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■ I/O Subsystem  
Performance,  
Part 2

■ The Problems  
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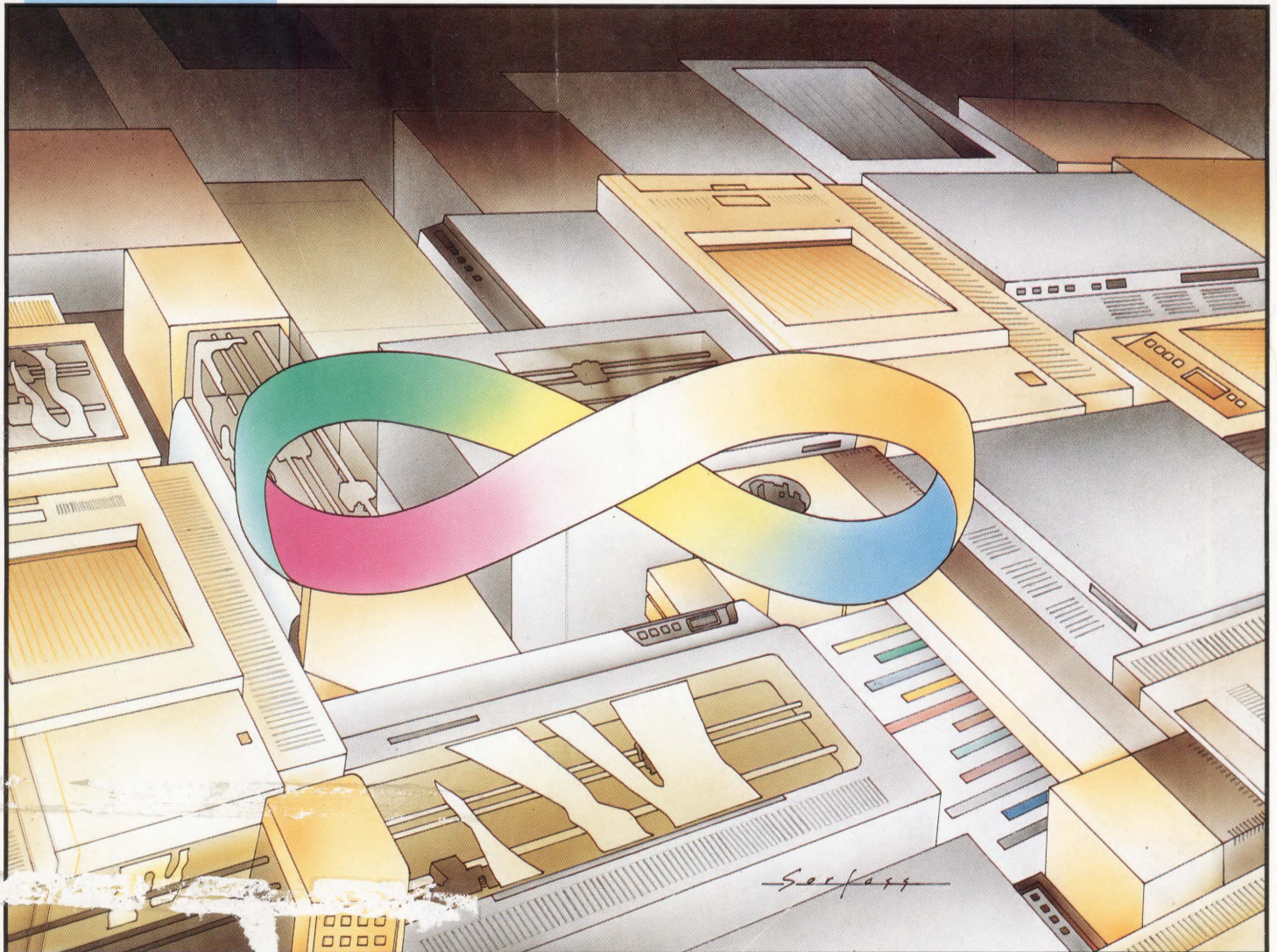
AUGUST ■ 1989

DEC

\$4.00 ■ VOL. 8, NO. 8

# Professional

*An Independent Magazine from Professional Press*



## Hardcopy Devices

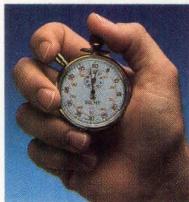




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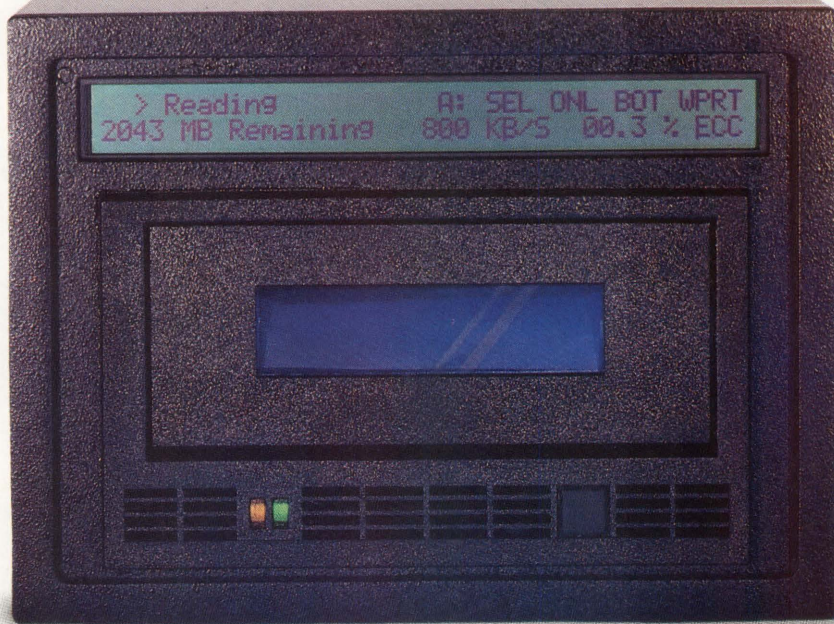
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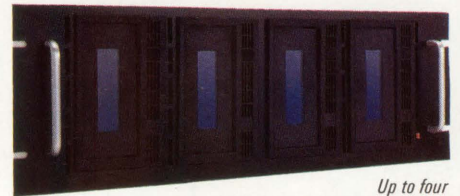
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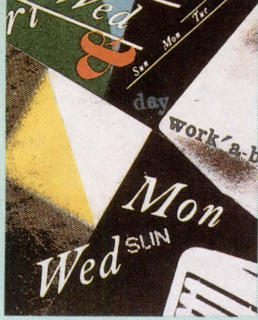
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DEC Professional

# C

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AUGUST 1989

VOL. 8, NO. 8

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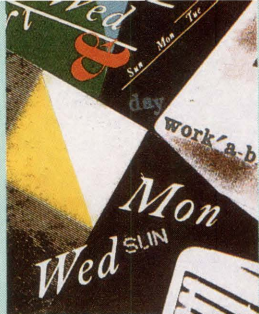
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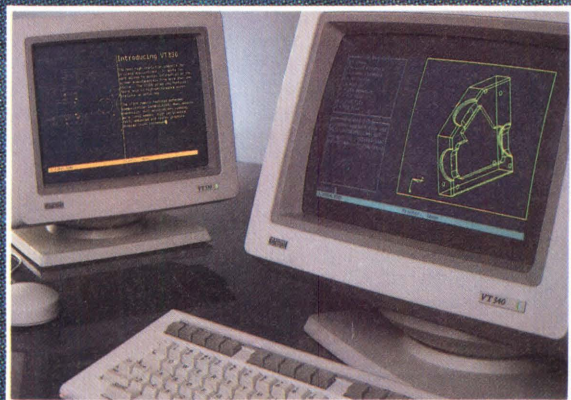
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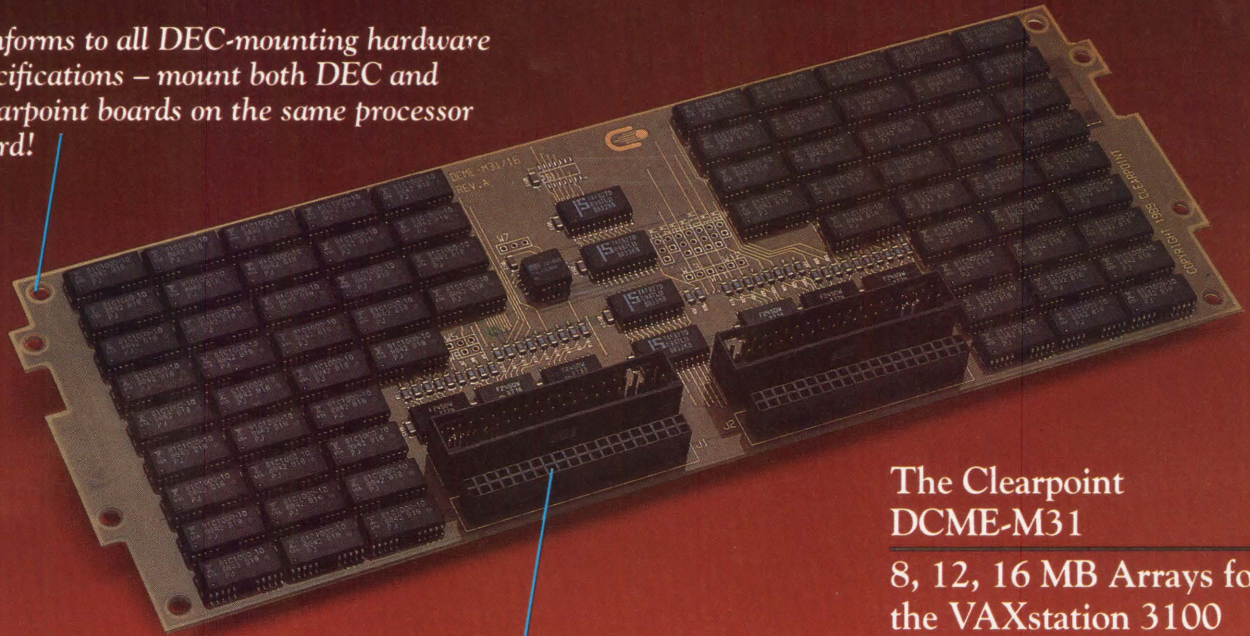
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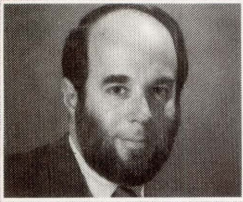
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CIRCLE 151 ON READER CARD





**PUBLISHER**

**Carl B. Marbach**

# American Success Story

most high-tech battles. The problem is that no one gives CDC the credit it deserves.

Until DEC started producing the RAXx series of disk drives, DEC disks were produced by other manufacturers. One of the first drives DEC delivered, the RP02, was produced by Sperry Univac, and the follow-on RP03 and RP04 were made by the same manufacturer. Later, the RP05 and RP06 came from Memorex, and when DEC was late with its RA-series Winchester, Memorex produced the RP07. But the RM02 and the MASSBUS RM03 were the removable disk drives of choice in the late '70s, and these were made by CDC.

Emulex and System Industries made their first major inroads into the third-party markets by selling CDC 9766 disk drives with more than three times the capacity of the top drive available from DEC. These 276-MB monsters had the same footprint as an RM02/RM03 but held three times as much data. Other companies, such as Diva Corporation and Century Data, also sold controllers and these drives, but they've either gone away or no longer serve the DEC market.

Eventually, DEC brought out the RM06 to match Emulex and System Industries, but their mark had been made. In a sense, the 9766/RM06 signified the time when disk drives grew up in the DEC market — they finally held enough data to accommodate the data processing needs of a company. This development, along with the venerable PDP-11/70, gave DEC its start in the commercial market. So, in a real way, CDC contributed to DEC's success in the commercial arena. Until this year, CDC continued to manufacture the 9766 to satisfy demand for a removable disk drive just now being satisfied by removable Winchesters.

At the start of this decade, Fujitsu brought out a 10 1/2-inch 160-MB Winchester that spelled the end of the removable disk drive as a way of life. The RM02/3/5 drives were washing machine-sized boxes that required lots of room. And, although they were reliable, removable media were easily contaminated and head crashes were a regular occurrence. More than one operator serially destroyed data by putting perfectly good disk packs in a drive whose heads had crashed on the previous pack, trying in vain to find a good pack when in fact the drive was the problem.

Winchesters almost ended head crashes. Professional Press installed its first 160-MB Fujitsu in 1981, and we've never lost a single bit of data because of a head crash.

Later, Fujitsu followed with a 450-MB+ version with the same 10 1/2-inch rack-mount footprint and the same reliability. DEC countered with its homemade RA81, but it was no match for the Fujitsu drives, and those who used third-party disks enjoyed better reliability and price/performance.

While the Winchester revolution was going on, CDC still was making hay with the venerable 9766, but it was soon to be totally outgunned in size, speed and reliability by the Winchester onslaught. There was no follow-on from CDC, the DEC business dried up as DEC brought its own disk manufacturing up to speed and the third parties turned to Japanese Winchesters for their offerings. CDC, at least in the DEC market, was out of the disk drive business.

It looked as if disks were to be like memory — *not* made in America. But the talented men and women from Minnesota didn't give up. After exhaustive research and development, CDC produced a series of Winchester drives that are beating the Far East drives in speed, reliability and price/performance. From the small Wren to the 1.2-GB Sabre, CDC came back. The Sabre is a 5 1/4-inch, half-size dynamo that has to be slowed to run with a KDB50 on the BI bus. Two of these drives give you a 5 1/4-inch rack with a capacity of 2.4 GB.

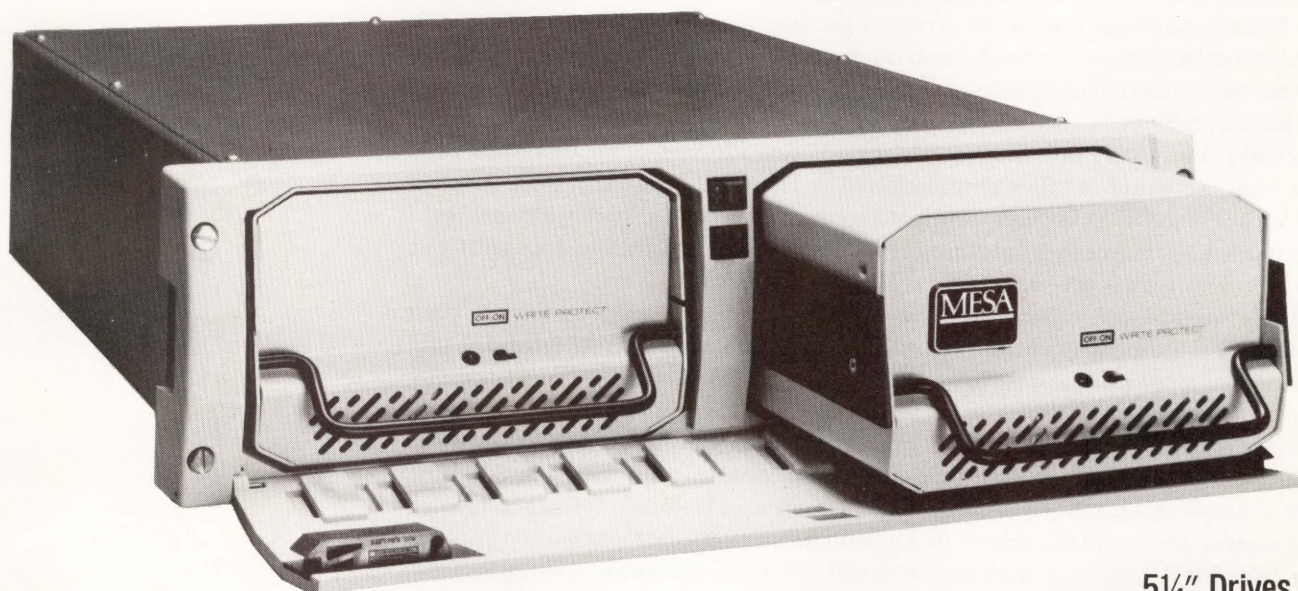
Unfortunately, for reasons that I don't understand and that are beyond the scope of this space, CDC will cease to exist as we know it. The ETA Supercomputer division has been closed, and the disk division was renamed Imprimis, which Seagate Corporation now hopes to purchase. It looks like a good deal for both sides, adding larger-drive technology to the Seagate line and getting Imprimis out from under the collapsing structure that was CDC.

But, for now, congratulations to the fine people at CDC. Your talent, energy and hard work prove that America can compete. Good luck to Imprimis in its proposed new home with Seagate.

On July 4, 1989 — thank you.



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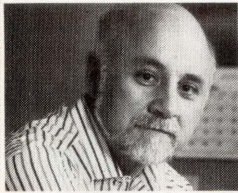
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## EDITORIAL

Dave Mallery

# Missed Opportunities

Professional Press is a fair-sized Digital customer. We own seven VAXs, two PDPs and a DECsystem 3100 ULTRIX engine.

Despite this array of equipment, we're too small to have a Digital salesperson. Instead, we deal with a distributor, Hamilton Avnet of Cherry Hill, New Jersey. I'm sure this sounds familiar to many of you.

Hamilton Avnet is wonderful. When we want something, its phone folks can't do enough to find and deliver. In many ways, it's giving me the best service I've had since 1976. That was the last time I had a Digital salesperson.

At Professional Press, I sit at the center of the Digital universe and get a close look at every product that's announced. I also can find my way around the electronic store, and I subscribe to the Digital reference service, so I have everything in writing. However, I still have a problem.

Recently, one of *DEC PROFESSIONAL*'s contributing editors told me that ALL-IN-1 is dominating the world of office automation. The last time I saw ALL-IN-1, it was a horrible CPU hog that only could dominate your machine, not a worldwide market.

My problem is, How can I find out more? Whom do I call? Distributors are great, but only if you know what you want to buy.

If Professional Press is representative of the majority of Digital customers, then Digital is missing a giant opportunity to sell into its installed base. Maybe Digital should create special software salespeople — SWAT teams that would make the rounds of a territory to ensure that the installed base was covered completely.

Recently, we encountered another opportunity for Digital to market its software. After upgrading our 8250 to an 8350, we found that we were spending all of our CPU time on the interrupt stack. DEC's Customer Support Center at Colorado Springs connected to our system and found the culprit in a few hours using the latest SPM.

It's time for DEC to stop ignoring the small and mid-sized firms, to stop missing opportunities to provide the customer base with tools it needs.

DEC customers don't buy products simply because they're announced. They buy products they need; and they only need products they understand. It's that simple.

## RISC And VAX: Together Forever

DEC's product introduction on July 11 featured the debut of RISC and VAX systems and software that will have a significant impact on the company's sales in 1990. Major products launched included:

- The IBM killer — The VAX 6000 Model 400 is the highest-performance VAX series ever. The series combines from one to six processors using SMP, achieving 85 percent greater performance than VAX 6000s, and spans performance levels of four IBM families.

- The Sun killer — The 10.4-mip RISC-based DECstation 2100 is priced from \$7,950. That's \$1,000 less than Sun's 12-mip SPARCstation 1.

- The HP killer — The DECsystem 5400 and 5800 are DEC's first foray into RISC/UNIX midrange servers. The MicroVAXlike 5400 is priced from \$49,900 and the 5800 is priced from \$121,500.

- The PS/2 killer — The multiuser MicroVAX 3100 is the new entry-level VAX with 2.5 times the performance of and a lower price than a MicroVAX 2000. With its corresponding VAXserver 3100s, the new MicroVAXs are competitively priced against the PS/2 Model 80 and the AS/400 B10. —*Evan Birkhead*

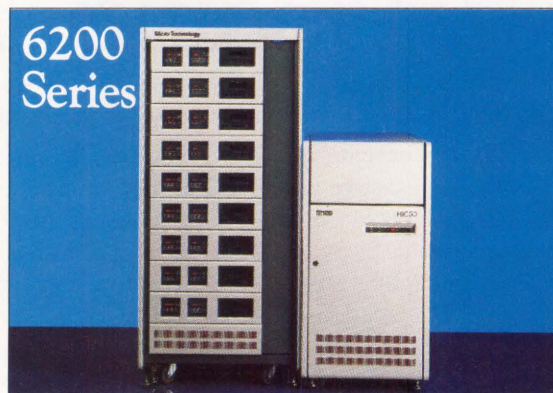


# The New Leader

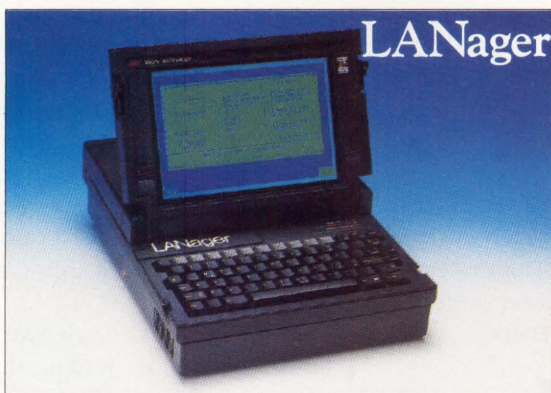
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CIRCLE 124 ON READER CARD



Evan Birkhead

# VMS And ULTRIX: Finding The Fit

UNIX has become an attractive alternative to proprietary operating systems. Every major system vendor, including IBM, DEC, HP and Unisys, offers a UNIX lookalike operating system on its standard hardware platforms. And some, most notably Sun Microsystems, have thrived by making UNIX their foundational operating system.

Because UNIX always has been readily (and inexpensively) available for these systems manufacturers, UNIX went from an operating system with a lot of potential to one with a lot of momentum. This momentum also can be attributed to other important factors:

1. Professionals emerged from colleges with skills in advanced UNIX programming.
2. Porting UNIX applications became easier than writing new applications from scratch.
3. UNIX features excellent process and I/O handling, a sophisticated filing system, a modular nature and built-in programming tools.
4. Success breeds success: UNIX carved out its own niche markets, ensuring survival, and its library of applications grew steadily.

UNIX-based systems have gained such momentum in the last year that many industry observers are forecasting a tenuous future for proprietary operating systems such as VAX/VMS.

Although VMS will undergo radical changes during the next decade, it probably won't disappear. VMS is DEC's primary breadwinner. DEC can't afford to see VMS survive only in niche

markets. DEC historically has pushed VMS first, because it's better suited to the VAX architecture, offers a wide range of functions (its oft-referred-to "elegance") and brings in significantly more revenue per sale than ULTRIX, DEC's version of UNIX.

But the company's entrance into the UNIX workstation arena with the RISC-based DECstation 3100 signals a shift in strategy. DEC now pours an equal amount of research and development funds into each of its operating systems. The ULTRIX side of the business is growing at a much faster rate and now accounts for more than 20 percent of overall business. This is an intriguing trend as the company enters the multivendor, open systems era of the 1990s.

Adding fuel to the UNIX fire, DEC President Ken Olsen, widely regarded as one who resists the UNIX movement, says that VMS' robustness eventually will be written into ULTRIX.

## ULTRIX Versus VMS

DEC has positioned ULTRIX as its "open" operating system. That means it complies with widely accepted application environments such as X/Open's CAE, the Open Software Foundation's (OSF) Motif and the National Institute of Standards and Technology's (NIST) POSIX system. DEC intends to sell ULTRIX primarily to multivendor environments (which today include virtually every computer site) and sites running applications on workstations.

The marked difference in design philosophy between ULTRIX and VMS is exemplified by their structural internals. According to DEC's ULTRIX Product Manager Jim Barclay, "There is a point at which UNIX functionality fails, forcing a turn to VMS." Barclay maintains

“  
**VMS will undergo radical  
changes during the  
next decade.**

that, for instance, UNIX isn't well-suited for production environments or high-throughput applications such as OLTP. According to Barclay, UNIX's file systems aren't proper, optimizing the wrong types of functions. Further, its scheduler isn't as good as VMS'. Finally, it's difficult and expensive to restructure UNIX for real-time applications. Still, these haven't stopped UNIX from growing in production and high-throughput markets.

Where does UNIX fit best? Government agencies are leading the switch from proprietary systems to UNIX, because their Federal Information Processing Standard (FIPS) specifies clean, neutral purchases. Other industries that purchase UNIX include telecommunications, primarily because it was written by AT&T, but also because it's an excellent switching system; computer science, because it's malleable and can be taken apart and put back together easily; and *Fortune* 100 companies such as Du Pont, General Motors and Shell Oil, because it's the open system commonly used in business. A vendor developing software for these industries probably will use UNIX, as well.

DEC's aim will be to continue to fit sites with appropriate solutions. "Applications integration and interoperability



will be one of DEC's biggest goals for the next five years," claims Barclay, adding that the three operating systems DEC licenses — MS-DOS, VMS and ULTRIX — "must be able to be installed together."

## Radical Change

DEC's VMS strategy is to score big sales in areas for which VMS is best suited. Because VMS was written to be a networked operating system, its performance is great in Ethernet settings. It also offers unique benefits such as clustering and journaling, and is a security-conscious operating system.

According to VMS Product Manager Phil Auberg, integrated, distributed environments will use VMS in the next decade. Such environments are popular in multinational corporations and OLTP sites. VMS also always will be there for customers who want a single-vendor solution.

"In technical and scientific applications, compatibility is important," indicates Auberg, explaining engineers' preference for different sizes of DEC processors, all of which run the same operating system.

"I'm sure that at some point in the 1990s there will be a radical change in terms of VMS technology," Auberg forecasts. "The [VMS] operating system will run on more powerful things in the future. And you may see parallel processors in the future with closer ties to heterogeneous computer environments."

The worst-case long-term scenario for VMS is that it will become the foundation of a hybrid operating system — probably VMS plus ULTRIX plus future extensions — with a user interface that can be configured by user preference to look like one or the other.

"VMS and ULTRIX service very different market needs," Auberg says. "If they didn't, we wouldn't be making both."

## The Role Of Standards

DEC is closely monitoring the emergence of standards from OSF, ISO and NIST. NIST's POSIX is a set of proposed standardized operating system

# Industry Watch

**Telephone Tag** — DEC is making a concerted move into computer-integrated telephony (CIT) technology. Aaron Holzer, a consultant with DEC's Engineering Systems Group, says that DEC's vision of computing environments in the next century includes hardware that integrates telephones and fax machines into networks and software that provides real-time voice recognition for communications and security.

This year DEC started major codevelopment relationships with Northern Telecom Inc. and AT&T that are steppingstones in that direction. Northern Telecom's ISDN/AP protocol software links the company's Meridian SL-1 PBX with auxiliary processors such as VAXs. The AT&T agreement is a pact to develop a PBX-to-VAX application interface based on DEC's CIT platform and AT&T's Adjunct Switch Application Interface (ASAI).

**Patents Versus Copyrights** — Courtrooms across the country are hearing cases that could be affected by the recent 9-0 U.S. Supreme Court decision that upholds a contracted programmer's right to copyright material he produces. Many in the industry are concerned that the Court's tendency to protect intellectual property may result in patents becoming more difficult to obtain, particularly for manufacturers of software clones, such as Lotus clones. This might limit freedom in improving existing software programs.

Patents are a stickier issue than copyrights. With copyrights, programs created independently have an automatic defense. With patents, whoever gets to the patent office first has a defense. The U.S. Patent Office is expected to release hundreds of software patents this summer, some of which have been pending for three years.

**Semi-Tough** — Just one month after DEC announced a complete redesign in the way it manufactures semiconductors, it became one of seven founding members of U.S. Memories Inc., which will manufacture IBM-style DRAMs on a large scale. The emergence of the corporation comes at a critical juncture in the U.S.'s ability to compete with the Far East in the production of advanced electronics. The other backers include IBM, Hewlett-Packard, National Semiconductor, Intel, LSI Logic and Advanced Micro Devices.

**Solid State** — The first subsystems to incorporate solid-state disks into VAXclusters have been introduced by System Industries. The VAXcluster Performance Pacs use HSC controllers for I/O and support large- and small-spindle Winchester in addition to solid-state devices. Prices range from \$75,000 to \$182,000.

**Standard Barriers** — Rich Lewan, product marketing and development manager for DEC's Engineering Systems Group, says that the company supports the Computer-Aided Acquisition and Logistical Support (CALs) initiative. CALs is the U.S. Government's standard for document management, sharing and access.

The problem for CALs developers is attaining a standard set of CALs-compliant products that allow government and industrial users to upgrade with CALs systems. DEC's CALs-compatible software products include CDA-related products, DECview3D and EDCS II.

**Community Relations** — Stratus Computer Inc. is the most recent of 35 systems vendors licensed to run CommUnity, the DECnet-compatible environment from Technology Concepts. Stratus manufactures XA2000 fault-tolerant, high-throughput systems. The software, called DNS/2000, lets an XA2000 participate as an end node in a Phase IV DECnet/Ethernet.

**Temporary Shelter** — Wellfleet Communications Inc. is delivering a set of client/server-based communications products that adhere to the Simple Network Management Protocol (SNMP), the current standard on the Department of Defense's Internet. SNMP is an interim standard that will be used until the move to the International Standards Organization (ISO) model. SNMP is ISO-like, but not part of the model. Wellfleet's versions run TCP/IP and use the X Window System environment.

**Networking** — Agreements with Chipcom Corporation and StrataCom Inc. signal DEC's willingness to cooperate with third-party vendors in building its enterprise networking strategy. Chipcom's ORnet fiber optic Ethernet system will help DEC comply with FDDI standards, while StrataCom will provide data, voice, video and image services over T1 networks.



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services. Jim Isaak, DEC's representative on the POSIX committee and resident open systems officer, says that the goal of POSIX is to isolate hardware platforms from the operating software so that code can be ported by recompiling between systems. "Ultimately, you'd have harmonization," says Isaak. "You'd be using the same words in different environments."

UNIX versions easily are made POSIX compliant. DEC is pursuing the difficult task of POSIX compliance for VMS, but POSIX is only a small part of open systems conformity; VMS offers most of the other components. VMS won't be POSIX-compliant for a few years. This will be accompanied by other efforts to establish closer ties to heterogeneous environments. "We're noticeably weak in the POSIX interface to the operating system," acknowledges Auberg. "But the POSIX application program interface will be a standard, integrated part of the operating system. VMS will conform to all standards in the future."

DON'T EXPECT VMS to go away mad based on the success of ULTRIX. Rather, expect DEC to make the two run together more easily by making them look more alike. If you think of the tale in Rudyard Kipling's *Just-So Stories* about how the tortoise and the hedgehog evolved into an armadillo by undergoing separate transformations, you're on the right track.

As part of VMS' evolution, expect DEC to attempt to improve VMS' performance on parallel (SMP) architectures versus ULTRIX. Simultaneously, the price of VMS must come down to a level competitive with the UNIX clones. DEC denies any plans to develop a RISC-based VMS machine, however, and many believe that RISC and VMS are mutually exclusive.

If VMS has a fatal flaw, it may prove to be price/performance or price/mips. Like IBM, DEC has inflated its prices, citing operating system elegance as the reason. Entering the 1990s, however, the bottom line is price. ■





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## LETTERS

### A QUALIFYING ERROR

In "Daemons" (February 1989), Kevin G. Barkes shows how to create a detached process with the RUN command. He neglects to point out that if the image is LOGINOUT, it's pointless to include the /ERROR qualifier, as SYSS\$ERROR will be the same as SYSS\$OUTPUT.

**Robert Firestine**  
San Jose, California

*Kevin G. Barkes:* The reader is correct. According to the *DCL Dictionary*, "the /ERROR qualifier is ignored if you're running SYSS\$SYSTEM:LOGINOUT."

To redirect SYSS\$ERROR, you must reassign it explicitly from within the command file specified as the input to LOGINOUT:

```
$ ASSIGN DETACH.ERROR SYSS$ERROR
```

Two other notes:

1. /OUTPUT must be defined, even if it's to the null device (NL:). Otherwise, the process will terminate when it can't find a file to assign to SYSS\$OUTPUT.
2. Error messages generated by DCL commands will appear in both the SYSS\$OUTPUT and SYSS\$ERROR files. Images that directly reference SYSS\$ERROR will send error messages only to SYSS\$ERROR.

### MORE ON MAPPING

John Reynolds' response to my letter of January 1989 (Letters, April 1989) describes a situation in which a large

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VAX is brought to a standstill. He incorrectly ascribes the blame to the use of mapped sections when the problem is an unrealistically high ratio of virtual pages to physical pages. In this situation, a process may be paging its page table, resulting in dead page table scans that flush the modified page list. Mapping is simply one tool that makes it easy to create this problem.

Consider two processes that want to bring the same large file into their virtual address spaces. The first process maps the file to a process private section. Page table entries are loaded as the section is created, resulting in one page fault for every 128 pages in the section. The second process uses RMS block I/O. Because the file is large compared to the working set, almost the entire file will be run through the working set, onto the modified page list and then to the page file. The cost is that of reading and then writing almost every page in the file.

From this point on, both processes

behave similarly, because both have the file in virtual memory with almost all of it on disk (in the section file for the first process and in a page file for the second process). The effects of a user wandering randomly through a large virtual address space will be equally deleterious to both processes and the system.

The question is whether or not the entire file must be in the process's virtual address space. If the answer is yes, then mapping is the most efficient way to get it there. Having done so, you must pay the price, either in performance degradation, which can result from the high ratio of virtual to physical memory, or in dollars to purchase additional physical memory to bring this ratio back into line.

Also, a large virtual address space may not be a problem if it can be accessed in such a way that locality of references is maximized. Further, if a file is mapped to a section and is writeable, the \$UPDSEC system service can be used to bypass the modified page list on writes. This can prevent modified page list flushing, although it doesn't reduce turnover on the free page list and consequently does nothing to reduce hard faults.

**Bob Heath**  
Edmonton, Alberta

### THE SOFTWARE SIDE

John C. Dvorak's "Hardware Versus Software" (April 1989) is a generalization of the early days of data processing.



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Dynamic Windows	Yes	No	Yes	No
Pop-Up Menus	Yes	No	Yes	No
Colors				
Per Session	16/262K	16/4K	—	—
Color Text Attributes	Yes	No	—	—
Screen Refresh Rate	70 Hz.	60 Hz.	70 Hz.	60 Hz.
Overscan/Borderscan	Yes	No	Yes	No
Ethernet Interface	Option	No	Option	No
RGB Interface	Option	No	—	—

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

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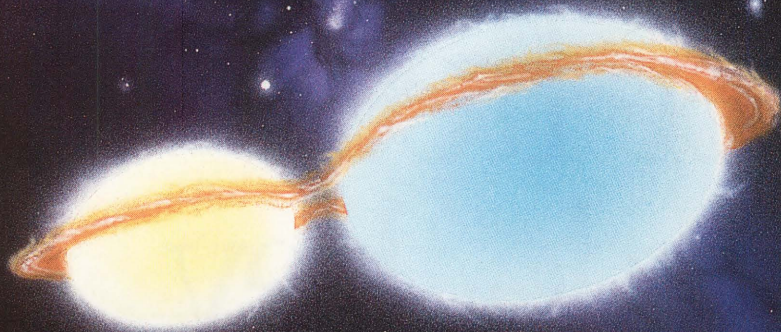
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Today, software engineers are more social and communicative than hardware engineers. Software engineers are more concerned with giving users what they want, doing it efficiently and meeting deadlines. Hardware engineers have to know only one machine, not multiple operating systems, applications and languages.

The greater degree of knowledge and flexibility required of software engineers emphasizes their worth. Reality contradicts Mr. Dvorak's article.

**Cheryl Colburn**  
Appleton, Wisconsin

### PORTRAIT OF THE ENGINEER

John C. Dvorak's "Hardware Versus Software" (April 1989) begs a reply. Hardware engineers do a fast, efficient job because their jobs can be done by anyone who can plug in a lamp.

Dvorak says that the classic hardware engineer smiles a lot and stays well-groomed. Hardware engineers smile a lot because they're thinking about lunch. They stay well-groomed to blend in with the crowd: Because anyone with a voltmeter can do their jobs, hardware engineers have to fall between the cracks during personnel cutbacks.

Software engineers dress, act and live as they do because they're artists. In a foreign language — FORTRAN, C or whatever — they build a manuscript that makes the hardware engineer's boards and cables jump through hoops. When something goes wrong, fixing it isn't a matter of plugging in a meter and letting it do the work. And each empty file at the beginning of an edit session is a canvas on which the software engineer paints his work of art.

Sure, software engineers are geeks, but have mercy on them. Van Gogh's contemporaries probably thought he was a pretty big dweeb, too.

**Wayde Killmeyer**  
College Park, Maryland ■

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## V5.1 PERFORMANCE

### QUERY:

**Steve Czernski** (SIG 37/MESS 924): We upgraded an 8-MB 750 to VMS V5.0-02 from V4.7. Everything's running slower, but I see no evidence of paging/swap-ping problems. It acts as if the operating system overhead has increased so much that the machine is running slower. Has anyone else had this experience?

### REPLIES:

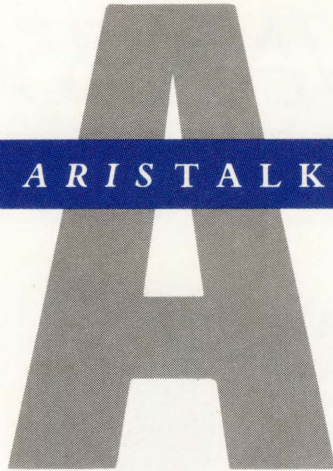
**Richard B. Gilbert** (SIG 37/MESS 925): If you're new to V5, you can expect a performance hit. According to DEC, V5 is about five percent slower.

There have been rumors about problems with paging files. If rebooting straightens you out for a while and then your paging rate starts to go up, that may be your problem. There's supposed to be a patch from CSC for this problem.

This hasn't happened to me. I have a pair of VAXstation 2000s on V5, and they both have enough memory. Therefore they don't do a lot of paging. **Lee Gleason** (SIG 37/MESS 926): There's a patch for the page file fragmentation problem for VMS versions 5.0, 5.0-1, 5.0-2 and 5.1. If you've been experiencing page file problems, the increase in performance is very noticeable. You can leave your VAXs up more than a few days without having them slow down.

It's called the "lost page" patch. The comments in the patch indicate that the problem was caused by memory management routines that occasionally would lose track of a page in the page file. These one-page orphans gradually prevent pieces of page-file space from recombining into big chunks.

The patch is available from Col-



## How To Use ARIS/BB

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

To log in, you'll need your subscription number from your mailing label. Set your terminal to seven data bits, one stop bit and space parity, or eight data bits, one stop bit and no parity. Set your terminal emulation to VT100 and dial:

- (215) 542-9458 - Pennsylvania
  - (818) 577-9100 - Southern California
  - (415) 873-2135 - Northern California
  - New!** ■ (617) 863-5010 - Massachusetts
- Baud rates: 300, 1,200 or 2,400.

The ARIS/BB symbol appears at the beginning of each article when the program is downloadable. *VAX PROFESSIONAL* programs are available to subscribers of *VAX PROFESSIONAL* only. For subscription information, contact Karol Hughes at (215) 542-7008, 9 a.m. - 5 p.m. EST. Use these recommendations at your own risk. Professional Press is not liable for any damages to your system that might be caused by the hardware, software, programs or procedures discussed here.

*XMODEM* and *KERMIT* are available. You must key in your name and subscription number before the ARIS/BB Welcome Screen appears.

## SIG Identification

The SIG categories referenced in this month's ARISTALK are:

- 21.....Controllers/Memory
- 37.....VMS
- 42.....Data/File Transfer

orado on request. If you have a large configuration with a lot of activity, I recommend it.

## MSV11-PL MEMORY

### QUERY:

**Douglas Taylor** (SIG 21/MESS 108): In an attempt to get an RX02 board to work in a MicroPDP-11, I strapped the 18-bit address jumper on a 512-KB DEC memory board. It didn't work, and now the memory board doesn't either. Could I have blown out the DEC memory board by doing this? The PDP-11/23 + CPU bootstrap comes up and says "no memory at location 000000".

### REPLIES:

**Dave Kaplan** (SIG 21/MESS 109): I'm not familiar with your specific hardware, but here's some information to get you started. Q-bus backplane slots exist in two variants: Q/Q and Q/CD (see Figure).

In the Q/Q backplane, slots 1-8 are identical, and dual-size boards can go in any AB or CD position. Bus grant follows the zigzag pattern as shown through all slots. In the Q/CD backplane, the first three slots are modified so that additional addressing lines (represented by \*) connect slots 1, 2 and 3 in positions CD, and the bus-grant path is modified accordingly.

These addressing lines use connections where power supply voltages otherwise would be present. Therefore, if you install a dual-wide 22-bit board in 1-3 CD of a Q/Q backplane, power voltages coming in on the extended addressing lines can damage the board.

**Brett Bump** (SIG 21/MESS 109): Dave, you got it right, just typed it wrong. You should have said be wary of the CD interconnect in the Q/CD backplane.





WORD-11 4.2 sets a new gold standard for VAX word processing.

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PF1

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- Automatic spelling correction
- Thesaurus
- Multiple wrapped columns
- Choice of a wide variety of printers
- VAX mail interface
- VAX/FAX option
- Calendar Manager option

WORD-11 was designed specifically for the VAX user, which means high performance with low CPU overhead. Plus, WORD-11 is available on the IBM PC with the identical format and gold key interface as the VAX version.

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## WORD-11

Data Processing Design, Inc.  
1400 N. Brasher St., Anaheim, CA 92807

800-843-1317

In California call 714-970-1515

Fax 714-779-7468



**F**

**FIGURE .**

	Q/Q-type 18-bit addressing	Q/CD-type 22-bit addressing
	A B C D	A B C D
1	→ v	*
2	v ← +	v *
3	+ → v	*
4	v ← +	+ → v
5	+ → v	v ← +
6	v ← +	+ → v
7	+ → v	v ← +
8	end ← +	+ → end

*Q-bus backplane slots exist in two variants: Q/Q and Q/CD.*

[Report From Dr. R.]

# The Age Of Aquarius

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

■ Admiral Olsen says full speed ahead with the successor to Nautilus. The air-cooled Aquarius is a hot new VAX CPU that will be available in uni through quadratic configurations and will deliver 30 through 108 VUPS scalar performance and 55 through 200 debit/credit transactions respectively.

Angling for vectors? Great, because Aquarius' built-in vector accelerator will belt out 18 Mflops (100 x 100 Linpack) and 125 Mflops (peak) on a per-CPU basis. That's substantially better than the performance of the vector option to be offered at some point in the future on the VAX 6400 and Firefox workstation.

Don't expect to see Aquarius in the Electronic Store until early next year. One- and two-CPU systems may ship in winter/spring 1990, but you'll have to wait a bit longer for three- and four-processor versions and ULTRIX support.

■ Uncle Ken and his crew are planning to spring a slew of new MicroVAXs on the DEC community. First, we'll see the MicroVAX 3100, an upscale replacement for the obsolescent MicroVAX 2000. Later in the year, we can expect DEC to transmute the Firefox workstation into a family of multiprocessor MicroVAXs. Alas, we'll have to wait until next year before DEC unleashes a 7-VUPS Rigel-based system.

■ The doctor is off to see the Wizard of OZIX. According to sources close to the DEC west lab, where this alluring new O/S is being crafted, OZIX is a next-generation VMS follow-on that will run on an as-yet unimplemented 64-bit version of the Mips RISC architecture. Can you say "Son of MICA?" Sure you can.

■ Finally, DEC needs your help. It seems that DEC is set to program-announce its much-vaunted (and even more heavily rumored) DECwindows terminal and needs a name for this \$2,500 gem. DT300 is the internal name for the product, but this sobriquet lacks zest appeal. Give DEC a hand, and maybe they'll send the winner to KAPRI.

Douglas, the MSV11-PL is a quad-slot memory board, so you shouldn't have a CD-interconnect problem such as Dave mentioned (assuming you're using a BA23 box). As long as you don't have anything on line AU1 or BU1 (not bussed by DEC), you can stick your board in upside down and probably get away with it. However, you can give your board brain damage just by handling it. If this occurs, replace it with a third-party board.

As far as your RX02 goes, I don't know what you're running, but I always use two different RX02 systems (one DEC eight-inch and one third-party 5¼-inch that thinks it's an RX) on 4-MB systems with RSTS and RT11.

**Douglas Taylor** (SIG 21/MESS 110): The memory board was in a MicroPDP-11 with the H9278 backplane. Your comments were helpful. I was moving the boards around to accommodate another controller and may have put the memory board into a slot where it wouldn't work.

The MSV11-PL memory board has been replaced with Chrislin Industries' 256-KB memory board, which works in the 11/23 +.

## KERMIT/MICROCOM

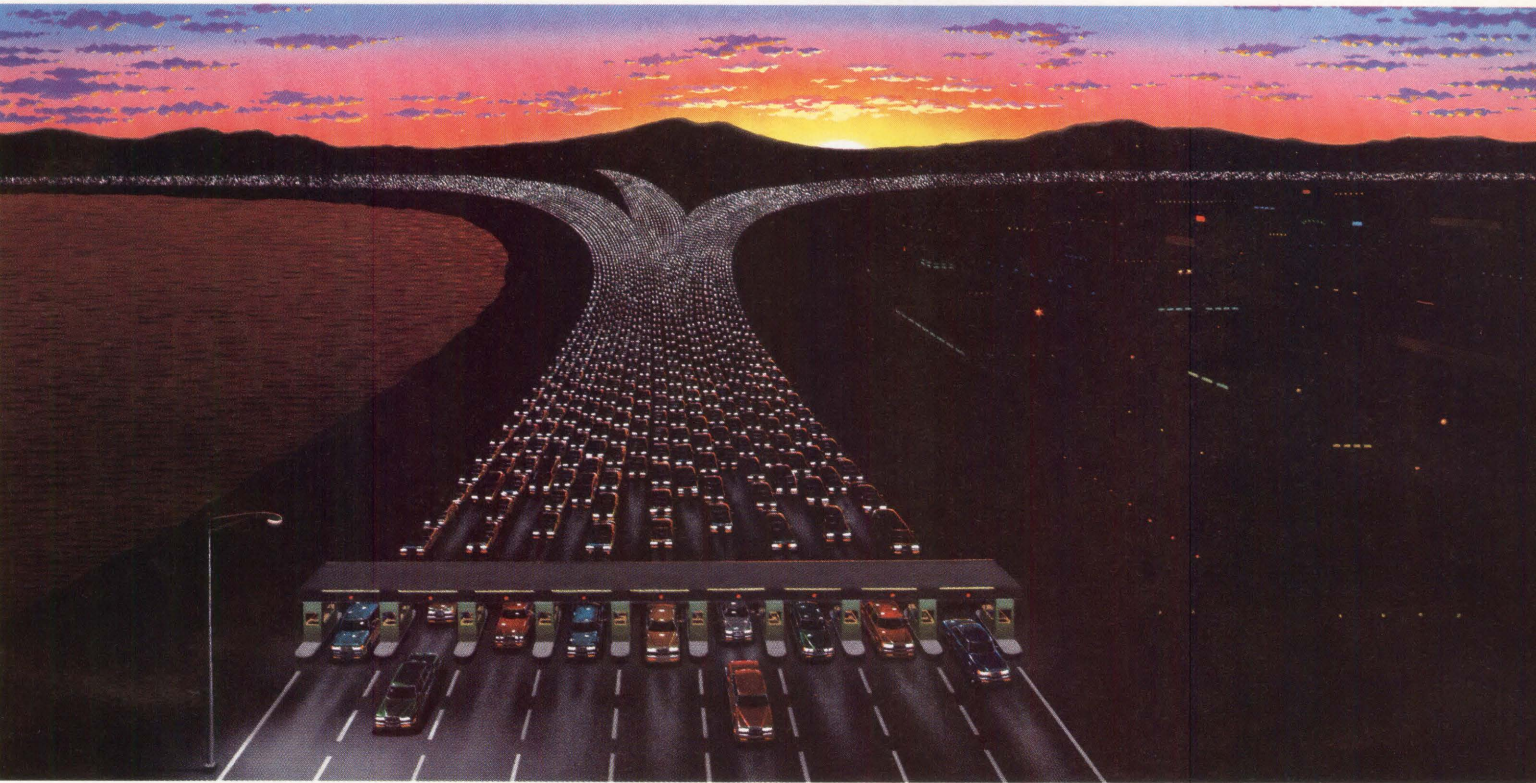
**David Kaplan** (SIG 42/MESS 495): I'm using ARIS for the first time, and I've been browsing through KERMIT-related messages. One problem I've seen several times is people unable to get KERMIT transfers to work when using MICROCOM modems.

Here's a simple solution: addressing AX/2400 and AX/2400C modems. By default, these modems look for a break character, which tells the modem to drop back into modem-command mode. This is the same function that's handled on Hayes modems by a three-second pause, then + + +, then a three-second pause.

The default break character is ASCII value of 1. When you start a KERMIT file transfer, eventually one of these gets sent down the line. To fix this, type the command SE0 at the modem's ! prompt. This disables the break character. ■



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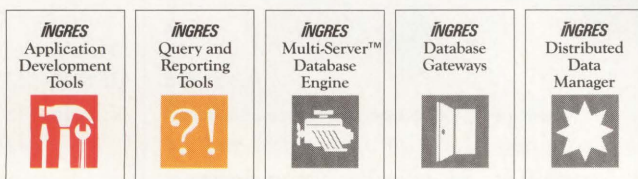
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CIRCLE 137 ON READER CARD

DP



## Color Printing With PostScript

*The QMS ColorScript 100 Model 20 Expands PostScript-Based Printer Family*

**Q**MS Inc. of Mobile, Alabama, has added a new member to its QMS ColorScript 100 printer family. The QMS ColorScript 100 Model 20 joins the Model 30 to form an Adobe PostScript-based color printer family.

"The QMS ColorScript 100 Model 20 provides users with an entry-level color PostScript print system that offers the same high-quality output as our QMS ColorScript 100 Model 30 printer," says Dr. Donald L. Parker, QMS executive vice president for products and technology.

The Model 20's external controller is based on QMS' Advanced System Architecture for PostScript (ASAP) technology, which features a 68020 MPU/16.67 MHz-based Atlas controller board with 4 MB of RAM, 1 MB of ROM, 35 resident Adobe typefaces and the latest release of color Adobe PostScript code.

Interfacing flexibility is a key feature of the Model 20

controller. With built-in RS-232, Centronics parallel and RS-422/AppleTalk interfaces, the Model 20 can connect quickly to most mini-computer, microcomputer and mainframe hosts. By adding the QMS PrintLink communications controller, the Model 20 can operate in any Ethernet TCP/IP network that supports FTP commands.

The Model 20 includes a SCSI interface that supports up to seven external

SCSI devices of unlimited size, including hard disks that can be used to store and retrieve additional fonts, forms, overlays and scanned images.

The ColorScript Model 20 uses the same high-resolution (300 x 300-dpi) Mitsubishi G650 thermal transfer print engine that's currently used in the QMS ColorScript 100 Model 30. When used with a four-color printer film roll, the engine generates four primary colors (yellow, magenta, cyan and black) and three secondary/additive colors (red, blue and green). With these seven base colors, the Model 20 can print more than 16 million

process color combinations.

The printer ships with a 150-sheet, letter/A4-size paper-input cassette. Output orientation is face up to a 50-sheet output tray.

The QMS ColorScript family, through a licensing agreement with Pantone Inc., can simulate all of the colors in the Pantone Matching System Process Simulator 747XR except for metallics and fluorescents.

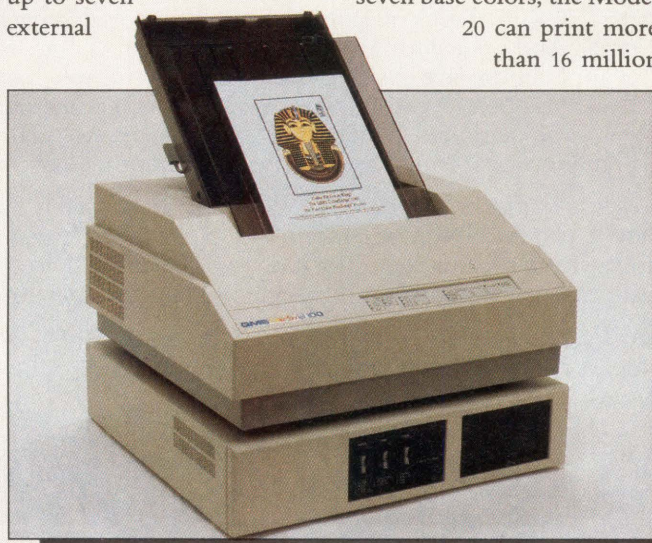
A controller upgrade is available for those who want to expand their output options to the 11 x 17-inch/A3-size capabilities that the QMS ColorScript 100 Model 30 offers. This field-installable upgrade option includes an additional 4 MB of RAM, a 20-MB hard disk, PS Exec software, a downloadable HP 7475A plotter (HP-GL) emulation and an 11 x 17-inch/A3 paper-input tray.

The QMS ColorScript 100 Model 20 costs \$16,995. The upgrade option to convert to the QMS ColorScript 100 Model 30 costs \$5,995.

For more information, contact QMS Inc., 1 Magnum Pass, Mobile, AL 36618; (205) 633-4300.

**Circle 435 on reader card**

—Pamela F. Fullerton



*The QMS ColorScript 100 Model 20 offers letter and A4 capabilities for color PostScript printing.*



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**CIRCLE 220 ON READER CARD**



## Merging In Real-Time

### Computer Giants Concurrent And Masscomp Consolidate Systems

The merger of Concurrent Computer Corporation of Tinton Falls, New Jersey, and Masscomp, two major players in the real-time computing market, has created a \$400 million corporation that must migrate two product lines into one. Completed in October 1988, the merger united Concurrent's OS/32-based 3200 series with Masscomp's RTU-based 6000 family (see "Real-Time UNIX," November 1988, p. 72). The new Concurrent has more than 30,000 installed systems.

While blueprints still were being drawn for a high-throughput computer series that would be upwardly compatible with both existing product sets, Concurrent introduced two processor series, the MicroThree and MicroFive, under the umbrella of the Micro3200 family.

These products will run the proprietary OS/32 real-time operating system, which consists of prioritized task scheduling that can be off-loaded to hardware. It also supports software development in FORTRAN, COBOL, C, Ada and PASCAL.

A suite of tools called Reliance Plus adds a software development environment for relational transaction processing and database management. Other features include streamlined intertask communication control, multiple record I/O and an

enhanced File Manager Directory.

The 6000 family, meanwhile, has been upgraded from a subsystem to a complete real-time system with the addition of six data acquisition products and an eight-plane color graphics subsystem that features a real-time implementation of the X Window System.

The data acquisition products include four hardware modules: a Waveform Digitizer, which is a 12-bit, VME-based analog-to-digital converter with a 16-channel analog multiplexer; a 64-channel analog multiplexer; a 32-channel simultaneous sample and hold board set for applications requiring samplings of large numbers of channels; and a Waveform Generator, which features four 12-bit digital-to-analog reconstruction channels, which let users display results as data is processed.

The two data acquisition software products include Data Acquisition Control Software, which provides a library of subroutines for direct control of all the data acquisition modules, and a new version of Concurrent's Laboratory Workbench applications development environment.

The new Micro3200 computers expand the 3200 series at the low end. Concurrent benchmarked the high-end Micro3200 family member against the VAX 6300 and claimed a 30 percent



*The MicroFive Expanded System, a member of Concurrent's Micro3200 series, can be used for real-time simulation.*

price/performance increase. Concurrent also said that the Micro3200 has a multilevel interrupt facility that provides a 15 ms interrupt response time.

The systems use multiple register sets and Concurrent's 40-MB-per-second Distributed Bus Link (DBL), which links multiple 3200 processors in a parallel architecture. Concurrent recommends these configurations where one CPU isn't fast enough and networks and clustering are impractical.

The Micro3200 line features six members based on the two processor boards. The MicroThree series includes the entry-level MicroThree Compact Chassis, the MicroThree Compact System and the MicroThree Expanded System. The high-end members of the MicroFive series are named similarly.

Software written for old Concurrent machines can

run unmodified on the new systems. The computational-intensive MicroFives reportedly run at 6 mips, while the 32-bit MicroThree, designed for applications that require a balance of I/O and computational power, run at 3.5 mips.

The systems use VLSI surface-mount technology, CMOS design and 200,000 gates. Memory expansion modules are available in increments of 8, 16 and 32 MB. The systems are also expandable to support four disk and two tape drives. Eight communication lines and a 160-amp power supply are included.

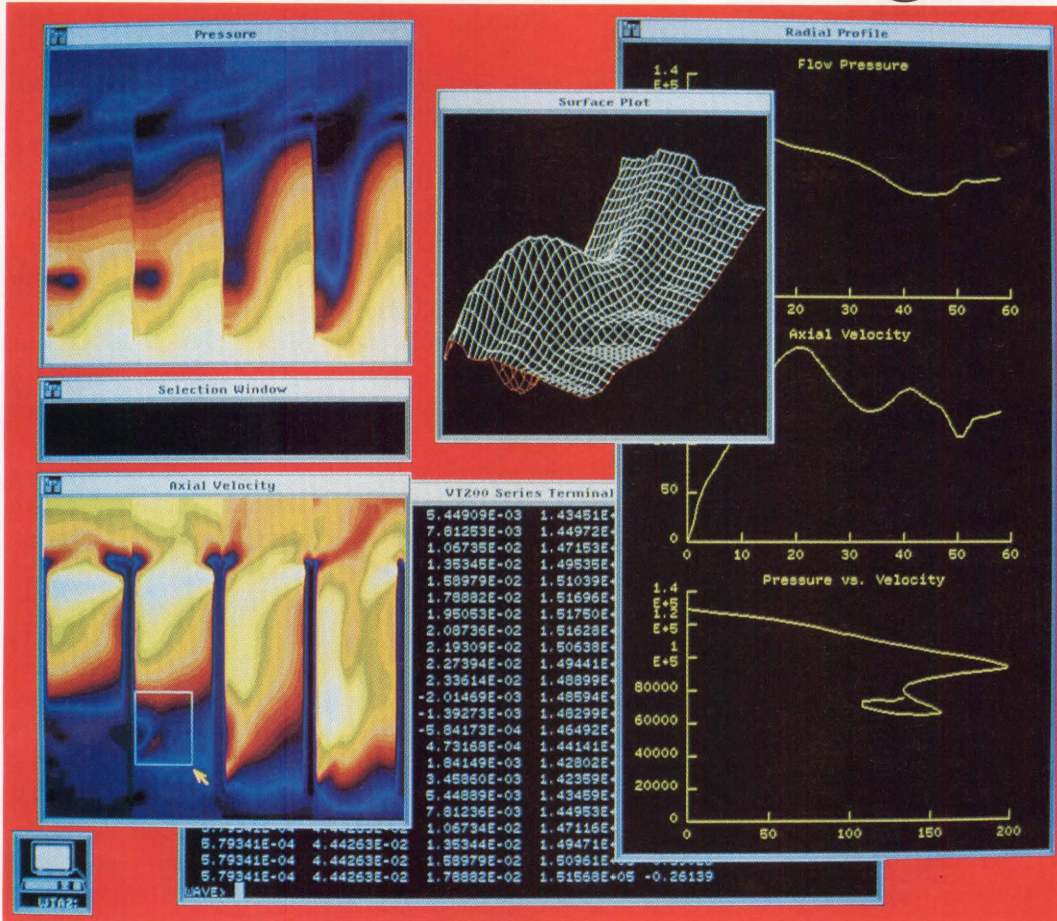
The MicroThree ranges in price from \$55,000 to \$100,000, while the MicroFive ranges from \$80,000 to \$160,000. Prices for the new 6000 products weren't available at press time.

For more information, contact Concurrent Computer Corp., 106 Apple St., Tinton Falls, NJ 07724; (201) 758-7000.

**Circle 449 on reader card**  
—Evan Birkhead



# Better Science Through Pictures



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

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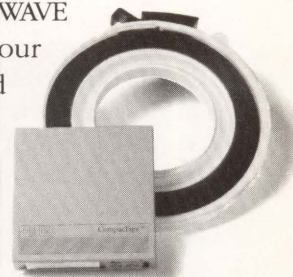
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## Today's Special: CocoNet

### *CocoNet Inc. Serves Up A Multiuser Server For DOS*

If you struggle with a DOS-only LAN, the CocoNet Tree Server may be for you. Developed by CocoNet Inc. of Coral Gables, Florida, the CocoNet Tree Server is a UNIX-based multiuser networking system for DOS PC users. For multiterminal applications, it provides a plug-and-play multiuser system with the speed and versatility of UNIX. It's 100 percent transparent to DOS users on the network.

CocoNet is designed for large financial departments requiring multiuser access of single applications, such as general ledger or payroll. However, it's appropriate for a variety of office situations, regardless of application. It offers 100 percent NetBIOS, TCP/IP and OS/2 compatibility. It also features support for Microsoft Windows on PC DOS machines with multiple log ins to different servers and a direct SNA-3270 Interface to IBM mainframes. In addition, it allows an interface with AppleTalk.

Further, CocoNet features 10 million bit-per-second network speed, multiuser, multitasking access to files and applications, DOS commands on UNIX files, UNIX services on DOS files, and DOS-to-UNIX and UNIX-to-DOS file transfers.

CocoNet offers drives D through Z with no partitions or size restrictions and nearly 299 MB of hard-drive

capacity on a single drive. It features guaranteed data integrity with the UNIX file system, virtual log ins from any PC to any server and program, and complete UNIX security and password protection at log in at directory and file levels and for each program. It also features remote backups. In addition, failed or disconnected nodes don't affect the server or the network. Diagnostics of any node or server are accomplished remotely via modem or any terminal.

This network server provides remote file sharing with built-in file and record locking and remote print spooling to any printer. It allows multiple servers, and

all DOS and UNIX machines on the network can be servers.

All UNIX services are available to each of the PCs connected to the network, as well as to the 32 or more dumb serial terminals supported. CocoNet functions as a complete multiuser UNIX system, simultaneously servicing network requests over an industry-standard 10-MB-per-second Ethernet link.

CocoNet contains proprietary software and an Intel 80386 server equipped with a monitor and keyboard, 4 MB of 32-bit main memory, an 80387 math coprocessor, a 1.2-MB floppy disk, a 380-MB ESDI hard disk and controller, a CocoNet Ethernet card, a 150-MB tape drive, remote diagnostics/management modem and an uninterruptible power supply.

The CocoNet system comes with the SCO UNIX Operating System and network software, PC Network Software, cables and terminator, and two serial and two parallel printer ports.

The system is completely assembled, and installation is simplified with autoloader and configuration of each node. The DOS side of the network requires a CocoNet card and the appropriate PC LAN software.

CocoNet comes with a one-year, on-site warranty provided by Intel Corporation of Santa Clara, California. Remote LAN management is offered free from CocoNet Inc. for one year.

For more information, contact CocoNet Inc., 4275 Aurora St., Ste. E, Coral Gables, FL 33146; (305) 447-4608.

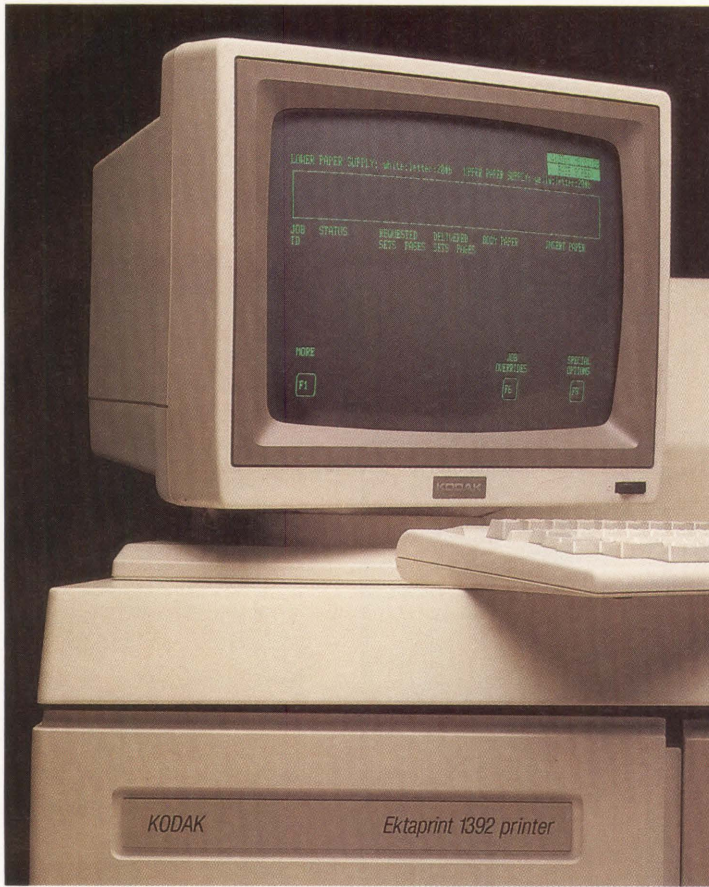
**Circle 546 on reader card**

—Eric Schoeniger



*CocoNet Inc.'s CocoNet Tree Server is a UNIX-based multiuser networking system for DOS PC users.*





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## The Object Objective

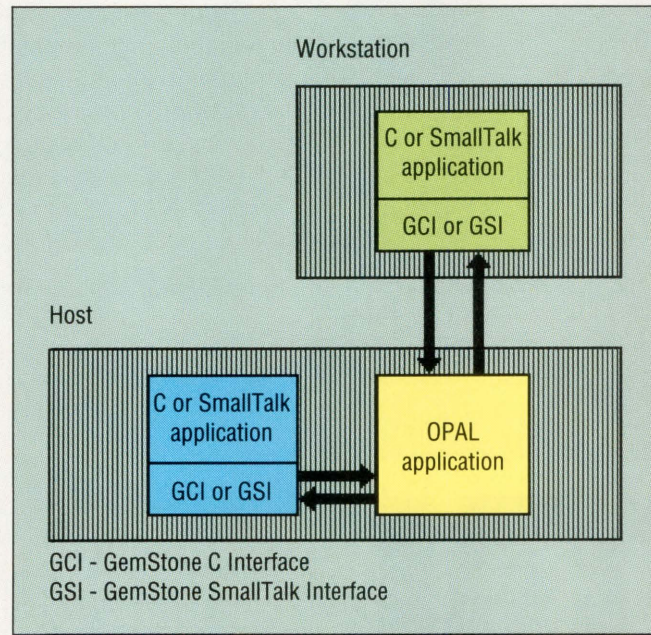
### Servio Logic's GemStone For VMS Manages Databases With Objects

The key behind object-oriented database management systems (OODBMS) is that they permit many simultaneous workstation users to share large amounts of data. Using point-to-screen objects and pull-down menus, the software is designed to be easy for non-technical people to use. It organizes information in an accessible fashion. It also provides many of the security, performance, data integrity and extensible features of RDBMSs.

During the last few years, *Fortune* 500 organizations have begun implementing this emerging database technology, and it successfully has completed the difficult transition from laboratory drawing board to real-world installations. Meanwhile, the object-oriented method has been gathering momentum, and many industry analysts claim that it could and should someday overtake the popularity of RDBMSs.

GemStone, from Servio Logic Development Corporation of Beaverton, Oregon, is one object-oriented package that already has many installations. Approximately 50 percent of GemStone object-oriented packages are sold to sites using CASE systems. The health-care industry and universities are among the early users of object systems.

Servio Logic projects that within five years GemStone will be used predominantly in business ap-



***In GemStone's client/server architecture, OPAL and GemStone sessions run on the VAX host but are accessible from workstations via communications interfaces.***

plications and document management, as well as in CIM environments. The company reports that it already has uncovered applications in integrated circuit design, computer-aided and architectural engineering, cartography and geography, office automation and large project management systems.

I saw a demonstration of GemStone on a Sun 386i front-ended by the SmallTalk communications package. It was a real estate application with 3,080 objects in the database representing every

county in the U.S. Using a mouse, the user could call up county maps and then click on "house" icons scattered across the maps to call up statistics on houses in areas of interest.

The statistics generally included a scanned image of the home's exterior plus data

manipulation; and a database that uses the object metaphor for describing complex data structures and their associated behaviors. The idea is that the user can define the structure, behavior and value of his data. GemStone uses a client/server architecture, with the server residing on the VAX.

GemStone is also available on the Sun 3 and Sun 4, Tektronix workstations and the IBM RT running AIX. However, applications can be developed on virtually any workstation, including the IBM PC and Mac 2, using versions of SmallTalk.

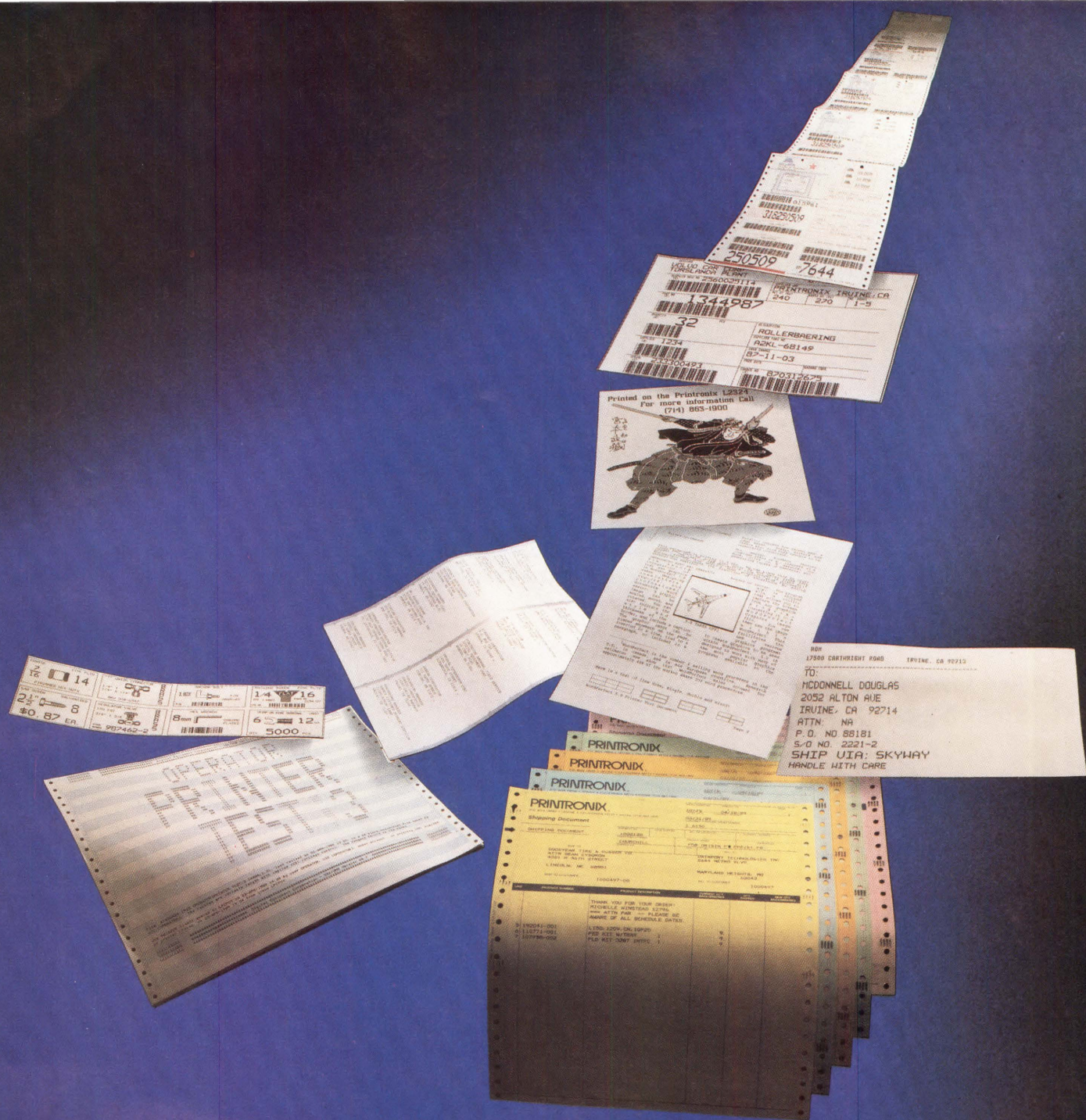
VMS system requirements for the GemStone object-oriented data manager and the OPAL environment include 1.5 MB of RAM for the database monitor and 3 MB of RAM for each simultaneous user; 10 MB of disk space for GemStone system files and 4 MB of disk space for data storage; a TK50 or 1,600-bpi 1/2-inch tape drive; VMS V5.0; and DECnet/VAX networking software.

The GemStone C Interface requires VMS C Compiler version 2.3, and TCP/IP is required for the Ethernet connection to Smalltalk workstations. Prices range from \$9,975 for a one- to four-user license on a MicroVAX II to \$119,700 for a one- to 64-user license on a VAX 8800.

For more information, contact Servio Logic Development Corp., 15220 N.W. Greenbrier Pkwy., Ste. 100, Beaverton, OR 97006; (503) 629-8383.

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## CHANGE DETAILS REPORT

System: ACCOUNTING.DEVELOPMENT/CON

Structure	Date;Time	User	Change-name
PAYROLL/SRC;3	01/06/86;15:26:06	JACKSON	CHG3008

### Description

Modified Social Security Number entry from single field to three fields to accommodate new reporting requirements.

### Actual changes

#1	Delete 1 line beginning with line 163: 05 SSN		PIC 9(9).
#2	Insert 4 lines: 163:1 05 SSN.		
163:2		10 SSN-1	PIC 999.
163:3		10 SSN-2	PIC 99.
163:4		10 SSN-3	PIC 9999.
	after line 163:0		

*This change to a COBOL source file is reported by CCC's change management facility.*

## Software Control

### *Softool Corporation's CCC Controls System Development Projects*

**C**ASE tools address the requirements definition, design, programming and maintenance phases of the software life cycle. Many tools have some form of version checking and change control. Change and Configuration Control (CCC), from Softool Corporation of Goleta, California, offers a complete solution.

CCC spans the entire software life cycle, giving management and developers the ability to track and manage system changes. Systematic change control ensures software integrity. Programmers won't have to worry about working with outdated versions of code. Changes to code must be authorized before they're included in a system's production release. Testing and validation procedures can be

automated to make sure production systems run smoothly before they're released in the field.

The first C in CCC designates change control. CCC can track changes to any machine-readable information, including source code written in any language, object and executable modules and documentation. A complete history of all changes is maintained. Previous versions of information can be reconstructed on demand. Changes are documented to ensure that the impact of a change can be tracked. Notification of emergency program repair helps developers coordinate system modification tasks. Change control is supported at line, program, application and system levels, so the impact of system modifications can be viewed from many perspectives.

The middle C designates configuration management. All versions of a product can be identified and controlled throughout the system life cycle. Multiple configurations are supported. Changes made to parallel systems can be monitored, allowing concurrent development to take place. Selected changes can be applied across a number of software configurations, eliminating the task of changing each system separately. All the components of a single configuration are kept in a single database. There's no need to manage multiple libraries. Storage space is saved because information common to two or more configurations is saved only once.

The third C relates to control. CCC can be integrated into existing software systems, providing immediate productivity improvements. Changes can

originate from a variety of sources, such as word processors, text editors, workstations and remote computer systems. Users can be given different levels of authority and responsibility to authorize and make system changes and to access data. Before a change is made, CCC produces reports detailing the impact such changes will have on the system.

Other reports can be generated based on various criteria, including differences among versions, users, dates and times. Audit trails are generated automatically, thus eliminating manual procedures. The level of archiving can be adjusted so that only the amount of information a manager requires needs to be kept. Test cases can be executed and the results compared, thus automating a time-consuming task.

Two new Softool products will be available this month. For smaller projects, Softool provides CCC/BASIC, a menu-driven, entry-level system. Prices for CCC/BASIC range from \$2,700 to \$56,000, depending on CPU. To enhance DEC's CMS, Softool also provides CCC/CMS. Development managers, quality assurance staff and production control personnel get the full benefit of CCC's capabilities, while programmers continue to use their CMS libraries. CCC/CMS is priced between \$2,500 and \$42,000.

For more information, contact Softool Corp., 340 S. Kellogg Ave., Goleta, CA 93117; (805) 683-5777.

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—David B. Miller



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# Trusting Your RDBMS

## Sybase Inc. Beefs Up RDBMS Security With The Secure SQL Server

The Sybase RDBMS, from Sybase Inc. of Emeryville, California, has the bizarre advantage of having entered the game late. With its first products shipping only about three years ago, Sybase was able to design a product based on current market demand and standards, unhindered by past database trends.

The resulting system is SQL-based, and offers a client/server architecture for database development and execution. The company has developed Sybase user-interface and front-end products for use with many major 4GLs, statistical packages, AI systems and graphic interfaces.

The system features two major components arranged in a client/server architecture. The client, called the Sybase SQL Toolset, runs the applications and development toolset and the server, called the Sybase SQL Server, runs the RDBMS. The server is a multithreaded single process that handles all database management functions and data requests from all users.

Now Sybase has released a new version of the SQL server called the Secure SQL Server, available for VAX ULTRIX systems. This adds the ability to store data of multiple security classifications within one database. Sybase reports that the system was designed to satisfy the requirements of the National Computer Security

Center (NCSC) Orange Book guidelines, which define levels of trusted systems.

The Secure SQL Server comes in two versions: one that adheres to the NCSC B1 level and runs with UNIX-based systems, and one that runs with the B2 level and is designed for bare hardware. B1 and B2 are measures of a trusted computer base's security enforcement mechanism.

Both server versions provide centralized control of data integrity, as well as mandatory and discretionary access control. Mandatory control is a label-based system that controls user access based on automatically assigned security labels. Discretionary control limits access based on user identity as opposed to data label.

The Secure SQL Server is priced from \$20,000 to \$200,000, depending on CPU size. This price doesn't include the SQL Toolset.

The other component of the Sybase RDBMS, the Sybase SQL Toolset, includes a set of programs called the Application Productivity Tools (APT) Workbench. These are windows-based tools used for prototyping, building and maintaining forms-based on-line applications. Sybase built APT to be extensible into visual, 4GL and 3GL environments. All developed applications also can be migrated to the Secure SQL Server.

The Sybase SQL Toolset's components include APT Build, a dictionary-driven automatic program generator; APT Edit, a visual forms editor for designing menus and screen layouts; APT SQL, an object-based 4GL for defining logic and processing for APT Edit forms; and APT

Execute, the environment for running these applications.

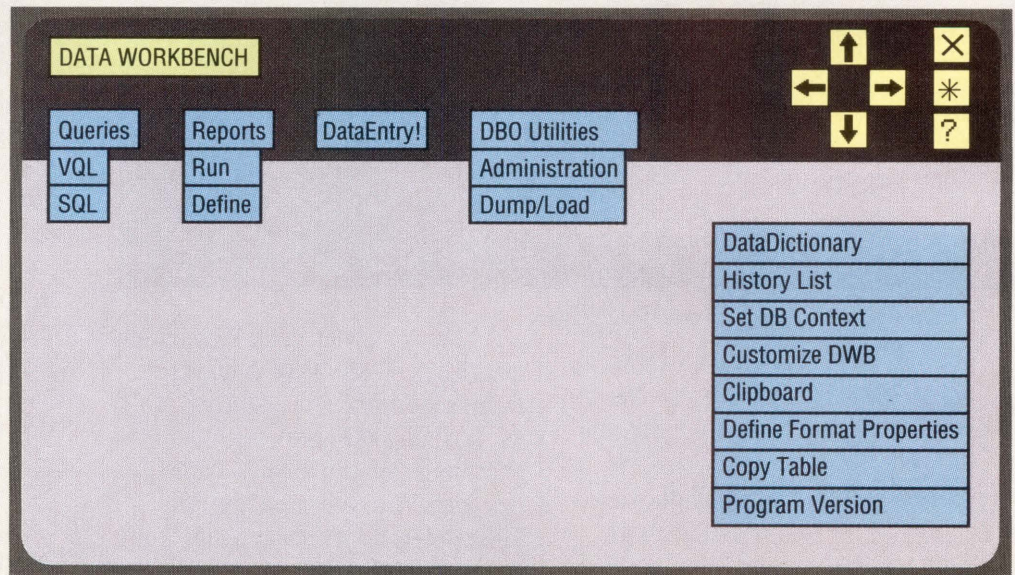
The Sybase SQL Toolset includes a Data Workbench that runs interactive SQL and visual SQL queries, reports and utilities. The program includes two programmable libraries: one for forms control from programs written in 3GLs; and one that provides a host-language interface from C, COBOL, PASCAL, FORTRAN or Ada to the Secure SQL Server.

Sybase has development and licensing agreements with such companies as Ashton-Tate, Interactive Development Environments, Microsoft, Next, Pyramid, Stratus Computer and Unify. There are more than 20 participants in the company's Sybase Software Partners Program.

For more information, contact Sybase Inc., 6475 Christie Ave., Emeryville, CA 94608; (415) 596-3500.

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—Evan Birkhead



*The SQL-oriented Data Workbench, which runs queries and reports, is an example of Sybase's pull-down menu structure.*



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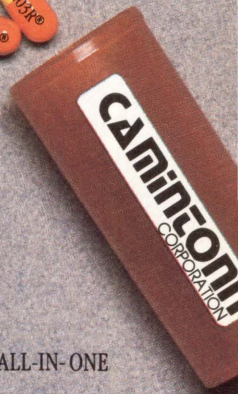
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## Going Tropical

### Tropical Communications Associates' pcX<sup>25</sup> Provides Link To X.25 Nets

The X.25 international standard network protocol provides error-free communications without the need to use file-transfer utilities such as KERMIT or XMODEM. It also allows long-distance access via local calls either by dial-up or leased-line communications.

pcX<sup>25</sup>, from Tropical Communications Associates Inc. (TCA) of Delray Beach, Florida, is a PC-compatible product that provides a synchronous link to private or public X.25 networks.

With pcX<sup>25</sup> and an internal or external Hayes, Universal Data Systems or Data Race modem, you can achieve remote X.25 access to a high-end VAX and can log onto multiple sessions with only one logical link. According to Sam Carter, president of Tropical Communications Associates, you

should be able to achieve remote access to any VAX that supports VT100 terminal emulation and packet data networks. (At press time, however, the company hadn't completed testing of this feature.)

Up to 20 simultaneous sessions are supported, and with a fixed split-screen capability you can view two sessions concurrently. For example, you can edit a document in one window and monitor file transfer in another. If you have more than two sessions running at once, a hot key lets you instantly switch display of the background session to the screen.

You can connect simultaneously to sessions on various VAXs or run several sessions from one VAX. Hot keys for switching displays of various sessions run from

1 through 0 (the first 10 sessions). Beyond that, you use two- or three-key macros.

Asynchronous and VT100 terminal emulation are supported (and you can use KERMIT or XMODEM), as is a print queue option in which you link your PC printer to the VAX and run "real-time" VAX print jobs in background on the PC printer while simultaneously working in foreground with other VAX sessions. The product treats the PC disk as its print spooler. Thus, print speed is determined by the speed of your modem. It can range up to 9,600 baud, depending on the modem you choose. (The Universal Data Systems modem is the only TCA-supported modem that achieves this speed.)

Both public and private networking are supported, although in North America X.25 public access lines are available only in major cities. The pcX<sup>25</sup> comes with 100 preconfigured North American dial-up numbers,

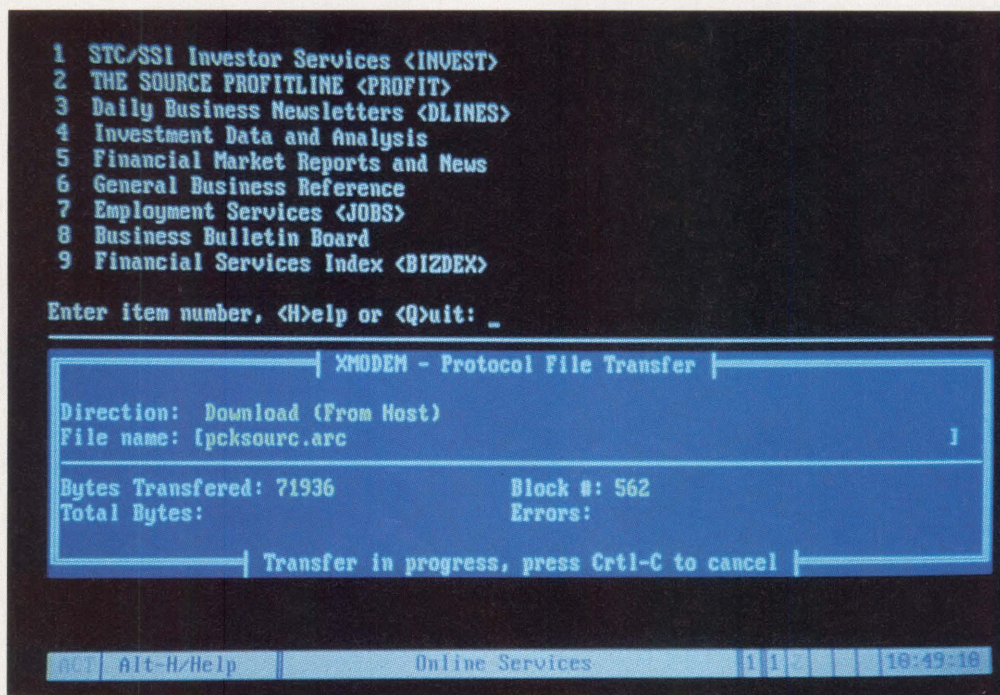
which access Tymnet, Tele-net, Datapac (a Canadian X.25 network) and others. Of the public networks, only Tymnet supports 9,600-baud communications, although Telenet reports that it will do so soon. Public information networks are also accessible. The product is preconfigured with dial-up numbers for The Source, CompuServe, MCI Mail and Dow Jones.

This menu-driven synchronous communications product requires an IBM PC XT/AT/PS2 or 100 percent-compatible microcomputer with at least 384 KB of RAM, MS DOS 2.1 or later and an internal or external Hayes, Universal Data Systems or Data Race modem. The software costs \$295.

For more information, contact Tropical Communications Associates Inc., P.O. Box 7057, Delray Beach, FL 33484; (407) 498-1302.

**Circle 451 on reader card**

—Elaine L. Appleton



*pcX<sup>25</sup> split-screen display with two active host sessions. The top session is menu selection, allowing keyboard entry. Bottom is XMODEM file transfer (to the same host).*



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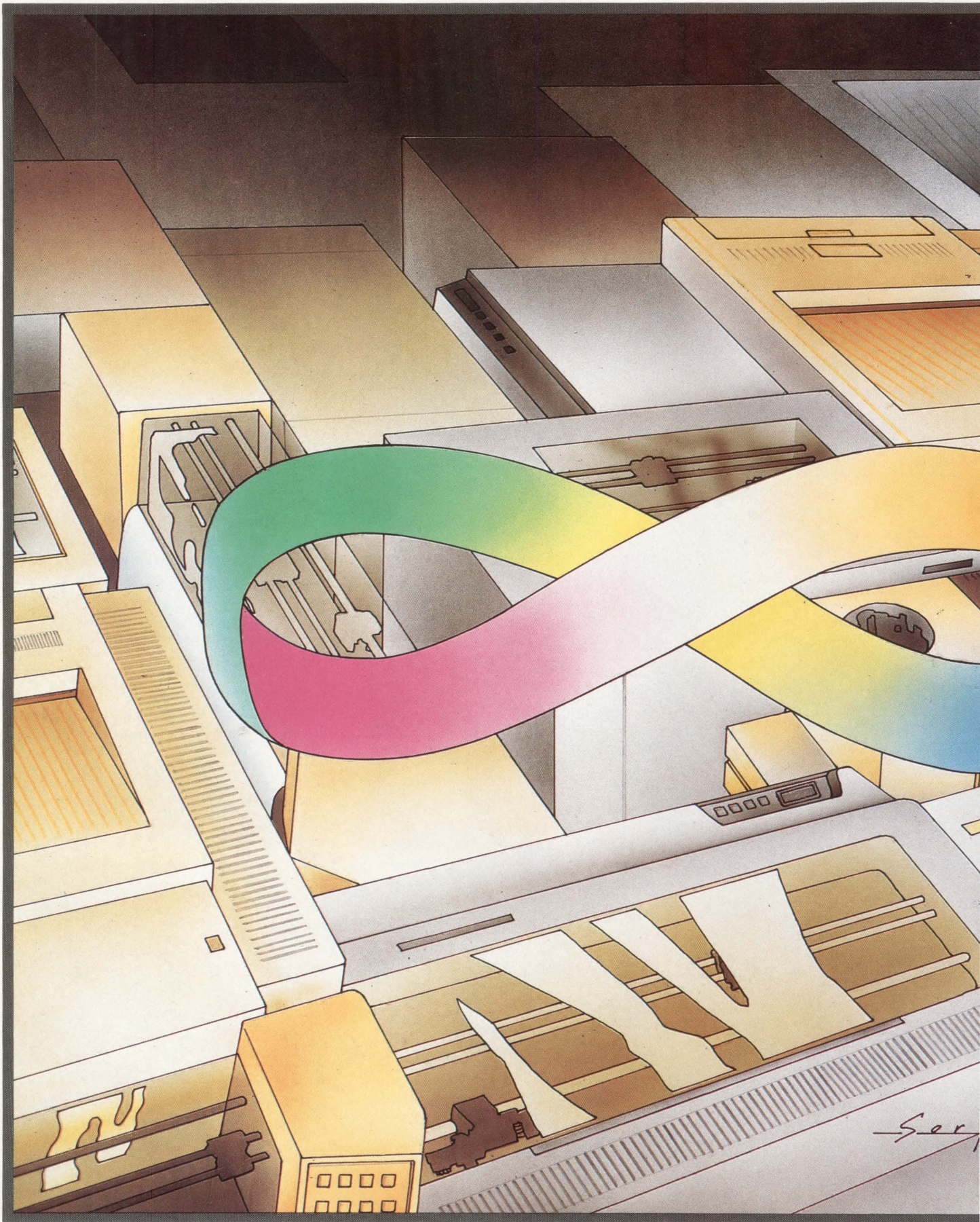


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# Printer Setup Modules

New software for ScriptPrinter

bridges ANSI and PostScript worlds.

THE CENTRAL IRONY of computer technology is that while systems and software become easier to use, the behind-the-scenes programming becomes more complex. Digital's latest release of its VAX ScriptPrinter Software, version 2.0, is a case in point.

In Digital's previous release of this software for its 8-ppm desktop PostScript laser printer (LN03R), you could print PostScript code and ANSI files that first had been translated into PostScript by the software's built-in ANSI-to-PostScript translator. Unfortunately, ANSI printer setup modules — small programs written to modify printer settings — posed a problem. The VAX ScriptPrinter Software couldn't

distinguish PostScript setup modules from ANSI setup modules.

In V2.0, Digital has added support for device control library search lists. Now you can specify a data type, ANSI or PostScript, for the device control libraries that contain your printer setup modules. You also can create a search list that specifies the order in which the device-control libraries will be searched for the printer setup modules you specify with the /SETUP or /FORM qualifier.

With the new printer software, ANSI setup modules and files automatically are translated by the software's ANSI-to-PostScript translator before being sent to the printers, while

BY DAVID C. LARRICK AND LEN F. WINMILL



## Using Printer Setup Modules With Non-Digital Printers

If your shop has non-Digital ANSI or PostScript printers, you still may be able to take advantage of ANSI and PostScript setup modules and files.

ANSI and PostScript code are highly transportable. You can send ANSI and PostScript setup modules and data files directly to non-Digital printers, as long as you don't mix data types. If you restrict PostScript modules and data files to PostScript printers and ANSI setup modules and data files to non-Digital ANSI printers, you'll stay out of trouble.

VAX ScriptPrinter Software is highly specific to Digital's 8-ppm desktop PostScript laser printer. It doesn't support non-Digital printers, PostScript or otherwise. This software features the device control library search list support and ANSI-to-PostScript translators required for seamless printer operation in a mixed ANSI/PostScript environment.

PostScript setup modules and files bypass the translation step. Digital's support for device control library search lists makes this process transparent to the user while protecting his investment in ANSI printer setup modules.

### Speaking The Language

In the recent past, you spoke only ANSI if you wanted to print text to a Digital printer. ANSI files consist of ASCII text — alphanumeric characters, punctuation and other symbols used in text representation — plus special non-printable strings.

These strings are called escape or control sequences, because they're introduced by ASCII 033, the escape character, or ASCII 155, the control sequence introducer (CSI). They perform a variety of printer operations required to generate properly printed pages. For example, sending the simple character string "PostScript Clones Don't Cut It" to an ANSI printer causes the printer to print that string. However, additional printer instructions are required so that you can obtain the printed output in its desired form.

One common command is the form feed, CTRL-L. Usually the last character in a print file, this command causes the printer to advance by one page. This is handy for an impact printer

such as the LA75, and vital for a laser printer such as the LN03 — unless you want the printed page to remain inside the printer.

Escape and control sequences can move the paper or current printing position up and down; select text attributes such as double-width/double-height characters; bold, underline, italicize and strike-through text; expand or compress horizontal and vertical pitch; set margins and tabs; and perform other functions.

Over the years, the ANSI standard has served many Digital users well. It's a fast, simple, consistent method of sending text to a printer. ANSI requires little or no text formatting for simple documents. In printing environments in which the appearance of the printed page isn't critical, ANSI is unsurpassed.

Now, technology and the marketplace are moving to more intelligent printers. Programmability and graphics capabilities rapidly are becoming product requirements. But the ANSI standard was designed for the character-cell environment. Thus, the simple ANSI model of sending character strings surrounded by printer control sequences — a descendant of the teletype — is ripe for succession.

Digital, along with IBM, Apple, Next and other industry notables, has adopted the PostScript page description

language from Adobe Systems Inc. PostScript is a complete programming language written for the specific purpose of describing the appearance of text and graphics on the printed page. PostScript's widespread acceptance as a de facto industry standard is indicative of its quality and capabilities.

PostScript adds new dimensions to familiar printing models. It provides complete control over how text and graphics appear on the printed page. PostScript applications can tap Adobe's scalable type outlines to generate text in a variety of sizes and styles. Among other things, PostScript can stretch, shrink and rotate graphic elements to any degree; overlay and superimpose text and graphics; print text in straight or curved lines; and fill characters with any texture or shade of gray.

PostScript commands perform powerful, page-oriented functions. Not surprisingly, a PostScript print file is different from an ANSI text file. Nevertheless, PostScript print files have an attractive characteristic: They normally don't contain non-printable characters. They're straight ASCII text. Therefore, PostScript files can be communicated easily among different systems.

### Peaceful Coexistence

Digital's first PostScript printer, the PrintServer 40 (LPS40), features built-in hardware accelerators that boost its maximum speed to 40 ppm for text files. Alongside the LPS40, Digital introduced version 1.0 of its VAX PrintServer 40 software. This software follows the client/server model, with two components: the client portion, which runs on a VAX/VMS system; and the server portion, which is downline-loaded to the PrintServer 40's embedded MicroVAX II processor. The PrintServer 40 software includes a PostScript interpreter and printer control software.

Because little PostScript application software was available for the VAX environment when the LPS40 was introduced, a key component of the PrintServer 40 software was a trio of software utilities that translate ANSI/





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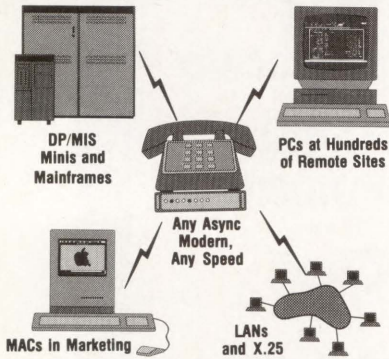
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CIRCLE 174 ON READER CARD

SIXEL, ReGIS and Tektronix 4010/4014 files into PostScript print files. The ANSI-to-PostScript software translator lets you print existing text files on the PostScript-only PrintServer 40 while migrating at your own pace to native PostScript applications.

Digital offered the same solution in the first release of the VAX ScriptPrinter software for its ScriptPrinter. At first glance, the ANSI translator solution seems ideal. But many Digital system managers and applications developers have discovered a nagging problem when attempting to bridge the ANSI and PostScript worlds: ANSI setup modules.

## ANSI Setup Modules

ANSI setup modules contain escape sequences, control commands and text. These modules are sent to a printer to set up the printer for a print job. They can contain forms information, letter-heads, page layout specifications, type-face information, boilerplate text and other setup parameters.

Setup modules are created with a standard text editor, such as EDT or TPU, and placed in device control libraries using the VMS LIBRARY/INSERT command. Suppose a system manager wants to make it easy for users to print memos on preprinted company letter-head. The system manager creates an ANSI setup module called MARGINSET that contains all the ANSI commands required to format the text to accommodate the company letterhead. These commands might reset the printer's top, bottom, left and right margins.

You can create simple letters containing straight text, leaving the page formatting to the setup module. To print a letter, LETTER.TXT, on company letterhead, at the VMS prompt type:

```
PRINT/SETUP=MARGINSET LETTER.TXT
```

This DCL command sends the MARGINSET setup module to the printer, adjusting margins, tabs and other printer characteristics. In other words, it sets up the printer for the text

file, LETTER.TXT.

In an all-ANSI world, ANSI setup modules are a convenient, time-saving solution for applications printing.

Many system managers have developed large libraries of them for their ANSI printers. Substituting a PostScript printer in this environment, even with the benefit of the ANSI translators, complicates matters considerably.

As a Digital computing environment migrates to PostScript printing, more native PostScript print files appear. These can be ordinary print files or PostScript setup modules that perform the same functions as ANSI setup modules. However, PostScript's flexibility lets developers create setup modules for performing complex printing tasks — tasks that ANSI setup modules would be unable to match.

PostScript setup modules and data files frequently coexist with ANSI setup modules and text files in the same environment. ANSI data, both setup modules and text files, must be translated into PostScript before printing. PostScript setup modules and data files must *not* be sent through the ANSI translator before printing.

In the mixed ANSI/PostScript environment, therefore, four distinct printing requirements emerge:

1. Using ANSI setup modules with ANSI files.
2. Using PostScript setup modules with ANSI files.
3. Using both ANSI and PostScript setup modules with ANSI files.
4. Using PostScript setup modules with PostScript.

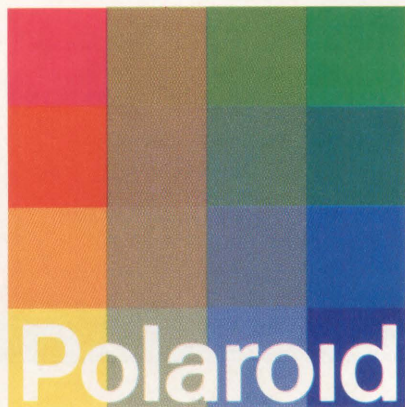
How can the software manage these printing scenarios? How can you control which files get translated and which don't? The answer is device control library search lists, a capability of Digital's ScriptPrinter software V2.0.

## Device Control Library Search Lists

Device control library search lists are Digital's solution to the challenges presented by a mixed print-file environ-



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ment. You must use different libraries for ANSI and PostScript setup modules; the two data types can't be mixed in the same library. Because setup modules reside in different device control libraries, ANSI and PostScript setup modules that perform the same function can have the same name.

In the following examples, an ANSI setup module, MARGINSET, changes the top, bottom, left and right text margins to accommodate a letterhead. Next, a PostScript setup module, named LETTERHEAD, prints the company letter-

terhead at the top of the page. Finally, an ANSI text file, PRINTER.TXT, generates the text of the letter (see Figure 1).

The first step is to create the setup modules. The following is a sample of an ANSI setup module:

```
<ESC> [11h<ESC> [71<ESC> [14
m<ESC> [750;3000r<ESC> [225;2225s
```

This ANSI setup module, MARGINSET, sets the printer's top, bottom, left and right margins to accommodate the company letterhead. It also

selects a 12-cpi elite type font.

Figure 2 shows a sample PostScript setup module. This PostScript setup module, LETTERHEAD, prints a company letterhead at the top of the page.

Next, you create device control libraries to contain the setup modules you've created. These libraries reside in SYSS\$LIBRARY. Use the following command:

```
$ LIBRARY/CREATE/TEXT-
SYSS$LIBRARY:libraryname.TLB
```

To create a PostScript device con-

**Figure 1.**

**NINI**  
New England International Networks, Inc.  
549 Buffalo Boulevard  
Boston, MA 02108

August 1, 1989

Shelley Beeman  
Account Representative  
Precipitous Printing Services, Inc.  
10000 Rodgers Road  
Millfield, MA 02020

Dear Ms. Beeman:

I am writing to let you know we will not be renewing next year's contract with PPS for printing services associated with our newsletter, the NINI News.

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Sincerely,

John P. Fahey

Vice-President, Corporate Communications  
New England International Networks, Inc.

JF:ss

Letterhead created with PostScript setup module

Text created by ANSI text file

Type font, top, bottom, left, right margins set with ANSI setup module

*This letter was produced in one print job.*

**Figure 2.**

```
%!
/in (72 mul) def
/page_width 8.5 in def
/y_value 10.5 in def
/point_size 10 def
/center_line {dup stringwidth pop page_width exch sub 2 div
} def
/next_line { y_value point_size 1.2 mul sub dup /y_value
exch def } def
/shl { center_line next_line moveto show } def
/Helvetica-Bold findfont 18 scalefont setfont
(NINI) center_line y_value moveto show
/Helvetica findfont point_size scalefont setfont
(New England International Networks, Inc.) shl
(549 Buffalo Boulevard) shl
(Boston, MA 02108) shl
```

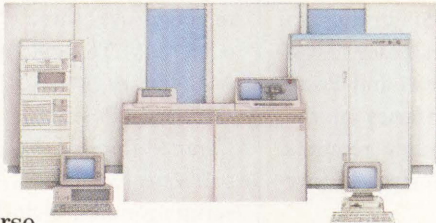


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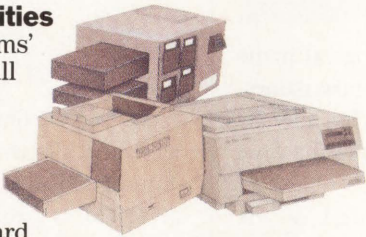
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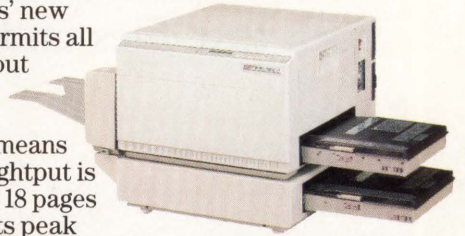
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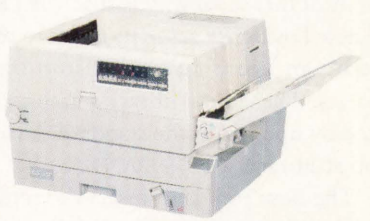
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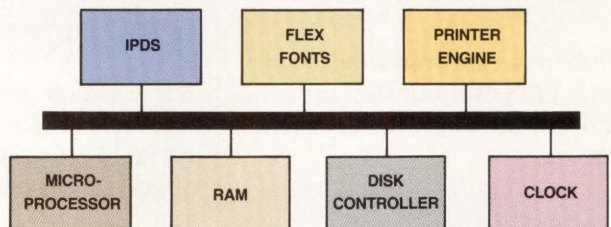


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Sometimes, you can have too much of a good thing. So Printer Systems developed the Intelliprint 106. It, too, is based on 32-bit RISC technology, so its 6 page per minute rated speed is its real throughput. And its duty cycle of 3,000 pages per month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



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CIRCLE 337 ON READER CARD



## NOW, DIGITAL USERS CAN MIX and match freely from among the ANSI and PostScript data types for both text files and setup modules.

control library named PS1.TLB, use:

```
$ LIBRARY/CREATE/TEXT-
SYSS$LIBRARY:PS1.TLB
```

Note that these commands require system management privileges. A key benefit of this capability is that you can add new PostScript setup modules to the system in your own, customized libraries. These new libraries aren't affected by updates to the standard device control library, CPSS\$DEVCTL.

The next step is to insert the setup modules into the device control libraries. To do this, use:

```
$ LIBRARY/INSERT-
SYSS$LIBRARY:libraryname.TLB module_filename
```

To insert a PostScript setup module named LETTERHEAD.PS into a PostScript device control library named PS1.TLB, use:

```
$ LIBRARY/INSERT-
SYSS$LIBRARY:PS1.TLB LETTERHEAD.PS
```

The next step is to add the libraries you've created to a library search list. In this step you provide the software with the information it needs to distinguish between PostScript and ANSI data types.

### Library Search Lists

If you've created both ANSI and PostScript device control libraries, the library search list enables the software to skip the libraries whose setup modules use the wrong data syntax for a given print job.

In other words, PostScript-only print jobs search only PostScript

libraries, skipping the ANSI libraries, so no ANSI translation takes place. ANSI print jobs search both ANSI and PostScript device control libraries in the event that the setup module requires translation into PostScript before printing.

Upon installation of the Print-Server software, the INITIALIZE/QUEUE command in CPSS\$STARTUP.COM includes the qualifier /LIBRARY=CPSS\$DEVCTL. To specify a library search order, edit the INITIALIZE/QUEUE command in CPSS\$STARTUP.COM as shown:

```
$ INITIALIZE/QUEUE-
.
.
.
/LIBRARY=logical-name
```

where logical-name is a logical name that expands to a list of library names. All the library names in the list must be in SYSS\$LIBRARY and have the file type TLB.

Next, add the definition of the logical name to be expanded to CPSS\$STARTUP.COM. The command to define the logical name is:

```
$ DEFINE/SYSTEM/EXECUTIVE-
logical-name search-list
```

where logical-name is the name you assign to the search-list and use with the INITIALIZE/QUEUE/LIBRARY command, and search-list is the list of libraries to be searched. For each library that includes the /DATA\_\_TYPE qualifier, enclose the library name and the qualifier in quotation marks. If you don't use the /DATA\_\_TYPE qualifier, you don't need

to enclose the library name in quotation marks. The default data type for a library is PostScript.

You must stop and start a queue to use a new definition of the logical device control library. If you only change the contents of a library, you don't need to stop and start the queue.

### Working Together

In the following example of a device control library search list, a system manager uses three PostScript libraries (CPSS\$DEVCTL, PS1 and PS2) and one ANSI library (ANSI1). CPSS\$DEVCTL is the standard PostScript device control library supplied by Digital with the software. PS1 and PS2 contain PostScript setup modules, including modules that have the same names as their equivalents in ANSI1. ANSI1, of course, contains ANSI setup modules.

The example specifies the search order CPSS\$DEVCTL, PS1, ANSI1, PS2:

```
$ DEFINE/SYSTEM/EXEC ALL_DEVCTL-
CPSS$DEVCTL,-
"PS1/DATA_TYPE=POST",-
"ANSI1/DATA_TYPE=ANSI",-
PS2
$ INITIALIZE/QUEUE-
/LIBRARY=ALL_DEVCTL-
.
.
.
```

Using the libraries and search order described, all print jobs look first in the standard device control library, CPSS\$DEVCTL, for the required setup modules and for any setup modules that explicitly had been specified with /SETUP or invoked implicitly with /FORM. The print job continues through the search list until it finds a match. After looking in CPSS\$DEVCTL, all print jobs look in PS1 for any specified setup modules not found in the standard device control library. Next, any ANSI job looks for ANSI setup modules in ANSI1; PostScript jobs skip the ANSI library. Finally, all jobs look for PostScript modules in PS2.

If you have identically named ANSI and PostScript modules that perform the same function, determine which you



want as the default for ANSI jobs. In the example above, you'd place the PostScript module in PS1 to use a PostScript default for ANSI jobs or in PS2 to use the ANSI module as the ANSI job default.

## Solution At Work

This solution shields the complexity of device control libraries from the user. Despite the added capabilities, the /SETUP qualifier of the print command works exactly as it did in previous releases of the ScriptPrinter software. It also works the same as it would for an ANSI printer in an all-ANSI environment. The software does the work in determining when or whether software translation from ANSI to PostScript is required.

Now, Digital users can mix and match freely from among the ANSI and PostScript data types for both text files and setup modules. Hybrids of new and existing applications code can enable system managers to deliver new features and functionality with minimal development expense. For example, a series of tax forms created by a new

PostScript setup module could be filled in with data extracted from existing ANSI data files generated by existing applications.

The latest release of the ScriptPrinter software merges two very different printing cultures. This creates a seamless applications environment. —David C. Larrick is a principal software

engineer, Printing Systems Software Engineering, and Len F. Winnill is a marketing consultant, Printers Base Product Marketing, for Digital's Desktop Systems Group in Westford, Massachusetts.

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**CIRCLE 344 ON READER CARD**





# Print And Print Share Alike

Sharing printers in a multivendor environment.

BY JOHN ENCK

ASK A PROGRAMMER about printing, and he'll tell you about character codes, carriage controls and the difference between WRITE BEFORE and AFTER output constructs. Ask a technical writer about printing, and he'll tell you about fonts, typefaces and character enhancements. Ask an electronic artist about printing, and he'll tell you about dpi, grayscaling and vector versus bit-mapped graphics.

In a single-vendor environment, this variety is constrained by the number and types of printers supported by that vendor. For example, it's unusual to find a DEC shop with an IBM 3287 workstation printer next to an LA75 or an HP 2567B line printer next to an LP29. Applying these considerations to a multi-

vendor arena, however, is a nightmare.

Aside from the variety of output, the amount of output is, in many environments, significant. For example, a 20-MB disk drive is equal to about 5,000 sheets of printed paper (at 4,125 characters per page), or 10 reams of paper. A disk drive lasts about five years, so it's not difficult to see how output can overshadow storage.

Because print is a disposable media, many people don't consider their print capacities. But the demand for output in many formats brings forth three important facts:

1. The demand is real.
2. Individual needs are diverse.
3. Individual needs and the abilities of a printer don't always match.

Implementing an efficient flow of printed information in a multivendor environment involves juggling these factors with the data communications issues to create optimum relationships of users to resources and of job submissions to job completions.

## **Please Pass The Printer**

In a Utopia where things cost what we think they should, the solution would be to give each person a printer. Low-end dot-matrix printers are a dime a dozen, but the output quality isn't the best. (Low-end printers, such as the LA50 and LA75, remain tremendous aids for situations that require high volumes of draft output.)

The expense of a printer isn't



limited to hardware and supplies alone. It's technically feasible to hook a printer to a terminal, but usually it's connected to DECnet via a DECserver. The combined cost of the terminal server port, the increased network traffic, the queuing overhead and space is significant when dealing with a lot of printers.

This train of thought inevitably leads to printer sharing. One or more high-end printers often are selected based on weighted needs for system, draft, quality and graphics output. In addition, a user's physical access to the final output must be considered. Forcing someone to travel 10 stories several times a day is unreasonable.

When the printed data involves personnel, payroll or other confidential material, the output device must be kept in a secure area. In computer shops that have traditional computer rooms, this output usually is handled in that secure environment to maintain a reasonable level of control. In environments in which no secure area exists, the need for individual output devices can be justified.

For this discussion, print output is grouped into four classes: simple text, dot-matrix, cartridge (non-PostScript) laser and PostScript. It's important to match an output file with a compatible output device.

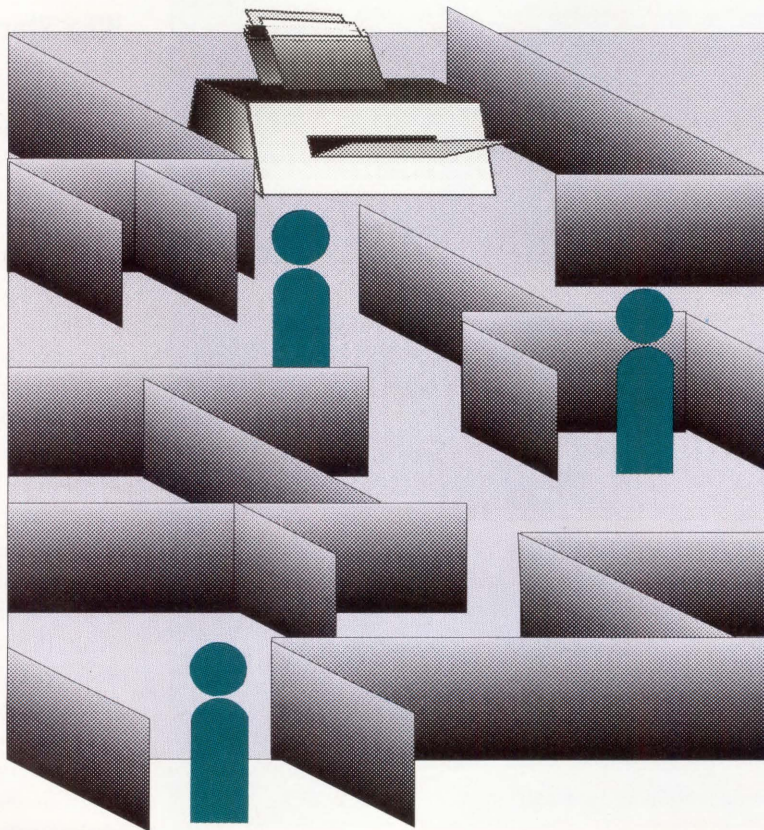
In a single-vendor environment, this match-up is rarely of concern, because the software normally is configured to use the correct printer for output. In multivendor environments, however, in which printers are shared among different computer types, forwarding the correct output to a com-

patible printer is complex.

Equipment can have fundamental differences in the representation of characters. For example, DEC uses ASCII for character representation and IBM uses EBCDIC. The ability to translate between these standards is critical if print resources are to be shared.

After you've resolved basic character representation, you must identify a mechanism for transporting the output files between the two makes of equipment. To make this selection, two questions must be answered:

1. What varieties of print format will be transferable?



2. Will the output be transferred automatically or by the user?

The answers are important in determining what type of transport should be used.

## Variety Is The Spice Of Print

The question of print format variety defines the intelligence required to handle the data conversion between systems and printers. Simple text transfers

require the minimal conversion of carriage-control characters. But if all possible print files are to be transferred, then the transfer tools must determine the type of output and an appropriate destination for the output, so it knows to what format to convert.

The dot-matrix class of output is one of the worst cases for print file conversions. For example, compare the standard DEC dot-matrix control sequences with the Epson FX-80 sequences. Although the text-control sequences are similar in intent, they're radically different in implementation. The significant difference between these

two is the way they handle graphics. (IBM graphics printers fall into the same category as the Epson.)

DEC developed the SIXEL representation for graphics to ensure that graphics data falls within the realm of displayable ASCII characters. Epson and IBM, however, had no such concern. To implement their graphics data representation, they used all eight bits to correspond to eight vertical printer dots. This makes it extremely difficult to transmit graphic print data destined for Epson/IBM printers using standard data communications protocols (see Figure 1).

Unfortunately, dot-matrix printers aren't alone in this category. At the higher end of the spectrum, the non-PostScript lasers share the same problem, only complicated by price and technology. You must consider the timesteps and sizes available. With font-optional lasers, it's extremely important to match the font requirements of the output with the fonts available on the printer. Printing a document formatted



## Figure 1.

■ **\_b0 LSB** Using SIXEL representation, each bit in a byte of graphics data corresponds to six vertical printer dots. Therefore, each encoded byte can contain a value between 00 (hex) and 3F (hex). To keep the data within the range of displayable ASCII characters, the value of 3F (hex) then is added to the encoded byte, resulting in a standard eight-bit byte containing values between 3F (hex) and 7E (hex). Because the graphics data falls within the realm of standard displayable characters, it has virtually no potential of interfering with data communication protocol handshakes.

■ **\_b0 LSB** Under the Epson/IBM graphics philosophies, each bit of a graphics byte corresponds to one of eight vertical printer dots. Given this encoding sequence, a given graphics byte can contain a value between 00 (hex) and FF (hex). This full use of all eight bits limits the options for transporting the data over data communications links — because all eight bits are used, either a bit-level protocol or a protocol supporting transparent (binary) data must be used. Further, care must be taken to ensure that any interpretation of data (CR/LF mapping, tab expansion, and so on) is disabled.

### SIXEL versus "Eightel" — bit-to-dot mapping.

## Figure 2.

### Bit-Mapped Graphics Line Draw Sequence

`<Escape><L><n1><n2><graphic data>`

Each byte of the graphic data indicates which of the vertical pins is to print for that horizontal position. The two bytes "n1" and "n2" represent the count of horizontal points to print. A trigger sequence (e.g., "ESC L") signals the start (and density) of a line of graphics data.

### PostScript Line Draw Sequence

`<x points><y points>rlineto`

In Page Description Languages, such as PostScript, commands are sent to the printer to control the operation. In this example, the draw relative line to (rlineto) command is used to draw a line from the current relative position to another point defined by the X and Y values. For example, the command "72 0 rlineto" would draw a horizontal line between the current position and a point 72 units (points) to the right. These commands are grouped into a text file to create a complete page description.

### Bit-mapped versus PostScript — a simple line.

for 8-point proportional font output on a laser with a 12-point, fixed-space font cartridge produces unfavorable results.

Only at opposite ends of the spectrum can we find adequate breathing room. At the low end are system printouts and simple text files. Neither requires graphics, and both move from system to system easily because they're so gracefully uncomplicated. On the high end are the PostScript printers that can produce extremely sophisticated output while remaining simple to interface with because they universally accept the same command file structures (see Figure 2).

### Who Started It?

If transfers are initiated manually, then the human interface is more significant than the size and performance of the product. However, for automatic transfer capability, the product must be lean and mean. It must be able to introduce itself into the system without any negative effects on overall performance.

For example, if only simple text files are to be transported, and the transfer is to be automatic, then any of the wide variety of gateway products (e.g., the DEC SNA gateway, the Forest Network Processor or JNet) will do a satisfactory job. These products provide RJE (or NJE) job functions that handle printed output as part of overall job management. In an SNA RJE environment, they emulate the IBM 3770 RJE station, comprising multiple input and output devices. In a bisynchronous RJE environment, the 2780 or 3780 RJE stations are typically emulated.

On the other end of the scale, if each transfer is initiated by the user, and any variety of print output is permitted, then the choices become more limited.

Because reality often introduces practical limitations to such complex problems, you can reach many compromises. Using KERMIT file transfer from system to system is acceptable, as are any of the wide variety of generalized file transfer products. However, these solutions tend to be isolated to more technical environments because of



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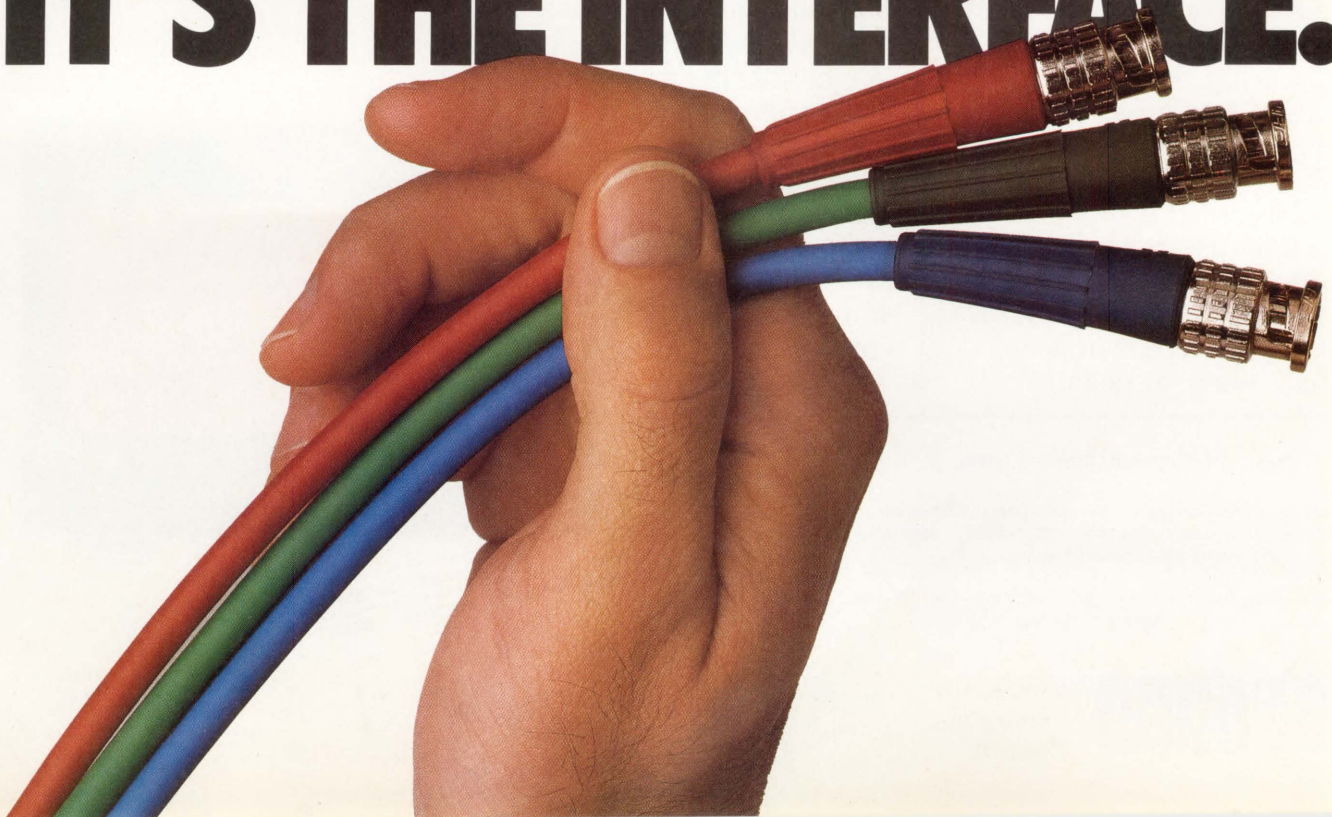
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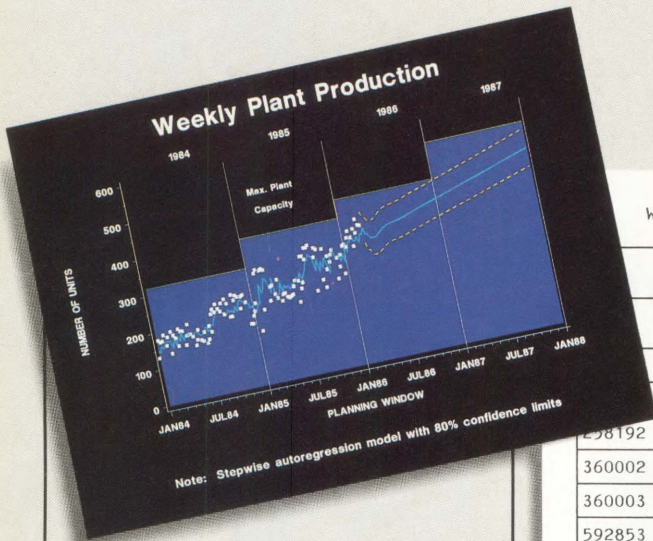
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60	6	4	9	6.5	83
70	7	4	10	7.0	85



AFTER THE ROOTS OF THE  
print are moved, the print  
can be generated locally  
for the native printers.

the absence of a friendly human interface.

**Attacking The Problem**

An alternative approach to printer sharing via print file transfers is to attack the problem at the roots by moving the source of the output. If the output is a letter, move the original document file. If it's a program listing, move the source file. If the output is a report, move the

data. After the roots of the print are moved, the print can be generated locally for the native printers.

This is a very reasonable approach if the data will be useful on the new machine. Moving the source of a program, for example, is pointless if that program won't be compiled and used on the target computer. Similarly, moving a database and/or a set of application programs is a non-trivial task that's an

exercise in futility if that data won't be maintained on the new host.

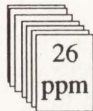
Moving source documents and graphics files presents different problems. Because each word processor or graphics program stores information in a special format, moving the data also requires a program on the new host that understands that same format. Graphics are more sensitive to this issue because, unlike word processing, there's a lack of format-conversion tools.

**The Bottom (Print) Line**

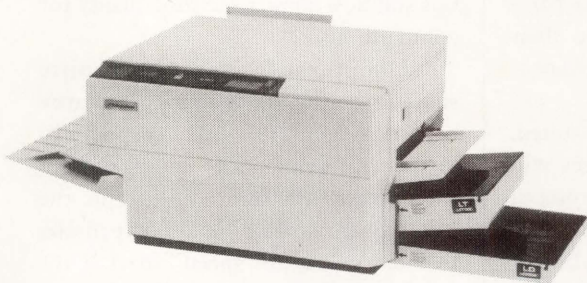
Here are some practical solutions to the problem of printing in a multivendor environment:

**1. Hardware solution** — The low-end solution for print sharing lies in hardware boxes that perform printer sharing — either by sharing multiple printers for one host or sharing one

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printer among multiple hosts.

Using such a device to share printers among hosts may be economical in low-volume environments but impractical if there's a large mix of printers. For example, although sharing one printer between two hosts is a practical solution, sharing two dissimilar printers on one host port serves virtually no purpose.

**2. Software solution** — An interesting home-grown solution is to imbed universal control characters into text streams to signify the beginning and end of character enhancements. Figure 3 shows example universal codes and corresponding printer values. These text streams then are run through print filters as appropriate for the actual output destination.

More specifically, print files are written by the application using these universal codes. When a print file then is routed to a specific printer, the spooler (or filter) for that printer translates the universal codes into the appropriate sequences for the destination printer.

Although this is an excellent application solution because it neatly addresses report and form-oriented output on all printers, it has limitations. Graphics support is difficult, although

**Figure 3.**

Universal	Meaning	LA75	Epson/IBM*
ESC B +	Begin bold	CSI 1 m	ESC E
ESC B -	End bold	CSI 22 m	ESC F
ESC U +	Begin underline	CSI 4 m	ESC - 1
ESC U -	End underline	CSI 24 m	ESC - 0
ESC I +	Begin italics	CSI 3 m	ESC 4
ESC I -	End italics	CSI 23 m	ESC 5
ESC L +	Begin large	CSI 4 w	ESC W 1
ESC L -	End large	CSI 0 w	ESC W 0
ESC S +	Begin small	CSI 6 w	SI
ESC S -	End small	CSI 0 w	DC2

\*This chart lists the values for the Epson FX-80. The values are identical to the IBM graphics printer for these cases. (The IBM graphic is extremely compatible with the Epson codes, but it isn't 100 percent compatible.)

**By using "universal" codes, the application is isolated from the physical printers. Spoolers and filters then translate the universal codes to the sequences appropriate for the physical device.**

not impossible, to implement. Also, off-the-shelf software doesn't conform to the universal standard. It leaves documentation and graphics departments out on a limb, because their dependence on third-party software is so strong.

**3. Off-the-shelf solution** — As noted, gateways and emulation packages will handle the movement and conversion of system printouts among dissimilar systems. If these products include binary file transfers, they also provide an efficient mechanism for moving all types of print files among systems.

The limitation to this solution is that it doesn't address dot-matrix or non-PostScript laser output. The actual print file can be transferred, but it's of almost no value on the opposite system. Still, these transport mechanisms can be used in conjunction with other solutions listed here.

**4. Often expensive solution** — Page Description Languages (PDL) are the ideal solution. Because the command language program is stored in a simple text file, that file easily can be routed to

any system for output on any PDL-compatible printer. Given the quality of output of today's PostScript printers, this solution doesn't sacrifice quality for compatibility.

Unfortunately, speed and price stand in the way of universal acceptance of PDL printers. PDL (especially PostScript) printers are excruciatingly slow as they interpret and execute the PDL sequences. They're also expensive. In today's "pay for speed" market, it's difficult to find acceptance for "pay to wait."

Handling print output is difficult. The subject serves as a platform for arguing whether or not the end justifies the means (good output is worth any price) or the means justify the end (ease of use overrides print quality). Final analysis shows that print sharing in a multivendor environment can be complex, but can yield real cost benefits. — *John Enck is product marketing analyst at Forest Computer Inc. in Okemos, Michigan.*

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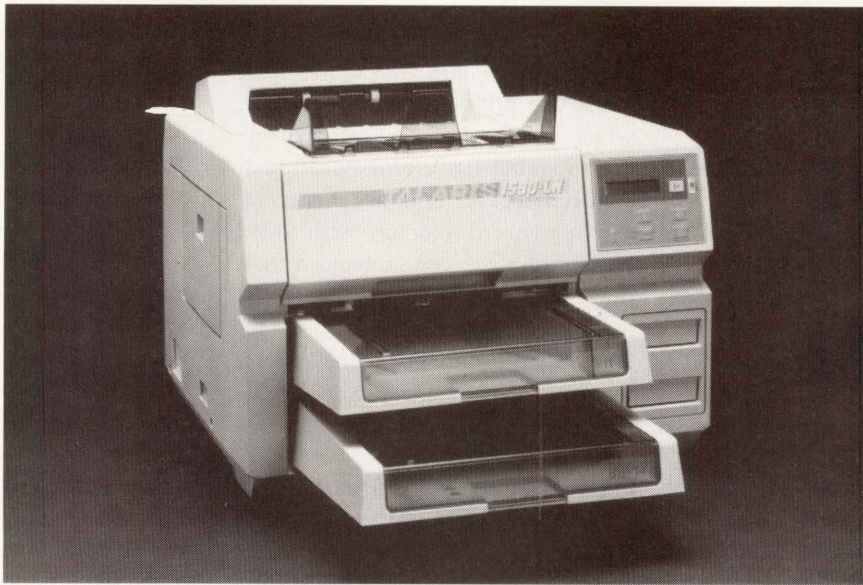


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# ROUNDTABLE

## UNIX or VMS?

### In An Era Of Change And Upheaval, Which Operating System Will Win Out?

Continuing our series of editorial roundtables, DEC PROFESSIONAL technical editors gathered in May for a teleconference on UNIX and VMS.

Participants included Publisher Carl B. Marbach; Editorial Director Dave Mallery; UNIX Editor Elaine L. Appleton; DCL Editor Kevin G. Barkes; Senior Editor Evan Birkhead; ULTRIX Editor Philip E. Bourne, Ph.D.; Manager, DP Laboratory and Testing Center David B. Miller; and Technology Editor Philip A. Naecker. The discussion was moderated by Managing Editor Lou Pilla.

**Pilla:** With the introduction of Sun's new workstations, HP's takeover of Apollo and the recent announcement of the DECsystem 3100, much attention has been focused on UNIX and the capabilities it provides. We hear about significant standards activity in the UNIX area. And DEC seems to be leaning toward UNIX and perhaps away from VMS. Why consider UNIX or ULTRIX as opposed to VMS?

**Barkes:** The selection of UNIX versus VMS depends on certain factors. There's a growing disparity between the cost of a VMS platform and a UNIX platform. You must consider what it costs to license your software

and determine whether or not the advantages inherent in VMS are worth it. It also depends on the environment in which you operate. If your environment requires tight security and such connectivity features as clustering, perhaps you should stay with VMS.

**Marbach:** Are you convinced that, for a given task, UNIX or ULTRIX is less expensive than VMS?

**Barkes:** No, but given the criteria many place on determining the value of an operating system, UNIX is less expensive.

**Marbach:** For a given task, is an ULTRIX-based computer a cheaper solution than a VMS-based computer? In my view, there's no cost justification for one operating system over another, because I don't have performance data. I can't say that, for a given task, one system is better, faster or cheaper.

**Barkes:** The key is the application. And, because of UNIX's infiltration into universities, you can get people with UNIX experience more easily than you can get people with VMS experience.

**Marbach:** Do you program in UNIX?

**Barkes:** No, but in terms of applications and the system side of applications, more people have a stronger base in UNIX.

**Marbach:** Systems programming and management are self-serving fields. Such people allow us to use a tool. The application programmers and the application itself do the real work, and that's what we should be concerned with.

**Naecker:** UNIX is the operating system on the most price-competitive machine that exists, at least for many applications. For example, there's no difference in the disks that you can get for VMS or for ULTRIX, so the disk subsystem performance for, say, a database application is a given.

**Marbach:** For the physical part it's a given but not for the logical part.

**Naecker:** Correct. But suppose you're running a real database application as part of a transaction processing back end. The determiner of overall performance and throughput is the computer subsystem performance.

**Marbach:** But one is a physical layer and the other a logical layer. How long does it take the software in the machine to determine what it must do



to issue a hardware instruction for it to go to a particular place on a disk? That can vary greatly depending on what happens inside the computer. It has nothing to do with the physical quantities of the disk.

**Naecker:** I don't know about that. The database operates at a relatively low level and doesn't go through many layers of VMS or get bogged down very much by the complexities of VMS. In a database system, there isn't much difference in the number of operations needed for it to do its work on a VMS system rather than on a RISC ULTRIX system.

**Marbach:** Suppose you used Oracle on the two of them. Would the performance be identical?

**Naecker:** The performance won't be identical among different architectures. Usually, disk performance will be the same. The database looks at the disk as a set of blocks, and it doesn't care what file structures are on it. The only difference is on the compute side. If you have 14 mips, you'll do better.

**Marbach:** Not if it takes 14 more instructions. You don't know how many instructions it will take.

**Naecker:** Don't forget that the numbers DEC uses for the DECstation are VAX units of processing [VUP]. It's running a suite of benchmarks, so it's equivalent processing. How you distribute your application benchmarks against the real world is a game you can play. You could weigh it toward certain computer operations, but the VUP is probably pretty good for most DEC users.

### Traveling UNIX

**Bourne:** Apart from cost, portability makes UNIX attractive. Also, many features within UNIX make it desirable, particularly process and I/O handling, the file system, its modular nature and its programming tools. The disadvantages of UNIX are the various shells and versions.



**"UNIX was designed so that you could keep adding to it. That's both good and bad. Because it didn't have a strict set of project-management rules, things got added ad hoc. But**

**there's always the option to add."**

**—Philip E. Bourne, Ph.D.**

**Marbach:** You said that the file system makes UNIX attractive. But why do HP and DEC believe that UNIX-based machines never will achieve more than about 50 percent of the transaction throughput you get from proprietary operating systems — MPE and VMS?

**Bourne:** I/O isn't necessarily terrific as far as the speed with which the data is transferred between disk and memory, but it's terrific in the way that you can use that data. There are advantages to having basically just a byte stream as opposed to the more structured environment in RMS and VMS.

**Mallery:** If you're doing transaction processing in VMS, you have to circumvent RMS, because it's too slow. Anyone who tries to optimize VMS for I/O spends a lot of time writing QIO, because that's the only way you can optimize. The byte stream is the primitive I/O level that you have to do with QIO in VMS.

**Marbach:** Since the creation of UNIX, people have been saying how portable it is. But to port among the hardware on which UNIX runs is non-trivial. The portability among VAX processors is far greater than the portability among UNIX processors. The key is porting applications — tak-

ing an application that runs on one platform and moving it to another platform. Isn't how an application is written more important than whether or not it's run on VMS or UNIX?

**Bourne:** Yes, but the new companies — whether in the workstation, mini-super or other arenas — use UNIX. It's easier to port UNIX to a different hardware platform than it is to write something from scratch. The portability has to come with the application, but that depends on whether your application is at the system level or just at a higher-language level.

### Standard Standoff

**Pilla:** Can someone provide a clear explanation of POSIX and POSIX compliancy?

**Mallery:** POSIX is a set of operating system services that's standardized. Any operating system that supplies these services is POSIX-compliant. Its possible, for instance, to make VMS POSIX compliant. DEC announced a program to do this, but it will take a few years.

**Pilla:** What happens when both UNIX and VMS become POSIX compliant?

**Mallery:** You should be able to port



code written for POSIX compliance between VMS and UNIX with essentially only a recompilation.

**Bourne:** Are you implying that if you take code that makes calls to the VMS run-time library, that code will compile and run under ULTRIX?

**Mallery:** No, I mean that they'll make a new VMS run-time library whose primitives or calls are the same as the set defined as the POSIX set. Effectively, you'll have the option of using the old VMS run-time library or some new POSIX-compliant run-time library. Or perhaps they'll merge the two — maybe the POSIX will be a subset of the full run-time library. But there will be a standard POSIX of run-time system services.

**Marbach:** It's like the standard FORTRAN compiler. Supposedly, if you write programs using only this ANSI standard and none of the machine-specific extensions to the FORTRAN compiler, you should be able to compile and run a program on a different system.

**Mallery:** This takes you a step further than the standard compiler, because within the compiler, if you use POSIX-compliant system service calls, you have a new degree of freedom. Before, you couldn't use any system service calls within the compiler. Now, you can use the POSIX set. The same set with the specific calls could be compiled on any POSIX machine. It's a big step in portability.

**Marbach:** We lose some of that portability when DEC, for instance, says, "We'll support the minimum POSIX standard of whatever. We'll also have the following enhancements, which will allow us to do transaction processing, etc." Suddenly we have a non-standard again.

**Barkes:** Imagine you have a UNIX kernel and a VMS kernel. You put a shell around each so they can work together, and then you add enhancements. It ends up as strange as the SQL situation, in which vendors of-



**"I'm surprised by Olsen's statement that all VMS features will be ported to ULTRIX. That ultimately means that VMS is dead. It reduces the pressure to stay with VMS and means that products developed for ULTRIX no doubt will migrate into more generic UNIX environments like the POSIX standard."**

**—Philip A. Naecker**

fer SQL, with enhancements. Vendors must add capabilities to a product to differentiate it from the generic model.

DEC makes money selling large boxes. Its profits are down, because it's pushing workstations. DEC doesn't want to get into the commodity market. So it makes itself a presence in the market, then adds things to it. You see a drift away from core operating systems. This happened before and will happen again.

**Bourne:** UNIX was designed so that you could keep adding to it. That's both good and bad. Because it didn't have a strict set of project-management rules, things got added ad hoc. But there's always the option to add. That explains the success of a real-time version of UNIX. VMS doesn't have that option.

### Working Together

**Pilla:** How well do UNIX and VMS systems work together? Can you run an ULTRIX DECwindows application on your VMS workstation?

**Barkes:** It isn't a question of operating systems, it's a question of how well the applications that run on

each system have been designed. The computers, the architectures themselves are different. It depends on how well the applications have been implemented on each platform.

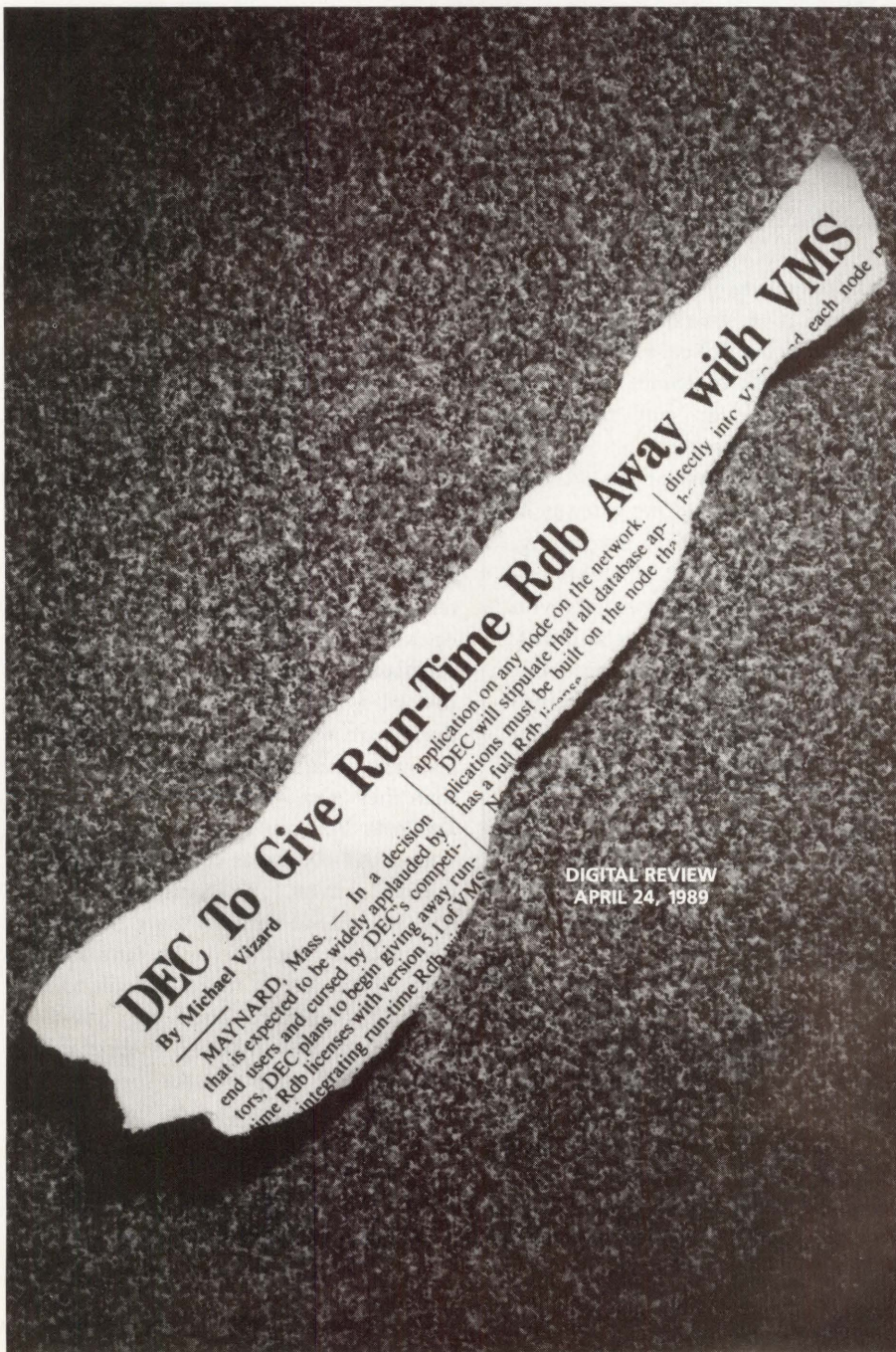
**Mallery:** The reworking of an existing application into an X client/server model is difficult. It's like writing a Mac application program. The programmer has to think differently about programming. There will be a significant change in the learning curve in the DEC industry while developers relearn how to write programs.

The salvation resides with people smart enough to write application generators for X client/server applications, even if they aren't efficient. I think it can be done. I've seen AI-style packages that produce windows — it's almost like Hypercard, but it can produce applications.

**Marbach:** We have to be careful not to run into the situation I see with the Mac. We find a so-called application putting itself between us and the Mac, then allowing us to develop our own application using another level of indirection. You get horrible performance and limitations imposed not just



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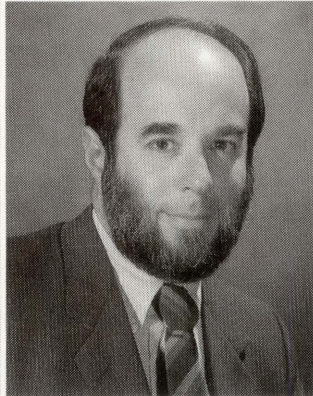
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**"T**here's a future for UNIX, ULTRIX and VMS. There's a future for the RISC processor and the VAX architecture. But making decisions is more difficult and requires more

**knowledge than ever before."**

— Carl B. Marbach

by the operating environment but by the application generator on which you're working. It keeps you very far away from the machine, making it easier to program but providing horrible performance.

**Bourne:** In terms of VMS/UNIX heterogeneity, the DECnet gateway in ULTRIX is a great asset in developing, managing and using UNIX/VMS environments. DECwindows lets you interact at the user interface as if they were one. The ability to cut a piece out of a UNIX window and paste it into a VMS window is a great feature. But there's a long way to go, and some problems never will be resolved. That's because they relate to philosophical issues that go into the makeup of VMS and UNIX — for example, the multiple versions of files that VMS allows that UNIX doesn't.

**Pilla:** What are other philosophical issues?

**Bourne:** Well, UNIX documentation is terse. The VMS help system is far superior because it's hierarchical.

**Mallery:** UNIX was a programmer's workbench. The entire shell-level user interface is made up of one- and two-letter code words with no relationship

to the operation they perform strung together in concatenated strings. I hope we'll be liberated from that by the window interface, which at least will be graphic-iconified and understandable. There's probably no salvation for these low-level interfaces, and we probably should fix it at a higher level.

**Pilla:** Have vendors included such interfaces between the user and the operating system?

**Appleton:** Vendors are moving toward a windows interface. They don't care to make their command lines any more understandable to users than they ever have.

**Barkes:** You can write shell scripts within ULTRIX just as you write command files in DCL, so the user doesn't have to contend with the more arcane command strings. If you're familiar with UNIX, it's no more difficult to write a command shell for less-experienced users than it is to write a command file using DCL for someone working on a VMS system.

**Bourne:** The success of that depends on the sophistication of the user. Many vendors of UNIX systems sell so-called VMS shells. Our experience





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with them is that they're successful only in the beginning. Eventually, you'll knuckle down to not only the arcane command names but also the use of pipes and redirection. I urge users to do that, because pipes and redirection are the strength of UNIX.

**Mallery:** Probably the biggest philosophical difference between VMS and UNIX is pipes and redirection, because there's nothing in VMS like them.

### Grand Unification

**Pilla:** Will DEC make it easy to move from VMS to UNIX?

**Mallery:** Ken Olsen says he's committed to providing all VMS functionality under ULTRIX.

**Marbach:** Is the resulting product VMS or ULTRIX?

**Mallery:** Maybe it's all one, maybe we're moving toward the grand unified theory.

**Barkes:** We can call it GUMIX — Grand Unified IX.

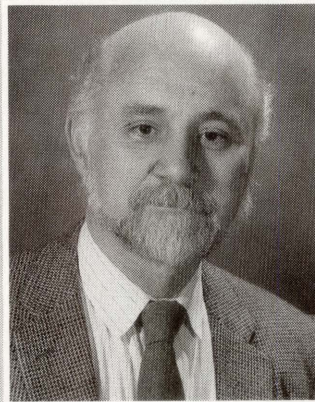
**Mallery:** In the 1990s, the operating system better become trivial and unimportant. There will be a unified user interface, a unified language standard and a unified set of POSIX system services. The operating system, like a VMS Cheshire Cat, will fade until there's nothing left but a smile.

**Pilla:** What advice would each of you offer people for the immediate and long-term future?

**Barkes:** UNIX runs on many hardware platforms. It wouldn't hurt to get a workstation or a 386 machine and run UNIX to get familiar with it.

**Bourne:** UNIX has and will continue to have — at least until about 1991 — a better price/performance ratio. I encourage sites to invest in UNIX boxes now. Further, sites must spend time with their VMS users at the beginning. There are many things to be learned, and the time you invest will pay off.

**Appleton:** The time investment will pay off, and although I feel the term



**"There will be a unified user interface, a unified language standard and a unified set of POSIX system services. The operating system, like a VMS Cheshire Cat, will fade until**

**there's nothing left but a smile."**

**—Dave Mallery**

is overused, open systems are the way of the future. However, your decision must be application-specific.

**Naecker:** I'm surprised by Olsen's statement that all VMS features will be ported to ULTRIX.

That ultimately means that VMS is dead. It reduces the pressure to stay with VMS and means that products developed for ULTRIX no doubt will migrate into more generic UNIX environments like the POSIX standard.

DEC isn't nervous about this, because its view of the operating system of the future is a client/server environment in which some things will run better on Y kind of machine or Y kind of operating system, and some things will run better on Z kind of machine or Z kind of operating system. The two will communicate over the network. DEC doesn't envision a commodity market. It will offer Y and Z and the glue between them.

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**Miller:** You're making a mistake if you lock yourself into one operating system. You have to look seriously at both systems and at your particular environment to determine your needs. It will be a mixed environment in many cases. Why should you rework an operating system to do something it isn't designed to do, when you can have both a lot sooner and can tie them together?

**Bourne:** UNIX has adapted to RISC, fine- and coarse-grained parallelism and vectorization. VMS has more trouble than that. Certainly it has symmetric multiprocessing, but even that's currently more limited than similar architectures built by other vendors on a UNIX platform. UNIX has the edge in adapting to different hardware architectures.

**Naecker:** POSIX standards don't consider the inside of the kernel or how the operating system works. They consider the interfaces to operating systems. These standards don't care if you redesign the entire kernel and have something new. That's why VMS could be POSIX-compliant.

**Birkhead:** DEC says that VMS will be much more elegant in five years but still will be an environment for production systems and OLTP. ULTRIX



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isn't built for that. ULTRIX is for people who want open systems.

**Mallery:** I tell software vendors to hire at any cost a computer wizard, lock him in a room and don't let him out until he has ported their applications to ULTRIX. I predict that by 1992, if not sooner, Digital will reduce the cost of a VMS mip radically. With the next two or three generations of CMOS technology coming on-line, DEC will be able to build very large VAX processors on a single chip that can be speeded in many more ways than a simple RISC machine.

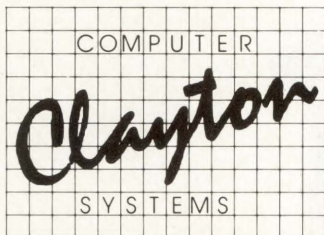
**Marbach:** I urge people not to panic. This is a time of change and upheaval greater than we've seen in computing history.

UNIX and ULTRIX will become the ANSI-standard operating systems. If a program is written to ANSI standards, it will run or compile on any

of the ANSI-standard compilers. It therefore would be possible to write an application on an ANSI-standard basis that would run on any base ANSI-standard operating system.

However, if there's something that can make the application run better or make the interface more user friendly, programmers will take advantage of it in the non-ANSI-standard portion. They'll make it machine or operating-system specific if it will run or look better on that machine or operating system. Windows are one solution to this problem, and windowing is supposed to be a kind of standard.

There's a future for UNIX, ULTRIX and VMS. There's a future for the RISC processor and the VAX architecture. But making decisions is more difficult and requires more knowledge than ever before. ■



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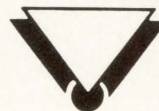
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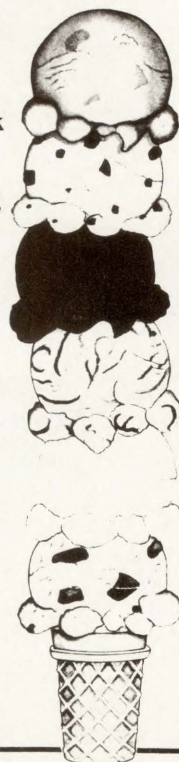
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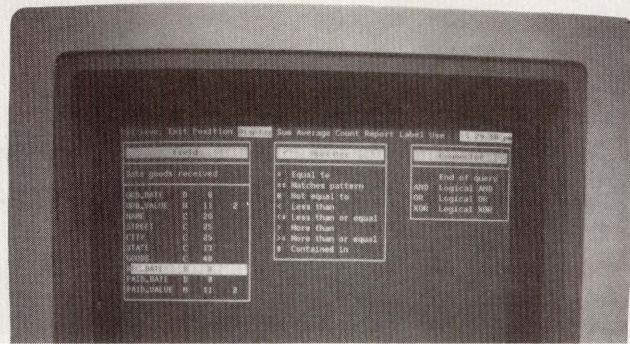
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## STORAGE

# I/O SUBSYSTEM PERFORMANCE

By **Kenneth H. Bates**

## Part 2: DSA Optimization Techniques.

Having examined performance metrics in Part 1 ("I/O Subsystem Performance," April 1989), we turn our attention to how the I/O subsystem can optimize each of them using the features of the Digital Storage Architecture (DSA). Although DSA was designed with reliability and extensibility in mind, performance was also a consideration. Let's look at how DSA makes it possible for the I/O subsystem to increase performance. We'll see which controllers implement which specific optimization schemes and how a programmer can take advantage of these features to increase I/O subsystem performance.

Prior to the implementation of DSA, the host operating system was responsible for operations involving the I/O subsystem. If the host wished to transfer data, it first had to check if the device was busy, then load special control registers to initiate the transfer to and from the disk. When the device had completed the operation, the host then had to check if there were any errors and proceed accordingly. As you might imagine, each device was treated differently, so not only was host execution time required to monitor the operation, but different code was executed for different device types.

DSA addresses this problem by isolating the subsystem from the host processor, communicating back and forth via a very generic set of commands known as Mass Storage Control Protocol (MSCP). Under DSA, a disk

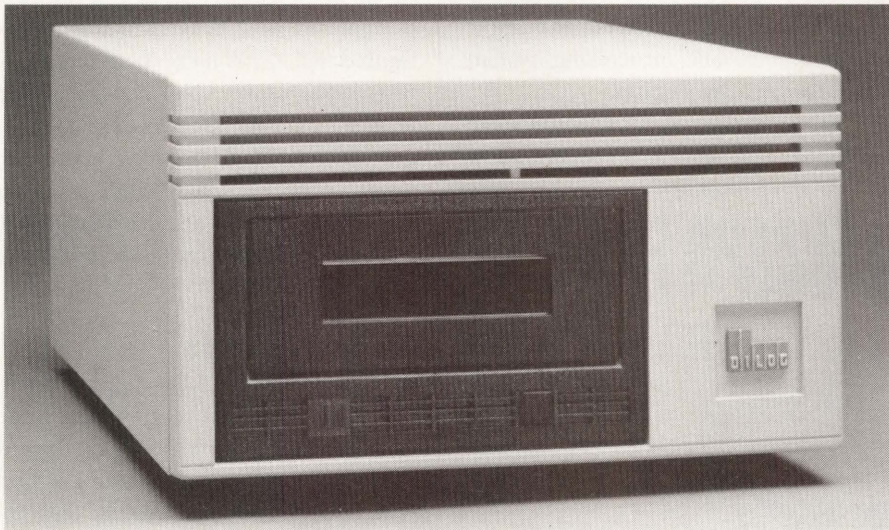
is presented to the host as a linear address space composed of logical blocks, each of which is referenced by its logical block number (LBN). Instead of the host having to be aware of different device registers for each disk type on the system, the host now only has to issue MSCP commands, such as ONLINE, READ and WRITE. When transferring data, the host need only specify an LBN on the device. The subsystem is responsible for decomposing the LBN address into the correct cylinder, surface and sector.

Because of this, the host is free to do what it does best: compute. Instead of being concerned with the intricacies of error recovery, it simply issues the command to the subsystem. If an error occurs, the subsystem is responsible for recovering it. Any device-specific error-recovery procedures are contained within the subsystem, so a single, generic "disk class driver" suffices for all DSA disks. Although it's difficult to place precise value on the performance increase, it's easy to see that if a host no longer deals with the details of I/O operations, it has increased the number of cycles it can devote to compute-intensive operations.

DSA also allows multiple commands to be outstanding to a single device. Because MSCP is a communications protocol that has an end packet associated with every command, the host knows that a command hasn't completed until the subsystem returns the end packet. If a host issues a data transfer to a particular disk, it not only can proceed with other work while awaiting the end packet, it also can issue a sec-



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ond command to the drive before the first has completed.

The subsystem is responsible for keeping track of these commands and returning the end packet for a command only when it has completed.

A benefit of this type of protocol is that the controller can transfer data from a read command into a host's buffer in any order it wishes. It can fill the buffer from top to bottom, from bottom to top or even in discontinuous pieces (middle, end, top). Because the host knows that the command isn't complete until it receives the end packet, it knows that the data buffer can't be examined while the command is proceeding. As we'll see later, this creates an opportunity for performance increases in high-end controllers.

Another feature of the MSCP protocol is that commands can be executed out of order. If a disk has more than one outstanding command, it's free to proc-

ess these commands in any order it wishes. It can work on part of the second command, switch to the first command and move on to another command. We'll see the performance advantages of this approach.

### Multiprocessor Controllers

Because much responsibility for I/O has been delegated to subsystems, they're designed with correspondingly higher-powered processors to handle the large number of I/O requests arriving from multiple hosts. In the case of high-end controllers, multiple processors have been used, working under a highly optimized operating system, to increase performance. An HSC is a prime example. Fully configured, an HSC70 has 19 processors in the controller, making it the largest parallel processing system manufactured by Digital.

Because the communication from controller to host and controller to disk

has been standardized by DSA, another optimization can be made by placing invariant functions in hardware, allowing the code that implements policy to be placed in software. In this manner, a channel card in the HSC can have highly specialized functions, such as the disk interface in ROM, while the intelligence that directs this policy exists in RAM. This allows easy updates.

Even with this parallelism, the fact that large numbers of disks can be attached to a controller dictates the need for an extremely fast controller. Although the code for controlling the disk I/O has been moved from the host computer, similar functions still need to be executed. Thus, high-speed processors are a must. The HSC is the best example of this, because a fully configured HSC70 has more than 60 mips of processing power. Not only is it the largest parallel processing system manufactured by Digital, it's also the fastest. On the other hand, you can argue that this is a prime example that mips stands for Meaningless Indication of Processor Speed!

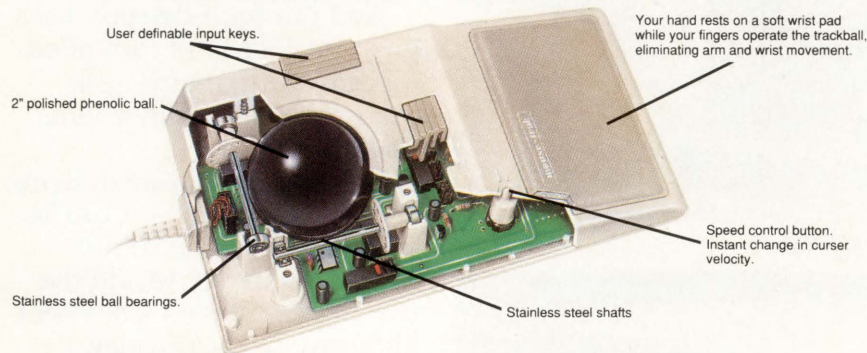
### Overlapped Seeks

In a traditional I/O subsystem, if a controller sends a seek command to the disk, it must wait until that command completes before proceeding. If a second command arrives for another disk attached to the same controller, it must wait until the first has completed before it can begin execution. The net effect of this is that the controller becomes a bottleneck, servicing incoming requests to all attached disks in a serial fashion.

A significant amount of time might be spent waiting for the seek to complete. Thus, considerable efforts were put into reducing this time as much as possible. At the same time, it was recognized that devoting an entire channel card to a single disk isn't the most cost-effective solution. Channel cards and single-board controllers thus were designed to handle up to four disks simultaneously.

Because a disk can't do other work while it's seeking, the DSA controllers

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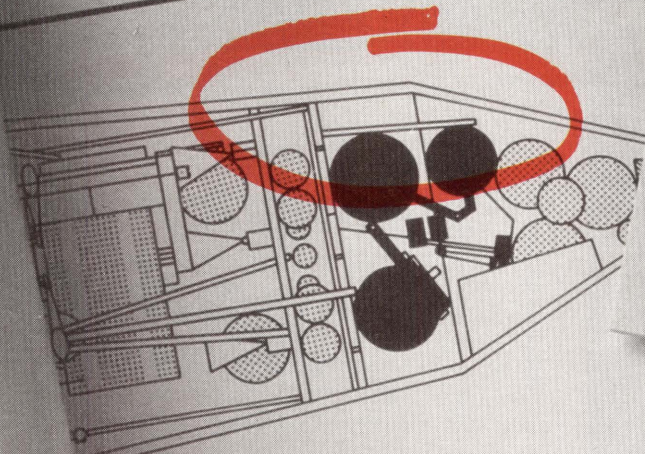


Figure 2-5

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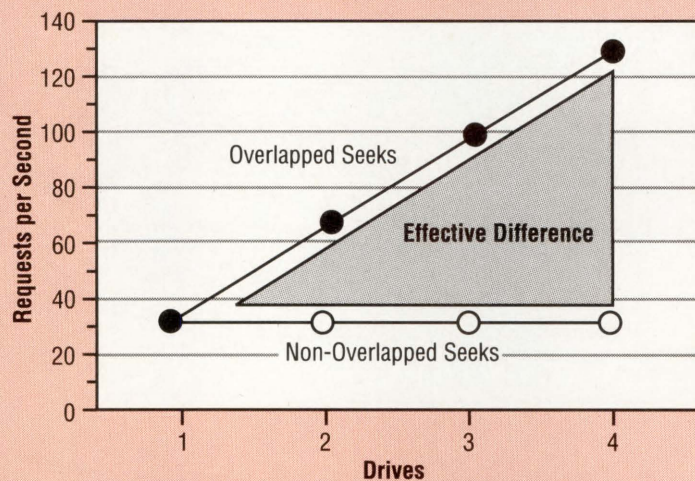
will, after issuing a seek, look for work on other drives. If a seek command is pending for one of the other drives, it will be issued, and both drives will seek in parallel while the controller looks for yet more work. In this manner, up to four seek commands per controller, or per channel card on the HSC, can be outstanding simultaneously, giving a high degree of parallelism instead of having the drives operate sequentially. The effect of this is shown in Figure 1, which shows the difference between overlapped and non-overlapped seeks.

The graph in Figure 1 was obtained by causing the disks to seek randomly over the entire surface. In the case of non-overlapped seeks, each disk must wait until the preceding disk has completed its seek before it can begin, so there's no difference in the overall request rate between one and four disks. With overlapped seeks, however, all disks can seek at the same time, so there's almost complete independence among the disks, and the request rate increases with more active disks. All current DSA controllers that support multiple drives perform overlapped seeks.

Because DSA allows requests to be returned to the host out of order, when the first seek completes, the controller performs the transfer command even if it wasn't the first one received from the host. This is possible because the channel card has two processors: one to handle seek commands (among other things) and one to transfer data. If a drive has completed a seek, one processor in the controller transfers the data while the other processor in the controller continues to monitor the outstanding seek commands on the other drives. In this manner, data from one drive can be transferred to the host at the same time the other drives continue to perform the seek operations.

Only one drive on a channel card (or board-level controller) can transfer data at a time, so if two drives arrive on cylinder at the same time, only one can

## FIGURE 1.



*The effect of overlapped seeks.*

transfer data. The other must wait.

Thus, a large performance increase can be realized if requests are distributed across multiple disks. Although only one disk on a channel can transfer data at any one time, if the time spent seeking is large in relation to the amount of time spent transferring data, the chances of two drives being ready to transfer simultaneously are small. Because of this parallelism, more than one active file shouldn't be placed on the same disk but instead should be distributed among many disks.

### Rotational Position Sensing

In the same manner that traditional controllers can have only one seek command outstanding at a time, a problem arises when two or more drives complete their seeks at nearly the same time. In a traditional controller, the first drive to complete is serviced. The second must wait before transferring data.

In a DSA controller that implements rotational position sensing, however, the controller constantly is monitoring the rotational position of the drive after it has arrived on cylinder. If two or more drives are on cylinder, the controller or channel card monitors them all. Because

the disks rotate at 60 revolutions per second, you can see why monitoring four at a time requires a powerful processor. Instead of servicing the requests in the order in which they arrive, the controller services the first disk whose desired LBN passes under the head. The two approaches are shown in Figure 2.

In a conventional controller, request 1 is serviced first, even though request 2 will pass under the disk heads first. In effect, there's a single queue at the controller, so it must service requests in the order in which they arrive. In this instance, the controller ignores request 2 and waits 0.75 revolutions to read request 1. In the meantime, request 2 has not only passed under the head, but has rotated beyond it, so the controller must wait an additional 0.375 revolutions for request 2 to rotate under the head again. The total time to read both requests is 1.125 revolutions.

With DSA, the controller knows that even though request 2 arrived from the host later, it will pass under the heads first. So, the controller transfers the data from request 2 first, then request 1. Because the total time to read



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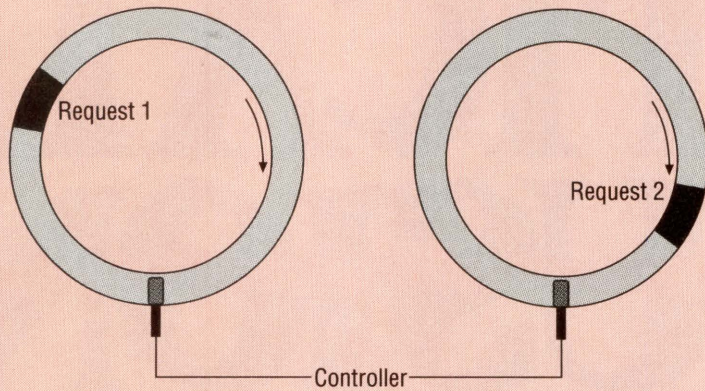
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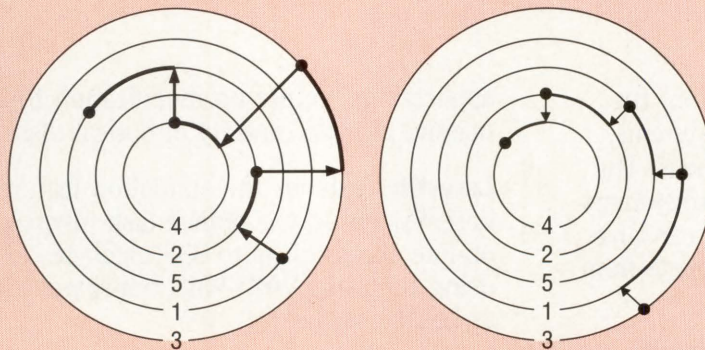


## FIGURE 2.



*Rotational position sensing.*

## FIGURE 3.



*Seek reordering.*

both requests will be the longest of all of the requests, this is now 0.75 revolutions, a savings of 0.375 revolutions over the previous method.

When up to four disks are serviced by a single controller or channel card, there are many opportunities for saving time. This is particularly noticeable in applications that issue requests with few seeks to different drives connected to the same channel card, because the effect of

overlapped seeks isn't as apparent. Rotational position sensing is offered on all current DSA controllers with the exception of the RQDX3.

### Seek Reordering

Although overlapped seeks and rotational position sensing can reduce the waiting time when multiple disks are active, there's also a way to reduce the time spent waiting for the disk arm to travel over the surface. If multiple com-

mands are sent to the disk by one or more hosts, the controller has an opportunity to arrange these requests in such a way as to minimize the total distance that the head must travel. As you might suspect, this requires that more than one request be outstanding at a time and becomes more effective as the number of outstanding requests increases. This is known as seek reordering or seek optimization and functions as shown in Figure 3.

In the example on the left of Figure 3, the requests are serviced in the order in which they arrive (1, 2, 3, 4, 5), resulting in a total of 11 cylinders being traversed. In the example on the right, however, the controller has reordered the requests to minimize head motion. They're serviced 3, 1, 5, 2 and 4, for a total of only four cylinders or 36 percent of the original travel. Recalling the amount of time a disk may spend seeking, it's clear that enormous performance increases are possible, assuming a sufficiently large number of requests are outstanding at the disk.

Figure 4 illustrates possible performance increases. To create this graph, a test was run on an RA81 disk drive connected to an HSC50 running V3.50. There's no noticeable difference between HSC50 and HSC70 controllers for any software version for this test. The requests were distributed randomly across the entire disk, and the number of outstanding requests was varied. In this graph, the number of outstanding requests is shown on the horizontal axis, and the resulting request rate is shown on the vertical axis.

With one request outstanding, the HSC has nothing to reorder, so the rate is about 23 requests per second. When two requests are outstanding, the controller has sent one to the channel card and is processing the second one to send to the channel card while the first one is executing.

Although the HSC can't reorder the requests (because the first was active



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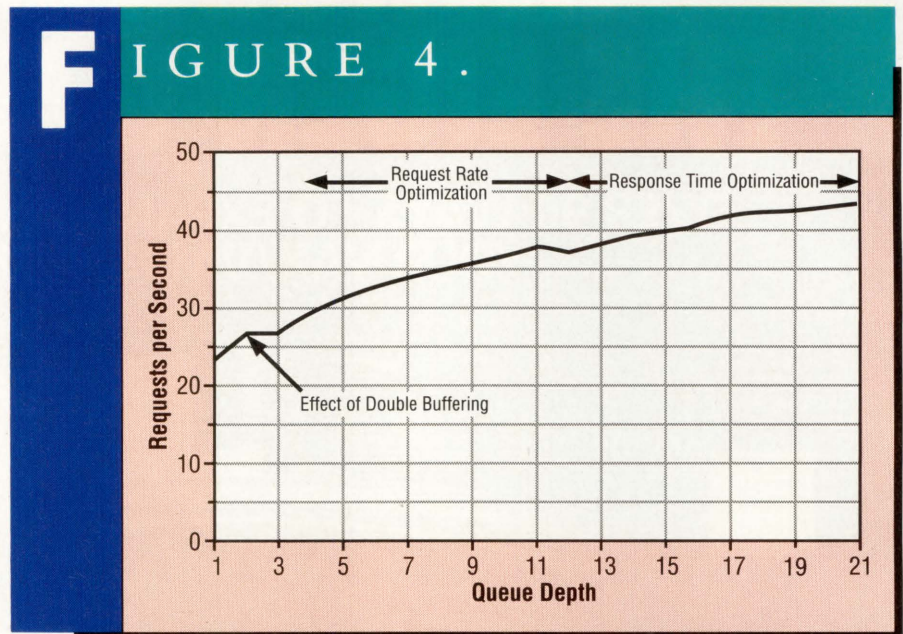
when the second was received), there's still some performance improvement. This is because the compute time of the HSC (request processing) and the compute time of VMS (QIO initiation and completion) are overlapped with the actual disk seek. After the first command has completed, the second is immediately available for the channel card to send to the drive. This illustrates the effect that double-buffering has on performance: Even though seek reordering isn't taking place, the request rate has increased from 23 to 27 requests per second. Thus, programs that can use double-buffering should do so.

With three outstanding requests, you see no increase in the request rate. This is because there's now one request on which the drive is working, one that already has been sent to the channel card and one the HSC places in a deferred seek list.

If four requests are outstanding, the situation changes. The disk is working on the first, and the second has been sent to the channel card. But there are two requests in the deferred seek list. When the disk completes the first request and starts the second, the HSC checks the deferred seek list and chooses the request closest to where the disk will be when it completes the second request. As a result, the rate increases from 27 to 30 requests per second. This trend continues, with the rate increasing as the HSC has more requests in its deferred seek list from which to choose.

Although the algorithm used by the HSC will increase the request rate as more requests are outstanding, the response time for an individual request may become longer. To prevent excessive response times, the HSC will change algorithms when the number of outstanding commands is greater than nine. You can see the effect of this in Figure 4.

At this point, the HSC changes from request-rate optimization to response-time optimization. As a result of this



*HSC seek optimization.*

new policy, the number of requests per second drops slightly, and the increase in the rate isn't as great as before. This is because the algorithm in the HSC is now more concerned with response time. It will place more emphasis on reducing response time than on merely increasing the request rate (although the rate continues to increase). This algorithm is implemented on a per-disk basis, so one disk may be optimized for request rates, while another is optimized for response time.

All current DSA controllers contain code that reorders incoming requests to increase the request rate. The HSC, however, is the only controller that contains multiple algorithms for increasing the request rate and decreasing the response time.

Although it's difficult to design a single program that can take advantage of the increased performance that results from high numbers of outstanding requests, it's important to note that the HSC only optimizes requests directed to a particular disk. Commands from multiple programs on multiple hosts appear to the HSC as a single command stream for the purposes of optimization. Because of this, request reordering can

take place on a disk, even though an individual program may be only single-buffering requests.

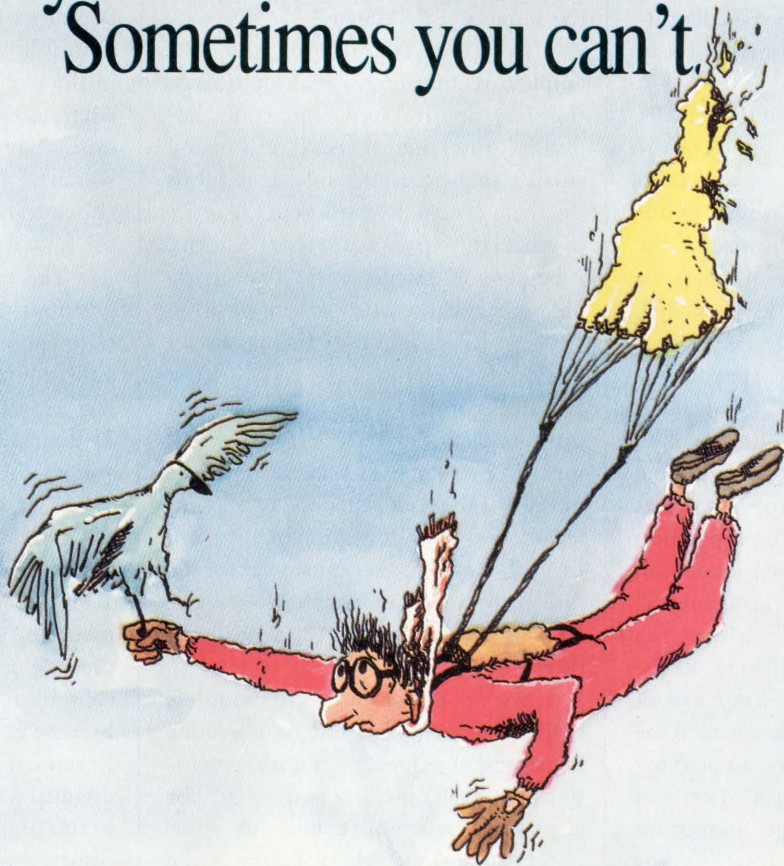
It's important to realize that if the number of outstanding commands becomes very large, even the response time reduction algorithms in the HSC may not be enough to reduce the response time to an acceptable level. The exact effects of disk queue depth and response times for different disks will be explored in detail in a future article.

### **Request Fragmentation**

The final optimization technique we'll discuss is called request fragmentation. In much the same manner that an HSC doesn't see the individual user transactions but only sees the MSCP request, the channel cards in the HSC see only those data transfer requests that the HSC central processor gives them. The request contains the beginning sector number of the transfer and the number of sectors to transfer (among other things). The channel card can begin transferring the data only at the beginning of the request. If the disk heads are in the middle of the request when the



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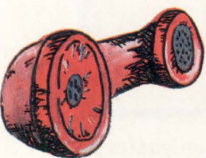
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channel card receives the request, it must wait until the disk rotates to the beginning sector of the request before it can transfer data.

As you might expect, if the transfer size is greater than one sector, it's possible that the request may have to wait to be serviced. The exact probability of this happening depends on the size of the transfer request and the number of sectors, not logical blocks, per disk revolution.

As an example, an RA82 has 58 sectors per track. If a 57-sector transfer is received, there's only one possible place to begin the transfer, even though there are 56 other sectors on the track that contain data. If the rotational position of the disk when the heads landed on the cylinder is completely probabilistic, there's only one chance in 58 that the transfer can begin immediately. In the other 57 instances, there's some loss of time waiting for the disk to rotate to the correct position. The time to actually transfer the data still takes 57 sectors of rotational time. Thus, the time spent waiting for the disk to rotate to the beginning of the transfer is effectively

wasted and adds to the response time of the request.

To help overcome this, the HSC employs request fragmentation. If large transfers are received, the controller divides this one request into many smaller requests and sends them all to the channel card. Regardless of the order in which the channel card receives them, it begins the transfer at the first possible point because of rotational position sensing. An example of this is shown in Figure 5.

In Figure 5, the left disk represents three requests that have arrived for service. Because the disk head is in the middle of the data called for by request number 1, the transfer can't begin. Instead, the controller must wait for the disk to rotate so that request 3 can be transferred, then request 2 and finally all of request 1.

The total time for this is about 0.88 revolutions (request 2 and 3, then to the beginning of request 1), plus 0.33 revolutions to transfer the data in request 1, for a total of about 1.21 revolutions.

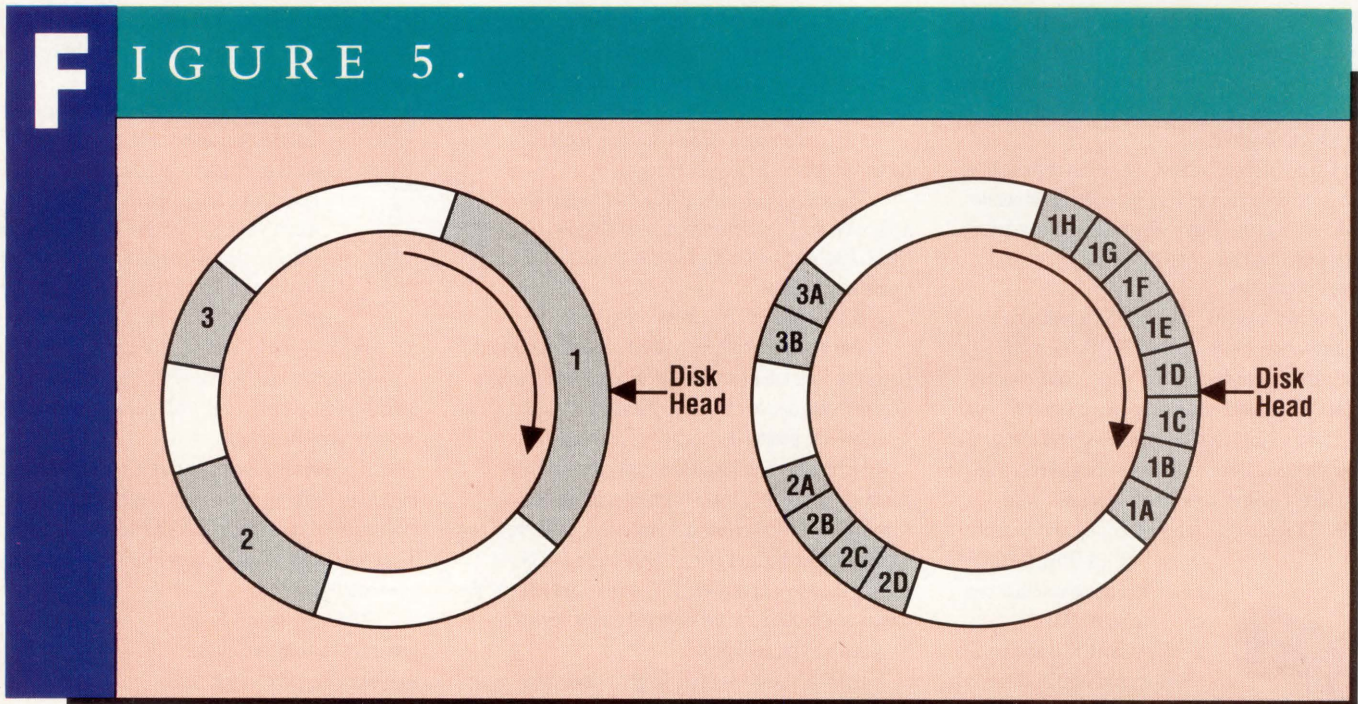
On the right side of Figure 5, the HSC has broken the large requests into

many smaller ones. As a result, request fragments 1D through 1H are transferred first, followed by requests 3 and 2 and finally request fragments 1A through 1C. All transfers are complete in one revolution, a savings of 0.21 revolutions. If it weren't for rotational position sensing, all requests would be serviced in order, for a total time of 2.46 revolutions.

The current software in the HSC (versions 3.7 and later) performs the fragmentation as follows:

1. If the request size is eight or fewer sectors, no fragmentation is performed.
2. If the request size is greater than eight sectors, the request is broken into fragments of four sectors each. The final fragment may be smaller if the total transfer size isn't evenly divisible by 4.

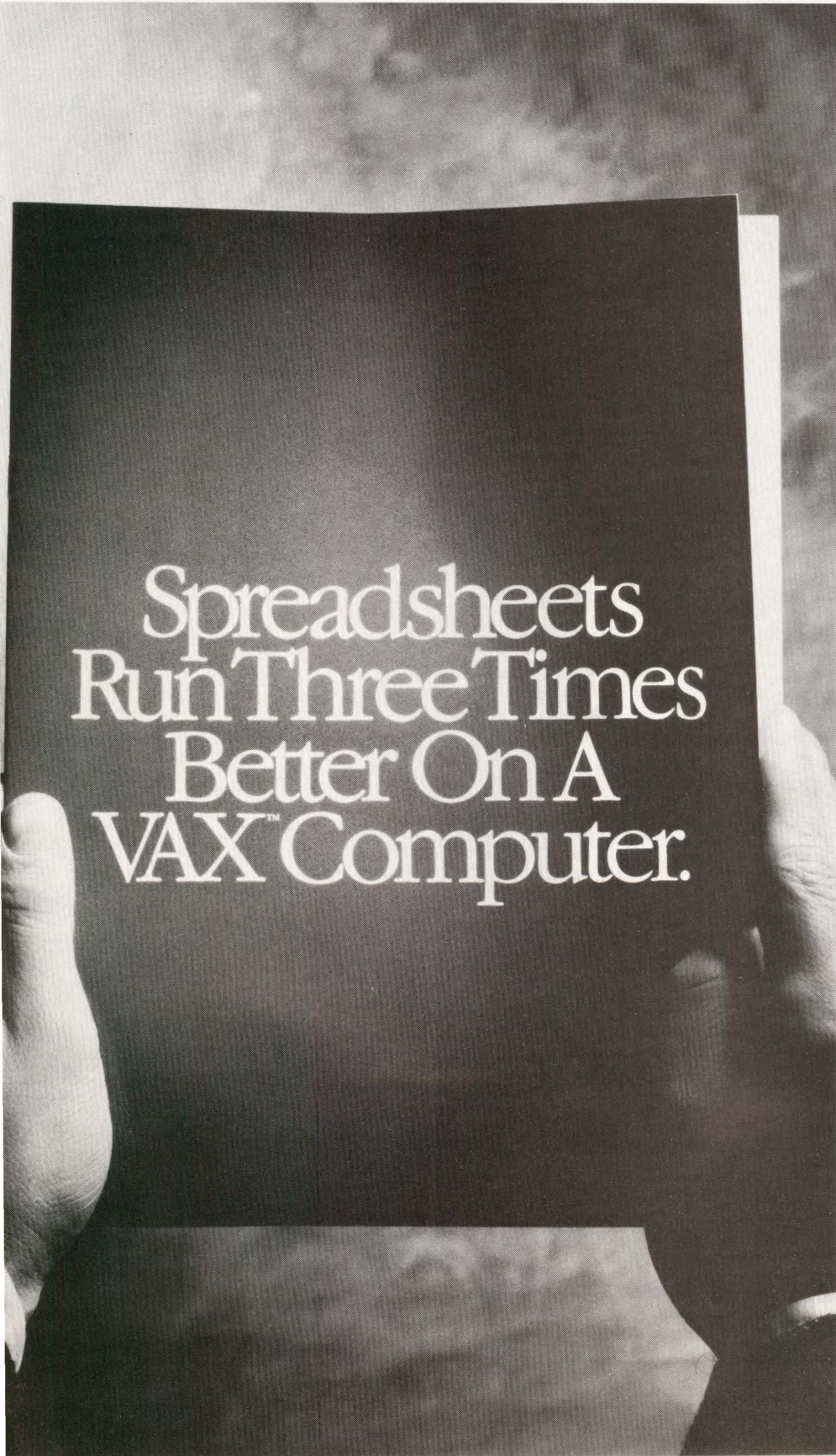
Although it may seem that a fragment size of one sector would produce the best results, keep in mind that the central processor within the HSC must become involved to fragment a request. Because it takes time to produce the individual fragments, too much time spent in this algorithm actually may increase response time instead of reduce it. The above values attempt to balance the time



*The effects of request fragmentation.*



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spent in fragmentation against the possible gains that may be realized.

Request fragmentation is only present on the HSC and the RF30 and RF71 disk subsystems. The RF30 and RF71 disk subsystems use a slightly different fragmentation algorithm, fragmenting a request greater than eight sectors into eight sector fragments.

Because fragmentation isn't performed until the request size exceeds eight sectors, only those programs that issue byte counts equal to or greater than 4,096 bytes gain any benefits from fragmentation. As such, combining small QIO requests into one large request may reduce overall response time.

### Program Optimization

Here are suggestions for increasing the performance of an application:

1. Whenever possible, active files should be placed on different disks. If this is done, they usually can be accessed in parallel to increase performance.

2. If possible, all I/O requests should be double-buffered.

3. The more requests outstanding to a particular disk drive, the higher the request rate it yields. This suggestion should be used cautiously, because the response times of individual requests may increase to an unacceptable level as a result, as will be shown in a future article.

4. The highest possible byte count should be used for all requests to allow data transfer fragmentation (HSC, RF31 and RF70 controllers only).

Although some applications don't lend themselves to the above techniques, if you can include any of these steps when designing a new application, it will provide many benefits and increase performance.

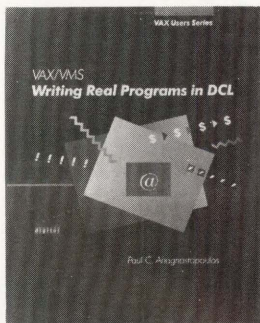
DSA has been designed from the start with performance in mind. Rather than specifying which specific algorithms the I/O subsystem must follow, it provides opportunities for increasing

performance at the option of the individual controller designer. In this way, low-end controllers can be developed without the expense of complex code, while high-end controllers with fast processors can avail themselves of advanced techniques.

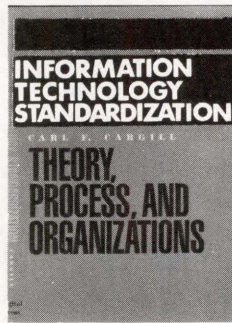
In the next article in this series, we'll focus on the effect of VMS workloads on the performance of the I/O subsystem. We'll also look at why performance in a typical VMS environment may differ greatly from what's expected from simply reading the specification of the subsystem. Further, we'll explore the fallacy of using benchmarks to evaluate a particular system and what to look for in your own system. —*Kenneth H. Bates is a consulting software engineer for Digital Equipment Corporation in Colorado Springs, Colorado, and a member of the I/O Performance Group.*

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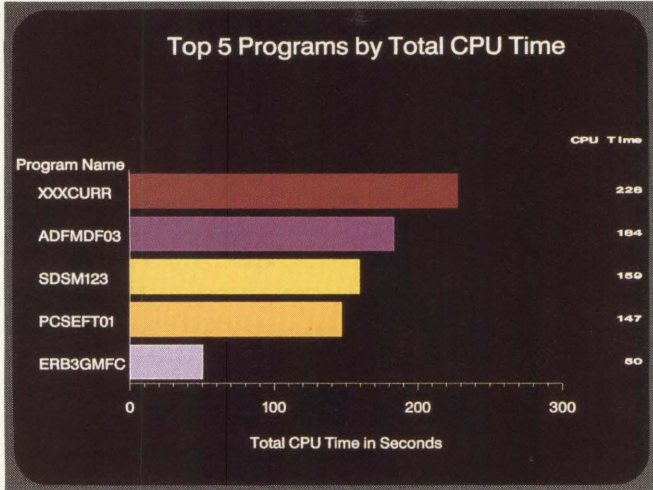
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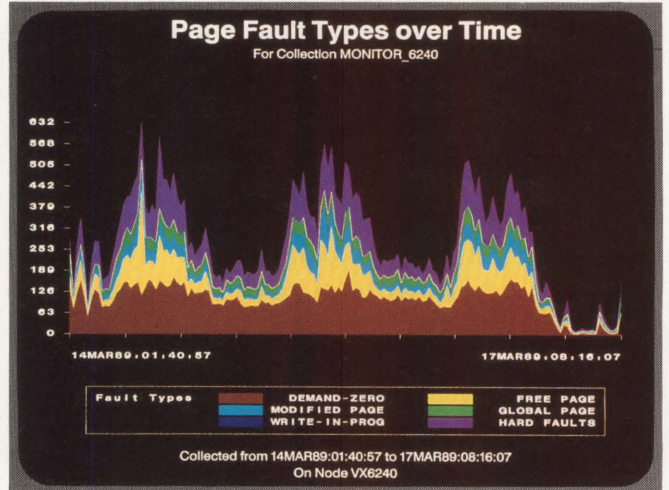
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Example of SAS/CPE ACCOUNTING report.



Example page fault report, run on a VAX 6240.

# Peaking Performance

An essential skill for system managers is the ability to prevent performance problems before they occur. That's easier said than done. It isn't difficult to lose yourself in the volumes of data you can collect with such VMS utilities as ACCOUNTING and MONITOR. You might spend more time setting up a collection and reporting process than analyzing and interpreting the data.

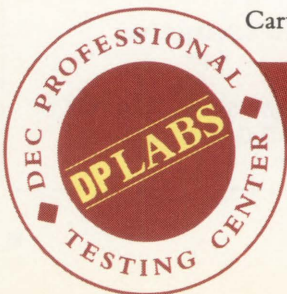
SAS/CPE, from SAS Institute Inc. of Cary, North Carolina, eliminates the

worries of establishing a collection and reporting scheme for your system's statistics. It does the work and gives you the time you need to analyze the data and plan for corrective measures.

We tested SAS/CPE version 1.1 on the Lab's MicroVAX II.

## Installation And Configuration

Release 5.18 of the base SAS system is required for SAS/CPE installation. To produce presentation-quality graphs,



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SAS/Graph also must be installed.

SAS/CPE has two installation options. Installing only the data collection portion requires 1,700 blocks of disk space. You need 4,300 blocks of disk space to install both the collection portion and the reporting portion. The split installation allows you to install the smaller data collection portion on every node except the node from which you do management tasks. Data collected on other nodes can be accessed from the central manager node to do reports.

SAS recommends a disk with 300,000 to 500,000 blocks of available disk space to hold all necessary software and the files generated by the collection processes.

VMSINSTAL takes care of the installation. Your only other concerns are to include the SAS\$CPE logical in your system startup procedure and to include statements in your system startup and shutdown command files to start and stop SAS automatically when you reboot your system.

## Using SAS/CPE

The base SAS product, as with any large statistical package, can present an imposing obstacle, especially if you don't need to use the SAS statistical package on a daily basis.

Fortunately, SAS is hidden under SAS/CPE. You don't need to know any SAS to use SAS/CPE. Customizing the product requires knowledge of SAS programming, but you can get by very nicely with basic SAS/CPE if you don't have special requirements.

The CPETOOL utility drives SAS/CPE. From it, you perform data collection, processing and reporting tasks. CPETOOL commands are DCL-like. Commands can be entered interactively or grouped into command files and run in batch.

The first step in looking at your system is to collect data. SAS/CPE can collect information from the VMS MONITOR and ACCOUNTING utilities, from a SAS-supplied DISKQUOTA utility (diskquotas must be enabled on your system for this to work) and from SPM.

## Figure 1.

```
CPETOOL> SHOW COLLECTION WEEK1
```

Name:	WEEK1	Begin:	1-JUN-1988 00:00:00.00
Facility:	MONITOR	End:	8-JUN-1988 00:00:00.00
Username:	Current user	Interval:	0 0:15:0
Queue:	SYS\$BATCH	PID:	Not running
		Data begin:	Not processed
		Data end:	Not processed
Disklist:	n/a	Started:	Not started
DQ Coll:	n/a	Processed:	Not processed
Version:	4.7	Raw data:	None collected
Level:	1		
File:	SAS\$CPE:[COLLECTION.MON_WEEK1.DATA]MON_DATA.DAT		
Classes:	ALL_CLASSES		
Flags:	Data sets not up-to-date		

The SHOW COLLECTION screen helps you check what you're doing before starting the process.

SAS/CPE doesn't have its own data collection facility other than DISKQUOTA. SAS Institute chose to work with the VMS tools rather than to write its own.

An example command to create a data collection using the MONITOR utility is:

```
CPETOOL> CREATE COLLECTION MONDATA
/BEGIN="1-JUN-1989 00:00:00" -
/END="+5
00:00:00"/FACILITY=MONITOR
```

In this case, data collection starts on June 1, 1989, and finishes five days later. Hence the +5 in the /END qualifier. MONDATA is the name of the collection.

You can customize the collection process. For example, the SET COLLECTION/CLASS=(list of MONITOR classes) lets you determine what classes of MONITOR statistics you want to collect. Similar qualifiers exist to help you tailor an ACCOUNTING data collection. To see a collection's characteristics, use the SHOW COLLECTION (collection name) command. An example SHOW COLLECTION screen is shown in Figure 1.

After you're happy with the collec-

tion's characteristics, you start the collection with:

```
CPETOOL> START COLLECTION MONDATA
```

Multiple collections can be placed in groups. This allows you to create individual files for periodic reports that can be appended together to generate reports for a longer time period. To save disk space, SAS will delete all variables not needed by subsequent reporting utilities.

You might think that the hard part is to process the collected data into raw SAS datasets, the next required step. Not so. Simply issue:

```
CPETOOL> PROCESS COLLECTION MONDATA
```

SAS takes care of the rest. You're now ready to generate reports.

Generating reports involves two options. The REPORT MENU facility guides you through the process screen by screen. Reports also can be generated using the REPORT SELECTION FACILITY command-line interface.

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Figure 2.

```

Change/View Setup Characteristics
Command ==>                               Press END to Save Characteristics

Batch Graphics Output:                     Interactive Graphics Output:
Device: TEK4105                             Device: TEK4105
X GOUT Catalog                             _ GOUT Catalog
_ Graphics Stream File                       _ Graphics Stream File
X Terminal

Print Command: PRINT/QUEUE=SYS$LETTER

Graphics Output Command: PRINT/QUEUE=SYS$PLOT/FORMS=3

Submit Command: SUBMIT/QUEUE=SYS$FAST/AFTER=23:00

```

You can customize the reporting process via this report setup screen.

reporting setups before generating reports. A sample setup screen is shown in Figure 2. The setup file controls the devices to be used to produce output. Graphics output can be sent to a graphics catalog and replayed later. Or, it can be sent to a graphics stream file and viewed or printed later. Graphics catalog entries can be replayed on devices other than the one specified in the setup file. Graphics stream files are device-specific and must be viewed or printed on the device specified in the setup file.

After you're happy with your setup parameters, you can review the statistics for the collection to be reported. You can specify a subset of the original collection's time interval if you don't want to see a report for the entire collection.

More than 30 standard reports can be generated. You simply select the reports you want to generate using CPETOOL's REPORT MENU facility.

Report choices include graphs for MONITOR statistics, such as time spent in processor modes, top CPU users, cache effectiveness and direct I/O use. Trendline projection reports can be generated for projected CPU use, projected page fault rate and projected direct I/O use.

ACCOUNTING reports include Top Images by Page Faults, Top Processes by CPU Time and special billing reports

that can be customized for your site. DISKQUOTA reports can reflect top disk-space users either over all disks or by individual disks.

Graphs can be generated in line-printer style for quick analysis. You can generate more sophisticated graphs using special devices such as plotters. Presentation-quality graphs are shown on page 82.

The ACCOUNTING billing report deserves further consideration. In addition to the billing generator, a sample rate table is supplied. You can customize this table to charge appropriate amounts for resource use. You can control what your primary and secondary hours are and what rates should be applied for items such as CPU use, direct I/O, interactive connect hours and pages printed. Rates can be established for batch jobs, as well. This rate table is applied against the collected ACCOUNTING statistics when reports are generated.

Because CPETOOL uses VMS utilities, the rules concerning collection file sizes and how large they can grow apply to CPETOOL. You still need to be careful about collecting so much data that your disk fills up. SAS/CPE maintains a well-defined directory hierarchy where all appropriate files are stored. You won't have difficulty finding where

SAS places the files it creates as data is collected, processed into SAS datasets and formatted for reporting.

## Documentation

The documentation for the entire SAS system is voluminous. The SAS/CPE *User's Guide*, however, is easy to follow. It won't take you long to do your first collection, processing and reporting cycle. In addition to the chapters on using the system, SAS provides information regarding how to integrate SAS/CPE into your daily system management routine. All CPETOOL commands are explained clearly in a reference section of the *User's Guide*. Information is supplied to help you customize and extend the reporting features offered by SAS/CPE.

SAS/CPE provides a well-rounded system management and accounting tool that's easy to use whether or not you have extensive SAS experience. Because the base SAS system is required for SAS/CPE to work, it's suspected that most SAS/CPE customers will be managers of sites that already run SAS. Those that do will find SAS/CPE a valuable add-on system management tool.

## SAS/CPE Version 1.1

**PLATFORMS:** VAX/VMS systems

**PRICE:** First-year price, \$850 to \$2,900, depending on machine classification. Base SAS required

## SAS INSTITUTE INC.

### HEADQUARTERS:

SAS Circle, Box 8000  
Cary, NC, 27512  
(919) 467-8000

**PRODUCT LINE:** Data management, analysis and presentation systems

**REVENUE:** \$170.4 million (1988)

**FOUNDED:** 1976

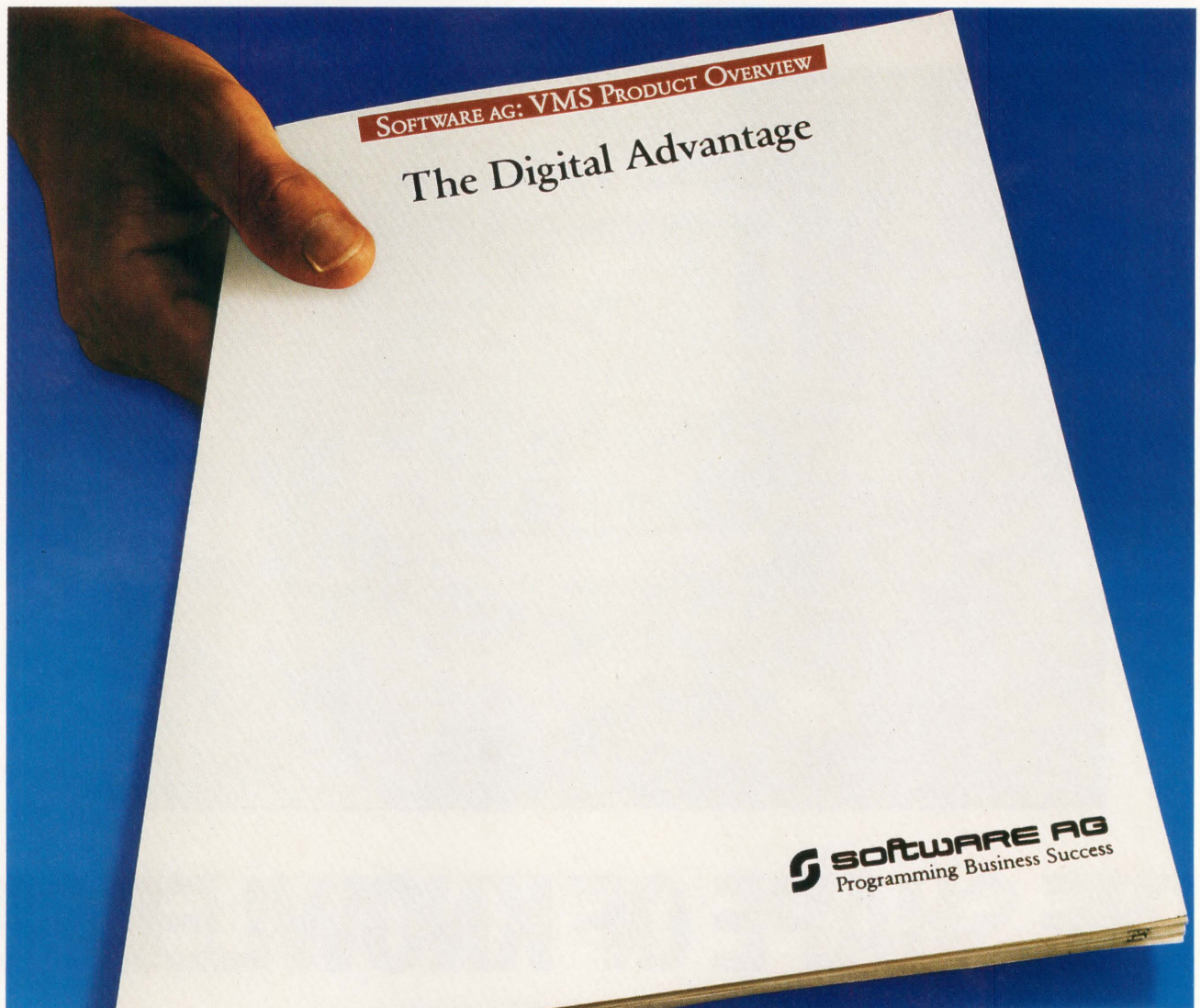
**OWNERSHIP:** Private

**BRANCHES:** Three domestic, 16 foreign subsidiaries, 12 foreign distributors

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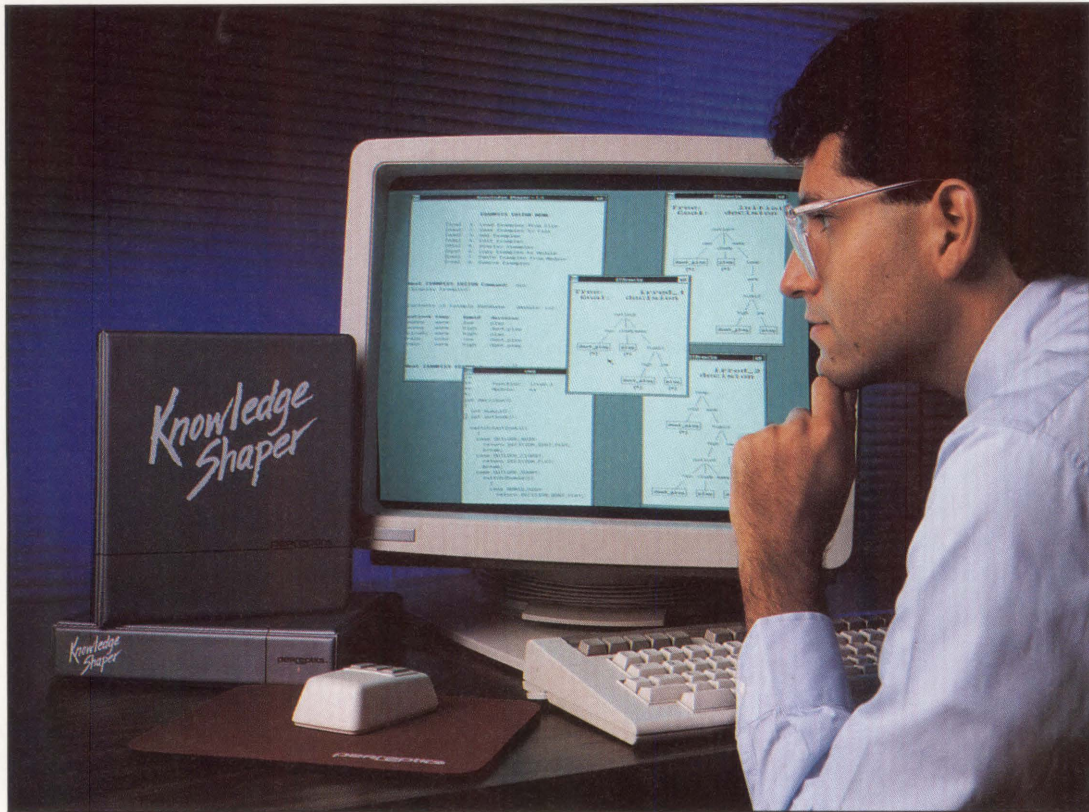
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# THE SHAPE OF KNOWLEDGE

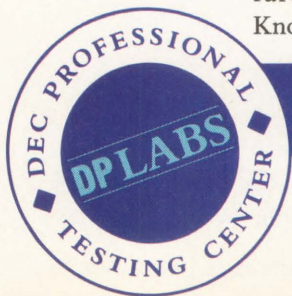
Expert systems are used to solve a variety of problems in commercial and technical environments. But they can become unwieldy as more knowledge is added to the knowledge base, and performance can degrade as the systems grow larger.

Knowledge Shaper, from Perceptics Corporation of Knoxville, Tennessee, takes expert systems development a step further. Not only can you use Knowledge Shaper to develop expert

systems, but you also can extract an optimal solution that best suits your needs.

We tested Knowledge Shaper version 1.0 on our Lab's MicroVAX II. We also tested the optional C source-code generator.

Knowledge Shaper is installed by first BACKing UP the distribution to a directory of your choice. Separate security codes, obtained from Perceptics, are required for Knowledge Shaper and any code generators you install. The



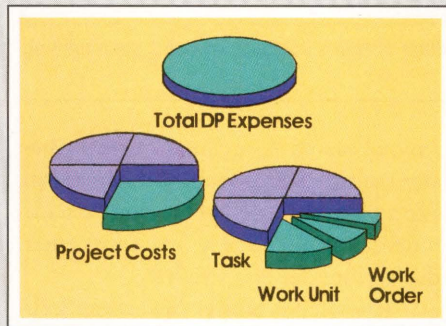
DAVID B. MILLER



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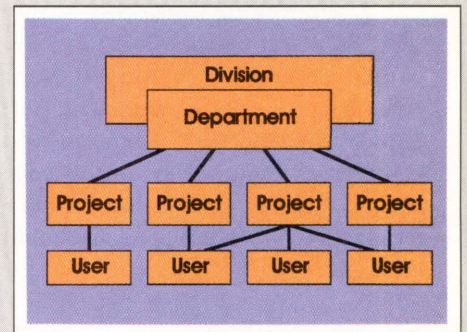
### Accurate, detailed project accounting.

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

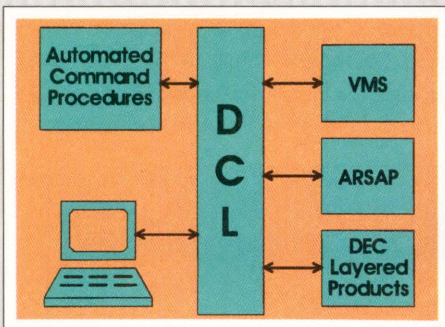
Only ARSAP includes features for printer forms charging, Intergraph plot charges, selective image surcharging and consistent disk charges even when samples are missing.

### Track your entire organization automatically.

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



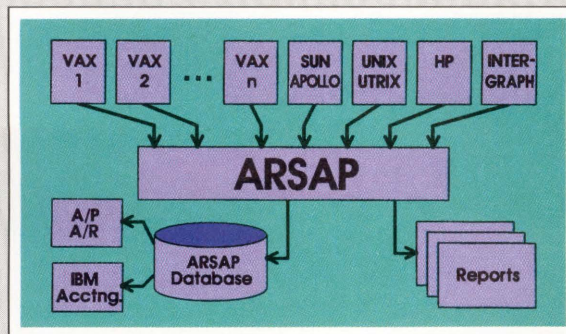
ARSAP can handle any situation—whether a company division contains five or 5,000 users; users belong to one department or several; a project consists of one or multiple users; or users from several departments are working on the same project.



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**Figure 1.**

outlook	temp	humid	decision
sunny	warm	low	play
sunny	warm	high	dont_play
cloudy	warm	high	play
rain	cold	low	dont_play
rain	warm	high	dont_play

Decision-making criteria can be entered into Knowledge Shaper's database by using such training sets as this.

code generators are integrated automatically with Knowledge Shaper when they're installed.

After invoking Knowledge Shaper with the KS command, a main-menu choice lets you customize your Knowledge Shaper environment. The SET-UP PREFERENCES menu lets you control such things as how Knowledge Shaper displays information on your terminal and what default editor should be used.

### Getting Into Shape

Knowledge Shaper is menu-driven. Menu names and menu choices have three-letter mnemonics associated with them for easy reference. You can move among menus easily without having to exit to a high-level menu to get to another low-level menu. It pays to familiarize yourself with the menu abbreviations. Using them is the easiest way to get around the system.

Shortcut commands are also available. For instance, pressing S from a menu spawns to the operating system so you can perform VMS-related duties. The M command returns you to the main menu.

The following golf example illustrates Knowledge Shaper's abilities. It's one of the excellent tutorials included in the Knowledge Shaper documentation. The five tutorials provided increase in complexity and illustrate Knowledge Shaper's advanced features.

If time and money are no object,

anyone planning a round of golf usually considers the weather. To create an expert system to help you decide whether or not to play, you must enter the various criteria needed.

Knowledge Shaper can accept decision criteria in the form of examples or production rules. The golf system uses examples. A typical example table, or training set, is shown in Figure 1. The table can be created with any text editor. The headings OUTLOOK, TEMP and HUMID are the categories of criteria used to make the DECISION. Each col-

umn lists the possible values for each category. Reading across row one, for example, you'd decide to play golf if OUTLOOK was sunny, TEMP was warm and HUMID was low.

An alternate method of inputting knowledge is through production rules. An example of a production rule for the golf example is:

```
IF outlook IS sunny
AND temp IS warm
AND humid IS high
THEN decision IS dont_play
```

You need to decide which method best suits your application. You can't mix the two methods in the same application.

Menus exist to work with examples (EXAMPLES EDITOR) and rules (RULES EDITOR). You can edit the text files containing the rules or examples, add or delete entries and load examples or rules from pre-existing files.

After examples or rules are established, a codomain entry for each attribute of the database is specified via the CODOMAIN EDITOR MENU. A codomain is a list of all possible values an attribute can be. For the golf exam-

**Figure 2.**

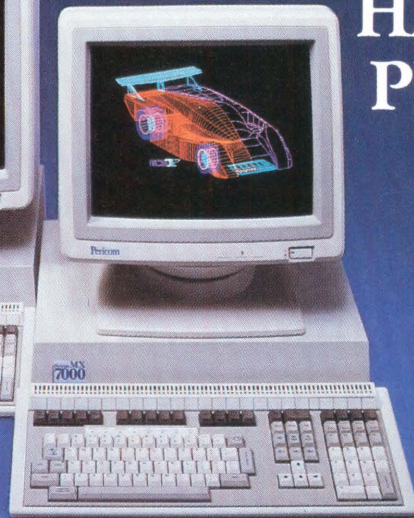
```
initial :: % NAME
decision :> % GOAL

outlook :[
  rain >> <: [dont_play]
           =>> temp :[
                    cold >> humid :[
                      low >> <: [dont_play]],
                      warm >> humid :[
                      high >> <: [dont_play]]],
  cloudy >> <: [play]
           =>> temp :[
                    warm >> humid :[
                      high >> <: [play]]],
  sunny >> temp :[
          warm >> humid :[
            high >> <: [dont_play],
            low >> <: [play]]]].
```

Decision trees you generate are displayed in textual format on non-graphics devices.



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ple, the codomain entries are:

```

CODOMAIN:
    humid IS high OR low.
CODOMAIN:
    decision IS dont_play OR play.
CODOMAIN:
    outlook IS rain, cloudy OR sunny.
CODOMAIN:
    temp IS cold OR warm.

```

The next step is to create a decision tree via the DECISION TREE EDITOR. You tell Knowledge Shaper what the goal of the procedure should be. In the golf example, the goal is to make a decision whether or not to play golf. Knowledge Shaper uses the example table or a set of production rules to develop the decision tree's procedural specification.

The decision tree derived from the golf example table is shown in Figure 2. On non-graphics devices, decision trees are displayed in textual format. On graphics-capable workstations, such as a MicroVAX 2000, the specification is displayed in a tree format, with the root

node at the top and leaf nodes at the bottom.

While generating a decision tree, Knowledge Shaper reports discrepancies and omissions. For instance, the golf example table doesn't provide a playing decision when the OUTLOOK is sunny and the TEMP is cold. You can return to the examples editor or rules editor to correct the situation, or you can choose to ignore it.

### Optimization

Some tree optimization is done automatically. For example, Knowledge Shaper realizes that no further decisions need to be made if the OUTLOOK is rain or cloudy. Further optimization can be achieved through the DECISION TREE OPTIMIZATION menu. This menu extracts all possible irreducible decision trees from the initial tree. Irreducible trees represent optimal solutions for the given problem. From the irreducible forms, you can choose the one that best solves your problem.

To help you choose the best optimization, the DECISION TREE

OPTIMIZER provides an analysis function. The analysis reports such items as average path length, maximum tree depth, the number of nodes, the number of leaves and other factors that affect system performance.

After choosing the best solution, you're ready to generate C or Ada code, if a generator was purchased. An example of the C source code generated for the golf example is shown in Figure 3.

An interface specification is generated for the functions within the tree structure. Interface specifications define how each C function generated for each part of the decision tree (e.g., decision, humid, outlook, temp) will be implemented. Although Knowledge Shaper can generate these, you have the option to create your own interface specifications.

To reduce the number of trees generated by Knowledge Shaper, you optionally can create Cost specifications and Control specifications to apply against the knowledge database before generating and optimizing decision trees.

Figure 3.

```

/*
** Code Generated by CGEN -- Release 1.0 (VMS)
** Copyright (C) 1988, Perceptics Corporation
*/
#define DECISION_DONT_PLAY      0
#define DECISION_PLAY          1

#define HUMID_HIGH              0
#define HUMID_LOW               1

#define OUTLOOK_RAIN            0
#define OUTLOOK_CLOUDY         1
#define OUTLOOK_SUNNY          2

/*
**      Function:      irred_1
**      Module:       ks
*/
int decision()
(
    int humid();

    int outlook();

    switch(outlook())
    (
        case OUTLOOK_RAIN:
            return DECISION_DONT_PLAY;
            break;
        case OUTLOOK_CLOUDY:
            return DECISION_PLAY;
            break;
        case OUTLOOK_SUNNY:
            switch(humid())
            (
                case HUMID_HIGH:
                    return DECISION_DONT_PLAY;
                    break;
                case HUMID_LOW:
                    return DECISION_PLAY;
                    break;
            )
            break;
    )
)

```



## Knowledge Shaper Version 1.0

**PLATFORMS:** VAX/VMS systems, Sun/SunOS

**PRICE:** Knowledge Shaper, \$4,995; C Code Generator, \$1,995; Ada Code Generator, \$3,495

### PERCEPTICS CORPORATION

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Knoxville, TN 37933  
(615) 966-9200

**PRODUCT LINE:** Products for image processing, pattern recognition, AI and optical storage applications

**FOUNDED:** 1980

**OWNERSHIP:** Public

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Cost specifications provide Knowledge Shaper with information on the relative costs of making decisions or performing tests. Cost specifications impose a hierarchy on the decisions in the system. This reduces the amount of processing required by the decision-tree optimization process. Optimized trees that don't meet the cost criteria aren't generated.

Control rules provide another means of reducing the processing involved in generating solutions. Control rules specifically define the order in which events take place. When you apply the control rules, the decision tree optimizer doesn't have to generate trees that don't meet the control sequence criteria that you specify.

Documentation consists of a three-ring binder with an introductory section, an excellent set of tutorial problems, detailed explanations of Knowledge Shaper's terms and a detailed guide to menus.

Knowledge Shaper provides a fast, easy-to-use way to develop expert systems. Its optimization capabilities should help correct the unwieldy nature of expert systems and let you develop your applications quickly.

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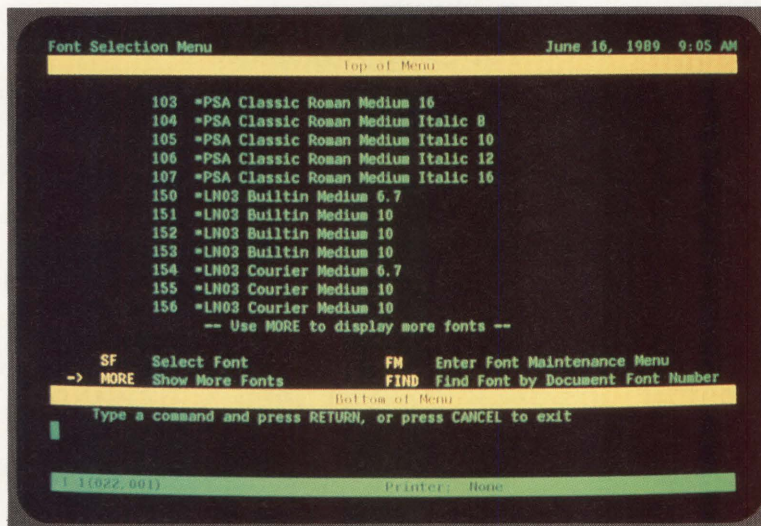
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Data Processing Design's Word-11 Features Font-Generation Capabilities That Make It Suitable For Many Publishing Applications.

# A Way With Words



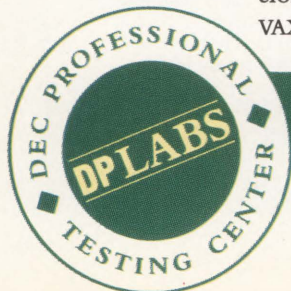
*Word-11 fonts are referenced by number.*

Word-11, from Data Processing Design (DPD) Inc. of Anaheim, California, is a Gold Key-style word processing package in the mold of such systems as DEC's WPS. With the addition of extra-cost options, including a Gold Key-oriented Calendar program and a fax facility, as well as the ability to send Word-11 documents over VAXmail, Word-11 has evolved into a multifaceted office system. Further, its font-generation capabilities make it suitable for many publishing applications.

DPD recently released Word-11 PC, which I tested on an AST 286 PC/AT clone. This program is identical to the VAX/VMS version of Word-11 version 4.2

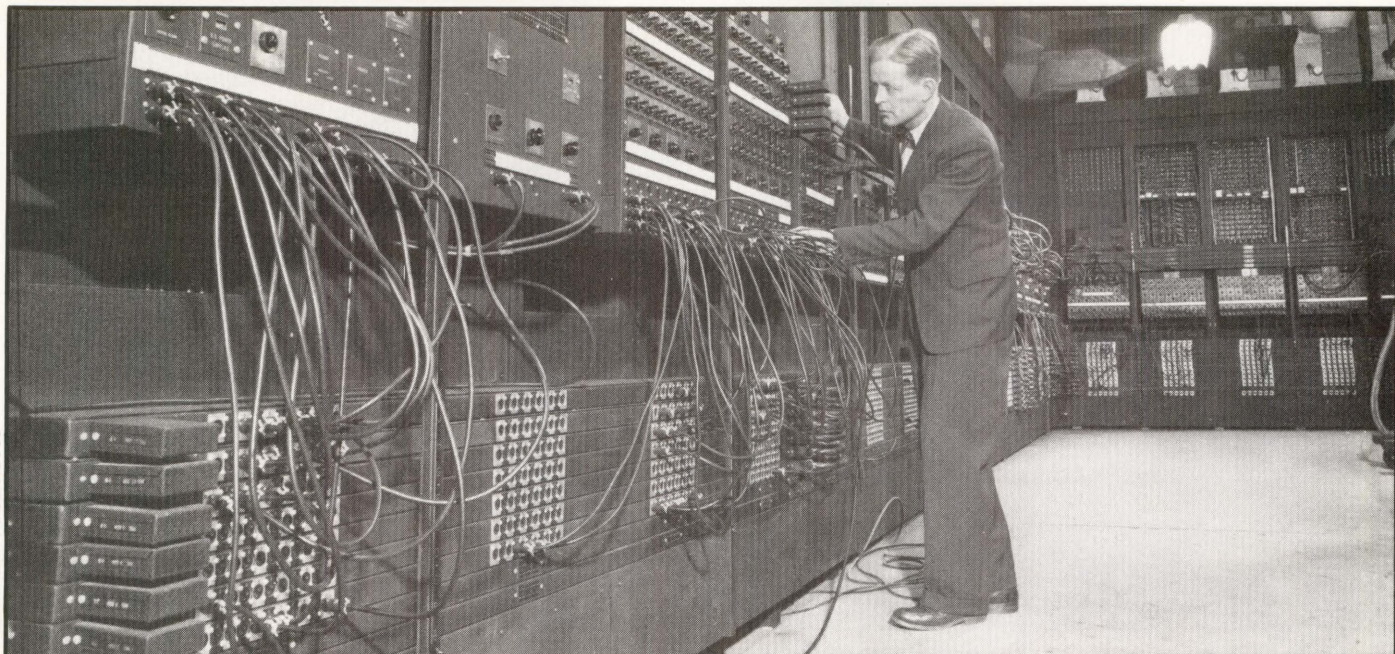
that I tested on SAURON:: (one of our Lab's VAXstation 2000s), right down to the use of Gold and Green keys. On the VT200/300 keyboard, the Gold and Green function keys are the keypad's PF1 and PF2, respectively. On the extended PC/AT keyboard, they're the same, labeled NUM LOCK and /. One difference I discovered between the two versions was the lack of a sophisticated font system in the PC version.

Many keys map a bit differently, but DPD supplies keyboard layouts of all of the Gold and Green function definitions. If you've used a word processor, these layouts are probably all you'll need for documentation. Perhaps I never had



EVAN BIRKHEAD





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                                April 20, 1989 11:36 AM
Document: (9) W11: 4.2 Handbook - AppB/C/D
Form or Direct Output  FO/DT LN03 (Form)
Printer Type           PT
VMS Queue Form Name   VF

Printer Margin Indent  PM 12      First Page to Print   FR 1
Lines in Top Margin    TM 6       Last Page to Print    TO 0
Lines in Bottom Margin BM 6       Bin Select            BS 1
Lines per Page         PS 66      Copies to Print       CP 1
Automatic Page Breaking AP NO     Stop Every Page       SE NO

Initial Page Number    IP 1       Create Index          IN NO
Characters per Inch    PI 10     Create Table of Contents TC NO
Extra Half-line Spacing EX 0     Print Header          PH NO
Print Extra Dark       DA NO     Delete After Printing DE NO
Include Change Bars    CB NO     Print Priority         PR 5
Print Endnotes         PE NO     Print Option          PO 4
Print Redlining        RL NO     Widow/Orphan Control WO 0

Type the letters and value and press RETURN.
Type GO and press RETURN if all settings are correct.

```

Figure: You can set a variety of print parameters in the print menu.

to reference the *Word-11 Handbook* because I've used WPS, Mass-11 and Interation's IT\*OS, which all look similar. But I also attribute it to the system's easy-to-absorb menu structure. The diminutive *Pocket Guide*, however, which lists key-striking sequences, was useful on several occasions.

## The First Screen

The top of Word-11 is a two-screen mnemonics menu that opens every door of the system. The oft-used functions are on the first screen, arranged in a descending order of how often you'll use them. They include:

[C]reating a new document, which only requires giving it a name.

[E]diting a document, which requires knowing the document's name or Index number. This can be found by reading the [I]ndex file. In all word processing facilities, Word-11 offers the last document accessed as the default.

[P]rinting an existing document, also referenced by name or number. This presents you with a print parameter selection screen, with your current working document as the default (see Figure).

[I]ndex, which lists documents in the order in which they were created, most recent first. You can realign the index from the [T]ransfer and Docu-

ment utility in the second main menu.

[D]elete a document, referenced by name or number.

[L]ist processing facilities, which merges, for example, form letters with addresses and can sort and print them alphabetically. Word-11 prompts you to label the form letter "Forms" and the addresses "List" and create a new document set that combines the two. The "Selection" prompt lets you similarly lift repetitious sections of text into specified areas of a document.

[M]ail utility — when documents are transferred, Word-11 strips them down to pure ASCII.

[U], which is the selection screen for printer options and utilities.

[F]inish, which is an exit to the \$ prompt. Hitting Gold-\$ also gives you system access.

## Going For Gold And Green

Striking [E] and identifying a document puts you inside that document.

Six status lines occupy the top of the document, and the tab/margin ruler occupies the seventh.

At the bottom of the document is a reversed <EOD> symbol beyond which you can't move. There are status indicators for Page Number (Gold-P starts a new page, Green-P sets a page number and Gold-R sets a new ruler);

the Document Name; the Edit Mode (hitting the F11 key puts you in Overstrike edit mode); and Entry Attributes.

Rulers can be accessed simply by scrolling onto the screen rule. Rulers can make side-by-side columns and serpentine newspaper columns. Rulers within rulers, called Nested Rulers, also can be designed.

The arrow keys move you about the document, while Keypad 0 and 1 are the Advance and Backup guides for your Gold moves. Hitting Keypad 1 then Gold-Keypad (the Page key) moves you back one page. You can advance by tab, word, line, sentence and paragraph. Combining these keystrokes with the PF4 (Delete) key will delete the selected text. Hitting Gold-Enter transposes selected letters. Gold-F or CTRL-Z files the document.

Cut and paste is accomplished by selecting text with the Select key, hitting Remove to cut, naming it, finding the preferred text location, and hitting Insert Here. Search and Replace is done with Gold-0/Find from the top of the document. Then you enter a word or passage for which to search. Hitting Keypad 0 prompts you for replacement text. Every instance of the word then is replaced with the replacement text. Gold keys also perform bolding, underlining and centering and create headers, footers, and date and time markers.

The spell checker (Gold-S) highlights unrecognized words and prompts for replacements.

[R]eplace substitutes new words, entered with [N]ew (arrows or mnemonics work here). You build two system dictionaries as you work: a Document Dictionary for each error-correction sequence, and a User Dictionary that accumulates from all spell checks. These dictionaries can be read by selecting the Copy the Dictionary to a Document option in the Spelling menu. The system builds its own Ignore list for words you don't want corrected. A thesaurus is invoked by moving to a word for which you want synonyms and hitting Green-S.

Other documents can be down-





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loaded into your current Word-11 document using Gold-G for Word-11 documents or Green-G for other ASCII documents. A library of frequently used text is created like a normal document, labeled Library Document and accessed by Gold-L. Gold-C copies your document to another document, which must be given a different name.

Three additional character sets are included in the system, accessible by Green Key sequences. These include Supplemental or European characters; Special Graphics, which lets you build boxes or grids; and DECSCI, which includes Greek characters and math symbols. A screen calculator lets you set up equations in columns and select Add, Subtract, Multiply or Divide.

### Fonts

Font style and size can be selected with Green and the period from the main keyboard. Green-slash-period gives you a font selection menu with the options to select a font, show more fonts, find a font by number or enter the font maintenance menu. The Word-11 system manager defines the font numbers (see screen on page 94). Using the font maintenance menu, you can determine which fonts are defaults for a given document. This menu lets you choose which fonts go with which documents, and several fonts can be called per document. You can set this menu to alternate fonts (on and off) using the Green key. You can change fonts on either a systemwide or documentwide basis. You can select a different set of fonts from each document, or you can set a

fixed set of fonts that everyone across the system must use.

Word-11 supports all fonts on laser printers such as the LN03, HP LaserJet Plus, Talaris 810 and 1590 and PostScript printers such as the Apple LaserWriter and the LN03R.

### The Second Screen

The options on the second menu screen are:

[T] is the document and transfer utility. By entering names of documents, you can create a duplicate document copy, rename a document or delete a document. The remaining capabilities affect the index. The index can be sorted by the edit date, document number or alphabetically in ascending or descending order. The index internals are affected by Reduce Size, which realigns it after a major document purge, and Rebuild Index, which renumbers the entire index after external documents have been imported.

[S] is your access to the spelling dictionaries, which you can put into Word-11 documents. These documents must be upgraded every time you read them, which entails deleting old dictionary documents.

[V]iew lets you inside a document, but changes you make can't be filed.

[DK] is the facility for defining user-defined or macro keys. Sequences are stored by a number and called into a document by Gold-U and the number. DK files can be edited or deleted like regular documents.

[OP] is the option menu.

[CD] lets you select a storage device

## Word-11 Version 4.2

**PLATFORMS:** VAX/VMS, IBM PC and compatibles

**PRICE:** \$995 on the VAXstation 2000 or 3100; \$5,900 on a MicroVAX II; \$10,000 on a MicroVAX 3800/3900; \$12,500 to \$20,500 on the VAX 63xx series; \$25,500 on the VAX 89xx series; \$295 for a single-user PC license, with multiple-order discounts available

### DATA PROCESSING DESIGN INC.

**HEADQUARTERS:**

1400 N. Brasher St.  
Anaheim, CA 92807  
(714) 970-1515

**FOUNDED:** 1977

**PRODUCT LINE:** Word processing system with calendar and fax options; business graphics package; RSTS backup utility

**OWNERSHIP:** Private

**BRANCHES:** San Francisco, Chicago, Boston and Washington, D.C.

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Pasadena, CA 91101  
(818) 796-9371

CIRCLE 536 ON READER CARD

Microsystems Engineering Corp.  
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Hoffman Estates, IL 60195  
(312) 882-0111

CIRCLE 527 ON READER CARD

Talaris Systems Inc.  
P.O. Box 261580  
San Diego, CA 92126  
(619) 587-0787

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on which to store your documents.

[CS] is used by the system manager to change user settings for the keyboard and terminal or to lock user's rulers, user-defined functions or print defaults.

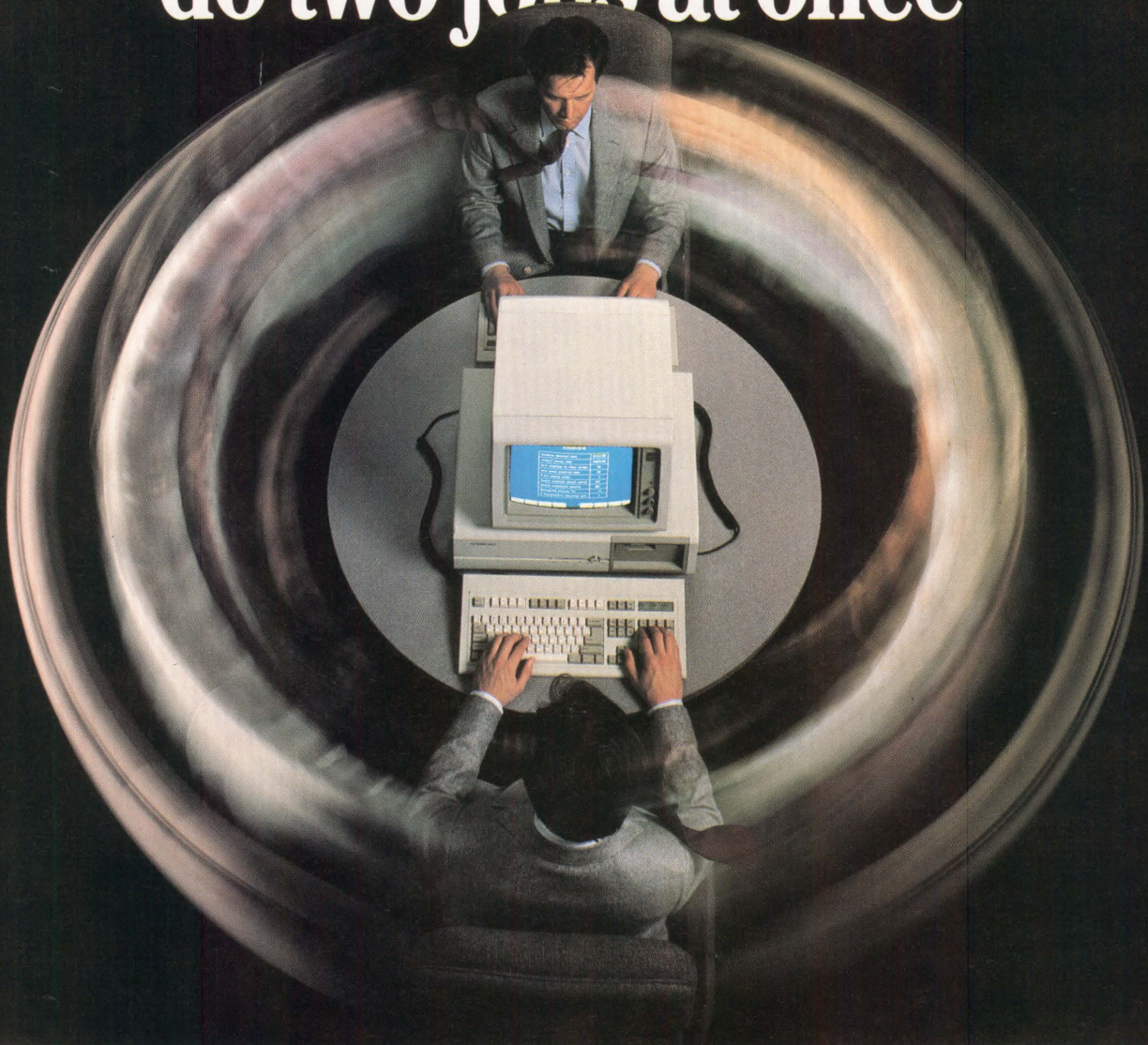
[XU] lets you execute a defined key from the command line. For example, if you plan to edit the same document every day for a month, you may want to set E <CR> Name of Document <CR> and execute it with XU.

[RE]cover is a buffer that reconstructs unfiled documents to the point leading up to the system crash. Mine worked fine after a mid-session reboot.

IF YOU'RE USED TO VMS-style editors, you'll appreciate Word-11. Now that Word-11 is equipped with the font directory, it's on its way to becoming a full-blown publishing system. With the mail and fax utilities (you select a document, then type a send code), Word-11 is already a complete office system.



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*M Software Inc.'s M\*PC Simulates An IBM PC  
Compatible Within The Context Of A VMS Process*

# Emulation EDGE

With workstations, windows and interoperability the buzzwords of the computer industry, software vendors are racing to market tools that exploit the capabilities of powerful desktop systems.

M\*PC, from M Software Inc. of Ann Arbor, Michigan, is a pioneer in the relatively new area of VAX software-based, commercially available foreign system emulators. The product provides a credible simulation of a full-blown, IBM PC compatible within the context of a VMS process.

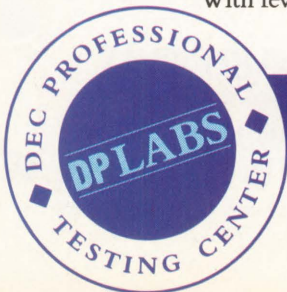
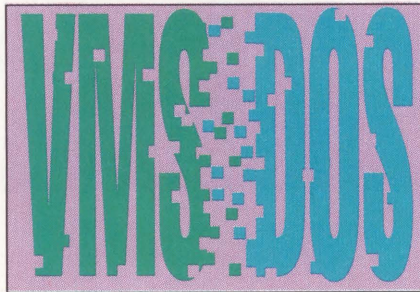
M\*PC version 2.5 theoretically is capable of running most of the 40,000 MS-DOS software packages on the market. With few limitations, it does a decent job of

tricking your VAX into thinking it's a PC clone.

Unlike hardware offerings, such as Logcraft's 386Ware, M\*PC is strictly software based. It provides each process running

the program with an environment equivalent to an IBM PC XT with 640 KB of memory, up to four 31-MB hard disks, two 360-KB floppies, two serial ports, three line printer ports, a monochrome screen and a PC keyboard.

M\*PC comes configured with two hard drives: C and D. C is the boot disk containing MS-DOS, while D is formatted and empty. M\*PC's hard disks are VAX-based files that start at 1,500 blocks and expand as necessary to contain PC files stored on them.



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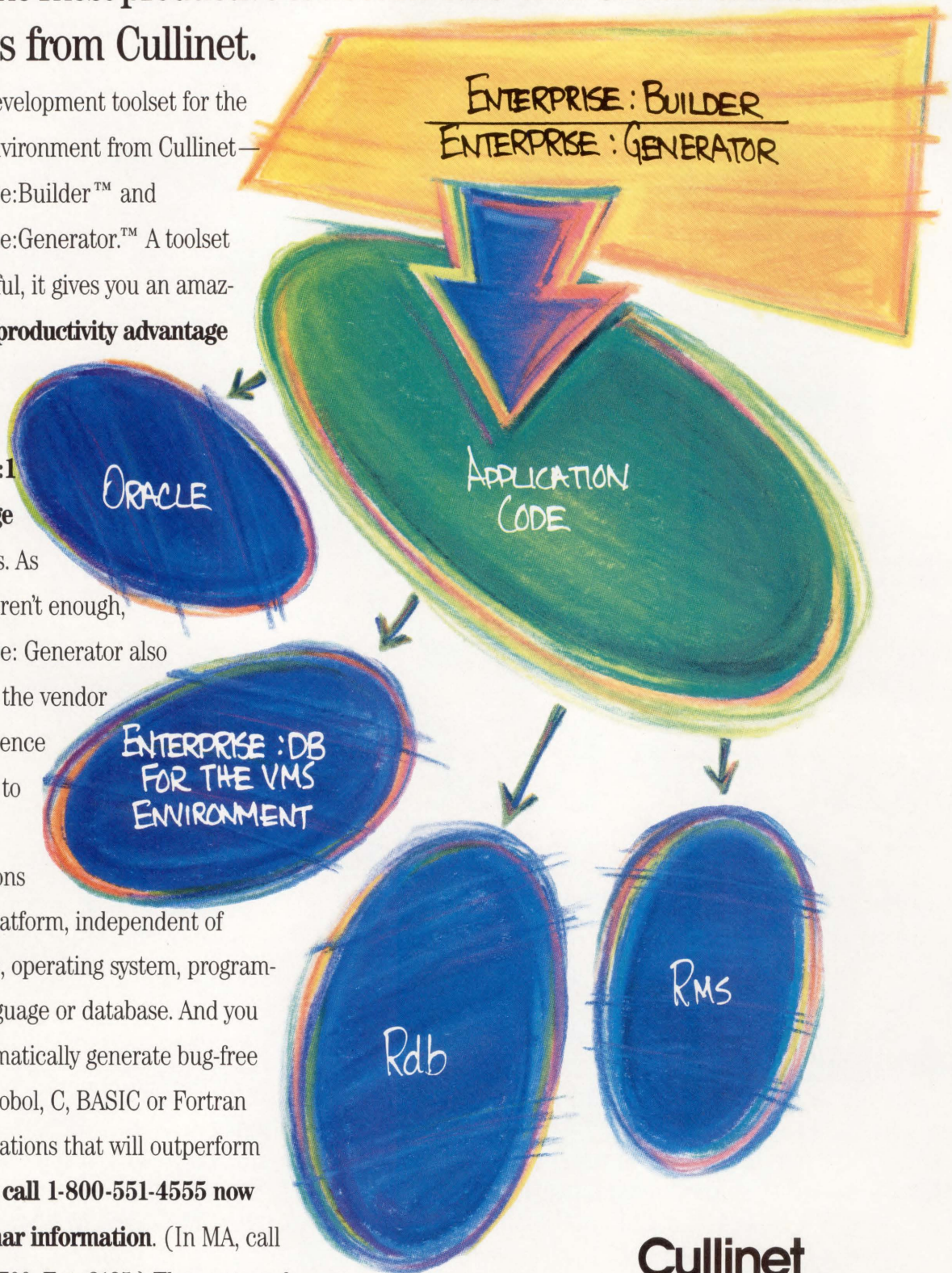
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Deleting PC files from the disks doesn't necessarily recover space from the VAX files serving as the disk emulators. Instructions are provided for regaining space by creating a new hard disk and copying files to it from the old one. The emulated hard disks can be accessed in read-only mode by multiple processes running M\*PC, so you can share a system disk and have your own hard disks for personal file storage.

The emulated floppies are 770-block VMS files and rarely are accessed. M Software recommends they be used only for copying information to the hard disk emulations because of performance considerations.

The serial ports COM1 and COM2 can be assigned to two VAX serial ports or left unassigned. Similarly, the printer ports LPT1, LPT2 and LPT3 can be a queued VAX printer, a serial port or blank.

Although M\*PC supports VT220 terminals and work-alikes, there's a problem with screen depth. A PC terminal has 25 lines, while a VT220 has 24. Certain non-DEC terminals, such as the Wyse 99, can support the 25th line. DEC's VT320 also handles the extra depth.

Other workarounds include configuring the PC software to only use 24 lines (which isn't an option in many cases) or using an M\*PC setup parameter that causes line 25 to overwrite line 24. If you're using a PC to access the VAX, M Software provides a program called MTERM that permits the VAX to handle the IBM keyboard codes properly. M\*PC's default setup is for a VT220 us-

ing ANSI codes.

M\*PC comes with several other utilities, including KERMIT for file transfers and programs for transferring VMS files into and out of the emulated hard disks. Software for converting MS-DOS files into formats compatible with EDT also are supplied, as well as programs for optimizing the manner in which M\*PC looks for keyboard input. MS-DOS version 3.3 is provided on a 5¼-inch DSDD floppy, although it's already installed on the emulated system disk.

### Performance

You won't mistake M\*PC for a 30-MHz 386 machine. On a workstation or an unloaded CVAX, M\*PC comes close to running at the speed of the original 4.77 MHz IBM PC. On an unloaded 11/750, M\*PC chugged along at about half the speed of my PC clone. Considering what's involved in emulating a foreign CPU in software, that isn't an unimpressive figure. Still, M\*PC will give disappointing results when being run on any but the fastest VAX processors.

M Software intended M\*PC to be used on workstations and high-end VAXs. It claims better performance than DEC's VAXpc MS-DOS software emulator. The performance estimate was based on reports that Phoenix Technologies used C to develop VAXpc. M\*PC is written in MACRO-32.

Norton's SI returned a computing index of .4 for M\*PC running on an 11/750, which was close to the rudimentary performance test I used: the execution time of a FOR-NEXT loop in GW Basic. However, Norton's SI thought that M\*PC was an 80286, a fact that puzzles Bob Materka, president of M Software.

M Software has made significant strides in improving M\*PC's performance. Three new versions of M\*PC were delivered during the six months we had the software for review.

If you evaluated the product during its initial release last year and gave up on it for being slow, you'll be pleasantly surprised with the latest ver-

### M\*PC Version 2.5

PLATFORMS: VAX/VMS version 4.4 or later

### M SOFTWARE INC.

#### HEADQUARTERS:

708 W. Huron  
Ann Arbor, MI 48103  
(313) 761-5800

FOUNDED: 1984

PRODUCT LINE: M\*PC

OWNERSHIP: Private

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sion. Materka explained that the problem with earlier releases was that the PC emulation was too precise. The original M\*PC constantly scanned the user's keyboard for input, just like a real PC, in the process consuming VAX CPU cycles with wild abandon.

The software was modified so that it now waits for keyboard input instead of constantly polling the character buffer. Many PC programs, such as Lotus 1-2-3 and WordPerfect, work fine under this configuration, although others require constant polling for proper operation. M\*PC handles this situation by placing the process in which it's running in hibernation if two minutes pass without any keyboard I/O. The keyboard scanning and hibernation functions can be set to conform with the needs of the software being run.

Still, you'll know when M\*PC kicks in on your VAX. The software will try to lock up to 1,500 pages of memory (750 KB) if it's available and the user's wsquota authorization permits it. However, this can be overridden. M\*PC's performance, like that of any VMS software, depends on system loading and resource availability.

## Using M\*PC

Getting M\*PC on your system involves creating an M\_PC directory on the VAX and copying a backup saveset to disk. A single logical name and one or two symbol assignments in the system or user log in file take care of the installation chores. The software can be configured so that several users share a common read-only system disk and have their own local disks. Or, each user can have a complete PC in a subdirectory of his own.

Because M\*PC provides a precise emulation of MS-DOS, users familiar with that operating system will have no problem using M\*PC. I copied the directory structure of my PC clone to M\*PC and was up and running in no time. Aside from making sure that specific M\*PC programs were executed in the AUTOEXEC.BAT file, the environment under M\*PC was identical to that of the clone.

The first several times you run

Ashton-Tate 20101 Hamilton Ave. Torrance, CA 90502 (213) 329-8000 CIRCLE 486 ON READER CARD	Lotus Development Corp. 55 Cambridge Pkwy. Cambridge, MA 02142 (617) 577-8500 CIRCLE 408 ON READER CARD	Phoenix Technologies Ltd. 846 University Ave. Norwood, MA 02062 (617) 551-4000 CIRCLE 442 ON READER CARD
Boston Business Computing Ltd. 360 Merrimack St. Lawrence, MA 01843 (508) 683-7920 CIRCLE 472 ON READER CARD	Mortice Kern Systems Inc. 35 King St. N. Waterloo, Ontario N2J 2W9 (519) 884-2251 CIRCLE 477 ON READER CARD	WordPerfect Corp. 1555 N. Technology Way Orem, UT 84057 (800) 321-4566 CIRCLE 489 ON READER CARD
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M\*PC, you'll probably want to go through the startup menu. These screens prompt for configuration information and let you control M\*PC's behavior. When you've become familiar with the product, you can bypass the menus and go straight to booting the PC.

Because I was running the product on an unloaded 11/750, response time was satisfactory. To make things easier, I used a PC running the supplied MTERM software so I could use the regular IBM keyboard instead of the special VT220 key assignments.

M\*PC handled most of the software I threw at it, including several text editors, dBase, a word processing file-conversion utility, a TSR utility and a shareware starship simulator. I had to alter some M\*PC parameters and keyboard scanning behaviors to get everything to run, but the adjustments were simple.

VCL, an MS-DOS program that emulates DCL on MS-DOS systems, worked fine, as did the UNIX-like software in Mortice Kern Systems' MKS Toolkit. At one time I was running emulated UNIX (MKS Toolkit) under emulated DCL (VCL) under emulated MS-DOS (M\*PC) under VMS. Aside from a slight disorientation on the user's part, everything worked well.

I managed to hang the PC when I fired up a word processor that expected to run in CGA mode. Also, it took several minutes to exit from the game program. A SHOW SYSTEM indicated my process was in a RWAST state — resource wait for system or special kernel AST.

These instances prompted me to call M Software's support line. I received prompt and accurate assistance. Aside from the toll call, support is free for the first year of the license.

M\*PC's original manual consisted of 35 pages of photocopied, one-sided typewritten pages in a plastic report holder. The latest release is longer, typeset and has a plastic spine. The M\*PC Guide's structure also has been improved.

The best way to use the M\*PC Guide is to start at the beginning and go straight through. The material is organized logically, although tabs or running page heads would improve it immensely. A two-page cheat sheet featuring VT220-PC key equivalents is a big help, although it isn't durable.

SHOULD YOU PURCHASE M\*PC? That depends. You shouldn't get the product if you're using an 11/7xx system, MicroVAX II or any non-CVAX-based processor. Performance will be marginal. On a workstation or fast VAX, M\*PC runs well and does a commendable job of making the system look like an IBM XT. It may be best suited for a workstation environment, in which the user is likely to switch between VAX and PC applications quickly.

Overall, M\*PC is a solid product that does a good job.

*Editor's note: M Software made three major announcements regarding M\*PC as we went to press. It costs \$595 per CPU, regardless of processor type or number of users; CGA and EGA graphics are supported on ReGIS-type terminals; and while not a full 286 emulation, M\*PC will execute 286 instructions.*



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## WORKSTATIONS

David W. Bynon

# The Problems With X Programming

Have you noticed that most technological solu-

tions are associated with implementation problems? The X Window System is no exception, and that's a problem.

Without an easy method of mating a graphical user interface (such as DEC's XUI) and the X protocol to existing and new applications, X might as well be a sinking ship. The problems involve understanding and time.

The X Window System (i.e., Xlib, X servers and the X wire protocol) is elegant. It's also very complex — not so much in how it works as in its magnitude. X is very large. Xlib function calls rival VMS System Services in number.

The time factor problem is twofold: time invested to learn X and time spent programming for X. The average programmer will spend four to eight weeks learning to program in the X environment. Further, a coding problem that once took several lines of code to solve can take pages of code for X.

## Weathering X

As an example, let's say we want a single Yes or No response about the day's weather. In C, we can use the `printf()` and `scanf()` functions to present a question and get user input:

```
printf("Is it sunny today (Y/N)? ");
scanf("%c", &yes_no);
```

To act on the user's response, you'd use a case statement to control what the program would do. Figure 1 is a complete C program that prompts for input and displays a message based on the user's response. The program took

“

*The average programmer will spend four to eight weeks learning to program in the X environment.*

”

about five minutes to type in and test.

This type of programming is easy to understand and implement, because the user is limited to a narrow scope. The program responds to two valid inputs. All other user input is invalid.

When programming a graphical user interface such as X, you shouldn't limit the user's scope to a single context. The purpose of the workstation and the graphical user interface is to let the user freely work on several tasks at once. To facilitate this type of user interface, the software must be capable of creating and managing more than one user interface and detecting when these interfaces are being manipulated. In X, this is accomplished through individual interface entities called windows and interrupt routines called event handlers.

An X program that is functionally equivalent to Figure 1 is roughly three pages of C code. Worse yet, I spent about four hours writing and debugging the X program. Figure 2 shows a portion of this program; the entire program is available in ARIS/BB.

To create the same simple application using X, you must:

1. Connect the application to an X server.
2. Get resource information about the X server.
3. Create and map several windows (parent and children).

4. Use Xlib functions to label the windows and get user input.
5. Create an event loop to wait for the user to click in a window.
6. Free client-specific data and disconnect from the X server.

After you've created several types of windows and interfaces, you then can use them as models for others. This saves some time, but it isn't ideal.

## Xworkbench

DEC, HP and others have eased the X programming burden by developing widget and graphics libraries. These libraries, such as the DECwindows toolkit, provide standard functions that call the low-level Xlib routines. This helps to remove the complexity and

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detail of programming X applications, but only for the available set of widgets or graphics calls.

Even with widget and graphic libraries, window geometry can drive a programmer crazy. Positioning windows, text and graphics is tedious. Graphing windows, text and graphics on graph paper works, but it's time-consuming and boring.

Perhaps the only solution to this X programming dilemma would be an interactive X application that did the programming for you. We can call this hypothetical program Xworkbench.

The Xworkbench program would be analogous to Microsoft Paint or MacDraw. The programmer would have a palate of objects (windows, widgets and gadgets) that could be selected, placed and manipulated. After the visual aspects of an object had been

defined, the Xworkbench would allow the programmer to define its function; i.e., parent window, child window, input, output and event handlers. After the function of each object had been defined, Xworkbench would let the programmer test the interfaces. The final output of Xworkbench would be the code and resource files needed to recreate the objects defined in the interactive session.

A program such as this would have several benefits, although the greatest impact would be the time savings. X graphical user interfaces could be designed, tested and implemented in minutes instead of hours. The program would inspire creativity while maintaining a look-and-feel standard.

The success of X will be reflected directly by the availability of such interactive development tools. ■

## FIGURE 1.

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

    printf("Is it sunny today (Y/N)? ");
    scanf("%1s", &yes_no);
    switch(yes_no) {
        case 'y':
            printf("Take the day off!\n");
            break;
        case 'n':
            printf("Too bad!\n");
            break;
        default:
            printf(" .7");
            break;
    }
}
```

## FIGURE 2.

```
.
.
.
main(argc,argv)
    unsigned int argc;
    char *argv[];
{
    /* Open a display */

    if (!(disp = XOpenDisplay(NULL))) {
        exit(1);
    }

    /* Create the parent window */

    window = XCreateSimpleWindow
        (disp,          /* pointer to display info */
         parent,      /* parent window id */
         DisplayWidth(disp,screen)/3, /* x offset from
root */
         DisplayHeight(disp,screen)/3, /* y offset from
root */
         250,200,     /* dimensions */
         borderWidth, /* border width*/
         black,       /* border color*/
         white);     /* background color */

    if (!window) {
        printf(stderr,"Error -- Can't open parent window\n");
        exit(1);
    }

    /* Create "YES" button window */

    yes_button = XCreateSimpleWindow(disp>window,25,25,50,50,
        borderWidth,black,white);

    if (!window) {
        printf(stderr,"Error -- Can't open yes_button window\n");
        exit(1);
    }

    /* Create "NO" button window */

    no_button = XCreateSimpleWindow(disp>window,100,25,50,50,
        borderWidth,black,white);

    if (!window) {
        printf(stderr,"Error -- Can't open no_button window\n");
        exit(1);
    }
}
```



Elaine L. Appleton

# Opening The UNIX Desktop

Imagine walking into a software store and picking up a

shrink-wrapped version of UNIX that included MIT's X Window System, DOS capabilities, networking facilities, a relational database and other useful tools. You buy the whole thing for \$1,000. Impossible? Not any more.

Santa Cruz Operation (SCO), a force in "low-end" UNIX system integration and reseller of Microsoft's XENIX as well as dozens of applications for XENIX systems, plans to release Open Desktop next month.

Open Desktop, designed to provide a mass-market platform for UNIX application developers, includes many facilities in a bundled package starting at \$995 for a single-user version.

Open Desktop, which will run on 80386-based systems, includes these components (see Figure):

1. UNIX System V/386 release 3.2. This most recent release of UNIX System V incorporates UNIX and XENIX. (UNIX System V release 4.0, due out at the end of the year, also should include Berkeley extensions.)
2. The X Window System, based on SCO Xsight, which originally was developed by Locus Computing.
3. TCP/IP networking.
4. Network File System (NFS) from Sun Microsystems.
5. DOS-UNIX integration, from Locus Computing, in the form of Merge 386, PC-Interface and PCILIB, an applications programming interface, allowing access to DOS applications in the multitasking environment. Merge 386, part of AT&T's UNIX System V source code, lets you run both DOS and UNIX applications on

your 386. You can run DOS and UNIX programs concurrently, and files are integrated, according to Locus.

PC-Interface lets you connect DOS PCs, one at a time or in LANs, to the Open Desktop workstation and lets you share Open Desktop files and printers. If you're using a DOS machine connected to Open Desktop, you can run UNIX programs through PC-Interface's terminal emulator. PCILIB provides tools for developing DOS and UNIX applications in one program.

6. The Open Software Foundation's (OSF) X11-based OSF/Motif graphical user interface. DEC's XUI toolkit underlies Motif's application programming interface (API), while the presentation description language is based on DEC's User Interface Language (UIL). HP's Window Manager provides 3-D windows and DEC contributed features from its own window manager, such as icon boxes.

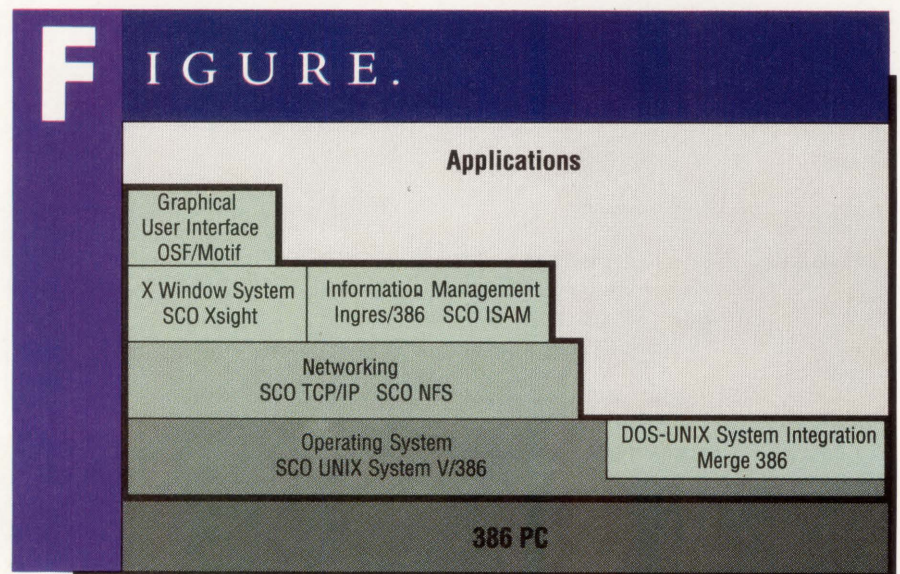
7. Ingres/386, an SQL-based RDBMS from Relational Technology Inc. (RTI).

Ingres/386 includes a General Communications Architecture (GCA) that RTI says is a database interface communications standard that will allow developers flexibility in porting and producing software. RTI has published the specifications for GCA as part of SCO's developer program, which began providing early releases of Open Desktop to developers in May.

## Living In The Land Of DOS

The point, according to SCO, is to provide a common applications programming interface and graphical user interface so that applications designed for the system will look and feel the same — just as applications designed for the Mac have for years. OS/2, which includes Presentation Manager, Microsoft's graphical user interface, and Extended Edition, an RDBMS, attempt to do the same.

Can UNIX live in the land of DOS and OS/2? Will DOS users, moving up to multiuser capacity on their 386



Open Desktop's components.





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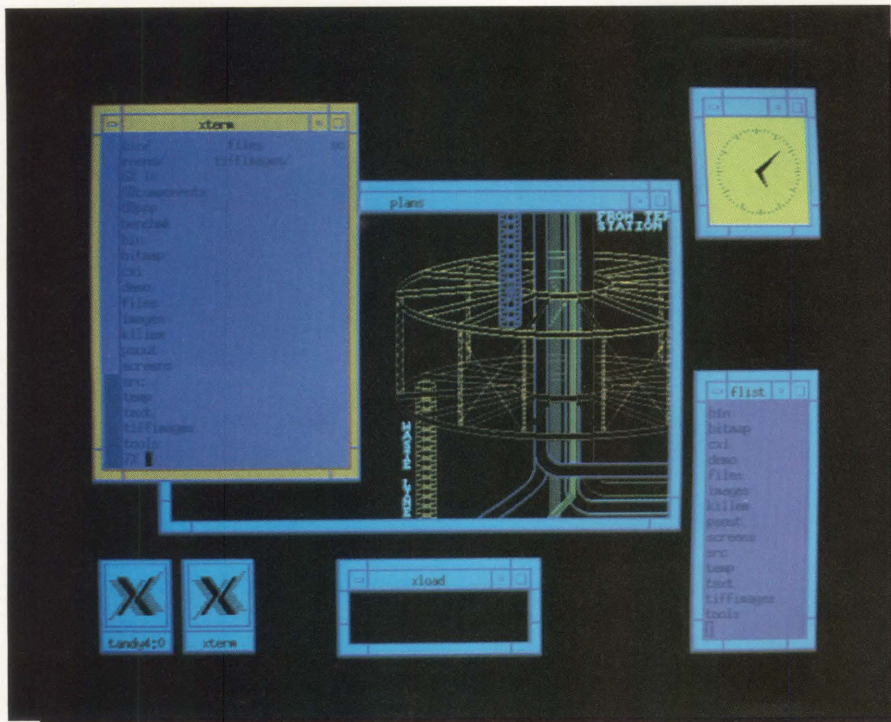
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*SCO's Open Desktop uses the OSF/Motif graphical user interface.*

machines, be willing to deal with the awkwardness of UNIX's cat, grep and awk? SCO, DEC, RTI, Locus and Tandy are betting they will.

Locus' X Sight, a version of the X Window System, Version 11.3, hides much of the UNIX command-line interface from the user. And SCO prides itself on making UNIX applications available to the commercial user — who's usually less technically astute and less interested in tinkering with the system than the engineer or scientist. This isn't new ground for SCO, but it could be fertile. And Tandy, which has a large installed base of XENIX users, is the first licensee of Open Desktop for its Tandy 4000 series and 5000MC machines.

Is this a battle between UNIX and OS/2? SCO won't admit that the software bundle is directed at the potential OS/2 buyer but does say that it's "an effort to provide an alternative for DOS users who have outgrown their systems."

Still, it's not outright war. SCO and its cohorts are aware that IBM exists in most corporate environments. What's

more, Microsoft owns up to 20 percent of SCO. This contributes to an effort toward integration. OSF/Motif is compatible with Presentation Manager, and SCO is cooperating with Microsoft to develop Presentation Manager/X (PM/X).

"PM/X brings two things to Open Desktop," says Alan Ginzburg, SCO director of marketing strategy. "It brings Presentation Manager API compatibility, so that an application designed for Presentation Manager would be easier to port to Open Desktop. And it brings an alternative localized windowing system, which is quite different philosophically from Open Desktop [which uses X, a distributed windowing system]."

"To the user," says Ginzburg, "this looks the same. But developers have a choice of developing an application that runs on OS/2 or UNIX. They may be developing some function that's difficult to run on X, such as games in which you have to drag a lot of images around the screen. This [type of application] may be easier to develop on Presentation Manager."

The first release of Open Desktop

will include some connectivity with Microsoft's LAN Manager, a LAN for desktop computers running OS/2. "The user will be able to plug into a network that has a LAN Manager server on it," says Ginzburg. "The idea of Open Desktop is that it needs to play in an IBM environment. We're providing the client side of NFS, we're providing TCP/IP, and we're providing the client side of LAN Manager, so you can take your Open Desktop workstation and plug it into any environment."

DOS users demand flexibility, and that means binary compatibility. "Any 386 PC running SCO's operating system is compatible at the binary level, which means you can buy shrink-wrapped applications. The thing that Open Desktop adds is a mass-market appeal — pricing, comprehensiveness and ease of use," says Ginzburg.

This is all well and good for the low-end UNIX customer or the DOS user interested in moving upward. But what's in it for DEC? DEC's decision to resell Tandy PCs is a result of its desire to become "the system integrator of choice," according to William Heffner, DEC's vice president of software systems. No company can do that without a DOS offering. Open Desktop, with its merge of UNIX capabilities and DOS emulation, lets hundreds of pre-existing UNIX, XENIX and DOS applications run immediately. It should leverage sales of the 386 machines for DEC.

Moving DEC PCs into the corporate environment makes sense. Moving DEC PCs that include Motif into the corporate environment makes even more sense, as it places DEC's XUI on the desktop — the company's main reason for participating in this venture.

## Should You Buy?

Should you buy copies of Open Desktop the minute the software hits the store? There are a number of points of view:

1. Go ahead. It could cost you up to \$15,000 to purchase all of Open



Desktop's pieces separately, so it's an incredible price savings.

2. Maybe. The memory requirements raise the price a lot. SCO recommends a minimum of 4 MB of RAM to run Open Desktop, and that's if you distribute the RTI database over more than one machine. If you choose to put front and back ends on the same desktop, RTI recommends 8 MB. SCO hopes that there will be Open Desktop applications available by September that take advantage of OSF/Motif and the RTI database engine, and if you buy one of these applications, you'll need even more memory.

3. Sure. If you want a distributed database situation on the low end and want to string X terminals off your Open Desktop workstation, it isn't a bad deal. The prices of such terminals aren't too high.

4. Why not? If your company is considering moving toward UNIX, but you've been hesitant about training your

users, this may be an easier way to make the transition, because it doesn't force users to learn those awkward verbs.

5. Maybe. Graphical user interfaces are the way of the future. Many believe character-cell interfaces are on the way out. But when Open Desktop is first

available, the 2,500 existing UNIX applications won't take advantage of Motif, and neither will the thousands of existing DOS programs. You'll be able to run programs in windows, but they'll still function with command lines, not icons — at least for now. ■

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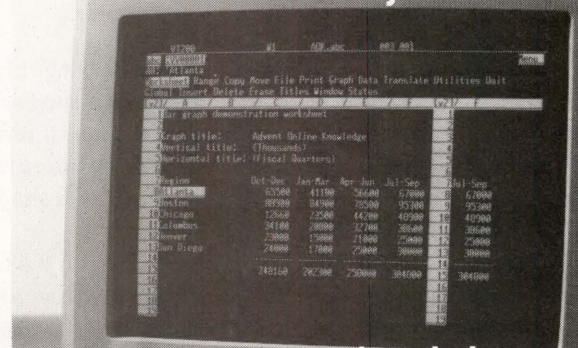
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# Pointers, Part 3

*Editor's note: This is the last in a three-part series about pointers. In this installment, Mr. Jaeschke discusses the relationship between arrays and pointers.*

*He introduces arrays of pointers, handling command-line arguments and the ANSI C addition, void pointers. He also indicates some common pointer errors.*

When the name of an array is used as a function argu-

“

**An array name can be thought of as a pointer to the first element in that array. However, the array name isn't a pointer.**

”

ment, it behaves like a pointer to the first element. This is almost always true whenever an array designator, such as an array name, appears in any expression. For example, if **name** is a **char** array and **pc** is a pointer to **char**, **pc = &name[0]** is equivalent to **pc = name**. And because the latter is simpler to write, it's more commonly used.

An array name can be thought of as a pointer to the first element in that array. However, the array name isn't a pointer. Pointers are variables, and therefore their value can change. But the address of the first element of an array is static: After an array is allocated space, its address remains constant and can't be changed.

Although there's a close relationship between arrays and pointers, they aren't completely interchangeable. In particular, in the scope of an array definition, that array name can't be used in all respects as a pointer. However, after the address of an array is passed to a function, within that function, the array's identity is lost.

Within that function, the array can be manipulated by using either array or pointer notation or by using both simultaneously. This is also true after the address of an array

element is stored in a pointer. From then on, the pointer doesn't know that it's pointing into an array. In fact, this aspect makes C as powerful as it is. Consider the following:

```
#include <stdio.h>

main()
(
    static float fa[] = {2.34, 3.45, 4.56, 5.67, 6.78};

    float *fp = fa;
    int i;

    for (i = 0; i < (sizeof(fa)/sizeof(fa[0])); ++i)
        printf("fa[%d] = %.2f\t*(fp + %d) = %.2f\n",
            i, fa[i], i, *(fp + i));
)
```

which produces the output:

```
fa[0] = 2.34 *(fp + 0) = 2.34
fa[1] = 3.45 *(fp + 1) = 3.45
fa[2] = 4.56 *(fp + 2) = 4.56
fa[3] = 5.67 *(fp + 3) = 5.67
fa[4] = 6.78 *(fp + 4) = 6.78
```

An array subscript is no more than an offset from a base address. As such, we can think of **fa[0]** as being that element at offset 0 from the start of the array, and that's exactly what it is. That's why arrays in C begin at subscript 0 instead of 1.

The meaning of expressions of the form **fa[i]** is obvious. However, that of **\*(fp + i)** may not be. Let's look at this expression more closely. Because the name of an array in an expression is treated as a pointer to its first element, this expression can be rewritten as:

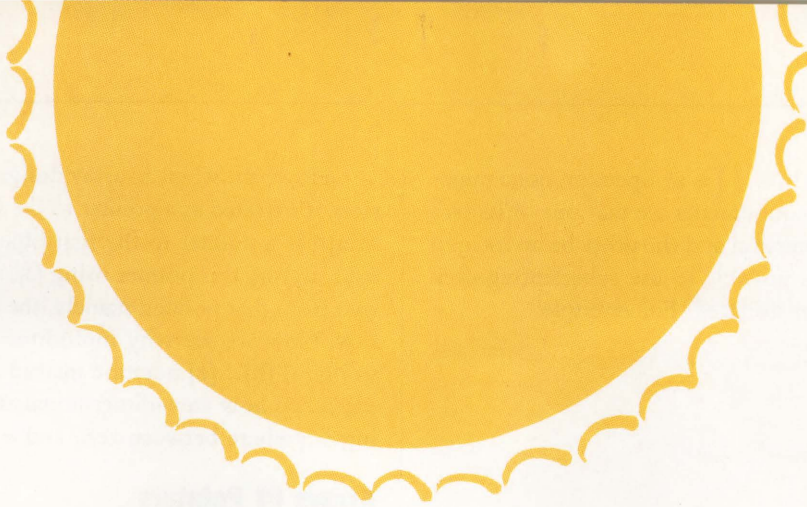
```
*(&fp[0] + i)
```

We also know that when an integer expression having value *v* is added to a pointer, the result is a pointer that points to a location *v* objects beyond the original pointer. That is, **&fp[0] + i** points to the *i*th object beyond **fp[0]**. And if we dereference that pointer, we get that *i*th object. Put simply, the formula for converting between array and pointer notation is:

```
a[i] is equivalent to *(a + i)
```

Because of this rule, array subscript expressions always can be rewritten as pointer expressions and vice versa. This





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is possible mainly because in C, [ ] is an operator, not a punctuator. As such, its only requirements are that one of its two operands be a pointer expression and the other be an integral expression. Therefore, it's possible to use subscripting even when no arrays have been declared. For example:

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

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

    return (dest);
}
```

Not only are we subscripting **dest** when it's declared as a pointer, we're dereferencing and incrementing **source** when it's declared as an array. This code is legitimate but not good style.

Programmers new to C usually stay with the subscripting method, because it's used in most other high-level languages. However, seasoned C programmers generally go the pointer route.

It's easy to recognize an array subscript expression and to convert it to its pointer equivalent. However, the opposite isn't always as obvious. Consider the following program:

```
#include <stdio.h>

main()
{
    double d = 1.234;
    double *pd = &d;

    printf("***pd = %6.3f, pd[0] = %6.3f\n", *pd, pd[0]);
}
```

The output produced is:

```
*pd = 1.234, pd[0] = 1.234
```

The expression **\*pd** is equivalent to **\*(pd + 0)**. By the conversion rule, this is equivalent to **pd[0]**. That is, we can deal with **d** indirectly through **pd** as an array of one element. And isn't that what a scalar is? Of course, we also could use **pd[1]**, but that would result in undefined behavior. Voila! We've discovered something magic about C. You arbitrarily can subscript any pointer to one level no matter what, and the resulting expression will have meaning.

If we apply this new-found knowledge to multidimensional arrays, we gain more insight into how they work. For example, **a[2][3]** declares an array of two rows, each having three objects. Because [ ] is an operator and operators at this precedence level associate left to right, the expression **a[1][2]** is equivalent to **(a[1])[2]**. **a[1]** designates the second row of the array. It's an array of three objects.

However, when an array designator is used in an expression, it's treated as a pointer to the first element, so the value of **a[1]** is a pointer to the first object in the second row. By subscripting this pointer using **[2]**, we get the object at offset two from that pointer, namely, the third object in the second row. Now we see why multidimensional arrays are written using **[a][b]...[z]** notation instead of **[a, b, ..., z]**. We've also explained how an *n*-dimensional array can be referenced using anywhere between zero and *n* subscripts.

## Arrays Of Pointers

Pointers are variables, and because we can have arrays of variables, we can have arrays of pointers. For example:

```
double d1 = 1.2;
double d2 = 2.3;
double d3 = 3.4;
double *pd[] = {&d1, &d2, &d3};
```

**pd** is an array of three pointers to **double**, and it's initialized with the addresses of three **double** variables:

```
#include <stdio.h>

char *table[] = {
    "Summer",
    "Fall",
    "Winter",
    "Spring",
    ""
};

main()
{
    int i = 0;

    while(*table[i] != '\0') {
        printf("table[%d] points to >%s<\n",
            i, table[i]);
        ++i;
    }
}
```

The output is:

```
table[0] points to >Summer<
table[1] points to >Fall<
table[2] points to >Winter<
table[3] points to >Spring<
```

In this case, **table** is an array of five pointers to **char**. Each element is initialized to point to a null-terminated array of **char** that's allocated space by the compiler. The empty string is used as a terminator, so we can traverse the array without knowing its size. The loop stops when **table[i]** points to a byte containing **'\0'**, and that's what an empty string contains.

## Command-Line Arguments

To date, every **main** function has had zero arguments. However, standard C permits **main** to have either zero or two arguments, and if two are present, they can be used to access



arguments entered on the command-line when the program is invoked. For example:

```
#include <stdio.h>

main(int argc, char *argv[])
{
    int i;

    for (i = 0; i < argc; ++i)
        printf("arg #%2d is >%s<\n", i, argv[i]);
}
```

When this program is invoked on PC-DOS V3.3 using the command-line:

```
test ABC def "ABC" "AB DE"
```

the results are:

```
arg # 0 is >C:\WRITING\LETSCNOW\TEST.EXE<
arg # 1 is >ABC<
arg # 2 is >def<
arg # 3 is >ABC<
arg # 4 is >AB DE<
```

**argv** is an array of pointers whose elements point to null-terminated command-line strings. **argc** contains the number of the strings found at program startup. By definition, **argv[0]** points to the name of the program, and the format of this string is implementation-defined (as are numerous other aspects of command-line processing). In this case, the program startup code provided by this compiler translates the program name to its full device and directory specification. Also, the case of arguments and any white space embedded in double quotes are preserved. This isn't guaranteed by ANSI C.

Because **argc** and **argv** are formal arguments, they can have any name the programmer wishes. However, it's common to use the names **argc** and **argv**.

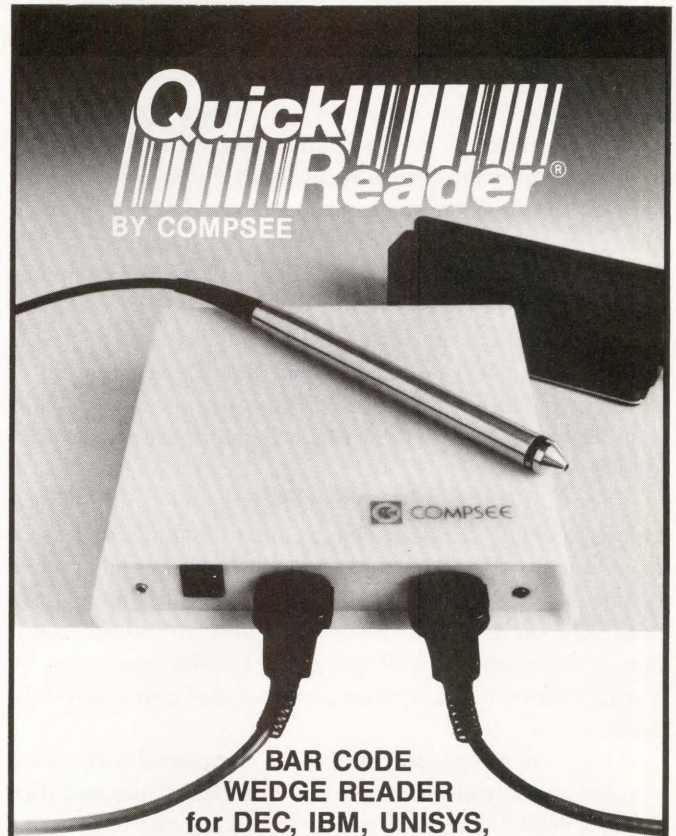
Many implementations (including UNIX, VAX C and most MS-DOS compilers) also provide a third argument to **main**. This generally is called **envp**, and like **argv**, it's an array of pointers to **char**. Each element points to a string describing some environment variable whose format is operating system-specific. The array contains a dummy last element with a value of **NULL**. ANSI C doesn't support **envp**.

Command-line argument processing can be used to make user-written programs look more like those utilities provided with the operating system. In fact, on UNIX, the operating system utilities are implemented exactly in this manner using C.

If **main** is defined without arguments, then any values passed to it by the startup code will be inaccessible by the program.

## Generic Pointers

On machines with word architectures, pointers to **char** generally have a different representation than pointers to other types. However, library routines, such as **memcpy** (in



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**string.h**), require arguments that are pointers to arbitrary objects. How then can the prototype for **memcpy** be written when we don't know the type of the pointer that will be given to it at compile time? Historically, **char \*** was used, because it was considered to be equivalent to a generic pointer. However, this was misleading. Also, functions such as the dynamic memory allocation routines in **stdlib.h** need to return generic pointers.

For these and other reasons, ANSI C invented a generic pointer type called pointer to **void**. It's written as **void \***; however, it has nothing to do with **void** functions or **void** in prototype argument lists. This is the third use for the **void** keyword.

You can create **void** pointer objects and arrays of such objects, and you can pass them to functions and return them from functions. In short, you can treat them like real pointers except that you can't dereference a **void** pointer or perform arithmetic on it. A **void** pointer is simply an address, and it has no other attributes. To get at the location pointed to by a **void** pointer, you first must assign or cast it to a non-**void** pointer.

All pointer types are assignment-compatible with a **void** pointer, and if you assign a pointer of type *T* into and then out of a **void** pointer, you're guaranteed to point to the same object to which you initially pointed. However, the results are undefined if you assign a pointer of more strict alignment criteria to a **void** pointer and then assign it out to a pointer of less strict alignment and dereference the final pointer.

Examples of **void** pointer usage are:

```
#include <string.h>

f()
(
    void *pv;
    char c1[10];
    char c2[50];
    double d1 = 1.2;
    double d2;
    double *pd = &d1;
    char *pc;
    void **abc[10][23];

    pv = memcpy(c1, c2, 5);

    pv = pd;           /* OK */
    pd = pv;           /* OK */
    d2 = *((double *) pv); /* OK */
    pv = pc;           /* OK */
    pd = pv;           /* ??? */
)
```

**memcpy** is given two **char** pointers when it expects two **void** pointers. However, these pointer types are compatible. To dereference **pv**, it's first cast to a pointer to **double**. The final assignment is questionable, because **pd** contains an address that isn't necessarily suitably aligned for a **double** object on certain machines. The assignment might be OK, but



**Pointers are variables, and because we can have arrays of variables, we can have arrays of pointers.**



attempts to dereference **pd** may fail.

**abc** is a 2-D array of pointers to **void** pointers. If you examine the headers of an implementation that's tracking the ANSI standard, you'll see numerous examples of **void \*** argument and function return declarations. In fact, **NULL** even may be defined as **(void \*)0**.

### Common Pointer Problems

One common error made when dealing with pointers is to allocate space for the pointer but not for the space to which it's to point. For example:

```
/* Incorrect pointer use */

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

main()
(
    char *txt;

    strcpy(txt, "A literal string");
    printf("txt points to >%s<\n", txt);
    printf("txt points to address %p\n", txt);
)
```

which produces the output:

```
txt points to >A literal string<
txt points to address xxxx
```

**txt** has an undefined initial value so **strcpy** copies its source string to an unknown location, possibly overwriting critical areas of memory. In fact, when this program was run on an MS-DOS system using the large memory model (which provides access to all memory, including that occupied by the operating system), part of MS-DOS was overwritten, causing a file on disk to be trashed. Then the system hung and had to be rebooted. When run on VAX/VMS, an access violation occurred, because the address **txt** pointed to was outside the program's address space. On another implementation, the program ran to completion.

Another problem occurs when arrays of **char** aren't null-terminated and their address is given to **printf** with a mask of **%s** or to **strcpy**, **strlen** and others, all of which expect to find a **'\0'**.

The result is that either a **'\0'** is found somewhere in



memory and the process completes after having run too far, or the **char** pointer is incremented so far that it produces an address outside the program's address space, causing the program to abort (at least on multitasking systems).

It can be confusing initially as to whether or not a **\*** is needed in a pointer expression. Consider the following:

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

void f()
{
    char array[100];
    char *pc;

    /* ... */

    strcpy(array, *pc);
    printf("text is %s\n", *pc);
}
```

In both function calls, **\*pc** is used instead of **pc**. That is, we've passed a **char** rather than the pointer to **char** expected by **strcpy** and **printf**. And because the value of a **char** on an 8-bit machine can range from 0 to 255, that's the magnitude of the address actually used by these routines. On MS-DOS systems using the large memory model, this maps into the interrupt vector table. On VAX/VMS, the first page of address

space (addresses 0 to 511) can't be accessed by the user program, resulting in an access violation.

If you're programming on a multiuser or even a single-user multitasking system, memory access violations are generated when you attempt to access memory not allocated to your executable image. If you're fortunate, your system provides some traceback mechanism to help locate the erroneous statement.

However, on a simple-minded system such as MS-DOS, there's no memory protection, and any address is accessible. Therefore, problems can go undetected for a long time, and the only safeguard you have is to compile using small memory models so that when something gets trashed, at least you restrict the damage to your own memory segment. That way, you can't cause any serious or permanent damage to the operating environment.

Readers are encouraged to submit C-related comments and suggestions to Rex Jaeschke, 2051 Swans Neck Way, Reston, Virginia 22091 or via the uucp address uunet!aussie!rex. —Rex Jaeschke is an independent consultant, author and lecturer. He's the C language editor of DEC PROFESSIONAL, our representative on the ANSI C Standards Committee, and the U.S. International Representative for ISO. Jaeschke is editor of the Journal of C Language Translation, a quarterly publication aimed at C implementers.

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# Digital: Straight Talk

Much has been said (and rumored) in the media about

Digital's present and future service/support philosophy. Digital's warranty changes earlier in the year and its recent Enterprise Services and Desktop Service Solutions announcements have added fuel to the speculations about the direction in which Digital is heading. To obtain insight into Digital's plans for user service and support over the next few years, *DEC PROFESSIONAL* visited Digital's Corporate Field Service headquarters in Stow, Massachusetts. We interviewed Will O'Brien, corporate strategic marketing manager for field service. O'Brien has held various positions at Digital in marketing and business management since 1972.

***DEC PROFESSIONAL:*** *What are your views on where computerization is headed as we enter the 1990s?*

O'Brien: The computing environments of the next few years will be different than they were a few years ago. The customer's use of information systems has changed. There will be more applications available and users will be more dependent on the information system. There will be more mixed-vendor systems in use by much more sophisticated users. At the same time, there will be more computer tools available for many more unsophisticated users. And all users will be as dependent on their information systems as they are on their telephones. Also, management will be faced with more government regulations pertaining to such things as archiving, data protection and audit trails.

On the technology front, a variety of operating systems are being used, and there's a general proliferation of applications from vendors, OEMs and software houses, some on portable platforms that require the implementation of standards across the industry. We see more systems "running" a voice/data mixture. It's a new ball game.

***DEC PROFESSIONAL:*** *How does this affect your service philosophy?*

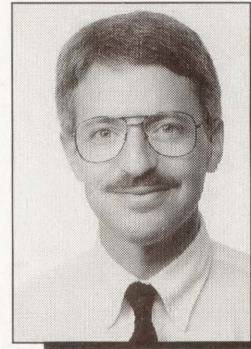
O'Brien: In the past, computer service referred to repair. Now, customers need a much more comprehensive level of support. Just three years ago, industry market servicing seemed to be the wave of the future — service to the banking industry, the manufacturing plant, the medical fields, and so on. Now, we see across-the-board computing environments. The recently initiated desktop services program is an example of this strategy. We're committed to it and are going in that direction. We feel that the computing environment will cut across various industry environments.

***DEC PROFESSIONAL:*** *You mean, for example, that a data communications center or a transaction processing system requires the same type of customer support and service regardless of the industry in which these environments are found?*

O'Brien: Exactly.

***DEC PROFESSIONAL:*** *How does Digital define service and support in this emerging environment?*

O'Brien: Support means bringing all resources of the vendor and its business partners to bear on the customer's business plan or problem. The main competition of the TPMS or independents will be the technology itself. Undoubtedly, there's more competition for Digital than ever before, and these competitors are making investments in service and support. Our response to



***Digital's  
Will O'Brien,  
corporate  
strategic  
marketing  
manager for  
field service.***

this increased competition and to the customer's changing demands has driven service to a higher level. We've spent \$1 billion over the years in service and support technology and continue to invest heavily in research and development. We need this type of investment to add value in the service/support area and to make the job in the field easier.

***DEC PROFESSIONAL:*** *How do you compare the added value needed in today's versus yesterday's support offerings?*

O'Brien: In the past, Digital and most other computer makers added value in the manufacture of systems that used off-the-shelf components. The added-value focus was systems engineering, e.g., the design and assembly of hardware and the development of operating systems. Soon, it became clear that the bigger challenge was making systems work together. Customers sought vendors that supported industry standards and developed architectures for chips, software and networks. This became the user's perception of the value-added point.

The focus is shifting again. Customers want program management of all the resources necessary to imple-



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ment complete solutions successfully — and that demand is increasing. Customers seek companies that not only understand their information system needs but that also can custom tailor a

“

**Vendors that are successful at integrating the equipment to meet customers' needs will win the service/support business of the future.**

”

solution out of available component products — not just the vendor's own.

**DEC PROFESSIONAL: In Digital's view of the future, what will be the value added to the customer service/support function?**

O'Brien: Customer support must include systems integration, applications development, global support, networking, high availability, configuration management and alliance management. The value-added concept is to make all of the user's equipment work in a system as defined by the customer. Vendors that are successful at integrating the equipment to meet customers' needs will win the service/support business of the future.

**DEC PROFESSIONAL: What's Digital doing now to position itself to provide this all-inclusive support?**

O'Brien: First, we've made a long-term commitment to industry standards. For example, Digital supports OSI and Ethernet, to name a few. We also can support most major operating systems. And when it comes to multivendor network support, we have more than 10 years of service experience.

**DEC PROFESSIONAL: What about the business partners you mentioned?**

O'Brien: Digital has formed alliances and relationships with those that can best serve our customers' needs. We have numerous business partners in our Cooperative Marketing Program and have agreements with several major software developers and the big eight consulting firms. We also have working arrangements with several network installers and major computer vendors/TPMs. These business alignments assist our customers with their growing multivendor environments.

**DEC PROFESSIONAL: Does Digital have other resources that offer customers added value over other service/support vendors vying for their business?**

O'Brien: We've invested heavily in expertise and advanced service technologies, such as AI, expert systems and our Customer Support Centers [CSC].

**DEC PROFESSIONAL: You mention AI and expert systems — how does remote support technology fit into Digital's future plans?**

O'Brien: Service and support always will be a people-intensive business. New advances, such as AI and expert systems, are just tools. They replace the oscilloscope, the multimeter, and so on. The intent isn't to replace site FEs; these tools complement our people and leverage their intelligence and ability to respond to customers. These and our other remote support tools help Digital provide cost-effective support. Today, about 60 percent of service calls come into our CSCs. Our surveys indicate that customer satisfaction is extremely high.

Customers expect high system availability, reliable products and fast remedial support when needed. By using new technologies to quickly “fix” a system before it fails, we free our people to aid the customer with other support needs.

**DEC PROFESSIONAL: What is the future role of the FE?**

O'Brien: The FE's main job will switch from “fix-it” to helping the customer implement and manage the computing environment. The FE will be a supportive partner with the customer. It will be a new role for the FE. Overall, there

will be more support personnel in the field but fewer in a “fix-it” role.

**DEC PROFESSIONAL: If their numbers grow, won't costs escalate?**

O'Brien: Labor cost will increase, but the added value they bring to the overall environment also will grow. The number of people in the field will grow to support our business as it grows and as more lines are added. For example, desktops, network services and systems integration will be high-growth areas for field employment.

**DEC PROFESSIONAL: Independents we've spoken with feel that the number of FEs will decrease as products become more reliable and remote support capabilities increase.**

O'Brien: I agree in the traditional sense. The number of FEs today who service equipment will decrease, but the manufacturer has a broader range of support than the independent service firms. When today's FEs and those who will provide the new levels of support we talked about earlier are counted, the overall number of field people will increase.

**DEC PROFESSIONAL: How big a revenue chunk is service for Digital today?**

O'Brien: Last year, Digital's service and other revenues were about \$4 billion out of total revenues of \$11.5 billion. Service/support is definitely very important to Digital.

**DEC PROFESSIONAL: What can the user expect to see from Digital in service/support pricing in the future?**

O'Brien: It will be a structured pricing arrangement. Traditional (fix-it) service will be priced competitively. Prices for new value-added services will have a two-tier approach. There will be a fee-defined setup for standard jobs or system work, and customized pricing for a specific project or task in which the customer pays for quality support and special skills, such as a systems integration project.

**DEC PROFESSIONAL: Digital, as well as the rest of the service industry, always talks**



about customer satisfaction. But to achieve this goal, a number of serious challenges will have to be overcome in the next few years. What do you consider the biggest and most important challenges that Digital must meet to win the service/support business of your user base?

O'Brien: Three come to mind immediately. First, we must provide quality support. Digital's goal isn't only to meet customer expectations in this area but to exceed them.

Second, today's computing environments require the continuous reskilling of our people. We're working hard on this now in such areas as UNIX-based support and transaction processing.

Third, we must control the cost of service/support. Traditionally, the business was just labor and materials. Now, support includes such things as administration, which can be substantial when managing 100 contracts; capital investment for improved productivity — new service technology and tools cost money; relationships — building and maintaining these has its costs; and marketing — service is a product that, like any other, must be sold.

We could have the greatest service and support programs in the world, but if the user can't afford them, they won't do our customers or DEC any good. So we have to balance cost and benefits and maintain a pricing structure under which the user gets good value that's affordable.

**DEC PROFESSIONAL:** Can you comment on service/support over the next three years?

O'Brien: We're in a tremendously exciting business. At Digital, we feel we have the opportunity to be the leader in the customer service/support field in the 1990s. Right now, only about 17 percent of desktops are networked. Within three years, that figure is expected to reach more than 50 percent. Digital is particularly strong in this area. Our corporate commitment to be the support provider across the customer's entire enterprise has positioned us well for the future. ■

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## XD88 Family Features Motorola 88000 Chip

Tektronix Inc. announced a family of graphics superworkstations combining Tek's graphics system with an implementation of Motorola's 88000 RISC chip. Tek's XD88 family includes two workstations, an applications processor and a file server, all with RISC-based compute engines at 14 to 17 VAX mips, 34,000 Dhrystones, 16 million single-precision Whetstones and 7 to 12 Mflops. The products handle databases in CAD/CAM, visualization, visual animation, earth resources, mapping, AEC, technical data analysis and graphics software development.

The XD88 architecture includes Motorola's 88100 processor, with on-chip integer and floating-point multiply, and four 88200 CMMUs, each providing 16 KB of cache memory for a total of 64 KB. The standard system configuration includes 8 MB of RAM (expandable to 176 MB), a 156-MB hard disk and a 15-MB streamer tape.

Base prices for the XD88 family range from \$24,950 to \$34,950.

For more information, contact Donna Loveland, Tektronix Inc., Interactive Technologies Division, P.O. Box 1000, Wilsonville, OR 97070; (503) 685-2838.

**Circle 415 on reader card**

## Cabletron Enhances Remote LANView

Cabletron Systems Inc. announced additions to its Remote LANView network management and control software as part of a plan for enterprisewide network management. Under the plan, management intelligence will be distributed across the network. Remote LANView will provide an open architecture for managing physical-layer connectivity and offering integration with upper-layer solutions such as IBM's Netview, AT&T's Unified Network Management Architecture (UNMA) and DEC's Enterprise Management Architecture (EMA).

Cabletron also introduced a software module for remote bridge management, extending Remote LANView beyond hub management. The bridge module is the first in a series that will include modules for controlling network devices, such as routers and gateways, across the enterprise. Remote LANView provides a three-tiered approach to Ethernet network management, including network monitoring, network control and

complete physical layer diagnostics.

For more information, contact Robert Monaco, Cabletron Systems Inc., 10 Main St., Box 6257, Rochester, NH 03867; (603) 332-9400.

**Circle 490 on reader card**

## TransRING 530 Connects Token Ring LANs

Vitalink Communications Corporation announced a midrange bridge for Token Ring networks, the TransRING 530. The TransRING 530 is a protocol-transparent remote bridge that connects multiple IBM Token Ring (IEEE 802.5) LANs into an integrated WAN based on IEEE and ISO standards.

TransRING 530 remotely connects 802.5 Token Ring LANs using standard data communications lines. It supports up to four remote links at speeds of up to 64 Kbps in single, parallel or full-mesh link configurations. It's fully compatible with Vitalink's TransRING 550 and the 802 WANmanager and can share wide-area links with Vitalink TransLAN bridges, which connect Ethernet LANs. Network management facilities are fully integrated into the TransRING 530, including support by the optional 802 WAN-

manager. Statistical analysis, prioritization and network optimization can be performed for the entire network from any location.

The TransRING 530 costs \$15,750, including software.

For more information, contact Randy Fardal, Vitalink Communications Corp., 6607 Kaiser Dr., Fremont, CA 94555; (415) 794-1100.

**Circle 505 on reader card**

## Spaceball Manipulates On Three Axes

Spatial Systems Inc. announced a compact I/O device called Spaceball. Spaceball lets workstation users control images in and around three axes.

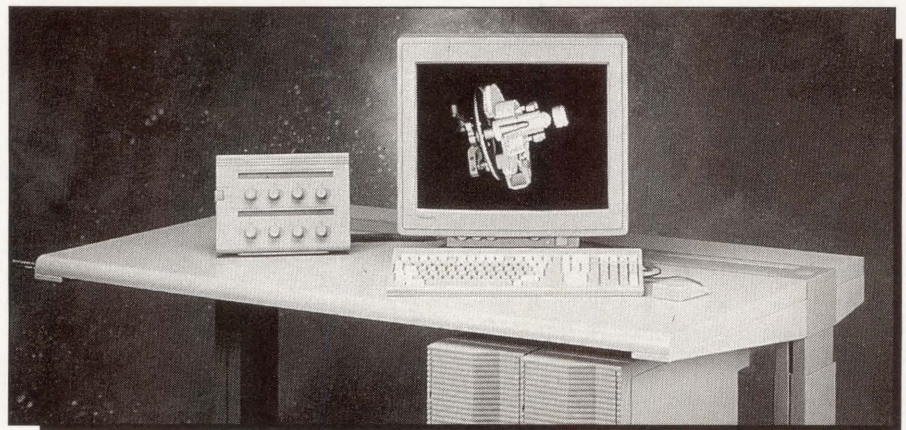
Unlike 2-D methods of control using joysticks, dials and tablets, Spaceball doesn't require you to translate the desired movement into a series of commands. It comes with a software library that contains a set of C language interface routines readily tailored to specific operating environments. Spaceball can be linked to any application and runs on major 3-D workstations, including those from Apollo, HP, Sun and DEC. Spaceball is beneficial to such 3-D applications as CAD/CAM/CAE, fluid dynamics, animation, molecular modeling and imaging.

For more information, contact Elsie Kitchen, Spatial Systems Inc., 472 Old Bedford Rd., Concord, MA 01742; (508) 369-8588.

**Circle 502 on reader card**

## MailMate Communicates Over DECnet

Alisa Systems Inc. announced a Mac-VAX electronic mail integration product, MailMate/QM. MailMate/QM is a Mac-



*Tektronix Inc.'s XD88-family workstation.*



based bridge for CE Software's QuickMail that provides two-way exchange of messages with VAXMail.

MailMate/QM communicates over DECnet using DEC's Mail-11 protocol. When used in conjunction with DEC's Message Router/MailBus services and the MRGATE gateway, mail exchange is possible between QuickMail and ALL-IN-1, IBM

PROFS, X.400 and other services supported by MailBus and optional DEC-supplied gateways. MailMate/QM uses QuickMail's open gateway architecture and Alisa's TSSnet DECnet package for the Mac, making the Mac a true DECnet node capable of sending and receiving DECnet mail. It operates with QuickMail's QM Administrator, which provides mail routing and translation of

messages between text and QuickMail formats.

MailMate/QM ranges in price from \$950 for one to 10 users to \$9,750 for an unlimited number of users.

For more information, contact Suzanne Young, Alisa Systems Inc., 221 E. Walnut St., Pasadena, CA 91101; (818) 792-9474.

**Circle 453 on reader card**

## DIGITAL PRODUCTS

■ DEC announced VAX ACMS V3.1, a monitor within the DECTp environment. Enhancements to VAX ACMS include support of DECforms and a commercial implementation of the ANSI/ISO FIMS standard.

Version 3.1 provides increased compatibility with data management products. It features a private asynchronous call interface to DECforms, yielding efficient use of memory by allowing a single forms run-time process to control multiple terminals simultaneously in a multithreaded fashion. It also can convert existing VAX ACMS definitions stored in the DMU to CDO format for use by the CDD/Plus dictionary, where all definitions are stored. Minimum requirements are VAX/VMS V5.0 and CDD/Plus V4.1.

Pricing is processor-dependent. Base prices are \$22,000 for a development license, \$11,000 for a run-time license and \$5,500 for a remote access license.

■ DEC announced hardware and WAN capabilities that provide multivendor desktop support, flexibility, price/performance and investment protection within an enterprisewide network.

1. The 3270 Terminal Option Card for the DECserver 550 enhances investments in IBM 3270s by allowing access to VAX applications such as ALL-IN-1.

2. The MUXserver 300/DECmux 300 Remote Terminal Server offers a cost-effective solution for connecting remote VTs to a local Ethernet network.

3. The MicroServer-SP provides, through a synchronous line, economical connectivity from remote locations to a corporate network. Based on this hardware, the DECrouter 100, DECnet/SNA 100 and X25router 100 provide remote networked PCs or workstations with access to a WAN such as SNA, X.25 or remote DECnet/OSI networks.

4. The DECrouter 2000 offers three times the price/performance of the previous version and provides high-speed synchronous wide-area communications up to 2 megabits among remote areas.

5. The DECrouter 200 offers twice the performance of the previous version and provides remote management capabilities and interconnection of up to eight PCs to DECnet/OSI networks.

6. The VMS/SNA provides fast, reliable processing and a single connection to an IBM host. Using the VAX Packetnet System Interface, VMS/SNA provides the SNA link over X.25 networks.

■ DEC's LP37 line printer is a high-performance impact printer

designed to bring high-volume, data processing-level printing capacity into open office, networked computing environments. Using improved band printing technology, it produces up to 1,200 132-character lpm on continuous fan-fold paper and runs at about the same noise level as an office copier.

The LP37 offers a printing capacity of 150,000 pages per month. It prints on several sizes and weights of paper stock, on multiple-part NCR or carbon-backed form sets and on various sizes and types of labels and preprinted forms. The LP37 is compatible with all VMS operating systems running on VAX 8000, 6000 and 11/70 series and MicroVAX II and 3000.

The product is priced at \$22,500.

■ DEC's VAXELN V4.0 features DECwindows support. This lets VAXs and VAXstations display multiple screens simultaneously in windows. With windowing, a real-time system running VAXELN can provide access to other VAXs in a network without affecting its monitoring or control functions.

VAXELN supports DECnet, allowing real-time applications to be integrated into overall computer operations. Embedded and dedicated computers can be linked seamlessly to LANs or WANs. VAXELN application programs can be developed to send a window across the network to a remote computer. The product runs on a variety of VAXs ranging from the KA620 to the rtVAX 6340.

VAXELN licenses cost from \$1,071 to \$25,833 for the basic development toolkit and from \$428 to \$32,340 for each run-time license for rtVAXs, depending on processor.

■ VAX/VMS Services for MS-DOS Server software V2.2 and DECnet/PCSA Client software feature access to network applications, PC mail and system management.

With VAX/VMS Services for MS-DOS, any VAX/VMS system on a DECnet network can act as file, disk, application, print, security and network server for MS-DOS PCs. New features include MS-DOS DECwindows Display Facility, broadcast, PC mail functionality, support for 720-KB and 1.44-MB disks and menu-driven administration features. DECnet/PCSA Client software provides access to DEC networks and shared resources for DECstation 210, 316 and 320 PCs, IBM PCs and supported compatibles.

In addition, prices of the DEPCA Ethernet controller and Network Integration Packages are now 33 to 44 percent lower. Unit pricing ranges from \$395 to \$845.

*For more information about these products, contact your local DEC sales office or call (800)-DIGITAL.*



## Champion II Offers Printer Emulation

DeRex Inc. announced the Champion II Raster Image Processor. The Champion II offers extended printer emulation capabilities and high-performance graphics output in association with the DeRex S3000 II and S4500 II ion printer series.

Champion II processors can be configured with one to four T414-15 Transputers and from 1 to 16 MB of dynamic RAM, enabling processor throughput and features to be matched to print engines from 12 to 100 ppm. A range of printer emulation, fonts and type styles are supported, any combination of which can be selected for an application. Champion II processor interfaces include parallel (Centronics, DataProducts), serial (RS-232C), SCSI and an optional RS-422. Character sets include ASCII, 96-character standard and IBM extended graphics. Memory includes 1 MB ROM, 5 MB RAM standard expandable to 32 MB, and 512 KB masked ROM.

Pricing for the DeRex ion printer subsystem (with the Champion II controller) is \$18,995 for the S3000 II and \$25,995 for the S4500 II. The Champion II is field-installable

in S3000 II and S4500 II installations and is priced at \$5,595.

For more information, contact Jim Rule, DeRex Inc., 7716 Wiles Rd., Coral Springs, FL 33067; (305) 753-0840.

Circle 495 on reader card

## CMX451 Expands DECstation Memory

Camintonn Corporation announced a DECstation 3100 memory upgrade kit, CMX451. The kit consists of two SIMM modules that are installed into expansion slots on the DECstation 3100.

Each kit adds 4 MB to the DECstation memory to a total of 24 MB. The standard configuration of DECstation memory is 8 MB. The CMX451 contains fast-access, 1-megabit surface-mount SOJ RAM devices and is completely hardware compatible with the 32-bit memory expansion slots on the DECstation 3100. The high-capacity RAMs on the CMX451 require fewer components, which results in higher MTBF.

The CMX451 is priced at \$2,500.

For more information, contact Camintonn Corp., 2332 McGaw Ave., Irvine, CA 92714; (714) 553-0247.

Circle on 491 reader card

## EQL Accesses Focus Database

Elliott Bay Computing Inc. announced EQL, an advanced natural-language front end for Information Builders Inc.'s Focus 4GL for VAXs. EQL can access any Focus database, independent of where it resides, on a mainframe, mini or micro.

EQL is available for all PCs, PS/2s and compatibles under DOS and for all VAXs and MicroVAXs under VMS. EQL provides productivity enhancements for users and developers. Focus users get answers to English questions without waiting for custom development. Focus developers get rapid prototypes of their query and reporting applications and TABLE source code that can be modified to fit the application's needs. EQL uses proprietary English parsing techniques. It automatically generates necessary code to link multiple database files.

EQL for the VAX is priced from \$770 on a VAXstation to \$29,880 on a VAX 8840 supporting 100 to 150 users. EQL is distributed by Information Builders Inc. of New York City, publishers of the Focus 4GL/DBMS.

For more information, contact Tim Winston,

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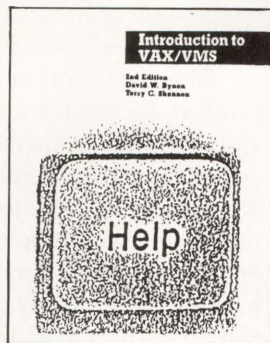
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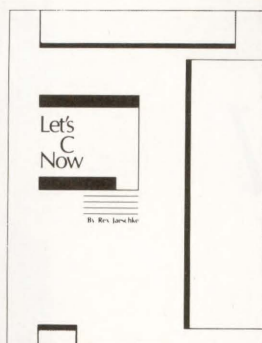
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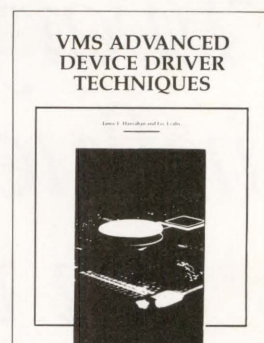


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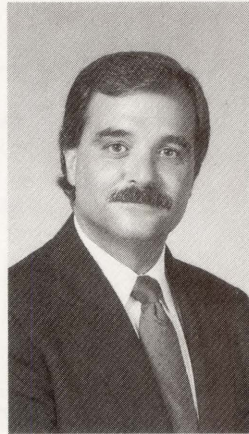
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Elliott Bay Computing Inc., 200 W. Mercer, Ste. 309, Seattle, WA 98119; (206) 286-8153.

**Circle 496 on reader card**

## Imaging Technology Enhances ITEX 200

Imaging Technology Inc. announced the enhancement of its Series 200 image processing system by adding more than 15 software routines to its ITEX 200 library. The Series 200 is a general-purpose, high-performance image processing subsystem for the MicroVAX II. ITEX 200 provides more than 150 C or FORTRAN callable image processing functions and an interactive line interpreter that speeds applications development by eliminating the need to recompile programs as changes are made.

The revision of ITEX 200 adds functions that broaden the applications base supported by the software. New capabilities include four-point warp; first, second and third moments; a Sobel edge finder with direction and magnitude; additional cursor functions; a cine function; a contiguous regions labeler and counter; and additional look-up table functions.

The Series 200 image processing subsystem with 3 MB of image memory is

priced at \$28,995. ITEX 200 will be distributed to existing Series 200 sites at no charge.

For more information, contact Betsy Minich, Imaging Technology Inc., 600 W. Cummings Park, Woburn, MA 01801; (617) 938-8444.

**Circle 497 on reader card**

## Omni 8800 GDS Family Meets CAD/CAE Demands

Omnicomp Graphics Corporation announced the Omni 8800 GDS, a family of modular graphics display products for the workstation and VME-bus markets. The Omni 8800 GDS family offers systems integrators a range of scalable, fully integrated solutions for graphics applications such as CAD/CAE, solids modeling, image processing, mapping, animation, simulation and process control.

Compatible with workstations from Sun, Apollo and others, the Omni 8800 GDS family teams Texas Instruments' TMS34020 graphics processor and 40-Mflops TMS34082 floating-point coprocessor with the Motorola MC88000 RISC processor. A fully configured Omni 8800 GDS delivers a 4- x 4-KB frame buffer with 1,600 x 1,280 display resolution, 24-bit true color and up

to 12 independent graphics overlay planes. The system supports up to four independent graphics channels, with each graphics display controller having up to 24 MB of on-board video memory and 1 MB of DRAM.

OEM pricing, per board, is from \$3,000, quantity one.

For more information, contact Omnicomp Graphics Corp., 1734 W. Belt N., Houston, TX 77043; (713) 464-2990.

**Circle 499 on reader card**

## 560DL Features DEC Emulations

Output Technology Corporation announced the 560DL, a two-headed, high-speed dot-matrix printer. It delivers speeds of 560 cps. Targeted for single- and multiple-user PC applications, the 560DL handles data processing, spreadsheets, financials, NLQ, bar codes, graphics and label printing. It's suitable for 80-column printing, is optimized for 136-column printing and excels in spreadsheet applications.

The 560DL offers a full array of standard features for added flexibility. These include front panel menu programming, built-in bar codes, data buffers up to 20 KB, front and bottom paper feed, multipitch printing,

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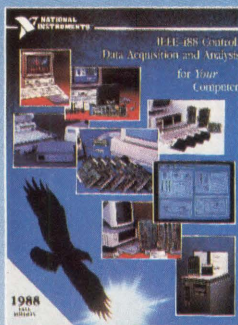
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full international character sets and serial parallel interfaces. It features DEC, Epson and IBM Proprinter XL emulations.

The 560DL is priced at \$1,995 and is backed by a six-month warranty and nationwide service.

For more information, contact Marie Hartis, Output Technology Corp, E. 9922 Montgomery, Spokane, WA 99206; (509) 926-3855.

**Circle 500 on reader card**

## I\* Software Runs With TCP/IP Networks

InterConnections Inc. announced that it has extended its I\* line of networking software for VAXs to include TCP/IP. The I\* product line, which lets VAX/VMS systems be integrated with PC LANs using the Microsoft Network (MS-Net) network operating system, consists of two products: I\*XNS, an interoperability solution for Ungermann-Bass Net/One customers, and I\*TCP.

I\*XNS and I\*TCP provide complete implementation of MS-Net for VAX/VMS. They're compatible with Net/One PC and interoperable with Net/One OS/2 LAN Manager. I\*XNS is based on the Xerox Network System protocol. I\*TCP is based on Network Research Corporation's Fusion TCP/IP software and protocols. I\*TCP lets Ungermann-Bass customers connect VAX/VMS systems to Net/One TCP/IP LANs via standard DEC Ethernet interfaces. I\*TCP can be used concurrently with I\*XNS, DECnet and LAT on the same Ethernet interface and can coexist with any other TCP/IP implementation in the same VAX by using multiple Ethernet interfaces.

For more information, contact InterConnections Inc., 14711 N.E. 29th Pl., Ste. 100, Bellevue, WA 98007; (206) 881-5773.

**Circle 553 on reader card**

## LAT/TCP Supports Reverse LAT

InterLan Inc. announced V1.1 of its LAT/TCP Terminal Server. LAT/TCP V1.1 supports full reverse-LAT capability, allowing non-DEC hosts to operate on LAT-based networks. It's supported on InterLan's NTS-100 and NTS-200 Terminal Servers and adds enhanced statistics and administrative commands.

The software supports host-initiated connections, allowing the creation and management of print queues. Administrative commands allow the display and manipulation of print queues, server management and enhanced LAT and TCP/IP session statistics. These commands enhance the sharing of network resources and provide the network administrator with information about potential problems. Non-

DEC hosts using an InterLAN terminal server supporting reverse LAT can take advantage of the LAT protocol.

A software upgrade is free for those who have maintenance agreements with InterLAN. Others can purchase an upgrade for \$159.

For more information, contact Charles Dillon, InterLan Inc., 155 Swanson Rd., Boxborough, MA 01719; (508) 263-9929.

**Circle 557 on reader card**

## Forest Connects AS/400 And DECnet

Forest Computer announced the Connection System, an IBM AS/400 and DECnet connectivity product. The Connection System is a turnkey solution that requires no third-party software on the DEC or IBM systems.

The Connection System accommodates bidirectional file transfers between the AS/400 and VAX equipment. On the IBM side, it uses an LU 6.2 transport into the AS/400 Distributed Data Management (DDM) facility, the same facility used to provide distributed file access in many IBM networks. The Connection System's hardware interface to IBM is via a Token Ring connection. It appears as an AS/400 to other AS/400s on the ring. On the DEC side, it uses a standard Ethernet hardware interface into DECnet and emulates a DECnet end node. It interfaces to DECnet's File Access Listener (FAL) using the Data Access Protocol (DAP).

The Connection System can be installed starting at \$24,000.

For more information, contact Jim Antonucci, Forest Computer, 1749 Hamilton Rd., Okemos, MI 48864; (517) 349-4700.

**Circle 555 on reader card**

## BBC Ports Software To DECstation 3100

Boston Business Computing Ltd. (BBC) announced that it's a DEC ISV. Under this program, BBC has ported two software packages to the DECstation 3100: VCL, a VMS emulator that implements commands in DCL; and EDT+, an emulation of VAX EDT.

VCL and EDT+ create a migration path for VAX/VMS users by providing a user interface to integrate the Mips RISC architecture with existing VAXs. VMS users can move between DECstations running ULTRIX and VAXs running VMS. VCL features more than 50 DCL commands and utilities with more than 300 qualifiers, logical expressions, command files with flow control, VMS file specification, a customizable Help facility, symbols, wildcards, line editing and command history. EDT+ implements all VAX EDT features,



including Gold Key editing, an extended ASCII character set, UDKs, customizable Help, multiple buffers, disaster recovery and macros.

Licenses for VCL and EDT+ on the DECstation 3100 cost from \$995.

For more information, contact Edward J. Gaudet, Boston Business Computing Ltd., 3 Dundee Park, Andover, MA 01810; (508) 470-0444.

Circle 463 on reader card

## PC Macsyma Targets Scientific Environment

Symbolics Inc. announced that its Macsyma product is available on 80386-based PCs running MS-DOS. PC Macsyma is targeted at the engineering and scientific environments.

PC Macsyma combines symbolic, numerical and graphical methods into an automated approach to mathematical computing, resulting in improvements in productivity and mathematical computing power. It features powerful programming tools, including a debugger, a compiler and code generators for C, FORTRAN and TeX. In addition to automating basic operations in algebra and calculus, PC Macsyma automates a range of advanced symbolic operations, such as solving differential and integral equations, computing Laplace and Fourier transforms, automating vector and tensor calculus and generating finite difference equations.

PC Macsyma is priced at \$2,900 for single copies. Educational discounts are available.

For more information, contact Symbolics Inc., 8 New England Executive Park, Burlington, MA 01803.

Circle 503 on reader card

## Control Data Enhances ProAct Program

Control Data Corporation announced an environmental monitoring component for its ProAct Program of Service Enhancements for VAX system managers. It also announced software-based improvements to its ProAct 1000- and 2000-level services.

ProAct 3000 provides software and sensors that monitor computer-room environmental conditions, including temperature, humidity, floor water and smoke. You can predefine parameters for normal system operation. When operating conditions extend beyond normal limits, the software automatically prompts the system to avert system failure or data loss. Software supplied with ProAct 3000 works with VAX/VMS V4.0 and later and requires a SAM 2010 controller and sensors from Intra

Computer. Improvements to ProAct 1000 and 2000 levels include disk utilization, process and security-monitoring capabilities.

Prices for ProAct 3000 begin at \$100 per site per month. Other ProAct prices range from five to 15 percent of monthly hardware maintenance costs.

For more information, contact Bill Stoessel, Control Data Corp., 8100 34th Ave. S., Minneapolis, MN 55440; (800) 345-9903; (612) 851-4131.

Circle 402 on reader card

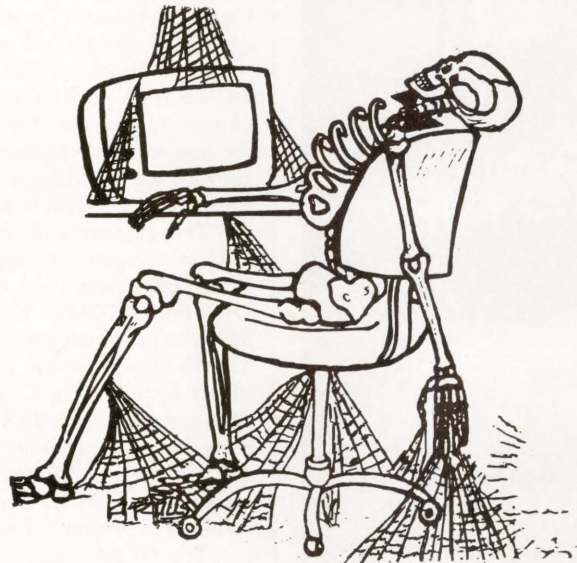
## Walker Richer & Quinn Offers PC/VAX Solution

Walker Richer & Quinn Inc. announced a solution for PC/VAX networking using Reflection, R-LAT and RSVP. R-LAT and RSVP work with Reflection to let PCs connect directly into Ethernet running the LAT protocol for terminal emulation, file transfer and printer services.

R-LAT is a PC-based LAT driver that

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directly connects PCs to Ethernet and bypasses the terminal server. R-LAT implements terminal server functions on a PC equipped with Ethernet adapter cards. You can establish single or multiple sessions with one or more LAT services on the network. RSVP is made up of RSVP-PC and RSVPlink. RSVPlink resides on the VAX and accepts printer output transferred from the PC through Reflection. The unaltered information is passed to the designated printer. PC output sent to a local printer is intercepted by RSVP-PC and spooled to the PC's hard disk.

For more information, contact Carolyn Bakamis, Walker Richer & Quinn Inc., 2825 Eastlake Ave. E., Seattle, WA 98102; (206) 324-0350.

**Circle 535 on reader card**

**DCME-M30/32MB Features  
 Proprietary Gate Array**

Clearpoint Research Corporation announced a single-slot, 32-MB memory upgrade compatible with the BA23 enclosure. The DCME-M30/32MB features Clearpoint's proprietary gate array. The gate array reduces the number of components on the board, allowing for the implementation of double-sided, surface-mount technology.

This gate array design ensures a high level of compatibility, regardless of DEC ROM code changes or CPU upgrades. The DCME-M30/32MB allows VAXstation 3200 users currently restricted to addressing 32 MB to address the maximum 64 MB offered by the system. Clearpoint's DCME-M30 series of MicroVAX and VAXstation 3xxx-compatible memory products includes 32-, 16- and 8-MB boards. Clearpoint memory products are supported by an unconditional lifetime warranty.

The DCME-M30/32MB is priced at \$11,500, with quantity discounts available.

For more information, contact Greely Summers, Clearpoint Research Corp., 99 South St., Hopkinton, MA 01748; (508) 435-2000.

**Circle 492 on reader card**

**CMS Enhancements Offers  
 VAX 3100 Subsystems**

CMS Enhancements Inc. announced internal and external hard-disk subsystems for VAX 3100s. The 3½-inch internal hard-disk subsystems offer 40 to 100 MB of storage capacity and feature an average access time of 8 ms. External hard-disk subsystems offer 155 to 766 MB of capacity and can be daisy chained for up to 5.6 GB of total storage capacity.

Tabletop and pedestal enclosures are available to consolidate systems if you need multiple drives. You can upgrade diskless computers to standalone workstations.

The subsystems are priced from \$715 to \$4,555.

For more information, contact Agha Mahmood, CMS Enhancements Inc., 1372 Valencia Ave., Tustin, CA 92680; (714) 259-5903.

**Circle 516 on reader card**

**Computer Associates  
 Unveils Masterpiece V2.0**

Computer Associates International Inc. announced version 2.0 of its Masterpiece Series of financial software applications. Version 2.0 features several enhancements. First, the applications are portable, so the same software will run in both IBM and DEC environments. Second, the software introduces user-interface technology that offers facilities previously available only on PCs. Third, client organizations can tailor the system to serve their requirements.

The nucleus of the Masterpiece Series is

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the Master Host Environment (MHE). The MHE is the insulating layer of software that lets the same applications logic be implemented across computing environments. The MHE provides a common set of features shared by Masterpiece applications. These include platform independence, centralized security, multilevel help and an advanced user interface. They also include task and process management, custom tailoring capabilities and query and reporting tools.

For more information, contact Susan D'Elia, Computer Assoc. Int'l. Inc., 711 Stewart Ave., Garden City, NY 11530; (516) 227-3300.

**Circle 493 on reader card**

## Access Technology Bridges 20/20 And Rdb

Access Technology Inc. announced the availability of the 20/20 Database Connection for use with Rdb. By using Rdb's embedded SQL, the 20/20 Database Connection provides a transparent bridge between 20/20 and Rdb. The product was designed to give spreadsheet users a way to retrieve information directly from a database into a 20/20 spreadsheet for reporting and analysis.

With the 20/20 Database Connection, you needn't know a query language. Inter-

mediate temporary files aren't needed. English-word menus and prompts communicate what type of information is available and guide you through each step of building a query. After each query is completed, database information is placed directly into the spreadsheet, which automatically is formatted for the appropriate data type. Access to the data is read-only. An option is available to connect to ALL-IN-1.

The 20/20 Database Connection is priced from \$250 for the VAXstation to \$16,800 for the VAX 8978.

For more information, contact Geoff Spillane, Access Technology Inc., 2 Natick Executive Park, Natick, MA 01760; (508) 655-9191.

**Circle 506 on reader card**

## MVX3 Memory Boards Are For MicroVAX 3000

EMC Corporation announced a series of memory boards for MicroVAX 3000 systems. The MVX3 boards are available in 8- and 16-MB capacities.

MVX3 memory boards are 100 percent compatible with MicroVAX 3000-series (3200 to 3900) systems. They're priced up to 40 percent lower than DEC'S MS650-AA

and BA boards. The boards use 1-megabit DRAMs and increase MicroVAX 3500 and 3600 system capacities up to 64 MB.

The MVX3 boards feature a lifetime warranty.

For more information, contact John J. Ryan, EMC Corp., 171 South St., Hopkinton, MA 01748; (508) 435-2541.

**Circle 404 on reader card**

## Sun Announces Servers And Workstations

Sun Microsystems Inc. announced several servers and workstations.

The SPARCstation 1 is a RISC-based system that performs at 12.5 mips and 1.4 Mflops. It runs at 20 MHz, and the standard configuration includes 8 MB of memory expandable to 16 MB. It features a preloaded operating system, two serial ports and two additional ports for Ethernet and SCSI-II peripherals. The product is priced at \$8,995.

The SPARCstation 300 family performs at 16 mips and 2.6 Mflops and offers expansion capabilities. The 330 offers 8 to 40 MB of main memory and 1.4 GB of SCSI mass storage. The 370 offers up to 56 MB of main memory and 5.5 GB of SMD disk storage. The family features 2- and 3-D graphics.

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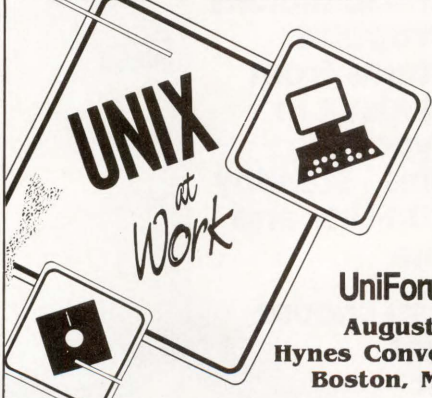
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Systems are priced from \$29,900 to 73,900.

The SPARCserver 300 family is based on the SPARC RISC microprocessor. The servers provide packaging options from five- or 12-slot desk-side systems to a 16-slot data center. They offer disk capacities up to 32 GB. SPARCservers can share their compute and data-storage resources with any workstation or PC on a network. Prices range from \$28,900 to \$71,900.

Sun also expanded the Sun-3 family. The Sun-3/80, Sun's lowest-cost workstation, performs 2- and 3-D graphics and renders 24-bit true-color images. The expandable Sun-3/400 family includes desk-side graphics workstations and servers. They are compatible with all Sun-3 systems. The Sun-3/80 family is priced from \$5,995 to \$13,995; the Sun-3/400 family is priced from \$40,900 to \$66,900.

For more information, contact John Loiacono, Sun Microsystems Inc., 2550 Garcia Ave., Mountain View, CA 94043; (415) 960-1300.

**Circle 518 on reader card**

## MacRAF Lets Apple Users Access Remote VAXs

Datability Software Systems Inc. announced MacRAF, a Mac-to-VAX integration software package. It enables Apple users to access and use the processing power of a remote VAX without having to know remote computer commands.

MacRAF offers the same capabilities to Mac users that Remote Access Facility (RAF) offers to IBM PC users. MacRAF features an LAT-compatible terminal emulator that lets you have multiple VT100/200 VAX sessions on one screen at the same time. In addition, MacRAF offers the same seamless file service and print service capabilities achieved with RAF. It takes full advantage of Ethernet networking technology, supporting any Ethernet Card that has an interface to the Ethertalk Driver, such as the Kinetics Etherport SE and Etherport II and the Interlan NIA310 MacConnect Card.

For more information, contact Christine Curtin, Datability Software Systems Inc., 322 8th Ave., New York, NY 10001; (212) 807-7800.

**Circle 508 on reader card**

## TurboCom Manages Fax, Telex And Teletex

EEC Systems Inc. announced TurboCom, a VAX/VMS communications product. TurboCom manages Fax, Telex and Teletex messages in a VAX/VMS environment. It gives VMS users access to these communications facilities from their own workstations or terminals.

With TurboCom, you can create and edit messages with the built-in editor, EDT or any word processing system that handles ASCII files. Within the built-in editor, standard text can be merged from TurboCom library files, from ASCII files already on the system or from archived messages already transmitted or received. TurboCom features message monitoring, a dialogue mode for Telex conversations and a text-search function. Hardware requirements include a VAX with at least 40,000 free disk blocks and VT100s with advanced video option or VT220/320s. Software requirements include VAX/VMS V4.2 or later and VAX FMS Run-Time license V2.2 or later.

For more information, contact Eric Dickman, EEC Systems Inc., 327/E Boston Post Rd., Sudbury, MA 01776; (508) 443-5106.

**Circle 509 on reader card**

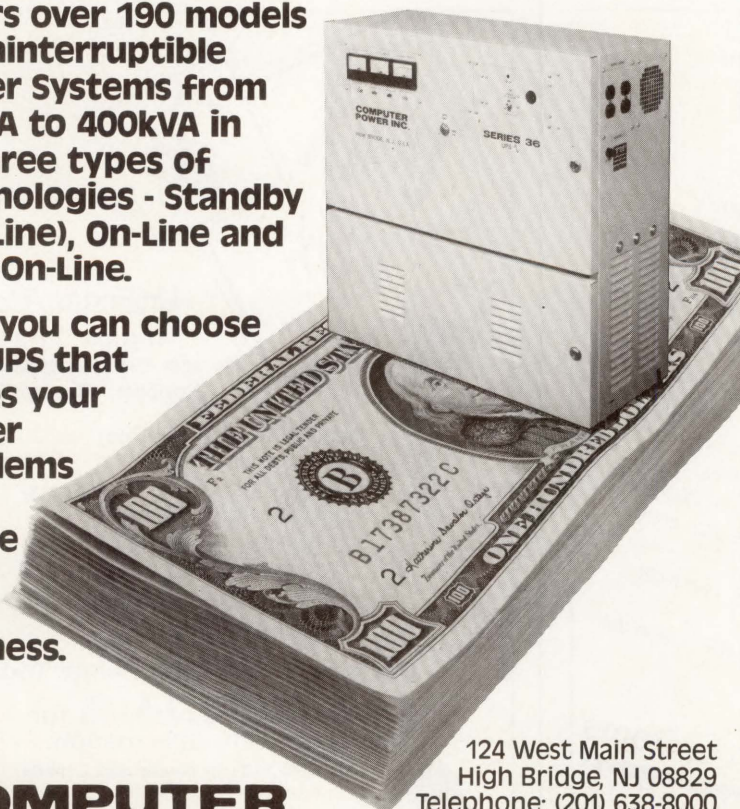
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CIRCLE 106 ON READER CARD



## ezBridge Links IBM And DEC

Systems Strategies Inc. announced ezBridge, a family of communications software products for linking IBM midrange and mainframe systems with VAXs. ezBridge is a combination of Systems Strategies' VAXLink and new products for connecting VAXs with IBM AS/400s, System/36s and System/38s.

ezBridge uses only IBM and DEC hardware. It's an integrated family of turnkey, plug-and-play software. It includes such products as On-Line, File Transfer/Mail, Peer-to-Peer (LU6.2/PU2.1), Remote Job Submission and X.25. It also includes APIs, which are toolkits that allow you to build your own real-time applications spanning DEC and IBM processors. Services offered include ezBridge installation programs, multivendor network design services, application integration and packaged training courses.

Prices for a single copy of each ezBridge software product range from \$3,500 to \$15,000, depending on configuration. Networked versions and quantity discounts are available.

For more information, contact Lynn Tusa, Systems Strategies Inc., 225 W. 34th St., New York, NY 10001; (212) 279-8400.

**Circle 514 on reader card**

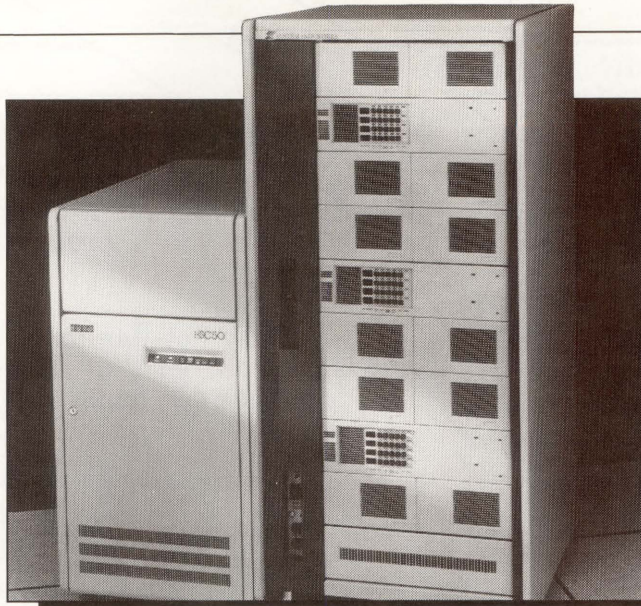
## Glare/Guard Filters Reduce Screen Glare

Optical Coating Laboratories Inc. announced that its Glare/Guard filters for color and monochrome monitors are available for DEC terminals. Glare/Guard filters enhance contrast, eliminate perception of screen flicker and are made with optically coated tempered glass.

Profile and ProfilePlus models conform to the VT220/230 curved monitor. They're mounted in a plastic frame that slips over the front of the monitor. Profile reduces glare by 95 percent. ProfilePlus reduces glare by 99 percent and eliminates VLF/ELF radiation, static and dust. Vantage and Professional Plus models are for VT52/55/240/246 and VT100-series terminals. Velcro strips allow easy installation and removal. Vantage reduces glare by 95 percent. Professional Plus reduces glare by 99 percent and eliminates VLF/ELF radiation, static and dust.

Profile and ProfilePlus cost \$69.95 and \$109.95, respectively. Vantage and Professional Plus cost \$59 and \$99, respectively. For more information, contact Optical Coating Laboratory Inc., 2789 Northpoint Pkwy., Santa Rosa, CA 95407; (707) 545-6440.

**Circle 512 on reader card**



*System Industries' SI92C data storage subsystem comes in two- to 12-drive configurations with formatted capacities from 1.7 to 10.3 GB.*

## SI92C Expands DSA-Compatible Disk Family

System Industries announced the expansion of its C-Series family of DSA-compatible disk drives with the introduction of an eight-inch 863-MB drive that provides 10.3 GB of formatted capacity per subsystem. The SI92C fits into the high midrange of drives currently available for direct connection to VAXclusters and DSA controllers.

Using sputtered media and a thin-film head, the SI92C's MTBF is more than 50,000 hours. SI92C-based subsystems are plug-compatible with HSC70/50/40, KDB50, KDA50 and UDA50 controllers for use on any VAXcluster, VAX or MicroVAX. To VMS or ULTRIX, the SI92C appears as a standard DEC disk drive fully compatible with SDI and MSCP. The SI92C is offered in two- to 12-drive configurations with formatted capacity ranging from 1.7 to 10.3 GB.

The SI92C is priced at \$185,000 for a 12-drive 10.5-GB system. The price includes installation and a one-year warranty.

For more information, contact Brian Edwards, System Industries, 560 Cottonwood Dr., P.O. Box 789, Milpitas, CA 95035; (408) 432-1212.

**Circle 414 on reader card**

## ACP 7000 Front Ends VAXBI Systems

Advanced Computer Communications announced the ACP 7000 communication processor. Available in two versions, the ACP 7100 (HDLC) and the ACP 7250 (X.25) are high-performance communications front-end processors for use on VAXBI computer systems.

The products support the same application interfaces the Q-bus and UNIBUS products use. The high-speed controllers

provide connections to satellite links and X.25 networks and provide a transparent migration path to the high-performance VAXBI environment. They support X.25 and HDLC at line speeds of up to T1. Extended frame and packet sequencing are supported for satellite links. HDLC framing-only mode is supported for use in custom configurations that don't require the entire HDLC protocol suite.

For more information, contact Marianne Wasielewski, Advanced Computer Communications, 720 Santa Barbara St., Santa Barbara, CA 93101; (805) 963-9431.

**Circle 507 on reader card**

## Laptop LANager Allows Network Troubleshooting

Micro Technology Inc. announced laptop and portable configurations of its LANager Ethernet analyzer. These transportable configurations enable network managers to troubleshoot multiple networks and networks in a wide geographic range. The battery-powered laptop configuration lets the LANager be used in government-secured networks without an isolated power supply.

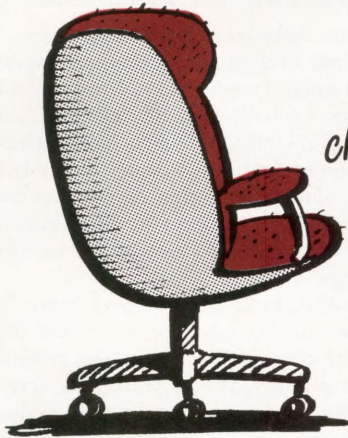
LANager is a standalone Ethernet analyzer for TCP/IP, AppleTalk, Sun, DECnet and user-written protocols. It's designed to troubleshoot network problems and help managers make decisions about modifying, scheduling or reconfiguring networks. LANager decodes, analyzes and interprets all seven layers of the OSI model. Protocol content, addresses, timing packet size, cumulative byte and network utilization data are reported in English.

LANager costs from \$20,500 to \$29,500. For more information, contact Micro Technology Inc., 5065 E. Hunter Ave., Anaheim, CA 92807; (800) 999-9MTI.

**Circle 511 on reader card**



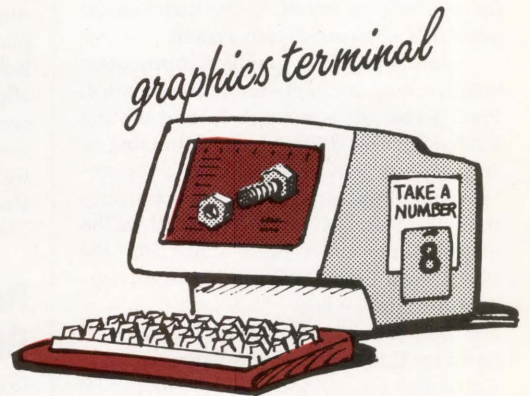
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graphics terminal

In the workplace you would never think of sharing your coffee mug or your chair. So why are you still trotting down the hall to find out if there is a terminal available for your mainframe graphics applications? With TGRAF and your desktop computer there's no need to share a terminal; you can have powerful graphics terminal emulation right at your desk, inexpensively.

## What Does TGRAF Do For Your Desktop Computer?

TGRAF will transform your desktop computer\* into a power-packed Tektronix graphics terminal.\*\* With TGRAF you won't have to leave your desk to run your host-based business, scientific, and CAD software. Plus, you'll have the additional benefits of a PC relative to a terminal: file transfer, hot-key between DOS and your host, simplified setup with local help files, and more.

## TGRAF Gives You The Power To Communicate

Grafpoint provides you with graphics terminal emulation software that communicates through RS-232 or Local Area Networks giving your desktop computer the flexibility to communicate over a serial line or a variety of LANs.

With TGRAF's comprehensive Tektronix graphics terminal emulation and Grafpoint's superior customer support service, you can forever put the terminal sharing blues behind you. Call Grafpoint for the name of your local distributor and order a no-risk 30-day evaluation copy.



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\*\*Grafpoint's TGRAF will emulate the following terminals: Tektronix's 4105/4107/4109/4205/4207/4208/4115/4125 graphics terminals and Digital Equipment Corporation's VT52/VT100/VT220.

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## **PixC Delivers Sun 386i Functionality**

International Software Corporation announced the PixC workstation, a 286- or 386-based DOS or UNIX workstation that runs UNIX and DOS in separate windows with X support. PixC delivers Sun 386i functionality on any PC at less than half the price of a compatible Sun system.

Consisting of a graphics coprocessor board, mouse and high-resolution monitor, PixC is available as an upgrade to an existing 8088, 80286 or 80386 system. Running as an independent X server, the PixC coprocessor board offloads X server functionality from the main PC. Using an Intel 82786 graphics chip and a NEC V50 CPU, the PixC board provides direct hardware support for windowing.

For more information, contact International Software Corp., Box 10648 Edgemont, 528 Commons Dr., Golden, CO 80401; (303) 526-0388.

**Circle 498 on reader card**

## **SWITCHmate II Provides LN03 Emulation**

Gold Key Electronics Inc. announced LN03 emulation for the HP LaserJet in the six-system-to-two-printer SWITCHmate II Intelligent Printer Switch. LN03 emulation, previously available only in two-system/one-printer and three-system/one-printer models, provides a high level of compatibility. It supports DEC fonts and character sets, SIXEL graphics, DECVEC line drawing and LN03 protocol and command set.

SWITCHmate II's user interface provides access to LaserJet features unavailable on the LN03. Features include a large font library; letter, legal, envelope and manual paper feeding; dual paper cassettes and a variety of third-party sheet feeders; and duplex printing.

The product is priced at \$1,295.

For more information, contact Deirdre Branch, Gold Key Electronics Inc., 11 Cote Ave., Goffstown, NH 03045; (603) 625-8518.

**Circle 494 on reader card**

## **Focus-CIT Interface Allows CIT Features**

Information Builders Inc. announced the Focus-CIT interface. It allows Focus users to develop VAX-based applications that incorporate DEC's Computer Integrated Telephony (CIT) technology. The Focus 4GL — with direct interfaces to RMS, Rdb, DBMS, Ingres, Oracle, Sybase, Britton Lee and Adabase — used in conjunction with CIT

and the Focus-CIT interface lets you build CIT functionality into applications.

The Focus-CIT interface provides programmers with a 4GL environment in which they can develop applications using CIT features. For example, using focus, programmers can develop applications that integrate and simultaneously transmit both voice and data from user to user and terminal to terminal. They also can initiate and disconnect phone calls, create conference calls and hold/retrieve a call. The Focus-CIT interface allows a security manager to control focus access to critical CIT functions.

For more information, contact Gary McClain, Information Builders Inc., 1250 Broadway, New York, NY 10001 (212) 736-4433.

**Circle 510 on reader card**

## **Recital V5.5C Expands RMS Bridge Capabilities**

Recital Corporation announced Recital version 5.5C. Many features have been added, including enhancements to the RMS Bridge.

The Recital RMS Bridge has support for relative and sequential RMS files with fixed-length record file structures. These enhancements let Recital support all RMS fixed-length record files. RMS data is accessible through the Recital 4GL or Recital's Assistant. VIEWS, temporary indexes, relationships between Recital tables and RMS files are supported through the Recital Bridge.

Pricing for Recital ranges from \$4,500 to \$45,000.

For more information, contact Tony Giannelli, Recital Corp., 85 Constitution Ln., Danvers, MA 01923; (508) 750-1066.

**Circle 513 on reader card**

## **Saber-C V2.1 Runs On Sun-3 Family**

Saber Software Inc. announced that Saber-C version 2.1 is available on Sun's Sun-3 hardware family, including the Sun-3/80 and Sun-3/400, and on SPARC-based workstations, including the SPARCstation 1, SPARCstation 330 and SPARCserver 330.

Saber-C V2.1 uses the capabilities and processing power of UNIX workstations to help software engineers cut development and maintenance costs. Performance improvements to Saber-C V2.1 allow programmers to test and debug C programs three times faster than the previous version. Saber-C combines a multiwindow user interface, an interpreter-based debugger and a comprehensive program checker. It's available for existing Sun-2, Sun-3 and Sun-4 workstations, as well as VAX computers running ULTRIX.

Saber-C V2.1 is priced at \$2,500.

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

**Circle 501 on reader card**

## **Q-Calc RealTime Processes On-Line Data**

Unipress Software Inc. announced Q-Calc RealTime, a real-time spreadsheet designed as an integrated module for real-time application development. Q-Calc RealTime users working in UNIX and XENIX workstation environments receive instantaneous updates in cell values from an electronic on-line data source, allowing them to monitor financial data, calculate new values and receive alert messages.

Q-Calc RealTime provides a Lotus-like interface and accepts Lotus-developed files and macro libraries. It gives users graphics as well as Lotus-style keystrokes and screen display so that Lotus users can be productive immediately. Q-Calc RealTime is available for Sun 3, 4, 386i, IBM RT, HP 9000/300, XENIX 386 and DEC 3100 workstations.

Q-Calc RealTime is priced from \$1,495 per workstation. Source code is available for \$25,000.

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

**Circle 515 on reader card**

## **QD35-III Enhances SMD-E Drive Performance**

Emulex Corporation announced the QD35-III SMD-E disk controller with 1 MB of cache memory designed specifically for MicroVAX 3500/3600/3800/3900-series computers. The QD35-III offers Emulex's controller features, including MSCP implementation, rotational positioning sensing and zero latency read, with the added capability of cache memory for such applications as imaging and graphics.

It features a 68020 microprocessor, caching per logical drive and zone caching. Zone caching is effective if you want to earmark only part of a large directory for cache. In this instance, only the portion of the data between logical block boundaries is read to cache. Caching per drive allows caching to be turned on or off per individual logical drive. The QD35-III also features a sector read-ahead feature.

Pricing for the controller begins at \$2,995.

For more information, contact Jean Ratajczak, Emulex Corp., 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626; (714) 662-5600.

**Circle 405 on reader card**



## Cipher Tape Drives Boost Storage Capacity

Cipher Data Products Inc. announced increased data storage capacity to 570 MB on its 3000i family of 1/2-inch cartridge tape drives using extended-length tape cartridges manufactured by BASF and Xidex. The 3000i drives use industry-standard 3480-type cartridges to ensure data reliability.

The drives offer data transfer rates up to nearly 1 MB per second, more than three times faster than 1/4-inch tape drives, 8mm tape drives and digital audio tape (DAT) drives. The 3000i backs up 1 GB of data in 20 minutes, compared to more than one hour for 8mm and DAT drives and more than two hours for 1/4-inch drives.

For more information, contact Tom Anderson, Cipher Data Products Inc., 9715 Business Park Ave., San Diego, CA 92131; (619) 693-7227.

Circle 466 on reader card

## PE106 Supports Five Full-Height Peripherals

Dyna Five Corporation announced a general-purpose expansion enclosure for systems such as the Q-bus Micro 11/MicroVAX and from such companies as Sun Microsystems. Designed to provide greater storage capacity where only additional peripherals are required, the PE106 enclosure supports up to five 5 1/4-inch full-height peripherals — floppies, Winchester or cartridge tapes. A combination of 5 1/4- and eight-inch peripherals can be used.

A 252-watt power supply operates on either 115V or 230V. The unit features power-fail detection and interrupt generation from power supply, thermal monitor and shut down and two peripheral and power-supply cooling fans. It features all metal construction and is designed for UL and FCC compliance.

For more information, contact Sam Lane, Dyna Five Corp., 173 Freedom Ave., Anaheim, CA 92801; (714) 525-8795.

Circle 467 on reader card

## ESS Maintains DEC Computers

Electronic Service Specialists Ltd. (ESS) announced that it provides depot repair services, spare parts and maintenance training for VAX 8500-, 8700- and 8800-series computers. ESS depot maintenance service includes all system peripherals for the series.

Maintenance training is conducted at ESS' training facilities or at your data processing center. Both new and repaired parts for the DEC superminicomputers are covered against failure by the ESS one-year warranty. ESS is part of Bell Atlantic's fourth-

party services and serves customers in the U.S., Canada, Europe and Australia. It provides hands-on instruction in DEC computer equipment maintenance and repair.

For more information, contact Keith Patterson, Electronic Service Specialists Ltd., N. 92 W. 14612 Anthony Ave., Menomonee Falls, WI 53051; (414) 255-4634.

Circle 550 on reader card

## Excelan Supports Appletalk Phase 2

Excelan Inc. announced support for AppleTalk Phase 2, the new version of Apple's networking protocol for Macs. Software upgrades providing Phase 2 compatibility are available for Excelan's line of Mac connectivity products, including the EtherPort series of network interface cards, the EtherSC external Ethernet connector and the FastPath 4 LocalTalk-to-Ethernet gateway.

FastPath 4 includes routing capabilities to support Phase 2's multiple zones. In addition to routing among AppleTalk, TCP/IP or DECnet protocols, it can serve as a bridge between AppleTalk and AppleTalk Phase 2.

FastPath 4 upgrades cost \$85.

For more information, contact Peter Troop, Excelan Inc., 2180 Fortune Dr., San Jose, CA 95131; (408) 473-8361.

Circle 551 on reader card

## Joiner Announces Jnet Version 3.4

Joiner Associates Inc. announced Jnet V3.4. Jnet is an implementation of IBM's NJE services for VAX/VMS. NJE is a standard application for file transfer among users and applications, distributed batch and print services and electronic mail and document distribution. V3.4 implements a new Jnet architecture.

Jnet BSC/370 V1.0, a component of previous Jnet versions, now is packaged as an optional product. V1.0 includes two line drivers used to communicate between VAX/VMS systems and IBM System/370-architecture mainframes running VM and MVS over dedicated BSC lines. Jnet V3.4 and Jnet BSC/370 V1.0 together replace Jnet V3.3. Their separation lets the Jnet product family support a range of networking needs without burdening every customer with the cost, installation and maintenance of every available link.

Jnet clusterwide licenses range in price from \$1,125 to \$51,375. Jnet BSC/370 is priced at \$6,000 per node.

For more information, contact Brian Koenig, Joiner Assoc. Inc., 3800 Regent St., Madison, WI 53705; (608) 238-8637.

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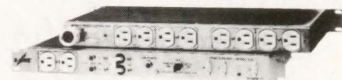
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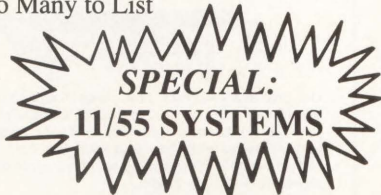
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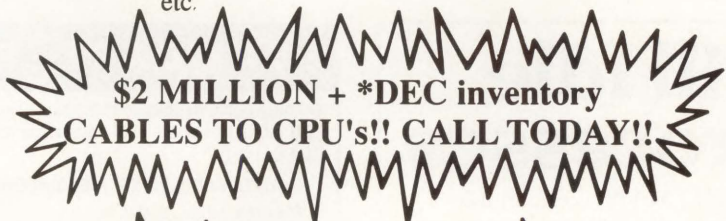
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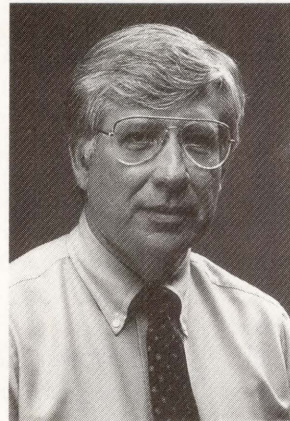
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CIRCLE 370 ON READER CARD



# Answers From Beyond The Grave

This month, the Back End is a question and answer

column in which readers ask questions of deceased computer scientists and celebrities. Swami John C. Dvorak has returned from a trip to Bombay where he learned to communicate with the world beyond the grave. As is often the case with psychic phenomenon, we've already received letters for these stiff.

**QUESTION:** I'd like to ask Alfred E. Neumann, the inventor of the stored program and the binary concept, if those ideas were his, a collaboration or stolen. Also, did he eat carbohydrates before he went into "idea mode"?

*D.R. Long*

*Island, New York*

**ANSWER:** It's Dr. John Von Neumann, not Alfred E. Neumann! Von Neumann appeared to me last night and said that he conceived the ideas during a nightmare he had in the fall of 1944. An army of ones fought an army of zeros. "It was then that I decided that binary is the key to computers, and the stored program is the key to their future," Von Neumann said. "As for carbohydrates, I wish I knew. I had a hot dog before the dream, which may have been responsible for the idea. I just can't say. I always enjoyed bread, I'll say that."

**QUESTION:** I'd like to ask Marvin Minsky if artificial intelligence developed as part of a feud between the mathematicians and the cybernetics types.

*D.B.*

*New Orleans, Louisiana*

**ANSWER:** Much to Minsky's delight, he's not dead. So we'll have to wait until he dies to get the answer from beyond the grave. Sorry.

**QUESTION:** I'd like to ask Tom Watson Sr. if he ever imagined that IBM would become what it is today. Does he have any suggestions for today's managers at IBM?

*M.S.*

*Perkinsville, Oregon*

**ANSWER:** Mr. Watson is dismayed by today's IBM and its lack of creativity and unwillingness to bet the company on new ideas. He's upset that employees have been laid off or asked to retire.

"And why did they stop using the company song book? People like to sing," he said. "The problem is they never updated the songs, and they ridiculed the old ones. Why can't they hire some modern rockers to write IBM lyrics? These new guys just aren't creative enough." His suggestion for today's managers: "Get a life!"

**QUESTION:** If you can contact Blaise Pascal, ask him if he'd like living in today's computerized world.

*O.T.*

*Orlando, Florida*

**ANSWER:** Pascal is pleased that a programming language was named after him, although he has no idea why. The idea of programming for a living makes him sick. "What I like most about the late 1900s is the phenomenal changes in the transportation network. If I could fly . . . can you imagine? Boy, would my arms be tired! Ha ha ha! Get it? Ha ha ha!" Apparently, Pascal is quite a kidder.

**QUESTION:** This may be radical, but can you ask Isaac Newton if he expected his Newtonian physics to be uprooted

and ruined by modern physics?

*J.S.*

*Montclair, California*

**ANSWER:** Newton says, "Hogwash! I had it right the first time. These new physics bozos haven't adequately explained gravity, have they? I defy them to get me a gravity particle! Let's face it, if these guys knew what they were doing, they'd be further along. Everyone leads the soft life today."

**QUESTION:** I want to ask a question of John C. Dvorak, undead columnist. Who are you kidding with this column? There's no such thing as psychic communication. What's your game?

*G.A.*

*Ft. Worth, Texas*

**ANSWER:** If there's no psychic communication, then explain why you wrote before the column was even published.

**QUESTION:** I'd like to ask three questions about Albert Einstein. First, did he like orange juice? I heard that he was on an orange-juice-drinking binge when he thought of the theory of relativity. Second, would things have been easier if he had a desktop computer at the time of his great discoveries? Finally, is there anything that he wishes he had back in the 1940s?

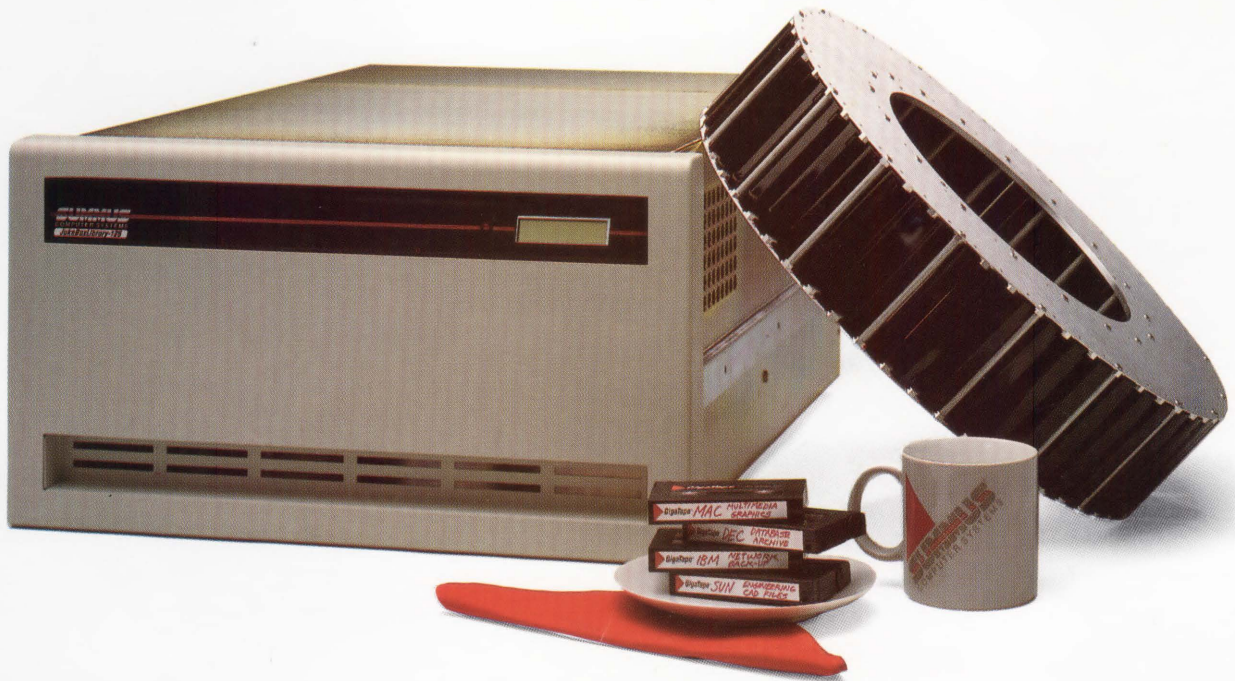
*F.J.*

*Toledo, Ohio*

**ANSWER:** Albert says that he wasn't a fan of orange juice and that the story was perpetrated by the orange-juice-hating Nazis. Second, he wishes he had a computer back then, but he can't understand why nobody can write a decent operating system. Finally, what does he wish he had in the 1940s? A wacky Dvorak column. That's what! ■



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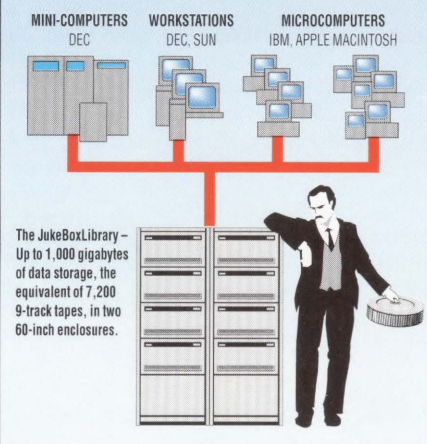


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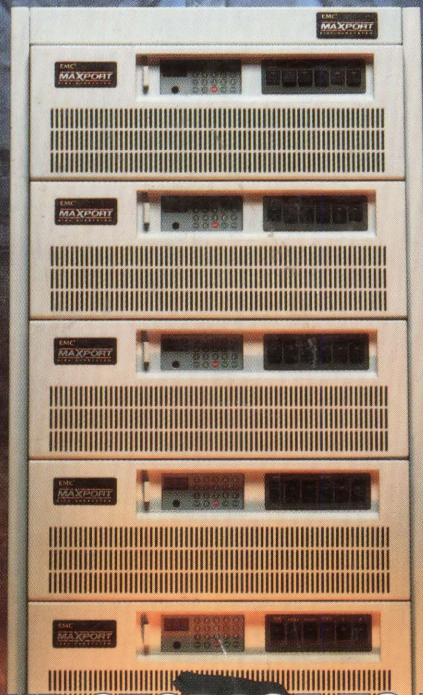
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# MAXPORT

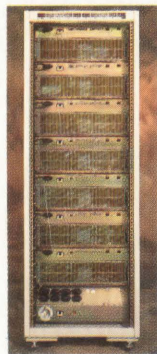


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