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JUNE ■ 1989

DEC Professional

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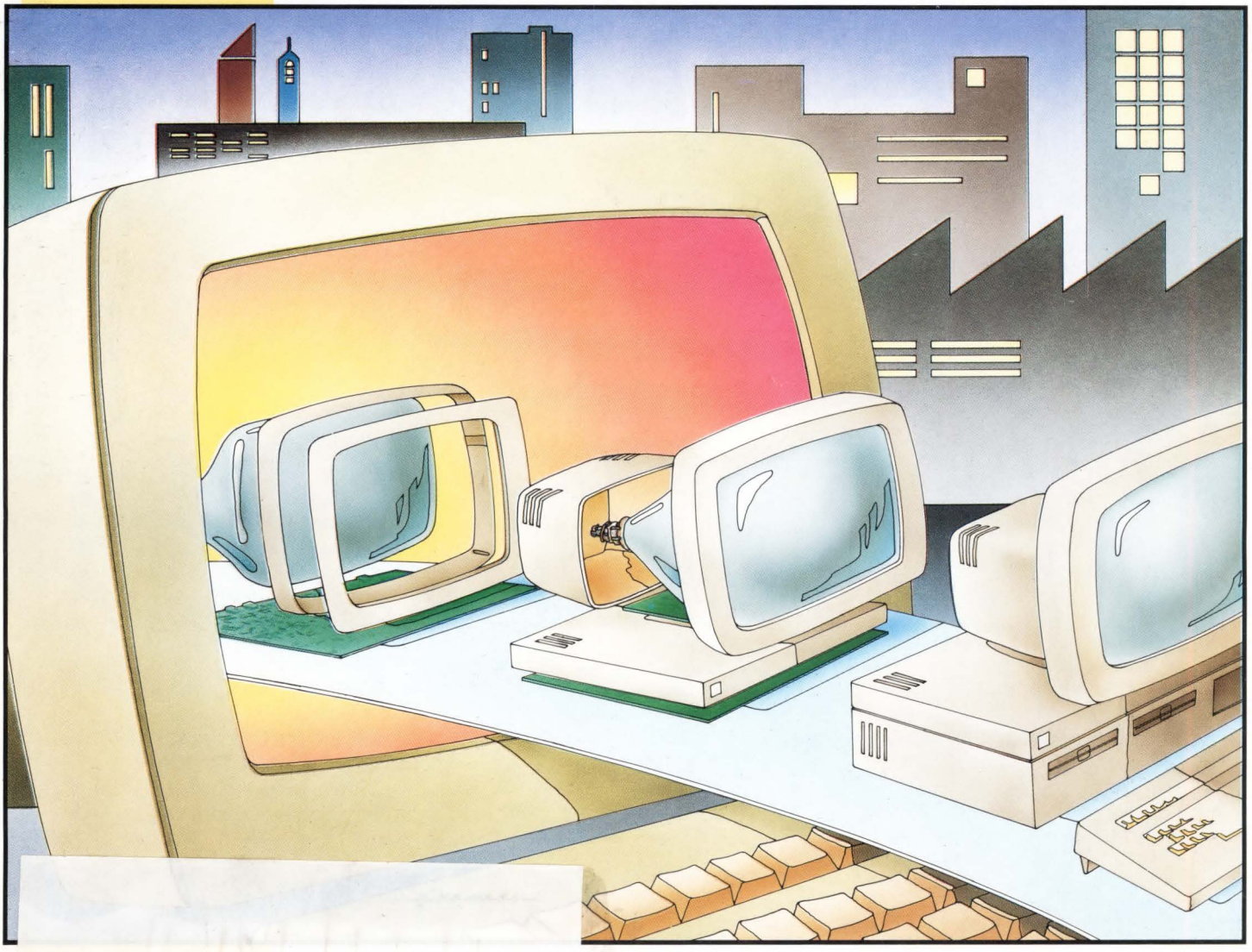

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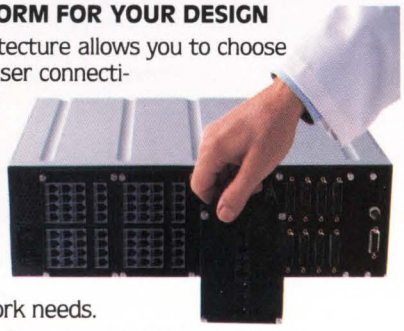

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CIRCLE 107 ON READER CARD

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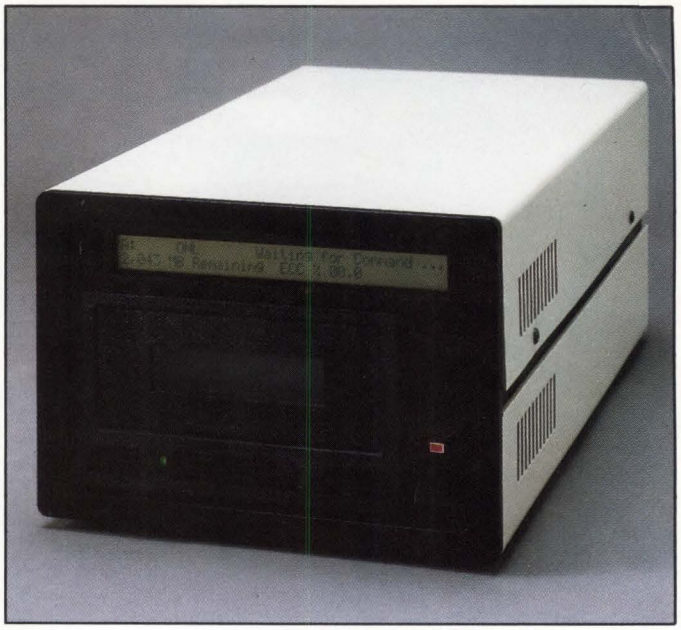

If you are using Pertec standard nine track tape drives for backup, you should consider moving to the new 8mm standard. Now it's easy to add all the benefits of Helical Scan Technology to your existing system, without special software drivers or additional controller cards. The CY-8200 interfaces to your Pertec compatible tape drive or controller as another nine track tape drive -a very fast, high capacity tape drive.

The new 8mm standard delivers performance. The CY-8200 gives you 2.3 gigabytes of formatted capacity per tape, making unattended backup a reality. With transfer rates of up to 15 megabytes per minute, backup is very fast.

The new 8mm standard delivers real cost savings. Each 8mm tape can replace 10 to 20 reels, at a typical cost of $10 per tape. Considering the number of reels you purchase each year at $15 or more, you can save thousands of dollars in media costs alone. Add the increased productivity of operators freed from mounting reels and attending to backups, and the switch to 8mm becomes easy to cost justify.

8mm tape backup is a proven standard. It has been a tremendous success, with thousands of installed subsystems. With no new technology on the horizon to surpass Helical Scan drives, 8mm will continue as the standard. And each CY-8200 is backed by a twelve month warranty, with extended warranty available.

The CY-8200 is a turnkey solution that can be ordered in any one of a variety of configurations to fit your site requirements:

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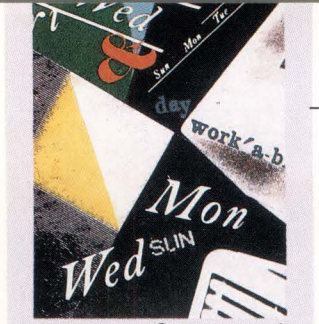
This month's cover illustration is the work of airbrush artist Jim Serfass, residing in Christiansted, St. Croix, U.S. V.I.



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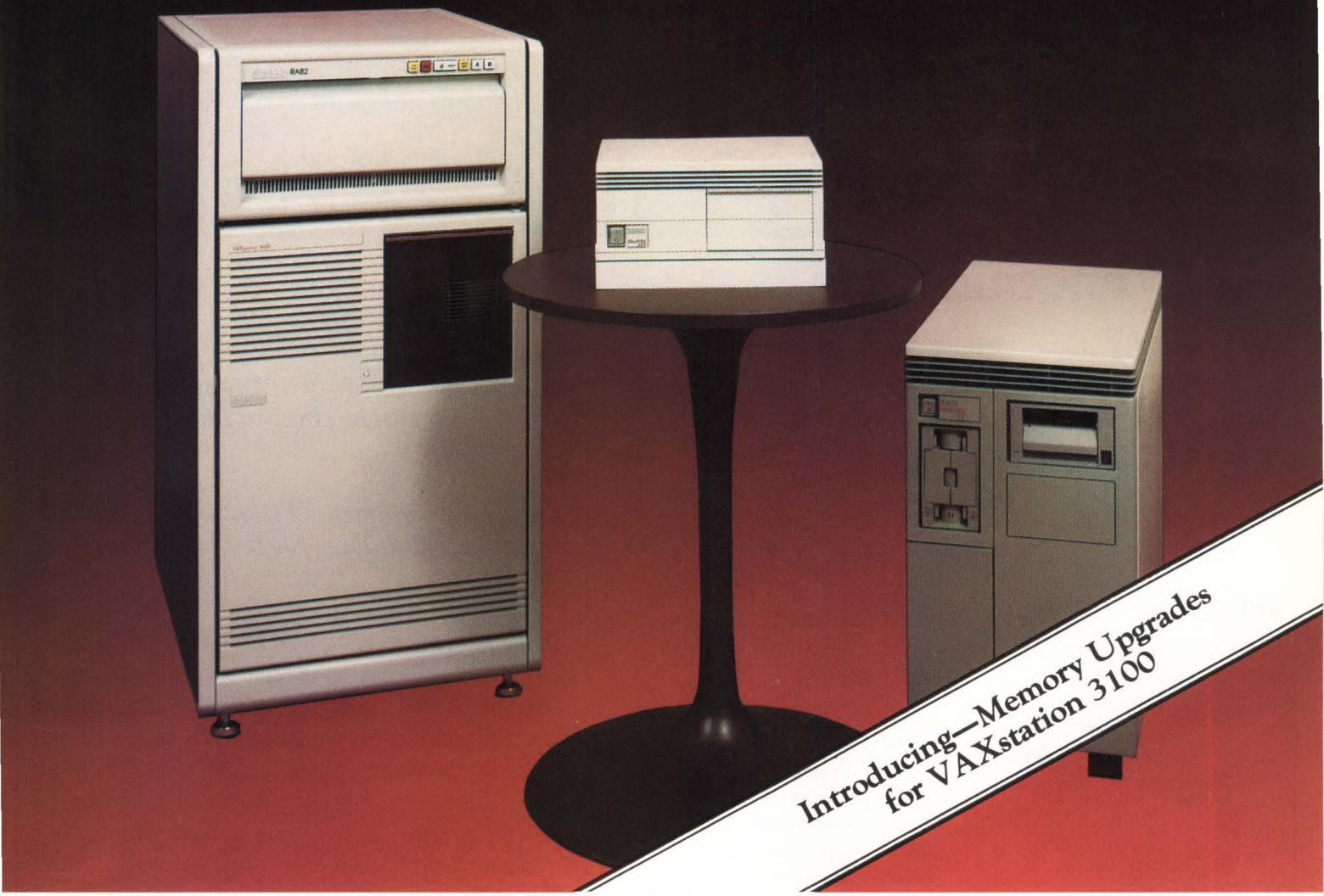

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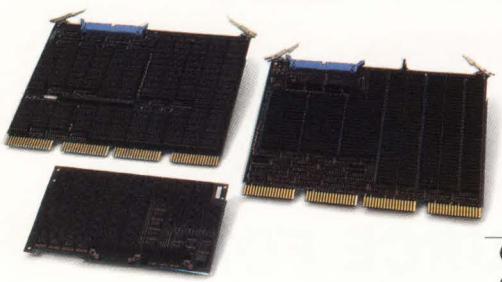

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PUBLISHER

Carl B. Marbach

Computer Slump Or Temporary Confusion?

The gurus of Wall Street have declared a computer slump. They point to lower earnings by DEC and IBM and the recent loss posted by Unisys. Digital's most recent financials show a healthy increase in gross revenues, but not as large a growth rate as in the past. Although DEC is controlling its spending carefully, lower-than-expected sales will result in lower earnings.

As usual, DEC's absolute performance isn't suffering. Rather, the shortfall is in realizing the large growth rates that Wall Street and DEC predicted. DEC should ask itself why, although it's financially sound, it didn't meet expectations. Yes, the 8800 high-end systems have been impacted by the 6300s, the MicroVAX 2000 is woefully out of date and overpriced, the VAXstation 3100 series can barely keep up with the speed of a Mac, and DEC's sales effort is as inept as ever.

But the real problem is consumer confusion. Buyers are waiting to understand where the computer market will go in the next 12 to 24 months. Is VAX still the answer, or will UNIX eclipse the VAX architecture and shorten its useful life?

The press has seized on the problem, and nearly every publication is touting, "UNIX is the wave of the future" or "RISC offers new performance realms." Starved for real news, journalists are jumping on the UNIX and RISC bandwagon. But the headlong rush toward UNIX just doesn't make sense to me. Too many illogical things are going on, and that usually means we don't have all the facts. At *DEC PROFESSIONAL*, we recently purchased a DECsystem 3100 for our Lab so that we can find answers to the many questions about ULTRIX.

There are three problems with the new UNIX systems: a lack of real standards; security that's only promised, not delivered; and questions about performance. As far as standards, IBM, HP and DEC are on one side of the UNIX fence, AT&T and Sun are on the other — so we have two standards already. When was the last time IBM allowed a standard? Oh yes, the PC standard, and IBM won't make that mistake again.

Any standard for UNIX will be a base-level implementation similar to the ANSI standard for FORTRAN or COBOL. Have you ever seen an ANSI-standard FORTRAN program on the VAX? Although the compilers are ANSI compatible, they all feature improvements, and most of us take advantage of them. ANSI-standard UNIX will be the same — a minimum standard exceeded by everyone.

UNIX security is severely lacking. The November 1988 Arpanet virus attack revealed just one of many holes in the armor. Security must be designed in from the beginning, not added on at the end. I can't see IBM, DEC and HP agreeing on how to handle security. The "standard" UNIX will have minimal security, and it will be up to each manufacturer to add the rest.

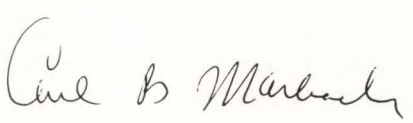
Further, do mips translate into performance? Is 12 mips four times faster for your application than 3 mips? Although the faster machine may execute more instructions per second, what if the architecture requires many more instructions to be executed to do your job?

It's no wonder system managers today find decisions difficult. Should they stay with the traditional VAX architecture, or is it time to switch to the newer UNIX engines? If they look hard, they might form the same conclusion that I have: UNIX isn't ready yet. Unless they're pushed, many system managers are choosing to wait. Waiting translates into slower sales as some of us move to the sidelines and watch what happens.

DEC is led by one man, and right now he's hedging his bets — moving two top VMS managers to the UNIX side, buying a piece of Mips Computer Systems Inc., and introducing the RISC-based DECstation and DECsystem 3100. Is this another slight of hand, DEC buying time as it did with its now back-burnered Apple deal?

DEC doesn't like to talk about unannounced products or future plans, but this is a special time. Fast-moving hardware generations and UNIX hype are scaring DEC's customers. They'd like to hear it from the top, from the man who has made so many right decisions for more than 20 years. What are DEC's real plans? Will DEC have two architectures and two operating systems? Is the future in RISC, VAX, both or neither?

It's time for Ken Olsen to step forward and tell it like it is.



UNATTENDED BACKUP

If backing up your VAX Cluster keeps you reeling all night, try the new MA-24 two gigabyte tape cartridge backup system from Micro Technology.

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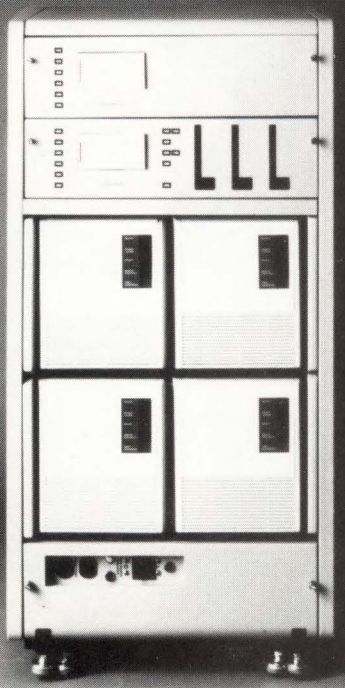

Some things are meant to be shared. Like our SI93 disk drive for instance. With a 15 ms average seek time and 50,000 hour MTBF, the SI93 is one of the fastest, most reliable disk drives ever made. But how can you share its performance without the high cost of VAXclusters?

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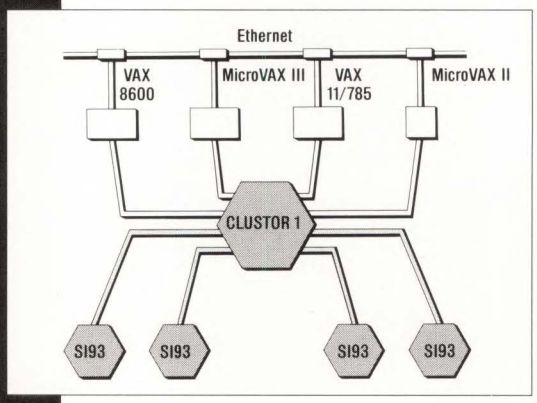

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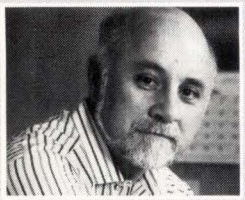


EDITORIAL

Dave Mallery

Mips Melee

In last month's editorial, I asked what you'd pay for a 5-mip VAX in a world of 60-mip workstations and 300-mip servers. The answer is not much, unless that 5-mip VAX runs your application faster, better or both.

Current propaganda says that UNIX (the U word) will never be any good at transaction processing. I remember when that was said about VMS, and it wasn't that long ago. If you note recent DEC announcements, you'll see that the song has changed.

Mostly, all you need is lots of horsepower and superlative disk bandwidth. Much of the ability to do OLTP resides in the database software and its performance. In my nearly 15 years as a DEC customer, I've yet to see a software problem that wouldn't yield to millions of dollars and a year or so of development.

The interesting thing is that just as the price of a mip is being set for the UNIX market by the merchant semiconductor houses, variants of UNIX push the software envelope in different directions. Take MACH for instance — that's the multiprocessor variant of the U word from Carnegie Mellon that was chosen for the NeXt machine. The UNIX-variant market will keep constant pressure on the ULTRIX development community.

Another fascinating area to watch is file servers. After you agree with Sun that "The network *is* the computer," you've admitted to the possibility of large-scale file server engines that don't necessarily come from Digital. These "Ether-Beasts" could be NFS engines, could respond to SQL, could be accessed by network remote procedure calls or could be fitted into the network in dozens of interesting ways. There are enough fascinating disks in the emerging technologies area (parity arrays) and enough really fast non-proprietary merchant backplanes available that such boxes will appear.

The network itself will change — by a power of 10, in fact. The 100-megabit-per-second FDDI is no secret. This effectively brings the bandwidth of the CI to the Ethernet. I believe in 10x multiples. They're clear, easy to understand and you can feel the difference.

I'm delighted that the genie is out of the lamp and the computer industry is back to a wide-open free-for-all.

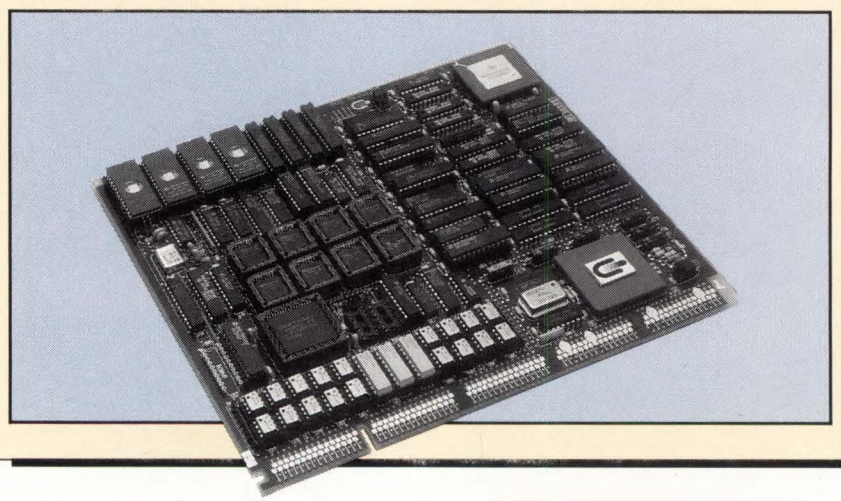
Now Playing On The VAXBI™

Clearpoint Research Corporation of Hopkinton, Massachusetts, ended two years of suspense by announcing its intention to ship a series of disk controllers and storage subsystems for the VAXBI, the I/O bus used on VAX 6000 and 8000 computers. Because DEC closed the specifications of the interface to the BI and prevented Clearpoint from producing controllers that used DEC's interface chip, Clearpoint designed its interface from scratch.

The DSB series improves upon DEC's devices. One Clearpoint controller supports seven drives, while DEC's comparable KDB50, at about the same price, requires two slots for a maximum of four ports. A Motorola 68020 and FIFO buffer produce a transfer rate of 4 MB per second, compared to 1.2 MB per second for the KDB50. The boards also feature a SCSI port running MSCP. An RS-232 port is for diagnostics. (The drives, which are eight-inch CDC 9720 Saber compatible, have a formatted capacity of 1 GB.)

Considering DEC's history of patent litigation, Clearpoint President Vince Bono anticipates a lawsuit. But Bono maintains that Clearpoint hasn't infringed on any of the BI's seven hardware patents, which he believes cover narrow points of functionality. "Our legal budget for the project," he says confidently, "is two and a half times the engineering budget."

Using a Mentor Graphics Hardware Modeling Library (HML), Clearpoint built and verified a design before analyzing a DEC chip. The 1.5-micron CMOS device uses different protocols than DEC's NMOS and generates proprietary logic. Clearpoint is applying for patents on its creative gate arrays. —*Evan Birkhead*



DIANA WALKER/TIME MAGAZINE

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LETTERS

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

MORE TALK, LESS TYPE

John C. Dvorak suffers from being "just as lame as those boring yearly predictions" that he describes in "Killing The Keyboard" (March 1989). He calls voice recognition "another interesting but impractical technology" because of lack of privacy. I imagine Alexander Graham Bell met with the same skepticism.

Most computer users type 40 words per minute, but can speak about 200. Thus, voice input has the potential to be five times faster than the keyboard. You wouldn't have to learn to type, and I/O would be as natural as talking to your mother.

Voice recognition is only as impractical an idea as the telephone.

Troy Frericks
Ames, Iowa

NOT AVAILABLE

Recently, when DEC Field Service installed our "new" 780, I was told to purchase, among other things, two mass bus terminators (70-09938-00). Field Service has them, but can't sell them as part of the installation. We tried the Digital Store, our salespeople and finally DEC's Unlisted Parts Service, which issued a formal quotation that read: "Not Available."

I had my first dealing with DEC in the mid-1960s. My DEC salesman, Bill Kieswetter, showed me how to use DEC "Flip Chips." He even took my first effort home with him to debug the nest of #24 red wires that filled two 1943 backplanes. Mr. Kieswetter provided excellent support.

Three months after we purchased our PDP-9, it was obsolete: The PDP-15 had been introduced. I then met Bob Reed, of DEC's Traditional Product Line (TPL). Mr. Reed got us all the parts, accessories, information and help that we needed to keep the PDP-9 running for 11 years. For example, in the mid-1970s, he sold us the newly introduced LP05 printer with an interface for the PDP-9, as well as more memory. I still remember his motto: "Electronically perfect and cosmetically acceptable." Mr. Reed provided legendary support.

In the late 1980s, I wonder how much of the support I've come to expect from these and many other friendly and helpful representatives of DEC is now "Not Available."

Robert F. Curley
Philadelphia, Pennsylvania

RSMing TO THE OCCASION

Bill Hancock's "Strategic Network Planning" (March 1989) indicates that DEC's Remote System Manager's (RSM) functionality is replaced by the SYSMAN facility, a new set of services that is part of VMS version 5.0. This isn't true.

Although there's some overlap in the two products, their functions are distinct. The main purpose of the current version of SYSMAN is to provide the VMS system manager with a mechanism for initiating synchronous standalone (non-interactive) procedures on other VMS systems. The main purpose of RSM is to provide the system manager with a mechanism for controlling basic system services, such as backup/restore and software installations, for remote systems in a LAN or WAN.

There are many features unique to RSM. RSM supports VMS and ULTRIX clients. The current version supports VMS V4.0 and 5.0. It provides a scheduling facility for the backup component that allows the RSM manager to uniquely identify the most appropriate configuration for handling the specific backup needs of remote systems. RSM lets you install applications and operating systems. Both types of software installations normally require potentially significant interaction. Finally, RSM uses the VAX Distributed Name Service (DNS) to store client and server names. Using DNS provides RSM with global access to these names. Additionally, DNS allows RSM to perform operations against groups. (A group is a collection of client names and/or other groups.)

This is a short list of the differences between RSM and SYSMAN. Neither eliminates the need for the other.

Karen Leonard
DECnet Systems Services
Marketing Manager
Littleton, Massachusetts

Now the best seller comes in an illustrated edition.

With the WY-85 at left, Wyse authored the best selling alternative to DEC's VT-220. It's fully compatible with the VT-220, but loaded with features that make it even more compatible with the people who use it.

Like a larger 14" screen. Tilt and swivel base. An easier set-up mode.

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Our new WY-99GT at right further illustrates Wyse's continuing drive to improve on a standard. It features the same advantages as the WY-85. Plus graphics, with full Tektronix 4010/4014 compatibility, and high resolution characters.

Our dual resolution mode lets you retain full VT-220 compatibility and shift from DEC resolution to hi res.

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WYSE

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*IDC 1986 U.S. Terminal Census.

CIRCLE 339 ON READER CARD

ACCOUNTING FOR ROSS

In regard to Evan Birkhead's "Accounting Software: Company Backbone" (March 1989), we too see a trend in large organizations toward decentralization of accounting computing systems, which requires integration of software applications. Although the essence of the article — the need for integration in accounting applications — was on target, I was surprised that Ross Systems was mentioned only in terms of its old MAPS product line. There was no mention of the company's current integrated financial-management and accounting software products.

In October 1988, Ross announced a generation of software called the Renaissance series, based on MAPS. Renaissance integrates Ross financial software with other business productivity tools into a seamless operating environment. This environment is a framework that enables integration of applications and gives users the flexibility to access information throughout an organization's computer system. Ross provides access to financial application data, as well as customer-specific or third-party applications. Ross also can access critical information contained in applications such as 20/20 and ALL-IN-1.

Acknowledging this trend toward distributed computing, Ross is developing Rdb-based financial applications for VAX/VMS. Ross believes that DEC's Rdb is the ideal foundation for distributed software.

Ross' 17-year history of serving and supporting VAX customers and its Renaissance software would have made it a worthwhile candidate for discussion in the article.

Dennis Vohs
Chairman and CEO
Ross Systems ■

"We've got FOCUS on the mainframe, FOCUS on the VAX, FOCUS on the Wang and a lot of PC/FOCUS."

George P. DiNardo

—George P. DiNardo,
Executive VP, Mellon Bank

"We're a big mainframe shop. Over 280 MIPS," explains Mr. DiNardo. "We've also got some DEC VAXs. A whole bunch of VS300s. PCs. Everything interconnected. And a lot of FOCUS."

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"Our mortgage department uses VAX FOCUS to quickly put together various mortgage packages for resale," said Mr. DiNardo.

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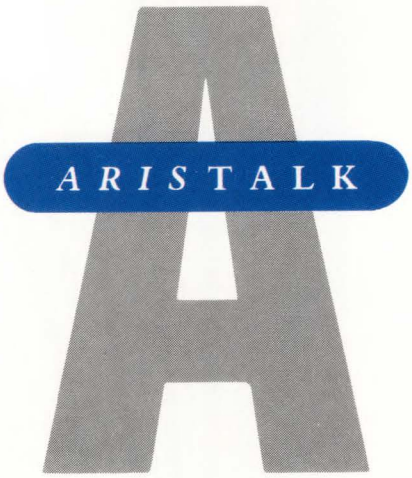
CIRCLE 235 ON READER CARD



PRINT SYMBIOSIS

QUERY:

Bob Zisek *(SIG 13/MESS 217):* How can I trace the source of high interrupt stack activity?

We're running MicroVMS V4.7 on a MicroVAX II. The terminal interface is DHV11, with a terminal print queue set on one of the ports. Every now and then, the interrupt stack activity is excessive to 25 to 50 percent. Stopping and restarting the print queue seems to alleviate the problem. The terminal characteristics basically are standard, with no special ones set. An LN03 is served by the queue. What, in relation to this queue, could be causing this problem? The communication doesn't go through any special connections, although the printer is located about 500 feet away.

REPLIES:

Lee K. Gleason *(SIG 13/MESS 218):* Because you mention that the problem disappears if you stop and start the queue, I'm suspicious of the print symbiont.

The VMS print symbiont contains three instances of $PURGWS. After growing to the working set size it needs, it frees most of those pages and shrinks.

In the days when VAXs didn't support much memory, it was worthwhile to keep real memory free for other uses. This needless bingeing and purging merely checkerboards the address space of the process and the free space in the page files.

Phil Anthony *(SIG 13/MESS 219):* You didn't mention how long the print queue had been operating without problems before you noticed the high interrupt stack activity. If it had been a fairly long time, look at the hardware before patching the print spooler. Your DHV may be having trouble. Do terminals on the same DHV occasionally get bursts of line noise or garbage characters on the screen — especially terminals plugged into adjacent slots?

You also didn't mention how you're running 500 feet to the LN03. Do you have shielded RS-232 lines wired as a null-modem, or are you running through twisted-pair off short-haul modems? If your RS-232 cables aren't shielded, or if you're using twisted pair, examine the cable path to see if a piece of machinery with a high radio frequency emission level, such as a photocopier, is placed too close. If the cable runs through the ceiling next to fluorescent light fixtures, check for a flickering bulb or a starter that needs replacing; you could be getting radio frequencies from that.

Put a breakout box on-line and check for line activity when the problem occurs. If disconnecting the printer from the line makes the interrupt stack activity go away, you've got it.

I'd be hesitant to patch DEC system software and void DEC support before giving the hardware a close look.

How To Use ARIS/BB

Subscribers to *DEC PROFESSIONAL* can call up our online 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, and dial:

- (215) 542-9458 - Pennsylvania
- (818) 577-9100 - Southern California
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New! ■ (617) 863-5010 - Massachusetts

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

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XMODEM and KERMIT are available.

SIG Identification

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

13 .....System Performance
23 .....MicroVAX
38 .....VAXELN

TK50/TK70

QUERY:

Ernest Adams *(SIG 23/MESS 196):* As far as we can determine, there's no way to use a TK50 tape without bulk erasing it. I'd rather take my chances with a bulk eraser hidden in my desk than throw away money on TK50s.

Nor is there a way to read a TK70 tape on a TK50, or to write a new tape on a 70 to be read on a 50.

We've got a MicroVAX II and a VAXstation 3500. Guess what has what drive? We don't have DECnet up between the MicroVAX II V4.7 and the VAXstation V5.0, so it's tape transfer or nothing. The trouble is, we can't go from the 3500 to the MicroVAX II.

REPLY:

Jim Reffelt *(SIG 23/MESS 198):* We had a similar problem when we tried to

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CIRCLE 243 ON READER CARD

upgrade a 3200 to V5.0. We didn't have a tape drive in the 3200, and our DECnet link to a Q5 was shut down by the installation procedure. We were stranded. However, if you don't mind playing with hardware a little, and if you have similar disks on both systems, you can copy tapes as well as backup to disk on the MicroVAX, then move or switch disks.

8300 TO 6310

QUERY:

Brian DeSantis *(SIG 38/MESS 16):* I'm switching systems from a VAX 8300 to a 6310. I'd like to hear from anyone who has a new Calypso. How are they? What problems should I expect?

The configuration will be with 64 MB of main memory, and I'm losing three RA81s for three or four RA82s, totaling three RA81s and three RA82s.

Also, I'm looking into one of the tape drives for unattended backups. Who has what, what do you use it for, and how do you like it?

REPLIES:

Robert G. Schaffrath *(SIG 38/MESS 17):* We just received a VAX 6330, and all I can say is I want my 8350 back! The 6330 is fast, but there's either a DWMBA timing problem, or VMS V5.1 can't handle the speed of the new processor. We have three BI channels with a KDB50 on each channel. One KDB50 has been replaced already. It keeps sending SDI errors to the disks connected to it. This results in fault lights going off, good disk blocks being revectored, and mount verifications every 10 minutes. I don't think this is a normal operating mode for a computer.

The TBK70 tape controller on the 6300 series has a port called PBx0 (where x is the controller designation) that's part of PBDRIVER and is supposed to be similar to the PTA0 port for a TU-81. Both SDA and SHOW CLUSTER believe this to be a CIBCI port.

Robert G. Schaffrath *(SIG 38/MESS 20):* I take back my statement about wanting the VAX 8350 back. The problem was a loose screw! After four KDB50 board swaps and having the XMI backplane reconfigured, it took a senior engineer to find a loose screw on the -15V power bus. The factory that made the 6330 will have to study its assembly methods.

Gavin Adams *(SIG 38/MESS 18):* Upgrading from the 83xx series to the 63xx posed very few problems at our site. The most notable difference is the decreased amount of time system startup takes and the ease of using the new CCP. The manual shows how the 6300 is superior to the 8300 for console processes.

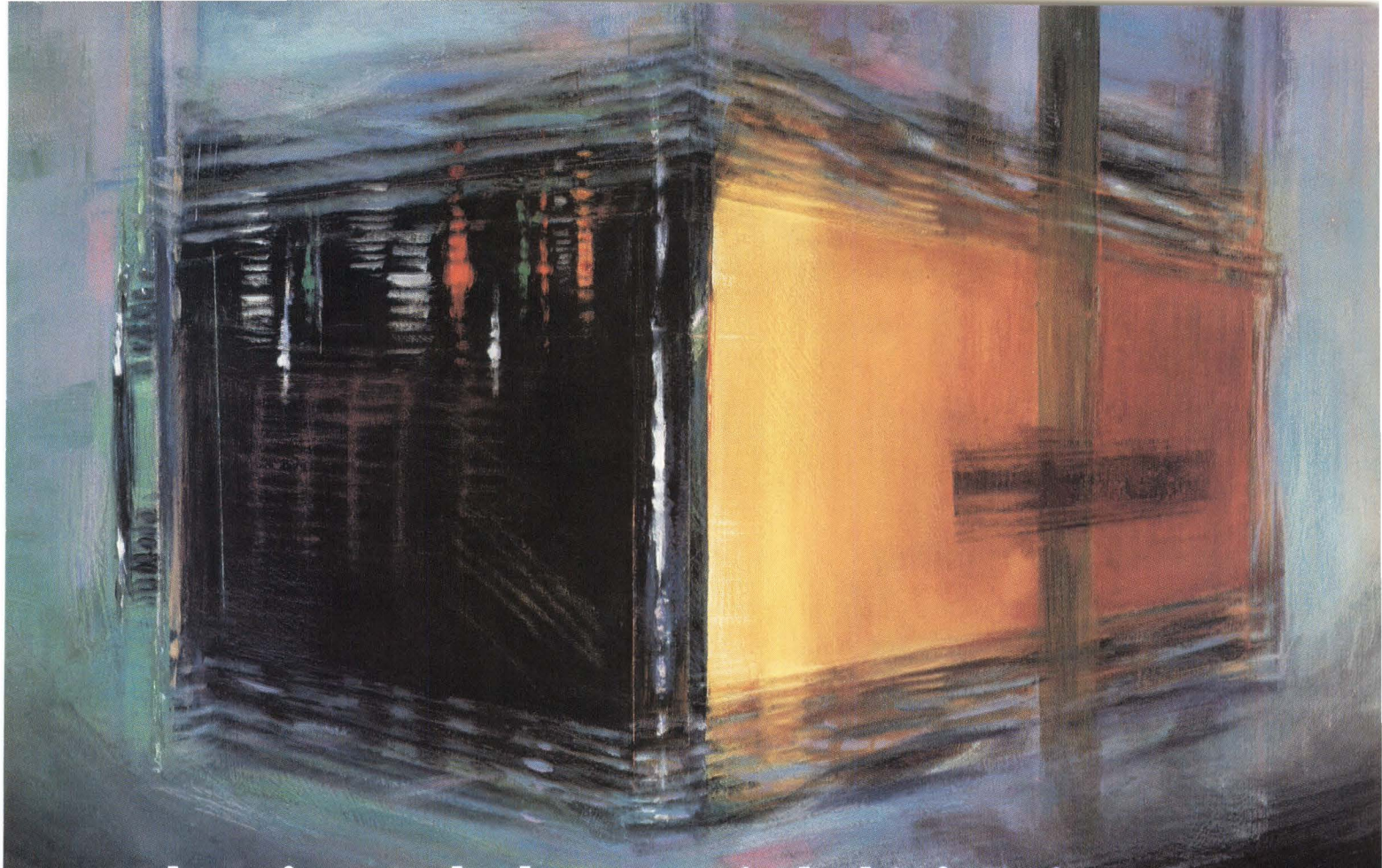
On the software end, benchmarks showed a 2½- to five-times decrease in the amount of CPU consumed, except for some programs compiled under COBOL V4.0. Because of the new CPU architecture, COBOL programs with COMPUTES doubled both CPU and real-time used on the 6330 versus the 8350.

Overall, I'm impressed with the performance of the 6300 series and am curious what increases the 6400 series will bring. I'm disappointed with the 6330 console media. We bought the machine as a 6230, and it came with a TK50 tape drive. I hope that next fiscal year will bring a TK70 to replace it.

Kitty George *(SIG 38/MESS 19):* Don't hold your breath waiting for a TK70 upgrade. Traditionally, DEC has recycled old storage media devices as console devices for new systems. Off the top of my head they include the RX01 floppy drive in the VAX 780, the TU58 tape cartridge in the VAX 750 and VAX 730, the RL02 in the VAX 8600, the Pro 380 as the console terminal for the 8800, and the TK50 for the 6300.

From DEC's viewpoint, it's a good way to clear out old inventory and media. The product-development engineers don't have to worry about troubleshooting another unproven component when creating new systems. If there's one thing you must depend on for getting a system up and running, it's the console device.

Robert G. Schaffrath *(SIG 38/MESS 21):* Our VAX 6330 has a TK70 tape drive hooked up to a TBK70 (module T1035) controller. If you have a VAX 6200 that was upgraded to a 6300, it doesn't include the TK70. The TK70 is available as an upgrade option. ■



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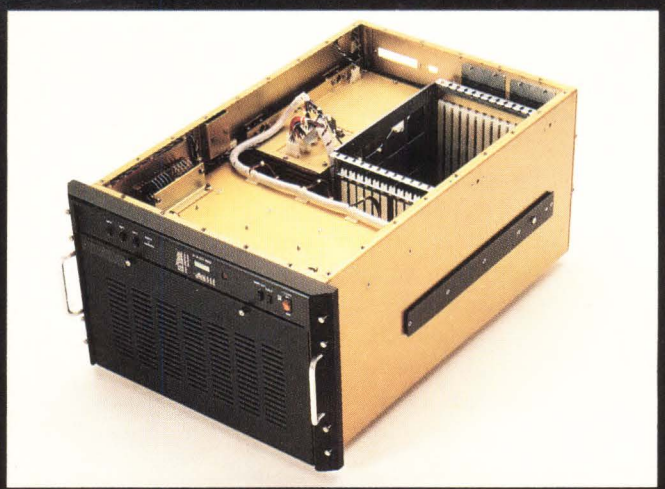

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CIRCLE 265 ON READER CARD

PRODUCT WATCH

Two Buses, One Highway

Bit 3 Computer Corporation's Adaptor Lets Q-Bus And VMEbus Share The Road

The model 432 Q22bus-VME Adaptor, from Bit 3 Computer Corporation of Minneapolis, Minnesota, connects Q-bus devices to any unit using the IEEE 1014 VMEbus. The model 432 consists of a quad-height Q-bus card and a 6U VME card. A ½-inch-diameter EMI shielded cable or a 50-foot microcoax cable can be used to connect them. The cards slip into empty slots on the respective system. No additional processor or controller cards are required.

Either system can act as the host or slave to access memory directly on the other system. Communication between systems can be accomplished in five different ways.

In the first method, a high-speed interface permits random-access 16-bit read/writes between systems at speeds comparable to read/write speeds for resident memory.

The second method of communicating is paging. A six-bit or eight-bit register for the Q-bus and VMEbus, respectively, is coupled with a page window in the host system address space. The address referenced in the window provides the upper limit address of memory in the destination system.

Block-mode DMA is the third method of communication. Target addresses for the sending and receiving systems and a word count are all that are needed to initiate a block-mode DMA transfer. Up to 128-KB transfer lengths are supported at a rate of 600 KB per second.

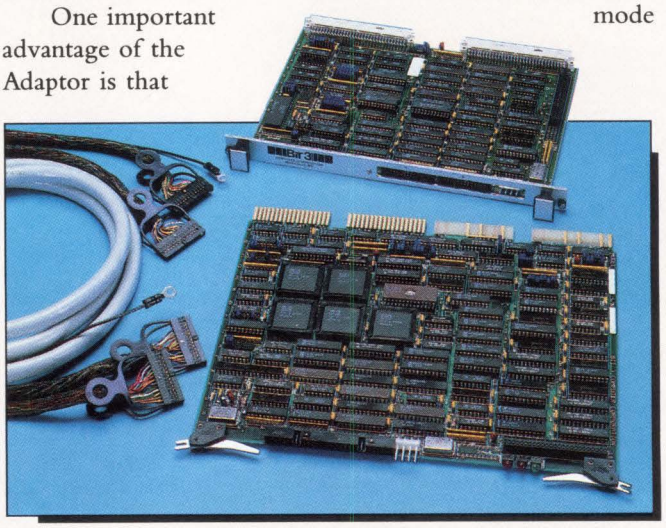
I/O is the fourth communication method. Q-bus I/O reads or writes are translated into VMEbus short I/O reads or writes. A DEC system can access VMEbus I/O as DEC memory references. On the other hand, a VMEbus system can access a DEC system's Q-bus memory with VMEbus short I/O references.

By using the fifth method, a Dual Port memory option, 32KB, 128KB or 1 MB of memory can be plugged into one of the Adaptors. Memory can be shared by both systems. This method ties up neither system's bus when writing to Dual Port memory. Larger sizes of Dual Port memory cards are planned.

One important advantage of the Adaptor is that each bus can operate independently. A link between systems occurs only when a request for memory across systems is initiated.

Setting jumpers also allows for interrupts to be passed between systems. Programmed interrupts can be exchanged between systems, and each system can generate an interrupt acknowledge cycle on the other bus.

Software support is provided for MicroVAX II users. The software enables a VMS application to read and write VME addresses as virtual memory addresses. It also permits block-mode DMA transfers between a DEC system and the VMEbus or between a MicroVAX and the VMEbus system's memory.



Bit 3's Q22bus-VME Adaptor provides a connectivity solution.

The 432 Q22bus-VME Adaptor costs $2,695.

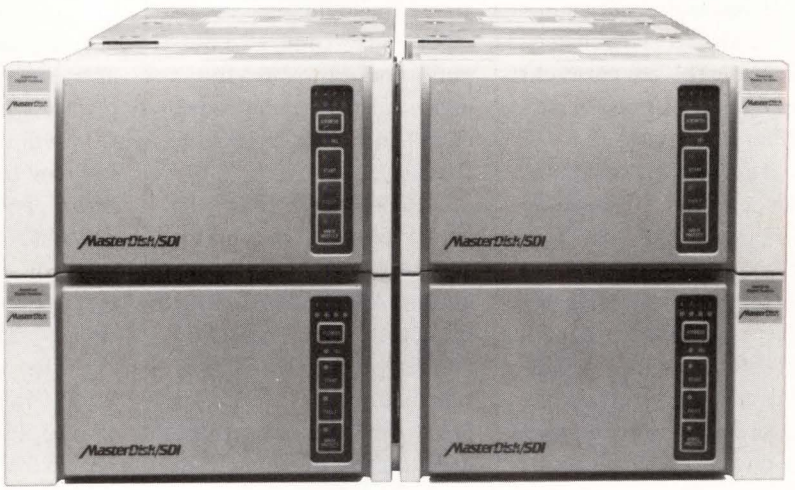
For more information, contact Bit 3 Computer Corp., 8120 Penn Ave. S., Minneapolis, MN 55431-1393; (612) 881-6955.

Circle 571 on reader card

— David B. Miller

The New MasterDisk/SDI Can Save You A Bundle

For the price of about 10 gigabytes of DEC disk, you can get 10-plus gigabytes of MasterDisk/SDI* for all VAXs and VAXclusters, a dozen DEC terminals, ten pairs of Gucci's, dinner for a month at 21, ten thousand in cash, four tickets to Springsteen, his and her Corvettes, two weeks in Paris, and a partridge in a pear tree. Plus 22ms average access time, and a lot of other advantages shown below.



Now why would anyone want another disk?

COMPARE FOR YOURSELF	ADS	DEC
Formatted Storage	10.365 gigabytes	9.952 gigabytes
Average Access	22.3 ms	32.3 ms
Peak Transfer Rate	2.75 MB/sec	2.4 MB/sec
Size	1- 40″ high rack;	4- 60″ high racks;
Power Consumption	1,000 watts	13,440 watts
MTBF Per Drive	40,000	25,000
Warranty	2 years	1 year
List Price	$194,000	$264,000
Required HSC Data Channels	1¼	4
Cost of Data Channels	$13,125	$42,000
Total Cost	$207,125 ($19.98 per megabyte)	$306,000 ($30.75 per megabyte)

***Capacities range from 137 to 16,584 megabytes within one rack.** MasterDisk/SDI will connect directly to any HSC 50/70, KDB 50, KDA 50, UDA 50. SDI is the Standard Drive Interface used on all DEC "RA" family drives.

DEC, HSC 50/70, VAX, VAXcluster are trademarks of Digital Equipment Corporation.

For more information, write or call American Digital Systems Inc., 490 Boston Post Rd., Sudbury, MA 01776. **(508) 443-7711.**

American Digital Systems Inc.

CIRCLE 149 ON READER CARD

Environmental Control

Intra Computer's SAM Systems Provide Environmental Security For Hardware And Data

Floods, leaks, fires, heat, intruders, too much or too little humidity, power surges and other factors can wreak havoc on your equipment and data. Fortunately, the power to prevent computer-room disasters is within your grasp.

The SAM2010 smart ambient monitor, from Intra Computer Inc. of New York City, can provide 24-hour computer-room disaster protection. Combined with host software, SAM can sample data related to temperature, humidity, smoke, water and power. Determinations can be made as to whether these factors exist at acceptable levels. If any don't, SAM can alert users and activate an audible alarm. If no help arrives in a specified time period and dangerous conditions still exist, SAM can arrange for an orderly shutdown of the host computer before powering it down completely.

The base SAM2010 system includes two temperature sensors, power shutdown cable, RS-232 cable, digital LED, an audible alarm, analog/digital sensor inputs, relay-controlled outputs, host software and a user manual. The unit comes in a 19-inch rack-mountable chassis.

Packages include the items you need to monitor various environmental conditions. A VAX/VMS package includes the SAM2010 monitor, a zero to 100 percent humidity sensor, a power-line monitor, an auto dialer capable of calling up to four people, a battery-powered smoke detector that can be mounted on the wall or ceiling, a water detector, an air-flow sensor and host software. Multiple sensors can be distributed throughout your computer room to cover large areas.

The host system software includes a routine to sample and log environmental data, provide user warnings and shut down system software and hardware in an emergency. Data is sampled every 10 minutes under normal conditions. In the case of a temperature problem, for example, a warning message is sent to system users. If temperature becomes critical, sampling intervals decrease to two minutes and more serious messages are sent to users. If the problem isn't corrected after five warnings, SAM will initiate an orderly software and hardware shutdown. Power can be shut down through a power distribution panel or through connection to a shunt-trip circuit breaker.

The SAM Interface Utility is another software routine. It's a screen-driven system that allows managers to access SAM's monitoring parameters and change them if necessary. The ability to customize monitoring parameters allows a SAM system to accommodate a wide variety of computer-room environments.

Recently, Intra Computer announced the SAM3010 unit. The new model includes a control panel to allow selection of one of 10 sensor measurements to be displayed on an LCD. Sensor thresholds can be programmed into non-volatile memory from the control panel.

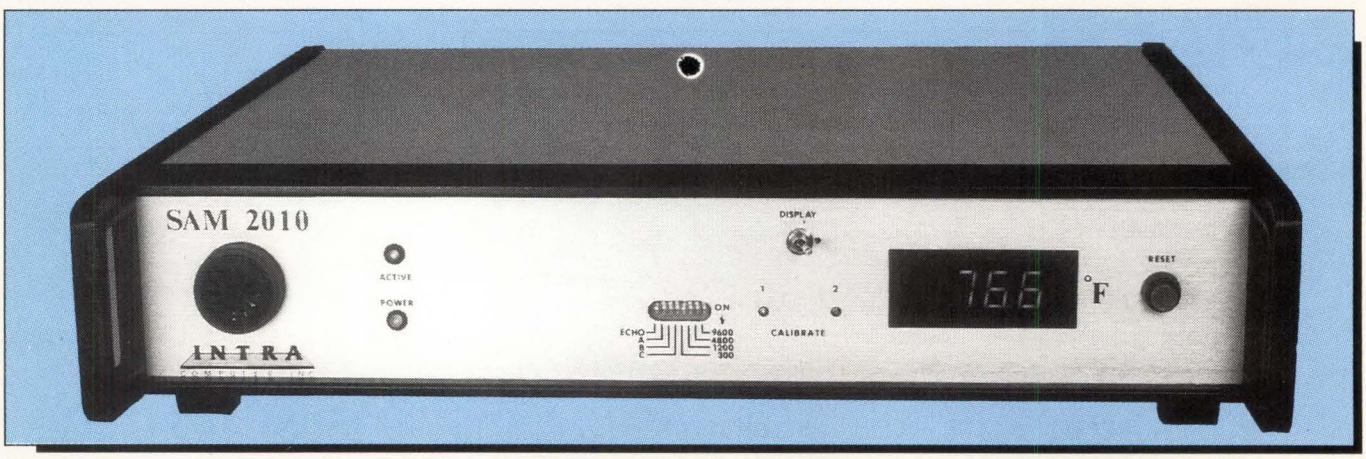
The SAM3010 includes a remote phone dial-out capability with a synthesized voice message/acknowledgement protocol. The unit can be set up to dial out to a remote monitoring facility. Or, a remote monitor can dial into the SAM3010 to track computer-room conditions from a distance. A battery backup is provided to keep the SAM3010 running in the event of a power failure.

Prices for the SAM2010 VAX/VMS package are $5,495 for a single VAX and $5,695 for a VAXcluster. The SAM3010 package starts at $7,495. The SAM2010 is available now. Deliveries of the SAM3010 are expected to begin in the third quarter of 1989.

For more information, contact Intra Computer Inc., 875 Avenue of the Americas, New York, NY 10001; (212) 947-5533.

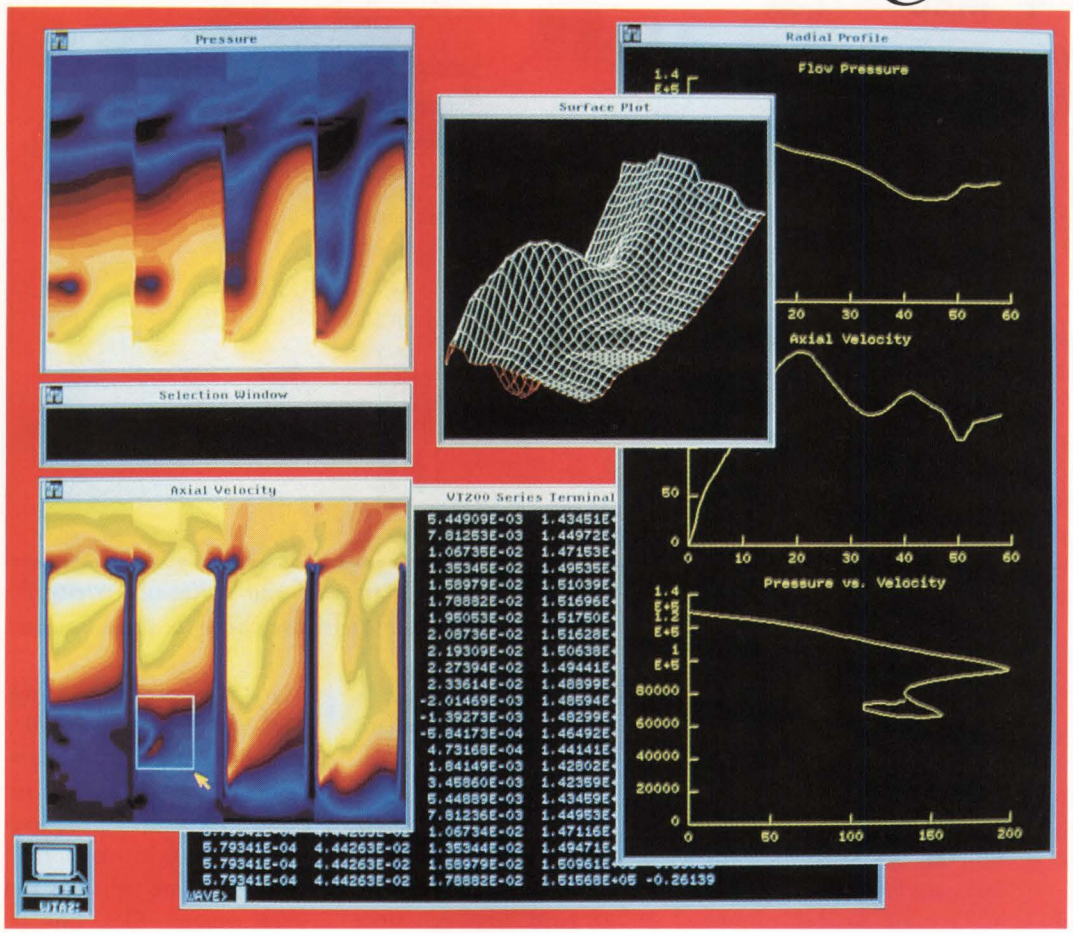
Circle 575 on reader card

—David B. Miller



The SAM2010 monitor provides environmental control to protect your computer resources.

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.

PV~WAVE

Interactive Data Display and Analysis Software

Immediate Visual Gratification

Explore, analyze, reduce and visualize your data interactively with PV~WAVE on your VAX, DEC or SUN workstations. Our Scientific Visualization software lets you interact directly with your data to navigate through data sets, select key features, and visually identify trends. Your data will be translated into publication-quality graphics fast — 262,000 data points from disk to display in less than 10 seconds!

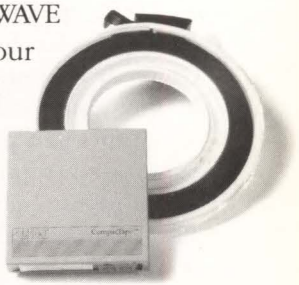
PV~WAVE; DEC, VAX, VAXstation 2000; and SUN are registered trademarks of Precision Visuals, Inc.; Digital Equipment Corporation; and SUN Microsystems, Inc., respectively.

See Inside Your Data Fast

PV~WAVE lets you select from a full range of analysis, image processing, and graphics visualization methods to let you see inside your data fast. With PV~WAVE you can access any data in nearly any format. Tie into your own software or commercially available products; there's no need to build or buy special data converters. And you can easily develop specialized applications to create custom interfaces using commands, macros or pop-up menus for all users — from novices to experts.

How Immediate? Let Us Show You!

Discover how PV~WAVE helps you see your data fast. And spend more time formulating important results. Call Chris Logan at **800/447-7147** to qualify for a free evaluation copy.



PrecisionVisuals®

Precision Visuals, Inc.
6260 Lookout Road
Boulder, Colorado 80301 USA
303/530-9000 Fax 303/530-9329

CIRCLE 172 ON READER CARD

Biscom + VAX + MEC = Fax

Biscom's Faxcom 1000+ And MEC's Fax Processor Software Enhance Faxes

Although no one can deny the speed advantages offered by fax machines, fax transmission has its drawbacks. First, transmission quality is good enough for most correspondence, but you wouldn't fax a final draft of a proposal or resume. Second, fax machines can generate long lines of impatient users. Third, you probably have to fax documents during the day, when telephone rates are highest.

The Faxcom 1000+, from Biscom Inc. of Chelmsford, Massachusetts, can provide a solution to your fax problems. If you're a devotee of Mass-11, from Microsystems Engineering Corporation (MEC) of Hoffman Estates, Illinois, you can streamline your fax processing by integrating the Faxcom 1000+ with Mass-11 word processing via MEC's Mass-11 Fax Processor.

The Faxcom 1000+ is a 20- x 6- x 17-inch fax unit that connects to your VAX over an asynchronous RS-232C serial port. It uses regular telephone lines to transmit documents to any Group III facsimile machine. It optionally can receive documents and print them on an attached printer.

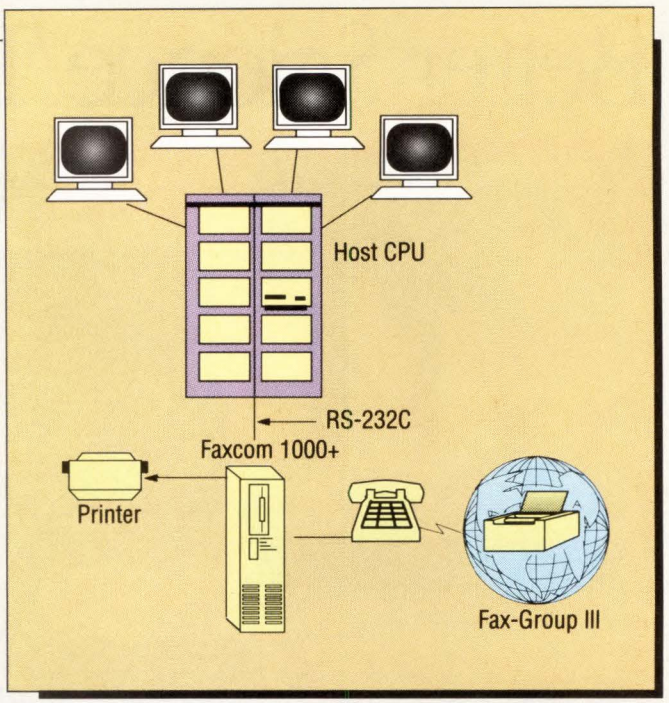
A robust command set allows terminal and workstation users to send documents from their desk. The Faxcom 1000+ initiates the call to the receiving fax machine and cares for the rest of the transmission. A status message is sent to the user on completion of transmission.

The Faxcom 1000+ can improve your fax quality in a number of ways:

1. Users can initiate the fax from their desks and forget about it.
2. Print quality is improved: Optical scanning is eliminated, and there's no paper to jam.
3. Telephone charges are reduced. Text is transmitted at 100 dpi rather than 200 dpi, reducing document transmission time without sacrificing print quality. Further, documents can be sent at prespecified times. Those not requiring immediate attention can be sent when phone rates are lower.
4. Graphic images can be merged with text to allow the incorporation of logos, signatures, and so on.
5. Faxes can be tracked. Managers can determine from where documents are being sent. Phone charges can be monitored on a cost-center basis.

As an option, Faxcom 1000+'s receive feature can direct incoming faxs either to a locally attached printer connected to the unit's Centronics parallel port or to a file on the host computer.

Other features of the Faxcom 1000+ include automatic transmission speed fallback from 9,600 baud to 7,200, 4,800 or 2,400 baud. A4 as well as standard



The Faxcom 1000+ can send and optionally receive fax transmissions while users carry on with their business.

8½-inch-wide documents can be handled. Standard document length is 11 inches. An option allows the Faxcom 1000+ to handle variable-length documents. A 360-KB floppy drive and a 20-MB hard drive can store documents locally. Host status reports and local printer reports are generated to let you know the status of your fax transmissions and receptions. The unit is available in either desktop or tower models.

At Interface '89 held in March, Biscom introduced a superset of the Faxcom 1000+. Faxcom/Publisher allows PostScript files to be sent to Group III fax machines directly from a host computer.

The 80386-based unit contains 4 MB of RAM. It can double as a PostScript printer controller for laser printers attached to its local printer port.

The Mass-11 Fax Processor is integrated with Mass-11 word processing. The Fax Processor handles all addressing, queue-management and status concerns. Most Mass-11 word processing features are supported. Mass-11 Draw metafiles and print image files can be transmitted.

The Faxcom 1000+ requires one RS-232C serial port on the host VAX. The Mass-11 Fax Processor requires the Faxcom 1000+ and VAX/VMS version 4.2 or later.

For more information, contact Biscom Inc., 2 Courthouse Ln., Chelmsford, MA 01824; (617) 441-0010.

Circle 573 on reader card

Microsystems Engineering Corp., 2400 W. Hassell Rd., Ste. 400, Hoffman Estates, IL 60195; (312) 882-0111.

Circle 574 on reader card

—David B. Miller

The idea behind our 8mm tape backup system's display panel.

The whole reason for putting instrumentation in cars is to help you avoid unpleasant surprises.

Well, that's exactly why we gave the new CTS-8000 8mm tape backup system a built-in status display. It lets you catch problems before they happen—not after.

A digital readout tells you how many megabytes of unused storage remain on a tape. When you put in a cartridge, you'll know for sure that you've got enough tape to finish the job.

The CTS-8000 also tells you the ECC error correction rate. By watching it for a minute or two, you can determine if the tape is in good enough condition to properly record your data. If the tape is unacceptable, you'll know before you leave at night—not when you return in the morning.

Still another first on the CTS-8000 is multi-host capability. It can back up data from as many as three hosts.

It's also TMSCP compatible and works with all your applications without any modifications.

And thanks to TTI's long line option, you can place the CTS-8000 up to 80 feet away from the host.

Don't settle for unattended backup with less than full instrumentation. For complete information on the CTS-8000, call (714) 744-1030. Or write Transitional Technology, Inc., 1411 N. Batavia, Suite 203, Orange, CA 92667.

TTi
TRANSITIONAL TECHNOLOGY, INC.

In Europe, call 0865 741345. Or write Transitional Technology, Suite 2, Kennett House, 108/110 London Road, Headington, Oxford OX3 9AW.

Boosting VAX Power In Scientific Applications

Aptec Computer Systems' I/O Computers Offload Processing From VAX Hosts

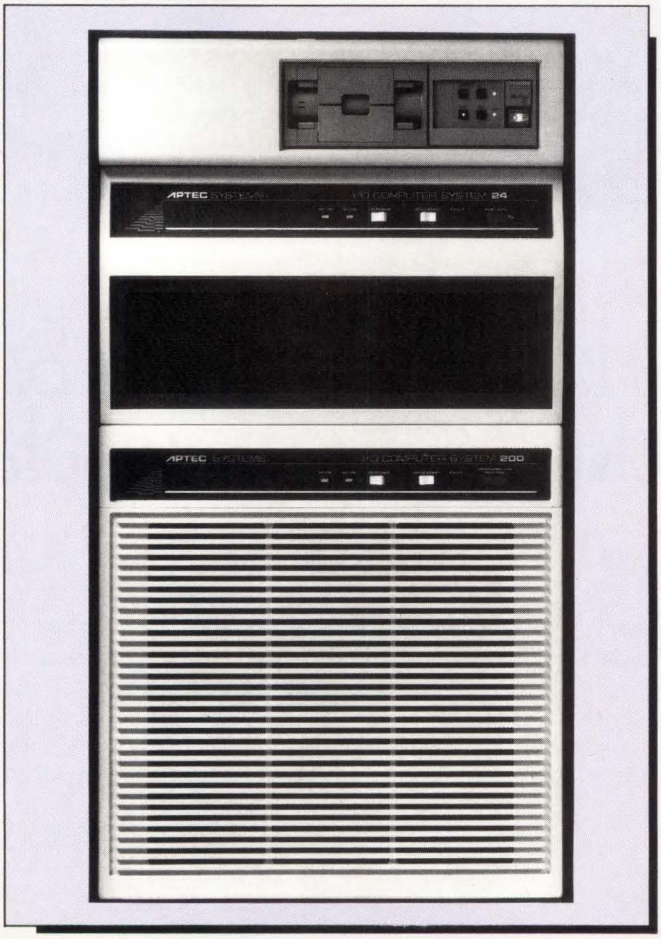
The number of applications requiring immense volumes of data is increasing rapidly. Today's scientists and engineers are bogged down with I/O-consuming projects in aerospace, seismic research and physics, which require real-time data acquisition for image processing and simulation. The applications include 3-D modeling, telemetry, and radar and sonar signal processing.

Aptec Computer Systems Inc. of Portland, Oregon, maintains that the scientific computing market currently is between $3 billion and $4 billion and will grow at a rate of 30 to 40 percent per year during the next five years. Aptec produces a pair of Input/Output Computers (IOC), which are high-speed subsystems designed to relieve throughput bottlenecks by offloading executions from host VAXs.

The smaller of the two, the IOC-24, has a bus speed of 24 MB per second, which far surpasses the 1.5 MB per second that the UNIBUS, for example, can handle. The larger IOC-200 has 200-MB total mass memory and data access speeds of up to 200 MB per second. The Aptec mass-storage subsystem supports up to 1.2 GB of formatted mass storage. The IOC-200 will sustain individual data streams of up to 50 MB per second.

The IOCs consist of three fundamental hardware components: the system bus, two types of user-programmable microcomputer I/O Processors (IOP) and up to 200 MB of main memory. The IOC's internal bus consists of three 32-bit synchronous buses (address, read and write) to minimize send and receive times. System memory is expandable via 2-, 4-, 8- and 16-MB boards. The system software includes extensive operating and development programs.

The IOPs run FORTRAN-77 and STAPLE, a special C-like language designed for I/O processing. There's usually one parallel, programmable IOP controlling the connection to each peripheral. These execute instructions at up to 6 mips and can support as many as seven parallel operations per 48-bit instruction word. One type of IOP connects to the host and another to the peripherals. The high-performance buses and dedicated peripherals are connected with a 12-MB per second. OPENbus IOP. Optional interfaces are needed to connect to the VME and BI buses.



Aptec Computer Systems' subsystems speed throughput of VAXs for real-time applications.

The key to the IOCs' performance is that they let high-speed peripherals exchange data with each other and the IOC shared memory. The devices that might be linked include disks and tapes drives, DMA boards, a/d converters, telemetry front ends, array, vector, and image processors. The peripherals can transfer information to each other, freeing up the host's processing time. The links also can be established with a supercomputer or superminicomputer.

Performance also can be enhanced by a Vector/Scalar Processor (VSP-1), available from Aptec. This optional peripheral balances scalar and vector processing on one board. It consists of a 20-MFLOP vector processor, a scalar processor and a data formatter, which are connected by an 80-MB per second synchronous bus. Up to 24 can be plugged into a dual-chassis IOC-24.

Aptec prices the IOC-24 from $35,000 to $74,000 and the IOC-200 from $124,900 to $175,000, depending on memory and storage configurations. The computers can connect to any VAX, from the MicroVAX II and up, including VAXBI-based computers, thanks to a license from DEC.

For more information, contact Aptec Computer Systems Inc., P.O. Box 6750, Portland, OR 97228-6750; (503) 626-9000.

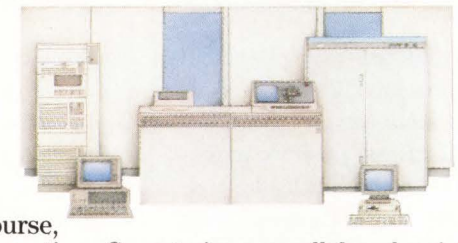
Circle 576 on reader card

—Evan Birkhead

Our laser printers give new meaning to "sharing"

Until now, sharing has been pretty one-sided: several workstations had to share one laser printer. But Printer Systems has redefined the idea of sharing. Now a laser printer can share across several dimensions.

Different platforms

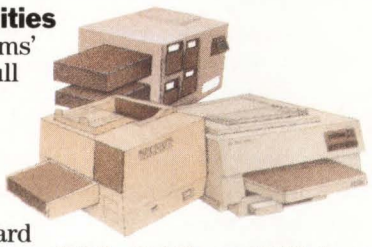


Printer Systems laser printers can be shared by several different kinds of computers. Like IBM. And DEC. And, of course, PCs. All at the same time. Coax, twinax, parallel, and serial connector ports are provided on all our laser printers.

Different applications

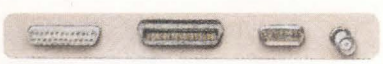
And you can get some pretty fancy things out of these different computers, without a lot of programming. Like barcodes. And FlexFonts from BitStream, with access to over 2,000 fonts. So now your mainframe can do what you thought you needed a PC for.

Different personalities



With Printer Systems' new laser printers, full emulation of the IBM 3812, the DEC LN03 Plus, and the HP LaserJet II is a given. In fact, our printers not only come standard with all the same fonts as IBM's, DEC's, and HP's laser printers, but our font matrices are precisely identical to theirs. So ours print exactly the same as theirs.

Real compatibility



Complete compatibility is a given, too, right down to the resolution. Like the IBM 3812, you can have 240 dpi for IBM applications. Or 300 dpi like the DEC LN03 Plus and the HP LaserJet II. In the same machine. Switched–not scaled–by the machine itself depending upon the application.

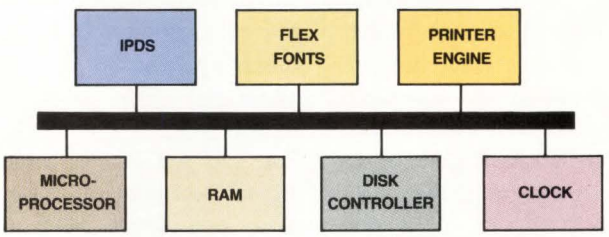
Introducing the Intelliprint 218®

Printer Systems' new Intelliprint 218 permits all this sharing without giving up performance. Its 32-bit RISC technology means that its real throughtput is the rated speed of 18 pages per minute. And its peak duty cycle of 50,000 pages per month means it can handle however much you demand of it.

And the Intelliprint 106®

Sometimes, you can have too much of a good thing. So Printer Systems developed the Intelliprint 106. It, too, is based on 32-bit RISC technology, so its 6 page per minute rated speed is its real throughput. And its duty cycle of 3,000 pages per month is ideal for lower-demand situations.

Open architecture on a PC bus



Printer Systems has also redefined "sharing" by putting a PC AT inside the Intelliprint 218. That provides all the functionality of a dedicated workstation. And, like any other workstation, it affords the flexibility to add options, like a LAN interface, for instance.

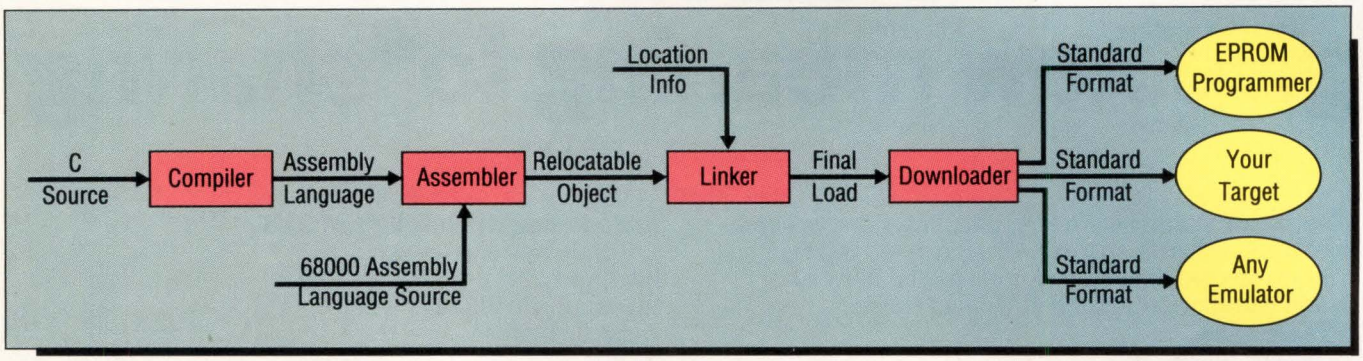
Wait, there's more

In fact, there's a lot more. Printer Systems has more up its sleeve, like spooling. And real-time, automatic switching between interfaces. And different graphics emulations. But we can't tell you about all of it yet. At least not here. Why not give us a call at 1-800-638-4041? We'd be delighted to fill you in. So you can start sharing the way sharing was meant to be.

Compatible in every way

Printer Systems Corporation, Corporate Headquarters: 9055 Comprint Court, Gaithersburg, Maryland 20877
(301) 258-5060, (800) 638-4041, Fax: (301) 926-7333, Telex II: 710 828 9621

CIRCLE 337 ON READER CARD



CrossCode C's four main components let you develop ROMable code for the Motorola 68000 processor family on your VAX.

Remote Software Development

Software Development Systems' CrossCode C Develops 68000-Based Applications On VAX

Developing 68000-based C code on a VAX seems a perfect lesson in inefficiency and waste. Why not just develop the code on the 68000 machine?

But, if you're developing software designed to run in such devices as a control unit or a laser scanner, this scenario might make sense. In these cases, the target machine isn't a full-fledged computer. There might not be disk drives, monitors and terminals associated with these products. However, a 68000-based CPU lies at the heart of the unit, and program code must be downloaded to it for it to run. How do you accomplish this?

CrossCode C, from Software Development Systems Inc. of Downers Grove, Illinois, lets software developers use their VAXs to write ROMable code for 68000-based products that aren't computers.

Object code generated by CrossCode C's compiler is converted to a format suitable for downloading to a 68000 microprocessor, where it can be executed.

CrossCode C includes four main tools to let you develop ROMable C code and place it where you want: the compiler, assembler, linker and downloader.

The compiler lets you generate assembly code from a source-code file of any size. Any combination of C and assembly code can be used. Assembly-language code is generated with your C source code as comments. You can see exactly what assembly-language code was generated from your C source. It supports many ANSI C enhancements, including type void, structure assignments and separate name pools for members of different structures. The extra instructions and addressing modes of the 68020 are supported. Generated code is compact and fully optimized.

The full-featured assembler generates fully relocatable object code. Code and data can be placed into up to 254 named memory sections for easy placement at link time. Its macro facility lets you use positional and named macro parameters. An absolute listing converter can be applied after linking the object modules to let you see absolute addresses for debugging purposes. A cross-reference listing can show you where variables appear in your program.

The assembler recognizes Motorola instruction mnemonics, directives and operand formats. By accepting C-like **#define**s, C language definitions of constants are recognized. Conditional assembly is supported through C-like **#ifdef**s. C language escape sequences embedded within assembly language strings are supported. Code can be developed for the 68000, 68010, 68020 or the 68020 and 68881 together.

The linker lets you organize your load at link time through a memory structure specification file. You can assign named memory sections to specific addresses, align them on a boundary or assign them a specific size. A full-featured librarian lets you link only those library modules you need. Global symbols can be created at link time. C type checking can check the type of each global symbol. Global cross references show each symbol, its value, and in what files it's contained. The linker supports intermediate links so that a number of smaller files can be consolidated into a larger file that can, in turn, be linked with other modules. The full 32-bit range of the 68020 is supported.

The downloader lets you translate your program into a standard format for downloading to an emulator or EPROM programmer. The downloader can generate Motorola S-records, Intel Hex, Tektronix Hex, Extended Tektronix Hex and Data I/O ASCII Hex. The output length of these records can be customized. A hex dump feature lets you view your work on a terminal. You can generate a record-based binary file from which you can extract the needed information via a user-written program.

For more information, contact Software Development Systems Inc., 4248 Belle Aire Ln., Downers Grove, IL 60515; (800) 448-7733.

Circle 555 on reader card

—David B. Miller

VAXBI BUS EXCLUSIVE:

NOW MEGATAPE OFFERS "DIRECT ATTACHMENT" 8MM CARTRIDGE BACKUP SUBSYSTEMS.

Interfacing our ½" tape cartridge system to the VAXBI bus was an amazing technical accomplishment all by itself.

But now we've gone a step further. Introducing the MegaTape GT-88 VAXBI backup subsystem. The only, repeat *only,* 8mm cartridge system with a direct connection to the VAXBI bus.

So now high-end VAX users have a choice for convenient, low-cost disk backup: an astounding 2.3 gigabytes on an 8mm cartridge. Or 630 megabytes on our proven ½" linear-format cartridge. Both priced dramatically lower than anything available from DEC.

MegaTape's proprietary VAXBI controller is completely TMSCP-compatible, and lets your system zip through backup chores using your standard VMS or Ultrix backup utilities.

MegaTape offers something else that's crucially important, too: support capability built on nearly a decade of advancing the state of the backup art.

So if you'd like reliable backup—fast—there's only one place to call: MegaTape. P.S. We also offer the industry's "best buy" QBUS and Unibus subsystems, too!

MEGATAPE CORPORATION
1041 Hamilton Road
Duarte, CA 91010-0317
(818) 357-9921 • Telex: 510 600 7131
Telefax: (818) 357-2369

MegaTape

THE GREAT LEAP FORWARD IN BACKUP.

The Optical Revolution On Paper

ICI Imagedata's Digital Paper Offers High Data Density

The optical revolution is continuing to foster new product introductions at a rapid pace. One such product is Digital Paper, from ICI Imagedata of Wilmington, Delaware, a new unit of ICI of the U.K.

Digital Paper is a new form of flexible, non-erasable optical storage material that can be cut into lengths of tape, stamped into disks, inserted into cassettes or formed into strips or tags. It offers the data density of optical disks and is readable by digital devices, with fast access and transfer rates. The high data density allows for rapid access.

Digital Paper is a dye polymer optical recording material coated onto a polyester-based substrate. It has the sensitivity necessary for laser writing, yet offers durability standards that ensure a life span of more than 15 years. Data is stored on the media using a solid-state laser of the kind already used in drives designed for use with rigid optical storage media. All recordings are indelible.

To gain insight into this new media, consider the following:

1. One 5¼-inch disk can provide 1.5 GB of data, with an average access time of 40 ms.
2. Storing one terabyte (1,000 GB) of data with optical tape requires just 0.1 cubic feet of space as compared to the 49 cubic feet needed for the same data on a 12-inch optical disk or the 2,373 cubic feet needed on standard 5¼-inch floppy disks.
3. In consumer terms, a 2,400-foot reel of ½-inch digital tape (of the same proportions as a conventional 10½-inch magnetic tape) would be capable of storing 600 GB of data. This is equal to about 1,000 compact disks.

Digital Paper brings storage costs down to less than a half-cent per MB of data stored. This is lower than any media in use today, including paper.

The Creo Optical Tape Recorder, an optical tape drive that employs the Digital Paper media, has been announced by Creo Products Inc. of Burnaby, British Columbia. The tape drive will be part of a very-high-capacity optical tape data storage system. The ICI tape designed for the Creo drive has a capacity of one terabyte.

The drive features an average access time of 28 seconds to any byte on a full tape. It can transfer data at a sustained rate of up to 3 MB per second. Forward error correction is used to ensure that a user's data is fully protected against loss. The new optical tape drive will be available commercially in October 1989. System integrators currently are working on Q-bus and UNIBUS interfaces for the product.

A 5¼-inch floppy-disk drive, based on Bernoulli technology and ICI flexible optical disks, is being developed by Bernoulli Optical Systems Company (BOSCO) of Boulder, Colorado, a subsidiary of Iomega Corporation. In this drive, a lightweight fixed-focus technology replaces the bulky focusing servo commonly found in rigid drives. A servo-system tracking methodology also replaces the secondary fine-positioning mechanisms used in most drives. By combining new technology and methodologies, the drive can deliver more power to the disk from the laser, thus increasing the data rate.

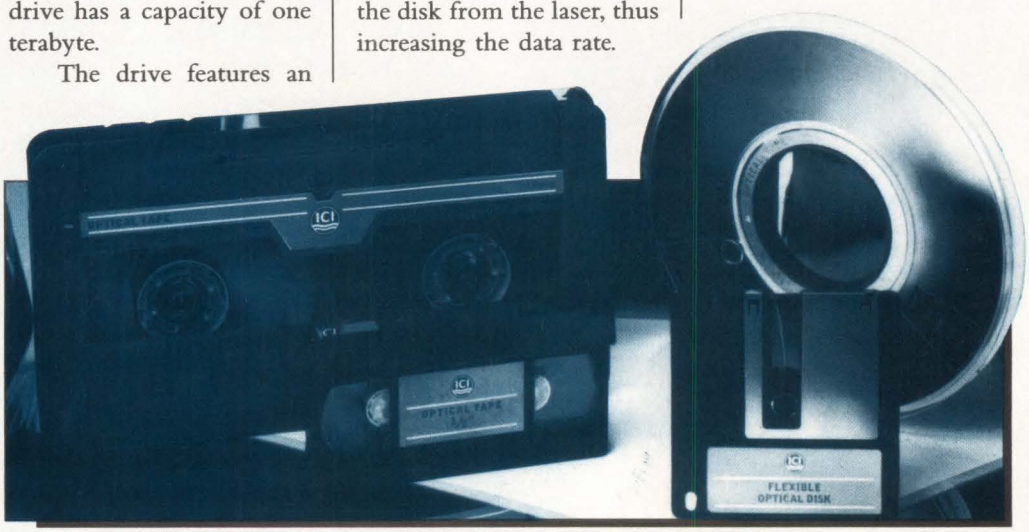
By employing compact packaging and the use of an optical microhead, a half-height drive can be designed for incorporation into desktop computers or workstations. These drives are being tied together with scanners and other input devices by system integrators for use in image storing systems. Bernoulli drive technology for optical disks, including designs, tooling and know-how, is available from ICI Imagedata.

For more information, contact ICI Imagedata, New Murphy Rd. and Concord Pk., Wilmington, DE 19897; (800) 456-3669.
Circle 434 on reader card

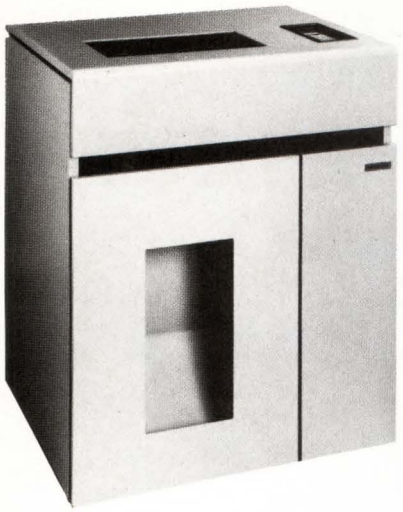
Bernoulli Optical Systems Co., 5700 Flatiron Pkwy., Boulder, CO 80301; (303) 939-8611.
Circle 412 on reader card

Creo Products Inc., 110-3700 Gilmore Way, Burnaby, BC V5G 4M1; (604) 437-6879.
Circle 411 on reader card

—Ron Levine



Digital Paper is flexible, non-erasable optical storage material that can be cut into lengths of tape, stamped into disks, inserted into cassettes or formed into strips or tags.



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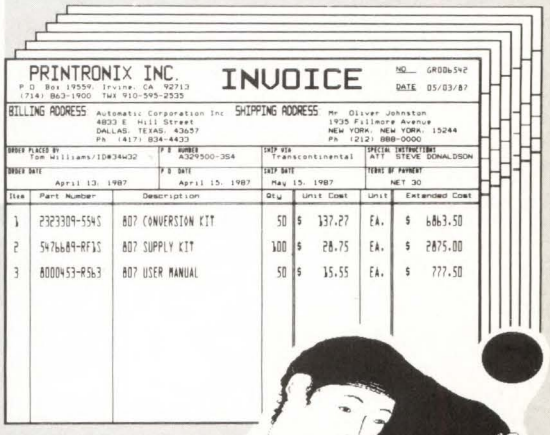

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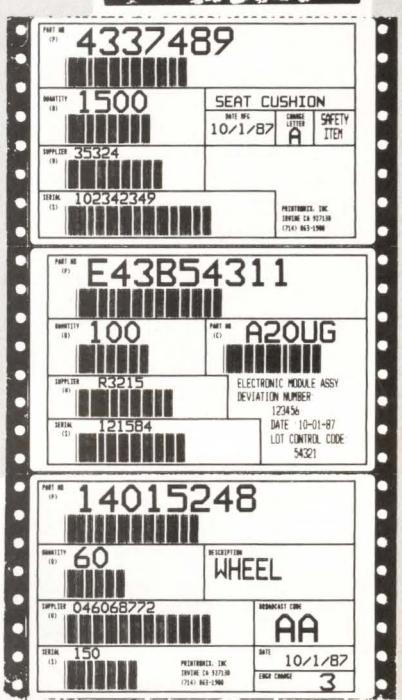

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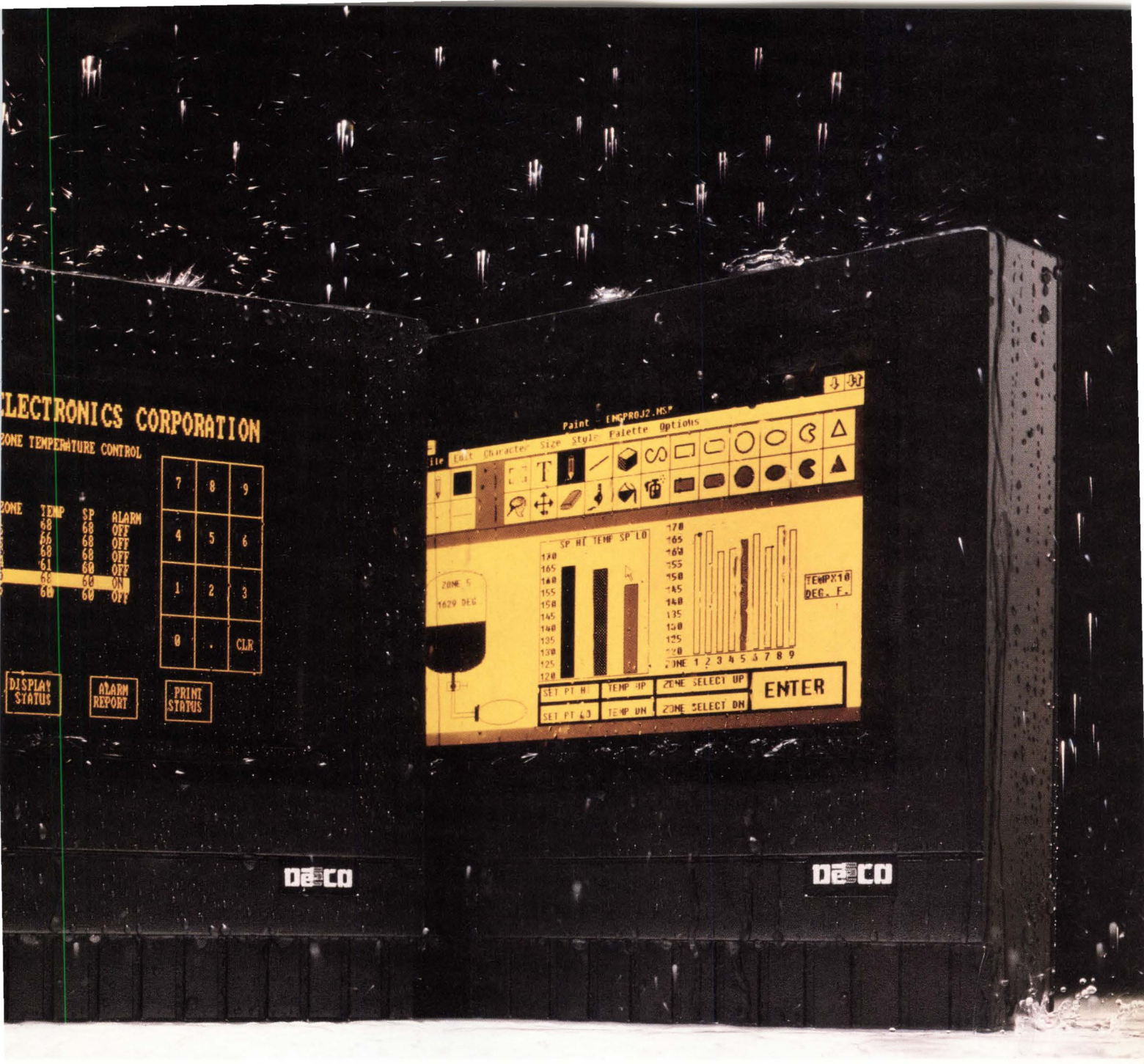

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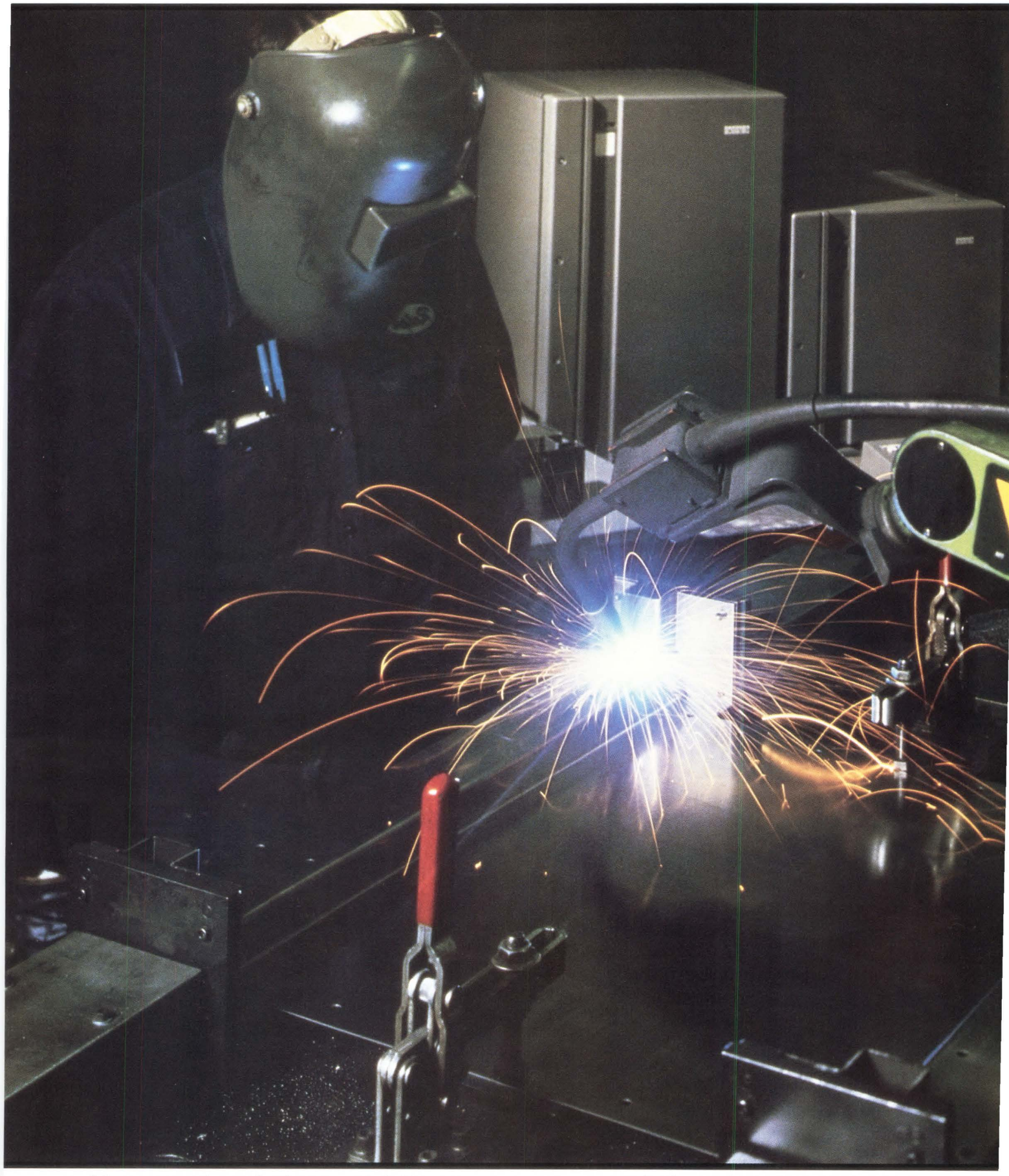
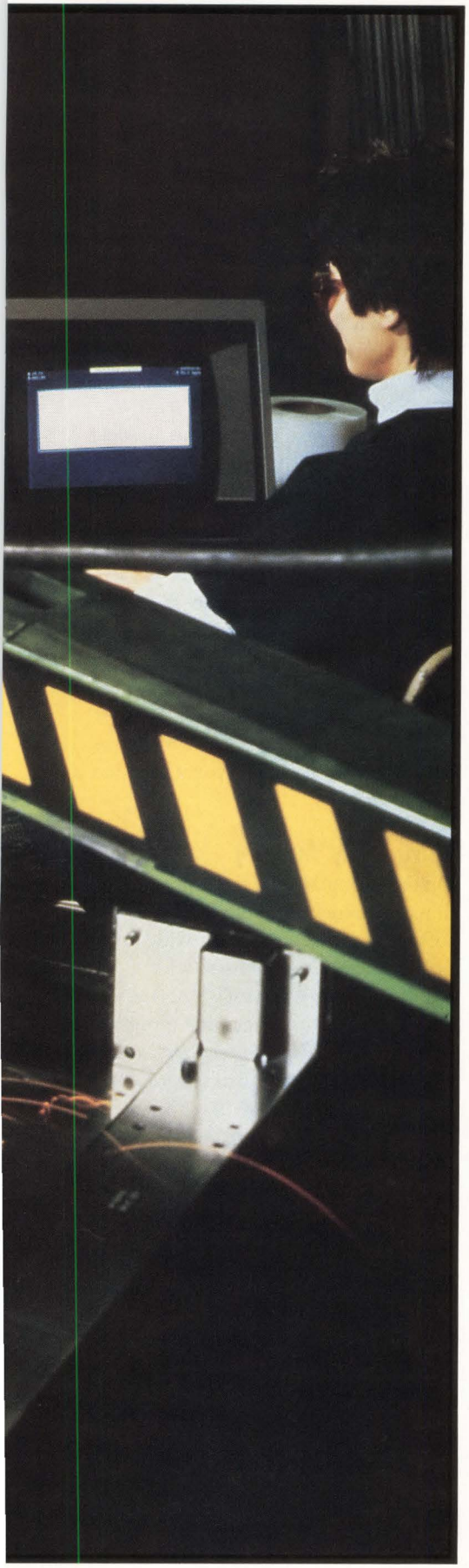


While communicating with other corporate divisions, computers must operate in harsh manufacturing environs.



Courtesy Digital Equipment Corporation

THE CIM SOLUTION

Advances in technology merge manufacturing with the organization.

IN LAST YEAR'S presidential elections, the U.S. Department of Defense (DoD) was denigrated for its overspending and its embarrassing tendency to produce aircraft that wouldn't fly. The new administration pinned much of the blame on the incompatibilities and inefficiencies of the automated production systems at the Pentagon's major aerospace and defense contractors.

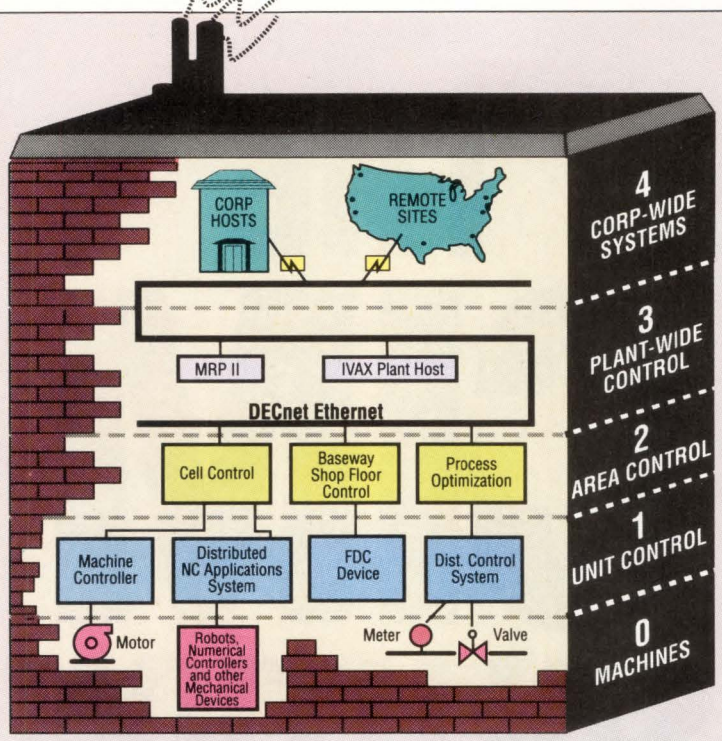
The result was an extensive study of the efficiency of the DoD's computer networks and factory-automation systems, which are run primarily by VAXs and Ethernet networks. The diagnosis was that these production plants are due for a major overhaul. The Pentagon and its contractors are installing sophisticated Computer-Integrated Manufacturing (CIM) systems that integrate software programs for planning, design and production with specially designed databases and reporting systems.

But by all accounts, the upgrade was slow in coming. The technology that permitted this integration has been maturing steadily for four or five years.

Integrating Software

Analysts report that, for reasons ranging from stubbornness to the costly stoppages caused by upgrades, buyers of

BY EVAN BIRKHEAD



Level 0 — The plant floor, where assembly-line machines are driven by robots and numerical controllers, and measurements are taken by analog devices.
Level 1 — Unit control devices, including machine controllers, I/O devices and distributed control systems.
Level 2 — Area control devices, which control several shop-floor unit devices simultaneously.
Level 3 — Plant-wide control systems, which include the VAX network automating the factory and computers running MRP II and inventory systems.
Level 4 — Corporate-based systems, such as accounting programs and WANs.

Figure: Digital's CIM strategy as it correlates to NIST's manufacturing automation model.

factory-automation systems in most manufacturing industries have been slow to keep pace with advances in technology. For example, the ability to link CAD-generated parts designs, accounting figures and inventory systems into numerical control systems on the factory floor is now attainable.

One defense contractor, Honeywell Aerospace, has a Digital installation that, thanks to third-party software, already covers much of this ground. Detailed parts assembly information is stored in a manufacturing database that's used to create new production plans illustrated with CAD systems. The plans then are sent to a shop-floor control system from a Manufacturing Resources Planning (MRP II) system, which oversees parts production.

The high level of integration at the Honeywell site was made possible by cooperation between three of Digital's software partners: CimTelligence Corporation, which produces a Computer-Aided Process Planning (CAPP) system called IntelliCapp; Palette Systems Inc., which provides a suite of engineering design modules that tie into a CAD/graphics database; and Consilium Inc., which makes Comets, a shop-floor control system. The Manufacturing Instruction Display System (MIDS) module from Palette sends assembly instructions to the shop floor. All of the programs send, manipulate and store data from the same database, accessible from a variety of departments.

This scenario closely approaches the dream factory-automation system for a discrete parts manufacturer: a single, seamless database that maintains the working CAD drawings of a given part that's to be introduced into a production line, as well as all information related to costs and assembly.

The Manufacturing Model

As defined by the National Institute of Standards Technology (NIST), there's a five-level hierarchy in manufacturing automation that hardware and software vendors slowly are tying together (see Figure).

Sufficiently sophisticated hardware is available at each level of this model. But software has been scarce, particularly at the unit and area levels. Software that integrates these levels (programming tools and communications) introduces a new concept entirely.

Digital has made greater strides in achieving this paperless factory — in which the entire process, from concept through design and production, is performed electronically — than any other hardware vendor. One of its secrets has been alliances with third-party software vendors.

Third-Party Activity

On the VAX platform, third-party solutions, encompassing both hardware and software, contribute to the wide array of integration possibilities:

- ASK Computer System's MANMAN, a manufacturing management program that encompasses interplant communications capabilities and cost accounting.
- Allen-Bradley Company's Pyramid Integrator, an industrial controller generated by a MicroVAX II that integrates applications such as MRP II and quality management with plant-floor data such as work in process or machine control.
- Cincom System's Control:Manufacturing, an RDBMS optimized for production settings that handles manufacturing applications from accounting and scheduling to shop-floor control and facilitates data sharing between VAXs and IBM systems.
- MCBA's MCBA, which integrates software packages for accounting,

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Shown through a bearing sleeve, this IVAX, a MicroVAX II-based system, governs operations on a plant floor.

Courtesy Digital Equipment Corporation

distribution, manufacturing and EDI.

- NREC's Work Cell Manager, a monitoring and control software system that integrates shop-floor equipment with plant-wide decision makers. The program monitors equipment status and utilization, maintenance, and performs many other supervisory control functions.
- Siemens Information Systems and other systems integrators, which adhere to standards such as OSI and Ethernet to solve the problems encountered in multivendor manufacturing environments. Siemens networks programmable controllers with VAXs.

By combining such systems, manufacturers intend to achieve goals beyond Digital's theme of integrating the enterprise: the maintenance of quality, the reduction of overhead, worldwide contributions to design and production, and faster times to market.

Leadership Secrets

Digital and the third party, particularly its Cooperative Marketing Program (CMP) and Independent Software Vendor (ISV) participants, have become the major players in the CIM market, thanks to Digital's long customer relationships in the arena and manufacturing's historic reliance on networking and distributed processing. A majority of factories and manufacturing facilities use Digital systems. Digital's strong VAX/VMS base was responsible for most of its sales to manufacturing installations last year, although interest in ULTRIX workstations is increasing.

Using its internal EasyNet worldwide network for engineering consultations and implementing proprietary expert system and CIM techniques, Digital practices what it preaches. Its production facilities have been virtually paperless for almost three years, and its time-to-market speed for new products is phenomenal.

However, there's much competition. UNIX-based workstations have become the in-vogue processors for CIM applications. According to the San Jose-based market-research firm Dataquest, Digital's strongest competitors in technical workstations are Sun Microsystems and Hewlett-Packard. The fastest-growing companies are Intergraph Corporation and Silicon Graphics Inc. Dataquest reports that CAD/CAM and other engineering applications were the major impetus behind the workstation market's 53 percent growth in 1988 to $4.1 billion.

According to CIMdata Inc., a research and consulting firm in Wellesley Hills, Massachusetts, total U.S. purchases in the CIM market will reach $25.4 billion by the end of 1989 and will skyrocket to $40.7 billion by 1993. Digital's split of the market for computers, workstations and terminals is roughly 30 percent. IBM, recognizing Digital's superior market share in the area, has coordinated a considerably large effort based on its AS/400.

Standards

Because the infiltration of workstations has become a major issue, and because virtually all environments are increasingly multivendor setups, manufacturing operation standards have become the

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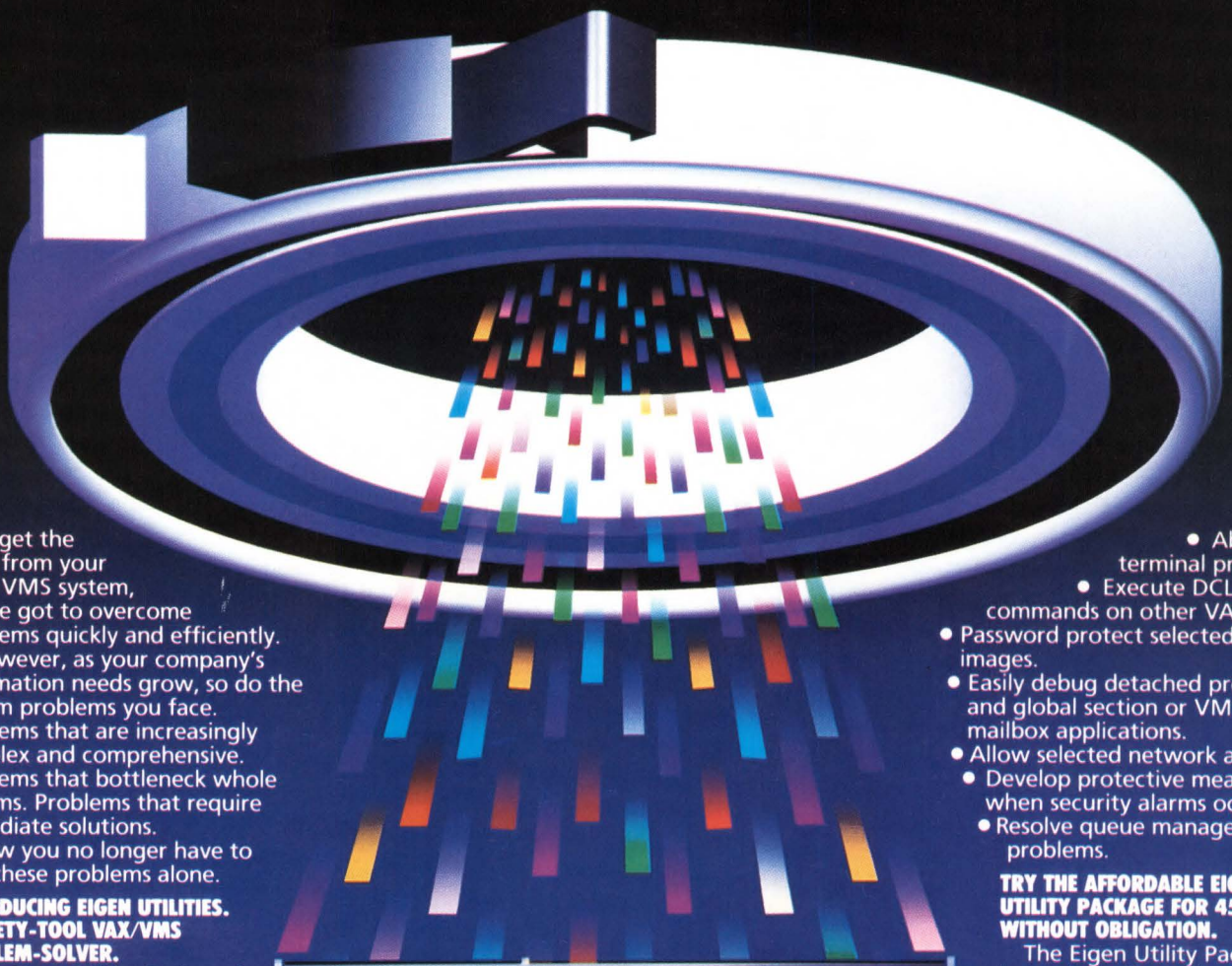

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Ruggedized VAXs

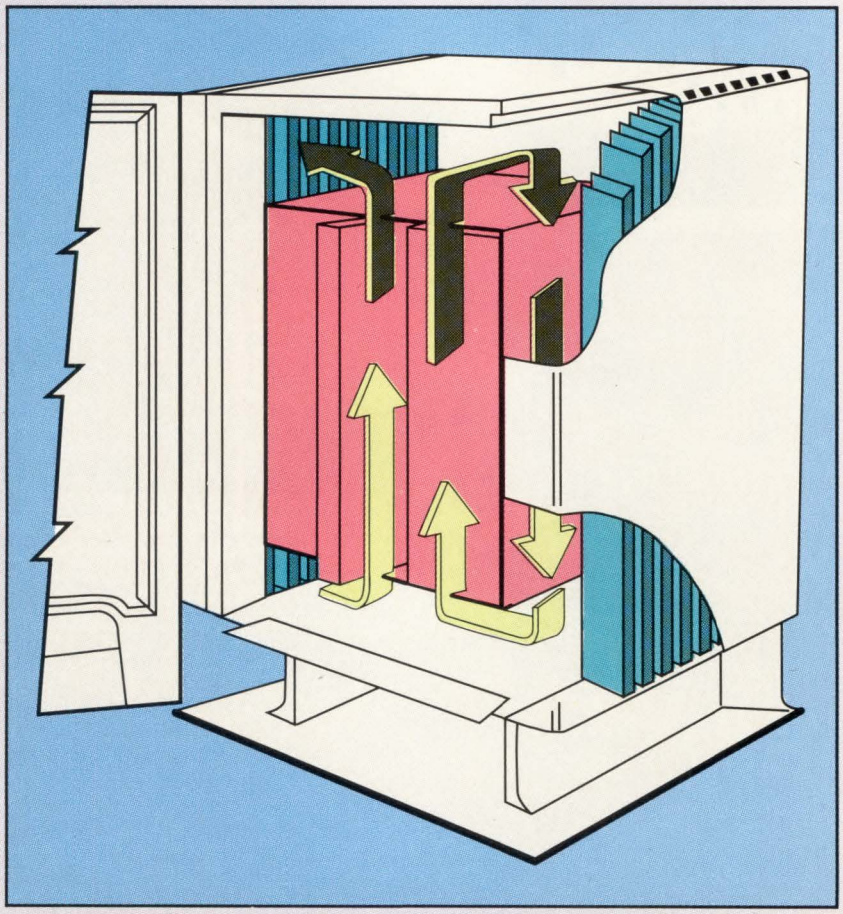
Digital's Industrial VAX (IVAX) series of computers is made up of standard VAX/VMS processors that are built to withstand the perils of the factory floor. These hard-hat cabinets have a special design that protects the CPU from high temperatures, vibrations, noise, collisions, liquid or oil spills, and airborn particles including dust, fabric or metal filings. Digital conforms to a standard called European IP 52 at a sealing specification level called NEMA 12.

IVAXs are more compact than regular VAXs, with fewer cables. The series includes:

- The IVAX 630, a 12-slot MicroVAX II with 5 MB of memory, a 71-MB disk and a 95-MB tape.
- The IVAX 620, a compact diskless MicroVAX II that runs VAXELN.
- The disk-based IVAX 620, with 1 MB of memory, a 71-MB disk and a 95-MB tape.
- The IPDP-11, a 12-slot MicroPDP-11/83 with 2 MB of memory, a 71-MB disk and 95-MB tape.

Prices range from about $11,000 for the diskless IVAX 620 to $32,000 for the IVAX 630.

Cyberchron Corporation makes an R8000 series of computers that's made up of a ruggedized version of Digital's VAXBI (8250 and 8350) CPUs. In addition to conforming to plant-floor protection standards, the R8000s meet the military's Tempest specifications. The systems support up to four removable disk or tape drives. RWT Corporation, Codar and Xycom Inc. also optimize hardware for the factory.



While running without air conditioners, Digital's IVAX computers protect the system boards from shock, liquids and airborn particles. Arrows indicate air flow.

industry's key issue.

Currently, Digital is pushing the Manufacturing Automation Protocol/Technical and Office Protocol (MAP/TOP), which defines the protocols for a multivendor broadband communications network. It's specified in a subset of the OSI model. Digital announced its intention to migrate all DECnet users to OSI in September 1987. Despite a rift between Digital and GM, MAP's original supporters, MAP remains an active issue. An organization of users called ITRC, composed of the U.S. MAP/TOP user groups and the Canadian MAP interest group, was founded late last year to provide a structure for unified advocacy among users, vendors and governments.

NIST currently is looking for participants to help fund and staff its OSI/ISDN Security Program. The goal of the project is to ensure that these multivendor networks are secure after they're open. NIST is building a research facility that will design, define and test for telecommunications, network management and security services in a distributed processing environment.

Digital, IBM and Sun already have loaned research equipment to the NIST laboratory. Digital's contribution was a

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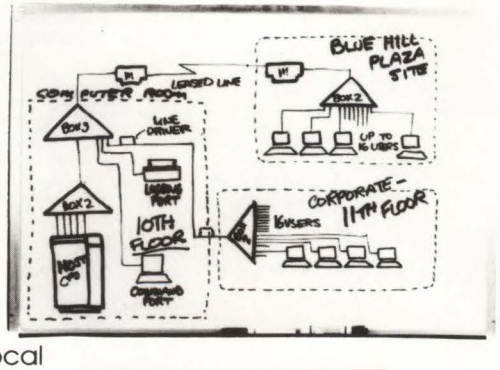

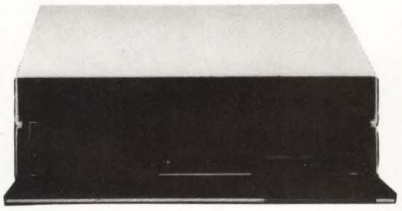

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VAX Semiconductor Automation Platform

Digital's Pacific Systems Group of Mountain View, California, develops software for automating the semiconductor industry. In May, Digital exhibited at SEMICON West 89 in San Mateo, California, a trade show for the semiconductor industry. Digital demonstrated a VAX Semiconductor Automation Platform (VSAP) controlling an etch process operation in semiconductor manufacturing. In the demonstration, wafers were moved from one step of processing to the next via monorail tracks, elevators and robots.

The VSAP demo showed how VAXs running VAX/VMS, DECnet and VSAP work to control semiconductor equipment, robots, monorails and test equipment.

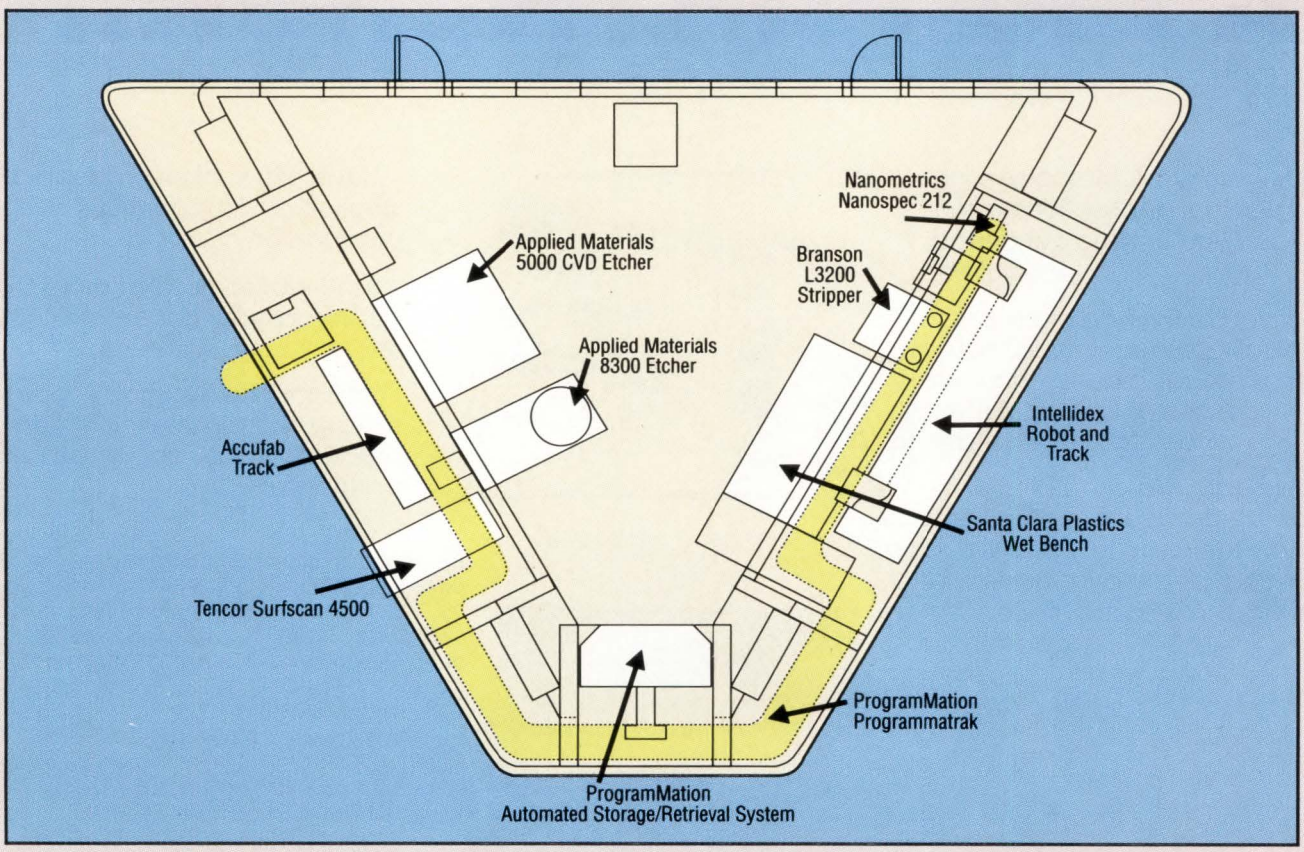
The booth featured equipment from nine vendors, as well as VMS-based software from Digital and four other vendors, working together in a hypothetical semiconductor processing environment. The recipes for semiconductor processing are carefully guarded secrets. Therefore, although the movement of the wafer cassettes was realistic, the processing procedures weren't.

Cassettes began at the ProgramMation Automated Storage/Retrieval System (AS/RS) and were transferred to an overhead track system. The overhead track, also supplied by ProgramMation, shuttled the cassettes to vertical transfer elevators positioned near the semiconductor processing equipment. After the wafers went down the elevators, robots on floor track systems from Accu-Fab and Intellidex took cassettes of wafers to various semiconductor processing equipment. The demo included a Wet Bench, from Santa Clara Plastics, where the wafers were lowered into sinks and dipped in chemicals; a stripper from Branson; and two etchers from Applied Materials, including its top-of-the-line Chemical Vapor Disposition (CVD) 5000.

After the wafers had been processed, the Nanometrics Nanospec 212 measured the film thickness and the Tencor Surfscan 4500 measured the particulate level.

Software running on the four VAXs controlled the processing and the movement of cassettes and wafers. All of this software ran on the VMS/DECnet platform, the basis for the network of VAXs, production machines and measurement instruments.

Consilium's Comets was used for shop-floor management and lot tracking. Thesis Group's AutoCell performed the cell control functions. Baylis Automation's Streamline controlled measurement stations. Finally, BBN Software's RS/1 processed the statistical information provided by the measurement instruments. *—Peggy King is West Coast Editor of* HP PROFESSIONAL, *a Professional Press publication covering the Hewlett-Packard market.*



Semiconductor processing equipment and measurement instruments are linked via VSAP running on a VMS/DECnet platform.

MicroVAX workstation and two Digital encryption system network controllers.

Digital's Factory

In Digital's parlance, CIM is the integration of computers in overlapping divisions of an enterprise, spanning production planning, product design and manufacture, and quality assurance. This encompasses several software technologies, including CAD, CAM, MRP, Material Billing and Control Systems (MBCS), Just-In-Time (JIT) and accounting and inventory systems.

The software side of Digital's factory is a conglomeration of expert systems tools, integration tools and applications. All are used internally at DEC. Baseview is the Digital software that annotates the original CAD drawings and distributes them to production personnel. The plant supervisory software package is called Baseway, which collects information from programmable controllers and other devices on the factory floor.

The fundamental integration package is DECscan, which links factory VAXs to measurement and control devices. A system called Distributed NC Applications Service integrates numerical control devices into the network. Basestar is a module that lets you tailor discrete manufacturing systems to integrate data with software applications.

VAX processors are the key to Digital's success. Digital's IVAX systems, ruggedized VAXs and MicroVAXs that are geared toward communications and control of factory-floor operations, are integral to its strategy (see Sidebar, "Ruggedized VAXs").

Rather than just selling hardware, however, Digital is establishing itself as a prime contractor. It recently announced multimillion dollar orders from manufacturing divisions of Boeing and McDonnell-Douglas. Both primarily were purchasers of VAXstations, but they included major integration projects. The Boeing deal is reportedly the basis of the largest CIM project in its history. It involves the integration of VAXstation 3200s controlling sheet-metal production on the factory floor with VAX 6300s that will provide area control, and VAXclusters that will provide corporate input. In turn, the operation will be networked via DECnet/Ethernet to other Boeing facilities.

Dee Wolsey, Boeing's director of sheet-metal operations, recalls that before the purchase, some parts could take 40 days to pass through 21 production steps, covering 1½ miles. "In the new center," Wolsey says, "the same parts will be completed in four days, requiring 13 production steps and traveling one-third of a mile as they move through the factory."

For Digital, the bottom line is keeping its customers happy. Likewise, the bottom line for a manufacturing firm is the delivery of a product that keeps its customer satisfaction high. The realization of corporate goals depends as much on smooth operations at the lowest common denominator, the factory floor, as anywhere else.

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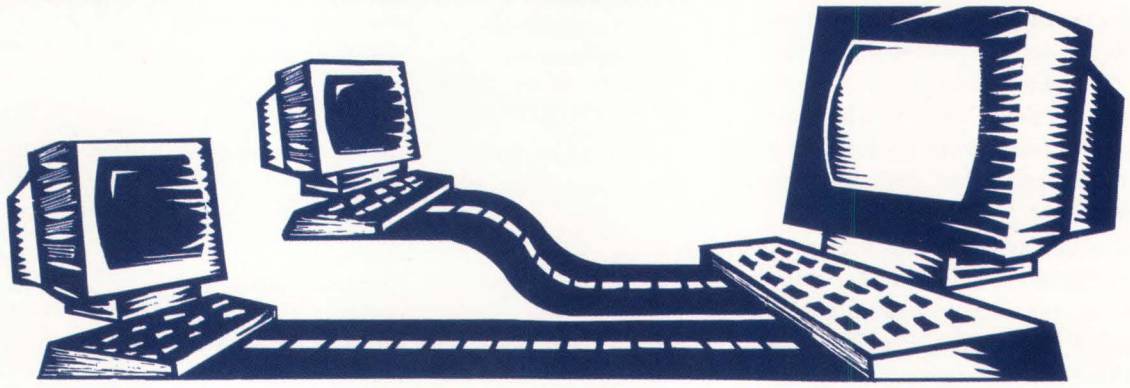
MERGING ON THE DATA HIGHWAY



A VAX interface to a process control system data highway.

BY ROBERT B. IRVIN

HISTORICALLY, PROCESS CONTROL systems and management information systems (MIS) have occupied opposite ends of the computing spectrum. Process control systems operate in a real-time environment and must respond quickly to changes in sensor inputs, sometimes within milliseconds. MIS, in contrast, generally operates in an environment in which speed is important only from the point of view of how long it takes a user to get a report or answer an inquiry against a database.

The City of Los Angeles Bureau of Sanitation is involved in a project to marry these two computing regimes. The effort will provide an integrated environment for process control and management information systems for the wastewater treatment plants located throughout the city.

These wastewater treatment plants are large and complex chemical processing facilities that take a feed stock, in this case wastewater, and use a number of physical, chemical and biological processes to produce a clean output product.

However, unlike many chemical facilities, which can be shut down periodically or in an emergency, a wastewater treatment plant must operate continuously, because the feed stream can never be shut off. Further, the treatment volumes are extremely large compared to other chemical processes. The more than three million people in Los Angeles and surrounding cities generate close to 450 million gallons of wastewater daily.

A $150 million project at the City of Los Angeles Hyperion Treatment Plant currently is under way to dispose

of the sewage sludge generated in the treatment process. As part of this project, the Westinghouse Distributed Processing Family (WDPF), a control system manufactured by Westinghouse Electric Corporation, is being installed (see Sidebar, "Energy Recovery System").

Distributing Control

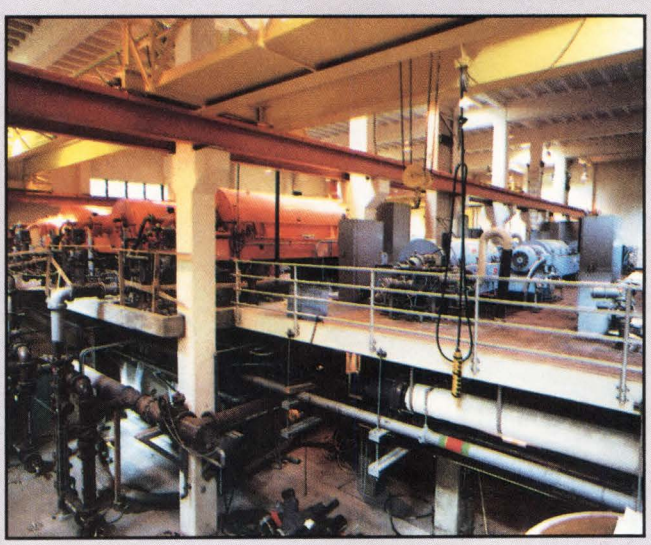
The distributed process control system is the latest evolutionary stage in the digital process control system world. Rather than relying on a centralized host computer to provide control and data-acquisition functions, a distributed process control system uses a large number of process control modules connected by a network.

In the case of the WDPF, the LAN is proprietary coaxial cable. Each process control module is a fairly sophisticated combination of microprocessors with a proprietary operating system, a LAN interface, and I/O interfaces for the field instruments and the final control element connections. Field instruments include flow meters, level switches and pressure indicators. Final control elements controlled by the process can be as simple as an on/off switch to a pump or as involved as a numerically controlled proportional valve controller.

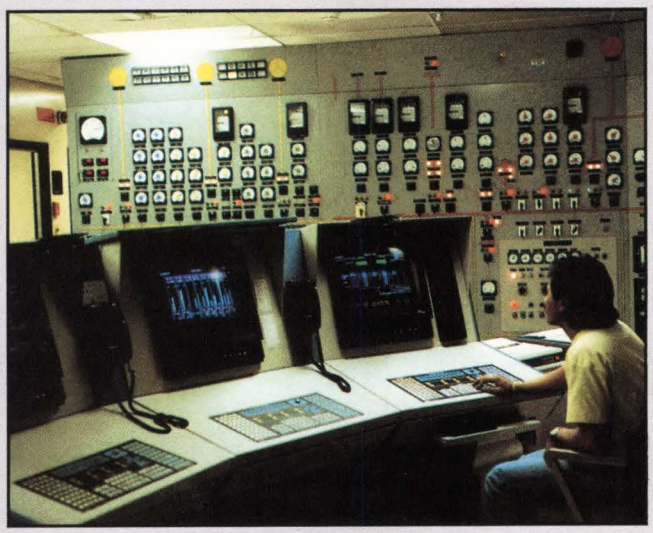
The technique of distributing the process control function was developed to minimize the reliance on only one computer system and communications network. In a distributed process control system, the failure of a single process control module doesn't affect the operation of other process control modules located on the data highway.

In a host-based process control environment, failure of the host computer results in the entire plant losing control and data-acquisition capabilities. Similarly, failure of communications between the host and remote equipment prevents proper functioning if the remote equipment isn't intelligent.

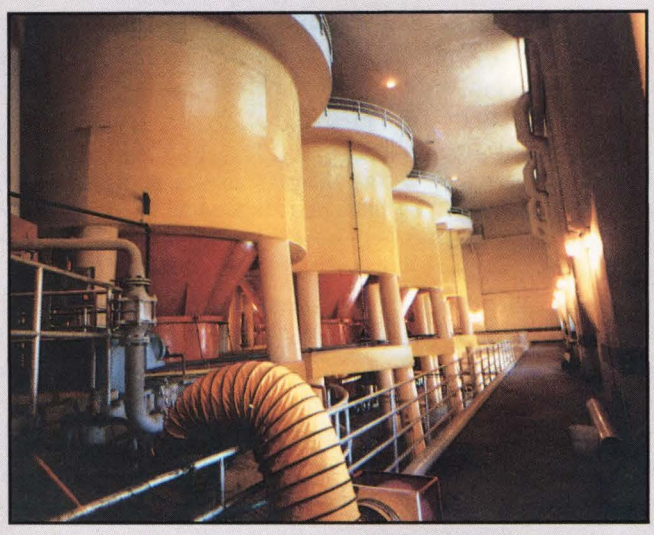
The distributed system's processors usually have redundancy built in. The combination of this redundancy with the distributed architecture provides higher availability and speed than is



Centrifuges and electrical turbines are used in the city's waste-to-energy plant.



Plant operators in a central control room receive alarms and control plant processes.



The level and feed rate in these hoppers are controlled automatically by the local distributed processing unit.

possible in a host-based configuration. There are 23 distributed processing units located in the Hyperion plant.

The distributed process control system provides the capability for sharing required common data among process control modules over the data highway. It also provides increased reliability, because each area with its own process control module can operate independently. In the operation of a wastewater treatment plant, for example, this increased reliability can ensure that failure of individual process control modules doesn't make the entire plant inoperable.

> . . . failure of individual process control modules doesn't make the entire plant inoperable.

LAN Connections

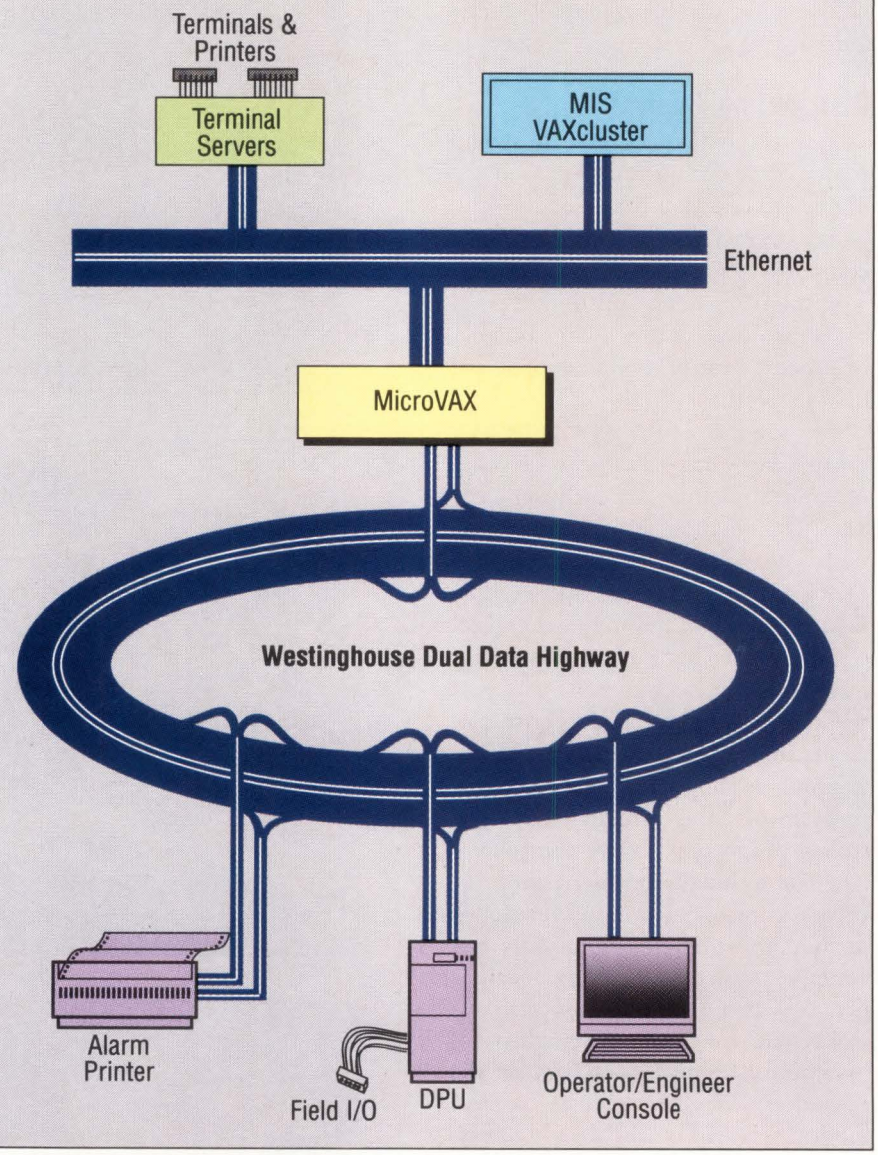
The Westinghouse Process Control System used in the Hyperion Energy Recovery facility has different kinds of LAN connections, or drops, available for collecting information and controlling the operation of treatment equipment (see Figure 1). The user interface to the system is provided by operational/engineering consoles. These are color terminals that have intelligence and data-communication capabilities. They connect directly to, and can interpret and extract data directly from, the data highway.

Some drops can provide historical data collection onto magnetic media. One drop serves as a microcomputer program interface. It has language compilers for PASCAL and FORTRAN and can be used to develop custom software.

However, none of the microcomputer drops can provide sophisticated statistical analysis or information management functions. These functions currently are performed on a VAXcluster at the plant. This management information system supports a number of large applications, including a maintenance management system for the more than $1 billion of equipment installed at the plant. The VAXcluster also produces most of the reports required by regulatory agencies. It relies primarily on VAX Information Architecture products to provide the data-management capabilities.

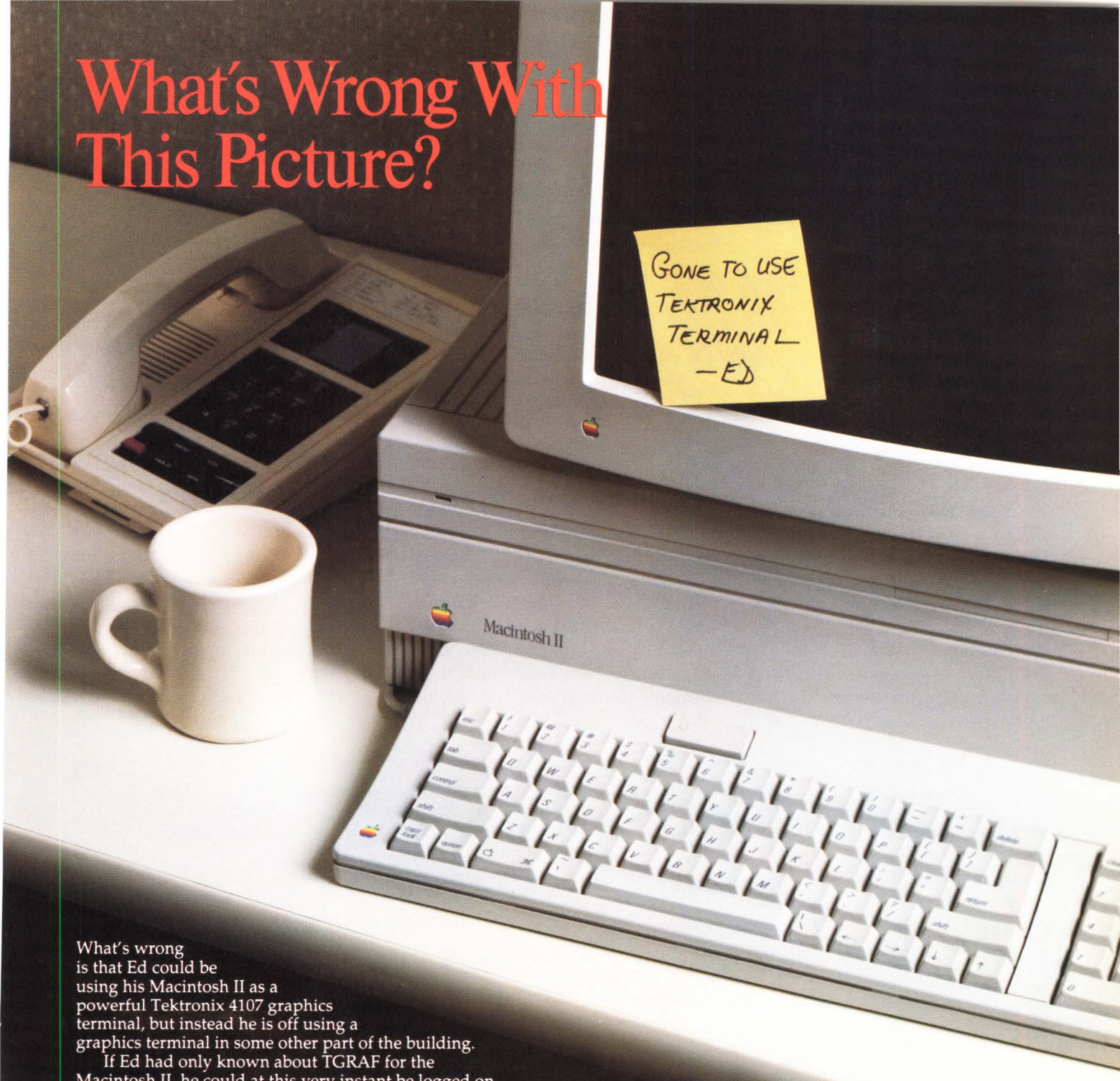
All of the plant data used in the MIS is input manually. Much of this data is collected by the process control system. By linking the Westinghouse Process

Figure 1.



The MicroVAX collects data from the Westinghouse data highway, using the VXI board and firmware coengineered by Digital and Westinghouse.

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.

If Ed had only known about TGRAF for the Macintosh II, he could at this very instant be logged on to his company's mainframe, right from his desktop with his Macintosh II. Ed could now be running any one of a hundred or so host applications, with his MAC II and TGRAF combination operating as a powerful graphics terminal.

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.

TGRAF has the powerful and seamless user interface that Macintosh users have come to expect. TGRAF supports Multifinder, cut & paste, pull-down menus, separate text windows with scroll bars, plus powerful graphics terminal features such as graphics displayed in sixteen on screen colors, full 640 x 480 resolution, 12 bit addressable space, etc.

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Control System with the VAXcluster, we can collect real-time process data and make it available in a sophisticated and powerful MIS and statistical computing environment. The capabilities for data and statistical analysis available on the VAXcluster wouldn't be possible in a process control system environment. Likewise, distributed process control capabilities ordinarily aren't available in a VAXcluster environment.

> . . . distributed process control capabilities ordinarily aren't available in a VAXcluster environment.

Interfacing

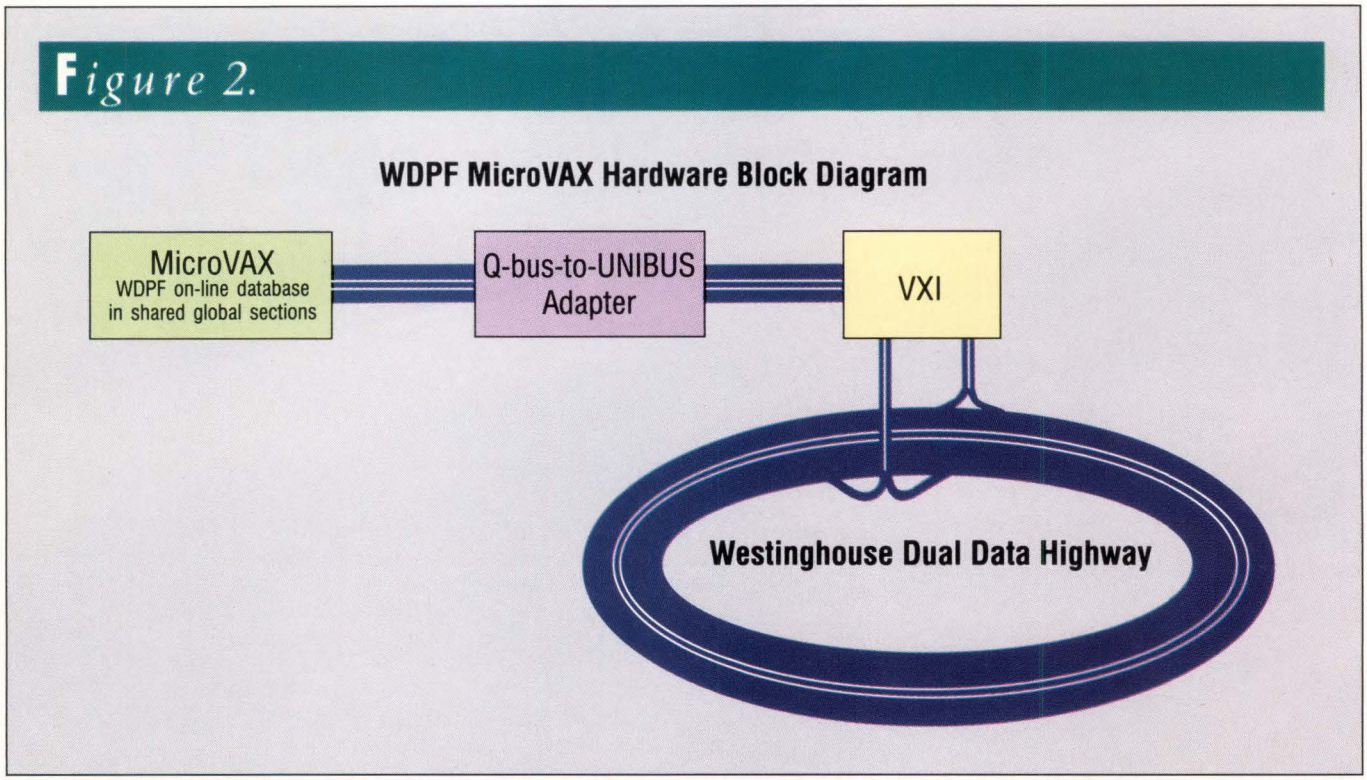
We'll use a Westinghouse MicroVAX calculator drop to interface the two systems. Westinghouse and Digital have coengineered a product called the VAX Interface Unit (VXI), a gateway interface between the WDPF data highway and VAXs (see Figure 2). The interface can operate on UNIBUS and Q-bus VAXs.

The VXI hardware is an 8086/8087 microprocessor with shared memory and a Multibus-to-UNIBUS adapter. The Multibus is the bus structure used on the WDPF. When this hardware was developed, the UNIBUS was the only bus available on the VAXs. The VXI is supplied with a Q-bus-to-UNIBUS adapter to allow the use of the Multibus-to-UNIBUS device in the MicroVAX world. The adapter provides a DMA interface to either the UNIBUS or the Q-bus and allows the VAX to be connected directly to the data highway. The DMA interface allows the processor to read and write directly to the bus memory locations as if they were local to the Multibus or UNIBUS. This provides a closely coupled link between the WDPF highway and the VAX memory with low VAX CPU duty-cycle requirements.

The firmware resident in the VXI maintains the database of the WDPF process data and general-message data between the WDPF LAN and VXI memory. It provides buffering for LAN transfers, maintenance of the tables necessary to communicate with the data highway controller, and the implementation of the WDPF LAN general-message protocol, so that the VAX can communicate in the Westinghouse WDPF native mode.

The VXI transmits data directly

Figure 2.



In the Westinghouse distributed control system, the MicroVAX provides a connection between the data highway and the VAX network.

Companies Mentioned In This Article

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between VAX main memory and the LAN using standard VAX/VMS Queue Input/Output (QIO) calls to a special device driver. The data structures in VAX memory, called highway request blocks (HRB), are shared global sections built by a process point compiler, which is software supplied by Westinghouse.

The HRB provides an interface between application programs and the WDPF data highway by setting up and maintaining a database of real-time process point information. It contains information such as most recently scanned value, point description, type of point (i.e., analog or digital) and scan frequency. This information is updated one to 10 times per second.

Application programs that need data from the control system simply include this global section in the source code. The program then can reference the data by control point name. Consequently, the access to control information isn't only fairly straightforward, it's also very fast, because this data is resident in VAX main memory.

Connection between the MicroVAX calculator and the VAXcluster will be provided via Ethernet and DECnet.

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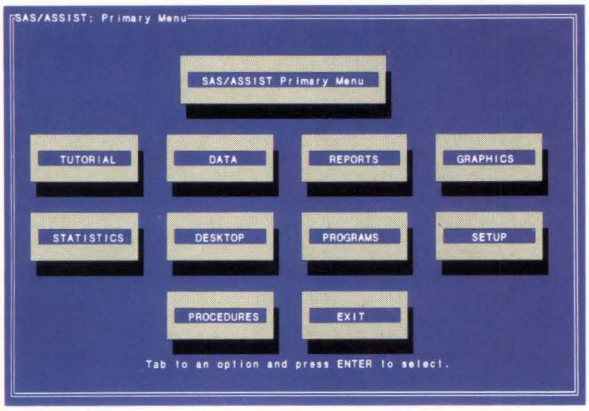

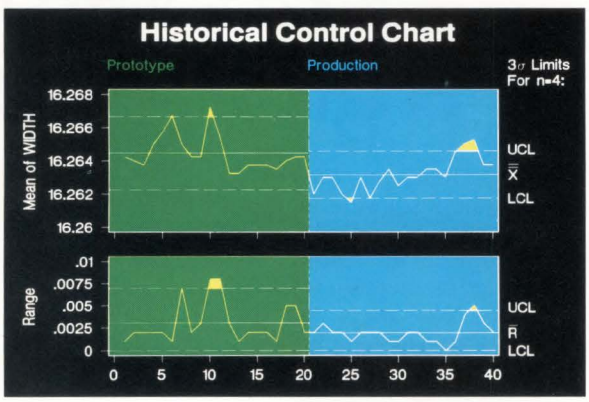

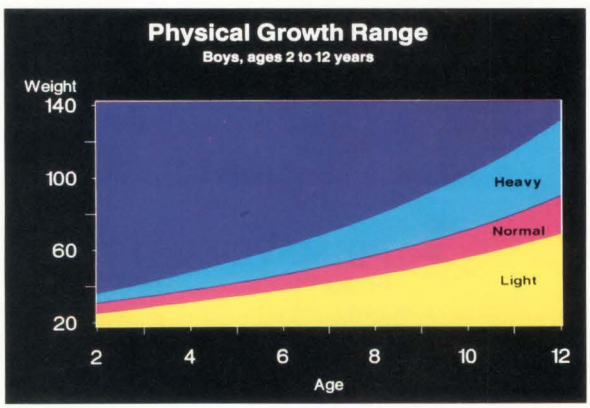

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We'll use FORTRAN programs to extract high and low daily values, average values, and values of particular interest out of this real-time common database. The information will be stored in other databases in the MicroVAX. Scientific and engineering staff members using the MIS can access the database files over DECnet and can use tools such as SAS, DATATRIEVE or other graphics packages available on the MIS.

The responsibility for collecting this real-time data is completely offloaded from the MIS hosts in this configuration. This provides a clear separation between the slower, database-intensive MIS world and the time-critical real-time process control world.

—Robert B. Irvin is manager of information and control systems for the City of Los Angeles Bureau of Sanitation.

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Energy Recovery System

The Bureau of Sanitation operates four wastewater treatment plants at various locations within the City of Los Angeles. Two of these plants are classified as water-reclamation plants. They take sewage wastewater and run it through three distinct processes (tertiary treatment). The final product is used as irrigation water for commercial parks and golf courses and as industrial cooling water.

The other two plants are wastewater treatment plants. They process the waste through two distinct processes (secondary treatment). The final product is discharged to the sea. The largest of these plants is the Hyperion Treatment Plant located south of the Los Angeles Airport in Playa Del Rey. The Hyperion Treatment Plant treats approximately 380 million gallons of wastewater and generates approximately 1,200 tons of sewage sludge solids daily.

In an effort to dispose of these sludge solids, the Hyperion Energy Recovery System (HERS) was constructed at the plant. It's designed to dry the sludge, burn it in a fluidized bed reactor and convert the resultant heat into electricity. Some of the electricity is used to operate the treatment plant. The excess is sold commercially. HERS is highly automated, and all of the processes are controlled by a large distributed process control system.

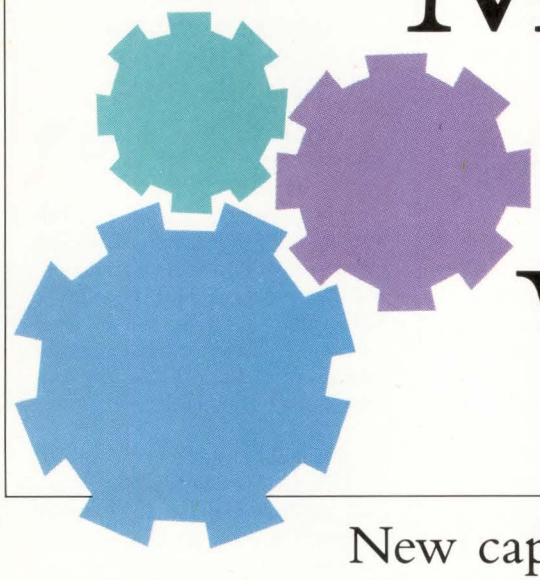
More than 12,000 analog and discrete points are monitored in this control system. Analog points are variable measurements such as flow or temperature. Discrete points are either on or off, such as the state of a motor, i.e., either running or not running.

HERS is divided into five operations, or trains. The solids first are digested anaerobically, and methane gas captured from this process is used to drive gas turbines that generate electricity. The digested solids then are centrifuged to remove the majority of liquid. This low-water-content solid then is put through a patented de-watering process, using high pressure, oil and heat. The dry powder that results is carried by a nitrogen conveyor to fluidized bed reactors where the powder is burned. The energy that is generated by the combustion is converted to steam and used to drive steam turbines.

The plant is scheduled to be in full operation within a year. At that time, it's expected to generate 25 megawatts of electrical energy daily, enough electricity for 25,000 homes. The plant is controlled by a distributed process control system manufactured by Westinghouse Electric Corporation.

Each of the process trains is controlled by a distributed process control module, a CPU on a LAN, called the data highway. Each of these process control modules operates numerous analog and digital inputs and outputs. The module is responsible for process control and process monitoring in the train where it's located.

The data highway LAN operates over a coaxial-type cable and runs at 2 Mbps. The data communication over this line is proprietary to Westinghouse. Each of the Westinghouse Distributed Processing Family modules that connects to the data highway has communication intelligence to let it extract sensor information from the LAN or make sensor information available to other modules. All functional units connect to the LAN.



Making Projects Work

New capabilities advance the state of the art in project management software.

BY STEVEN SALEMI

NO BUSINESS CAN AFFORD to manage projects poorly. The ever-increasing constraints of costs, resources, quality and time make project management a serious business. Accordingly, today's project management packages are powerful, complex pieces of software.

Automotive, aerospace and pharmaceutical manufacturers rely on project management software to get high-quality products out the door on time and within budget. Elsewhere, project management applications are used for building skyscrapers and developing software.

As a formal discipline, project management appeared in the 1950s, with the Program Evaluation and Review Technique (PERT) analysis for Polaris missiles. About the same time, Du Pont developed the Critical Path Method (CPM) to manage large, complex technical projects. Commercial project management software packages arrived in the 1970s.

Many popular project management software applications were developed on PDP-11 or VAX systems and ported to other platforms, including IBM mainframes. Today, project management software development on Digital systems is accelerating, as Digital stocks its workstation arsenal with fast CVAX and RISC hardware.

With the successive introduction of minis, micros and technical workstations, project management software applications have found an increasingly broad hardware platform: MS-DOS PCs; VAX, MicroVAX and VAXstation systems; UNIX workstations from Digital and Sun; and IBM minis and mainframes. The industry's leading packages will continue to be available on Digital systems, because Digital has a strong presence in manufacturing, engineering and other disciplines that rely on project management software.

Every software application uses a model to replicate the real-world task it attempts to automate. For project management software, CPM is a prominent model. CPM defines a series of activities and its relationship to other activities. Time, resources and costs are factored in. The result is a graphical representation of the project time line. This is usually a GANTT chart with activities displayed as horizontal bars. Although no model is perfect, CPM comes closest to the way that projects progress in the real world.

The latest crop of project management software packages focus on enhanced features, database technology and integration with other hardware and software systems.

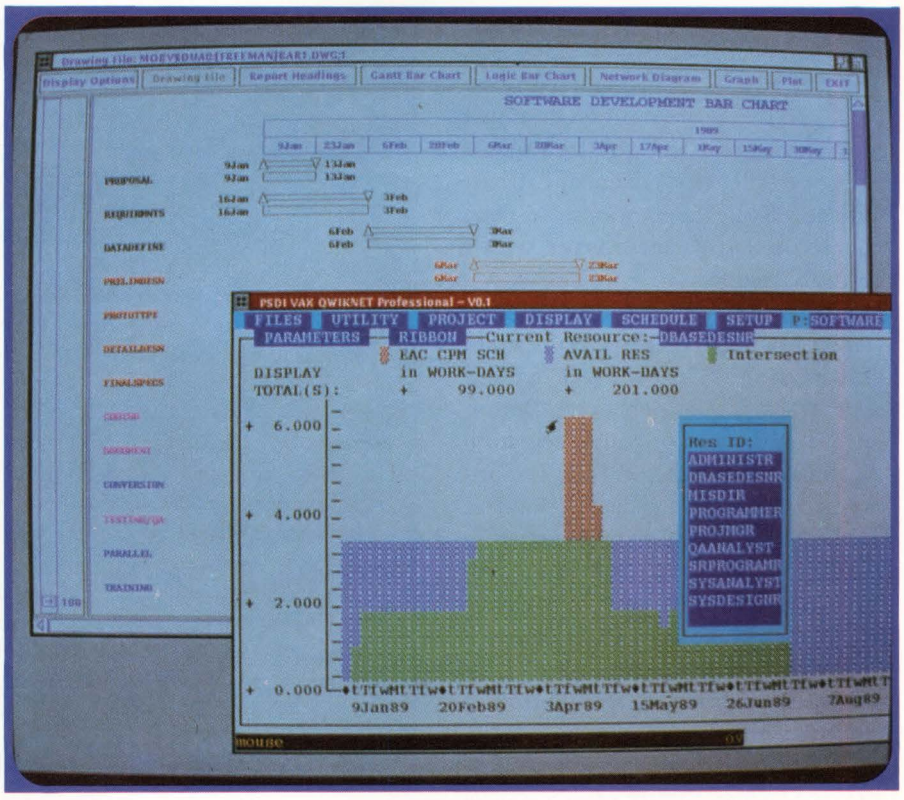
Any project management software package can determine whether or not

a project can be completed on time with existing resources. But some packages perform risk analysis to determine the likelihood of project completion under different scenarios. With this software, users define range-of-time estimates for the completion of various tasks. A project scheduler rolls up the distribution curves associated with each of these tasks. The result is a report or graphic listing a range of project-completion dates, with probabilities assigned to each date.

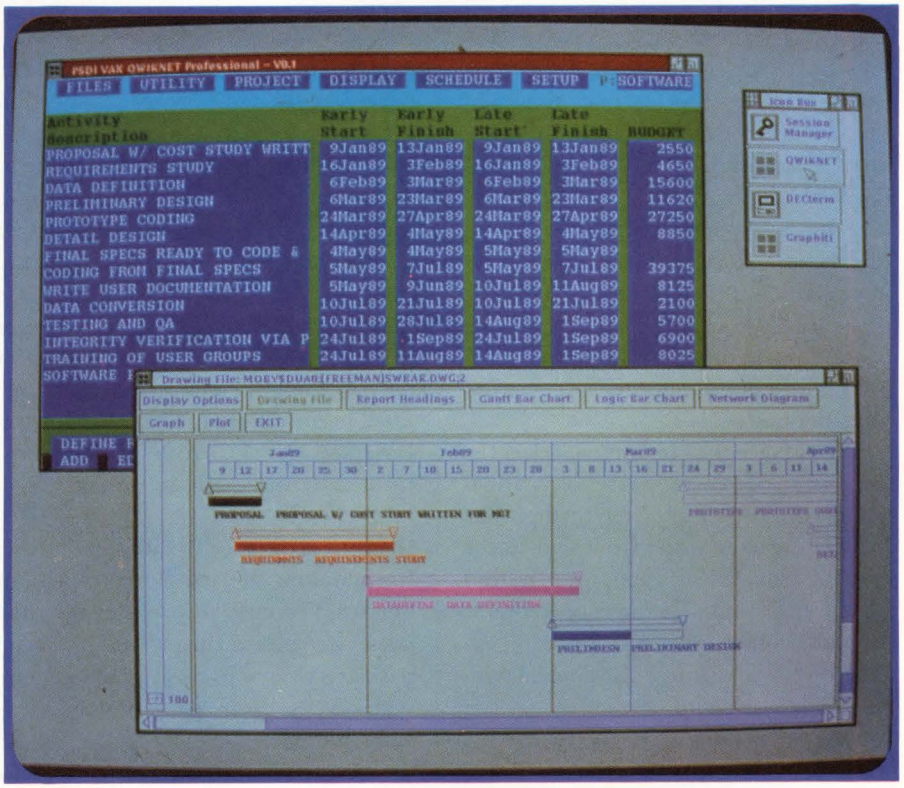
Support for simultaneous multiple users of a single project plan is a recent development. Some packages don't support multiple users. Others circumvent the problem by creating separate data records for each user and merging them later. True multiuser systems enable groups of users to access individual projects and make simultaneous updates to them.

One popular application accomplishes this by tracking users who have selected a project. With two or more users, the program monitors each user's operating mode (where they are in the application). When users are querying or browsing (i.e., when no database updates are required), the system functions normally. But when a user enters an update mode in which writes to the database can be made, a wait lock locks the database record. The record remains locked until the user exits the update mode. For multiuser minicomputer and LAN implementations, tight integration of the project management application with database record-locking schemes is mandatory.

Another leading project management application features a loop detector to prevent users from designing networks with endless loops. Because projects involve large numbers of interdependent activities, users of many project management applications can create project models with endless activity loops. This could be two activities that require each other's completion before they can commence. Systems without loop detectors can crank away for hours, oblivious of any flawed logic.



DECwindows-based project management system shows resource histogram of how a labor type is being used in a software development project. The histogram overlaps a plotted bar chart showing activity duration.



DECwindows-based project management software illustrates a bar chart with progress up to a status date overlaying a schedule report including budgeted cost of activities.

Some packages use proprietary database systems written by the vendor. The database is integrated with and dedicated to its parent program. Other programs work in tandem with Digital's Rdb or third-party relational database systems. Some applications let users choose among database types with a software toggle.

When project management software is run as a standalone application, the database issue isn't compelling. Both approaches get the job done. But an open database can provide integration capabilities beyond ASCII file import/export. An open, industry-standard database can be a means for integrating project management software with other companywide computer systems, including Manufacturing Resource Planning (MRP II) systems.

In an automated manufacturing operation, project management software can be integrated with engineering, prototyping, manufacturing, quality control and other systems. The relational database serves as the repository for data created by all of the systems. Events are triggered by the changing status of various systems and resources. Process status is reflected by the information in the database. Resource algorithms are used to communicate the process status in database terms.

In this way, the database becomes the common tongue spoken by the MRP II systems and the project management systems. It's an integration tool for systems that may have no other easy means of communicating and sharing information.

One recent development takes the benefits of third-party relational database technology a step further. The database becomes the front end to the project management application, instead of the back end. The developer builds the project management application using the development tools supplied with the database. This breed of project management package ships with a runtime version of the database.

This "project manager within the database" approach has some promising advantages. First, the system is immediately familiar to users familiar with the database: commands, queries, reports, and the like, are accessed the same way. In addition, the application can be customized with the same database development tools used to create it. Also, the availability of such packages for new operating environments, such as DECwindows, can follow quickly upon the introduction of the database for that environment. No major rewrites of the application are required. Most of the programming effort needed to conform to the environment's Application Program Interface (API) can be performed by the database vendor.

Integration Made Easy

Integration with database systems is but one form of integration offered by the latest project management software packages. Many packages can integrate with other software programs and hardware systems.

ASCII file import/export capabilities are a near-universal means of exchanging information between project management software packages and other information systems. Users control how these ASCII files are formatted. By modifying the file header and trailer information, as well as the file, field and record delimiters, the files can be used by other systems. For example, ASCII files produced by an IBM-based MRP II system could be sent over a DECnet/SNA Gateway and imported into a VAX-based project management software application.

In addition to ASCII files, many project management software packages support file import/export in popular PC formats, such as SDF, DIF, dBase and Lotus 1-2-3 .WKS. The industry-standard .DXF graphics exchange format also is supported. As other standards evolve, such as Microsoft Excel's .XLS worksheet, you can expect to see these supported, too.

Many packages integrate with other software tools, usually marketed with the package by the same vendor. One package, for example, offers a cost estimator package integrated with the main program. Originally developed

Project Management From DEC

VAX Software Project Manager, a Digital-developed project management software offering, is designed for estimating, planning and managing software development projects. It contains an integrated software-estimation feature. This projects total effort, time to deliver and staffing required. Without this feature, it can serve as a generic project management tool.

VAX Software Project Manager imposes no limits to project size, resources per project or resources per activity. Support for fractional resources allows the same resources to be devoted to different activities. Project presentations can be tailored to include only the information the user wants to review: project tasks, milestones or both, for example. Similarly, a report-writing capability allows users to select any information in the project database and format that information for reporting purposes.

Users can choose a menu-oriented mode with graphical interface, as well as a DCL-style command line mode. The menu interface requires a Digital graphics video terminal or equivalent. The graphics mode presents project data as trees, nodes, graphs and charts. Users can switch quickly between menu and DCL modes.

Like other members of Digital's VAX Information Architecture (VIA) family, Project Manager is integrated with Digital's networks. Users can access projects across a Digital LAN or WAN by setting the default library to a remote directory. The Project Manager database permits simultaneous updates by two or more users.

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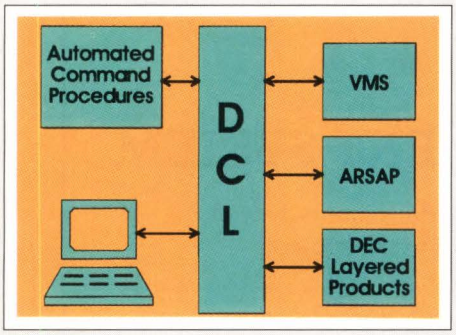

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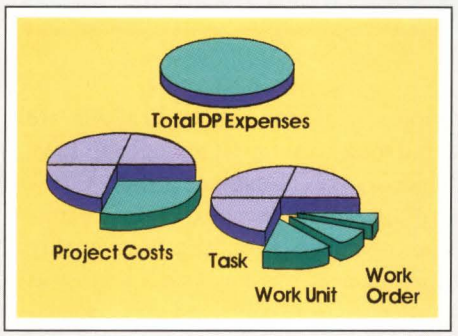

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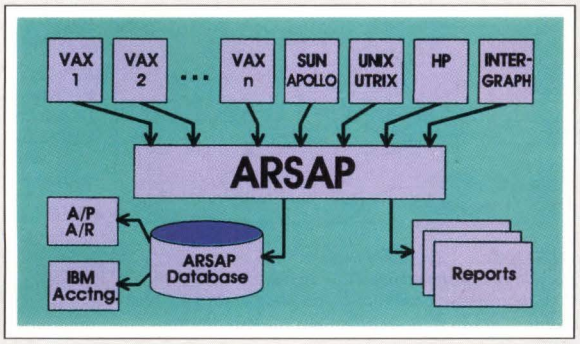

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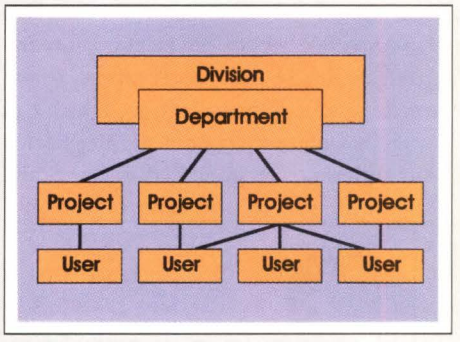

ARSAP can handle any situation—whether a company division contains five or 5,000 users; users belong to one department or several; a project consists of one or multiple users; or users from several departments are working on the same project.

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separately, the user only sees one package.

One vendor features an easy-to-use, graphical-based front end for its command-driven system. This gives users a choice between fast and easy interfaces. It also provides flexibility to the manufacturing organization, which can deploy different versions of the package to different categories of users. Some project management applications are built for integration with high- or low-end packages in the same product family. Sometimes these packages are subsets or supersets of the functionality contained in the core package. Just as often, vendors offer the same packages, with identical functionality, on minicomputer and PC platforms, providing users with a range of functionality depending on their needs. A project composed of 1,500 activities may run fine on a PC, but a project with 30,000 activities requires a VAX.

Typically, these packages integrate via ASCII file transfers or by sharing a back-end relational database. When a vendor's minicomputer and PC packages don't share a database, the vendor usually includes commands to automate the transfer of information between the two versions of its software. With Digital's VMS Services for MS-DOS software, users of minicomputer and PC packages can share data files without the need for system-to-system file transfers.

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workstation window, recalculate the schedule and see the effect displayed in another window. Users can run multiple WHAT-IF analyses in different windows, keeping an eye on each result.

will allow more flexibility in planning contingencies and risks. It also will mean a closer fit between the project model and reality.

Another trend is the adaptation of expert systems and AI technology to project management software. Over time, the project models or networks devised by each package gradually will reflect the expertise of experienced planners.

One technique compares the details of proposed plans to previous plans. Such a program would have the ability to learn. Imagine an intelligent dialog box flashing this warning: "In the past five years, four project plans similar to this one have gone over budget. Are you sure you want to proceed?"

A third trend is the incorporation of project management software packages and other automation tools into integrated project support environments (IPSE). An IPSE links the software tools used in development projects. It can help monitor, track and coordinate activities across the entire development cycle.

An IPSE, for example, can integrate project management software with an enterprisewide electronic mail package. Without human intervention, the IPSE can send messages to engineers, alerting them that important project milestones are imminent. Such a system can greatly increase the chances of a project being completed to plan. *—Steven Salemi is president of Bottom Line Communications Inc., Concord, Massachusetts. He has written extensively about DEC hardware, software and services.*

MOST LEADING VENDORS
who sell their wares to the Digital installed base probably will port their software to DECwindows.

A number of project management software vendors have announced support for DECwindows, Digital's integrated applications environment. Other vendors, in less specific terms, talk about support for the Digital strategy. Most leading vendors who sell their wares to the Digital installed base probably will port their software to DECwindows.

By rewriting the user interface for DECwindows, developers can retain the core portions of existing programs. One vendor estimated that this task represents 20 percent of the entire program.

From the organizational point of view, open operating environments, such as the X Window System and DECwindows, promise applications portability. A software package can be accessed by any system that supports DECwindows.

Looking Ahead

You should keep an eye on several trends unique to the project management field. One is the development of profession-specific packages, spinoffs from leading core packages. As competing project management software packages develop equivalent capabilities, these packages will allow vendors to distinguish themselves in the marketplace.

These packages will enable user organizations to account in their project plans for the unique activities, resources and bottlenecks found in each field. This

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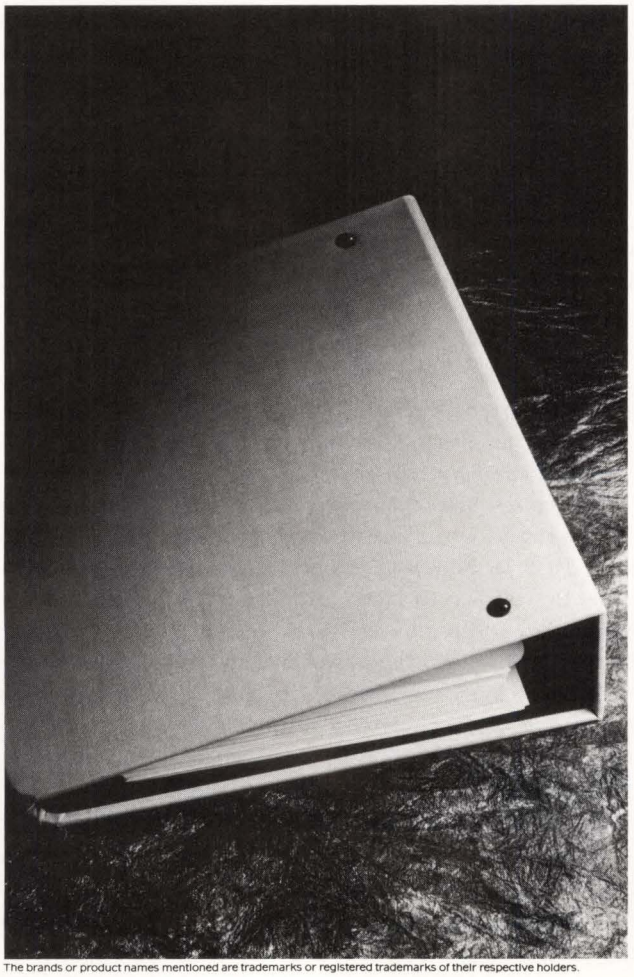

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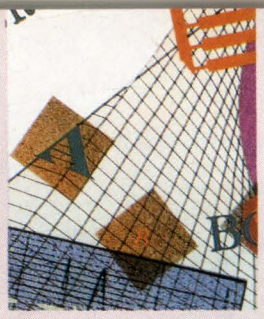

CONNECTIVITY

DISTRIBUTED QUEUING SERVICE

By Philip A. Naecker

A Facility That Allows You To Put VAX Printing Where You Want It.

Editor's note: This is the last in a series on Digital's DECnet System Services (DSS). These layered products combine multiple VAX systems into an integrated, distributed environment. See "Netting DECnet System Services" (April 1988), "To Name Me Is To Know Me" (June 1988), "One Doing The Work Of Many" (November 1988) and "Distributed File Service" (January 1989).

"The network is the system." That marketing slogan from Digital reflects a great deal about VAX computing today. It's no longer adequate for resources to be available to anyone using a single machine or even to all of the users on a VAXcluster. To be truly cost effective, resources such as printers must be available to every user and application throughout the network.

Making resources available across the network is really what Distributed Queuing Service (DQS) is about. DQS is one of Digital's DECnet System Services (DSS) products. Like the rest of the DSS products, DQS is a strategic product that leverages the power of Digital's networking architecture and takes the best advantage of powerful availability features, such as clusters. DQS makes VAX printers available to all nodes in the network, with functionality identical to that of local printers.

There are many reasons why it's especially important to make printer resources available across the network. The most obvious is locality of printing. Users want to print on the printer closest to their desk, regardless of the machine on which they're working. This is especially true in WANs in which there's a remote small machine or workstation with a printer attached, but the user uses a central cluster for some of his work. In this case, DQS lets a print job on the cluster send its output directly to a printer on the remote machine — the one near the user.

In a distributed organization, you may want to print files generated by one job on printers scattered about the organization. For example, a central accounting department might want to print accounting information for each office in a large company. Using DQS in a process that's essentially an extension of the locality-of-printing feature, a single job can print files on many printers in a network, even if those printers span the entire country. This is a vast improvement over centrally printing, then manually bursting and physically mailing the printout to the remote offices.

Another great demand for distributed printing capability is in specialized printing resources. In our example of a branch office and central cluster, the branch office might generate large printed reports to be delivered to someone in the central office. Instead of printing these reports on the small local printer and then physically mailing them to the central office, DQS lets you print the job directly on a large central printer, without loss of formatting or other job-control capabilities.

The DQS mechanism supports any kind of output device compatible with the standard

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VMS printing model, no matter what type of print symbiont it uses. This means that specialized output devices that use queues, such as plotters, computer output microfilm or even custom devices, can use DQS to provide that output service to all the nodes in the network. DQS does this using the standard features of VMS queues and DECnet.

Without DQS, standard VMS printing allows you three basic modes of operation:

1. Printing to a printer directly connected to your VAX.
2. Printing to a printer connected to any currently running machine in the VAXcluster (VMS distributed job controller).
3. Printing to a printer connected to a terminal server, possibly shared in a round-robin mode by multiple hosts.

You also can use a feature called remote printing ($PRINT/REMOTE), but the functionality available with that command is very limited. It basically amounts to printing a file already on a remote node on the default printer on that node with the default print characteristics.

The first method of printing, local printing, is fine if all you have is a standalone system. However, most VAXs are networked, so local printing isn't enough. The second method, VAXcluster distributed job controller, helps only if all of your systems are in a cluster.

Many sites have tried to solve the distributed-printing problem using the multiple-host capability of terminal servers. This capability allows a terminal server to search, round-robin style, through a series of machines, each with a queue pointing to the printer. There are enough problems with this approach that it turns out not to be useful except in some very simple circumstances.

First, limitations in terminal-server memory make it feasible only for a small number of hosts. Second, it only works across a LAN and not in a WAN. Futher, because there's no way to tell what jobs are waiting in the logical queue (only some of the jobs are on any one host), there's no way to tell how long it might be before your job prints. One long print job or thoughtless user can upset the whole apple cart.

Some very large sites have tried to write their own distributed queuing mechanism. Most of the hooks to do that are available in the public interfaces to VMS and DECnet. However, some aren't, and the problem is too large for most sites to tackle.

There are also public-domain tools to do remote printing. These tools work well for small networks and small numbers of queues but don't have the full functionality needed for industrial-strength printing in complex networks.

If you're running in a network, you really want a print queue on your machine for any printer you might want

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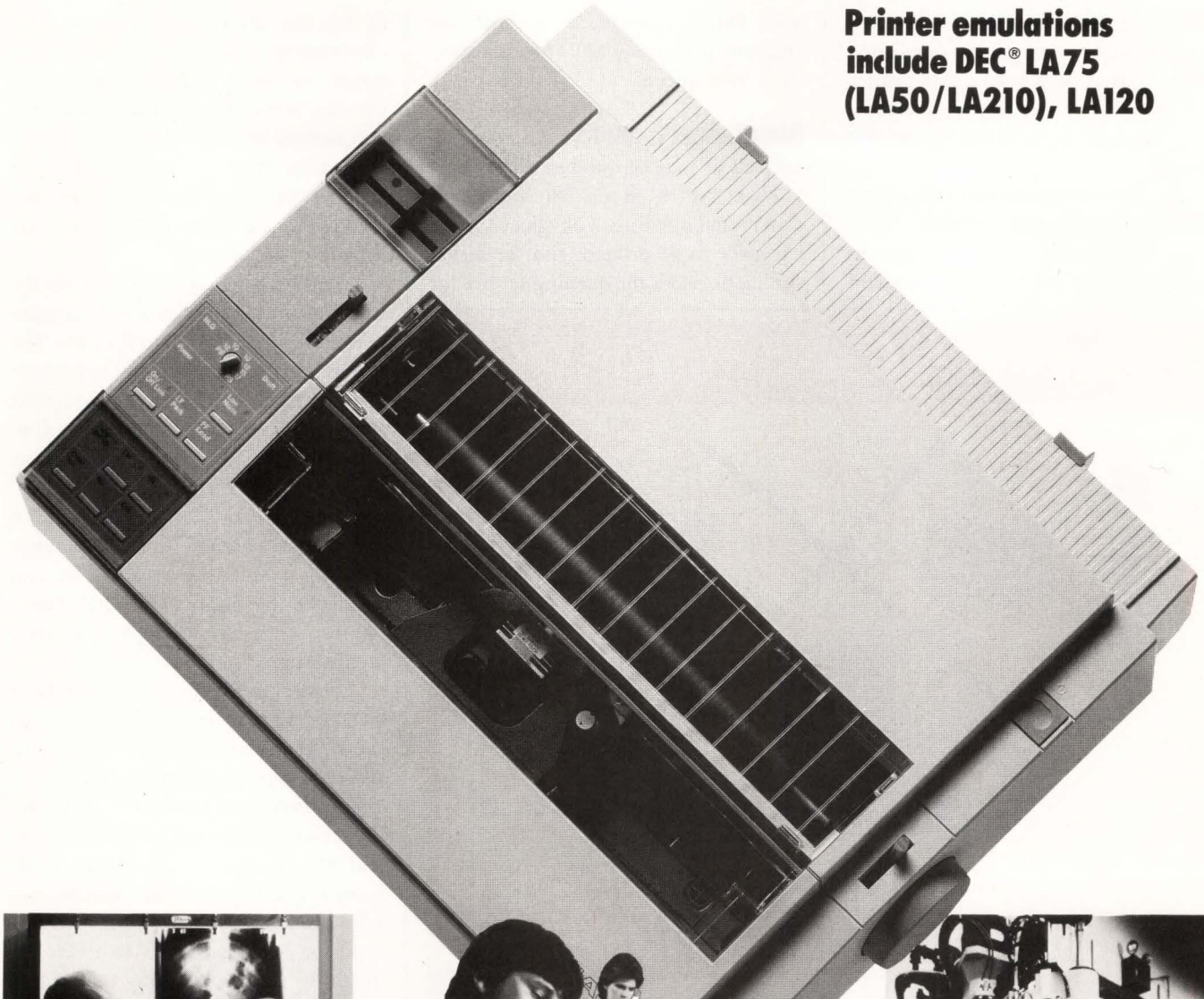

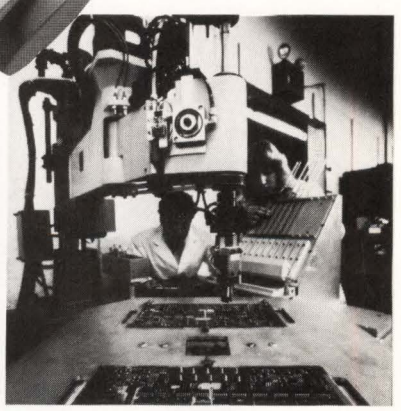

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to use. You aren't concerned with which machine might be physically connected to that printer or whether that printer is in the same cluster as your machine. You just want to print *that* file on *that* printer.

DQS accomplishes this task in just about the simplest way possible. There are no special commands for the user to learn to print the file. DQS uses standard VMS PRINT commands, because the DQS queue that you PRINT to is a standard VMS queue.

Distributed Queuing

Like all of the DSS products, DQS uses a client-server model to implement distributed queuing. The client system has a file to be printed, and the server system provides the queuing service (or in this case the printing service). In a client-server system, the client and the server cooperate to provide service to the user. Ideally, the fact that both clients and servers are involved is transparent to the user. The user should just see that a request for a specific task was satisfied and be insulated from exactly how that function was provided.

Although DQS isn't perfectly transparent, it provides a very consistent view of a print job to the user. The lack of perfect transparency is because of limitations in the current VMS print symbiont interface. Expect to see slow but steady improvements in this area as new versions of VMS are released.

The Sidebar, "Using DQS," shows the structure of DQS and how it functions for a PRINT command. You can see from the Figure that DQS layers neatly into the VMS printing architecture.

However, the distributed nature of DQS means that there are a number of thorny problems that the product has to solve. For starters, there are at least two queues involved: the client queue and the server or target queue. Both are normal VAX queues, but the server queue is on a different machine than the user who prints the job. Therefore, there's a need for new commands to access the queue in ways analogous to the SET QUEUE, DELETE/ENTRY and SHOW QUEUE commands.

DQS accomplishes these functions with a new set of commands: QSET, QDELETE and QSHOW. These commands understand the distributed nature of DQS queues. For example, if you do QSHOW on a local (client) DQS queue, it will tell you not only about files that are waiting in the local queue to be transferred to the remote system but also about files that are already on the remote system and are either printing or are waiting to be printed. Similarly, QDELETE and QSET will operate on either the client queue or the remote queue, depending on the location of the printing file, as required.

These Q* commands aren't ideal. The DQS developers probably would

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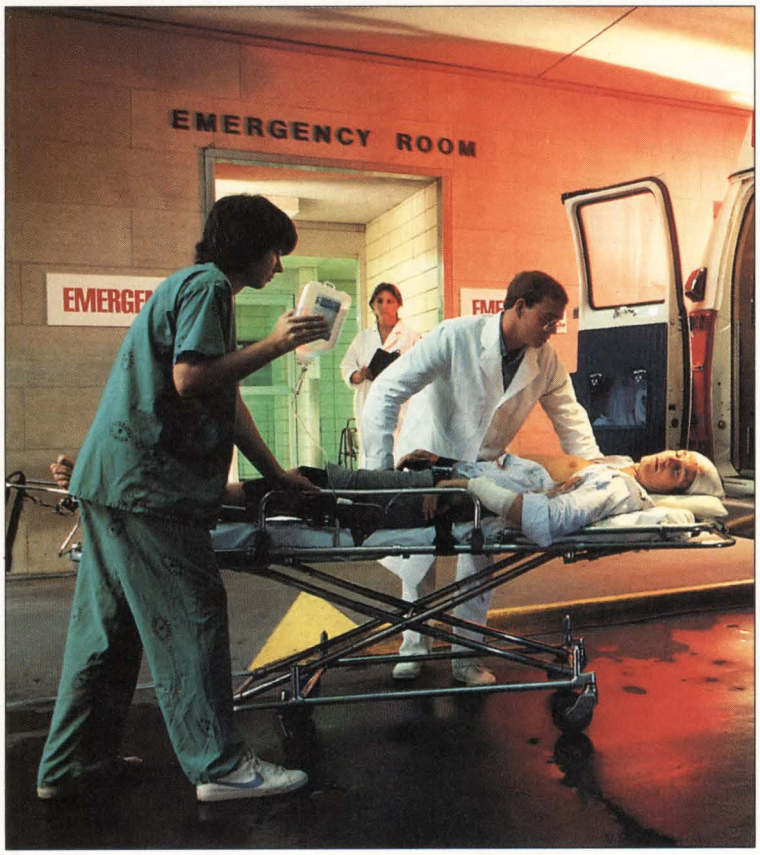

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like to incorporate some knowledge of client and server queues into the VMS job controller and queue interfaces. After this is done, users of DQS queues will be able to use the same familiar commands (SET/SHOW QUEUE, SET/SHOW ENTRY) on DQS queues as on non-DQS queues. Until then, however, the Q* commands are a nice compromise. Figure 1 shows an example QSHOW session.

The distributed nature of DQS makes receipt of job completion notices interesting. If you use PRINT/NOTIFY to a DQS client queue, you get two notification messages. Because the client queue is a completely normal VAX queue, the VMS job controller on the client system will see your request for /NOTIFY and send you a job-completed message when the job is "printed." However, a client queue doesn't have the actual printer connected to it, but instead is connected to a virtual device that transfers the file to the remote system. Thus, the job is "printed," as far as the client job controller is concerned, when the job has been transferred to the remote system. This is when you get your first notification message.

The /NOTIFY qualifier also tells the DQS server queue that you want to be notified when the job has been printed. The delivery of this message is a little trickier, as Figure 2 shows. When the job has completed printing on the server queue, a notifier process (DQS$NOTIFIER) detects this by checking all queues looking for DQS jobs that have completed. DQS$NOTIFIER then sends a message to a process on the client, which in turn sends a message to you. This second message tells you that the job has been printed.

The difference in the messages between DQS and normal VMS printing may be a little confusing for novice users. It can be especially confusing in a LAN in which the first notice is delivered almost immediately but the job may take a while to print. However, most users quickly get accustomed to this quirk, and in any case the QSHOW command gives detailed information on the status of print jobs.

Print Anywhere

DQS layers on top of standard DECnet, so you can print anywhere on your VAX network. Unlike other remote printing products, DQS isn't limited to LANs. In the *DEC PROFESSIONAL* Lab, we used DQS to print across a WAN that includes two LANS, leased lines and dynamic asynchronous DECnet lines.

DQS doesn't care what your DECnet connections look like. In fact, although both the client and server nodes must be VMS nodes, intermediate nodes or routers in the network can be any Phase IV node. DQS will work just as well if you use Ethernet, leased lines, X.25 lines, asynchronous lines or any such combination.

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

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

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

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

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

We think C.Itoh's CIT334 and 344 are simply more terminal for the money than the DEC VT330/340. And when you compare, we think you'll agree.

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CIRCLE 327 ON READER CARD

One of the neatest features of DQS is its ability to start the file transfer whenever the network comes up. For example, I frequently print to a printer that's on a VAXstation networked to my own VAXstation via a dynamic asynchronous line. The user on the remote VAXstation also prints to the printer that's connected to my VAXstation.

During the day, when either of us wishes to print to the other's printer, we simply print to the client queue on our local machine. Sometimes this printing is done by batch jobs, too.

Occasionally, one of us will want to do some interactive work on the other's machine or transfer files between them. We have command procedures to set up dynamic asynchronous DECnet on demand. But DQS is very smart. When it sees the network come up, it automatically starts transferring the files in the client queues. When the file transfers completely, the job prints and notifications are displayed for the submitting user.

This is very convenient. Because DQS manages the file transfer intelligently and transparently, we no longer concern ourselves with transferring files for printing. We simply queue them up on the client node and rest assured that they'll be printed on the server node at the earliest possible time. If we want to make sure that they print right away, we just have to set up the network link.

Standardized Queues

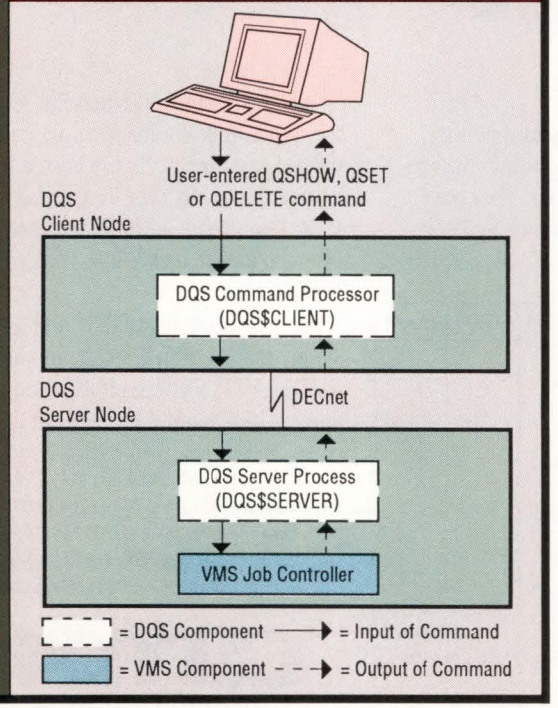
In a large network, using DQS is a great opportunity to standardize queues and thus make printing transparent to location. DQS helps accomplish this in several ways.

First, the system manager can decide on standardized queue names, forms and characteristics. For example, you might want to call all LN03 printers PRINTER_LN03 and have associated forms PORTRAIT, LANDSCAPE, EXTRA_WIDE, and so on. DQS provides a mechanism to keep the forms for client and server queues in sync. This is important, because the client-server nature of DQS means that the PRINT command is processed and validated (including the /FORMS qualifier) on the client node. If the server node has different forms, the PRINT command will succeed, but DQS will return an error later when it tries to print the file on the server.

After queue names and characteristics are standardized, the system manager can move printers around the network to satisfy print requests in the most effective way. For example, if a machine doesn't frequently use the PRINTER_LN03 queue, the system manager can use a DQS client queue on that machine, pointing the client to a DQS server that has an actual LN03. This eliminates the "I have to run this job on a machine that has an LN03" syndrome.

But you don't have to limit queues to printer-type queues. For example, you also might want to have a queue associated with every office in a company. That's the way Professional Press does it — with PRINTER_PASADENA, PRINTER_SPRING_HOUSE, and so on. For the machines in Pasadena, California, the SYS$PRINT logical is defined as PRINTER_PASADENA. However, if we

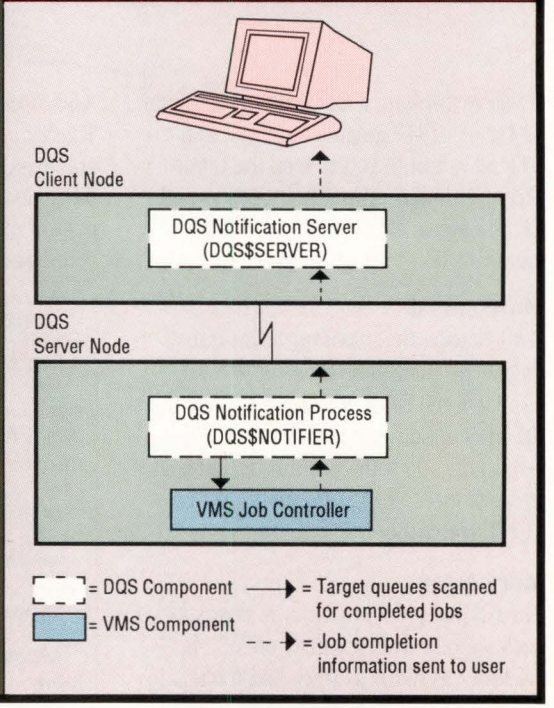
FIGURE 1.



Courtesy Digital Equipment Corporation

Function of QSHOW, QSET/ENTRY, QDELETE/ENTRY.

FIGURE 2.



Courtesy Digital Equipment Corporation

Delivery of notification messages.

How to Protect Your DEC® Computer And Make It Last Longer

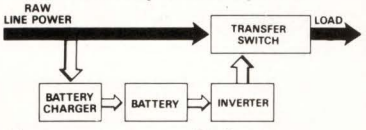
World's largest manufacturer of uninterruptible power systems for Minis, Micros, and LANs tells how

Your DEC computer is bombarded daily by spikes, sags, surges, noise, and blackouts. Bad power eats away at fragile electronic circuits, increases service costs, damages disks and causes down time.

You can eliminate these problems by investing in an Uninterruptible Power System (UPS). Your investment in a UPS will mean reduced down time, increased equipment life, and lower service costs. Typically, a UPS will pay for itself in less than one year, but not all UPS are created equal. Many are off-line, standby systems. Most won't even provide isolation from the power line or a separately derived neutral.

Shown below are three traditional UPS configurations. Each has its advantages and disadvantages.

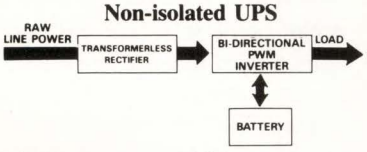
Standby Power System



Advantages:
- Low cost
- Inverter normally off
- High efficiency

Disadvantages:
- No derived neutral
- Break in transfer
- Poor isolation
- Poor brownout protection
- Poor high line protection
- Poor lightning protection

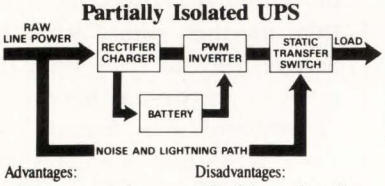
Non-isolated UPS



Advantages:
- Moderate cost
- Brownout protection
- High line protection
- No break system

Disadvantages:
- No derived neutral
- Poor isolation
- Inverter on continuously
- Poor lightning protection
- Non-linear load

Partially Isolated UPS



Advantages:
- Brownout protection
- High line protection
- Partial no-break system
- Separately derived neutral

Disadvantages:
- Break in transfer to line
- Poor isolation
- Poor lightning protection
- Non-linear load
- Poor efficiency
- Expensive

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Best Power Technology's new Uninterruptible Power System called FERRUPS® is a breakthrough in computer power protection. FERRUPS represents a major advance over the three traditional types of UPS technology.

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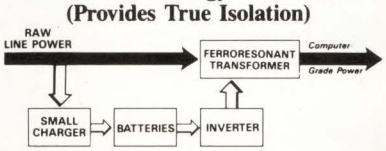

FERRUPS uses a ferroresonant transformer which is on-line continuously to provide outstanding isolation and eliminate spikes, sags, noise and brownouts. If power fails, the inverter takes over. Because of the flywheel effect of the ferro transformer, there is absolutely no break in output power. FERRUPS provides continuous on-line computer-grade uninterruptible power.

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- Filters non-linear loads
- High line protection
- Low cost
- Separately derived neutral
- High isolation
- No-break transfer
- Brownout protection
- Lightning protection

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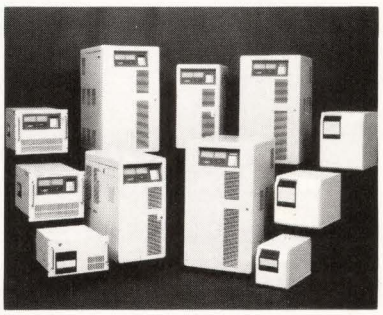

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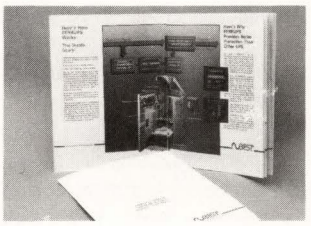
Alarm Messages: Low Battery, Near Low Battery, High Battery or DC Bad, Low Run Time Left, Low AC Out, High AC Out, Output Overload, Ambient Over Temp, Heat Sink Over Temp.



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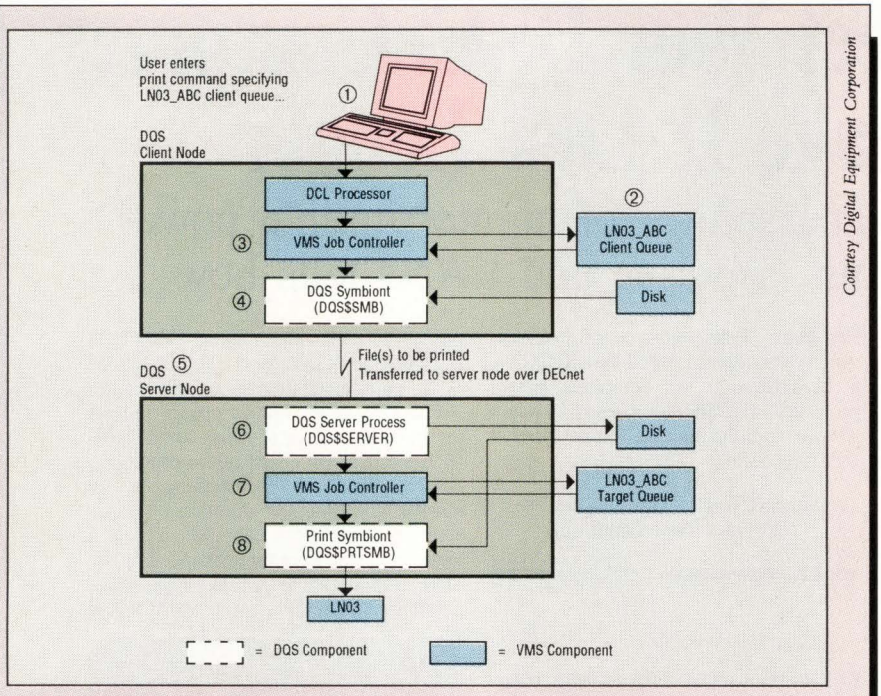
CIRCLE 103 ON READER CARD



Courtesy Digital Equipment Corporation

The structure of DQS.

Using DQS

Reading from the top to the bottom of the Figure, Distributed Queuing Service (DQS) works as follows:

1. Enter a PRINT command, which is processed in the normal fashion by DCL. Specify a queue (either explicitly with the /QUEUE qualifier or implicitly through the normal SYS$PRINT logical name) and a file to be printed.
2. The job controller enters the print request into the system queue database (JBCSYSQUE.DAT) on the client node. The print job now is entered in the queue on the client side, and a normal SHOW QUEUE command will reveal that the job is waiting to be printed.
3. Some time later (but probably immediately), the job controller on the system that has the client queue installed takes the job out of the queue file and passes it to the DQS print symbiont. The node that takes the job out of the queue may be the same node or a different node, as in the case of a VAXcluster with a distributed job controller.
4. The DQS print symbiont locates the file. It then establishes a connection with the server node, which services the target queue on which you requested the job to be printed. If the network link to the server is down, the symbiont waits until the link is up.
5. The file to be printed is transferred to the server node, together with information on the printing options requested (forms, setup modules, burst pages, and so on).
6. The DQS server process receives the file and stores it on a disk local to the server system. It also receives the printing options and enters them and the name of the file to be printed into the queue database for the target node.
7. At this point, the job is really a normal print job. The job controller takes the print request out of the server's queue database and prints it just like any other job.
8. The symbiont doing the printing can be either a standard VMS print symbiont, a user-written symbiont or a DQS-provided slightly modified version of the standard print symbiont. The modifications (which you can do yourself to user-written print symbionts) just allow the print symbiont to read a message from the server process that provides information about the job on the client node. Using this information, the flag page on the printed job will contain the correct time, job number, username and node name of the client (rather than the server) queue. This avoids confusion, because you generally only see the client queue information.

want to print in Spring House, Pennsylvania, we just do PRINT/QUEUE=SPRING_HOUSE.

We don't care which machine in Spring House services the queue. So when users in Spring House log onto the Pasadena node, they just redefine the SYS$PRINT logical and work normally. If they print a MAIL message, it automatically will print at the right place.

You can use the same concept in a large office with multiple printers. Although the printers may be served by many machines, you transparently can define which printer you want to be yours, unconcerned about which VAX might be serving that printer.

Because you can have many different client queues pointing at the same server queues, you might have five machines with PRINTER_PASADENA queues and PRINTER_LN03 queues all pointing at the same server queue. The flexibility of DQS is impressive. It lets you build a queue model that matches the way you work, not the way your machines and printers are physically connected.

DQS is also very smart about clusters. In a typical cluster, any node can print to any printer by virtue of the VMS distributed job controller. You can tell DQS that you want to use this feature by defining a logical name. When you start DQS, it will set up a single generic queue for each client queue, with an execution queue on each cluster member. This lets you take advantage of the high-availability features of clusters, because DQS will continue to transfer jobs from remote nodes even if one cluster member shuts down.

However, if you don't need all of the features of clusters, you still can use DQS together with Distributed File Service (DFS) to share both files and printers across a network. (See "Distributed File Service," January 1989.) When used with DFS, DQS lets you print a file stored anywhere on the network to any printer on the network.

For a system manager who thoroughly understands queues and

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.

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reads the DQS manual, setting up DQS should be a piece of cake. For less knowledgeable users, DQS provides excellent instructions and a series of command files that get the ball rolling. For most sites, a simple procedure called DQS$IMPORT.COM will prompt for a server node and queue, then download the necessary information on forms and such. DQS$IMPORT then defines the queue and adds the necessary commands to DQS$STARTUP to start the queue each time the system boots.

You can associate pseudo-devices with the client queues. This allows programs that want to output to a device instead of a queue to write to the server printer as if it were local. For example, you might want to do $ DEFINE FOR$ OUTPUT NAA0:, where NAA0: is the pseudo-device for a client queue, thus allowing a FORTRAN program to print directly on the queued device that's physically connected to another machine.

Bear in mind that because DQS prints on the server node using standard VMS queuing mechanisms, DQS doesn't care how that printer is attached to the VAX. For example, DQS can print to a printer attached to a terminal port, a line printer, a printer attached to a terminal server or a printer driven by a user-modified or user-written print symbiont. However, DQS relies on the symbiont to print the correct queue, job number and user information on the flag page (the information from the client node, not the information from the server node). In the case of a user-written or user-modified symbiont, the DQS manual gives directions on making the minor changes necessary to implement this.

In the case of the LATSYM (the symbiont used with a Digital terminal server), because you don't have the source code, you can't make the required modifications. The result of this is that header-page information might be confusing to the user or the person distributing the output.

DQS also has a limitation on its use of devices that must interact with the host. The VMS model of printing is that the user or application program provides a file, some optional control parameters and then just says, "Print it." This works well with DQS, because with DQS the client-server nature of printing means that there's no way for an application program to interact with the output device.

In some application packages, especially those ported from non-VMS environments, there's a need for the host program to interact directly with the output device. If you can write a symbiont that performs the interaction when given a file, then you can use the standard VMS printing services and thus DQS. If you can't write a standard VMS symbiont for these services, then you can't use DQS either. This limitation most often appears with poorly designed plotting systems and is really a limitation of the VMS printing model rather than of DQS.

However, it would be nice if DQS provided a call interface mirroring the job controller interface provided by VMS. Without this interface, full interaction with active DQS jobs is possible only using the Q* commands, making DQS less flexible than standard VMS queues.

In a complex client-server system, DQS can end up in one of several "funny states." For example, jobs may get stuck in either the client or the server queues, user notification may not work, or queue information may be missing from QSHOW output. However, the DQS documentation includes an excellent section on troubleshooting such problems. It provided quick solutions when I had problems.

WHATEVER YOUR NETWORK configuration is, it will be more complex tomorrow. In a network environment that's growing by leaps and bounds, DQS is one way that you can reduce the cost and increase the flexibility of your network resources.

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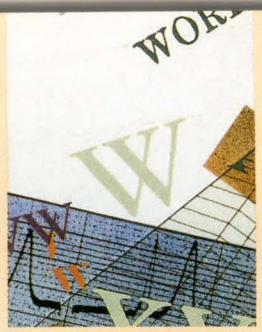

DESIGN & TESTING

STAYING COMPETITIVE

By Evan Birkhead

Hardware Manufacturers Depend Heavily On Quality Assurance.

The nightmare of a quality assurance (QA) director: You've been with the company one month. It's after 6 p.m., a dark evening. You're late with a major shipment. Everyone is rushing, hustling to beat the deadline. Mountains of paperwork surround you. The tension is increasing.

Then the phone rings, startling everyone. Everything stops.

You're visibly shaken. You glare at the phone. It rings again. You sense trouble, but you answer it. It's a customer, and it is trouble. The drives you shipped him have a high failure rate. Disk heads are crashing, and he's losing data left and right. You'll try to help.

You hang up the phone. Then it starts ringing again. ...

Good Report Card

This scenario really happened to Don Long, the quality assurance director at System Industries Inc. (SI), one of the largest producers of storage subsystems in the DEC marketplace. But to hear Long tell it, SI is "better off for the wear and tear."

The drive in question, the SI93, showed substantial price/performance improvements after going back to the drawing board, and the company's Quality Assurance Division learned valuable lessons from the experience.

An investigation into the saga of the SI93 reveals that SI's quality-control safety net worked according to the book, thanks to extensive quality planning (see box, p. 84). In fact, you'll be pleased to learn that the majority of the third-party hardware producers I talked to in the DEC market — manufacturers and integrators of connectivity, communications and storage products — considered QA their top priority.

Most of the companies I talked to:

1. Invest millions into QA and Quality Control (QC).
2. Employ personnel in upper management who are educated and experienced experts in the field.
3. Have their primary manufacturing facility in the U.S.
4. Are constantly changing, continually redesigning assembly lines and updating testing practices.
5. Use the stringent quality specifications written for military manufacturing sites.
6. Devote entire corporate divisions to monitoring and improving the manufacturing process.
7. Are serious QA philosophers, complete with society memberships, such as the American Society of Quality Control (ASQC) and subscriptions to periodical manuals.

The primary trend among these companies is the channeling of efforts to build quality into products, paying now rather than later. "The idea is practicing good health rather than using preventative medicine," says Pat

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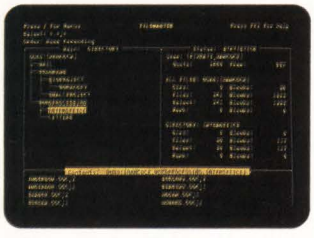

Filemaster's flexible multi-window display lets you see directory structure, file names, file contents and attributes at the same time. Using arrow keys to navigate, it takes seconds to find any file; across directories, disks and even network nodes.

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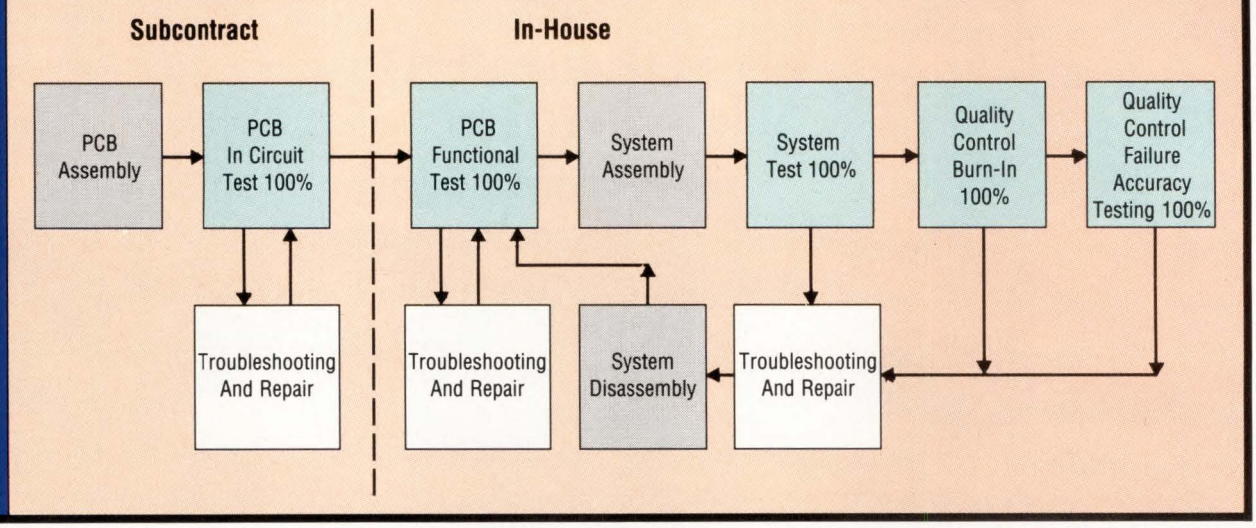
Take out the trash in your VAX system. And stop throwing away valuable time, and expensive disk space. For more information on Filemaster, or for a free 30 day trial, contact us at Hancock Software, 115 Watertown Street, Watertown, MA 02172. Or call **1 800 VAX-MGMT** today.

FILEMASTER

HANCOCK SOFTWARE, INC.

CIRCLE 312 ON READER CARD

FIGURE 1.



Courtesy Chipcom Corporation.

Subcontractors providing Just-In-Time (JIT) turnkey systems are key to efficient assembly.

Bell, the QA manager at Cabletron Systems Inc., a manufacturer of networking devices. "You want to have failures show up in the factory, not in the field."

People And Planning

QA managers are a unique breed. By managing people and inventory, they have the unenviable task of achieving high levels of quality standards. How do you measure quality, anyway?

Pat Venditti, QA director at Xyplex Inc., governs a diverse hardware/software line that includes terminal servers and cluster connectivity products. Venditti says that quality is difficult to define, "but you know when you see it."

American manufacturers are sensitive about the issue of quality. But this has helped spark a reassessment of values and a new determination in this country that has been well-documented. Over the past five years or so, many companies have stepped back, looked at their manufacturing operations, and decided to start over from scratch.

It's no secret who the current international hotshots of quality are. "We're swamped with books on how the Japanese did it," says Tom Hatch, director of manufacturing at Chipcom Corporation.

At Chipcom, a producer of Ethernet communications devices, seven years in business has provided of wealth of QA experience. The company's management hierarchy for manufacturing operations provides an excellent example of how QA fits into the corporate structure. Chipcom's manufacturing is split into four overlapping branches:

1. Materials — Besides Purchasing, this includes divisions for Inventory Control and Production Control.
2. QA/QC — Gioria Kedem, Chipcom's director of QA, says that QA represents the ground rules of quality: measurements, evaluations and feedback. QC represents the process of engineering quality into a product.
3. Production — This involves assembly from the board level and up, mechanical (final) assembly, and testing of boards and systems.
4. Manufacturing Engineering — This group phases new products and designs into the parts assembly flow and provides support for the mechanical and technical processes.

Chipcom has designed its manufacturing sequence to allow parts for specific customer orders to be retrieved quickly and assembled into a customized kit, without disrupting other processes on the assembly line. But not all the pieces are assembled by Chipcom. Hatch estimates that Chipcom uses products from 200 semiconductor and parts producers in its boards.

Subcontracting has become an important part of the business. By farming out much of the board-level assembly, Hatch says that Chipcom's production costs are trimmed substantially and that the production facility is more streamlined (see Figure 1). This means the company is better able to focus on test and integration of boards, power supplies, fans and subassemblies. Xyplex and SI also use outside production houses for component manufacture and assembly. "Twice a week," says Xyplex's Venditti, "we send an inspector to the source where the boards are assembled. No boards come here until after those inspections."

"We expect suppliers to have process controls," adds Long, who deals

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Many of today's subcontractors use Just-In-Time (JIT) turnkey systems that reduce the number of hands that handle the equipment.

with approximately 500 suppliers, including 25 OEMs. "They have to prove to us that they meet specs."

Big Business

These outside board manufacturers are becoming big business. On the West Coast, Sigma Information Systems assembles boards and custom systems for many major computer and storage producers, including DEC and Emulex. The company also engineers a great deal of the logic and design work that's involved.

The operation has grown so fast that Sigma's president Paul Clarke, preferring steady growth, has limited the number of contracts he'll commit to.

Like the subsystem builders, Sigma has reinvested heavily to institute a sophisticated testing program. But Sigma's case is important, because it underscores the importance of establishing a reputation simply by putting quality worksmanship in the field.

Many of today's subcontractors use Just-In-Time (JIT) turnkey systems that reduce the number of hands that handle the equipment. Eventually, these sites should look like Steve Jobs' Next Inc. facility, where computers are assembled entirely by robots from board level on up.

The Assembly Line

The assembly lines I saw were generally laid out with Receiving at one end of the room, Shipping at the other, and an easily traceable maze of Building, Testing, and Inspection tables connecting these two ends (see Figure 2). Every part is tagged and initialed in sequence. Inventory rooms with countless drawers of wire, semiconductors, and power components are kept in giant cages that are grounded to the earth.

In general, the sequence is testing of parts, parts assembled on boards, testing of boards, boards assembled in backplane cages, and testing for functionality. "There is an enormous amount of data collection during the process," says Cabletron's Bell. "We check weekly to examine which products fail the most frequently."

In the manufacturing facility, the biggest fear is static. Styrofoam coffee cups are banned and everyone must wear a static band before handling equipment. A component can be damaged with just 200 or 300 volts of static (you can't feel less than 3,000 volts of static electricity).

Test Procedures

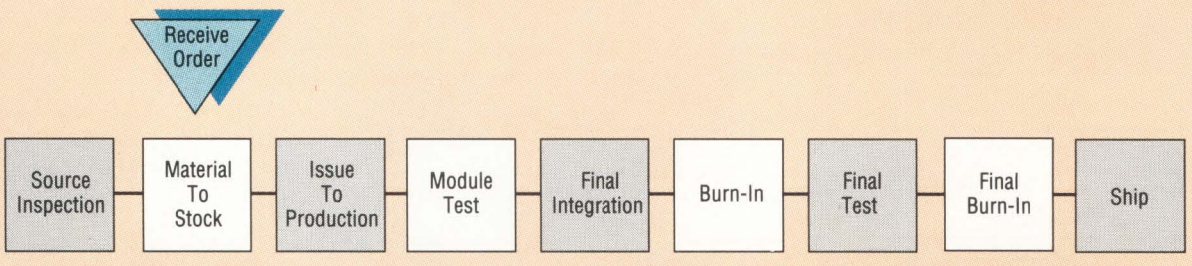
The board and component testing process can be grouped into two basic categories: manufacturing tests that find bad parts at the component level, and design verification tests that determine whether a part was assembled correctly and can perform the function it was built to perform.

Design verification also includes running circuit and operating system tests in heat chambers and vibrating cabinets. There's also the famous drop test. This test, governed by the National Safe Transit Authority (NSTA), measures the integrity of package designs by dropping the packages from various heights.

Major types of QC tests, listed in an approximate chronological order (assembling components into systems), are:

1. PCB Cross-Section — Which runs random electronic patterns through raw boards.
2. PCB Open Shorts — A test for prob-

FIGURE 2.



Courtesy Chipcom Corporation.

Typical organization of time on a manufacturing assembly line.

TALARIS PRINTSTATIONS

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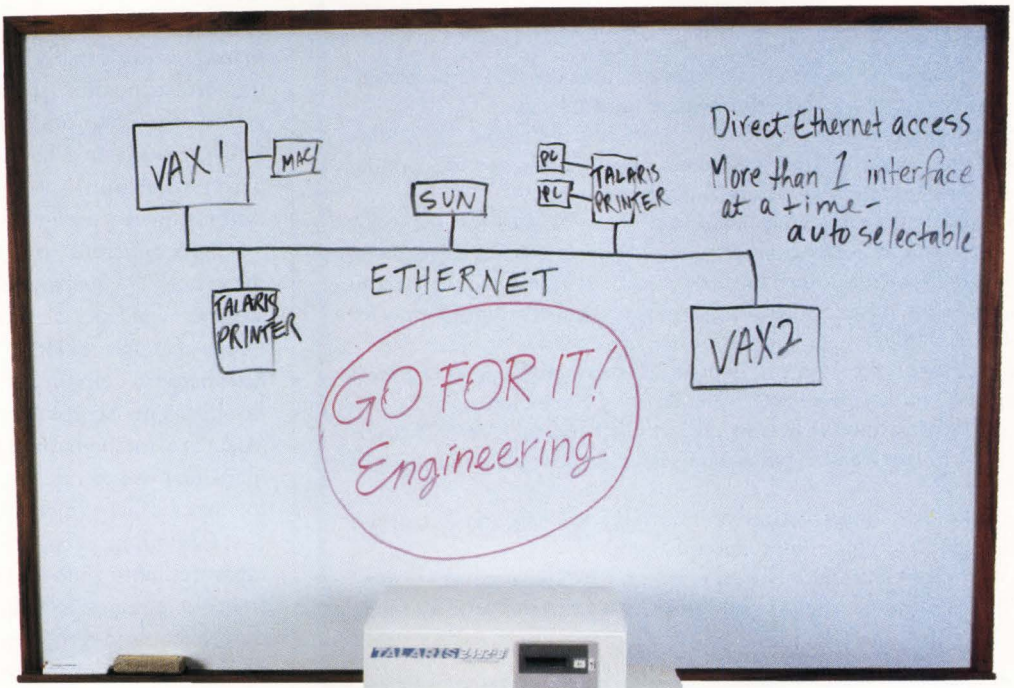

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Quality Assurance At Work

It was in November 1987 when Don Long, quality assurance director at System Industries Inc., first heard complaints about the 1.1-GB SI93. The storage subsystem had been shipping for a few months, and more customers than usual were reporting disk-head crashes.

Because the normal rate of failure is less than one percent of all drives, more than one problem seemed unusual to Long. "It's a science of probabilities," he explains. "But this was hard to believe."

SI's plan of attack illustrates the intricacies of today's technology and provides an understanding of just how advanced QA programs must be.

After a two-month investigation that included visiting customer sites, dismantling the machines and inspecting individual components, SI gathered enough data to draw some conclusions. It immediately informed its customers that, although only 20 percent of the drives would eventually fail, the potential to fail was in every drive.

Finally, a chemical analysis of the drives revealed the presence of organic contaminants.

"There's only one place in the entire Silicon Valley that does contaminant analysis," says Long. "It's a highly precise and highly expensive undertaking."

The contamination appeared in the Head-Disk Assembly of the NEC D2363 Winchester, a major OEM product for SI. Both companies put engineers to work locating the source of the substance at the NEC factory in Japan.

The team found a few sources, including outgassing from an improperly cured gasket and hydrocarbons from an unsealed container. Because NEC built all of its drives in the same factory, design improvements had to be made quickly. It shut down the plant in July 1988, worked on a new solution — an ultraclean room and a better drive — for two months, and began reshipping an improved drive in October.

"I was quite pleased with the way NEC responded," says Long. SI kept engineers overseas, Long explains, "to make sure NEC made this new recipe permanent."

The original shipment of the subsystems claimed 30,000 hours MTBF. The new drives, with a 9-inch form factor and 15 ms average seek time, are demonstrating well over 60,000 hours MTBF.

SI's relationship with NEC is better than ever, according to Long, and SI has since added new tests to determine failures in products it OEMs.

But the story didn't have a completely happy ending. "We lost some customers," Long points out. "Some we could help out and some had interim alternatives of their own."

lems in specific components.

3. IC Burn-In — A check for Error Checking and Correction (ECC) functions. Burn-in tests often are performed in rooms with high temperatures to weed out weak circuits and components.
4. System Test — Which ensures that a subsystem performs the function it's supposed to.
5. System Burn-In — Which sends a series of packets through a board and puts it through loopback exercises.
6. Final Acceptance Test — Which determines if the final assembly works according to specs before it's shipped.

Companies have differing philosophies about burn-in. Basically, it depends on the subsystem level. At SI, for example, boards that SI integrates often have been already burned in. "In manufacturing, I don't want to do it very much," claims Long. "You don't need to burn in if you've done the work right."

Because SI's subsystems are often large-scale, integrating many parts, the only testing performed determines whether or not the system was built correctly. Depending on the system, repeated burn-in could take much life out of a system before it's shipped.

In some instances, burn-in tests involve quite high temperatures. Chipcom's basic test bakes boards at 45 C for 40 hours as they perform a loopback procedure in self-test mode. According to Hatch, this is the equivalent of three to six months in the field.

Venditti reports that Military Workmanship Manuals (Milspecs) recommend that integrated circuits should be burned in for 168 hours at 125 C.

Testing The Testers

Using Milspecs that detail testing calculations and procedures, QA managers can establish techniques and numerical quality specifications that guide the manufacturing process. Publicly available, Milspecs include both parts inspection and test equipment calibration requirements.

Specifications and testing equipment help QA managers measure such abstract concepts as Mean Time Between Failure (MTBF), the estimated time before a component will stop functioning. The Acceptable Quality Limit (AQL) is a mathematical rating that QA managers use to rate the potential performance of large inventories of devices.

Regarding parts, the goal of these measurements is to discover growing trends in equipment failure rates before they become a problem. Failed components are returned to the QA area, where the details are logged for trends analysis.

With sophisticated testing equipment in-house, manufacturers are responsible for keeping their testing equipment properly calibrated. "We have a calibration program for all of Xyplex's testing equipment," relates Venditti. "Some are on six-month cycles, others are on 12-month cycles. The tools stay in-house, but much of the test equipment and scopes get sent out."

Responsibilities

Above all, the QA manager must be on the beat every day and must institute a system that allows parts and problems

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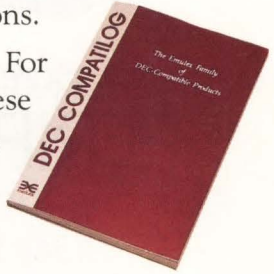

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to be traced fast. This begins with material requirements planning and a logical assembly line process. Someone has to make sure the company is buying the right parts and plugging them into the right places. With QA, delegation and organization are just as important as implementation.

The job often requires ingenuity. Clearpoint Inc., a manufacturer of workstation memory, developed the Universal Memory Tester (UMT), a microprocessor-based system that provides a sophisticated burn-in and test environment. The testing and tracking of boards is facilitated by the UMT, but is monitored by both QA and design engineers. The environmental test generally takes 72 hours.

Chipcom fabricated a unique piece of equipment called the Ethernet Tester (ET) that duplicates the interplay of a network by sending packets through the devices to be tested.

THE DEC INDUSTRY is among the world's leaders in providing state-of-the-art QA. But it isn't Milspecs or burn-in ovens or analyzer scopes that assure quality, it's people.

"Good quality means cooperation," says Bell. "The teamwork involves not only subcontractors and the people here, but feedback from the customers, as well."

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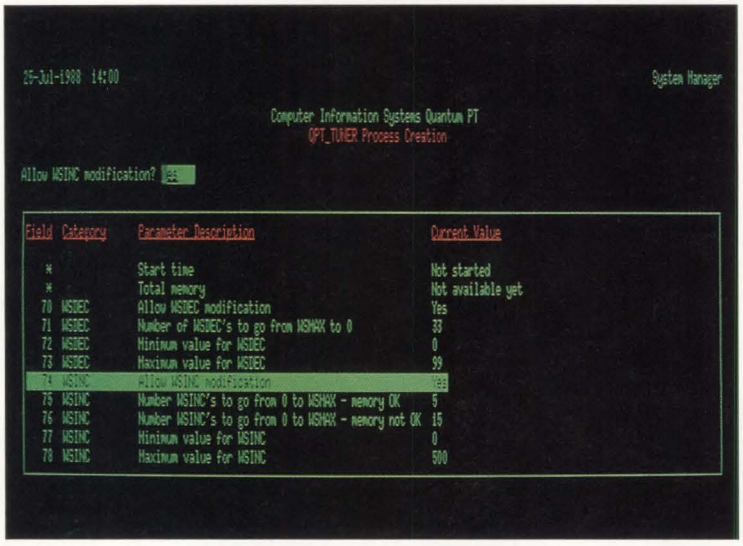
Computer Information Systems' Quantum PT Can Alleviate Your Tuning Burden.

VAX TUNING



Parameters can be adjusted prior to starting Quantum PT.

Keeping your VAX systems tuned and running efficiently can present a formidable challenge. For one thing, the number of factors to consider can be overwhelming. Also, new or inexperienced system managers might not know where to look to improve system performance. And, although tuning and performance issues are critical, system managers can't dedicate all of their time to tweaking SYSGEN parameters and reconfiguring hardware and software.

In recent years, software products have appeared that alleviate the tuning burden. Their goal is to tune a running system dynamically to achieve maximum performance at all times. Quantum PT, designed by Computer Information Systems Inc. (CIS) of Newton, Massachusetts, and marketed by Braintree Technology of Norwell, Massachusetts, is one of these products. We tested Quantum PT version 2.0 for VAX/VMS version 4.7 on our VAXstation 2000 and VAX 8250.

PT Overview

Quantum PT consists of modules that perform dynamic tuning, monitor the system's performance and display and report the results.

Quantum PT achieves its tuning goals using three methods: dynamic schedule adjustment, dynamic VMS SYSGEN parameter modification and dynamic process memory allocation.

For dynamic schedule adjustment, Quantum PT updates only the memory-

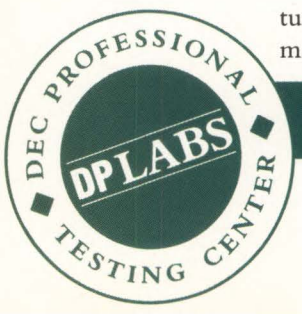


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Figure 1.

Processor Type	How Conducted	Average Response (Seconds) Invoking MAIL	
		Running	Not Running
THORIN:: (VAX 8250)	Business Hours Average 15 Users	7.24	6.79
SAURON:: (VAXstation 2000)	Single User	3.13	3.70
SAURON:: (VAXstation 2000)	CIS Benchmark Load Generator Terminal, CPU, Memory Load	8.28	8.98

Sample response times from our VAX 8250 and VAXstation 2000 with the tuner turned on and off.

resident code of a running VMS system. No disk-resident VMS images are altered or replaced. Your system is returned to its original state if it's rebooted. In adjusting the VMS scheduler, processes are given the time and priority boosts needed to keep overall system response time consistent.

Of the more than 250 VMS SYSGEN parameters, Quantum PT can work with the subset of parameters classified as dynamic, i.e., they can be altered on a running system without rebooting. Quantum PT continually evaluates dynamic parameter values and adjusts them as needed. SYSGEN parameters, such as QUANTUM and IOTA, as well as parameters related to working set adjustment and swapper activity, are included in this group.

The memory reallocation feature removes memory from inactive processes and distributes it to active processes. This provides for more efficient resource use.

Quantum PT requires 5,600 blocks of disk storage on your system disk for installation and 5,600 blocks of disk storage on the target disk on which it will reside permanently. If you purchase the optional Data Representation Facility, disk space requirements increase to 9,000 blocks.

VMSINSTAL is used to install the software. The tuner isn't started immediately after the installation completes; you must start it manually. Be sure to include lines in your system startup command file to set up Quantum PT automatically if your system needs a reboot.

Interface

Quantum PT's interface is consistent with CIS' Applications Architecture approach to user interfaces. CIS' Applications Architecture provides a clear, consistent user interface that includes command recall, supplied default values, spawning options to DCL, snapshot generation, menu-driven input control, and syntax, data and context help.

A time-saving feature of the Applications Architecture is its script-writing capability. Script files can be built automatically as you work through the menu system. Scripts can be set up to pause for input. After a script file is built, you need only invoke its execution and supply any information required by built-in prompts. If set up properly, script files can be executed in batch.

Invoking Quantum PT doesn't automatically start the tuning module. Before the tuner process is created, you have the option of adjusting its parameters. These include dynamic SYSGEN parameters, as well as the parameters that control the statistical logging feature and dynamic schedule adjustment. A subset of the tuner's parameters also can be adjusted while the tuner is running. The screen on page 88 displays the Adjustment Process Screen and some of the many parameters you can change before the tuner module starts.

After the tuning process is started, it resides on the system as a detached process. Stopping the tuner poses no hazards other than perhaps the risk of being inundated with calls asking why the system suddenly slowed down.

Running In-House

To determine how Quantum PT could help our system, we ran three tests, each consisting of 10 trials. For each test, we measured system response time by noting how long it took to get the MAIL> prompt after invoking the VMS MAIL utility. For each trial, the tuner alternately was started and stopped, and MAIL was invoked each time the tuner was and wasn't running. The tuner ran with default parameters for each trial.

Figure 1 shows the average response time for each test. Test one was

For Information On Quantum PT, Contact: Braintree Technology, 600 Cordwainer Dr., Ste. 102, Norwell, MA 02061; (617) 982-0200

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Quantum PT Version 2.0

PLATFORMS: VAX systems running VMS version 4.7. Quantum PT version 2.1 is designed for VAX systems running VMS version 5.0 or later

PRICE: From $850 to $3,750, depending on CPU. Quantity discounts available

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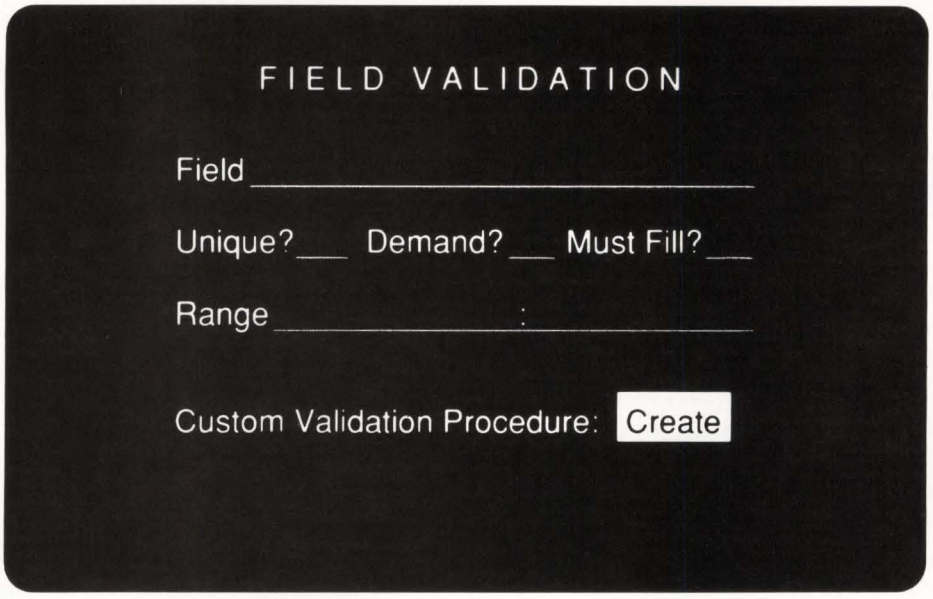

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Figure 2.

21-Apr-89 Quantum PT SYSGEN Dynamic Display 17:04:53

CPU busy: 32%	Idle: 68%	CPU state: Not busy		Memory state: Ample
Total memory: 18432	VMS: 4631	User: 8408	Free: 4444	Mod: 949
Memory percentages	VMS: 25%	User: 46%	Free: 24%	Mod: 5%

SYSGEN Parameter	Units	Current	Last	Delta
QUANTUM	10Ms	9	12	-3
AWSTIME	10Ms	6	8	-2
IOTA	10Ms	3	4	-1
PFRATH	Flts/10Sec	43	39	+4
PFRATL	Flts/10Sec	0	0	0
WSINC	Pages	500	500	0
WSDEC	Pages	0	0	0
LONGWAIT	Seconds	20	20	0
DORMANTWAIT	Seconds	4	4	0

SYSGEN timer: 30 **Last SYSGEN Modification: 21-Apr-1989 17:04:40**

The default dynamic display shows SYSGEN parameter information and system CPU and memory statistics. Delta values indicate changes made to dynamic SYSGEN parameters.

conducted during normal business hours on THORIN::, our 8250. Test two was done after hours on SAURON::, our VAXstation 2000, with a single user. Although the test is artificial, it's interesting to note the dramatic decrease in response time (15 percent) when the system was being tuned.

For test three, I used QUANTUM_PT_BENCHMARK, a program supplied by CIS, to generate a load on the system. The program can be invoked to place a terminal, memory, disk or CPU load on your system. I ran QUANTUM_PT_BENCHMARK in three separate subprocesses to generate a mixed load for memory, terminal I/O and CPU. That stressed the VAXstation so much that I didn't chance invoking the disk load version. There were no other users on the system during this test. This time, we realized a 7 percent decrease in response time when the tuner was running.

Quantum PT is designed to help performance in CPU- and/or memory-constrained systems. Because your system can vary in regard to the load placed on it, it's best to try Quantum PT and monitor performance during your normal workload cycle on the system you wish to tune before rendering any judgments.

Displays And Reports

Information about the running tuner, the processes active on your system and the SYSGEN parameters that can affect performance can be obtained via Quantum PT's reporting functions. Examples of a dynamic SYSGEN parameter report are shown in Figure 2.

In addition to dynamic displays, Quantum PT can collect tuner and system statistics in a log file. You can run reports on this data later. Reports can be generated using combined log files. Data can be totaled across time intervals, such as time of day or day of week. The system can report on more than 160 statistics. You can tailor the report to include the statistics you need.

An optional feature, the Data Representation Facility, provides more output options than Quantum PT's reporting functions. It includes functions to produce bar graphs, pie charts, trend graphs and more sophisticated tabular reports. In addition to buying the extra module, you also need GKS, so that your graphs can be displayed on terminals.

For input, the Data Representation Facility uses normalized data files that can be generated by Quantum PT's reporting functions. Normalized files are ASCII data files that contain additional information required to draw a graph or to produce tabular reports.

Graphs can be viewed on any GKS-supported monochrome or color terminal. Graphs also can be sent directly to a file or to a hardcopy device. Supported hardcopy devices include the LA50, LA210, LN03, Hewlett-Packard plotters and the Tektronix 4014 and 4017. You can specify what data to graph, the order in which it's to be sorted and the graph's attributes. Graph settings can be saved in a definition file. The settings can be used on various sets of data.

For tabular reports, you can specify which columns to graph, the format of each column, what totals calculations to perform and what should be contained in the report's titles, column headings, page headers and footers.

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Customized Projects

DSD Corporation's C-Plan Offers A Large And Flexible Set Of Cost And Scheduling Functions.

EVAN BIRKHEAD

C-Plan, from DSD Corporation of Bothell, Washington, is a growing package of project-management software with a well-organized menu structure. It offers a surprisingly large and flexible set of cost and scheduling functions for its competitive price. After you become familiar with the terms associated with project management and C-Plan, you'll find the system a convenient data-entry program that customizes graphs and reports using submenu selections. Following in the footsteps of DSD's C-Calc spreadsheet, C-Plan was introduced in January 1988.

C-Plan's user interface seems cluttered and imposing, but that doesn't matter, because the documentation and on-line Help are excellent. You're guided through the screens by hitting carriage returns and mnemonics, and your project-development goals are spelled out nicely in chapter headings and concise descriptions in the manual. After you determine the C-Plan term for what you're trying to do, you get simple keystroke descriptions.

C-Plan is an end-user/data-entry-oriented system. It's much like PC software with its menu-selection highlighting scheme and the way it backs in and out of screens and saves them. A screen reference number on the top status line prevents you from getting lost in the descending tree of menus. The BACK menu option lets you climb out the way you came in. QUIT takes you back to the top Project screen (see Figure 1). After you've set up or updated a project or subproject, the system requires you to SAVE all changes before backing out to the $ prompt.

On-line Help is a menu option on each screen that offers an explanation of the highlighted item on which C-Plan is waiting for you to act.

Translations

C-Plan is organized to let you track your project and measure its relative

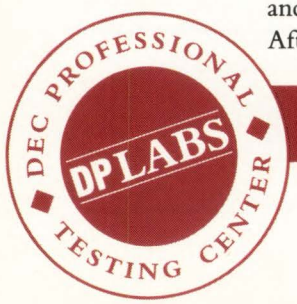

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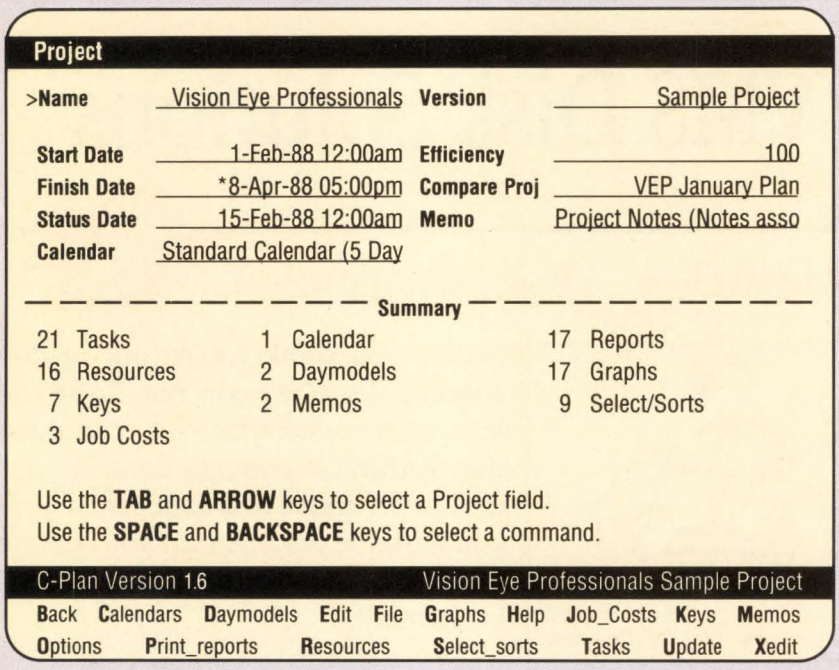
Figure 1.



After you create the project, this screen maintains the fundamental project data and doubles as main menu.

success at any stage. The very nature of keeping records of real-life versus planned goals encourages data analysis and comparisons, which can be cleanly displayed by C-Plan graphs and reports. The style of data entry, updating and report generation allows you to select data that's relevant to your project summaries.

You first must determine how your project's cost and time variables can be translated into C-Plan terminology. Terms you must understand include:

1. Field — the blanks on the data-entry screen.
2. Task — the basic job unit.
3. Project — a group of related tasks.
4. Resource — names, materials or dollar amounts.
5. Calendar — the units of time on the project schedule. (The basic concept of C-Plan is tasks use resources over time.)
6. Duration — time needed to finish a task.
7. Update — a menu command that recalculates entered data so it can be graphed or otherwise reported.
8. Gantt chart — a horizontal bar chart. A Task Gantt Chart, for example, shows tasks versus time for the entire project. Graphs can be displayed on-screen or printed on a printer or plotter.
9. Daymodel — designates every minute of a 24-hour period as working or non-working.

I reviewed C-Plan Version 1.6 on SAURON::, a VAXstation 2000 with 16 MB of memory on our LAVc. The program was installed with VMSINSTAL and required 4,000 free blocks of disk space, 450 free global pages and two free global sections. Before you can access the software, you must call DSD for a license key.

Data Entry

After creating your project name and time frame on the top screen, called the Project Index, you can identify tasks and resources through the submenus. The next screen you encounter is the Projects screen, C-Plan's pivotal menu. From here, you can descend to the Project Calendar, which maintains month-by-month deadlines; Daymodels, which break down goals into 24-hour periods; databases of Resources and Tasks, including a Task Gantt Chart; or select options for Graphs and Reports.

Hitting G from the Projects screen brings up the graph menu. It lets you select the type of graph — bar, line, histogram, Gantt, and so on — and the variables it will measure. The graphs then are generated automatically (see Figure 2). Graphs that correspond to either the Program Evaluation Review Technique (PERT) or Critical Path Method (CPM) styles of project management are available from the graph menu. Gantt charts are the best visual tool for comparing your progress to the actual plan. In C-Plan, they can display your original schedule against current schedules, or check the progress

C-Plan Version 1.6

PLATFORMS: VMS. It soon will run on major UNIX platforms

PRICE: Depending on CPU size, $4,950 on a VAXstation 2000; $8,250 on a MicroVAX II; and from $10,000 to $18,000 on VAX 6xxx and 8xxx. Site licenses and special prices for clusters are available

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(206) 485-7564

FOUNDED: 1982

PRODUCT LINE: C-Plan project-management system and C-Calc and C-Calc Plus multiuser spreadsheets. Upcoming versions will integrate C-Calc with C-Plan

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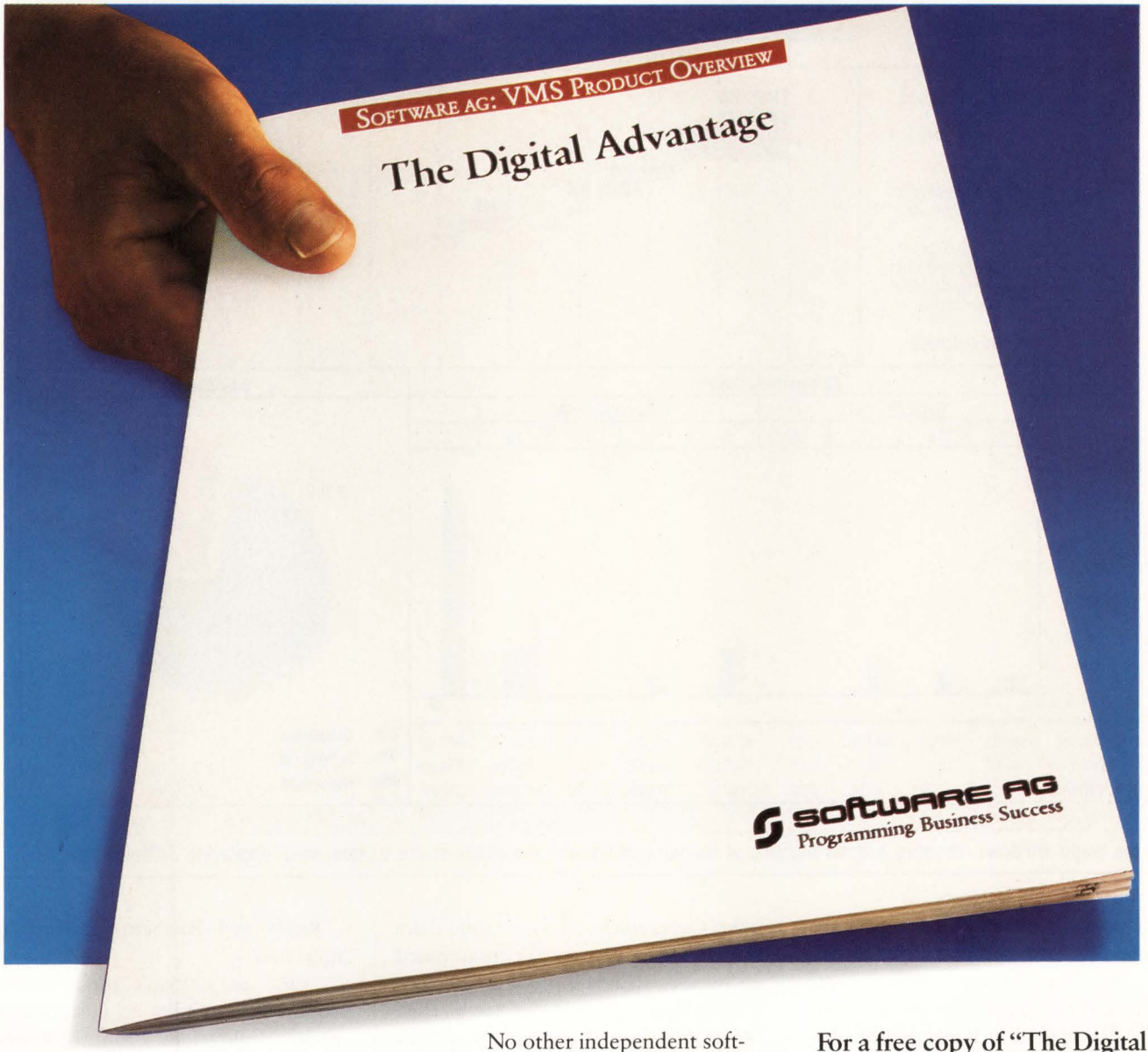

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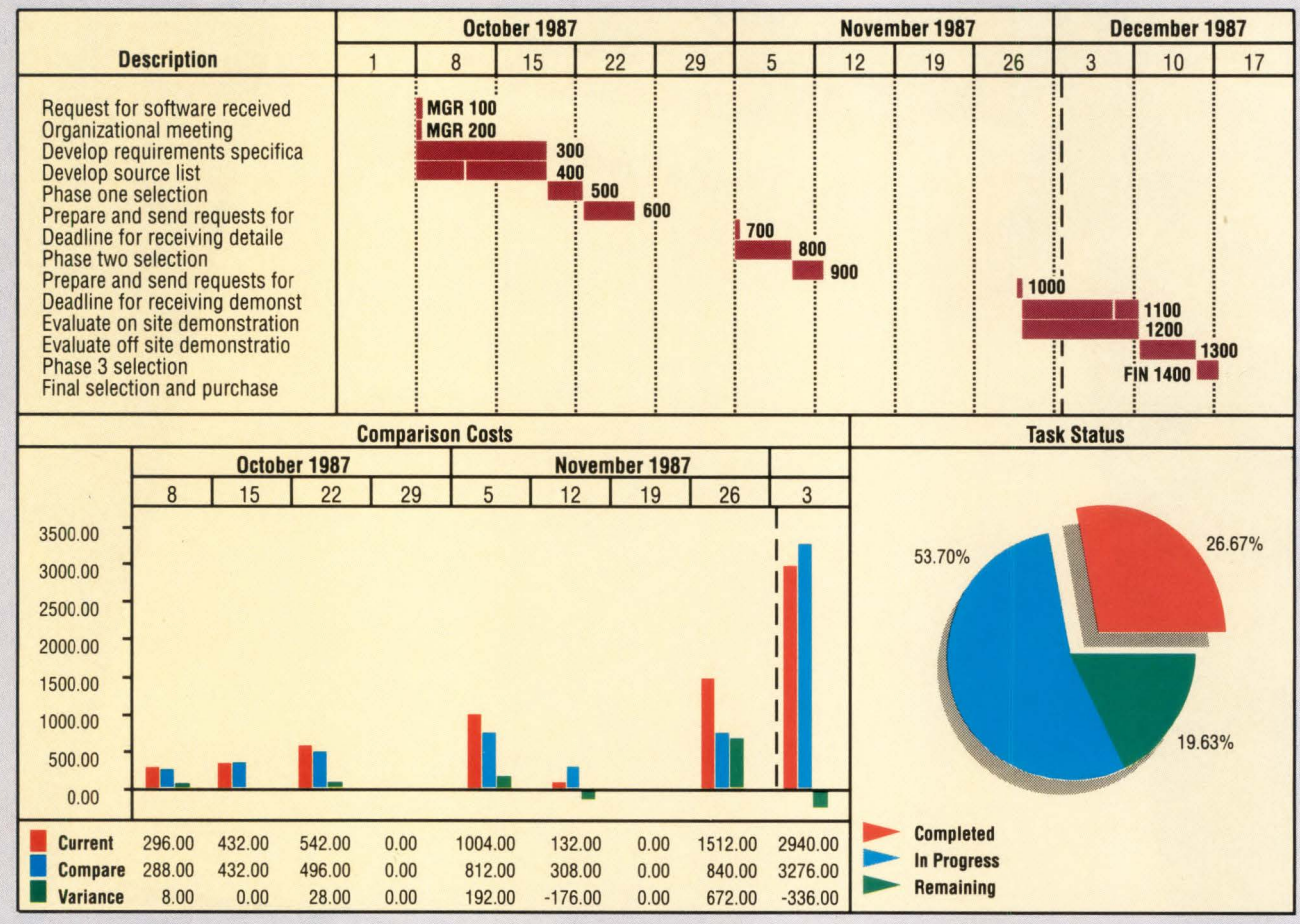
Figure 2.



Sample graph windows, showing a Gantt timeline at the top and bar and pie charts at the bottom, each displaying different statistics.

of a plan regarding the use of time, resources or the completion of tasks.

Compiling the same information as Graphs, about 40 possible combinations can be compared in Reports. Selecting these lets you view project interrelationships, such as Task and Resource costs or dates. Our HP LaserJet was one of several printers supported by the program.

Version 2.0

Most of the refinements in the next major version of C-Plan are geared toward comparisons between actual and planned values. Version 2.0 began shipping in May. Some notable enhancements:

1. Tasks can be broken down into subtasks. Costs, usages, durations and dates that are set in the subtasks are summed up by task statistics.
2. The Project Task screen can be used for comparisons between actual and planned values of start and finish times, and calendar and person durations.
3. Values have been added that are supported in Graphs and Reports. These include Earned Value, which combines planned cost with the actual work done to that point; Planned Value, the cost of work to be done; Budget, which calculates the budgeted amount at completion; Actual, the amount of work actually completed; and Projected, the amount of work that needs to be completed before the finish date.
4. ReGIS and PostScript devices are supported.

One of C-Plan's most notable benefits is its ability to customize to specific applications. From the Project Options screen, I could create new commands, associated prompts and help. This is a good way to integrate C-Plan with other databases. Screens can be changed using much the same sequences.

Because it's well-organized at the top, C-Plan is easy to learn. A project of any size can be developed, depending on available disk space. Most important, after C-Plan is installed, it's a true end-user data-entry tool that requires little support. MIS can sit back and relax. That's a significant plus. ■

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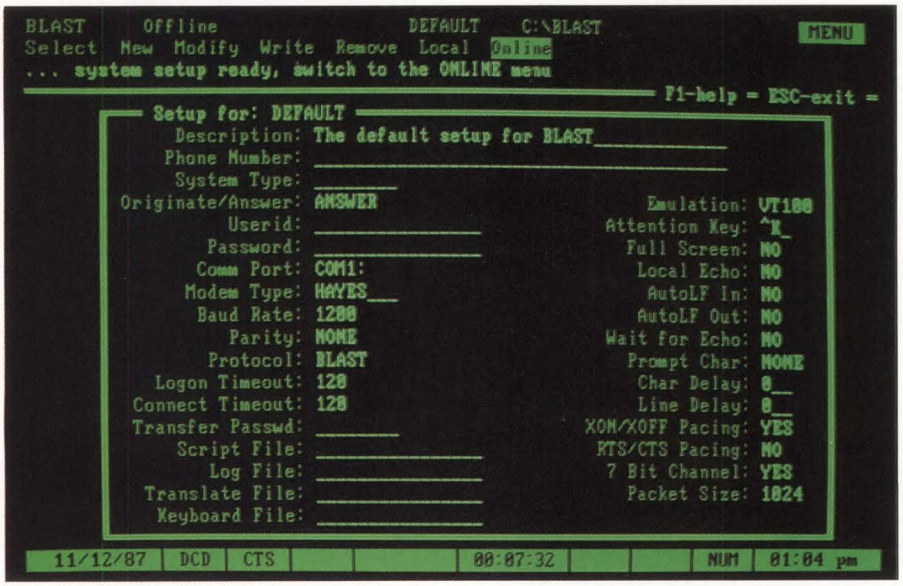


A sample setup screen for the PC version of Blast II.

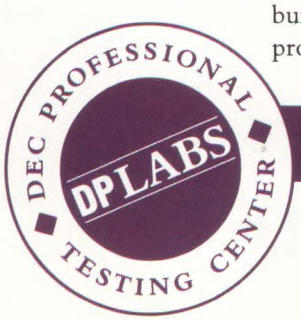
Blast II, from Communications Research Group Inc. (CRG) of Baton Rouge, Louisiana, is more than just a catchy name. It's short for BLocked ASynchronous Transfer, the designation given to CRG's file-transfer protocol built into all of its communications products.

Blast II runs on a number of computer platforms, including the Mac, the VAX under VMS, and IBM PCs and compatibles running MS-DOS. We tested version 8.4 for the VAX (VAX Blast II) on our VAXcluster and version 8.3.2 for PCs (PC Blast II) on our AST Premium/286.

An installation program is provided for the PC version of Blast II. VMSINSTAL is used to install Blast II on a VAX. Our copy of VAX Blast II contained a misnamed file that wouldn't allow VMSINSTAL to complete. Therefore, we BACKed up the tape to disk and ran the command files provided with the media to define the required logical and symbol names.

The VAX version requires that a communications port be assigned the logical name BLAST_PORT. The chosen port should be the one most often used for communications. It's recommended that you change the SYSGEN parameter TTY_ALTYPAHD to 512.

Blast II's screen- and menu-driven interface for the VAX and PC versions resembles that of Lotus 1-2-3. Blast II controls its operations by using setup files that determine the parameters of the



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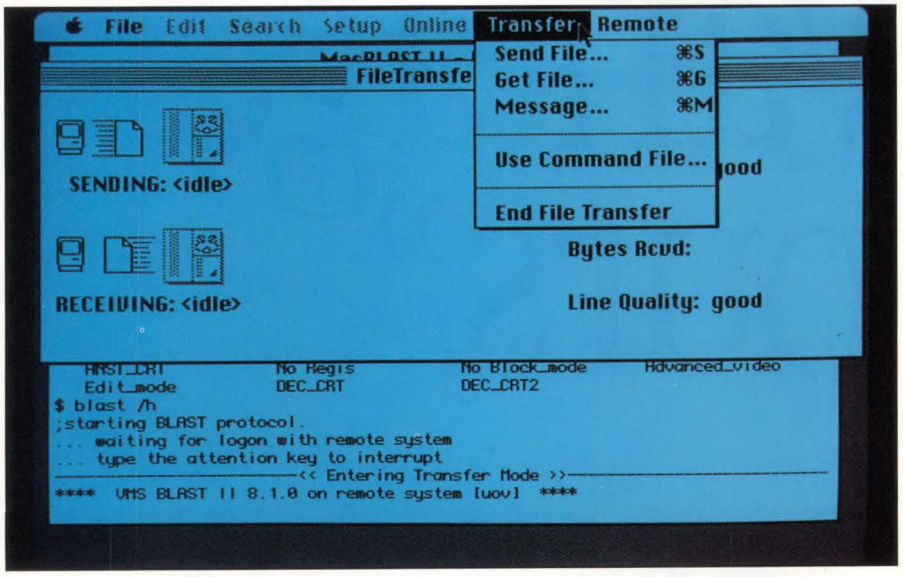


Figure 1: The FileTransfer screen of the Mac version of Blast II shows how Blast II uses pull-down menus and the mouse.

communications session. A sample setup screen for PC Blast II is shown on page 100. You can create custom setups for your site. After starting Blast II, you can choose the setup you need to communicate with your host.

On-line help is available for all Blast II options. Pressing the help key while an option is highlighted produces help on that topic.

File Transfer

We used Blast II to transfer files between our Premium/286 PC and our VAXcluster.

File transfer is Blast II's forte. In addition to CRG's proprietary protocol, Blast II allows simple text file uploading and downloading for situations in which one of the two endpoint systems lacks Blast II. XMODEM also is supported.

For other types of transfer, including text, you need to choose the FileTransfer option of Blast II's ONLINE menu after logging in to your VAX host. A sample FileTransfer screen is displayed in Figure 1. The Blast II protocol can be used when both endpoint systems are running Blast II. When you choose the FileTransfer menu option in PC Blast II, for example, Blast II automatically is started on your VAX host.

Binary and text files can be transferred 100 percent error-free using Blast II's protocol. Its full-duplex operation allows data to be transferred in both directions at the same time. Data compression techniques are employed to speed up transmission. Figure 2 shows sample transfer times attained between our PC and our VAXstation 2000. The PC was connected directly to the VAXstation 2000's serial port. Although not designed to be a benchmark, the Figure will give you some idea of Blast II's file-transfer capabilities.

Blast II's protocol is robust enough to handle noisy lines and even interrupted file transfers. Blast II didn't flinch when we pulled the plug, so to speak, on a file transfer by disconnecting the serial cable from the back of our VAXstation. The file transfer stopped, and Blast II waited until the connection was restored. Processing continued from the point of interruption with no problems.

I tried killing the Blast II process on the VAX from another VAX terminal while a file transfer was taking place. Blast II recorded how much of the file was transferred successfully. I created a new Blast II session on the VAX and attempted to restart the transfer. Blast II picked up where it left off and transmitted the remainder of the file as if nothing had happened. You only have to retransmit the entire file in cases of power failure and unexpected system crashes.

Scripts

Blast II provides a powerful and easy-to-use scripting feature. Scripts can be written to automate a variety of tasks, including system log in and file transfer.

Blast II's script language includes commands to access the package's menu functions, as well as a host of commands you'd find in traditional programming

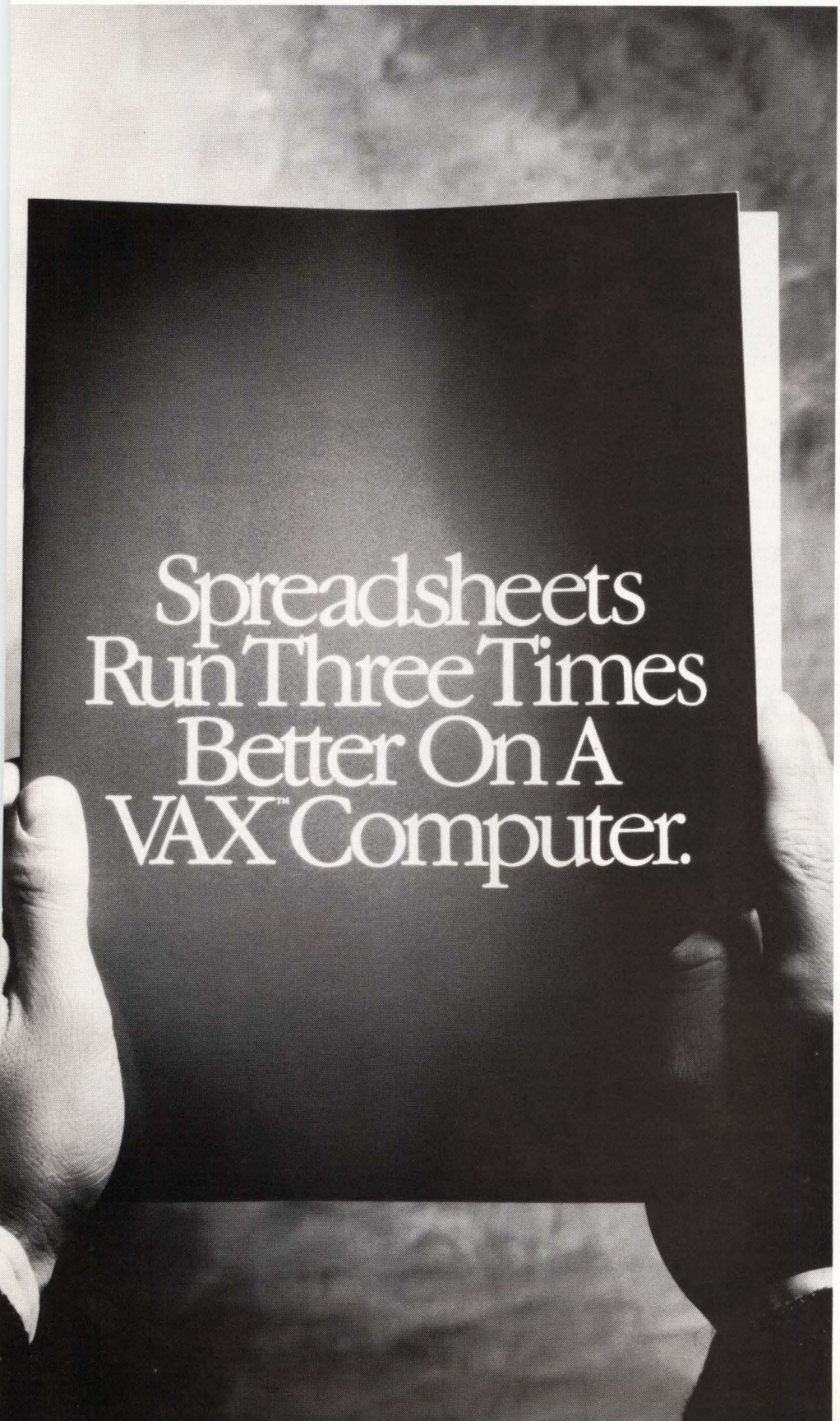
Figure 2.

Baud Rate: 9,600
File: 250-block ASCII file

Packet Size	7/8-Bit Mode	VAX to PC	PC to VAX
84	7	1 min. 59 sec.	2 min. 02 sec.
256	7	2 min. 22 sec.	2 min. 35 sec.
512	7	2 min. 01 sec.	2 min. 43 sec.
84	8	2 min. 01 sec.	2 min. 08 sec.
256	8	2 min. 09 sec.	2 min. 25 sec.
512	8	2 min. 00 sec.	2 min. 26 sec.

Sample file-transfer times between our AT-compatible PC and VAXstation 2000.

The Authoritative Work On The Subject.



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languages. The command set includes statements for string manipulation, file access, cursor addressing, use of variables and branching. In addition to tackling small tasks, you can develop sophisticated applications using Blast II's language. A simple example of a Blast II script that prompts you for file names and that initiates a file transfer is shown in Figure 3.

There's no need to exit Blast II to run a text editor to write script files. Blast II includes a MicroPro WordStar-like editor. In addition to the basic editing features, Blast II's editor includes cutting, pasting, pattern searching and text-replacement features.

For file transfers, an alternative to using a Blast II script is the error-free command file. Error-free command files employ a different syntax than that of script files. They're more limited in what they can do. However, they're useful for file-transfer functions. They can be called from script files or invoked manually through the Blast II menu system.

Figure 3.

```
# A sample script to transfer files
ask "Are you sending or getting a file?? (S/G)", @sendget
ask "Enter options... T, O, A -->", @options
let @sure = "N"
.getfiles
    if upper @sure = "Y" then goto .filesok
     ask "Enter first file name -->", @firstfil
     ask "Enter second file name -->", @secfil
     ask "Are these names correct? (Y/N)", @sure
     goto .getfiles
.filesok
   filetransfer                  #access menu and transfer files
   @sendget                      #S or G
   @firstfil                     #source file
   @secfil                       #destination file
   @options                      #options - Text, Overwrite, Append
.goback
   esc                           #return to Blast menu
```

A simple script file example. Blast II's script language is robust enough to develop sizable applications.

Terminal Emulation

Blast II offers a number of terminal emulations, including VT52, VT100 and VT220. VT220 emulation is the default.

We encountered problems using the VT220 emulator on our AST Premium/286. Characters were dropped and displays were generally a mess. However, running PC Blast II on another machine was successful. It turns out that AST has had some problems with its VGA card. AST is aware of the problem, which will be corrected in its next BIOS release. If you have an AST microcomputer with an AST-VGA video adapter, you might want to contact AST about the problem.

Documentation

Documentation includes a *Getting Started* manual that describes Blast II's basics and provides a tutorial chapter. A *Communications Concepts* guide is helpful to those not familiar with data communications. A *Blast II Concepts and Reference Manual* supplies more information on Blast II commands and its script language.

CRG provides a free tutorial dial-in service. New users can follow along in the *Getting Started* manual as they work through Blast II's menus and get familiar with its workings.

BLAST II'S MAJOR strengths are its file-transfer functions and its robust scripting language. Further, it can run on a number of platforms. Anyone who does a lot of file transfers on a regular basis and who wishes to automate the process with a minimum of fuss should take a close look at Blast II.

Companies Mentioned In This Article

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Blast II

PLATFORMS: A variety of platforms including VAX/VMS, IBM PCs and compatibles and Macs

PRICE: PC Blast II — $250 to $495, depending on configuration. VAX Blast II — $595 to $2,495, depending on CPU and operating system. MacBlast — $195

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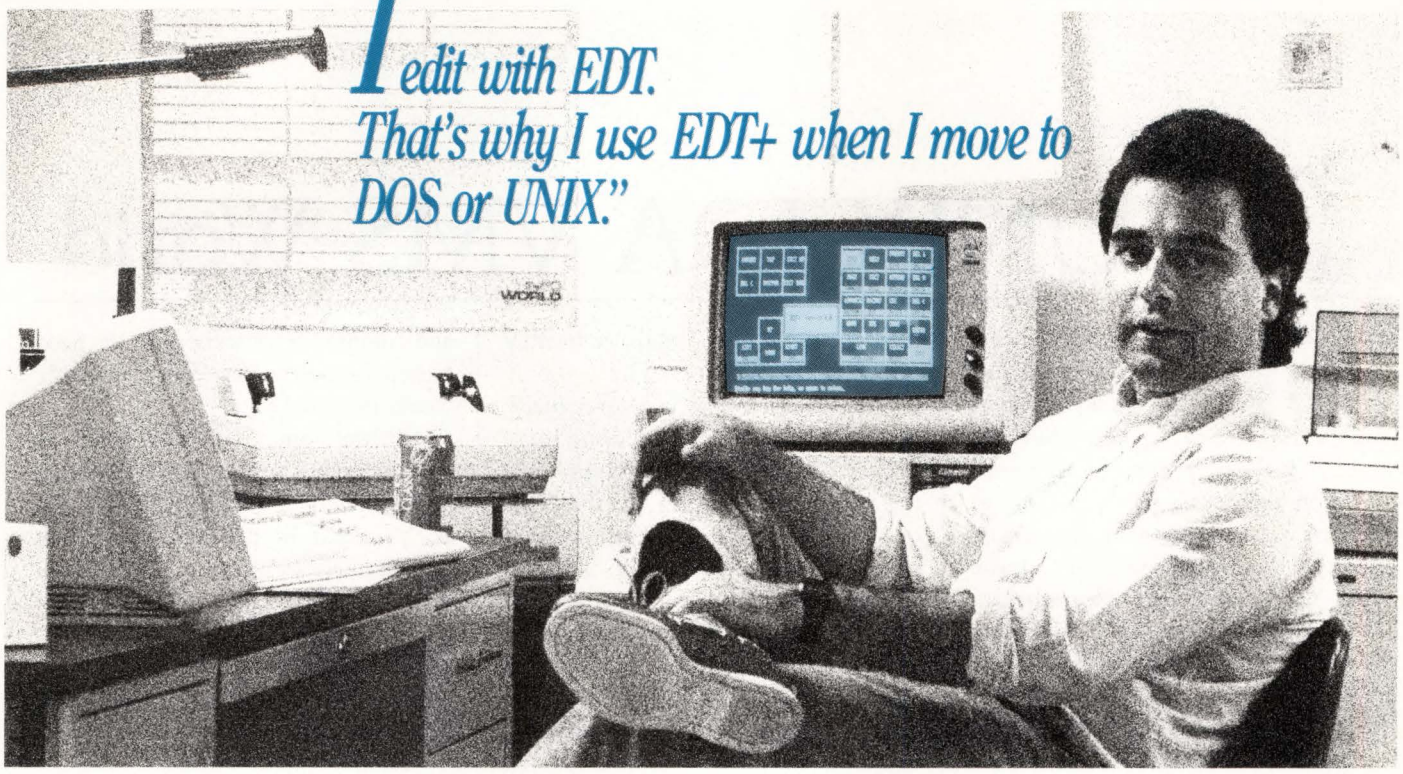

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ULTRIX

UNIX In A VMS World

Philip E. Bourne, Ph.D.

Editor's note: This is the first in a series of articles discussing UNIX from the perspective of VMS users.

Although 1984 is only a memory to most of us, we know that the horrors predicted in George Orwell's classic novel never came true. Nevertheless, 1984 was the year in which the Orwellian concept of *Doublethink* — the power to hold two contradictory beliefs in one's mind and accept both of them — began to take hold.

The beliefs I refer to are VMS and UNIX. Both were available before 1984, but in that year DEC introduced ULTRIX version 1.0.

UNIX had been running on PDPs since 1969 and on VAXs since 1979. But those implementations were pretty much restricted to universities and sites where the low capital and operational cost of an operating system were more important than durability and a high level of support. DEC changed that for VAX users by offering a serious alternative to VMS.

In the non-DEC world, UNIX use was expanding rapidly. Fledgling companies such as Sun Microsystems adopted UNIX as the quickest and least expensive way to bring a product to market. As Sun and other companies like it grew, so did the popularity of UNIX. For many, the price/performance ratio of UNIX processors, particularly workstations and minisupercomputers, couldn't be ignored. This is still true.

This isn't to say that VMS and other vendors' proprietary operating systems are in danger of extinction. The size of the installed base, the level of quality control, the layered products available and the reluctance of some users to learn a new operating system are some of the considerations that ensure a healthy future for VMS.

What this means is heterogeneity — a screen capable of displaying more than one type of default prompt, with the application dictating whether VMS or UNIX is the underlying operating system. Some may argue that the operating system is irrelevant, because user interaction is hidden behind a windowing interface common to UNIX and VMS. This may be, but many of us aren't content to look through the window and compute from a distance. We need to step through and experience the inner world firsthand.

In the coming months, we'll explore this inner world of UNIX from the perspective of a VMS user. Topics will be discussed in the order in which they're likely to be encountered at the terminal.

VMS And UNIX

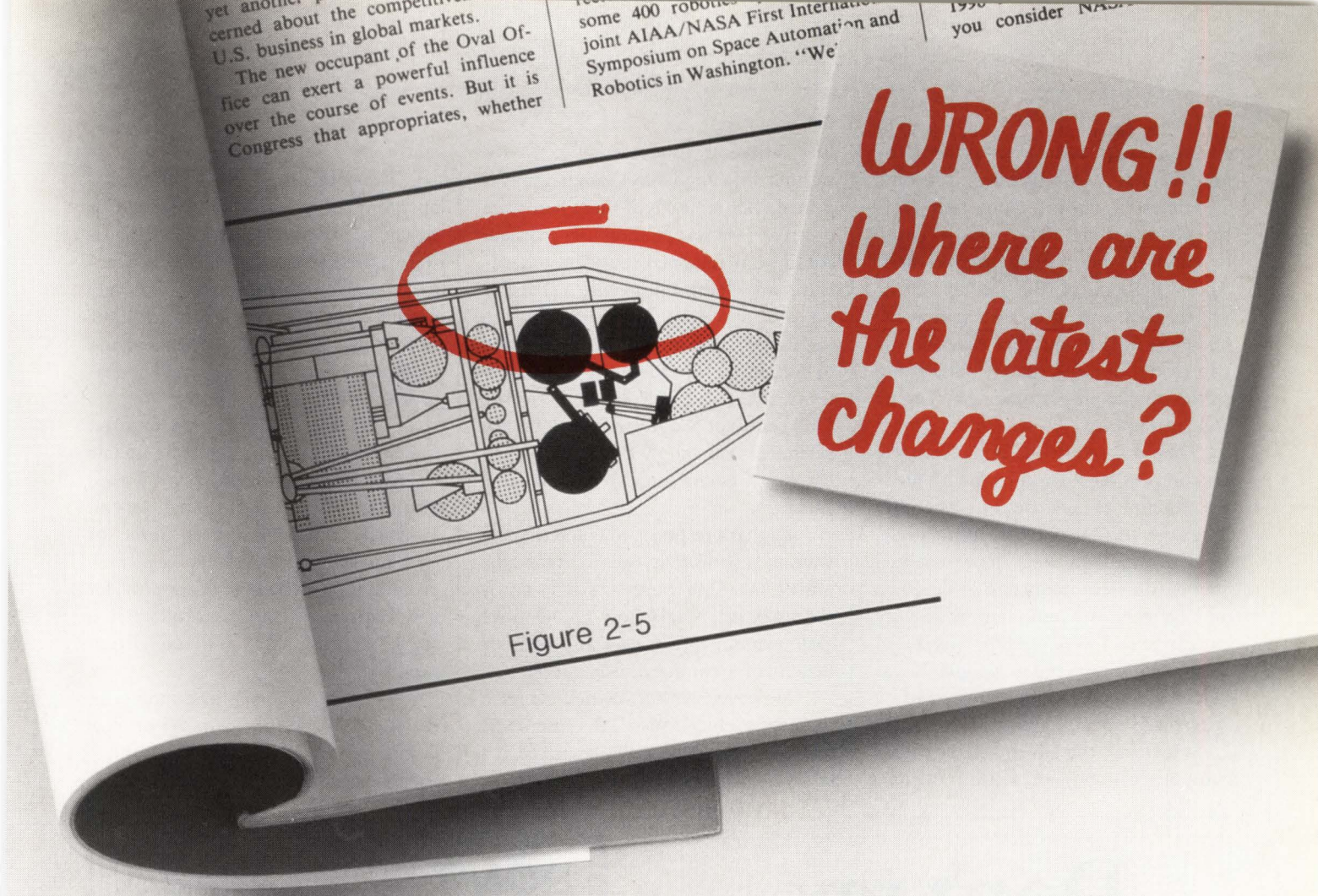
UNIX was written at AT&T Bell Laboratories in the early days of interac-

FIGURE.

	VMS	UNIX	UNIX Function
Editors	EDT	ed	Line editor
	TECO	ex	Line editor
	TPU	vi	Screen editor
Communications	MAIL	mail	Electronic mail
	REPLY	write	Send messages
	PHONE	talk	Interactive communications
	DECNET*	ftp	Remote file transfer
		telnet	Remove logins
		"r command(s)"	Remove command execution
Compilers	FORTRAN*	f77	Compile FORTRAN code
	C*	cc	Compile C code
Text Processing	RUNOFF	troff	Typesetting
		nroff	Word processing
		eqn	Equation formatting
		tbl	Table formatting
		awk	String handler
		lex	Lexical analyzer
		sed	Stream editor
	SORT	sort	Sort files
	MERGE	merge	Merge files
Program Development Tools	LINK	link	Linker
	DEBUG	adb/dbx	Debugger
	LIBRARIAN	ar/ranlib	Maintain libraries
	SCA*	prof	Profiler
	DEC/MMS*	make	Maintain independent files
		yacc	Lexical analyzer
	DEC/CMS*	scs	Revision control system
Miscellaneous	DECalc*	bc/dc	Calculator
	DECspell*	spell	Spell checker
	DECgraph*	graph	Simple plotting
		plot	

*Available as optional products from DEC

UNIX and VMS functionality compared.



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tive computing as an aid to skilled programmers. It wasn't intended to become a commercial product. Conversely, VMS was written to sell VAX computers used by novices and skilled programmers. The difference in the audiences for which each operating system was intended is still obvious. For example, the complexity of UNIX can be intimidating to the novice programmer. So why its sudden popularity?

The major reason stems from the decisions of Ken Thompson and Dennis Ritchie to rewrite the assembly language version of UNIX in the high-level C language. This unprecedented step didn't seem important in the 1960s and early 1970s. Computers were very expensive and were used for specialized applications by very few people. It was advantageous for the vendor to use a specialized operating system.

However, the advent of the minicomputer, PC and workstation changed that situation fundamentally. UNIX, written in a high-level language, was ported easily to each of these hardware types, and thus a common user interface could be maintained. Suddenly, hardware was being tailored to particular types of applications, each needing to exchange information. UNIX was poised to become a major player in the connectivity game. TCP/IP, developed at the University of California at Berkeley, permitted fast communications between UNIX processors connected to the same Ethernet.

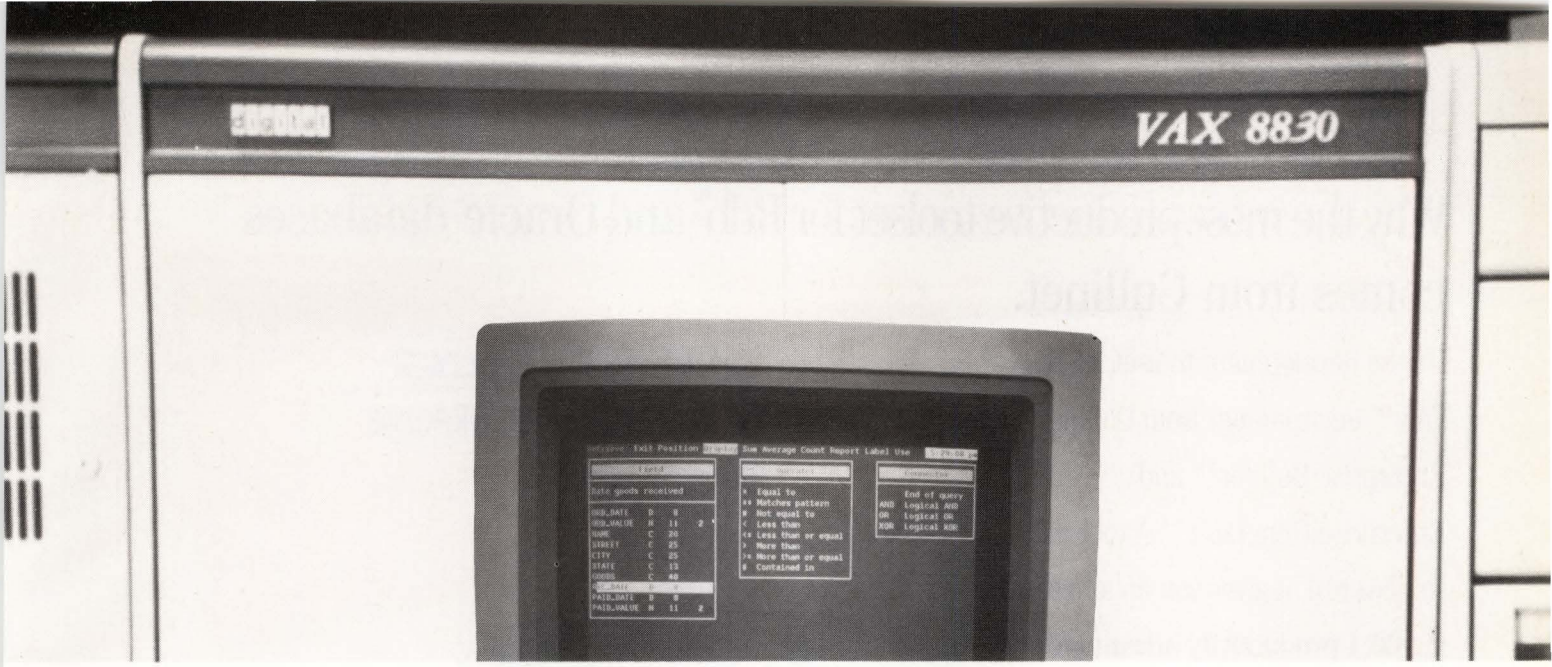
Digital's response to tailored hardware and connectivity was to expand the line of VAX/VMS processors and to provide DECnet. Users now could move easily among processors and had the benefit of a common user interface.

However, VAX/VMS now faces a different problem: speed. Because UNIX is written in a high-level language, it's easily ported to the latest innovations in hardware technology.

The performance price you pay for operating in a high-level language is small compared to the advances in hardware technology. UNIX runs on sequential, vector, multiprocessor, massively parallel and RISC-based hardware. VMS, in contrast, is hardware dependent and restricted to the sequential and multiprocessor VAX architecture.

VMS has been subjected to strict project management. A major update has been released every two years, each bringing some major enhancement. Similarly, there have been three or four minor upgrades every year, each providing bug fixes and support for new hardware. This has resulted in a stable, predictable and consistent product.

Conversely, UNIX has undergone far less project management. An original design goal was to make it modular, thereby encouraging programmers to



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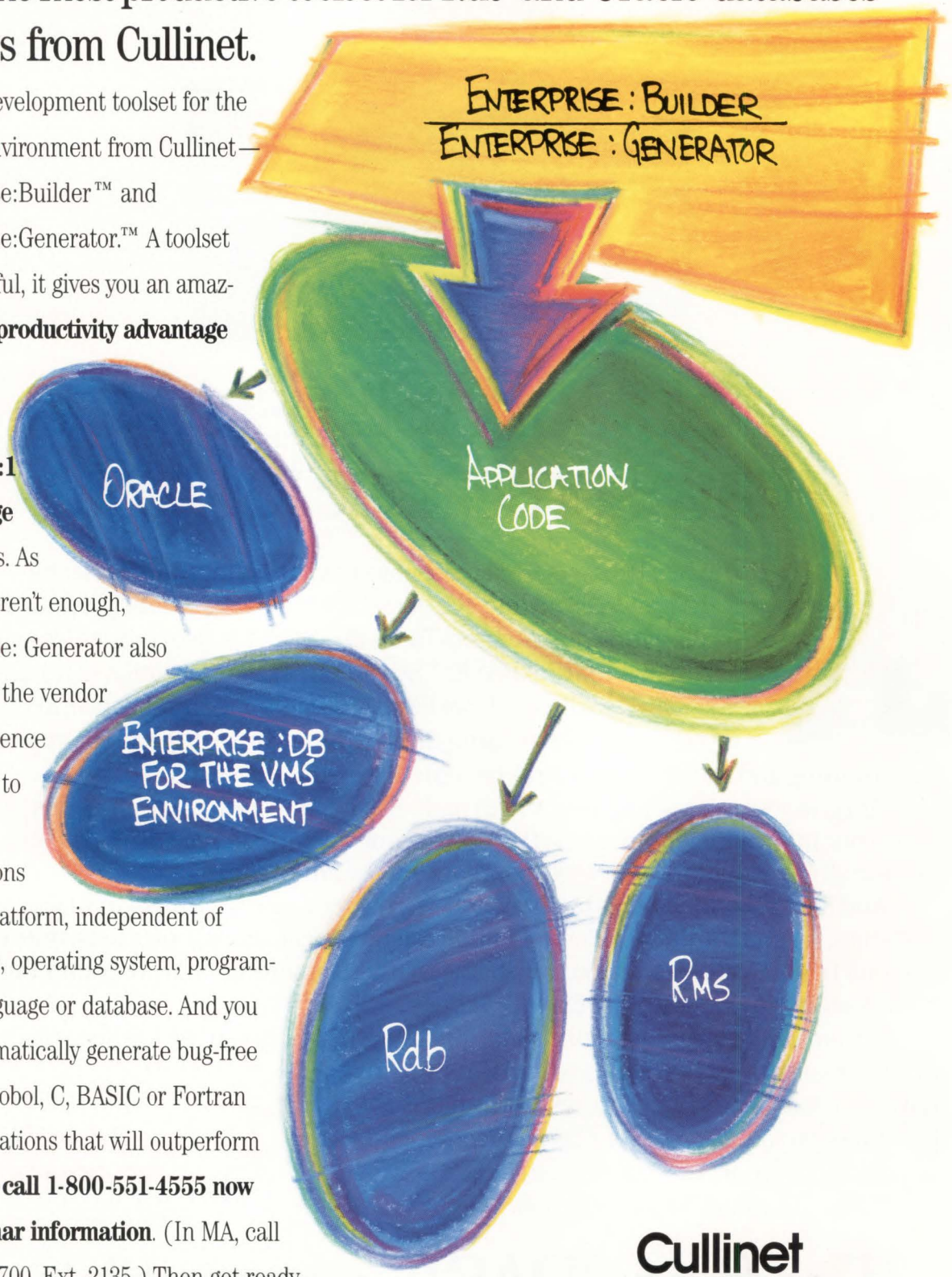

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include their own code. Code introduced in this way added functionality but wasn't necessarily consistent. Several modifications were substantial enough to have evolved into separate versions. Today we have Berkeley BSD 4.3, UNIX version 9 from Bell Labs, and AT&T System V release 3. We soon can expect to see a version of UNIX from the Open Software Foundation (OSF) and a new release of AT&T System V.

The multiplicity of UNIX versions is further complicated by the availability of different shells. The shell is UNIX parlance for the equivalent of the VMS command language interpreter. Whereas the VMS user is restricted to DCL (and possibly RSX-compatibility mode), UNIX offers three common shells: the Bourne shell (sh), the C shell (csh) and the Korn shell (ksh). The abbreviations sh, csh and ksh are the program names for the shells.

The Bourne shell is the original and simplest of the shells and is available with all versions of UNIX. The C and Korn shells are enhanced shells originally written for BSD and System V, respectively. Today, the C shell is available for System V and the Korn shell is available for BSD. Such diversity is alien to a VMS user. However, in the early stages of UNIX use (provided the VMS user stays with the same shell), little difference is likely to be noticed in moving from one UNIX version to another. Rather, the major hurdle for the VMS user is the distinctly different look and feel of UNIX.

Each version of UNIX now may be regarded as stable, i.e., unlikely to crash the computer on a regular basis. But is UNIX predictable, secure and consistent? Definitely not. Idiosyncracies in the UNIX operating system result from it never having had the strict project management that's applied to commercial products.

Differences

UNIX command syntax isn't consistent, nor do command names necessarily bear any resemblance to function. Examples of the latter are: **cat** (catenate and print — compare the VMS TYPE command); **grep** (global regular expression print — compare the VMS SEARCH command); and, last but definitely not least, **biff**.

Examples of inconsistent command syntax are found in the UNIX command options. UNIX commands have options, just as VMS commands have qualifiers. Both modify the action of the command. UNIX options are usually, but not always, represented by a single lowercase letter. For example, **o filename** (compare the VMS /OUTPUT= filename qualifier) redirects output to filename rather than the terminal for some commands. An exception is **of filename** used by the command **dd** (compare the VMS EXCHANGE command). Analogously, the **o** option for the **od** command (compare the VMS DUMP command) causes the contents of an input file to be translated into octal rather than be redirected to an output file.

Another characteristic of UNIX that's irksome to the VMS user is the uninformative error-reporting features of both the shell and the many programs that make up the command set. For example, "Bailing out at line so and so . . . " as the only error-reporting feature of the **awk** utility, a complex string handler, isn't that helpful. But at least you know approximately where to look in the code for the error. (A utility is arbitrarily distinguished from a command by its complexity. For example, UNIX mail [compare VMS MAIL] is considered a utility, having many subcommands.)

Worse is struggling with a complex line. Each time the line is parsed by the shell, a vaguely helpful error message is returned. Finally, when no error message is returned, you breathe a sigh of relief, only to realize that the command still hasn't worked and the shell has failed to return any error message.

UNIX doesn't have structured error reporting *(%facility-l-ident, text)*. For example, *%DCL-W-IVVERB, unrecognized command verb — check validity and spelling* is self-explanatory. Nor does UNIX have a manual such as the *VMS System*

Messages and Recovery Procedures Reference Volume, in which reported errors may be referenced for a fix to the problem.

To the VMS user, inadequate error reporting is part of a larger problem: how to find an answer to any UNIX question. At least the ULTRIX documentation set covers three feet of shelf space and has a general index, in both respects exceeding many other versions.

However, the basic problem facing the VMS user is the format of the documentation, which hasn't changed since the early releases. Explanations are terse and examples are lacking. On-line help is confined to versions of the manual pages without the VMS LIBRARIAN to locate appropriate topics easily.

To poke fun at these shortcomings is unfair. Some of the beauty of UNIX most likely would have been lost if the creative minds had been stifled by strict project management.

The software that has been added to UNIX over the years may not be totally consistent, but it must be regarded as comprehensive, powerful and often elegant. Some of this software, part of the standard UNIX distribution, is available to the VMS user as layered products requiring a separate license and thus financial outlay.

The **make** utility is a good example. This utility maintains a group of files that are in some way dependent on each other. It has many uses, the most common being the maintenance of large programs. The executable image is dependent on a number of object files, which in turn are dependent on a number of source-code files. These routines are maintained with **make**. When a change is made to one or more routines, **make** remembers which ones need to be recompiled to produce a current executable image, reducing compile time significantly. The **make** utility is part of every UNIX distribution but must be purchased as the layered product DEC/MMS by the VMS user.

THE FIGURE ON PAGE 106 summarizes the components of the UNIX operating system and indicates the equivalent VMS component or layered product. Let's put each UNIX component in perspective.

Editors — UNIX editors, like UNIX, were designed to be generic. This is good and bad. It's good because the UNIX **vi** full-screen editor functions on

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VT330-CA/BW	VT330 amber phosphor, std. keybd.	$1995	$1795	$1695	25
VT330-DA/BW	VT330 white phosphor, WPS keybd.	$1995	$1795	$1695	25
VT330-EA/BW	VT330 green phosphor, WPS keybd.	$1995	$1795	$1695	25
VT330-FA/BW	VT330 amber phosphor, WPS keybd.	$1995	$1795	$1695	25
VT340-AA/BW	VT340, std. keybd.	$2795	$2595	$2495	25
VT340-DA/BW	VT340, WPS keybd.	$2795	$2595	$2495	25
LA75-CA/BW	LA75 Companion Printer	$895	$795	$745	25
LA75P-CA/BW	LA75P parallel Companion Printer	$895	$795	$745	25
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LN03R-AA/BW	LN03 ScriptPrinter	$5595	$5233	$4995	10

[1]Applies to products purchased through 800-Digital or Digital's on-line electronic ordering system. No order number prefix is necessary to order, e.g. 10 VT320-AA.

[2]Applies to products purchased on the same purchase order with systems, CPU upgrades or terminal servers or in the minimum quantity specified. Orders with quantity pricing must have only one "ship to" location. To order, use a DL-prefix ahead of the order number, e.g. 5 DL-VT320-AA (for Fill-the-Ports) or 50 DL-VT320-AA (for Quantity).

*Shipped within 30 days.

a variety of terminals — unlike VMS EDT, which requires a VT series terminal or compatible. It's bad because the editor takes no advantage of the special features of certain terminal types. VMS users migrating to UNIX might consider EMACS, a public-domain programmable editor available for most versions of UNIX. Also, Boston Business Computing offers a native EDT emulation for most versions of UNIX.

Communications — UNIX includes software for networking; VMS requires that the user purchase a separate DECnet license. The major difference in networking software is that UNIX has the "r commands," which permit a user with access privileges to execute a command on a remote computer. To do this in VMS is more cumbersome, except in the case of a local command that accesses a remote file.

Network File System (NFS) was developed and is freely licensed by Sun Microsystems and is available for most versions of UNIX. NFS typifies the UNIX approach: If enough users like it, then it becomes a de facto standard. ULTRIX includes NFS at no extra cost. Other hardware vendors may require you to purchase an additional license. NFS functions much like a Local Area VAXcluster (LAVc). Where a file resides in a distributed environment of processors is irrelevant, because it's accessible via Ethernet as if it were resident on a physical device attached to the local computer.

Compilers — Most versions of UNIX come with high-level language compilers. For example, FORTRAN, PASCAL, LISP and C compilers are included with ULTRIX. As in the case of the UNIX editors, this is both good and bad. Code written for these compilers will run on any version of UNIX that supports them. Thus, code is portable across hardware types. However, the compilers take no advantage of hardware peculiar to a hardware vendor. Hence, these compilers are always slower than native compilers, if not at compiling code, then certainly at running it. The original Berkeley C compiler and VAX C are distributed with ULTRIX.

Text Processing — Prior to the introduction of the PC in the early 1980s, UNIX was renowned for its text processing tools. In the early days of UNIX development, much programmer energy was spent on text processing tools in an attempt to attract the attention of the Bell Laboratories management.

Like most other components of UNIX, the text processing tools that resulted were powerful but not easy to use. The only advantage they have over today's desktop publishing software and hardware, as is true of Digital Standard Runoff (DSR), is that they're a giveaway with the operating system and they're portable. A **troff** or **nroff** file can be formatted using any version of UNIX.

Program-Development Tools — UNIX was developed for programmers. It isn't surprising, therefore, that the programming tools are comprehensive and powerful.

Miscellaneous — The remaining software items support the saying, "You get what you pay for." The UNIX software in this category comes as part of the operating system, and it doesn't have the functionality or the ease of use of the VMS counterparts that must be purchased separately.

UNIX diehards are sure to have had their hackles raised by this discussion. Yet, this represents how many VMS users perceive UNIX at first encounter. This perception slowly changes as the power and elegance of UNIX unfold. Next month's discussion of the UNIX file system and UNIX processing exemplify this power and elegance.

Author's note: Any hints or kinks useful to VMS users grappling with UNIX will be received gratefully. Please send any information via e-mail to SYSTEM@CUMBG.BITNET or pbourne@cunixc.columbia.edu. *—Philip E. Bourne, Ph.D., is senior associate at the Howard Hughes Medical Institute at Columbia University and the author of* UNIX for VMS Users, *soon to be published by Digital Press.*

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LET'S C NOW

Rex Jaeschke

Pointers, Part 1

Editor's note: This is the first of a three-part series that covers pointers. Although Mr. Jaeschke formally addressed this subject several years ago, much has happened with the evolution of the ANSI C Standard, particularly in the area of defining a better vocabulary to describe pointers and their relationship with arrays. Whether you're a C novice or expert, this series will contain something new.

Pointers are powerful and easy to use, but without care they can make code unreadable, difficult to debug, unmaintainable and difficult to port to other systems. In short, pointers can provide a lot of capability and a lot of trouble. And if your system includes a symbolic debugger, you'll probably get to know it well at this time. The only way to really understand pointers is to use them repeatedly.

What Are Pointers?

Simply stated, a pointer is a variable that contains the address of another variable. If the address of a variable is stored in a pointer, the contents of that variable can be accessed indirectly through the pointer. Accessing an object via a pointer to it is known as dereferencing that pointer. That is, when you dereference a pointer, you get the value of the object it currently points to.

It's possible to implement many simple ANSI terminal escape sequences without using pointers. However, they're needed if we're to implement others. For example, to interrogate the terminal to see what the cursor's current line and column position are, we need to have a function return two values, the line and column. The problem is, a function only can return one value at most, and by default all scalars are passed in by value. To have a function give us more than one value, we must pass in arguments by address, allowing the function to deal directly with objects rather than copies of objects. In this case, we must pass in pointers to the variables into which we want the function to store the line and column values.

C always passes arrays by address. That is, when we use the name of an array as an argument to a function, the address of the first element in the array actually is passed by value. As such, a pointer to the first element is passed in. And because a string literal is implemented as an array of **char**, every example we've used of passing string literals to functions has involved the use of pointers. The first argument to **printf** is one common example.

We rarely are interested in the actual address of an object. We simply store its address so we can get at it indirectly. In fact, objects having automatic storage duration may have different addresses each time they're created dynamically. This would be true for such objects defined in a function called recursively.

Let's look at a simple example to see how pointers are declared and used. The task is to define an **int** variable **var** and to store its address in a pointer **pvar**. Then, **var** will be accessed indirectly via **pvar**, and its value will be copied to another **int**, **newvar**:

```
#include <stdio.h>

main()
{
        int var = 10;
        int *pvar;
        int newvar;


        pvar = &var;                /* find var's address */

        newvar = *pvar;             /* access var indirectly */

        printf("Value of var is %d\n", var);
        printf("Value of newvar is %d\n", newvar);
        printf("Address of var is %p\n", pvar);
        printf("Address of pvar is %p\n", &pvar);
}
```

which produces the output:

```
Value of var is 10
Value of newvar is 10
Address of var is 364E:0FD2
Address of pvar is 364E:0FD4
```

The declaration **int *pvar;** declares **pvar** to be a pointer to an **int**. That is, at any time, **pvar** may contain the actual address (absolute or virtual, depending on your system) of an **int** object. However, at the time of declaration, we haven't said which particular **int** object it points to. Automatic objects have undefined initial values by default. Therefore, **pvar** initially points into the wild blue yonder. In fact, the "address" it contains may not even be part of our program's address space. On a real-memory machine (as opposed to virtual-memory machine), such a memory location may not even physically exist. Of course, this is irrelevant unless you try to access that possibly non-existent memory location. The rule, therefore, is to not dereference a pointer until it has been initialized to point to some predictable memory location and one you have appropriate access to.

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The declaration **int *pvar** can be read in one of two ways, both of which are equivalent. You can read, "**pvar** is a pointer to an **int**," or, "The contents of the location pointed to by **pvar** is an **int**."

Note that a pointer declaration specifies the type of the object pointed to, in this case an **int**. Other than this, a pointer has no type of its own, per se. And after a pointer is declared, it may only point to objects of the specified type. Attempting to make **pvar** point to a **double**, for example, should cause a compilation error. (Many pre-ANSI compilers are lenient in this respect and freely permit the mixing of apples and oranges.) However, in systems programming it's sometimes useful to be able to make a pointer point to arbitrary type objects. This is possible, although ANSI C requires it to be done overtly, as we'll see later.

Like several other punctuation characters we've seen, **&** is used for different purposes. We've seen it used as the binary bit-wise AND operator (and in the **&=** assignment operator) and in the logical AND operator **&&**. It also can be used as a unary operator in the prefix position, as is the case in this example. The expression **&var** is read as "take the address of **var**." (You can't apply **&** to a variable declared with class **register**.) Therefore:

```
pvar = &var;
```

assigns the address of **var** to **pvar**, such that **pvar** now points to **var**. We don't write:

```
*pvar = &var;
```

When we're assigning an address to a pointer, such as in this case, the * must not be used. Because **var** is an automatic variable, its address isn't known until run time. However, because **pvar** is also an automatic object, its initializer can be any run-time expression of the appropriate type. Therefore, we could have declared **pvar** as follows:

```
int *pvar = &var;
```

Although the * is part of the declaration of **pvar**, it takes no part in the initialization. The initializer always applies to the identifier being declared, in this case to **pvar**.

Assignment requires both operands to either have the same type or to be assignment compatible. In this case, **pvar** is declared to be a pointer to an **int**, and **var** is an **int**. By definition, the type of the expression **&var** is also "pointer to **int**," so it's compatible with **pvar**.

The statement **newvar = *pvar;** causes **pvar** to be dereferenced. That is, it takes the **int** value stored at the location **pvar** points to, and copies it to the variable **newvar**. The type of **newvar** is **int** and that of **pvar** is pointer to **int**. The unary * prefix operator is used to get at the object pointed to, indirectly and by definition, the expression:

```
*pointer-to-type-T
```

has type T. Therefore, ***pvar** has type **int** and its value can be assigned to **newvar** directly.

Perhaps the most difficult thing to remember when learning pointers is when to use or omit the * in pointer expressions. The * prefix operator should only be used when you wish to get at the object the pointer points to. If you wish to get at the value of the pointer, the * must be omitted.

If we omitted the * in the assignment of **newvar**, we should get a compilation error. However, many pre-ANSI compilers were very liberal and treated pointers and integral expressions as being assignment compatible. ANSI C doesn't, and any attempt to do so will result in a compilation error. If your compiler doesn't enforce such strict compatibility checking and it provides a compilation switch to enable such checking, you're advised *always* to enable that switch. To do otherwise almost certainly will cost you hours of needless debugging.

Occasionally, it's useful to display the value of a pointer. Therefore, ANSI C provided a special edit mask **%p** for this purpose. The output format, however, is implementation defined, because addressing notation and memory layout details are quite system specific.

The example shown was run on an MS-DOS system, and because the Intel 80x86 chip series has a segmented architecture, a reasonable way to display an address is with a segment base address and offset in the format bbbb:oooo. Implementations running on machines such as a VAX or M68K might display an address as a hexadecimal or octal number.

Prior to the invention of **%p**, it was common to see pointers displayed using **%u** or **%lu**. While this will work on many implementations, it requires that pointers have the same size representation as an **unsigned int** or **unsigned long int**. Note that addresses are signed on some systems. In any event, never deal with addresses as signed or unsigned integers.

We've said that **pvar** is a variable. Therefore, we can change its value at run time. In fact, we can make it point to any **int** object we wish. It also means that **pvar** is allocated some storage space and, as such, that storage has an address. Therefore, we can take the address of a pointer, and we do so with the expression **&pvar**. However, what's the type of this expression? **pvar** has type pointer to **int**, and **&** creates a new level of indirection. Therefore, the resulting type must be pointer to pointer to **int**. If we were to declare an identifier of this type, we would use:

```
int **ppi;
```

This makes sense, because a pointer is a variable that contains the address of another variable and can contain the address of another pointer. Actually, there's no limit to the number of levels of indirection. However, beyond two levels,

it's hard for a programmer to keep track of it in his mind. Knowing this, we even could initialize a pointer with its own address.

The amount of storage allocated to a pointer is implementation defined. For example, on VAX C it's 32 bits, on Cray machines it's 64 bits and on MS-DOS machines it can be either 16 or 32 bits, as the programmer wishes. In fact, on DOS machines, a program can contain 16- and 32-bit pointers simultaneously. Also, all pointers aren't necessarily created equal. For example, a pointer to type *T1* might have a different representation than a pointer to type *T2*.

Pointers may point to objects of any type that you can declare legitimately. Pointers even may point to executable code, in which case they're known as pointers to functions.

The following example can be used to display the amount of space allocated to various types of pointers for any implementation:

```
#include <stdio.h>

main()
{
        unsigned long int size;

        size = sizeof(char *);
        printf("Size of char * = %lu\n", size);

        size = sizeof(int *);
        printf("Size of int * = %lu\n", size);

        size = sizeof(double *);
        printf("Size of double * = %lu\n", size);

        size = sizeof(long int **);
        printf("Size of long int ** = %lu\n", size);

        size = sizeof(float ***);
        printf("Size of float *** = %lu\n", size);
}
```

The output produced from one implementation is:

```
Size of char * = 4
Size of int * = 4
Size of double * = 4
Size of long int ** = 4
Size of float *** = 4
```

The type of **sizeof** is implementation defined. It's either **unsigned int** or **unsigned long int**. To make this program maximally portable, we assign the size to an **unsigned long int** and display that value using **%lu**.

Pointers And Casts

In the previous section, we showed an example that displayed the size of various pointer types. Each part of that example could have been written in a simpler way. For example:

```
#include <stdio.h>
main()
{
```

```
        printf("Size of char * = %lu\n",
                (unsigned long) sizeof(char *));
}
```

Because pointers are types, you may cast to and from pointer types. Be careful, because dereferencing a pointer that was created via a cast can be catastrophic. For example:

```
main()
{
        char c;
        int i;
        int *pi;

        pi = (int *) &c;
        i = *pi;        /* ??? */
}
```

Here, we've taken the address of the **char c**, resulting in an expression of type pointer to **char**. By casting this to type pointer to **int**, **pi** thinks it's pointing to an **int**, when in fact it isn't. On subsequent attempts to access the "**int**" pointed to, the program's behavior may vary from actually producing an **int** value to causing a fatal run-time error.

Let's assume an **int** and a **char** have different representations (they almost always do). Using the pointer to access more bits than exist in the **char** will cause either adjacent bytes, or words, to be interpreted as well, or will cause some kind of access violation if these extra bytes don't belong to this program or are otherwise inaccessible. On the PDP-11, for example, if the address of **c** was odd, all attempts to access that address via a non-**char** pointer result in a fatal "odd address trap."

Incrementing And Decrementing Pointers

We know that when the ++ and -- operators are used with arithmetic operands, they simply mean increment by one or, in the case of floating-point operands, by 1.0. However, these operators also can be used with pointer operands as follows:

```
#include <stdio.h>

main()
{
        static char name[40];
        char *pc;

        printf("Please input a string (39 chars max): ");
        scanf("%39s", name);          /* get string from standard input */

        pc = &name[0];                /* point to start of name */
        while (*pc != '\0') {         /* test if end of string found */
                putchar(*pc);         /* if not, display char */
                ++pc;
        }

        putchar('\n');
}
```

One set of output produces the following:

```
Please input a string (39 chars max): Some_test_data!!
Some_test_data!!
```

The array **name** has been initialized using the library function **scanf**. This function uses edit masks much like **printf**. However, because **scanf** returns values back through its argument list, every argument *must* be a pointer. The **%s** mask accepts characters until white space is detected or the limit (in this case 39) is reached. **scanf** automatically adds a null character terminator.

The expression **&name[0]** is the address of the first character in this array. Therefore, it has type pointer to **char** and can be assigned to **pc**. If **pc** has type pointer to **char**, then ***pc** has type **char** and in the first iteration of the loop has value **'T'**. The loop body executes until **pc** points to the terminating null character. During each iteration, the character currently pointed to is written to standard output and the pointer is incremented to point to the next **char** in the array.

By definition, when a pointer is incremented or decremented, the increment or decrement is scaled by the size of the object being pointed to. Therefore, if **pt** points to an object of type *T*, **++pt** points to the object of type *T* immediately following in memory. This is guaranteed on all C implementations regardless of the size and representation of any pointer type.

The loop body also can be written as follows:

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

Here we've combined the pointer dereference and increment into one expression. This combination of unary operators is common in pointer expressions. However, it's less overt than the first approach. According to the precedence table, the unary operators * and ++ have the same precedence. However, they associate right to left. Therefore, ++ is evaluated first. The expression is equivalent to ***(pc++)**. By definition, the value of **pc++** is **pc** before it's incremented. Therefore, the pointer dereferenced is actually **pc**, not one more than **pc**. So while the ++ has precedence, it doesn't change the operand of *.

It's also common practice to further abbreviate this loop as follows:

```
while (*pc)
        putchar(*pc++);
```

Because '\0' has a value of zero by definition, a comparison of != '\' is the same as testing for true. Therefore, the controlling expression can be written as a logical test instead. It's strongly suggested that you explicitly write in the '\' comparison to make the expression's meaning obvious. Any compiler worth its price should generate the same code from either approach, in which case readability should take precedence.

Consider the following example in which a **double**

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pointer is decremented:

```
#include <stdio.h>
main()
{
        static double da[] = {0.0, 1.1, 2.2, 3.3, 4.4, 5.5};
        double *pd = &da[5];
        while (*pd > 0.0)
                printf("%6.2f\t", *pd--);
        putchar('\n');
}
```

The output produced is:

```
5.50    4.40    3.30    2.20    1.10
```

The **while** loop terminates when it gets to the first element, **da[0]**. Consider the case in which you also want to print that element. A common suggestion for doing this would be to change the loop test criteria to be **while (*pd > = 0.0)**. Nice try, but no cigar. Let's look at what resulted when this was run with one compiler:

```
5.50    4.40    3.30    2.20    1.10    0.00    3969690.64    76345.23
```

We got the first element and a few other numbers. Where did they come from? You may recall that C has no run-time array bounds checking. There's no facility to check if a pointer such as **pd** is incremented or decremented beyond an array's bounds. We see two extra values printed because by chance that's what was stored in the two **double** values in memory, immediately before the storage area that contained the array **da**. The **double** immediately prior to them must have had a negative value, causing the controlling expression to test false.

To process all elements in an array, you must know the number of elements in that array or know the value of the first or last element values. The only special case is when processing **char** arrays in the forward direction, and the array is terminated by a null character.

In Part 2, we'll look further at the **strcpy** library function and cover functions that return pointers and pointer arithmetic.

Readers are encouraged to submit any C-related comments and suggestions to Rex Jaeschke, 2051 Swans Neck Way, Reston, Virginia 22091 or via the uucp address uunet!aussie!rex. *—Rex Jaeschke is an independent consultant, author and lecturer. He is the C language editor of* DEC PROFESSIONAL *and our representative on the ANSI C Standards Committee.*

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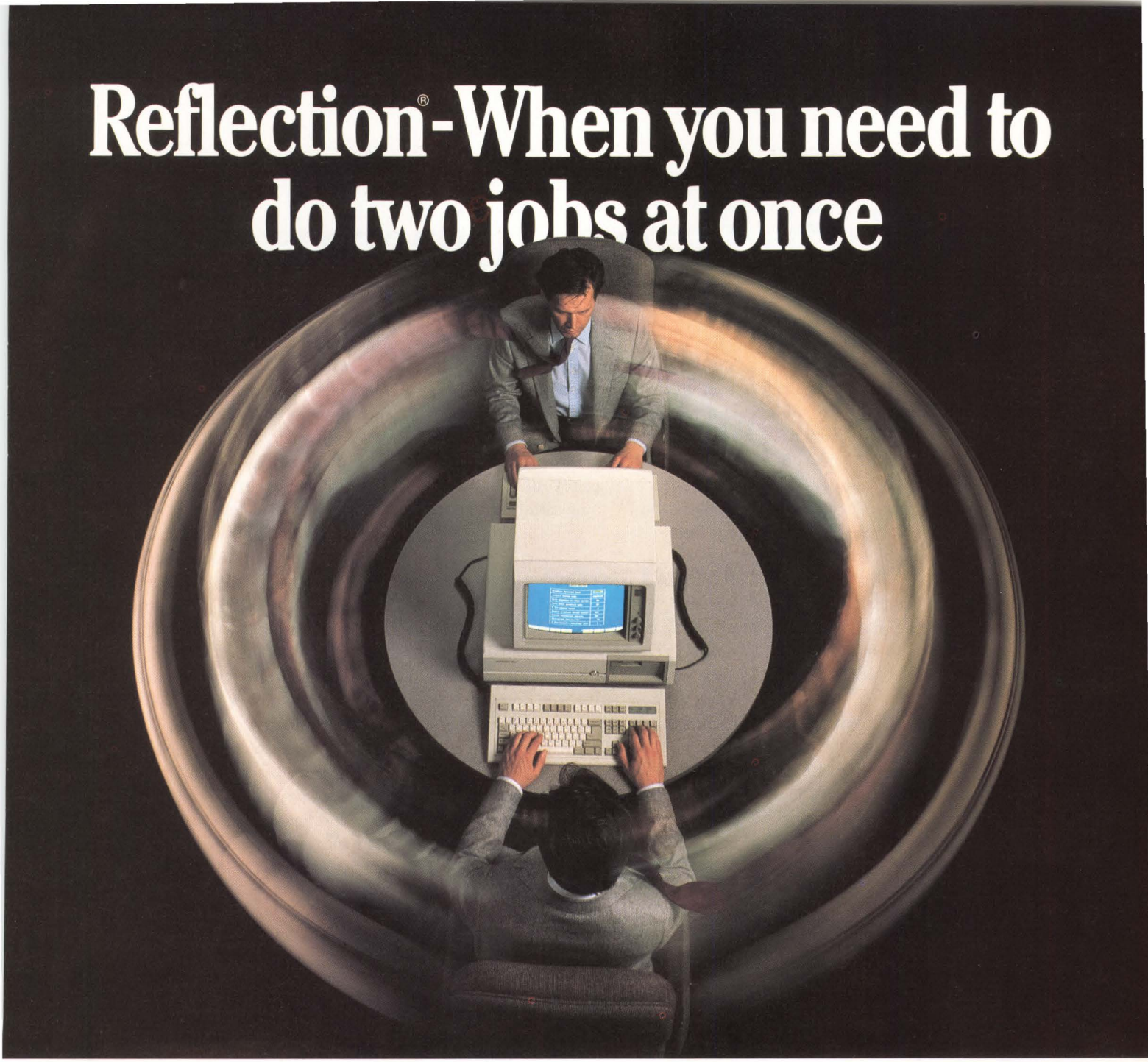

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DIGITAL WATCH

Evan Birkhead

Education Initiative

The contributions of educational institutions to the history of computing have been substantial. In the 1940s, Von Neumann's stored program architecture was conceived and developed at Princeton. Also in that decade, pioneering computers were built at Cambridge (EDSAC), Harvard (Mark I) and the University of Pennsylvania (ENIAC).

DEC's roots are planted as firmly in academia as anyone's. The genesis of DEC, in fact, was Ken Olsen's work at the electronics labs at MIT, which started in the 1950s.

Ken and company invented the concept of time-sharing and commercially sold interactive computers with a bargain basement price tag of less than $1 million.

DEC calls its relationship with education a partnership, and the company has worked closely with many institutions worldwide by providing the equipment for campuswide networks and by funding and collaborating on research and advanced development projects. Education is one area in which DEC is recognized by both industry analysts and its competition as a clear-cut leader.

Realigned Approach

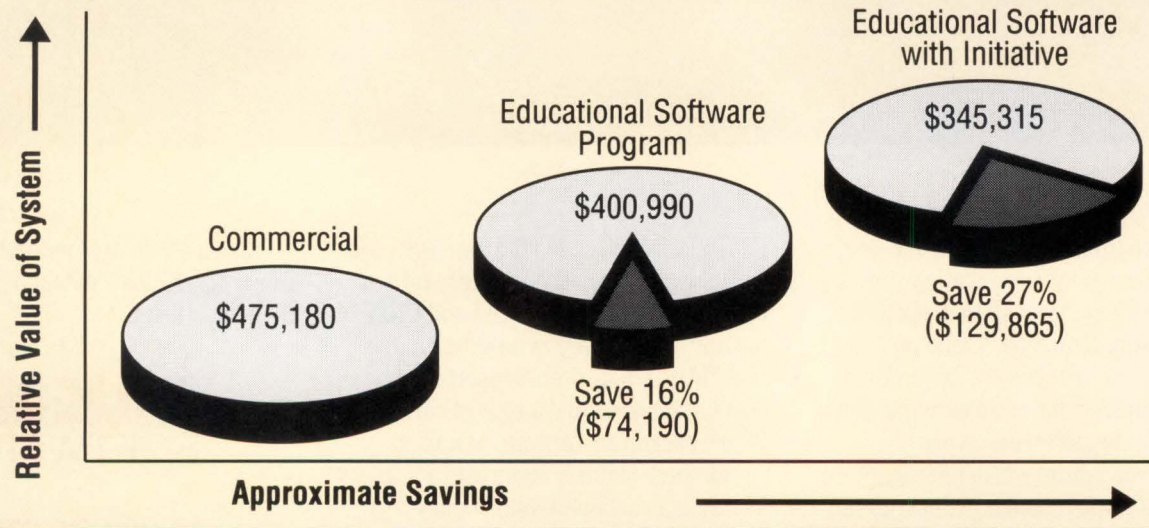
Recently, DEC realigned its sales approach to educational institutions. The new program is outlined in an umbrella package called the Education Initiative. Under the initiative, DEC provides:

1. Initial software distribution kits, consisting of media, documentation and updates.
2. The right to copy all non-royalty products anywhere, any number of times.
3. Hardware maintenance, including parts at a 50 percent discount, labor (the $1,000 incident fee is waived), the DECmailer five-day turnaround board agreement and access to DEC's expertise, including software support specialists.
4. A self-maintenance plan, complete with diagnostics.
5. Enrollment in DEC training courses.

In return, DEC asks that one site on campus (preferably with the same systems manager that handles purchasing) keeps track of users and file reports to DEC. DEC also expects the site to double as a campus technical support center. DEC charges a $15,000 annual fee that covers all software upgrades and a per-CPU fee that ranges from $20 to $300.

The initiative enhances the effectiveness of an existing program, called the Software Library. This program is designed specifically to make the support and maintenance of software in academic research more affordable. The

FIGURE.



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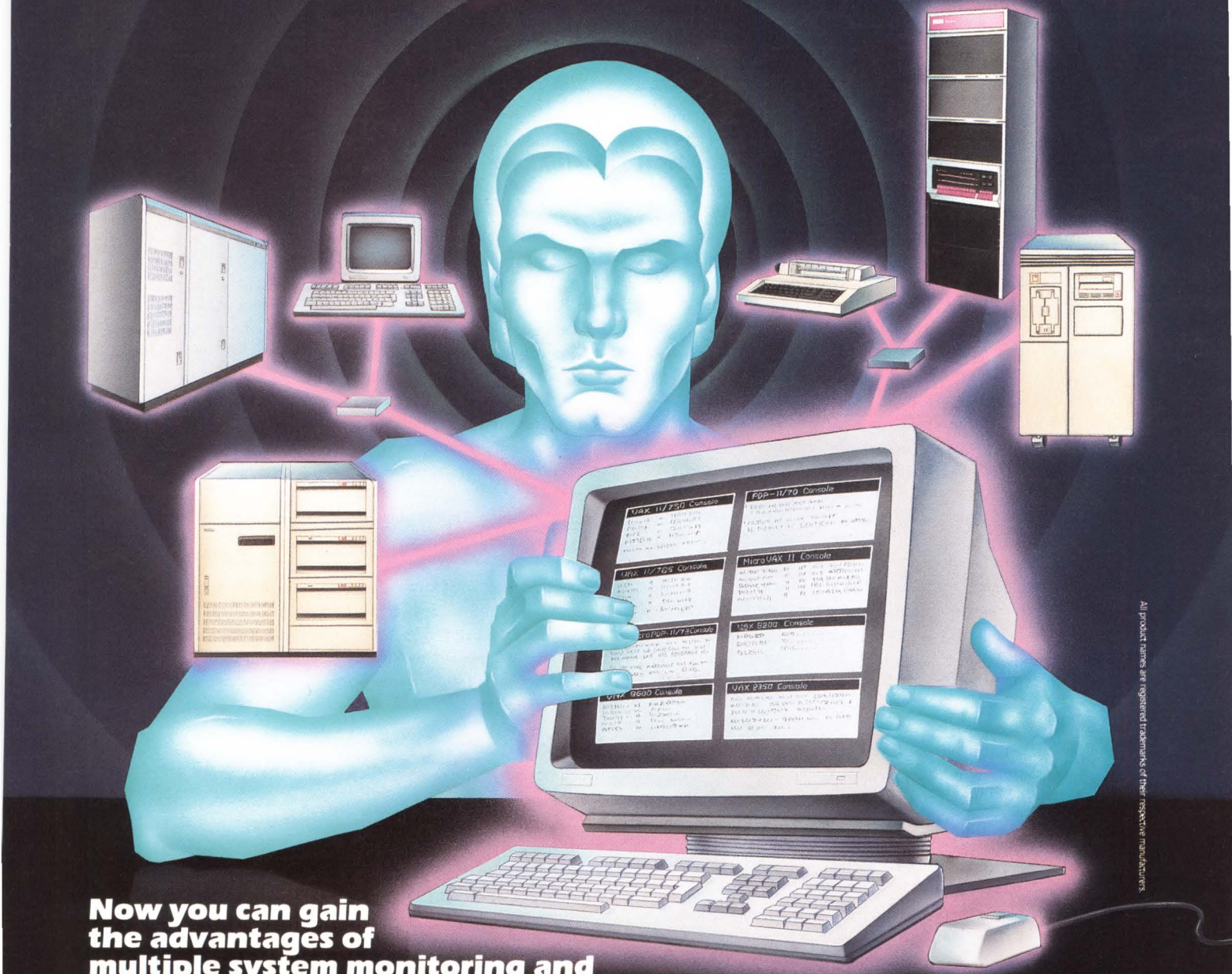

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library covers software for all VAXs and the DECstation 3100. Approximately 35 libraries are now in place. The library costs $10,000 to start and carries a $15,000 annual fee.

The initiative already has swayed a few customers. For example, Syracuse University, a large DEC user, reports that it was planning a major purchase of Suns before DEC announced its program, but decided to go with the initiative.

"Traditionally, industry has supported education in the form of research and equipment grants to help schools acquire more computing power," said Roger Strickland, manager of DEC's Education Group, at the November 1988

MicroVAX Catch-22

DEC's April 10 announcement of its improved MicroVAX chip set was upstaged that same day by Intel's introduction of the 486. Although both announcements went according to expectations, DEC's paled in comparison, looking like just another product enhancement next to Intel's new generation of CPUs.

That isn't to say that the new MicroVAXs and their associated servers and storage devices aren't impressive. Technologically, the CPUs, based on the 60 ns CVAX semiconductors used in the VAX 6300, show superior innovation. For $81,000 — reasonable as VMS machines go — the MicroVAX 3800 provides 3.8 times the performance of a VAX 11/780. Additionally, the 3800 has a DSSI storage bus, dual-host LAVc capabilities and support for multiple 400-MB RF71s. Priced at $120,200, the more powerful MicroVAX 3900 looks like a 3800 but accommodates up to eight 1.2-GB RA90 drives.

The 16-MB VAXserver 3800, which comes with DECnet/Ethernet and DSSI adapters, is priced at $56,100; the 32-MB VAXserver 3900 costs $84,900.

The announcement was accompanied by startling price reductions and upgrade packages for older MicroVAXs. These packages let you upgrade MicroVAX 3500/3600s into 3800/3900s for $20,000 or upgrade VAXservers into MicroVAXs at various costs. Other products include new configurations of low-end MicroVAX and VAXserver 3300s, a $31,000 rtVAX 3800 running VAXELN and, most significantly, the $110,000 ESE20 120-MB disk — DEC's first solid-state effort and its highest-performance drive to date.

Leapfrog

The flurry of product introductions didn't end with DEC and Intel. Two days later, Sun Microsystems, the number one workstation vendor, stole the limelight with the biggest introduction in its history, featuring workstations and servers with strong price/performance curves.

The topper to the new product line was the SPARCstation 1, which runs at 12 mips, for about $9,000.

But Hewlett-Packard got the last word. HP acquired Apollo Computer just a few hours before Sun's big show. The merger of the number three and number four workstation vendors makes HP, everyone's favorite underdog, the market share leader.

This game of leapfrog should teach DEC some important lessons. Even though the midrange MicroVAX isn't DEC's workstation warrior, the announcement of the 3800/3900 series shows that the company is in the midst of upgrade-mania that may strain customer confidence. We'll see VAXstation and DECstation upgrades early this summer.

The other workstation companies appear streamlined and focused with emphasis on RISC, UNIX and faster throughput speeds. The nice thing about Sun's and Intel's announcements is that they had finality. It was as if they said, "This is our state-of-the-art product set and it will be around for a while, so you might as well buy it now." The new MicroVAXs, on the other hand, further muddy DEC's waters.

DEC's 1989 barrage of computer introductions has confused customers. For VAX/VMS machines, the fundamental stumbling block is price/performance. Many users are rebelling against the inflated price of DEC's elegant proprietary system.

DEC President Ken Olsen may have simplified the VMS versus ULTRIX purchasing decision for many people.

At the April 10 MicroVAX announcement, he said that he intends to ingrain the robustness and features of VMS into future versions of ULTRIX. Additionally, DEC reports that it will achieve a steeper performance curve with three generations of CMOS chips that it's developing. The key technologies will add chip cache and extend the throughput pipeline, which RISC can't do.

Besides its pricing strategy and game plan, DEC faces a marketing dilemma from the rapidity with which VAXs outdate themselves. A classic catch-22 has developed. For the past three years, DEC's time-to-manufacture speeds have increased to the extent that there's a danger of diminishing buyers' trust. DEC is staying competitive at the workstation level with HP and Sun, at the midrange (MicroVAX to 6300) with IBM, and at the mainframe level (Aridus, Aquarius, VAXclusters) with IBM. But who will buy a machine on its ship date when six months later there are two better alternatives: buy the first upgrade, which could have twice the performance for the same price, or buy the original system at a clearance rate?

Seeing The Pattern

The VAX-user community is catching on to the pattern. Consider the following:

1. When the MicroVAX II was released, it eliminated all reasons for buying a MicroVAX I or a VAX 11/780.
2. With DSSI storage and two to three times the performance of a MicroVAX 2000, the MicroVAX 3300/3400 usurped the 2000 and the 3500/3600 for many installations.
3. An additional CPU board will render the 8250 obsolete and turn it into an 8350, which is twice as powerful.
4. Nine months after the release of the 6200, DEC introduced the 6300. The new machine cost about the same, but added twice the expansion range and offered approximately 35 percent higher performance. Further, the 6300s diminished the high-priced, high-end cluster configurations to worthless dinosaurs.

With the 3800/3900, history repeats itself.

This is particularly a drawback during a period when all the major computer manufacturers, DEC and IBM included, have announced that they expect dramatically reduced sales in 1989. The key for DEC is to "unconfuse" its product line by re-establishing a corporate strategy less nebulous than Networking the Enterprise.

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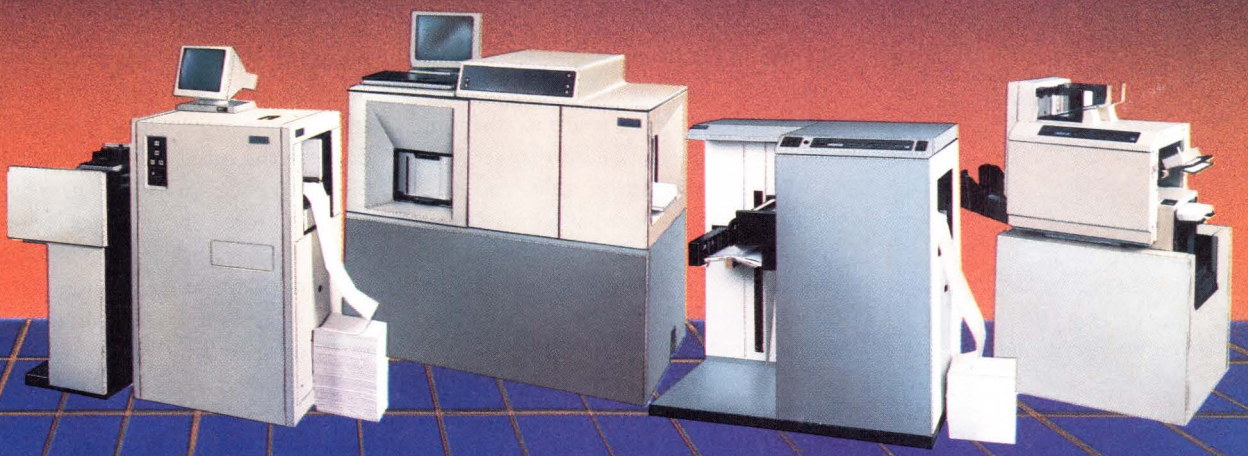

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policy announcement. (Strickland's group shouldn't be confused with DEC's Educational Services Group, which runs a worldwide training/seminar series.) The program was announced in Nashville at CAUSE '88, a technology and education conference. "The problem has shifted from acquiring equipment to controlling the cost of ownership. The long-term costs of technology now are in software acquisition, software support and hardware service.

"We're suggesting that you use your resources to do what you do best," Strickland told his audience of educators, "and we use our resources to do what we do best. The result will be a substantial savings to you.

"Research isn't necessarily what the focus is on," Strickland reflected, a few months after the announcement. "The real benefit of this program is that colleges have the freedom to concentrate on their work and thereby improve the state of technology." The big story, says Strickland, is how the users will increase productivity and be stimulated to new ideas. Hence the term initiative.

Why would DEC restructure a program that already was arguably the most successful in the industry? "We can do more for education if it can do more for itself," reasons Strickland. "We can't be satisfied with the status quo."

Spirit Of Cooperation

DEC has maintained its leadership status by listening to and communicating with its educational customer base. The company benefits from this spirit of cooperation in at least four ways.

First, engineers and researchers trained on DEC equipment in the colleges entered the working world with a preconceived notion of the way they wanted to work. Although these techies may not have had purchasing clout initially, the world slowly changed from batch processing to interactive/time-sharing as people began to recognize the productivity increases apparent in campus environments.

After the time-sharing battle was won, corporations began to realize that they could save a year or more of training by hiring DEC-literate computerphiles straight from school. So, the second way that DEC benefits is that educational institutions become an important source of employees for its customers. The third and fourth ways that DEC benefits are in types of research. Although DEC spent more than $50 million internally on research and development last year, it was outdone by the more than 120 educational institutions it was funding. The first type of research involves advanced development work for DEC, designing portions of operating systems, databases or other areas that DEC can't afford to focus on internally.

"They're our best critics," proclaims Strickland. "Feedback from universities is a bellwether for our products." As an example, Strickland says that DEC's education customers heavily influenced production of the RISC/ULTRIX DECstation 3100. Notable first-day orders of the workstation from colleges and universities reflect this.

External research, which is the use of computers for research in science, medicine, engineering, and so on, is a separate issue, handled by a separate internal division. DEC's policy toward schools performing external research isn't affected by the Education Initiative. These sales are negotiated on an individual basis, with DEC providing support in the form of equipment grants, faculty support or cash. There's no structured program or policy for external research, only general procedural guidelines.

The Market Basket

When DEC provides an educational institution with a campus license, the benefit for the school is a reduction of the cost of system ownership. For VAX users, educators and otherwise, the real cost of ownership comes down to the long-term cost of ownership: service and support. To compensate for this burden, which is enormous at any level, DEC historically has provided signifi-

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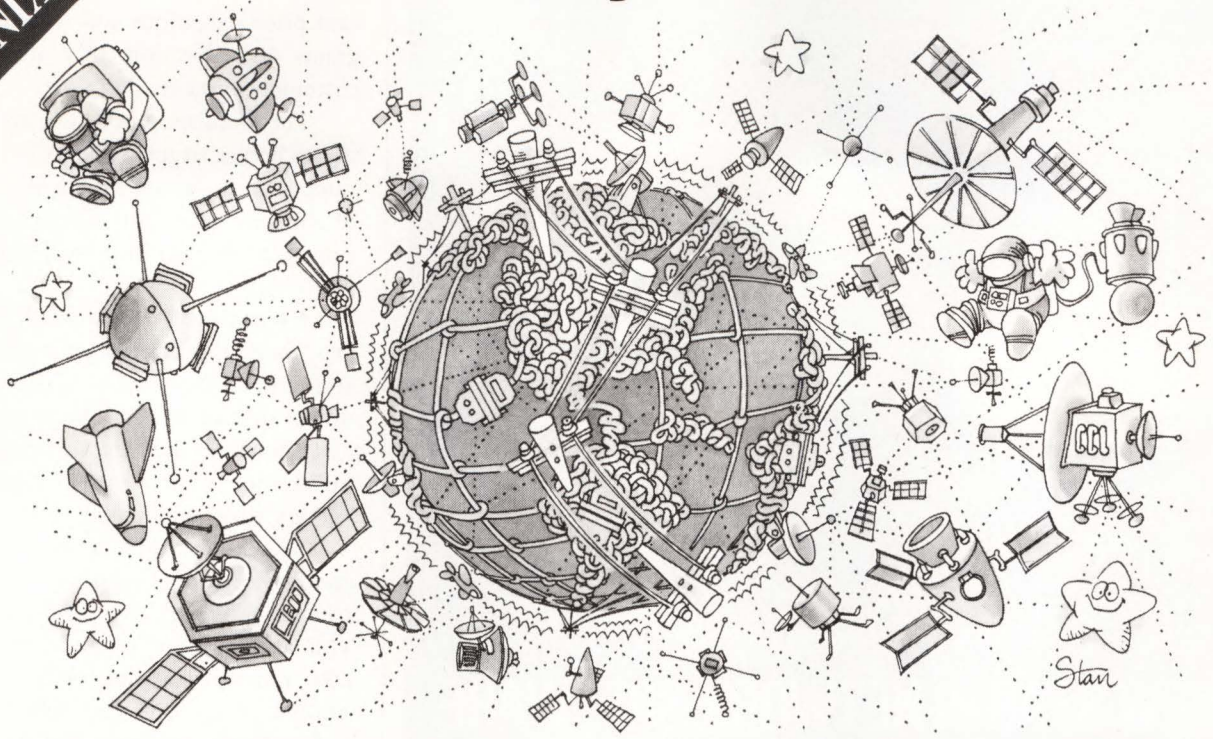

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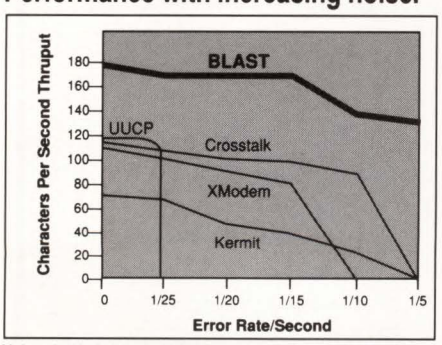

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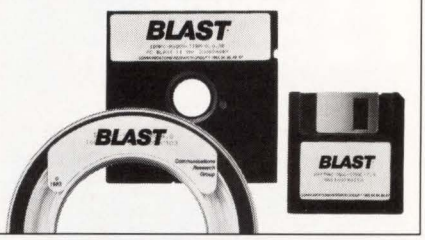

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cant price reductions and service programs to education that its other customer segments don't get.

The foundation of DEC's approach was to license large numbers of CPUs to campuses and provide them with a lot of software. DEC also maintained and supported the hardware and software (see Figure).

Even with all this leeway, however, DEC found that educational institutions still were having trouble. "People were doing strange things, like developing CASE tools on their own," remembers Strickland. "They weren't spending enough time researching."

The Education Market Basket is another initiative program that discounts administrative and academic VMS and MS-DOS products for which DEC must pay a royalty fee, such as ALL-IN-1, VAX Rdb and WPS Plus, as well as distributed third-party packages.

The Market Basket license includes languages, utilities, networking and communications software, CASE tools and office automation software. For

Companies Mentioned In This Article

Digital Equipment Corp.
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Maynard, MA 01754
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Hewlett-Packard
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Santa Clara, CA 95051
(408) 987-8080
CIRCLE 487 ON READER CARD

Sun Microsystems Inc.
2550 Garcia Ave.
Mountain View, CA 94043
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reference, it would cost $700,000 to license this much software for a VAXstation, and $6 million for a mainframe-sized cluster. The grant is applicable at any educational institution, including public elementary and secondary schools.

The new initiative has earned the praise of several participating universities, as well as national education governing bodies. But the proof of its success will be when strange things stop happening in academic development labs and universities begin to take advantage of this freedom to continue their contributions to computing history. ■

What If . . . You Have It Now?

If you own an older VAX 11/7xx and it isn't part of a cluster of VAXs, don't be surprised if a Hewlett-Packard sales representative comes calling. Perhaps as a retaliation for DEC's VAXattract program that began in the fall of 1986, when many HP 3000 owners were frustrated with their long wait for a Spectrum, HP has launched its own offensive. The goal is to make its HP Precision Architecture (PA) systems an affordable option for 11/7xx owners dissatisfied with the price/performance and maintenance costs of their vintage VAXs. HP uses the term HP PA to refer to all of its RISC-based systems, formerly called Spectrum.

HP introduced these programs in January, after systems engineers (SE) had field tested them for several months. The targeted prospects are companies with aging standalone 11/750s and 11/780s. At that time, HP's offer of a chance to try standards-based computing and RISC architecture in a multiuser system was something DEC couldn't provide. On March 1, DEC announced the DECsystem 3100, which supports up to 64 users and features 24 MB of memory.

When DEC begins shipping the DECsystem in volume this month, its customers can get a 16-user system for about $38,000, compared to $45,000 for HP's 16-user 835S that supports up to 30 terminals. But customers who need a subsystem that supports more than 64 users still will have an incentive to test drive the 400-user 855S, the 300-user 850S or even the 78-user 835SE.

Migration Tools

DEC's VAXattract program has a larger set of software tools for migration than HP's, with something to offer both commercial and technical applications. DEC has translators for COBOL, FORTRAN and even HP BASIC, but HP's software-conversion tools are offered only for FORTRAN. Nevertheless, HP's migration program is more comprehensive than DEC's, because it encompasses the financial, user-interface and training aspects of migration. The program consists of three related DEC Migration programs: the RISC Free program, the VAX Buyback program and PORT/VX migration tools bundled with consulting services.

In contrast with the VAXattract program, which induces customers to change from one proprietary operating system to another, the goal of the DEC Migration programs is to get customers to switch from the proprietary VAX/VMS systems to any one of four HP Series 9000 Model 800 multiuser models that run on the standards-based HP-UX operating system.

To that end, owners of older VAXs can test HP PA hardware at their own sites for up to three months. If you're considering the top-of-the-line Model 855S (with a price of up to $308,500), the trial period may be extended for an additional three months. The free trial includes use of magnetic and cartridge tape drives, disk drives, HP-IB (Hewlett Packard's Proprietary Interface Board) and mux hardware, printers, a systems console and terminals. The software includes the HP-UX operating system, Network File Services (NFS), LAN management software and ARPA services for electronic mail.

HP also has put together an attractive financing package. Sonny Ng, sales promotional manager for the VAX Buyback program, claims that the customer's out-of-pocket expense for buying an HP system during the first year is less than the cost of maintaining an aging VAX. As part of the VAX Buyback program, HP has made arrangements with a VAX reseller so that VAX owners are paid the fair market value of their existing DEC system if they wish to sell it. However, don't expect that figure to be as large as it was before DEC announced it no longer would manufacture the 11/7xx series.

If you choose any Series 9000 Model 800, HP stands ready to help you buy, rent or lease. The Finance and Remarketing Division handles these transactions. The plan with the lowest monthly payment is HP Lease with Option to Purchase (LWOP).

Another facet of the plan is designed to assist customers with porting FORTRAN applications from the VAX to a Series 9000 system. The PORT/VX product consists of software tools and five days of on-site consulting services to help you use these tools. An HP SE works at the customer site for five days to evaluate each prospect's migration needs. DEC will sell its VAXattract/H3K migration tools without the consulting, but HP won't send out the tapes without sending an SE to the site. The five days of consulting are included in the price.

The SE shows the people responsible for the migration effort how to move application files from VMS to HP-UX, demonstrates how the FORTRAN Code Analyzer (FCA) is used to predict the ease or difficulty of migration and introduces the PORT/VX tools. The PORT/VX tools include a FORTRAN Code Translator (FCT), a Data File Translator (DFT), a transport utility (VBACKUP) and migration libraries to use in compatibility mode until applications can be ported to native mode.

The SE also helps your department through the migration of a selected application and assists you in developing a migration plan and a performance plan to verify that the migration is complete. Migrators also can use one of HP's field-migration centers or the Technology Access Center in Cupertino, California, for further assistance.

DEC's marketing material for the VAXattract program borrows the slogan that long has been used in HP's advertising campaign. The corner of each data sheet says, "What if . . . you choose Digital?" If HP retaliates in like fashion, look for computer-room posters that say, "HP Has It Now" hanging above the HP Series 9000 Model 800 in the space left vacant by the departure of an old VAX. *—Peggy King is West Coast editor of* HP PROFESSIONAL, *a Professional Press publication covering the Hewlett-Packard market.*

DEFEXIT.DOC

DCL DIALOGUE

Kevin G. Barkes

EXIT Examined

If the *DCL Dictionary* had been produced in yearbook format, the caption under EXIT would read, "Command most likely to be ignored."

Poor EXIT gets no respect. It's omitted from many command files, particularly those of the straight-line variety, which don't contain multiple command paths. DCL supplies a sort of implicit EXIT when the command interpreter reaches the end of a file in a procedure.

Many DCL command procedure writers view EXIT in the same manner in which most people view an appendix: as a relatively useless construct that hangs idly by at the end of a command file. Still, EXIT serves several legitimate purposes.

EXIT Versus STOP

To paraphrase President Bush, EXIT affords a kinder, gentler way of terminating an interrupted image or a command procedure than the related STOP command.

EXIT, when entered interactively after a program has been interrupted with a CTRL-Y, causes the image to terminate normally. Any exit handlers in the program are executed. RUNning another image also causes the interrupted program to perform a normal rundown.

STOP immediately halts the image. Exit handlers aren't run, and the program terminates abnormally.

When encountered in a command file, EXIT terminates the currently executing procedure and returns to the command level from which the procedure was called.

The following code demonstrates EXIT's operation. Procedure 1 is executed interactively; it calls procedure 2, which calls procedure 3. Each procedure ends with an EXIT command:

```
$ @procedure1.com (command level 0)
   Procedure 1 executing (command level 1)
   Invoking procedure2.com:
   Procedure 2 executing (command level 2)
   Invoking procedure3.com:
   Procedure 3 executing (command level 3)
   EXITing procedure3
   Back in procedure2    (command level 2)
   EXITing procedure2
   Back in procedure1    (command level 1)
   EXITing back to DCL (user $ prompt)
$                        (command level 0)
```

Conversely, STOP acts like an emergency brake. When encountered, the process breaks out of all procedures and returns immediately to command level 0:

```
$ @procedure1.com (command level 0)
   Procedure 1 executing (command level 1)
   Invoking procedure2.com:
   Procedure 2 executing (command level 2)
   Invoking procedure3.com:
   Procedure 3 executing (command level 3)
   STOP reached in procedure 3
$                        (command level 0)
```

When executed in a job running in non-interactive mode, STOP causes the process to terminate immediately. EXIT causes non-interactive process termination only if encountered at command level 0, i.e., the original .COM file.

ON And IF

EXIT and STOP can be the targets of ON and IF commands:

```
$ ON ERROR THEN EXIT

$ IF $SEVERITY .NE. 1 THEN STOP
```

Note that you can have labels named EXIT: and STOP:

```
$ ON ERROR THEN GOTO EXIT
.
.
.
$ EXIT:
$ WRITE SYS$OUTPUT "Error encountered."
$ EXIT
```

Using EXIT and STOP as labels is mentioned only because it's frequently a source of confusion for beginning DCL procedure writers. Bear in mind that there's a big difference between:

```
$ ON ERROR THEN GOTO EXIT
```

and:

```
$ ON ERROR THEN EXIT
```

It isn't a bad idea to avoid using labels having the same name as DCL commands. However, it's mostly a matter of personal discretion. Many DEC-supplied procedures use EXIT: labels.

The EXIT Parameter

During my training seminars, I'm always surprised by the number of people unaware that EXIT can have a command parameter, namely a value that gets placed in the reserved global symbol $STATUS. This value can be tested by the next highest command level using standard DCL error-handling techniques.

Consider the following command procedures:

```
$! Procedure1
$  SAY := WRITE SYS$OUTPUT
$  ON WARNING THEN GOTO ERROR
$  @PROCEDURE2
$  SAY "No warnings."
$  EXIT
```

```
$  ERROR:
$  SAY "Called procedure had error."
$  EXIT

$! Procedure2
$  NOCOMMAND
$  EXIT
```

Watch what happens when we execute procedure 1:

```
$@PROCEDURE1
%DCL-W-IVVERB, unrecognized command verb
 - check validity and spelling \NOCOMMAND\
Called procedure had error.
```

When procedure 2 exited, the warning condition was passed back to procedure 1, which branched to the ERROR: label. If we modify procedure 2 to read:

```
$! Procedure2
$  NOCOMMAND
$  EXIT 1
```

and execute procedure 1:

```
$ @PROCEDURE1
%DCL-W-IVVERB, unrecognized command verb
 - check validity and spelling \NOCOMMAND\
No warnings.
```

The usefulness of EXIT's optional status code parameter is obvious. We can use it to force the calling procedure to perform any type of ON error handling, $STATUS or $SEVERITY checking we want. It's another method of bullet-proofing DCL procedures. No matter what happens to the called procedure, we always can be certain that the calling procedure performs predictably.

In the above example, you may have noted that even though the error was passed from procedure 2 to procedure 1, the warning only appeared once. That's because DCL changes the high-order digit of $STATUS to 1, while keeping the rest of the symbol's value intact. This eliminates error messages generated by the command and the procedure.

Should you go through all your .COM files and add EXITs to them? Probably not. But it couldn't hurt, and it may surprise you to find the number of procedures that could become even more useful if you exploited EXIT's parameter-passing ability.

Vancouver Postscript

To those sharp individuals who attended my DCL session at the DECUS Canada Symposium, held in Vancouver in February, here's the answer to your question regarding exceptions to the $STATUS and $SEVERITY rule.

Certain commands don't update those symbols when they execute successfully. CONTINUE, DECK, DEPOSIT, EOD, EXAMINE, GOTO, IF, SET SYMBOL/SCOPE, SHOW STATUS, SHOW SYMBOL, STOP and WAIT change the values of $STATUS and $SEVERITY only if an error is generated when they run. Consider:

```
$ TYPE NOFILE.HERE
%TYPE-W-SEARCHFAIL, error searching for
DUA0:[USER]NOFILE.HERE;
-RMS-E-FNF, file not found
$ CONTINUE
$ WRITE SYS$OUTPUT F$MESSAGE($STATUS)
%TYPE-W-SEARCHFAIL, error searching for !AS
```

Aside from the fact the ASCII string (!AS) isn't available to F$MESSAGE(), the intervening CONTINUE command didn't change the content of $STATUS.

I plead severe jet lag and misplaced session notes.

FOR A LISTING of all FidoNet public bulletin board 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, Kevin G. Barkes Consulting Services, 4107 Overlook St., Library, Pennsylvania 15129.

The list is also available on-line from my SYS$OUTPUT bulletin board system: (412) 854-0511, 1,200/2,400 baud, 8 bits, 1 stop bit, no parity.

If you're active on FidoNet, ask your local SYSOP to file request DECBBS.LST from 1:129/38. *—Kevin G. Barkes is an independent consultant in VAX systems software, management, tuning and training, based in Library, Pennsylvania.*

PRODUCTS

Investigator Plus Secures System

Absolute Security Inc. and FEL Computing jointly announced Investigator Plus for VAX/VMS. Investigator Plus brings automated management, audit and security capability to the VAX/PC environment linked by FEL Computing's Mobius software.

Mobius creates a seamless connection between PCs and VAX systems. This software product includes terminal emulation, file transfer, a virtual file system, printer support, task-to-task communication and a high-level task-description language. For Mobius users requiring a secure environment with software change management control, auditing and software quality assurance, Investigator Plus provides total system security. It detects file modifications to source code and executable code, controls file activity and provides recoverable backup and full audit trail of system changes. It also ensures file and application software integrity and automatically documents changes.

To find out more, contact Carol Riddle, Absolute Security Inc., 63 Great Rd., Maynard, MA 01754; (508) 897-1991.

Circle 490 on reader card

R8000 Performs Under Severe Conditions

Cyberchron Corporation announced the R8000 Series of ruggedized computers. The R8000 Series offers the standard architecture advantages of the VAXBI family of processors. Based on VAX 8250 and 8350 CPUs, the R8000 Series meets the most demanding application requirements for computers fielded under severe environmental conditions.

The R8000 consists of two subsystem chassis assemblies, the Advanced Processor Assembly (APA) and the Disk Storage Assembly (DSA). Both are compact, lightweight systems designed to operate reliably under the adverse effects of shock, vibration and extreme temperatures. The APA includes a ruggedized version of the VAXBI backplanes and either a VAX 8250 or a VAX 8350 processor. The APA can be used as the central processor for a system using the DSA for mass storage support or standalone with other compatible peripherals or subsystems. The DSA provides ruggedized provisions for up to four individually removable 5¼-inch form factor disk or tape devices and one fixed, non-removable 5¼-inch device.

Find out more by contacting Ron Davies, Cyberchron Corp., 3720 Farragut Ave., Kensington, MD 20895; (301) 946-6488.

Circle 496 on reader card

ACS 4100 Platform Provides Flexibility

Advanced Computer Communications announced the ACS 4100 hardware platform, which connects two or more geographically remote LANs into a single, integrated network. Targeted at medium- to large-scale users requiring high performance and network management, the ACS 4100 platform provides software and hardware flexibility.

Products based on the ACS 4100 feature SNMP, which provides performance and troubleshooting statistics needed to plan the network, measure system traffic loads and isolate network errors. The network-management system maintains the entire network topology at one location, dynamically adapting to changes or network failures to ensure that data continues to flow with no breaks in service. The ACS 4100 architecture allows data transmission at speeds up to T1 rates over a single link. Two serial links can be split to connect LANs in different directions and transmit data at different speeds or act as a redundant connection between two Ethernets.

Learn more by contacting Marianne Wasielewski, Advanced Computer Communications, 720 Santa Barbara St., Santa Barbara, CA 93101; (805) 963-9431.

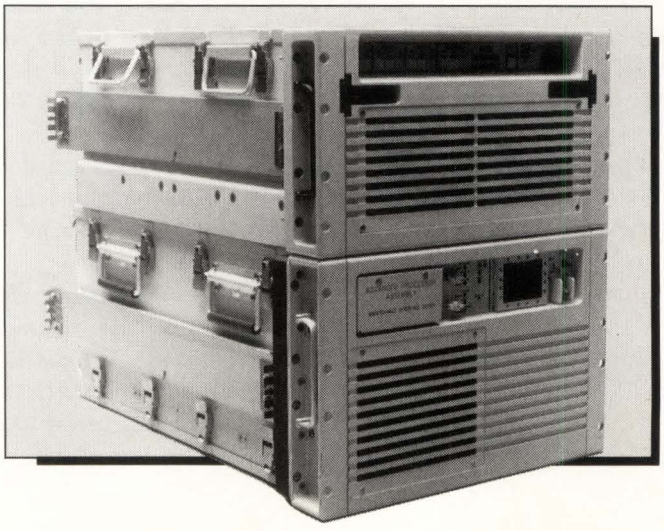
Circle 491 on reader card

VNBACP Establishes Communication Link

C & C Technology Inc. announced the VNBACP and VNBACP/SMB high-level NetBIOS protocol software. These standard interface packages allow integrators to establish high-speed program-to-program communications among Q-bus systems and the IBM PC AT/XT over the token-passing ARCNET network.

The VNBACP NetBIOS interface establishes a secure, transparent, full-duplex communications link among tasks that reside on the same or different network nodes. A VAX application programming interface that complies with the standard NetBIOS protocol specification is included. Also included is a network connection for terminal-emulation packages, allowing any PC to access any VAX within the same network structure. VNBACP/SMB adds the Syntax SMBServer, which provides file and printer services on the VAX. It maps NetBOIS resource names onto VAX RMS directory trees.

Single-license pricing for the VNBACP



Cyberchron Corporation's R8000 Series ruggedized computer.

starts at $3,000 for 16 channels, plus media charge. Single-license pricing for the VNBACP/SMB starts at $6,000 for 16 channels, plus media charge.

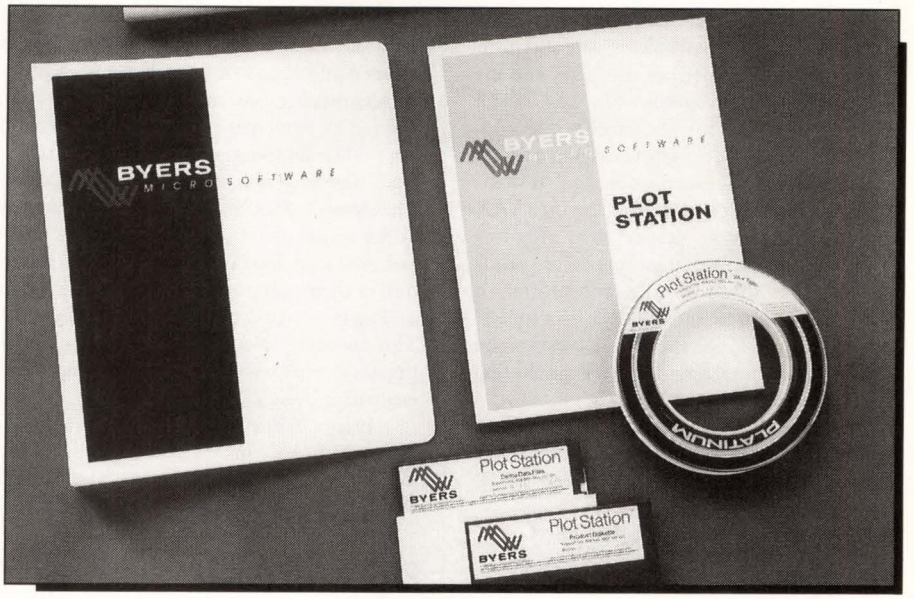
For additional details, contact Randy Cochran, C & C Technology Inc., 245 W. Roosevelt Rd., Bldg. 9, Unit 60, W. Chicago, IL 60185; (312) 231-0015.

Circle 493 on reader card

Byers Plot Station Supports 3-D

Byers Engineering Company is shipping Plot Station release 5.0, which supports 3-D elements for Intergraph and MicroStation design files. A key feature of this release is the processing of both 2-D and 3-D B-splines, uniform and non-uniform, and rational and non-rational. It also lets you control the smoothness of curved elements such as B-splines, arcs and ellipses.

Other features include a Plot Log that



Byers Engineering Company's Plot Station 5.0.

Digital Products

DEC announced the addition of a general-purpose system to its family of RISC-based UNIX computer systems. The DECsystem 3100 can be designed in a variety of configurations to serve from four to 64 users. DECsystem 3100 configurations include licenses for ULTRIX, TCP/IP, NFS, DECwindows/X Window System, and an optimizing C compiler for the RISC architecture. It's based on the R2000/R2010 chip set from Mips Computer, providing 14 mips and 3.7 single-precision Linpack Mflops of performance. It's expandable to 24 MB in 4-MB increments.

Prices for typical DECsystem 3100 configurations range from $20,400 for a four-user system to $55,604 for a 32-user system.

Circle 403 on reader card

DEC announced software capabilities under the Computer Integrated Telephony (CIT) program. DEC's layered VMS CIT Server software links a VAX system and a CIT-compatible PBX to provide integrated voice and data application solutions at the desktop. In addition, DEC's VMS CIT Applications Interface client software enables applications programmers to initiate calls and monitor the use of telephones connected to a PBX. Access to the CIT Server is through DEC's VMS CIT Applications Interface software.

The VMS CIT Server software is priced at $3,000. Prices for the VMS CIT Applications Interface software range from $450 to $14,250, depending on the hardware configuration.

Circle 403 on reader card

The VAXstation 3520 and 3540 are high-performance 3-D workstations featuring the DECwindows user interface. The multiprocessing systems can be expanded to 24 bit planes of display memory with a palette of 16.7 million colors. They come standard with dual CPU and a graphics accelerator. The 3540 supports VMS; the 3520 supports either VMS or ULTRIX. The 3520 is expandable from 8 MB to 64 MB of memory. Both can be diskless or can support up to 1.3 GB of disk storage, and both are DECnet network compatible.

Pricing starts at $29,950 for a diskless, 8-bit-plane 3520 configured with 8 MB of memory and either VMS or ULTRIX.

Circle 403 on reader card

DEC announced UNIX software support for its PrintServer 40, a networked laser printer. The software packages are PrintServer DECnet Client Software for ULTRIX and PrintServer TCP/IP Software for ULTRIX. The PrintServer DECnet Client Software is designed for environments that use ULTRIX and VMS systems on the same DECnet network. VMS PrintServer Supporting Host Software is required for the PrintServer 40. It boots the PrintServer upon powerup. The PrintServer TCP/IP Software includes both client and supporting host modules and requires an ULTRIX VAX as the supporting host.

The PrintServer 40 with DECnet or TCP/IP licenses costs $50,650.

Circle 403 on reader card

DEC's HA3000 three-phase UPS provides protection against the effects of a power outage and common power aberrations, such as voltage surges, voltage spikes, high-energy transients, electrical noise and low-voltage conditions. In the event of a power outage, the UPS supplies a nominal 15 minutes of battery backup power to the critical load without interruption to computer operation. The standard HA3000 configuration consists of a UPS cabinet and battery cabinet. Options include an Input Total Harmonic Distortion (THD) reduction filter, an Input Isolation Transformer, a Distribution Cabinet and Remote Status Panel.

The HA3000 series ranges in price from $37,500 to $75,500 for units from 20 kVa to 80 kVa.

Circle 403 on reader card

tracks usage, including plot name, design file name, plot size and parameters, date and time. The log is independent of the VAX and includes a plot-search routine. The data, which is stored in ASCII format, can be used with products such as Lotus as a management tool. Plot Station is PC-based software that manages plotting from multiple queues on a VAX or network servers. It performs all plot-processing (stroking) functions before sending the files to an electrostatic plotter. It requires a standard 286/386 PC, is compatible with most VAX and PC networks and can support mulitiple plotters, including several laser and color plotters.

For complete information, contact Barbara Stafford, Byers Engineering Co., 6285 Barfield Rd., Atlanta, GA 30328; (404) 843-1003.

Circle 492 on reader card

Computer-Link's 3880 Maintains Cartridges

Computer-Link Corporation announced the Model 3880 Tape Cartridge Maintenance System for IBM 3480 tape cartridges. The system automatically cleans, evaluates and sorts cartridges based on tape quality.

The Model 3880 features a 10-cartridge automatic batch feeder that loads tapes without operator intervention. Each tape is cleaned and tested in accordance with user-programmable criteria. Test parameters are entered by front-panel menu/mode selection keys while an integral CRT confirms selections and progress of the entire operation. The Model 3880 evaluates tape cartridges under actual operating conditions to ensure test integrity. Tape cartridges are graded into one of three categories — Archival, Scratch or Reject — depending on errors detected. The microprocessor-based unit uses a proprietary mechanism for cleaning and evaluating tape cartridges.

Prices begin at $27,500.

For additional information, contact Joe Pogoda, Computer-Link Corp., 3 Lopez Rd., Wilmington, MA 01887; (508) 657-8820.

Circle 495 on reader card

Eigen Network Security Protects Network

Eigen Corporation announced version 2.0 of its Network Security package for VAX/VMS systems. Eigen Network Security keeps unauthorized users out of networked VAX/VMS systems. It allows system managers to tailor their networks so that intruders can't access a system through the network, regardless of how large or diverse the network is.

Eigen Network Security protects against access from nodes that aren't in the DECnet database but are electrically connected to the network. Authorized users within the set of nodes specified are given full network access, but no other nodes can SET HOST to or otherwise access the local node. For each account on the network, system managers can specify what privileges that account will have on each node. This ensures maximum protection for the network without unduly restricting user access. Eigen Network Security runs on VMS versions 5.0 and 4.0+.

The package costs $500 to $2,500 per VAX, depending on CPU type.

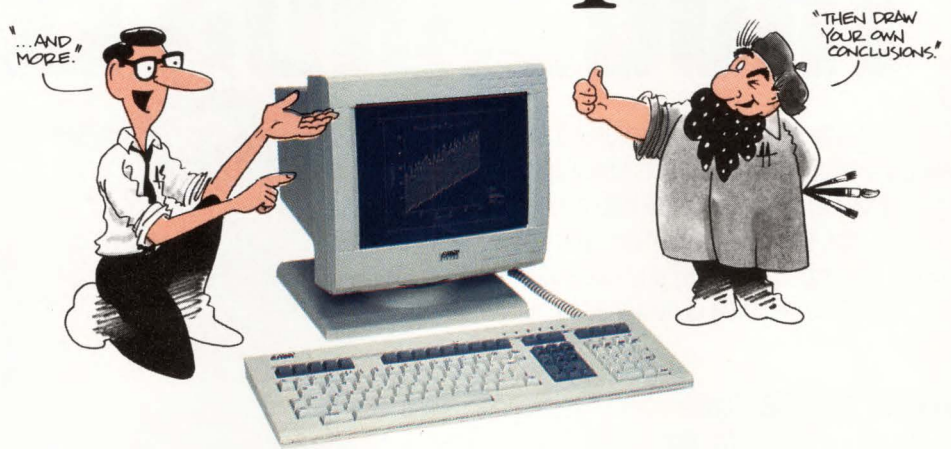
Obtain more information by contacting Robert Zampardi, Eigen Corp., 82 Wall St., Ste. 1105, New York, NY 10005; (212) 749-7513.

Circle 499 on reader card

DBA Companion Assists Developers And DBAs

D & N Systems announced the DBA Companion. This Oracle security, application and resource-management system is designed to

"Picture DEC graphics for $1300 less than DEC prices."



If it weren't so darned expensive, the DEC® VT330 would be a nice graphics terminal. And if it only did graphics, the DEC VT320 would have a nice price.

So how do you get affordable DEC graphics?

Buy a C. Itoh CIT328.

Competent, compatible, affordable.

At $699, the CIT328 is compatible both with your budget and with the DEC VT320, VT220, VT100, VT52 and Tektronix® 4010/4014 software. It's also compatible with the DEC Office Connect® interface standard and the VT131's local block editing mode.

But most importantly, the CIT328 gives you text and graphics and a host of advanced features for about the same price as a VT320. Now that's affordable.

Extras built in.

Among other extras you get with the CIT328: a flicker-free 70 Hz refresh rate, four pages of line text memory, a tilt/swivel base, calendar and calculator desk accessories, and access to three times as many programmable function keys as the VT320.

And like all C. Itoh DEC-compatible terminals and printers, the CIT328 is backed by a one-year warranty and a reputation for unfailing quality. Our advice: see one.

And start thinking about what you could do with an extra $1300.

Feature	VT320	CIT328	VT330
Tektronix Graphics	No	Yes	Yes
Sixel Graphics Hard Copy	No	Yes	Yes
ReGIS Graphics	No	No	Yes
Block Transmission Mode	No	Yes	Yes
Dual Host/Dual Sessions	No	No	Yes
Display Refresh Rate	60 Hz	70 Hz	60 Hz
Text Pages of Memory	1	4	6
DEC Office Connect	Yes	Yes	Yes
RS423/RS232	Opt	Yes	Yes
Desk Top Accessories	No	Yes	No
Tilt and Swivel	Opt	Yes	Yes
Price	$545	$699	$1995

Call (800) 347-2484 or (714) 757-4492
Southeastern Regional Office **(404) 368-9183**
Eastern Regional Office **(609) 235-3400**
Midwestern Regional Office **(312) 850-9500**
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2505 McCabe Way, Irvine, CA 92714

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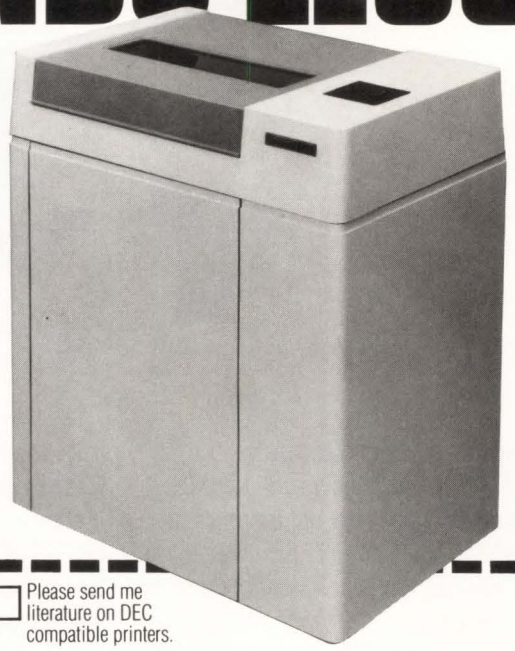
CIRCLE 285 ON READER CARD

DEC® PRINTER CLONE SELLS FOR THOUSANDS AND THOUSANDS LESS.

At $8990 for 800-lpm, high speed printing has never been more affordable. As a comparison, that's the price you pay for 300-lpm from DEC. It gets better. How about $11,990 for 1200-lpm! DEC's 1200-lpm offering goes for $29,000. And in the bargain, you get bar code and business graphics capability.

Reliability? You bet?

Taneum Computer Products has modified the ruggedly reliable Mannesmann Tally 600-Series matrix line printer into a DEC line printer compatible machine. Plus, our prices include installation, a full 90-day on-site warranty and operator training. Also, nationwide factory service maintenance contracts are available from Mannesmann Tally at substantial savings. For example, pay only $148 monthly for a 1200-lpm model. If you know printers, you know Mannesmann Tally leads the league in quality and dependability. And steadfast output. Their 1200-lpm machine is designed to deliver 5000 pages per day.



Taneum – the printer people. Taneum can fill your printer needs even if LG01 compatibility isn't required. We also provide Dataproducts, Printronix, Centronics or QMS compatibility; and should your future needs change, we can modify at any time to give you DEC LG01 compatibility.

Plus, we optionally offer 13.3, 16.7 and 20 characters per inch.

Act Now! This is an incredible offer. High speed line printing at prices thousands of dollars less than from your mainframe supplier. So why pay such a high tariff for mainframe color and logo. Get fast delivery by picking up the phone and calling us now.

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P.S. LG01 OEM ribbons at great savings.
For IBM systems with twin-ax or co-ax, significant printer savings are available.

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CIRCLE 263 ON READER CARD

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Title _____

Company _____

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Building 9, Unit G
Renton, WA 98055

The printer people

Taneum Computer Products

DEC VAR inquiries invited.

assist developers and DBAs in managing source code, security, physical space, applications and users for development and production Oracle environments. More than 45 reports describe the state of the DBA Companion database and site applications, and provide trend analysis about table, partition and use activity.

The security-management module assists DBAs in controlling and monitoring Oracle security. A menu facility consults the DBA Companion database at run time to control user access to applications and resources. The resource-management module assists database administration personnel in managing the physical resources of an Oracle database through a set of system reports. The application-management module consists of scanner routines that extract Oracle DML, DDL and DCL statements from .SQL, .INP, .RPT, .COB, .FOR and C files. The semantic content of the statements are loaded into an information resource dictionary and this information is used to define user privileges. For more information, contact D & N Systems, 8 New England Executive Park, Burlington, MA 01803; (617) 270-4150.

Circle 497 on reader card

Forest Interfaces IBM And DEC

Forest Computer announced The Forest Network Processor, which provides the capability to interface NS/3000 with IBM and DEC systems. With the Forest Network Processor, NS/3000 LANs can be attached to DECnet LANs and SNA networks, allowing multidirectional terminal and file access.

At the core of the implementation is the HP3000 LAN Adapter, a software module in the Forest Network Processor. The HP3000 LAN Adapter interfaces with other host adapters, allowing HP terminals and programs to connect to IBM/DEC systems as though they were native IBM/DEC devices and allowing IBM/DEC terminals to connect to an HP3000 as if they were native HP terminals. File transfer, RJE and printer emulation services are available in many configurations. It supports attachments between HP3000 and HP1000; IBM 3090, 4381, 9370, System/38 and AS/400; Unisys A- and V-Series; and VAX hosts.

Prices start at $40,000 for an HP3000/IBM solution and at $37,000 for an HP3000/DEC solution.

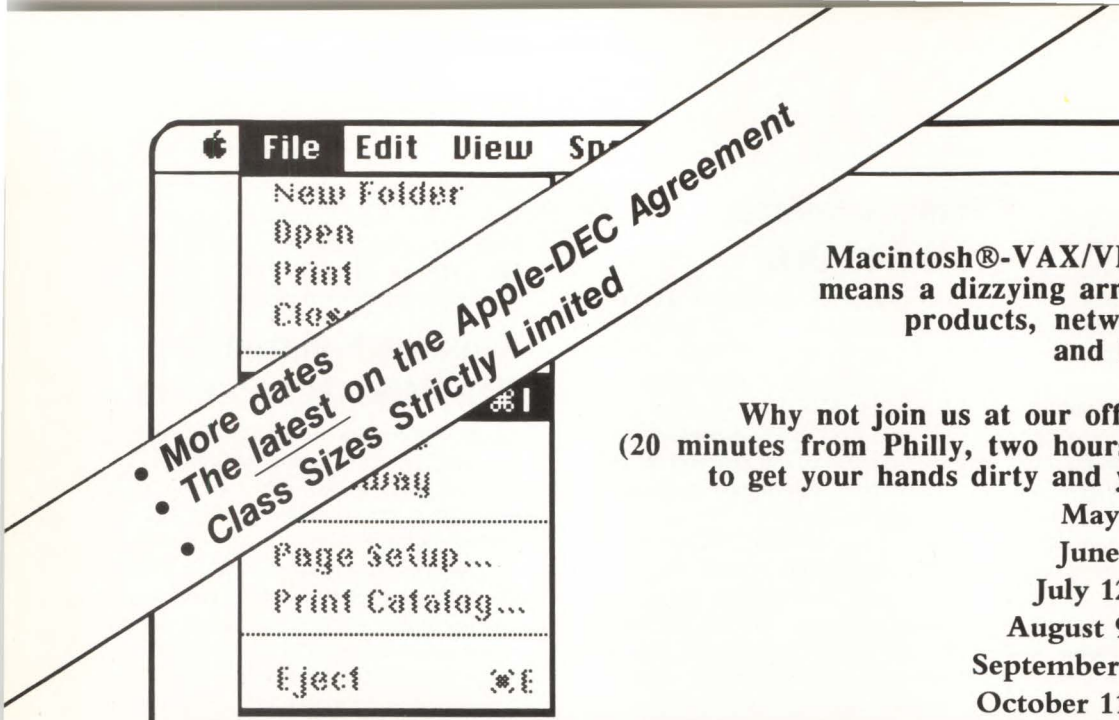
For more information, contact Jim Antonucci, Forest Computer, 1749 Hamilton Rd., Okemos, MI 48864; (517) 349-4700.

Circle 500 on reader card

SafeSwitch Maximizes Non-Networked Printers

Graftel Systems Inc. announced SafeSwitch, a printer resource-sharing multiplexer. The product maximizes the use of non-networked, serial and/or parallel printers among multiple users.

SafeSwitch interfaces as many as four terminals or workstations to as many as two laser printers, daisy-wheel printers, pen writers, thermal printers or ink-jet printers in any combination. SafeSwitch is software transparent to each user and shared device, so each user appears to have exclusive use of the shared device. Each user can operate independently and simultaneously at his own speed. Data automatically is stored, scheduled and output on a first-come, first-served basis. SafeSwitch dynamically allocates memory to each port as needed. Therefore, all ports can be active at the same time.



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Course length - 3 days

Tuition - $950

Training Objectives:

- Find out how to connect your Macintosh and IBM PC-compatible workstations through a VAX
- Understand AppleTalk and DECnet network architectures.
- Learn how to install and use various AppleTalk network hardware products.
- Learn how to install and manage various DECnet and AppleTalk based Mac/VAX networking products.
- Learn how to use and evaluate Macintosh terminal emulators.
- Learn how to develop VAX-based macintosh database applications

Topics Covered:

Network Architectures •
DECnet, AppleTalk

Network Hardware •
Ethernet
LocalTalk
Bridges
Gateways

Network Management •

Terminal Emulators •
VT100, VT220,VT240
Tektronix

VAX/VMS File Servers •
AlisaTalk, PacerShare

Networked Databases •

Apple - DEC Development Efforts •

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SafeSwitch is available in 115V and 230V versions with either 256-KB or 512-KB buffer sizes. It supports both serial and parallel communications.

The product is priced from $1,195 to $1,495.

To learn more, contact Alan Barrett, Graftel Systems Inc., 323 New Boston St., Wilmington, MA 01887; (617) 933-8170.

Circle 501 on reader card

Interlan Announces Three Products

Interlan Inc. announced three products highlighting SCO XENIX-NET support, DECnet on UNIX System V release 3.2 and the X Window System running across Ethernet.

The NP621-386 version 2.0 hardware/software package is for use with 80386-based PC ATs. The software provides TCP/IP protocol and complete XENIX-NET support for SCO XENIX operating systems. The NP622 and NP622A products provide high-performance TCP/IP networking for Interactive's 386/ix and AT&T's UNIX System V release 3.2, respectively. The NP642 package permits PCs to operate as nodes on a Phase IV DECnet. Operating under UNIX System V release 3.2, the NP642 provides client and server capabilities to the full range of DEC machines, including VAX and MicroVAX products. The NP642 allows virtual-terminal support, remote file-transfer capabilities and remote directory listings.

The NP621-386 costs $1,290, the NP622 costs $1,290, the NP622A costs $1,490 and the NP642 costs $1,450.

Obtain additional information by contacting Stephen Stickells, Interlan Inc., 155 Swanson Rd., Boxborough, MA 01719; (508) 263-9929.

Circle 504 on reader card

Huddle Allows On-Line Conferences

Innovative Software announced Huddle, an electronic conferencing and bulletin board system for VAX/VMS. Huddle is a dynamic communication tool that enables on-line conferences.

Huddle is fully integrated with VMS. It offers three different user interfaces, VMS Mail-style syntax, and news and file-transfer systems. It features privilege levels, public and private conferences, choice of any text editor and low disk requirements. Complete documentation, including on-line help and printed manuals as well as full customer support, is available.

Prices range from $387 for VAXstations to $9,274 for the VAX 8800, excluding cluster and multiple-license discounts.

For complete details, contact Innovative Software, P.O. Box 85629, Seattle, WA 98145; (206) 632-5232.

Circle 502 on reader card

MathStation Features Free-Form Interface

MathSoft Inc. announced the development of its MathStation software-applications package for the DECstation 3100 and VAXstation 3100 workstations. MathStation is an open environment for technical computing that helps you develop sophisticated mathematical applications and models, perform a wide variety of numerical analyses, and document results. It combines the power, speed and networking of engineering workstations with typeset math, text and graphics.

MathStation's features include a WYSIWYG free-form interface based on DECwindows that combines real math, text and graphics to let you express problems in

familiar math notation. The MathStation language includes loops, conditionals, functions, procedures and other standard programming constructs for building algorithms and complex models. It allows integration of existing FORTRAN subroutines and libraries without modification to protect software investments.

For complete details, contact Gordon Gossage, MathSoft Inc., One Kendell Sq., Cambridge, MA 02139; (617) 577-1017.

Circle 505 on reader card

XSQL Bridges SQL*Plus And VAX/VMS

Milcom Systems Corporation announced a software product called XSQL that's designed specifically to provide a secure, efficient and flexible bridge between Oracle's SQL*Plus and the VAX/VMS operating system. XSQL provides an alternative to running SQL*Plus interactively, and effectively allows VAX system managers to prioritize, manage and schedule specific I/O- and CPU-intensive SQL*Plus operations.

XSQL is written in VAX C and allows Oracle DBMS users in one DCL-like command to submit and execute SQL*Plus command files to any batch queue. At the same time, any SQL*Plus output files can be directed to any printer queue setup on your VAX system. On-line help for XSQL is included and is integrated with the VAX/VMS on-line Help facility. XSQL uses the same access security as provided with the Oracle DBMS. Before any SQL*Plus file is submitted to a batch queue or run interactively, you're prompted for a valid Oracle username and password.

For more information, contact Milcom Systems Corp., 532 Viking Dr., Virginia Beach, VA 23452; (800) 446-8539.

Circle 507 on reader card

Mips Computer Systems Broadens RISC Family

Mips Computer Systems Inc. announced an entry-level server and a new line of graphics RISCstations that broaden the company's family of RISC-powered computing systems.

A 12-mip compute server halves the entry price of the RISComputer line of binary-compatible servers. The RISCstation line provides graphics front ends that complement Mips' distributed solutions. It includes a high-resolution display station and a 12-mip desktop workstation. Both RISCstations run RISCwindows, Mips' user environment based on a tuned version of the X Window System and the standard user interface endorsed by OSF.

Mips' new desktop systems primarily are targeted at OEMs and VARs in the technical and commercial computing markets. For resellers, Mips offers building-block configurations that unbundle base units, graphics cards, and Mips' operating system and optimizing compilers.

Learn more by contacting Beverly Jerman, Mips Computer Systems Inc., 928 Arques Ave., Sunnyvale, CA 94086; (408) 720-1700.

Circle 508 on reader card

Mitek Systems Adds OpenConnect Server

Mitek Systems Corporation announced the OpenConnect Server Model M2030-256. This offering provides high-speed channel attachment as well as increased performance by providing support for up to 256 concurrent sessions.

The OpenConnect product line provides bi-directional communications between IBM hosts and systems from companies such as

DEC, HP, IBM and AT&T. It provides connections between IBM mainframe/midrange systems and systems on TCP/IP networks. OpenConnect products permit you transparently to perform full-screen editing, support TN3270, conduct remote job entry, and connect non-IBM systems to the MVS, VM, VSE and IBM midrange operating systems, which include the System/36, System/38 and AS/400.

Mitek's OpenConnect Server Model M2030-256 is available for $39,500.

Obtain complete details be contacting Catherine Milburn, Mitek Systems Corp., 2033 Chennault Dr., Ste. 100, Carrollton, TX 75006; (214) 490-4090.

Circle 509 on reader card

Morss Provides Automated Scheduling

Morss Software Development announced version 3.1 of Command File Scheduler to automate batch processing for VAX/VMS computers. The product provides automated scheduling by generating the executable DCL command files and performing the proper submit commands. The substitution capability provides for unlimited swaps. When combined with its Calendar and Date calculations, it's a perpetual command file scheduler that automates all batch schedules.

In addition to eliminating the need to make massive daily changes to static command files, the calendar-driven Command File Scheduler provides for error trapping and logging, automatic date substitution, report distribution to multiple sites, chargeback reporting for computer resource control, pre-processing and post-processing reports, and flexible scheduling with only the programs needed on a given day being run.

Prices start at $6,000.

Learn more by contacting Robert Morss, Morss Software Development, P.O. Box 1024, Bellevue, WA 98009; (206) 682-5116.

Circle 510 on reader card

McDonnell Douglas Expands DEC Service

McDonnell Douglas announced the expansion of its service options on DEC equipment to include the VAX 8000 series, VAX 3000 series and VAXstation 2000 series. This expanded service broadens McDonnell Douglas' capabilities on the low-end VAX product line through the high-end 8000 series and is available in most major metropolitan centers across North America.

This expansion is targeted at customers that require across-the-board service from a single-source provider in strategic locations. To find out more, contact Pat Dwight, McDonnell Douglas, 1801 E. St. Andrew Pl., Santa Ana, CA 92705; (714) 250-1000.

Circle 506 on reader card

Video Family Manages System

Performance Software Inc. announced the VAX-based Video range of terminal-monitoring software. The Video products provide a range of system-management functions useful in security surveillance, systems support, software development, training and quality control. All are based on proprietary terminal-monitoring technology developed to work in close conjunction with the VMS operating system.

The full product set is made up of three modules. Video-Slave allows one terminal's activity to be replicated on any number of other VTs. Video-Seer allows an authorized user to observe the activity of any other terminal on the same VAX, with or without the

user's knowledge. Video-Replay allows terminal sessions to be recorded and played back or printed later. The Video family operates under standard VMS version 4.6, 4.7 or 5.0.

The full Video package is priced at $1,950. For users with VMS V4.6 or V4.7, an upgrade for VMS V5.0 costs $150.
For complete details, contact Harriet Silbaugh, Performance Software Inc., The Carriage House, 28 Green St., Newburyport, MA 01950; (508) 462-0737.

Circle 481 on reader card

Metamorphosis Translates Source Programs

J.H. Shannon Associates Inc. announced Metamorphosis, a generic utility program that facilitates the transformation of any syntactically reducible character-oriented file to any other form, while preserving its synonomy. Given the syntactical definition of the source and target languages, it translates source programs from one language to another.

Metamorphosis also functions as a custom compiler, assembler, macro processor, query-language processor, command-language processor, graphics-language processor and report generator. It facilitates reformating of database files and analysis of natural language, grammar, sequential and parallel procedures and computational signatures. In addition to generic Metamorphosis, preconfigured translators are available, including FORTRAN IV to C, PL/I(subset G) to C and CMS-2M to Ada.

Generic Metamorphosis costs $387.
Learn more by contacting J.H. Shannon Associates Inc., P.O. Box 597, Chapel Hill, NC 27514; (919) 929-6863.

Circle 516 on reader card

Peripherals Announces Tape Cleaner/Rewinder

Peripherals announced a microprocessor-based controlled portable computer tape cleaner/rewinder. The cleaner/rewinder's microprocessor self-testing motion control allows detection of missing BOT and EOT. Standard equipment includes fail-safe brakes, a quick-release hub, an anti-skew rugged packer arm and a special 200-ips archival wind for tapes being put in storage. Normal speed is 350 ips — 3½ minutes for a 2,400-foot reel.

The cleaner/rewinder features a rugged, scratch-resistant case that weighs less than 26 pounds. Tabletop and rack-mountable models are also available.
Find out more by contacting R. Carboy, Peripherals, 1363 Logan Ave., Costa Mesa, CA 92626; (714) 540-4925.

Circle 513 on reader card

Persoft Supports DECnet-DOS

Persoft Inc. announced connectivity support for DECnet-DOS. This allows Persoft's terminal-emulation products for microcomputers, SmarTerm 240 and SmarTerm 220, to connect to DEC's LAT, which gives PC users access to VAX applications software. The combination of SmarTerm and DECnet-DOS provides rapid access to the VAX/VMS host.

In addition to DECnet-DOS, supported systems include the Novell NACS and NetWare VMS, IBM LANACS, Ungermann-Bass Net/One, Bridge Communications EtherTerm system, Datability RAF Remote Access Ability and Network Products Corporation Network Communications.
To learn more, contact Kathleen Riddiough, Persoft Inc., 465 Science Dr., Madison, WI 53711; (608) 273-6000.

Circle 514 on reader card

APPLE AND DIGITAL WON'T START A CONVERSATION WITHOUT US.

Because we're the software networking company that got them talking together in the first place. And we're still the one company that provides Mac to VAX total networking solutions.

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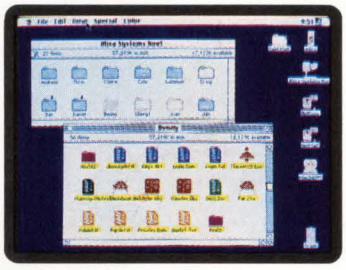
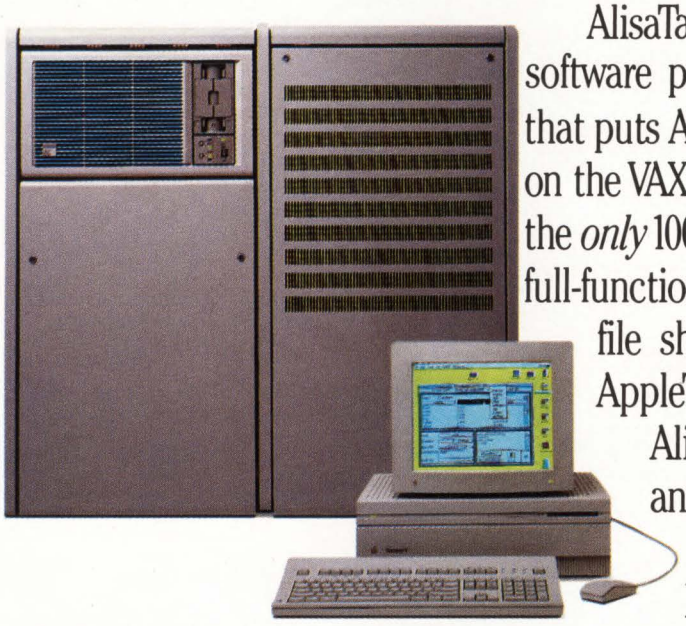
The people that brought you AlisaTalk.™

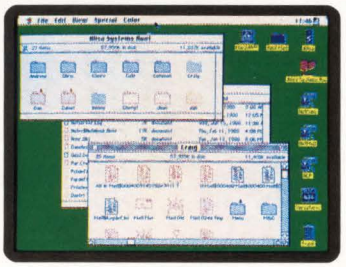




AlisaTalk is a software package that puts AppleTalk on the VAX. And at its heart beats AlisaShare,™ the *only* 100% AppleShare, VAX/VMS based full-function file server. Providing transparent file sharing compatible with the AppleTalk Filing Protocol (AFP).

AlisaShare is easy to learn and use, and requires no change in file handling procedures. It shares files with VMS users. Lets you store private files on the server using AppleShare folder security. Allows you to share information via multi-user databases. And makes the most of each and every Apple and Digital standard.

AlisaTalk is just one of our total networking solutions for Mac to VAX connectivity. One of many. For more information, contact us at Alisa. We'll show you how to put your Macs and VAXes on speaking terms.



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Touch Technologies' Dynamic Tape Accelerator makes tape drives start...and then accelerate to full speed. *That's fast. That's streaming fast!*

With the Dynamic Tape Accelerator, all applications...all VMS utilities...and yes...even VMS backup finishes faster!

You'll see faster backup operations, less operator waiting time, and more system availability time. Dynamic Tape Accelerator is completely safe and 100% compatible with VMS backup. No DCL or application code changes are necessary.

Why spend two, three, six or more hours each day waiting for your slow tape drives to complete...when you could be accelerating your tapes to *streaming* speeds!

Experience the performance of high speed streaming for yourself! Order a Dynamic Tape Accelerator "Evaluation Kit" today for $69.95. All orders are shipped Federal Express and come complete with a full graphic display, media, and documentation.

Dynamic Tape Accelerator is available for all VAX/VMS-based tape subsystems.

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TOUCH TECHNOLOGIES, INC.

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Dynamic Tape Accelerator is a trademark of TOUCH TECHNOLOGIES, INC.

CIRCLE 165 ON READER CARD

SPS Ports EPOS And RE-SPEC To VAX/VMS

SPS Software Products & Services Inc. announced that the CASE environment EPOS and its reverse-engineering tool RE-SPEC have been ported to the entire VAX family under VAX/VMS version 5.0.

EPOS is an integrated project-support environment with development and project-management support capabilities. In addition to the assistance provided in all phases from requirements to maintenance, EPOS provides general export/import capabilities to incorporate other tools or to operate in a corporate support environment.

RE-SPEC, which works in conjunction with EPOS, automatically generates existing reverse-engineering source code and generates EPOS design specifications. EPOS then automatically can produce an array of documentation in textual and graphical fashion, as well as perform analysis of design or generate code in other languages.

Obtain more information by contacting Shellen Keohane, SPS Software Products & Services Inc., 14 E. 38th St., 14th Fl., New York, NY 10016; (212) 686-3790.

Circle 517 on reader card

MAXLink Uses Less Than 10 KB Of RAM

Velox International announced MAXLink, a software package for PC users operating over Ethernet on VAX/VMS systems. The software uses less than 10 KB of RAM. MAXLink and its various modules serve as gatekeepers, letting you download your work and move to new tasks. After it's downloaded, the MAXLink package directs the work as you instruct.

The MAX print server and MAX disk server are two of the modules available with the basic software package. The print server lets multiple PC users share a laser printer through the VAX while retaining choice of font and other selections. The disk server allows the definition of virtual disk drives on the VAX as though they were connected to the PC.

MAXLink is priced at less than $10,000. For more information, contact John Kufchock, Velox Int'l, 2200 Green Rd., Ann Arbor, MI 48105; (313) 761-4848.

Circle 526 on reader card

Dual-Host Workstation Holds IBM-DEC Sessions

Intelligent Information Systems Inc. announced a workstation that can hold simultaneous sessions in the IBM 3270 and DEC environments. The dual-host workstation allows for full IBM 3270 feature compatibility while adding asynchronous communications capability with DEC, Data General, Prime and others. The workstation is enhanced by a hot key that enables easy switching and data transfer between the IBM 3270 and asynchronous environments.

The dual-host workstation features windowing that splits the display screen into two windows and lets you work in both environments simultaneously. The top window shows the IBM 3270 display image and the bottom window shows the asynchronous image. The windows can be sized and each window image can be scrolled independently. The option supports four user-selectable modes, data transfer and local-print features for screen hard copies.

The dual-host workstation ranges in price from $1,445 to $2,475.

Find out more by contacting Zeev Lerner, Intelligent Information Systems Inc., 92 Kansas St., Hackensack, NJ 07601; (201) 343-8353.

Circle 503 on reader card

db__VISTA III Supports Microsoft Windows 2.0

Raima Corporation announced that its network model database for C applications developers now supports Microsoft Windows 2.0. Applications using db__VISTA III 3.1 adhere to Windows' memory-management requirements. The release allows multiuser operation through multiple windows running separate db__VISTA applications simultaneously.

The system supports Windows and OS/2 because it's written in C and supports any C language environment. The entire source code is available, so environments not currently supported can be ported. Three modules make up the db__VISTA III database development system. db__VISTA is a high-performance DBMS that uses the network database model and B-tree indexing for fast access to data with minimal data redundancy. db__QUERY, an SQL-based query and report writer, provides a relational view of the high-performance network model database. db__REVISE enables the developer to restructure the database, allowing nearly any type of modification.

For more details, contact John W. Bryant, Raima Corp., 3055 112th Ave. N.E., Bellevue, WA 98004; (206) 828-4636.

Circle 515 on reader card

Nastec Enhances CASE 2000 DesignAid

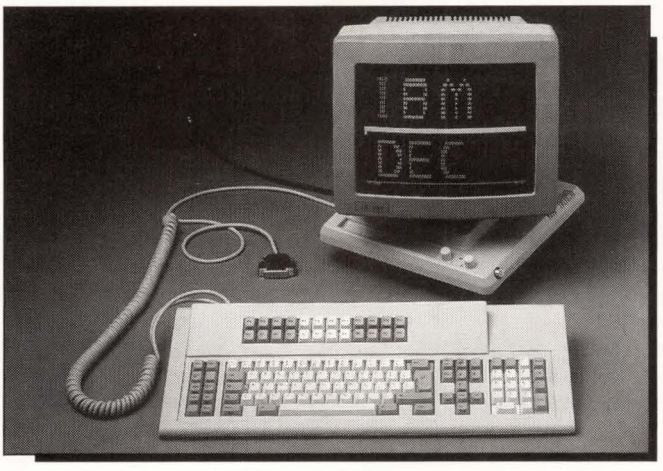
Nastec Corporation announced a release of CASE 2000 DesignAid for VAXstation products. The release incorporates enhanced drawing features, improved word processing and data-dictionary enhancements.

DesignAid 4.1 provides two new options. The Real-Time System Design option supports Ward-Mellor graphics, including state-transition diagrams, control flows, control stores and Hatley control bars. The Real-Time option also supports rule-based validation from state-transition diagrams to transformation schemas, as well as balancing across all levels. The Data Modeling option provides diagramming support for ERDs based on Chen notations and techniques, with extensions for improved data-modeling accuracy. DesignAid runs on the VAXstation II or higher. Network support, including true multiuser access to the design dictionary, is standard.

The single-license price is $6,900, with quantity discounts available for network systems. The Real-Time option single-license price is $1,500.

To find out more, contact Tom Stanton, Nastec Corp., 24681 Northwestern Hwy., Southfield, MI 48075; (313) 353-3300.

Circle 511 on reader card



Intelligent Information Systems Inc.'s dual-host workstation.

Lasar V6.4 Speeds Fault Simulation

Teradyne Inc. announced Lasar version 6.4, which enhances the simulation system's capabilities for design and test of complex VLSI devices and circuit boards. Lasar V6.4 cuts fault simulation run times with its support of distributed fault analysis in networked computer environments. It lets you apportion parts of the fault list to more than one computer.

The release also supports the use of Teradyne's DATASource VLSI modeling system as a network resource. DATASource enables the use of physical devices in logic and fault simulation. Other key features include enhanced waveform display capabilities, extensions of Lasar's behavioral modeling language, and features for more accurate modeling of complex devices such as ASICs. The product runs on VAX/VMS systems and Sun Microsystems' Series 3 workstations.

Prices for Lasar V6.4 licenses range from $15,000 on a VAXstation 2000 to $280,000 on a VAX 8800 series, depending on CPU. To find out more, contact Georgia Marszalek, Teradyne Inc., 321 Harrison Ave., Boston, MA 02118; (617) 980-5212.

Circle 527 on reader card

TelnetManager Supports TCP/IP Network Software

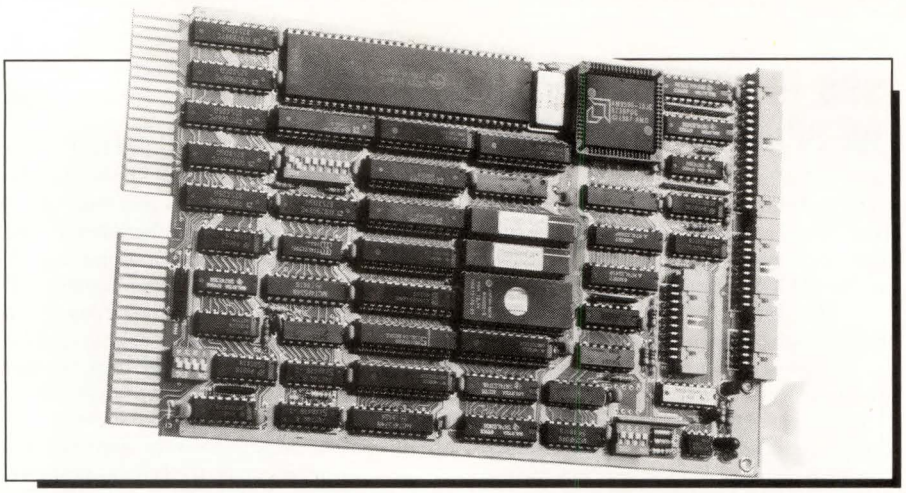
Walker Richer & Quinn Inc. announced TelnetManager, a TCP/IP network link for PC-to-host communication. A complement to Reflection, TelnetManager is a PC-based implementation of the TELNET protocol that provides terminal sessions between networked PCs and hosts.

You can establish single or multiple sessions to one or more host computers from within Reflection using TelnetManager's session-management capabilities. TelnetManager supports TCP/IP network software from Sun, FTP Software and Excelan. It requires Reflection 1 Plus, 2 Plus, 4 Plus or 7 Plus version 3.33 or later. Running under Reflection, it requires an IBM PC, XT, AT, PS/2 or compatible with a minimum of 512 KB of RAM; a TCP/IP network connection between the PC and the host; and a TELNET server running on the host. Reflection and TelnetManager software provide emulation of HP 2392, HP 2627, HP 700/92, VT220/240/241, and 16-color 340 ReGIS graphic terminals.

TelnetManager costs $99.

For more information, contact Carolyn Bakamis, Walker Richer & Quinn Inc., 2825 Eastlake Ave. E., Seattle, WA 98102; (206) 324-0350.

Circle 528 on reader card



Sigma Information Systems' SDC-RQD11-DESDI disk controller.

Sigma Controller For Dual ESDI Drives

Sigma Information Systems announced the SDC-RQD11-DESDI, a high-performance controller that interfaces two ESDI drives to a MicroVAX II, MicroVAX 3000 or LSI-11 Q-bus system. The dual-wide controller responds to MSCP commands as if it were a standard RQDX2/3 controller.

The controller features a dynamic bad block replacement that replaces any blocks it detects as bad with an alternative block from a replacement block pool. Combined with error correction (ECC), the controller presents error-free media to the host computer. WOMBAT menu-driven, firmware-based utilities permit interactive disk formatting and maintenance operation. The formatter partitions each drive into virtual units that are addressed by the host as individual drives. Each virtual unit can be any size up to the size of the entire drive, with up to 16 virtual units assigned to each controller.

The SDC-RQD11-DESDI costs $915. To find out more, contact Helen Mitchell, Sigma Information Systems, 3401 E. LaPalma Ave., Anaheim, CA 92806; (714) 630-5417.

Circle 523 on reader card

Transaction Accelerator Supports VAX Networks

Telematics International Inc. announced the Transaction Accelerator network system, which allows VAX computer systems to support up to 30 percent more users. It reduces network costs by decreasing traffic up to 80 percent and provides remote terminal users with the same response time as local terminals.

The Transaction Accelerator consists of an Ethernet-attached front-end processor and remote VT cluster controllers. The front end handles network processing and management for VAX hosts and offloads terminal handling for local terminals. The VT cluster controllers provide remote users with local terminal handling, screen management and network links to VAXs. The Transaction Accelerator runs VMS version 4.6 and later software. It's completely compatible with the standard VMS terminal driver and supports all applications without software modifications.

The Transaction Accelerator costs $45,000.

For complete information, contact Telematics Int'l Inc., 1201 Cypress Creek Rd., Fort Lauderdale, FL 33309; (305) 772-3070.

Circle 525 on reader card

Shadow Series Subsystem Protects MicroVAX Data

System Industries announced the Shadow Series data storage subsystem, which provides on-line, fault-tolerant protection of disk-based data for MicroVAX computers.

The Micro Power Pac Shadow Series offers up to 1.2 GB of data storage per subsystem and makes HSC-style shadowing available on the Q-bus using 5¼-inch disk drives. Each subsystem supports up to four disk drives or two shadowed pairs. In a shadowing configuration, data is written on two drives simultaneously. The second drive of the pair serves as a shadow copy of the first. If either drive fails, the other maintains normal I/O operations. Shadow Series is packaged in a BA123-style enclosure and is available with System Industries' 380-MB S156 or 760-MB S157 disk drives.

The product is priced from $22,900 for a two-drive S156 configuration to $52,000 for a four-drive S157 configuration.

To learn more, contact Brian Edwards, System Industries, 560 Cottonwood Dr., P.O. Box 789, Milpitas, CA 95035; (408) 432-1212.

Circle 482 on reader card

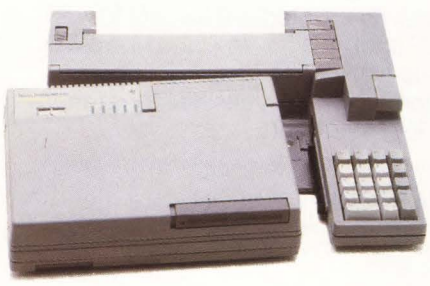
TI's new TravelMate™ LT220. It's the closest thing to carrying a VAX™ in your briefcase.

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

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

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

New credit-card-sized memory cards



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

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

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

TEXAS INSTRUMENTS

CMS Enhancements Adds Storage Subsystems

CMS Enhancements Inc. announced a series of tape and disk mass storage subsystems for Q-bus and UNIBUS systems. Capacities range from 155 MB to 2.8 GB.

The subsystems, with 3½-, 5¼- and 8-inch form factors, use ST506, ESDI or synchronous and asynchronous SCSI interfaces that are 100 percent compatible with the DECstation 210, 316 and 320 PCs; VAXstation 3100 (models 30 and 40); VAXstation 2000; MicroVAX I, II and III; MicroPDP-11; PDP-11; and VAX-11 systems. The synchronous SCSI interfaces have a transfer rate of 4.8 MB per second. For both tape and disk devices, CMS Enhancements offers SCSI host adapters that provide optional differential drivers to support applications requiring SCSI bus lengths in excess of the current industry limitation of three meters. The subsystems are available with either an internal cabinet-mounting kit or an external single-drive enclosure with an external mounting kit for use with 5¼-inch footprint tape or disk units.

For more information, contact Agha Mahmood, CMS Enhancements Inc., 1372 Valencia Ave., Tustin, CA 92680; (714) 259-5903.

Circle 518 on reader card

Focus Interfaces To Adabas Database

Information Builders Inc. announced a read-only interface between Focus for VAX 4GL/DBMS and the Adabas DBMS. With the interface, all of Focus' reporting, graphics, spreadsheet and data-analysis facilities can access data stored on Adabas systems directly.

With the Focus interface to Adabas, tables can be joined relationally to other Adabas, RMS, Rdb, DBMS, Britton Lee, Ingres, Oracle, Sybase and Focus files. Focus, via the interface to Adabas, accesses the records directly using optimized queries, thereby eliminating the need for any data conversion. Focus contains full database and application-development facilities as well as decision-support features, including a report writer, graphics, statistics, a spreadsheet and a financial-reporting language.

Prices for the Focus interface to Adabas range from $1,750 ($70 per month rental) for the MicroVAX II to $14,000 ($400 per month rental) for the VAX 8840.

Learn more by contacting Jennifer Oshin, Information Builders Inc., 1250 Broadway, New York, NY 10001; (212) 736-4433.

Circle 423 on reader card

Mass-11 Spreadsheet Meets CALS Standards

Microsystems Engineering Corporation announced Mass-11 Spreadsheet, a spreadsheet package that complies with the government-required computer-aided acquisition logistics and support (CALS) standards. CALS is a Department of Defense specification that will be implemented in January 1990 and will require all government contractors to submit documents in electronic format.

Mass-11 Spreadsheet has a Lotus-like interface and can import Lotus data, graphs and macros. Other features include scalar or matrix math, trig in degrees or radians, statistical functions, linear and exponential curve fitting, multiple regression analyses and an advanced data fill function. It can sort up to 253 columns concurrently in ascending or descending order, and has eight concurrent lenses with intermixed data and graphics. It provides full business graphics and can

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HARDWARE: Standard IBM AT with 640 K RAM.

No. of Records	ORACLE	MDBS III
1,000	*	16.43 sec.
2,000	*	32.68 sec.
4,000	*	65.31 sec.
10,000	*	165.71 sec.

* Although ORACLE's license agreement prohibits us from disclosing actual benchmark timings, we *can* say that the phrase *"over 10 times faster"* was heard many times in and around the **mdbs** testing center that day.

For a copy of the data on which this benchmark was performed, or for more information on MDBS III, complete and send the coupon or call **mdbs** Sales Support at (800) 344-5832. In Indiana call (317) 463-2581 and in Canada call (416) 733-4380.

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display bar, pie, stack, line, x-y and Hi-Lo-Close graphs. It offers printing capabilities, including headers and footers, font selection, PostScript support, bolding and underlining. To find out more, contact Microsystems Engineering Corp., 2400 W. Hassell Rd., Ste. 400, Hoffman Estates, IL 60195; (312) 882-0111.

Circle 519 on reader card

ASK Links Manman And Dataport

ASK Computer Systems Inc. announced Manman/Dataport, an electronic interface that links Manman with an Intermec shop-floor data-collection system. It also facilitates interplant inventory transfers for Manman VAX release 7.0 users.

Manman is an integrated management-information system for manufacturing companies. It operates on HP and DEC minicomputers. Dataport is available for VAX-based Manman users. Dataport accepts data transferred from the shop floor and updates the Manman database. Dataport links with Intermec's Data Collection for Manman (DCMM). DCMM is a microcomputer-based product that accepts data entered by workers from up to 140 barcode readers scattered throughout the shop floor. Data then is centralized in DCMM before being transferred to Dataport.

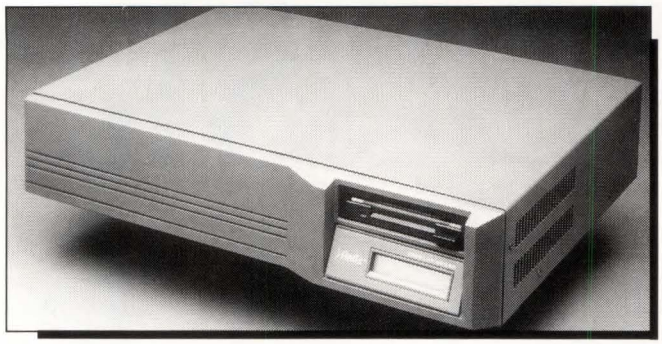
Manman/Dataport is priced from $5,184 to $50,400, depending on configuration.
For more information, contact Karen Marvin, ASK Computer Systems Inc., 2440 W. El Camino Real, Mountain View, CA; (415) 969-4442.

Circle 451 on reader card

Computer Associates Enhances Masterpiece/ABS

Computer Associates International Inc. announced an enhanced version of its Masterpiece/ABS series of financial-management software for VAX/VMS hardware systems. Masterpiece/ABS version 6.1 provides enhanced screen capabilities and integration with office automation and graphics.

The Masterpiece/ABS products' enhanced screen capabilities provide quick menu and program selection and entry of data. In addition, all Masterpiece/ABS applications are integrated with ALL-IN-1 to allow rapid user access to the system. Enhanced navigation capabilities let you transfer freely between programs and menus without using sequential menu screens. A Choice capability simplifies data entry by displaying possible entry options, and an enhanced Help facility provides detailed help text to any field.



Retix's model 4880 LAN bridge.

Find out more by contacting Susan D'Elia, Computer Associates Int'l Inc., 711 Stewart Ave., Garden City, NY 11530; (516) 227-3300.

Circle 452 on reader card

Retix Adds Remote Ethernet Bridges

Retix announced three products in a family of remote LAN bridges and systems. The offerings are the model 4880, a high-performance bridge designed for large T1 networks; the model 4820 bridge, designed for lower bandwidth requirements; and the model 5010 Network Management Center, a central network manager for Retix's local and remote bridges.

The 4880 High Performance Remote Bridge uses two high-speed T1 or 2.048-megabit-per-second links. It saturates two links simultaneously. Its dual-68020 architecture can filter up to 14,880 frames per second.

The 4820 bridge is designed for lower bandwidth applications, such as linking PC LANs to larger networks. It supports up to 128-kilobit-per-second links.

The 5010 Network Management Center, a graphics-oriented central network manager running under Microsoft Windows, lets you manage Retix's local and remote bridges from a single location.
To obtain more information, contact Pam Schulz, Retix, 2644 30th St., Santa Monica, CA 90405; (213) 399-2200.

Circle 465 on reader card

IDEF/Leverage Drives Database Designs

D. Appleton Company (DACOM) announced release 2.1 of its IDEF/Leverage activity and data-modeling software for IBM mainframe and VAX computers. Seven new features increase its power to drive database designs and help corporations and government agencies manage their data resources. IDEF/Leverage uses the processing power of VAX or IBM host computers to integrate, analyze and normalize standard IDEF models and transform them to a relational database design.

IDEF/Leverage 2.1 features model quality assessment, environmental hierarchies for glossaries, expanded SQL support for Oracle and VAX Rdb, and graphics download to PC dot-matrix printers. It also offers plotter support for graphics and an improved messaging and help system.

IDEF/Leverage is available at no charge to Subscription Service clients. For others, prices range from $10,000 for a one-user VAXstation to $65,000 for 128-plus-user VAX 89xx or IBM 3xxx.
Learn more by contacting Dave Schoeff, D. Appleton Co., 1334 Park Ave., Ste. 220, Manhattan Beach, CA 90266; (213) 546-7575.

Circle 453 on reader card

Filetab-D Provides Database Access

The National Computing Centre U.K. Ltd. announced Filetab-D, a 4GL optimized for interactive system development on the VAX. The product is marketed by Corporate Information Group Inc. Filetab-D provides access to any database, because it isn't restricted to specific file structures. It directly supports RMS file structures, the VAX DBMS network database, and Oracle. It's suitable for on-line and batch systems.

Filetab-D lets the MIS director access any data, regardless of the file structure in which that data is stored. Data then can be reported, sent to another application or put to any use. Filetab-D can be used to create an application from crude prototype to fully working system by interaction between the designer and user working at a single terminal.

Five-year user licenses cost $5,500 on the MicroVAX to $46,000 on larger VAXs. Software maintenance is mandatory and is 10 percent of the five-year license fee per year. To find out more, contact Kathryn Collins, Corporate Information Group Inc., 8111 LBJ Freeway, Ste. 560, Dallas, TX 75251; (214) 234-5100.

Circle 522 on reader card

Striped Lightning Works On VAX

Peripheral Software Concepts Inc. announced its Striped Lightning family of bar-code-based data-collection and shop-floor management products for the VAX. Striped Lightning applications provide an interface between major host-based MRP II systems and a variety of bar-code-based data-collection devices. MRP interfaces on the VAX include ASK Computer Systems' Manman. They enable manufacturing management to achieve on-line, real-time shop-floor monitoring and control of materials and production.

Major applications include labor data collection, time and attendance reporting, factory time-clock synchronization, pre-payroll processing, WIP material tracking, physical inventory and cycle counting, detailed serial number and lot tracking, and non-stop data collection. The Striped Lightning family has been ported to the VAX from the HP 3000 line of midrange computers, including the HP 3000 9xx RISC-architecture-based series.

To find out more, contact Lou Harm, Peripherals Software Concepts Inc., 600 Johnson Ave., Bohemia, NY 11716; (516) 563-7000.

Circle 454 on reader card

BRS/Search 5.0 Features Pluralization

BRS Information Technologies announced release 5.0 of BRS/Search, a full text management software product. The release offers improved performance characteristics and such features as pluralization, document weighting, Word Perfect and Mass-11 import/export capabilities, and a Thesaurus.

BRS/Search lets information that won't fit in a relational DBMS because of required size and access points be indexed by every word and accessed by words or word phrases. You can specify that words be adjacent, within so many words, or within the same document, paragraph or sentence. BRS/Search allows wild-card searching, truncation, save searches and print-time formatting. Two word processing filters let you store documents within BRS/Search fully revisable from Word Perfect or Mass-11. BRS/Search software is available on various hardware platforms, including AT&T, Unisys, DG, IBM, Amdahl and DEC. The data and software is transportable across all platforms.

To find out more, contact BRS Information Technologies, BRS/Search Software Group, 1200 Rte. 7, Latham, NY 12110; (800) 468-0908.

Circle 498 on reader card

Perceptics Announces Subsystem And Jukebox

Perceptics Corporation announced LaserSystem 525, an optical disk storage subsystem, and LaserStar 525, an optical disk jukebox subsystem, for VAXs and MicroVAXs running VMS.

LaserSystem 525 provides more than 300 MB of on-line storage per optical disk drive and is totally transparent to VMS. It's a complete, integrated optical disk subsystem. It includes an optical disk drive, a host adapter, Perceptics LaserWare software, cables and connectors, and support. Installation and maintenance are standard services.

Laserstar 525 provides automatic, VMS-transparent access to the storage capacity of optical disk jukeboxes. A variety of drive/media configurations is available. LaserStar 525 is a complete, integrated optical disk jukebox subsystem. It's configured with the Cygnet 5250 optical disk jukebox and 5¼-inch optical disk drives. It includes a SCSI host adapter, Perceptics LaserStar software and support.

Learn more by contacting Robert J. Sexton, Perceptics Corp., 725 Pellissippi Pkwy., P.O. Box 22991, Knoxville, TN 37933; (615) 966-9200.

Circle 524 on reader card

Ingres Supports Portable Netware

Relational Technology Inc. announced that its Ingres RDBMS supports Novell's Portable Netware on PCs running DOS and minicomputers running UNIX. Support for Portable Netware allows users running Ingres PC applications direct access to databases on other PCs, workstations and minicomputers through a Novell network. Application processing can take place at the PC level while database functions are handled on a server such as a larger UNIX-based minicomputer.

Portable Netware lets you combine a PC's interface and software with the power, storage capabilities and multitasking operating system of a UNIX-based minicomputer. Ingres users can take advantage of Portable Netware's implementation of a client/server model of database management. With this model, the PC on a network handles the interactive application processing while the data and database engine remain on the minicomputer. This allows increased performance, because network traffic is reduced.

To find out more, contact Kevin Gallagher, Relational Technology Inc., 1080 Marina Village Pkwy., Alameda, CA 94501; (415) 769-1400

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MUST Reading
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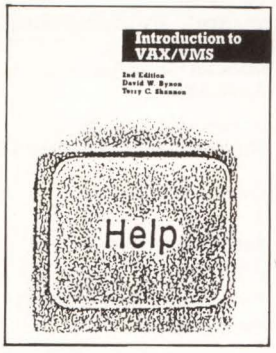

Introduction to VAX/VMS, Second Edition

Introduction to VAX/VMS is a guide for beginners and a reference for the experienced user. From the basics to systems and programming, Introduction to VAX/VMS gives easy to follow instructions about the VAX computer family, DCL command language, command procedures, mail, backup and help features and more. Through pictures, examples and programs, you get explicit instructions for everyday use of VAX/VMS and tips for problems. Plus 8 Appendices and a Glossary for added reference.

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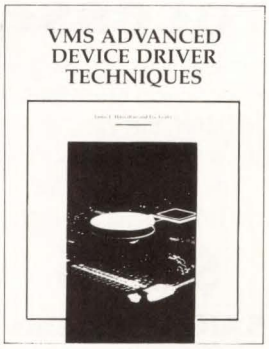

NEW . . . VMS Advanced Device Driver Techniques

By Experts Lee Leahy of Digital Equipment Corporation and Jamie Hanrahan of Simpact Associates

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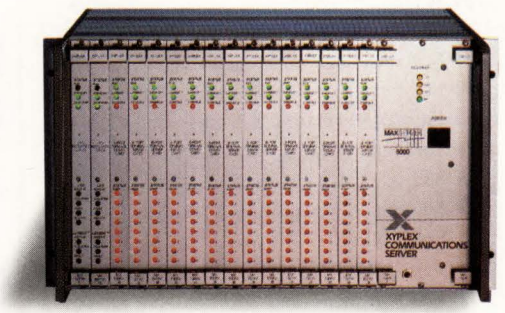

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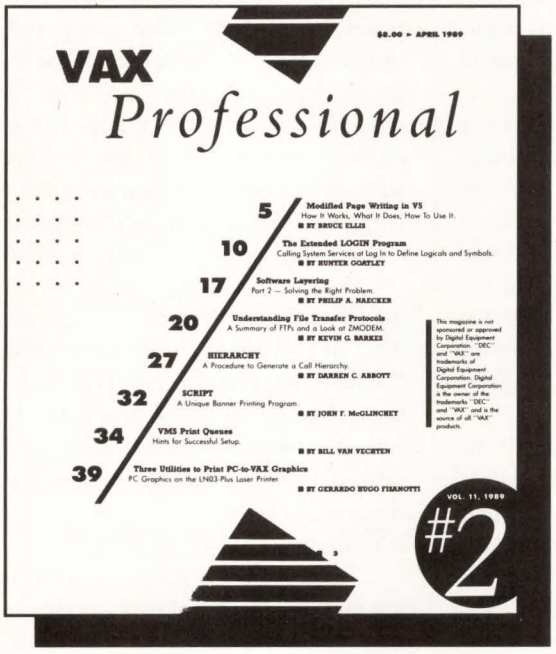

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BACK END

John C. Dvorak

The Zig And Zag Of UNIX

It was the 1989 Personal Computer Forum. I was at the same table as Mitch Kapor, founder of Lotus Development Corporation, paying little attention to the scene until Kapor spoke up. "Do you know why Lotus never released 1-2-3 for the Mac? Because Steve Jobs told us he didn't want it on the Mac. He said the Mac was different. It was distinctive. It needed something special. Something different. So we believed him and did Jazz for the Mac." Since then, Lotus has stayed away from the Mac.

That's when it dawned on me. None of the mainstream business-applications purveyors in the IBM community shows much interest in the Mac world. One of the world's biggest software firms is Computer Associates. A mini conglomeration of smaller firms specializing in accounting software, it almost ignores the Mac completely. Its SuperCalc 5 should have been ported to the Mac years ago.

Ashton-Tate only recently has dribbled into the Mac community. Its efforts are half-hearted.

Lotus took a stab with Jazz and has been gun-shy ever since. It obviously didn't understand the Mac market from the beginning. The market for spreadsheets on the Mac is owned by Microsoft, which, after its own Multiplan on the PC was beaten to death by Lotus 1-2-3, saw the Mac market as an easy opportunity for Excel.

Except for Microsoft, there are no big-name PC players in the Mac community. Even Microsoft, which dominates the language scene, doesn't promote its languages into the Mac world with any zeal.

The companies that Mac users might be familiar with are newcomers: Aldus, Lightspeed and Adobe.

As far as micros are concerned, this phenomenon goes back to the days of the Apple II. There were few, if any, software firms supplying code for the CP/M and the Apple worlds. Only Microsoft, with its Z-80 add-in card, straddled the fence. Microsoft has maintained its position as the only successful fence straddler.

Lotus should have become a force in the Mac community if for no other reason than that Lotus 1-2-3 is a descendant of VisiCalc, a product originally designed to run on the Apple II. The Apple computer launched the notion of spreadsheets but suddenly was abandoned by the software it promoted. The solution was Jazz, one of the great duds of our time.

Let's extrapolate my point to the UNIX and VMS worlds. UNIX vendors pretty much stick to UNIX for their market. The same holds for VMS, VM, MVS, you name it. The operating environments are part of the personalities of the software vendors. This means that should the world suddenly change, as it did in 1981 with the introduction of the PC and DOS, then those in the catbird's seat will be different players. Lotus, Ashton-Tate, Borland and others will be a memory. They'll go the way of VisiCorp, IUS, JRT Software and those who were mired in CP/M or Apple II.

Microsoft is the only company not only to flourish but also to hedge its bet. Besides vending Xenix, it has invested in the Santa Cruz Operation (SCO), a premier UNIX house. While on the surface Microsoft is promoting OS/2, it seems willing and able to jump into a newly emerging UNIX scene.

In 1982, UNIX went through a period of hype. Billed as the next great mass-market operating system, it had books written about it and computers designed around it. The most memorable flop was the Fortune 16/32, an overly ambitious desktop UNIX machine that now appears to have been ahead of its time. Sun found that UNIX on a big-screen workstation was the ticket. So, as UNIX faded into popular oblivion, Sun Microsystems thrived in the background. Not only that, but while Sun thrived, UNIX guru Bill Joy showed everyone how the perceived flaws in the operating system could be corrected, thus making UNIX as secure and reliable as any OS (well, almost).

A new decade approaches, and suddenly hardware designers go ape over RISC. It's all anyone talks about. Why? Because the performance potential of the technology is phenomenal. The key is the hardware designers driving the industry. In this case, they're driving it right into the waiting arms of the UNIX community.

Because RISC is perceived as changing rapidly in terms of performance and creating incompatibilities from one RISC design to the next, unless some other superportable (and bulletproof) OS comes along, UNIX will be the only conceivable OS for these new chips.

Suddenly, UNIX is the hot new OS for "the rest of us." Holy cow! A shift in fortunes takes place, and before you know it, we're looking back on MS-DOS as an iteration of CP/M — and long forgotten.

Suddenly, all the software players have new names. All, of course, except one: Microsoft. Although he makes it look easy, Bill Gates' ability to zig and zag at the right moment is why he's a billionaire. ■

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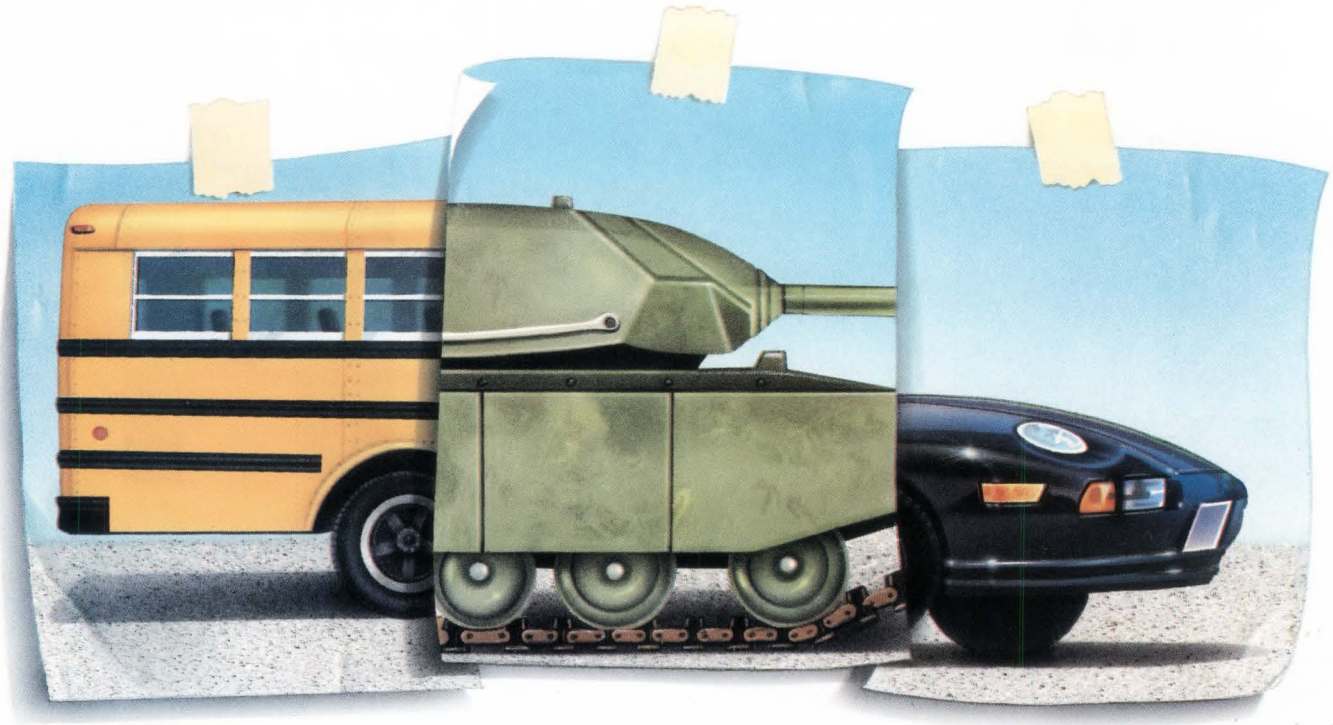

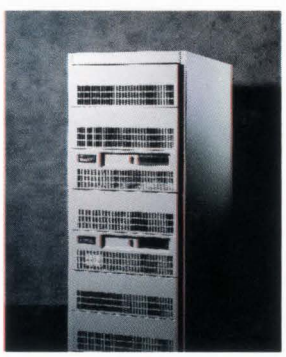

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