECIMAL qualifier to EXAMINE converts the contents of the memory location to a decimal value, which shows that there are 4,535 pages of memory on the free-page list. This is great, but you can't get the value from EXAMINE directly into the procedure command stream.

Although not documented in the *DCL Dictionary*, the F$FAO lexical function also can examine memory locations using the !AD directive. (For more information about $FAO's capabilities, look in the System Services documentation.)

We enter:

```
$ WRITE SYS$OUTPUT
   F$FAO("!AD",4,%X80004018
```

and the VAX responds with gibberish.

The problem is that F$FAO returned the value as a string not precisely within the bounds of the ASCII character set.

Consider the following:

```
$ TEST[0,4] = 65
$ WRITE SYS$OUTPUT TEST
A
```

We've placed the value 65 into the

FIGURE

Symbol	VMS 5.1-1 Description Address	
SYS$GW_BJOBCNT	%X800044C4	Current number of batch jobs
SYS$GW_BJOBLIM	%X800082E0	(SYSGEN) Batch job limit
SYS$GW_IJOBCNT	%X800044C0	Current number of interactive users
SYS$GW_IJOBLIM	%X800082DE	(SYSGEN) Interactive user limit
SYS$GW_NJOBCNT	%X800044C2	Current number of network jobs
SYS$GW_NJOBLIM	%X800082E2	(SYSGEN) Network job limit
SCH$GL_FREECNT	%X80004018	Current number of free pages

Examples of information available by direct memory examination.

symbol TEST. When we write the symbol, we get the uppercase letter A, which is ASCII code 65 decimal.

We need to do more conversion. This is performed easily with the F$CVUI lexical function, which extracts bit fields from character-string data and converts the extracted value into an unsigned integer.

When we try our example, we get:

```
$ WRITE SYS$OUTPUT F$CVUI(0,16,TEST)
65
```

When we plug in the "peek" from SCH$GL_FREECNT, we get:

```
$ WRITE SYS$OUTPUT -
F$CVUI(0,16,-
F$FAO("!AD",4,%X80004018))
4535
```

A few caveats are in order. The size of the free-page list varies constantly. When you look at it using the lexical call and then compare it with a SHOW MEMORY command, the values are different, because your process is running the SHOW program, which uses more memory than the lexical call. Unless you have your VAX to yourself, other processes also affect memory use continuously.

If you include these "peeks" in your command files, be aware that changes in VMS versions result in shifts in the addresses of the global symbols. When you install a new version of the operating system, you may have to update all the command files containing global symbol references.

And when you send your buddy on V4.7 a tape of your nifty procedure written under V5.x, he'll doubt your sanity.

The Figure contains interesting symbols useful in writing system management-oriented procedures. The values of all SYSGEN parameters ar accessible in this manner, and their use is limited only by the procedure writer's imagination.

Rummaging through SYS.MAP and the internals book can be entertaining, and finding symbols with a useful DCL application can be rewarding. Grab your cowboy hat and whip, and do some exciting VMS archaeology.

FOR AN "I Love DCL" sticker or a listing of all FidoNet public BB systems in the U.S. featuring 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 St., Library, PA 15129.

The list also is available on-line from my SYS$OUTPUT BB 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.*

PRODUCTS

Teamwork 3.1 Supports CASE Industry Standards

Cadre Technologies Inc. announced release 3.1 of its Teamwork product family. Teamwork 3.1 advances object-oriented analysis and design technology and enhances support of CASE industry standards.

Teamwork generates requirements traceability matrices from the Teamwork Project Database. It lets you map requirements onto analysis models, design models, and code and test information stored in the Teamwork Project Database. Cadre's Unified CASE offering covers support for the embedded systems development lifecycle. With requirements traceability matrices, projects can document traceability throughout the development lifecycle. Teamwork 3.1 is available on all workstation platforms from DEC, Sun, IBM, HP and Apollo.

Teamwork 3.1 will be shipped free to Teamwork maintenance subscribers.

For more information, contact Thor Johnson, Cadre Technologies Inc., 222 Richmond St., Providence, RI 02903; (401) 351-5950.

Circle 437 on reader card

CPlex Upgrades Linear Programming Software

CPlex Optimization Inc. announced V1.1 of its linear programming software products. The CPlex Linear Optimizer is a general-purpose linear program solver. CPlex Callable Library and CPlex Interface Source let you empower custom applications with the CPlex 1.1 solver routines.

CPlex 1.1 is an implementation of a piecewise linear variant of the Simplex method. Written in C, it's available on many platforms. The CPlex Linear Optimizer is accessed through an interactive user interface. Linear programs can be entered interactively from a terminal or workstation or read from MPS files. CPlex Callable Library object code modules can be called from user-written C or FORTRAN. CPlex is available on VMS or ULTRIX, IBM mainframes and PCs and compatibles, Sun and Mips workstations and Cray-2, Y-MP and X-MP supercomputers.

CPlex Linear Optimizer license fees range from $1,400 to $34,000. The CPlex Callable Library and Interface Source options cost an additional $600 to $7,000, depending on platform.

For more information, contact Todd Lowe, CPlex Optimization Inc., 7710-T Cherry Park, Ste. 124, Houston, TX 77095; (713) 550-9763.

Circle 438 on reader card

Tektronix Launches X Station Series

Tektronix Inc. announced monochrome and color graphics display stations that wed Tek's network terminal capabilities with the X Window System. The color XN11 and monochrome XN5 X Stations are alternatives to workstations for users who don't need desktop applications processing.

The XN11 is compatible with more than 100,000 applications written for Tek's 4211 Netstation and 4111- and 4200-series terminals, including the plot 10R software family. The XN11 features VT200 compatibility and an optional IBM 3179G coax interface. Connectivity options let the XN1 and XN5 fit into heterogeneous computer environments that include workstations, minicomputers, mainframes and supercomputers. An Ethernet TCP/IP LAN interface and RS-232C host port are standard. The XN11 includes two RS-232C peripheral ports, a Centronics parallel port and an RGB output port.

The XN11 in standard configuration costs $7,495. The XN5 costs $2,795.

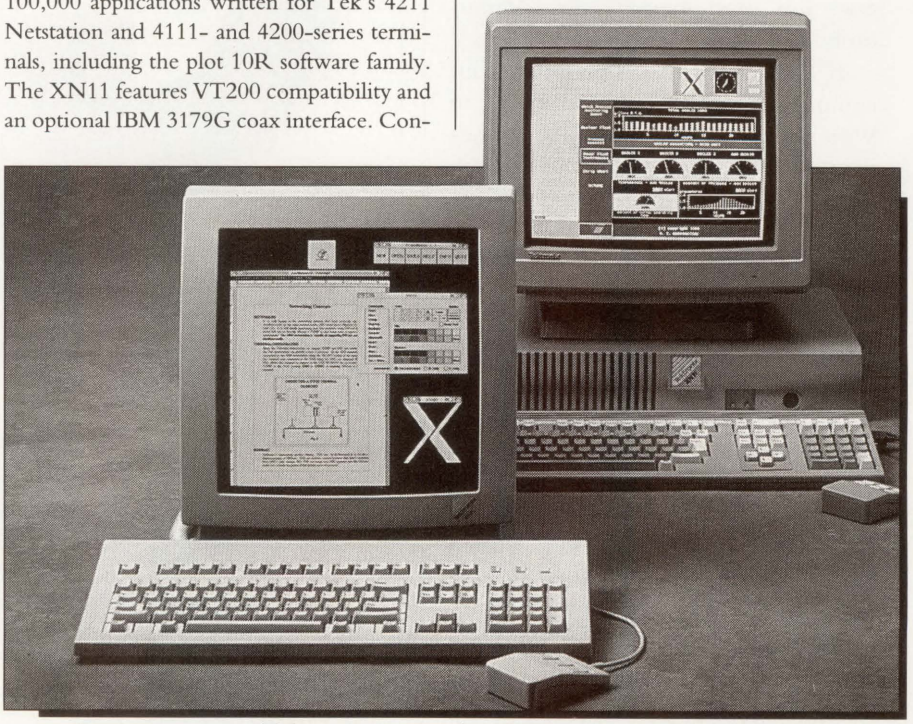
For more information, contact Donna Loveland, Tektronix Inc., P.O. Box 1000, MS 60-380, Wilsonville, OR 97070; (503) 685-2838.

Circle 415 on reader card

Synchronize Offers X-Based Organization

CrossWind Technologies Inc. announced Synchronize, a multiuser office automation software package based on the X Window System standard. The product is a graphics-based personal and multiuser time-organization tool.

A multiuser appointment calendar displays commonly available time slots for selected group members and resources, schedules and



Tektronix Inc.'s color XN11 and monochrome XN5 X Stations.

confirms meetings, highlights recent updates and automatically schedules recurring events. A to-do task list automatically adds regular tasks and carries over incomplete tasks to the next day. A work diary maintains a record of time usage for later review, billing purposes or status reports. Pop-up notes allow you to keep and communicate information regarding meeting topics or tasks.

Synchronize is priced at $100 per user.
For more information, contact Chris Knudsen, CrossWind Technologies Inc., 6630 Hwy. 9, Ste. 201, Felton, CA 95018; (408) 335-4988.

Circle 439 on reader card

Spock Information Station Queries Oracle

Dynamics Research Corporation (DRC) announced the Spock Information Station. The product is designed to be a complete, centrally located natural language processing workstation. It incorporates Spock software, DRC's natural language query and reporting software for Oracle databases running on VAXs.

The Spock Information Station lets users in a workgroup enter queries for Oracle in English. The information instantly is retrieved for display, printing or filing. There's no need to know a specialized query language or the arrangement of the databases. Spock software allows for easy customization for any application. The product is made up of Spock software bundled in a 386 PC/AT-compatible with 4 MB of RAM, a 387 coprocessor, a 1.2-MB floppy, a 40-MB hard disk, an EGA color monitor and the Spock Oracle Data Accessor software that runs on the VAX. The system runs on MS-DOS 3.3.

The packages costs $8,949.
For more information, contact John Ragosta, Dynamics Research Corp., 60 Frontage Rd., Andover, MA 01810; (508) 475-9090.

Circle 449 on reader card

Edison Software Systems Bundles Tape Utilities

Edison Software Systems announced the total compatibility of its line of tape utilities — Convert 4.0 and Image 1.3 — with the new Trap Tape Management System.

The Trap System consolidates Edison's product line to cover all aspects of tape handling in the DEC environment. It features menu-driven screens and gives the operation manager total control of the tape library. Convert is designed for DEC-to-IBM magnetic tape conversion, reading/writing standard IBM labels on a VAX. Image allows for tape-to-tape copying of any tape on a VAX, including the copying of savesets and VMS backups regardless of parity errors or bad blocks. Convert and Image can be included in the Trap System as menu items. They're also available separately.
For more information, contact Edison Software Systems, P.O. Box 211, Metuchen, NJ 08840; (201) 906-1321.

Circle 450 on reader card

Gescan V3.7 Reads From Wire Services

Gescan International Inc. announced V3.7 of its Gescan full text retrieval system that includes an option for reading information from wire services, identifying topics of interest and instantly alerting users to information entering an information system from any source.

Gescan accepts input directly from wire services following the ANPA wire service transmission guideline and standard government message formats including DOI 103, Janap 128 and ACP 127. It has enhanced optical character reader (OCR) interfaces. Other features include a new report generator for faster generation and printing of reports and added capability for defining report formats; improved manipulation of search results including new sort functions and display formats; and improved OCR software for faster loading of hardcopy documents into a database. Gescan V3.7 is available for DEC systems running VMS V5.1.

The product is priced from $25,000 to $40,000, depending on CPU.
For more information, contact David Morris, Gescan Int'l Inc., P.O. Box 12599, Research Triangle Park, NC 27709; (919) 460-3100.

Circle 451 on reader card

XL/Doc Creates Formatted Documents

Index Technology Corporation announced a document generator that automatically creates formatted documents that meet a variety of government and business documentation standards directly from Excelerator, the company's systems analysis and design product.

XL/Doc creates production-quality documents that conform to the DoD 2167A standard, a series of documentation and specification requirments for software-development contractors. XL/Doc eliminates manual formatting of 2167A documents by automatically extracting data directly from the dictionary of Excelerator/RTS. It includes such features as boilerplate text insertion, automatic

paragraph numbering, table of contents generation, external file inclusion and automatic table creation. It's tightly integrated with the excelerator dictionary to ensure consistency. It can be customized to conform with other government standards.

XL/Doc costs $7,900.

For more information, contact Victoria Bundonis, Index Technology Corp., 1 Main St., Cambridge, MA 02142; (617) 494-8200.

Circle 440 on reader card

InterLan Makes LAN Manager TCP/IP-Capable

InterLan Inc. announced that it has extended Microsoft's LAN Manager with TCP/IP transport software for DOS and OS/2. Available for PC AT/XT and MicroChannel architectures, it supports PC workgroup resources sharing and adds connectivity to departmental operating systems such as VMS and UNIX system using TCP/IP protocols.

It provides a range of TCP/IP services for LAN Manager, including Telnet, FTP, SMTP and Sockets. This protocol suite eliminates the need to add non-standard protocols. Workstation, workgroup and departmental PCs using LAN Manager are interoperable with SMB servers for UNIX, XENIX and VMS provided by SCO and Interconnections Inc. InterLan supplies bundled versions of LAN Manager. These packages include the LAN Manager operating system and TCP/IP transport software for DOS or OS/2. TCP/IP transport software also may be purchased separately.

The bundled LAN Manager operating system costs from $995 to $2,195.

For more information, contact Richard Henkus, InterLan Inc., 155 Swanson Rd., Boxborough, MA 01719; (508) 263-9929.

Circle 441 on reader card

MGS Software's Mvi Assists In UNIX Training

MGS Software announced Mvi, an editor for VAX/VMS systems that offers the full functionality of the industry-standard vi text editor for UNIX. Mvi, which is fully compatible with the UNIX vi editor, supports VMS V4.x and V5.x.

Mvi reduces training costs for migration from VMS to UNIX by letting you train users on the Mvi editor before migrating to UNIX. It expands an existing VAX/VMS system's editing variety by accommodating a diverse group of users. In addition to the standard features of the UNIX vi editor, Mvi provides on-line help, visual YANK and DELETE commands (text is displayed in reverse video) and file selection from the file argument list using arrow keys. Mvi features system crash file recovery capability and supports all UNIX vi commands, including line-mode commands.

Prices start at $795 for a VAX workstation and $995 for a MicroVAX. Cluster licenses cost $4,495, and site licenses cost $6,995.

For more information, contact Michael Sullivan, MGS Software, P.O. Box 742945, Dallas, TX 75374; (214) 558-2412.

Circle 443 on reader card

Accent R 4GL Offers 3GL Within SQL Database

National Information Systems Inc. announced V11 of the Accent R 4GL and DB-Mach2 RDBMS. This version expands the capabilities of Accent R, a high-productivity environment for developing applications that features a 3GL within an open SQL database architecture. DB-Mach2 is a hybrid relational database

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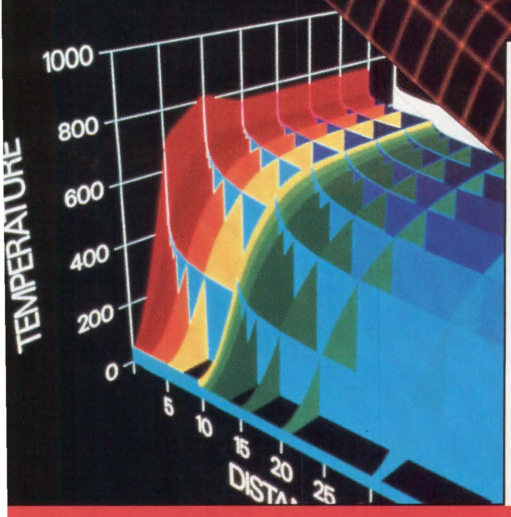

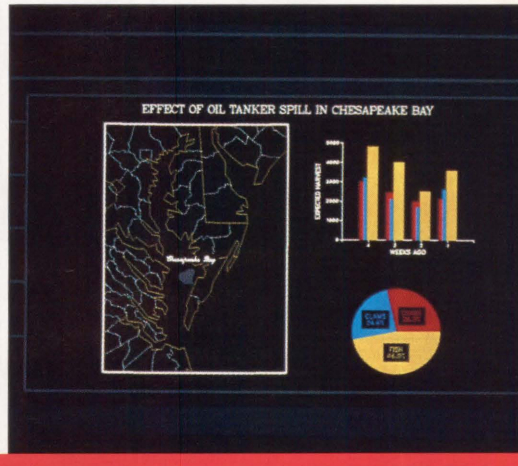

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CIRCLE 188 ON READER CARD

product that seamlessly supports RMS files and high-performance indexes within the open architecture of Accent R.

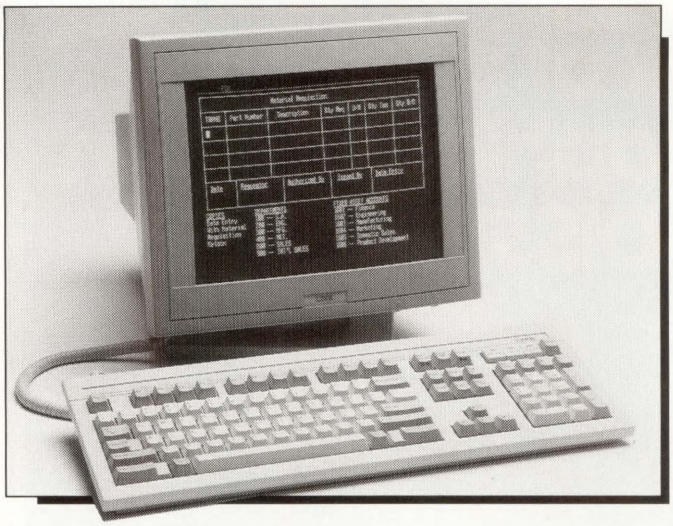
In Accent R V11, the compiler for the SPL is optimized to boost the execution speed of the code and provide a library capability for shared logic segmentation. SPL statements are compiled to machine code that executes close to that of COBOL and FORTRAN in CPU usage when tested with similar benchmark suites. SPL can be coded directly as a procedural language by the developer as well as generated by the 4th Generation Tools. The resultant generated code has been designed and commented to facilitate ease of modification for developers.

For more information, contact Dave Wagner, National Information Systems Inc., 1190 Saratoga Ave., San Jose, CA 95129; (408) 985-7100.

Circle 452 on reader card

MC2 Features Fast Video Refresh Rate

Link Technologies Inc. announced the MC2 multiple emulation video display terminal.



Link Technologies Inc.'s MC2 multiple emulation video display terminal.

The MC2 is a general-purpose ASCII terminal that features a high video refresh rate and a high-resolution character cell.

The MC2 employs Link's video circuitry to provide improvements in display presentation. The unit uses a 14-inch flat screen and features a 78-Hz screen refresh that completely eliminates screen flicker. The display uses high-resolution characters in a 10 x 13 cell. Function keys are fully programmable and stored in non-volatile memory. The use of proprietary VLSI-based electronics improves reliability and functionality without increasing cost. The MC2 is designed and tested to comply with all domestic and international regulatory requirements. It's certified to meet the requirements

of FCC class A, UL, CSA and VDE, among others. The product is priced at $409.

For more information, contact Link Technologies Inc., 47339 Warm Springs Blvd., Fremont, CA 94539; (415) 651-8000.

Circle 442 on reader card

Oracle Runs On The Ncube 2 Scaler Supercomputer

Oracle Corporation announced Oracle for Ncube 2. The Ncube 2 scalar supercomputer is designed to deliver thousands of transactions per second on large configurations when combined with Oracle. Smaller configurations are designed to reach 1,000 tps.

Oracle's parallel server architecture allows multiple copies of the DBMS software and its tools to run simultaneously on many central processors, sharing the total workload and cooperating in handling user requests for transaction and database services. Thousands of Ncube 2's processors can run Oracle simultaneously with almost linear increases in system performance as processors are added. Up to 60,000 mips can be harnessed. The processors can cooperate in accessing more than 500 billion characters of information. You can access Oracle on Ncube 2 from UNIX running on Ncube 2 or on networked smaller computers connected to Ncube 2 via an Ethernet LAN and TCP/IP. Interfaces are planned that allow direct access from IBM mainframes and DEC minicomputers.

Shipments are planned for the first quarter of 1990.

For more information, contact Ed Kramer, Oracle Corp., 20 Davis Dr., Belmont, CA 94002; (415) 637-0800

Circle 411 on reader card

SuperCluster Improves Processing Power

Paracom Inc. announced SuperCluster, a parallel processing supercomputer based on the Inmos Transputer chip. The SuperCluster series starts with a 64-processor system and 800 mips/120 Mflops performance. With no centralized internal bus structure, throughput bottlenecks are eliminated.

SuperCluster features a hierarchically oriented cluster architecture. A cluster can be a local collection of interconnected processing resources that process information and communicate with other clusters or peripheral devices via dedicated, assignable communication links. The basic subunit of SuperCluster is its Computing Cluster (cc), designed around 16 T800 Transputers operating at 25 MHz, and a Network Configuration Unit (NCU) for control of internal link configurations. Each unit can be partitioned to handle Paracom's standalone systems or up to 16 workstations via bus bridges for IBM PC XT/AT and PS/2, Mac II, Sun3/4, VMEbus-based systems, Q-bus and other bus structures.

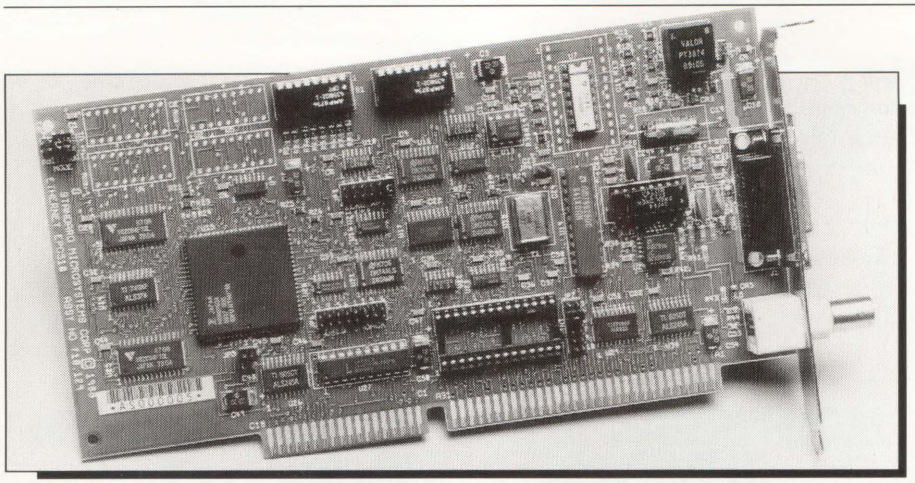
A 64-node SuperCluster costs from $336,500.

For more information, contact Randy Cochran, Paracom Inc., Bldg. 6, Unit 60, 245 W. Roosevelt Rd., W. Chicago, IL 60185; (312) 293-9500.

Circle 444 on reader card

SCO's Grafkit V3.1 Supports DECwindows

SCO Inc. announced Grafkit V3.1, which features new and faster color fill routines, improved gray-scale rendering, enhanced



Standard Microsystems Corp.'s Ethernet-PC510 controller board.

surface and contouring routines, new and enhanced device drivers and documentation updates.

In V3.1, color fill is available for polygons, mapping and contours. Gray-scale rendering has been added when color-filled areas are displayed on PostScript printers. The surface function now provides user-controllable scaling of output plots, allowing visual comparison of information in different images. Contouring has been enhanced for individual contour line color control. V3.1 supports major operating systems and platforms from DEC and Sun, including VMS V5.0, ULTRIX V3.0 and SunOS V4.0. Grafkit and Grafkit's GKS support the DECstation 3100. Support for windowing systems, including DECwindows and SunView, has been added or enhanced. HP LaserJet and DEC LJ250 and LA210 drivers have been improved to optimize software rasterization, decreasing the time required to translate a CGM into a device-specific datafile.

For more information, contact Leslie Ross, SCO Inc., 740C S. Pierce Ave., Louisville, CO 80027; (303) 666-5400.

Circle 446 on reader card

Ethernet-PC510 Uses I/O Mapping

Standard Microsystems Corporation announced an Ethernet controller board, the SMC Ethernet-PC510. It's designed around the Fujitsu EtherStar chip, which contains the intelligence that usually is supplied by a local processor, including the board's controlling functions and functions that manage the on-board buffer memory.

The Ethernet-PC510 uses I/O mapping, which enables the board to operate with high-speed PCs. I/O mapping eliminates the overlapping address problem installers often encounter because of multivendor cards. Additional flexibility is provided by an EEPROM that allows the network address to be modified via software. The product is compatible with

Ethernet and Thin Ethernet and provides flexibility by operating in 8-bit (PC/XT and compatible) and 16-bit (PC/AT and compatible) modes. It provides 10-Mbps CSMA/CD operation. All board components are surface-mounted.

For more information, contact Standard Microsystems Corp., 35 Marcus Blvd., Hauppauge, NY 11788; (516) 273-3100.

Circle 465 on reader card

DCME-M31 Upgrades VAXstation 3100

Clearpoint Research Corporation announced a series of VAXstation 3100-compatible memory upgrades in 8-, 12- and 16-MB stackable array cards. The DCME-M31 series allows users maximum flexibility to configure Model 30 and 40 systems to a total of 16, 20, 24 or 32 MB.

Model 30 users can preserve their initial investment in DEC's 4-MB array cards by using them in conjunction with Clearpoint's 8- and 16-MB array cards. The DCME-M31 series connect to the VAXstation 3100 CPU board using DEC's factory-installed connectors and are customer-installable.

Prices are $5,400, $7,200 and $9,600 for the DCME-M31/8MB, DCME-M331/12MB and DCME-M31/16MB respectively. Quantity discounts are available. Clearpoint memory products are supported by a lifetime warranty and 24-hour replacement policy.

For more information, contact Greely Summers, Clearpoint Research Corp., 35 Parkwood Dr., Hopkinton, MA 01748; (508) 435-2000.

Circle 436 on reader card

BBN Software Products' CQC Analyzes Data

BBN Software Products Corporation announced a quality-control package, CQC software for shop-floor quality analysis, to complement its RS Series of data analysis software and provide real-time tracking of process parameters in manufacturing applications. CQC software runs on VAX/VMS. It's an option to RS/1 data analysis and graphics software.

CQC is designed for use with Comets, a factory-floor data collection and management system from Consilium Corporation. Within five seconds after collection, CQC analyzes, makes trend rule comparisons and displays out-of-spec data. It has a bi-directional interface so that, following analysis, CQC results can be sent back to Comets for corrective action. CQC has more than 30 routines for generating a basic library of control charts. These routines can be extended by the user with BBN's RPL Toolkit, a fourth-generation programming language toolkit that simplifies code management and quality software procedure development.

For more information, contact Lynn Hearl, BBN Software Products Corp., 10 Fawcett St., Cambridge, MA 02238; (617) 873-8108.

Circle 493 on reader card

5800 Series Of Array Processors Offers Speed Increase

FPS Computing announced the 5800 Series of array processors. It offers four times the performance of the FPS 5000 Series.

The FPS 5800 Series delivers a base performance of 48 Mflops. When fully configured with three arithmetic coprocessors, it delivers peak performance of 102 Mflops. For large problems, it supports up to 2.5 Mwords of directly addressable system memory. Mul-

tiple FPS 5800s can be configured to operate in parallel. The 5800 Series is code-compatible with FPS array processors Models AP120B, 5100, 5200, 5300 and 5400, so existing FPS customers can move their applications intact. FPS I/O processors and math coprocessors plug directly into the 5800 Series. The FPS 5800 Series interfaces with Q-bus, UNIBUS and VAXBI bus systems.

Prices start at $83,250.

For more information, contact Terry Pennington, FPS Computing, 3601 S.W. Murray Blvd., Beaverton, OR 97005; (503)641-3151.

Circle 475 on reader card

ST3220 Withstands Industrial Environments

Digital Electronics Corporation (DeeCO) announced the ST3220 SealTouch terminal. This Full Pixel Drawing Graphics, VT100 text-emulation, NEMA 4- and 12-rated touch-screen terminal is designed to withstand industrial environments.

The ST3220 uses an Intel 80186 as its main processor and couples 640 x 400 Electroluminescent display technology with DeeCO's interactive IR touch system in a sealed cast aluminum case. The main terminal processor and the graphics processor provide fast response times for host communications, graphics processing and touch response. The VT100 terminal emulation provides full-screen 80-character x 25-line text display. The graphics processor provides high-level drawing capability on two pages of internal video memory. A sliding viewport can be moved along these contiguous video memory pages, allowing flexibility in the information displayed and worked on in background mode.

The product is priced at $4,950.

For more information, contact Bill Lepior, Digital Electronics Corp., 31047 Genstar Rd., Hayward, CA 94544; (415) 471-4700.

Circle 455 on reader card

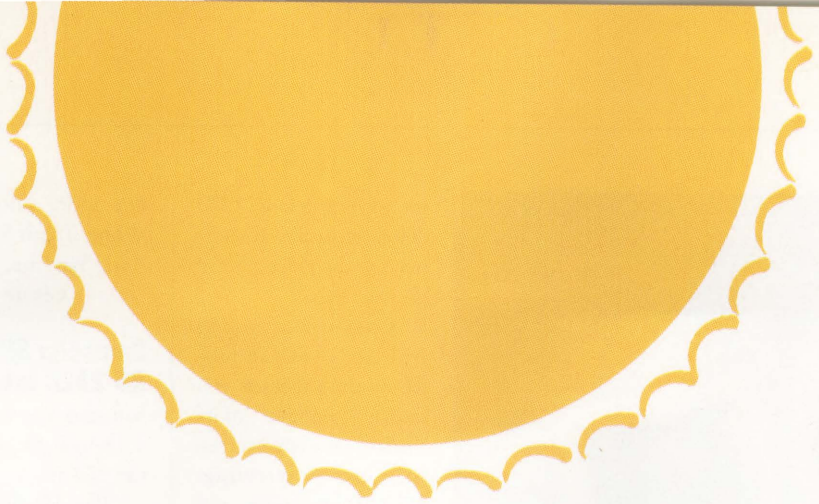
Pro-Guard Monitors VAX And MicroVAX

Electronic Service Specialists Ltd. (ESS) announced Pro-Guard, standalone software that proactively monitors error conditions on VAX and MicroVAX/VMS systems.

Pro-Guard is designed to maximize system uptime and reduce mean-time-to-repair, maintenance costs, service calls and system outages. The proactive software has applications for self-maintenance and third-party maintenance companies. Pro-Guard interrogates a system's CPU and peripherals for errors or degradations. It lets systems managers set alarm parameters based on error level or error rate. The program also provides flexibility in custom command or program execution for each device monitored. This lets you tailor Pro-Guard to take actions after a predetermined error threshold has been reached. Pro-Guard is designed for VAXs using VMS V4.0 and later. It's available on 1,600-bpi nine-track magnetic tape or TK50 tape cartridges.

For more information, contact Keith Patterson, Electronic Service Specialists Ltd., N92 W14612 Anthony Ave., Menomonee Falls, WI 53051; (414) 255-4634.

Circle 456 on reader card



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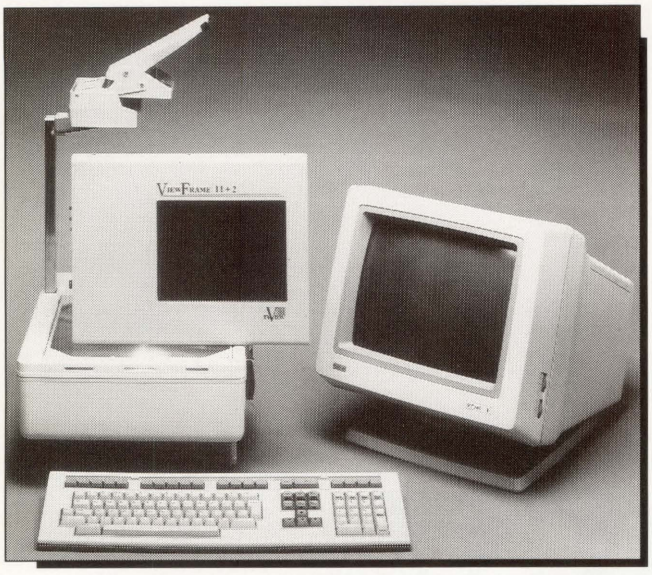

nView Corp.'s ViewFrame II+2 LCD projection panel.

Unitronix Simplifies JiT Functions

Unitronix Corporation announced the Praxa Synchronized Manufacturing Planning & Control System. Synchronized Manufacturing is designed to simplify and gain control over repetitive, mixed-mode JiT and job shop functions, streamlining operations and production output for manufacturers upgrading from traditional work-order and paper-driven manufacturing techniques to JiT.

The new Praxa system enables repetitive and mixed-mode manufacturers to adopt JiT techniques while continuing their manufacturing methods without interruption. It's modularized into two applications: Praxa rate-based production scheduling and Praxa synchronized shop floor control. Praxa synchronized manufacturing is a significant addition to the company's VAX and MicroVAX-based Praxa manufacturing resource planning (MRP II) system. Praxa MRP II integrates financial, manufacturing and distribution applications into one on-line system. It provides an integrated solution for multicompany, multisite environments.

For more information, contact Barbel French, Unitronix Corp., 1021 Centennial Ave., Piscataway, NJ 08854; (201) 981-1600.

Circle 447 on reader card

ViewFrame II+2 Displays Mainframe Information

nView Corporation announced an updated version of its ViewFrame II+2 LCD projection panel that's compatible with the VT220 monochrome and VT340 color terminals. It connects to the video port of popular PCs.

Used in combination with an overhead projector, the panel lets you display computer information on a large screen for group viewing. VT220/340 users can display mainframe computer information. A composite input jack lets the VT220 be used with the panel. A video interface board gives the VT340 an external jack to project computer-based presentations. The ViewFrame II+2 displays colors on the VT340 as eight true shades of grey. The circuitry allows simultaneous use of the resident monitor and the panel. The panel can be used with rear-screen projection systems. The product works with terminals from DEC, Apple, AT&T, HP and IBM.

For more information, contact Bob Brown, nView Corp., 11835 Canon Blvd., Newport News, VA 23606; (804) 873-1354.

Circle 462 on reader card

Model E Provides Ethernet Interface

Esprit Systems Inc. announced LANTerm Model E. The Model E provides an Ethernet interface to access and locally process PC applications over LANs while providing host computer communications through VT100 emulation.

The Model E uses an IEEE 802.2- and 802.3-compliant 10-Mbps Ethernet interface designed by Esprit. Unlike other diskless PCs, which must have an Ethernet card inserted in a bus slot, the integrated LANTerm design allows for direct linkage between the Ethernet controller and the V40 CPU without the need for interfacing through the system bus. This linkage allows for buffering of up to 64 KB of network information through dynamically allocated system RAM. This shared memory method of host RAM access is faster than programmed I/O and direct memory access. The Model E includes diskless boot support for running Novell NetWare O/S software products.

The LANTerm Model E costs $1,195.

For more information, contact James M. Wong, Esprit Systems Inc., 2115 Ringwood Ave., San Jose, CA 95131; (408) 954-9900.

Circle 457 on reader card

Samsung SD-50 Features RS-232C Interface

Samsung Electron Devices America Inc. offers a 14-inch flat-screen video display terminal, the SD-50.

The SD-50 features a 14-inch diagonal non-glare display in green, amber or white paper. It features a 24-line, 80-character display format, including a user-selectable 25th status/setup line. The character formation is a 7 x 7 matrix in a 9 x 12 cell, with two dot descenders. The character set is 96 ASCII characters, 16 graphic symbols and 32 control character symbols. It features blink, blank, reverse video, underline and half-intensity.

The SD-50 offers an EIA RS-232C interface with an optional 20mA current loop RS-422 interface, as well as a printer/auxiliary port. It provides conversational, half- or full-duplex, local-edit, black-setup, monitor and self-test modes.

For more information, contact Samsung Electron Devices America Inc., 14251 E. Firestone Blvd., Ste. 101, La Mirada, CA 90638; (213) 802-8425.

Circle 453 on reader card

VP-3 Operates At 150 Mflops

Star Technologies Inc. announced the VP-3, an addition to its Vector Processor (VP) Series. Operating at speeds of up to 150 Mflops, the VP-3 is designed for real-time and compute-intensive applications.

The VP-3 is the most powerful of the VP Series, an expandable family of high-performance array processors that offers a performance range of 50 to 150 Mflops. The VP Series lets you configure a system to your performance requirements. Attached to general-purpose hosts, VP Series processors offload and process the compute-intensive portions of vector problems, performing floating-point operations such as convolutions and 2-D Fast Fourier Transforms. The VP Series connects to a range of hosts, including DEC (UNIBUS, Q-bus and VAXBI), IBM and Sun. VP Series processors can be attached simultaneously as shared resources to up to three dissimilar hosts.

For more information, contact Helen Ryan, Star Technologies Inc., 515 Shaw Rd., Sterling, VA 22170; (703) 689-4400.

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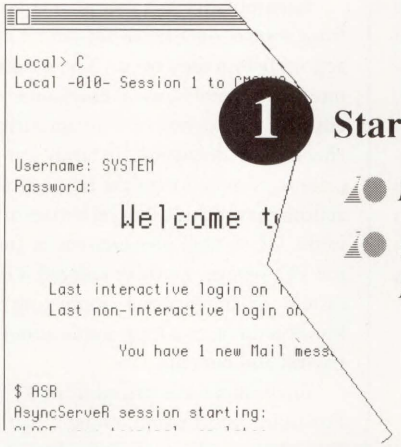

1

Start AsyncServeR on your VAX™

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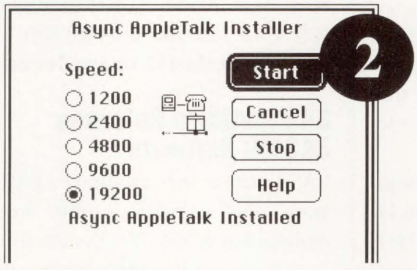

2

Activate AsyncServeR on your Macintosh™

- *Start it with our Desk Accessory*
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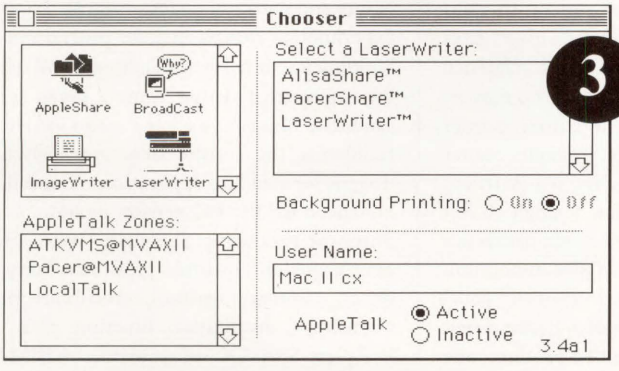

3

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NCD16 Display Station Supports DECnet

Network Computing Devices Inc. announced support for DECnet communication protocols in its NCD16 X-based Network Display Station, allowing the NCD16 to access and display data from VAX hosts running DECwindows under VMS or ULTRIX.

Called NCDnet, this capability is a software option to the NCD16. NCDnet provides a complete set of DECnet-compatible services, allowing the NCD16 to participate as a DECnet Phase IV end node over Ethernet or serial data links. Serial communication is handled using DDCMP, which operates over direct RS-232 connections or high-speed modems. NCDnet also supports communication via CTERM to provide a single terminal-emulation session over DECnet to a remote host. This can be used for starting a DECwindows Session Manager or Window Manager or for communicating with hosts without X or DECwindows support.

The NCDnet option is priced at $200.

For more information, contact Judy Estrin, Network Computing Devices Inc., 350 N. Bernardo Ave., Mountain View, CA 94043; (415) 694-0650.

Circle 461 on reader card

Honeywell Announces Mass Storage System

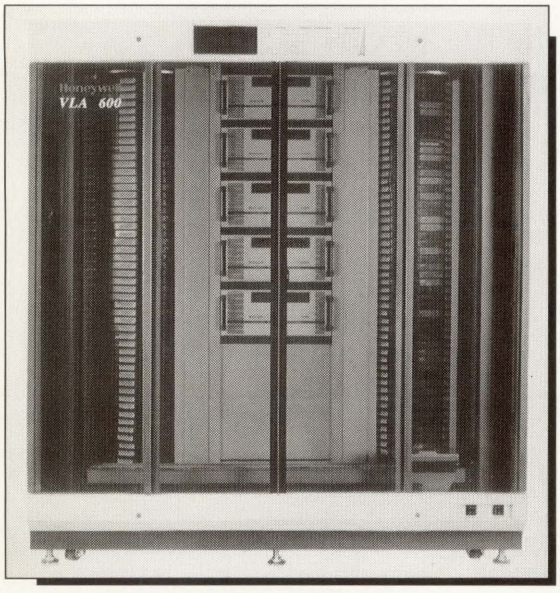
Honeywell Inc. announced a multiterabyte data storage system using videocassette recording media. The Very Large Archive/Very Large Archive Server (VLA/VLAS) uses Honeywell's Very Large Data Store (VLDS) drive, a high-performance robotics assembly and VME-based controller, and can store more than 3,000 GB. The VLA provides storage capacity equal to more than 18,000 reels of 6,250-bpi nine-track tape.

The VLDS drive has a storage capacity of 5.2 GB on a single T-120 videocassette and provides a sustained transfer rate of up to 4 MB per second. The robotics assembly used in the VLA can store and retrieve 600 cassettes, with a worst-case access time of eight seconds. The VLAS offers archive services in a standard network environment. It uses industry standards (VME bus, SCSI bus, UNIX, Ethernet, TCP/IP) in its architecture.

The VLA with 600-cartridge robotics assembly, universal control and two VLDS tape drives costs $524,900. With four VLDS drives it costs $599,000.

For more information, contact Susan Wright, Honeywell Inc., Test Instruments Div., Denver, CO 80217; (303) 773-4581.

Circle 476 on reader card



Honeywell Inc.'s VLA/VLAS data storage system.

Precision Image Enhances Plotters

Precision Image Corporation announced two firmware features, plot composition and paneling, that enhance the capabilities of the company's line of large-format electrostatic plotters.

Plot composition lets you collect drawings d-size or smaller and plot them simultaneously on a single sheet of d- or e-size paper. Plot composition also lets you select your choice of cutting reference marks in auto random sizes and auto fixed sizes modes. Types of cutting reference marks available include no corner, ell corner, triangle corner, border and combination triangle corner and border. Paneling is a firmware feature that splits a single CAD drawing file into e-size panels according to desired plot dimension. Panel overlap and automatic panel labeling are provided. E-size panels can be combined to produce one plot of up to 12.8 feet. Paneling is standard with all new orders and to all maintenance program customers.

For more information, contact Gary Hughes, Precision Image Corporation, 501 Chesapeake Drive, Redwood City, CA 94036; (415) 366-8900.

Circle 445 on reader card

Encumbrance Controls Funds Allocations

Ross Systems Inc. announced its new Encumbrance Accounting system. Designed to meet the accounting requirements of government agencies and not-for-profit organizations, the Encumbrance system is a specialized extension of Ross' Renaissance series, a set of accounting applications and tools providing seamless integration of Ross and third-party VAX applications into a single environment.

Encumbrance lets you maintain strict up-front control over funds allocations and transactions before they occur. The systems is fully integrated with Ross' Renaissance modules, ensuring that all transactions automatically are checked to determine if funds are available prior to completion of the transaction. Transactions may include journal entries originating in the GL system, procurement requests from the PO system, invoices entered into the PA system or transactions originating in other business or accounting applications such as payroll and benefits.

Encumbrance is priced from $10,000.

For more information, contact Laura Olson, Ross Systems Inc., 1860 Embarcadero Rd., Palo Alto, CA 94303; (415) 856-1100.

Circle 463 on reader card

SAS Institute Releases SAS/QC Software

SAS Institute Inc. announced SAS/QC software, the statistical quality improvement component of the SAS System for the PC.

The release includes tools for experimental design and statistical quality control. Tools for experimental design include procedures for building fractional factorial designs and selecting an optimal design from a given set of candidate points as well as a menu system for facilitating the construction and analysis of designs for standard applications. Capabilities enhanced for the PC version include procedures for producing Shewhart charts, histograms, quantile-quantile plots, capability indexes, summary statistics, probability plots, cumulative distribution function plots and P-P plots. SAS/QC software runs on IBM PS/2, PC AT and compatibles under PC-DOS and MS-DOS.

First-year license fees for SAS/QC software cost from $395 for one workstation to $7,500 for 500 workstations.

For more information, contact Hilary Yeo, SAS Institute Inc., SAS Circle, Box 8000, Cary, NC 27512; (919) 467-8000.

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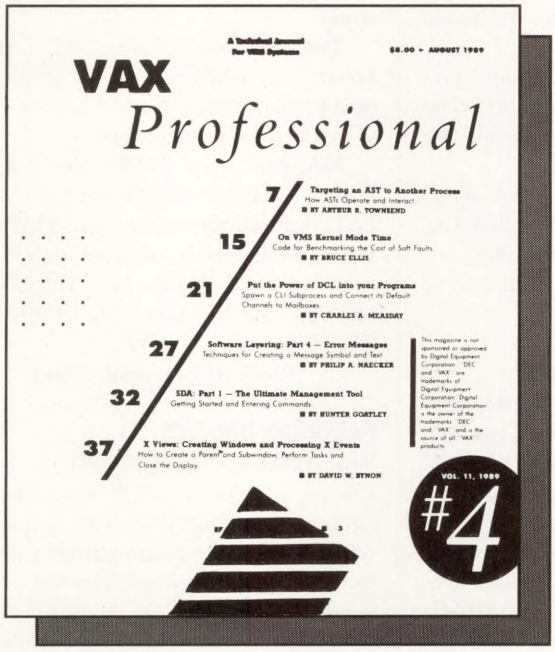
Deadline: November 30, 1989



VAX PROFESSIONAL, the technical journal for VMS systems, wants to consider your paper on ***SOFTWARE SECURITY*** for publication. Describe in a 200- to 500-word outline:

- Your software security problem
- The steps you took to solve it
- The reasons for taking those steps
- The benefits from your solution
- A description of the software you wrote to implement the solution

The ***VAX PROFESSIONAL*** Review Board will select the top three ideas for publication in the *April* 1990 issue. Its members comprise:

- an expert in system management and connectivity
- a manager of software systems programming
- a DCL expert
- a senior software engineer
- a manager of operating systems development
- the computer facility director at an Ivy League university

Winners will be notified by mail:

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2ND PRIZE — $750
3RD PRIZE — $500

Submit your outline to:
Karen Detwiler , Managing Editor
VAX PROFESSIONAL
101 Witmer Road
Horsham, PA 19044

Include your name, address, company and a daytime phone number. To obtain a copy of the ***VAX PROFESSIONAL*** author's guidelines and programming guidelines, call Karen Detwiler at (215) 957-1500.

Simpact DBS Software Uses MicroVAX

Simpact Associates Inc. announced its Q17000 Data Broadcast Switch (DBS) software that lets a MicroVAX computer serve as the basic building block for a self-configuring, store-and-forward data broadcast network. A single transmission request from any terminal on the network can send large data files to many destinations.

A Data Broadcast Switch consists of a MicroVAX computer, the DBS software and up to eight of Simpact's Intelligent Communications Processor (ICP) boards running X.25 or ADCCP protocol software. The standalone version of DBS software is targeted for small networks consisting of a single switch connected to 32 PC-based terminals communicating via X.25 at 19.2 Kbps. DBS software is configured to support a network of 255 destination terminals but can be expanded to handle up to 3,000.

A software license for the standalone version of DBS software costs $10,000. The large-network, multinode version costs $15,000 per DBS.

For more information, contact Jack Buell, Simpact Associates Inc., 9210 Sky Park Ct., San Diego, CA 92123; (619) 565-1865.

Circle 479 on reader card

ADC V7 Provides Configuration Management

Software Maintenance and Development Systems Inc. announced the Aide-De-Camp (ADC) software management system V7. ADC provides configuration management and full lifecycle support for software development.

ADC is available on a range of vendor systems of any CASE tool, including VAX/VMS and ULTRIX systems and the DECstation 3100. Support for managing binary and any other non-ASCII files is a new feature. Binary libraries can be managed either inside or outside an ADC database, enabling fast and reliable build procedures. With control of binary files, ADC automatically performs full or incremental builds for a development organization. ADC can track any binary, object, data or library file on a version-by-version basis. It offers enhanced support for parallel development paths, integrated problem report management, automated build procedures and software structural scanning. Improved management reporting facilities enable better software project tracking.

For more information, contact Mary Cole, Software Maintenance and Development Systems Inc., P.O. Box 555, Concord, MA 01742; (508) 369-7398.

Circle 464 on reader card

Xyplex's Three Options Expand Server Line

Xyplex Inc. announced three options for integrating terminals, printers and terminal server management services for MAXserver.

MAXman provides a host-independent centralized management solution for loading, configuring and monitoring communication servers. You can plug MAXman into a MAXserver chassis to provide VAX-independent server operations.

The MAXserver Network Printer Card provides a high-speed parallel printer port for MAXserver. Network nodes that support TCP/IP and LAT communication protocols can access and share printers across the network.

The MAXserver 16-port LAT Terminal Server Card supports the LAT protocol. It doubles the density of a MAXserver chassis from 120 to 240 connections.

MAXman costs $3,995, the Network Printer Card costs $1,295 and the 16-port LAT Terminal Server Card costs $1,995.

For more information, contact Kathleen Coleman-Goodwin, Xyplex Inc., 330 Codman Hill Rd., Boxborough, MA 01719; (508) 264-9900.

Circle 467 on reader card

RoboMon Handles VAX System Management

Computer Information Systems Inc. announced RoboMon VAX/VMS system software. Designed for system managers and operations staff, RoboMon takes on routine system-management tasks and carries out actions based on system events and conditions.

RoboMon can detect subtle changes in system conditions and take user-defined actions before problems occur. It lets VAX managers create their own rules, defining conditions they're looking for and actions they want to take. A range of CPU, device and process information can be tested. Actions range from sending information to a user or terminal to executing a user-defined DCL procedure. A variety of routine tasks can be delegated to RoboMon, as well as activities involving security, performance and operations issues. RoboMon provides central management and control in a distributed network.

RoboMon costs from $750 to $15,000.

For more information, contact Computer

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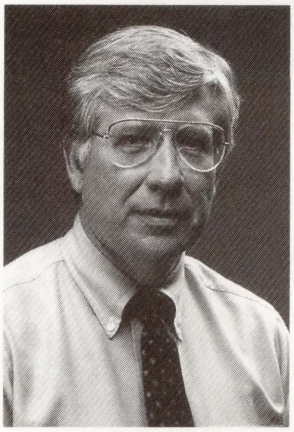

graphics workstations, application software, color printers/plotters, monitors, image processors and other associated products.

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CIRCLE 370 ON READER CARD

Information Systems Inc., 120 Wells Ave., Newton, MA 02159; (617) 527-1550.

Circle 448 on reader card

Silicon Graphics Expands IRIS Power Series

Silicon Graphics Inc. announced computer systems that expand its line of IRIS Power Series systems.

The Power Center 4D/280 is an eight-processor system offering 160 mips and 28 Mflops sustained performance. The systems are based on a 62-inch-high 19-inch rack-mount computer system chassis and include eight 25-MHz CPU/FPUs. They are designed primarily as servers. The IRIS 4D/210, the midrange member of the Power Series, delivers 2 mips and 3.3 Mflops performance. The IRIS 4D/210 is based on a single 25-MHz CPU/FPU. The IRIS Power Series is available in graphic workstations and computer servers. Based on the Mips R3000 CPU, it uses Silicon Graphics' PowerPath multiprocessing architecture and runs IRIX, the company's symmetric multiprocessing implementation of UNIX.

The Power Center 4D/280 is priced at $172,500. The 4D/210S is priced at $54,900, and the 4D/210GTX is priced at $94,900.
For more information, contact Silicon Graphics Inc., 2011 N. Shoreline Blvd., Mountain View, CA 94039; (415) 960-1980.

Circle 480 on reader card

Deft V4.0 Supports Popular RDBMS Products

Deft announced V4.0 of its CASE products for RDBMS engineers, which offers multiuser capabilities and support for popular RDBMS products. It uses AppleTalk to access a LAN-based repository that can be housed on a Mac or VAX/VMS system.

V4.0 supports Oracle, Rdb, Sybase, Informix, DB2 and Ingres V6.x. It lets you choose with which RDBMS you want to work. Pop-up menus let you choose the correct data type for each attribute, and you can choose the relevant index structure from those supported by the chosen database. It supports specific design alternatives provided by each database and allows automatic conversion from one choice to another. You can complete a design for an RDBMS and change the design by choosing another RDBMS. Deft automatically converts the data types and index structures defined in one RDBMS to those in the other.

Deft is priced from $2,900 to $29,000, depending on configuration.
For more information, contact Eric Goldman, Deft, 557 Dixon Rd., Ste. 111, Rexdale, ON M9W 1H7; (416) 249-2246.

Circle 471 on reader card ■

Digital Products

■ DEC's enhanced software for management and integration of engineering design data includes EDCS II data revision control software, which manages and controls engineering data in a variety of applications, and DECview3D integration software, which lets you integrate and share engineering designs (2-D and 3-D wireframe) among different applications and technical documents (text and graphics) under CDA.

EDCS II provides a configurable review manager that can establish relationships among files and documents in a user-defined hierarchical structure. DECview3D will merge and enhance baseview V1.2 with internal tools to provide an application for viewing, manipulating, analyzing and annotating engineering designs on DECwindows workstations and terminals.

■ DEC's VAX Message Router Telex (MR-Telex) gateway is a component of DEC's MAILbus electronic messaging products. It lets users of DEC's electronic mail products exchange messages from their mail accounts with any telex machine worldwide.

Users of electronic mail capabilities within ALL-IN-1, for example, can connect directly with the public telex network. MR-Telex interfaces with the Hasler Telex unit provided by Hasler Ltd. This hardware device connected to the VAX converts information to telex format and transfers it to the public telex network for distribution. It accepts telex information from the telex network, converts it to ASCII text format and, without operator intervention, sends it to MR-Telex for distribution to users' electronic mail accounts. MR-Telex also can be accessed from non-DEC systems connected to a MAILbus network.

■ DEC and Eastman Kodak Company will work to market a fast PostScript network printer. Under the agreement, part of DEC's CMP, they'll offer DEC customers high-volume, quality networked printing with the Kodak Ektaprint 1392 printer model 24.

The printer is designed for applications printing 200,000 to 1.5 million pages per month at speeds of up to 92 images per minute. It offers direct Ethernet connection and integration with DEC's computing environment. It supports enterprisewide publishing applications that generate PostScript PDL output, such as DECwrite, DECpage, VAX Document and Interleaf.

■ DEC announced a security program with products and services targeted at the government marketplace. These include new members of the TEMPEST family, removable media and security software.

Among the TEMPEST products are TEMPEST versions of the VAXstation 3100, MicroVAX 3800, MicroVAX 3600 and VAX 6000 Model 300. Also included are a TEMPEST VT320, DECserver 200, Laser Printer, Removable Disk Drives, Ethernet Interface and a Zenith TEMPEST PC-to-TEMPEST Ethernet Interconnect.

The RF30 and RF71 RSEs and the RA70 Removable Storage Array offer security and flexibility. The RF71 and RF30 allow expansion by using a common canister. Up to three RSE pedestals can be connected to a system for up to 900 MB using RF30s and 2.4 GB using RF71s. The RA70 connects to HSC, KDA, KDB and UDA controllers and provides up to 4.48 GB of removable storage.

VMS/SES V5.1 extends B1 functionality to the full range of VAX processors. SES V5.1 is a combination of SEVMS V5.1 and SES that brings licensed software and documentation the services of a DEC consultant. The consultant installs SES V5.1 software, assesses security operations and trains systems managers and users.

For more information, contact your local DEC sales office or call (800) DIGITAL.

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Our new WY-185 is fully compatible with DEC's VT320. But it also gives you everything that you wanted in the VT320—and didn't get.

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Of course you also get advanced design and ergonomics—plus a lower price. In short, all the things that have made Wyse both the leader in DEC compatibles and the number one independent terminal maker.

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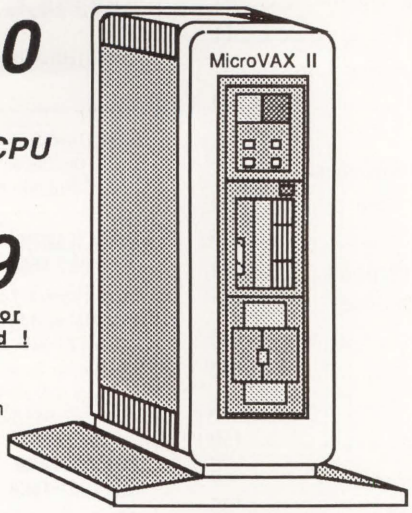

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BACK END

John C. Dvorak

Computer Stores In The Parallel Universe

A few years ago I was shown the entrance to the parallel universe by a Parallel Universe Negotiating Kommittee (PUNK) agent. My job was to compare the computer technologies of the parallel universe to ours. I've been there maybe a dozen times. The fascinating thing about the parallel universe is that it's just like our universe, only different.

Recently, I went there again, this time to check out computer stores. I arrived at San Francisco's Embarcadero underground MUNI light rail station. The empty train with the blue disk in the window came right on time. I signaled the engineer by holding up one finger on my left hand and two on my right, while jumping once. A set of doors opened quickly. I hopped in as the train took off, leaving the others behind at the station. We soon zipped onto a siding and headed toward the secret station under Chinatown.

Moments later I entered the doorway to the parallel universe. For some reason, the door leads to a downtown parallel Cleveland car rental agency. I rented a Zombie ZX-800, the "in" car in the parallel universe, and headed for the biggest chain of computer stores.

The stores there weren't much different from those in our universe. The guys wore three-piece suits and didn't want to wait on anyone. I wandered around a stark store with carefully planned workstations, each containing a high-priced system. No one waited on me until I sat in a cubicle and typed on a keyboard.

"Excuse me!" said a salesman abruptly. "Don't you see the Do Not Touch sign?"

"I just wanted to see how this keyboard felt. I've been looking for a new keyboard for my PC. Do you have replacements?"

"Why do you need a replacement? Is yours broken? You can go to the parts department and order an exact replacement. They cost about $300." He pointed to a sign that said Parts and Service. The guy there was using a huge screwdriver to pry open an office phone.

"You miss my point. My keyboard is fine. I want something that feels better, that's all."

"That's mail-order stuff. We don't do that. Maybe you should leave." He pointed to the door.

"Well, maybe I can get some magazines while I'm here."

The salesman rolled his eyes. "There's the rack over there, the cashier will take care of you. I have customers to deal with." He pointed again.

I looked around — there weren't any customers. There wasn't a cashier, either. Nonetheless, I meandered over to the magazine rack and found a mish-mosh of old magazines. I went to the cashier's counter and rang the small bell there. A head poked out of a paneled door behind the counter and said, "Someone will be right with you." I could see into the back room — all the salespeople were sitting there playing cards! A few seconds after the door slammed shut I heard grumbling. "He's your customer." "But he's not buying anything." "Tell him to get lost then." "You do it!" "I did the last one."

Suddenly, the head popped out again. "He'll be right with you." Soon that same grumpy salesman was pushed out of the back room.

"I thought I told you to have the cashier take care of the magazines!"

"What cashier? Besides, all those magazines are old. Where are the new ones?"

"We don't carry them anymore. They have too many ads for mail order. It ruins our business."

"Ruins your business? You don't carry much stuff here."

"The mail-order houses sell Bloated 1- 2-3 at a discount and offer no support. We can't afford to sell it at a discount with the kind of support we give. Besides, nobody reads magazines anymore, especially now that stores have trained personnel. It isn't like before when people had to learn about stuff in a magazine." He raised his eyebrows as he saw someone come in with (speak of the devil) a copy of Bloated 1-2-3.

"Can I help you?" asked the salesman.

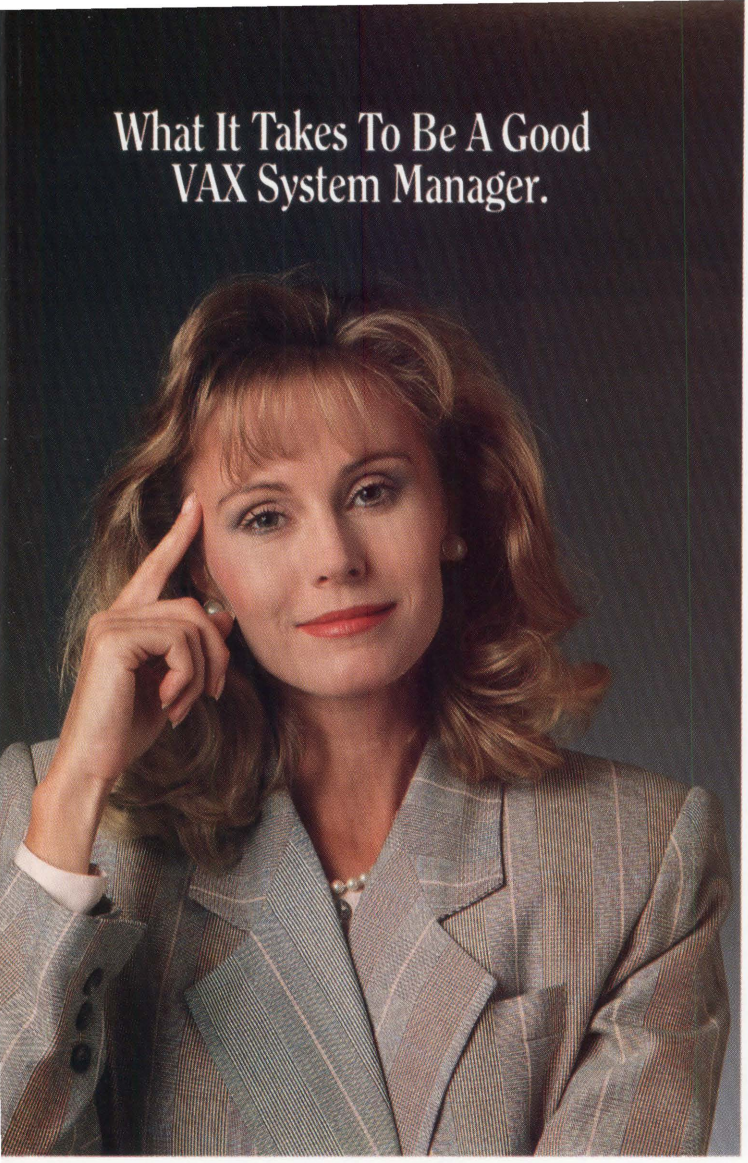
"This is a bad copy. It only boots after I turn the machine on and off over and over." He handed the disk to the salesman.

The salesman looked up. "Have you checked your parallel and serial port adapters?"

"Huh?"

"Go home and check them. If that doesn't help, there's nothing we can do. You'll have to get the manufacturer to help you."

As the twosome began to argue, I sneaked out of the store and back into the real universe. I suppose if there's anything universal in the galaxy, it's computer stores and their salespeople. Oh, yes — used-car dealers are the same everywhere, too. ■



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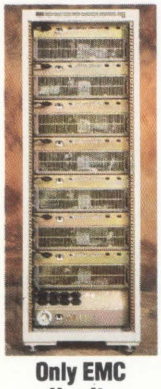

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