APRIL ■ 1988 VOL. 7, NO. 4 ■ $4.00

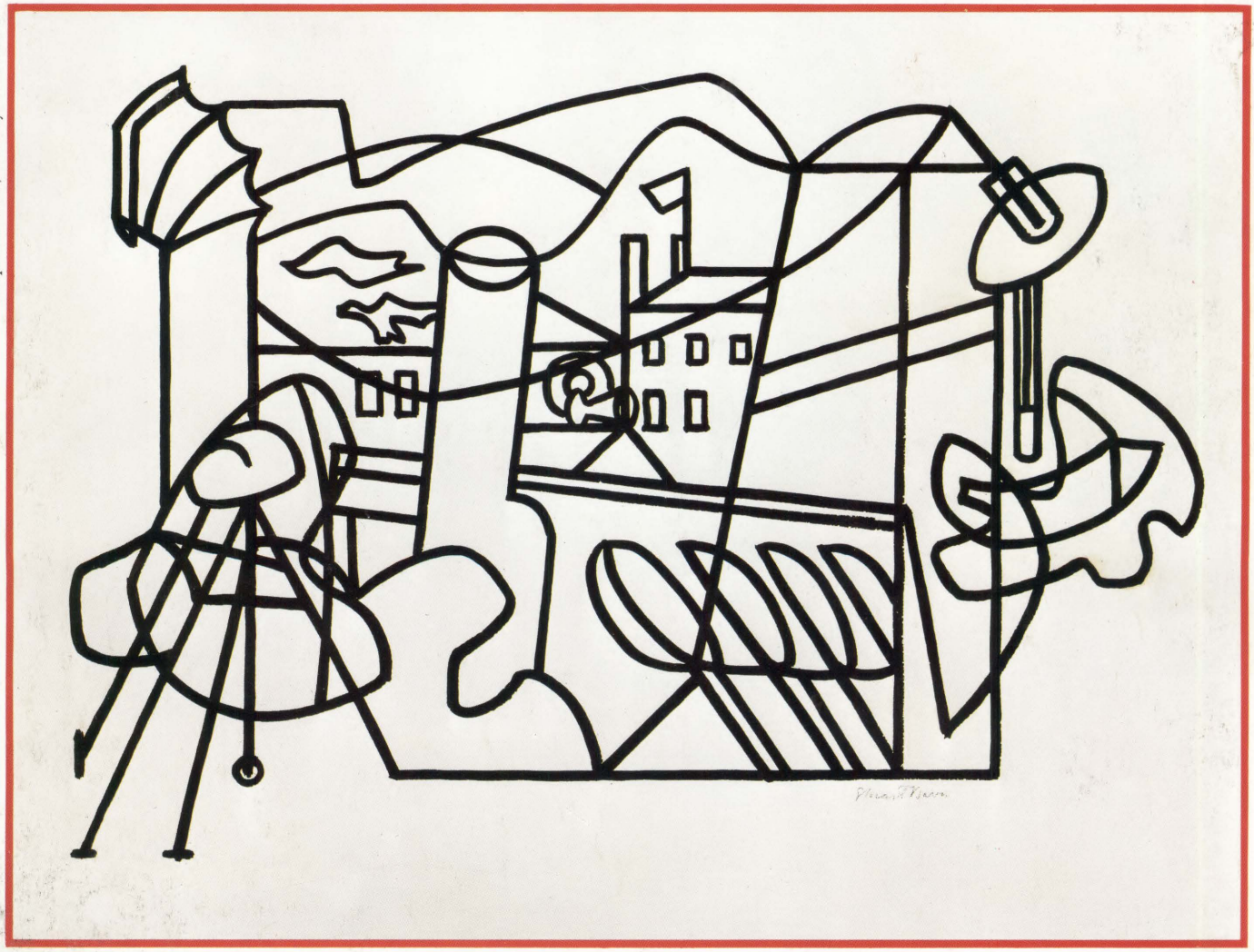
REVIEW

poly-STAR/240

DEC PROFESSIONAL

A PROFESSIONAL PRESS PUBLICATION

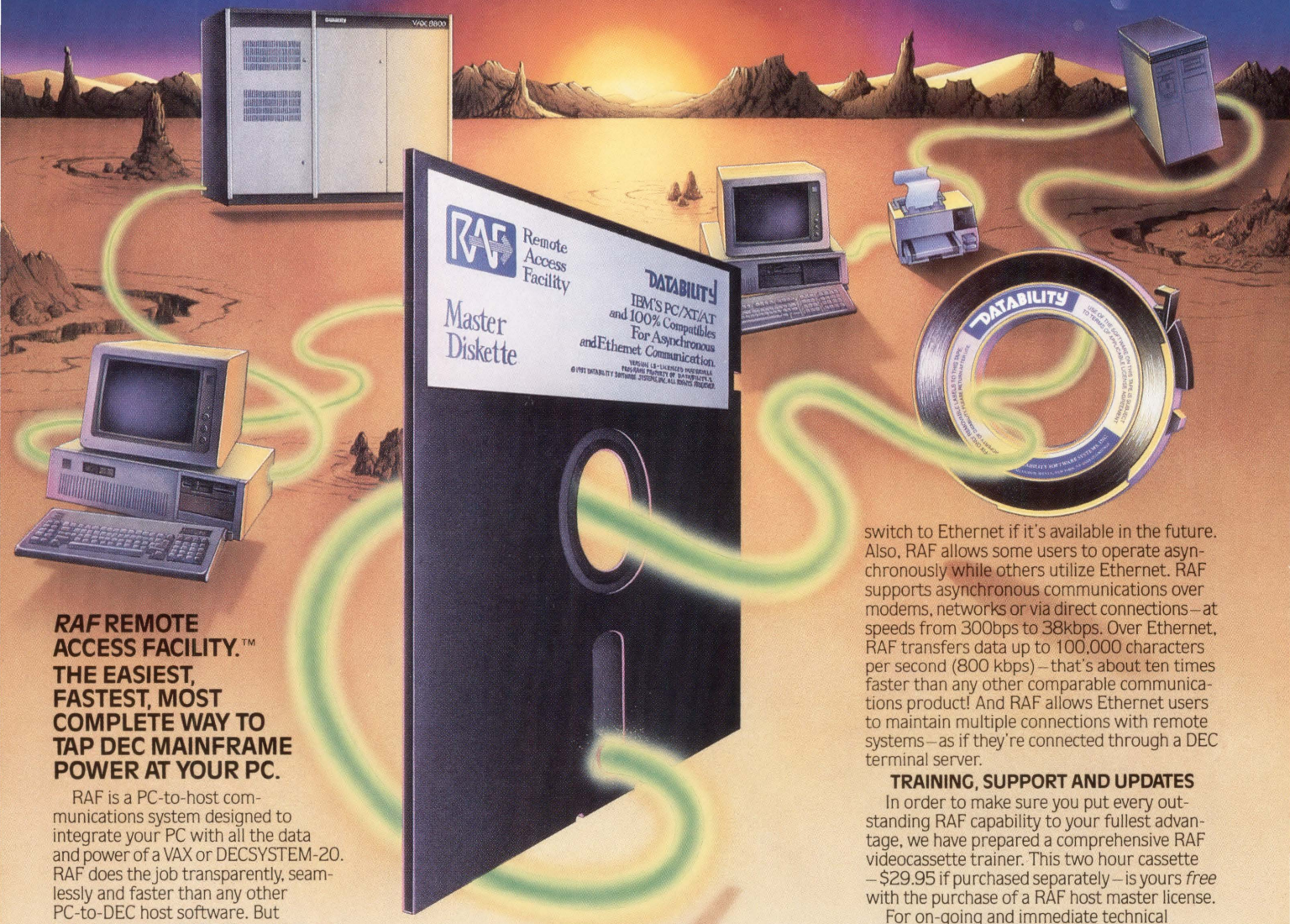
- Managing DECNET/SNA Gateways
- VAX Symmetrical Processing
- The Emerging X Window System



Composition No.5., 1932 by Stuart Davis.

Connectivity

RAF. THE MAINLINE TO YOUR MAINFRAME.



RAF REMOTE ACCESS FACILITY.™ THE EASIEST, FASTEST, MOST COMPLETE WAY TO TAP DEC MAINFRAME POWER AT YOUR PC.

RAF is a PC-to-host communications system designed to integrate your PC with all the data and power of a VAX or DECSYSTEM-20. RAF does the job transparently, seamlessly and faster than any other PC-to-DEC host software. But read on, because RAF offers a lot more!

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COMPLETE ACCESS OF REMOTE COMPUTERS

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- Pop-up calculator

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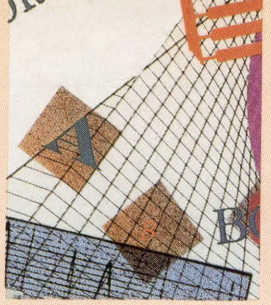

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CONTENTS

APRIL 1988 VOL. 7, NO. 4

CONNECTIVITY TECHNOLOGY

ARTICLES

Continued on page 4.

LABORATORY DECPRO TESTING CENTER

The lab seal indicates that the product reviewed has been tested by one of our experts in our Laboratory and Testing Center.

ON THE COVER:
Stuart Davis. Composition No. 5. *(Gloucester, Massachusetts, 1932). Brush and ink, The Museum of Modern Art, New York. Gift of Abby Aldrich Rockefeller. Photograph* © *1988. The Museum of Modern Art, New York.*

CONTENTS

Continued from page 3.

DEPARTMENTS & COLUMNS

The ARIS symbol on an article indicates that the program segments are available electronically on our Automated Reader Information Service. Dial (215) 542-9458.

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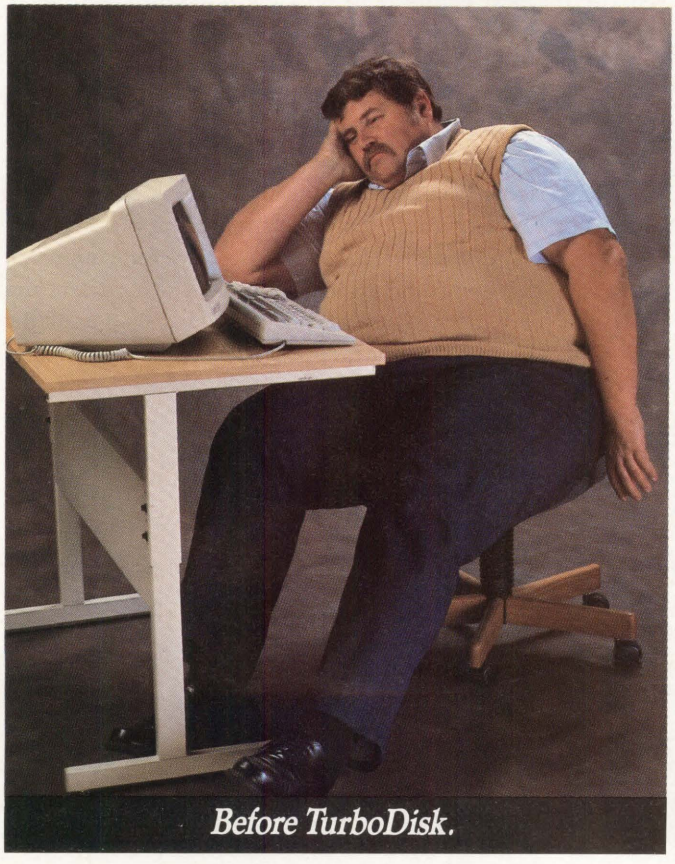
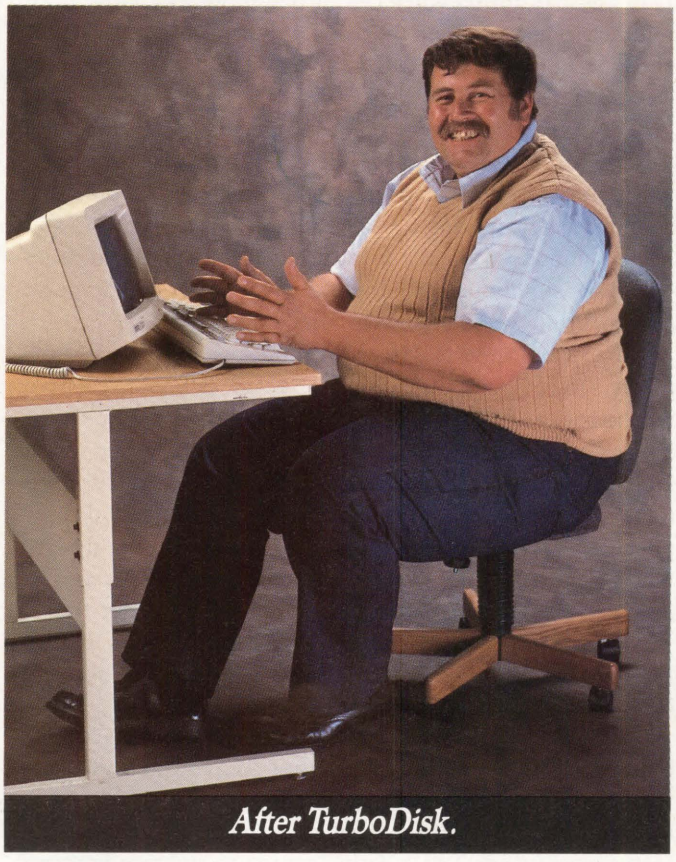


Before TurboDisk.



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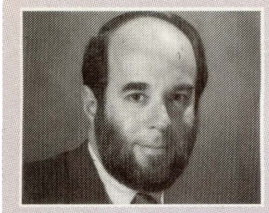


PUBLISHER

Carl B. Marbach

Bottom Up, Not Top Down Networking

The network is the computer. For DEC, networking is what it has when the ads say, "Digital has it now."

DECNET has been linking VAXs together since the beginning. Closer ties among processors became possible with VAXCLUSTERS, and clustering was made easier with the advent of Local Area VAXCLUSTERS (LAVC) with VAXs connected only by Ethernet.

Some time ago, PC connectibility became an issue. Third-party companies developed software for linking PCs to VAXs. This was legitimized when DEC brought out a PC clone with an Ethernet connector on the back, and Ethernet became a way of connecting PCs to the VAX network. The network that was the computer consisted of VAXs and PCs.

This year DEC and Apple announced an agreement to develop and market connectibility between Macintosh and VAX computers. As usual, this announcement was preceded by third-party products that accomplished what DEC and Apple announced for the future. Nevertheless, Macintoshes were now solidly on the network. Our expanding computer (network) now had PCs, Macs and VAXs.

The Macs and the PCs were thought of as personal computers. Today, we might think of them as less specialized workstations. The more sophisticated workstation market is heating up. Sun, Apollo, DEC, Hewlett-Packard, etc., built high-performance graphical, interactive workstations designed to be used by one person. Initial uses of these powerful computers included CAD/CAM and interactive graphic design. Now, like the PCs and Macs that preceded them, they are being connected to the network.

The promise of "the network is the computer" is that we can deliver computing power to users DEC style: file sharing, device sharing, mail, communications, etc.

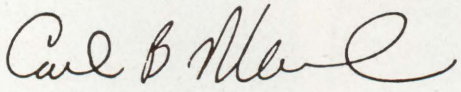
It hasn't been easy; PCs speak MS-DOS, Macs have their own special user interface (operating system) and now the workstations, which mostly speak UNIX. Tying these systems into a coherent network is a challenge for both hardware and software engineers. DEC's early decision to embrace Ethernet has opened up the architecture of the network for everyone. DECNET has offered an opportunity for true peer-to-peer networking, but the third party also has offered us other types of file serving as an alternative.

A typical VAX network could embrace PCs for accountants to run *Lotus 1-2-3*, Macs for public relations people, VAXSTATIONS for programmers, Suns for interactive video designers, HP 9000s for the CAD/CAM engineers, Apollos for CAE architects and space planners, VT330s for the data entry department, remote VAXs for transaction processing, local VAXs for the corporate databases — all connected to the same Ethernet and, therefore, all connected to each other. Does this sound like a closed architecture to you?

While touring the recent Uniforum, I realized that I could attach almost any of the wonderful computers (workstations) I saw and run most of the software being shown at the software booths — without losing my network concept, and using my existing VAX systems and Ethernet. I was free to choose the best platform to provide individuals and work groups with what they need to be more productive.

Connectibility and networking aren't just words, and they aren't the future either. They're here today. Our challenge is to build our systems so that we can take advantage of all the technologies available now and in the future.

The original PDP-8 had seven instructions; today's systems are far more complicated than that simple (but powerful for its day) machine. While we have more power at our command, exercising that command is more difficult. The hardware and software vendors have done a wonderful job giving us all the pieces. It's up to us to put them together into the computer of the future — the network.



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In other words, "The COLORSCAN/2," according to Frank J. Derfler, Jr., editor of *PC Magazine*, "is an excellent solution to desktop clutter for any combination of PC, LAN-based and host-based applications."

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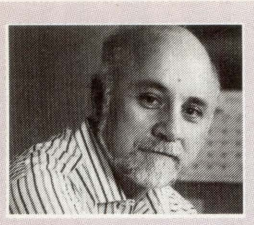

EDITORIAL

Dave Mallery

A Summit, But No Treaty

The sun is setting on the land of UNIX. Ever since Sun and AT&T became entangled via a 20 percent stock purchase, there have been rumblings that maybe UNIX is no longer the land of the free. It seems that AT&T has developed a new version of UNIX that's somehow linked with the Sun SPARC chip set.

A summit meeting was held in New York during the last week of January with Vittorio Cassoni of AT&T and representatives of HP, DEC, Apollo and other leading vendors who license UNIX. After the meeting, a vendor spokesmen said that there were no assurances that release 4 of AT&T's System V would remain non-proprietary. This isn't unlike the lease on Hong Kong.

I always have wondered just who was going to pay for the subsequent releases of UNIX. It seemed to me that too much of the income from UNIX licenses was going into corporate bottom lines instead of further development. Some form of shakeout or shakedown was inevitable. After all, how long should AT&T provide an "open" operating system to a world in which DEC is making hay (hay = $billions) with a closed VMS? Now that AT&T has brought a piece of an accomplished computer maker, why continue to help the competition?

Also, how could UNIX ever survive in a situation where Digital is pouring money into an aggressive development, following one plan and heading one way? If the enhancements to a release of UNIX have to filter through a myriad of committees consisting of many vendors before they reach the common core release, how can there be a plan or even a steady direction?

One wonders just how airtight the license agreements between AT&T and the various vendors really are. It's too late for the vendors to make a transition to Berkeley. What recourse do the users have? Sounds like the litigation event of the decade. I have heard much grandstanding about open systems and standards for years now. Let's see how fast all that noble talk unravels.

There's another answer. It's called POSIX, a nascent standard that's being developed by the industry standard making group called X/Open. It consists of a minimum set of system services to be supplied by any operating system. If you supply these services, you're POSIX compliant. If you write your software to be POSIX compliant, you can port to any POSIX compliant O/S.

What if VMS becomes POSIX compliant?

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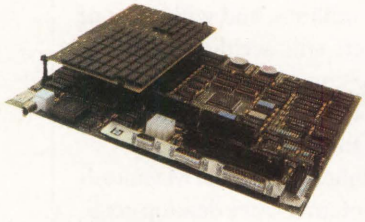

The **MV2000/16 MB*** nearly triples the density offered by DEC. Achieve identical processor and memory performance to the full configuration MicroVAX II —at half the cost!

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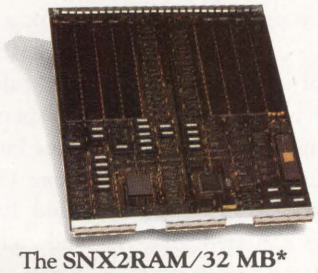

The **SNX2RAM/32 MB*** delivers the Sun 3/2XX system maximum on a single board. It also offers the enhanced functionality of a microprocessor-managed "on-board hotline" for local and remote diagnostics.

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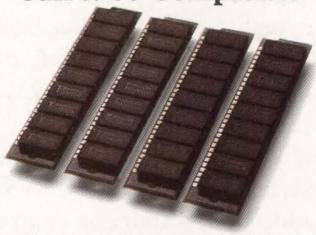

The **SNX60**, comes in 4 MB SIMM sets that upgrade your Sun 3/60 to an expansive 24 MB. Each SIMM is one MB of reliable Clearpoint memory with a 1 megabit DRAM to support parity checking.

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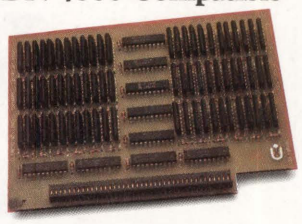

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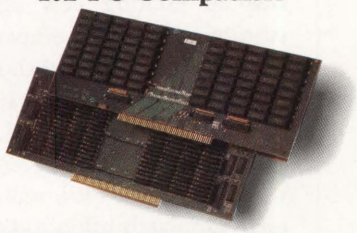

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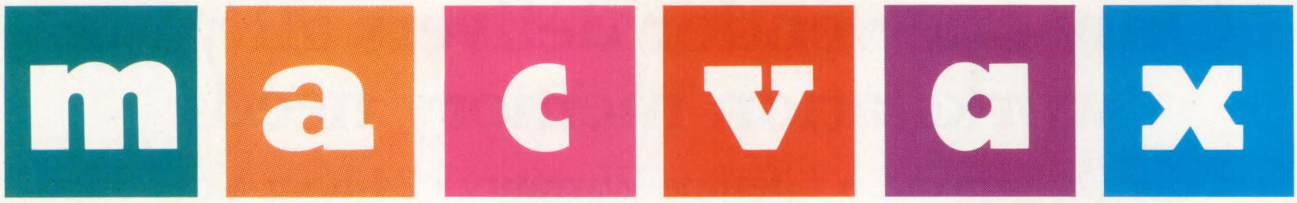

VAXWINDOWS And 'GlobalTalk'

Promises of the Apple/DEC development agreement.

BY AL CINI

THE JANUARY 22, 1988, announcement of a "joint development agreement" between Apple Computer Inc. and Digital Equipment Corporation heralds an exciting new age for the customers of both companies. Long on general themes and short on specifics, this announcement suggests little in the way of real-world products and timetables. Who's going to build what, and when? How will this agreement ultimately affect today's buying decisions? This article explores the agreement and provides an informed outsider's speculation on what it means today and where it might lead in the future.

WHAT'S IN IT FOR APPLE?

FROM A SALES viewpoint, the joint agreement gives Apple's Macintosh an immediate boost in the business marketplace. Apple dealers can exploit the inroads made by Digital during the last several years, especially on Big Blue turf like banking and manufacturing, to sell the Macintosh as a credible business computing workstation.

From a technical viewpoint, the VAX represents the mid-range and mainframe computing resource into which a Macintosh user could never grow with products from Apple alone. VAX databases can feed gigabytes of corporate data to users on a Macintosh. VAX DECNET wide area networks can link hundreds of AppleTalk LANs into a true "GlobalTalk village." With a VAX network behind a Macintosh, a Mac user never needs to seek high-end products from IBM.

WHAT'S IN IT FOR DEC?

MARKETWISE, DEC GAINS an immediate opportunity to promote its VAX product family, especially the MICROVAX, as a general computer server for Macintosh users. With an installed base in the millions, and with most of its customers still deciding where to go for a big computer, the Macintosh market is a shooting gallery for the DEC sales force.

In technical terms, the Macintosh is the kind of innovative desktop computer Digital always has wanted to build. Its solid underlying architecture and naturally integral family of Apple and third-party application software make it a dynamite VAX front end.

WHERE'S THIS LEADING?

BOTH COMPANIES ARE quick to point out that their mutual agreement isn't a merger. Macintosh personal computers won't be finding their way into the *DECDIRECT* catalog, and Apple won't be selling VAX-based file

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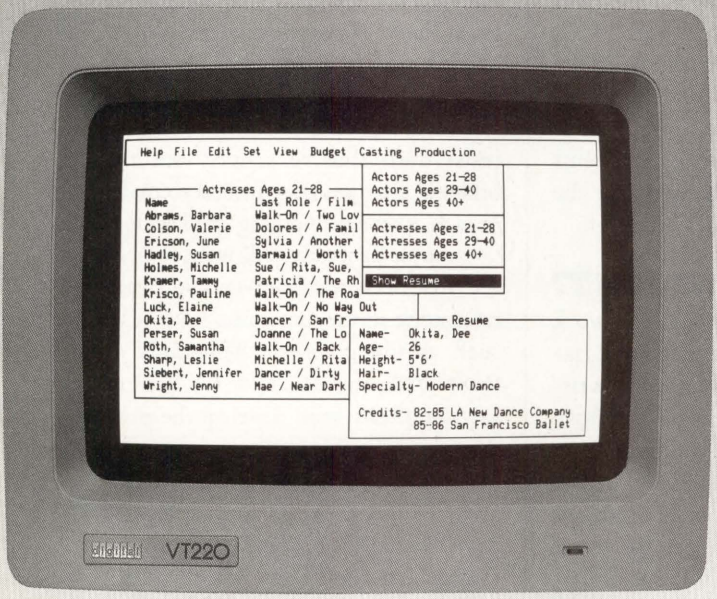

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servers. The agreement carries strong statements of mutual technological respect, with Digital recognizing that it needs to provide bridges between AppleTalk LANs, and Apple stating its responsibility to conform with DEC standard architectures such as DECWINDOWS. This bilateral tilt toward a common technical direction is based on both vendors' commitment to supporting multivendor networks through adherence to international standards, such as ISO's Open Systems Interconnect (OSI) layered network protocols.

WHAT'S HAPPENING NOW?

THE APPLE/DEC agreement announces no new products or services. The announcement includes a reference to a joint developers' conference, to be held in August, where both companies promise to publish standards that will help third-party developers (the announcement refers to them as Independent Software Vendors [ISVs]) build cooperative Mac/VAX products.

Despite the lack of specifics, there's a good deal of grass roots sales interest already brewing between the two companies. All over the world, Apple's dealers and national account representatives are meeting with DEC's sales organization to find ways of working together. DEC still makes and sells VAXMATES and VAXSTATIONs, and in sales situations where the customer hasn't made a firm workstation decision, DEC will continue to push its own desktop computing technology. Still, this agreement leaves DEC sales free to endorse a customer's commitment to the Macintosh, and to sell VAX technology along with it in its traditional role of departmental computer and network server. With this sort of relationship, DEC becomes a systems integrator, firmly planted in the driver's seat of the sales situation.

Companies Mentioned In This Article

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WHAT HAPPENS NEXT?

THE DETAILS MAY take a while to work out, but DEC's field service organization is sure to take an interest in writing service contracts for Macintosh personal computers. Given that Digital's revenues increasingly depend on its services as well as its products, DEC's instinctive urge to write Macintosh service contracts is understandable. While DEC soon may be writing such service agreements for its VAX customers who use the Macintosh, it's unlikely that they'll soon, if ever, cultivate an AppleCare-style Macintosh service plan for the general Mac market.

As for networking products, various ISVs already offer several workable alternatives, from DECNET solutions for the Macintosh to AppleTalk software on the VAX. Until DEC and Apple begin to develop their own products, Apple dealers and DEC sales representatives will be proposing these third-party products to their customers who want to begin right away to build Macintosh/VAX networks.

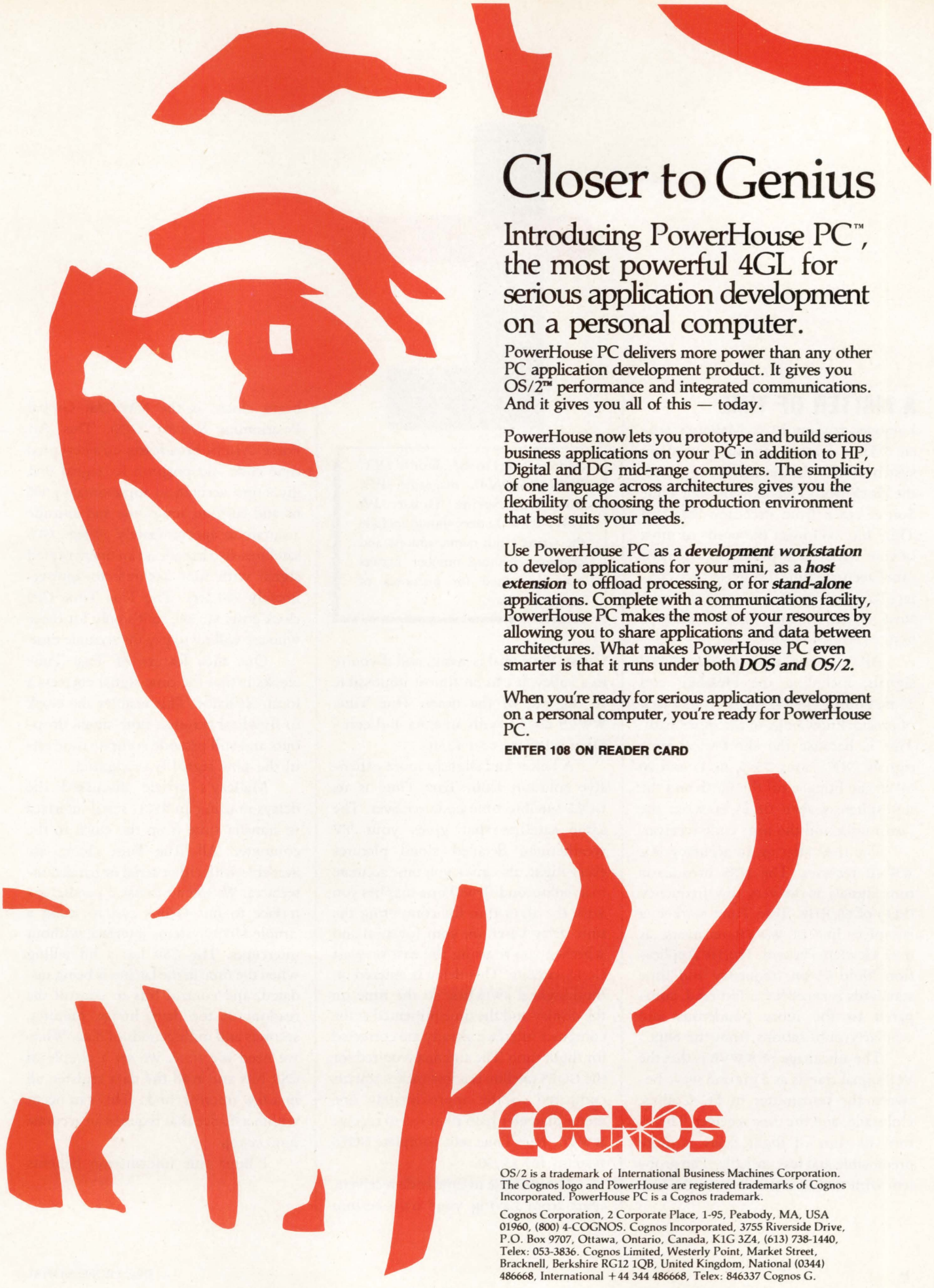
It seems likely that Digital eventually will want to expand its umbrella of Personal Computer Systems Architecture, which currently includes its VAX/VMS Services for MS-DOS, to cover the Macintosh. Consistent with Digital's policy of maintaining transparency to the workstation user, it seems likely that this new product will be AppleShare-compatible. Even with the prodigious development effort involved, it will be 1990 before such a product appears in DEC's price list. Will DEC buy and relabel an existing ISV product such as AlisaTalk or PacerShare? Market pressure to offer a product immediately may push them in this direction, but the technical purists at Apple and DEC are likely to resist until they've scoped out the bilateral changes they intend to make in each other's networking architectures.

Apple probably will want to own the VAX network front-end software referred to in the joint announcement, such as the planned client ends of VAXNOTES and *ALL-IN-1*. It's hard to say whether it will develop the products itself, or if it will evangelize ISVs to write them. Given its recent trend away from application software development, it probably will go the evangelism route after jointly hammering out a client networking architecture with DEC.

WHAT DO I DO NOW?

THE MOST NATURAL instinct is to wait and see what DEC and Apple will do, but that could turn out to be a big mistake. Most of the development basics, such as networking protocols and developers' tools, already are in place. Today's file servers, database software and terminal emulators are based on committed standards. Future developments, if any, from DEC and Apple will build on today's technology rather than replace it. In short, the network you build today will continue to work in the future.

"Don't wait for us," says Richard Smith, DEC's business development manager for the MICROVAX product family. In the unique strengths of the VAX and Macintosh, coupled by today's family of Macintosh/VAX connectivity products, Digital and Apple really do "have it now." ■



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LETTERS

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

A MATTER OF TIME

I enjoyed reading Dave Mallery's article "Time Source" (January 1988) on system clocks. As the article suggested, the clock from Heathkit and the Time Source clock from Precision Standard Time Inc. will meet the needs of most of your readers. For those few who need more accurate time, I suggest they contact Kinemetrics True Time, 3243 Santa Rosa Avenue, Santa Rosa, California 95401; (707) 528-1230.

All systems that receive WWV signals, including the Heathkit and Time Source clocks, suffer from a lack of precise knowledge of the signal path. This is because the short-wave time signals (WWV uses 2.5, 5, 10, 15 and 20 MHz) can bounce off the Earth and the ionosphere several times between the transmitter and the time code receiver.

The next step up in accuracy is a WWVB receiver. The NBS broadcasts time signals at the very low frequency (VLF) of 60 KHz. True Time markets a complete line of WWVB receivers, as does Hewlett-Packard. The HP Application Note 52 on frequency and time standards is excellent; a fast read, compared to the more ponderous and scholarly publications from the NBS.

The advantage of WWVB is that the VLF signal travels as a ground wave between the transmitter in Ft. Collins, Colorado, and the time receiver. Therefore, its time of flight delay is more predictable and less variable. The problem with WWVB is that here on the East Coast, the signal is weak, and if you're in a valley, it can be almost impossible to dig out of the noise. True Time WWVB clocks with antenna and computer interface cost $2,900.

A better and slightly more expensive solution from True Time is its GOES satellite time code receiver. The same satellite that gives your TV weatherman detailed cloud pictures every night, also gives you time accurate to a millisecond. True Time supplies you with the algorithm for computing the time delay based on your location and whether you're using the east or west GOES satellite. This delay is entered on thumbwheel switches, so the time on the display and the time presented at the computer interface already are corrected for flight time. The antenna required for the GOES satellite is a few inches square, compared to the approximately one meter diameter halo required to receive WWVB. True Time sells complete GOES systems for $3,750.

The ultimate in time code receivers, apart from having your own cesium beam clock, is the NAVSTAR Global Positioning System (GPS). This Air Force system broadcasts an encrypted time code and position fix signal that gives time accurate to approximately 100 ns and latitude, longitude and altitude accurate to approximately 50 feet. GPS satellites also broadcast an unencrypted signal with time accurate to approximately 200 feet. The True Time GPS clock costs $15,500, so it's only for those who are willing to pay for accurate time.

One nice feature of True Time clocks is that the time signal corrects a local oscillator. This enables the clock to flywheel through time signal dropouts and still provide accurate time until the time signal is reacquired.

Mallery's article discussed the delays in using an RS232 serial interface to transfer time from the clock to the computer. All True Time clocks are available with either serial or parallel interfaces. We intend to use a parallel interface to our Q-bus system using a simple MDB Systems interface without interrupts. The CSR has a bit telling when the time in the latches is being updated, and control bits to control the readout of the days, hours, minutes, seconds and milliseconds of data. When we need the time, we set a couple of CSR bits and read the data register, all in a few microseconds. This can occur within a device that requires an accurate time stamp.

I hope this information benefits

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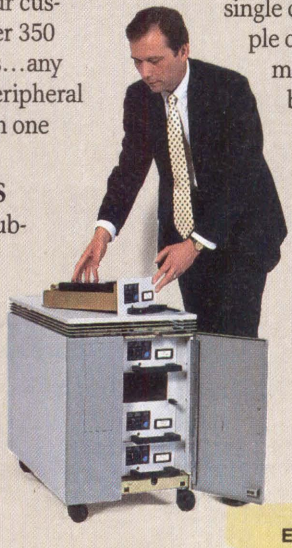

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readers who need very accurate time in their computer systems. I'll be happy to correspond with readers about their specific needs.

Mark Trueblood
Winer Mobile Observatory
Potomac, Maryland

Editor's Note: Interested readers may contact Mr. Trueblood c/o DEC PROFESSIONAL, *921 Bethlehem Pike, Spring House, PA 19477, Attn: Editorial Dept.*

ANOTHER SOLUTION

This is in response to Mitchell Kaufman and William Ellis' article "Who's On First?" (January 1988) that described a method of listing all of the users on a cluster.

We faced the same problem when we upgraded to a two node cluster (8300 & 8350) with a common system disk in November 1987. The DEC software engineers on site for the installation came up with the following to show all of the users on our cluster.

Their solution was to use the TYPE command and a command file in the DECNET directory. The TYPE command was:

```
$ TYPE your__node__name" "::
  "0 = SHOWUSER"
```

An easy way to use this command is with a symbol set to a command file consisting of a TYPE command for each node in the cluster.

The SHOWUSER command file in the [DECNET] directory consisted of:

```
$ IF F$MODE( ) .EQS. "NETWORK" THEN
  DEFINE/USER SYS$OUTPUT SYS$NET
$SHOW USER
$LOGOUT
```

Note that this procedure creates a log file in the DECNET directory each time it's used, so we've limited the number of versions kept on these log files.

Alan Lee Briscoe
Macy's California
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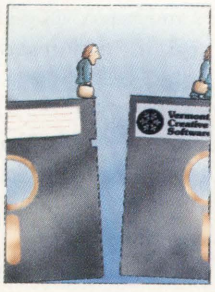

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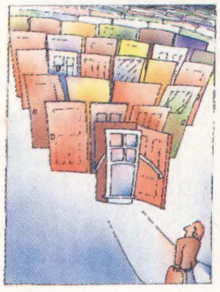

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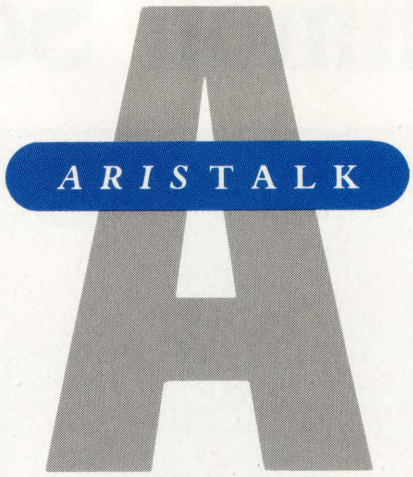

TERMINAL LOGGING

QUERY:

Bob Zisek *(SIG 37/MESS 460):* Is there a way in VMS to enable the logging of an interactive session to a text file? I know about the redefinition of SYS$OUTPUT, however, I was wondering if there was a method of having this logging process totally transparent to the user and having the session logged to an output file. We're running VMS V4.5 on DECNET with no clusters.

REPLIES:

Rich Dowey *(SIG 37/MESS 464):* Recently, I had to monitor the activities of one of many users. To get this logging effect, I used the SET HOST/LOG feature of DECNET. However, if you're not a DECNET site, you may be interested in a product *Contrl* from Clyde Digital Systems in Orem, Utah. It will allow you to not only monitor and log the activities of other users but control their session as if it were your own (interactively).

Bob Eisenbart *(SIG 37/MESS 466):* There's also a package called *Advisor* from Precision Business Systems, New York, that will allow you to see everything that transpires on another terminal and even enter commands as if you were at that terminal.

I tested Clyde Digital Systems' *Contrl* and found anomalies while running it. Screens didn't display properly on the advising terminal. I've never had any glitches using the *Advisor* package.

Also, neither package works if you have terminal servers. We're using DMF-32-compatible controllers from Emulex, and the software works fine. We tried installing a Xyplex terminal server on the system a few months ago; when we tried to advise a terminal server port, the system crashed. I spoke with Clyde and Precision about their respective software, and they informed me that their programs couldn't handle terminal server ports.

Steve Thomas *(SIG 37/MESS 465):* You can log your terminal session by using $ SET HOST/LOG = LOGFILE.LOG 0. This will connect you to your own node and log the session. If you don't have DECNET, there's some software that will do this, but it will cost you a little. I once talked to someone at Colorado Customer Support who had this program for sale.

Unsigned *(SIG 37/MESS 469):* Everyone with a non-MICROVAX has enough DECNET for this little trick: You don't need a DECNET license to use DECNET to establish a connection to the node you're on with SET HOST. DECNET licenses only are required to turn on a circuit to connect to any other node. @SYS$MANAGER:NETCONFIG will get you in the ball game and @SYS$MANAGER:STARNET will get you to SYSTEM STARTUP thereafter. Then you can SET HOST/LOG 0 to your heart's content.

It's missing on MICROVAXs because of space considerations. But, soon MICRO VMS and true VMS will be the same kit, so that distinction should disappear.

Hunter Goatley *(SIG 37/MESS 478):* I wanted to respond to Bob Eisenbart's comments about our product, *Contrl*. He mentioned that he encountered anomalies while running *Contrl*.

The only way that differences would appear between the controlling terminal and the controllee's would be if they were two different terminal

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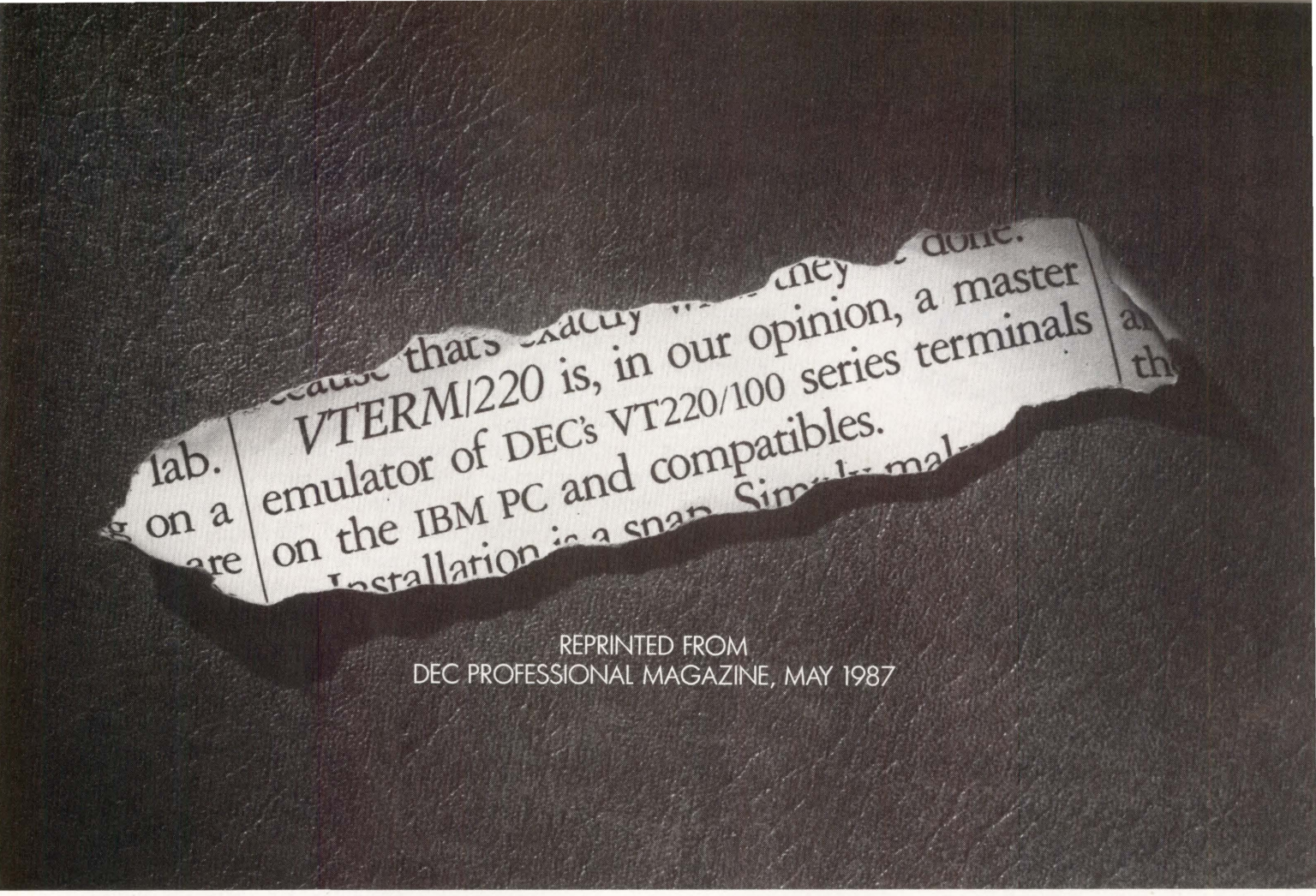
SIG Identifications

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

37 ..... VMS
46 ..... Utilities



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*VTERM refers to VTERM/220, VTERM III and VTERM/4010 from Coefficient Systems Corporation.

types; i.e., a VT100 and VT220, respectively. *Contrl* even allows a person to monitor a terminal that's running at a different baud rate from his terminal without losing any characters.

Mr. Eisenbart goes on to say that *Contrl* doesn't work with terminal servers. He must be referring to an older version of *Contrl*, because *Contrl* works with DECSERVERS. As for Xyplex, its original terminal server software strayed from the VMS driver format. According to Xyplex, it has a terminal server in Beta release that works with our monitoring software. Also, *Contrl* won't crash a system using the current Xyplex terminal server; it checks to be sure that it can monitor a device before attempting to do so. In the case of Xyplex, *Contrl* will report that it can't monitor those devices.

We continuously are maintaining *Contrl* so that it works with all new versions of VMS. This includes VMS V4.2 through V4.7, and, in Beta test, a version that works under VMS V5.0. I just wanted to set the record straight.

MAIL CALL

QUERY:

Harry Nicholos *(SIG 46/MESS 189):* I'm having problems with a user who, upon logging in, is informed that he has one mail message. He cranks up Mail and it again informs him of his one new mail message. READ tells him there aren't any mail messages. Is there a fix short of calling DEC?

REPLIES:

Mike Sisson *(SIG 46/MESS 190):* I've heard of this happening before when someone deletes a mail file before reading the new message. The fix is to enter Mail and then type READ/NEW. This supposedly will delete the new mail message. Hope this helps.

Sarah McKneally *(SIG 46/MESS 193):*

```
MAIL> READ/NEW
MAIL> DIR/NEW
MAIL> EXIT
```

And then the new mail count is correct for your personal account.

Steven P. Davis *(SIG 46/MESS 191):* The file:

```
SYS$SYSTEM:VMSMAIL.DAT
```

is where the number of new messages is kept. When you log in or invoke Mail, this file is checked. If the "new mail" count is non-zero, you're informed. I assume that it's reset by Mail on exit, after new messages are read.

It's likely that for some reason it was not reset. The file has a record for each user in the system. I'd bet that if you deleted the user's record from the VMSMAIL.DAT file, it would be recreated next time a new message was sent.

Kitty George *(SIG 46/MESS 192):* This will get rid of the "You have x mail messages" for the poor soul who sees the message, but in reality has no mail. I'll bet you created this account by copying information from another account with AUTHORIZE, and the account that was copied had unread mail at the time.

Assuming you have the proper privileges, here's the solution:
Assume the person with the problem has the name RALPH.

```
$ SET DEFAULT SYS$EXAMPLES
$ @MAILUAF
MAILUAF> REMOVE RALPH
MAILUAF> ADD RALPH
```

That's it! MAILUAF maintains the VMSMAIL file. I've used MAILUAF to fix your type of problem and also to establish forwarding addresses for people with accounts on more than one VAX in our network. By using the MODIFY command, I can redirect all of their mail to the VAX on which these people are most likely to be found, thus eliminating their chore of having to log in on all nodes to find all their mail.

Mike Ramos *(SIG 46/MESS 194):* One thing to note: I think you need to type READ/NEW once for each ghost message you have. ■

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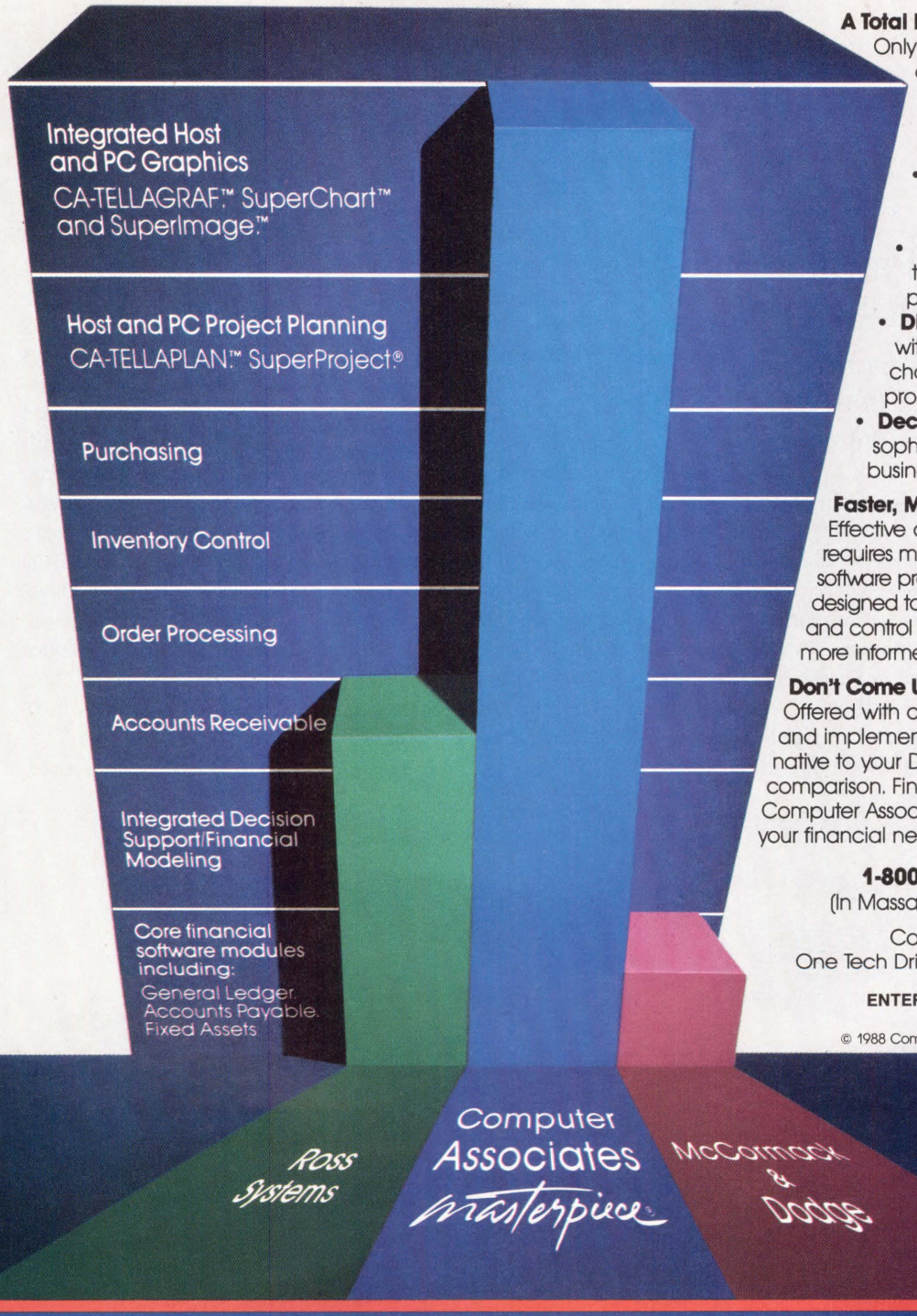

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Multiport Repeater Provides Full Ethernet Interconnect Solutions

The RL7100 Multiport Repeater Joins The Family Of Ethernet Thin-Net Repeaters From American Photonics

The philosophy is full compatibility; the focus is to provide complete and efficient Ethernet interconnect solutions. American Photonics Inc. (API) of Brookfield Center, Connecticut, addresses these areas with the RL7100 Multiport Repeater.

The RL7100 Multiport Repeater provides efficient and cost-effective connection between several thin-net coax segments. The RL7100 is made up of two products: the RL7100L Local Multiport Repeater and the RL7100R Remote Multiport Repeater.

The RL7100L interconnects up to eight RG-58 thin-coaxial Ethernet segments and allows connection to a standard thick-coax backbone. It includes eight integral transceivers to allow direct connection to the thin-net segments via BNC type connectors, eliminating the need for external transceivers and cable.

The RL7100R Remote Multiport Repeater provides all the features of the local version, in addition to a fiber optic interface. It acts as a thin-net substar to American Photonics' RL8000 Ethernet Star Distribution System. Connection to the RL8000 System is possible by using multimode fiber optic cable up to 3,000 meters. For connecting thin-net segments to a remote thick coax, the RL7100R also communicates with the company's RL5000 Ethernet Expander over fiber optic cable.

According to Don Heidrich, manager of marketing, "The RL7100 Series reinforces API's position as a systems-oriented equipment supplier. Like our other Ethernet products, the RL7100 Series is designed to go beyond the specifications to allow networks to operate with degraded signals that can result from mixed-vendor environments."

The RL7100 Series Repeaters are fully compatible with Ethernet V2.0 and IEEE 802.3 LANs; and with API Ethernet Transceivers, Repeaters, Expanders and Star Distribution Systems. The RL7100L lists for $2,450 and the RL7100R for $3,150. For further information, contact American Photonics Inc., 71 Commerce Dr., Brookfield Center, CT 06805; (203) 775-8950.

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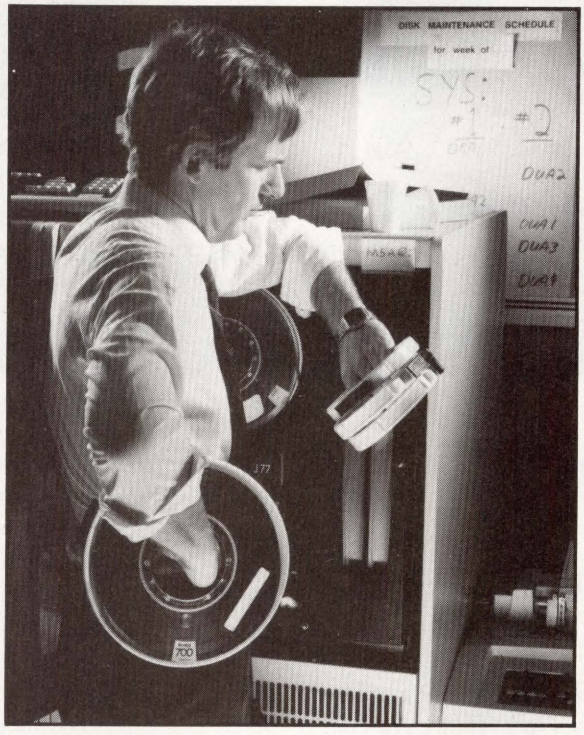
American Photonics' family of Ethernet Thin-Net Repeaters includes the RL7100, the RL7100L Single-Port and the RL8000 Ethernet Star Distribution System.

Our Biggest Competitor is Backup and Restore.

SQUEEZPAK is your efficient alternative to backup and restore. SQUEEZPAK will clean up your file and free space fragmentation... quickly, conveniently and in complete safety while your disk is still online and available to users.
Backup and Restore was never specifically designed to deal with disk fragmentation, a recognized leading cause of poor system performance. Yet many VAX managers still rely on this time consuming "off line" approach.



Powerful

System managers and users report many benefits from SQUEEZPAK:

- Performance improvements as high as 50 percent.
- No more off hours wasted on tedious Backup and Restore procedures.
- Substantially reduced times for backups.

You Can Benefit Too

Call us today, or use the coupon to find out more about the efficient alternative, SQUEEZPAK. We'll give you the information you need to assess the impact of disk fragmentation on your site, as well as the true cost of your current Backup and Restore program.

Cost Effective

SQUEEZPAK's cost is surprisingly low. Most users recover their entire investment in just a few months.

Safe

Solid engineering design, built-in program safeguards and our successful field proven record are your guarantee that your files are in safe hands with SQUEEZPAK. Even a total crash or power failure can't cause SQUEEZPAK to lose any of your valuable data.

Free Trial

We're so confident you'll realize the tremendous savings in time and performance that SQUEEZPAK can bring to your site that we're offering you a FREE NO-HASSLE TRIAL! Call us, or write today, for more information.

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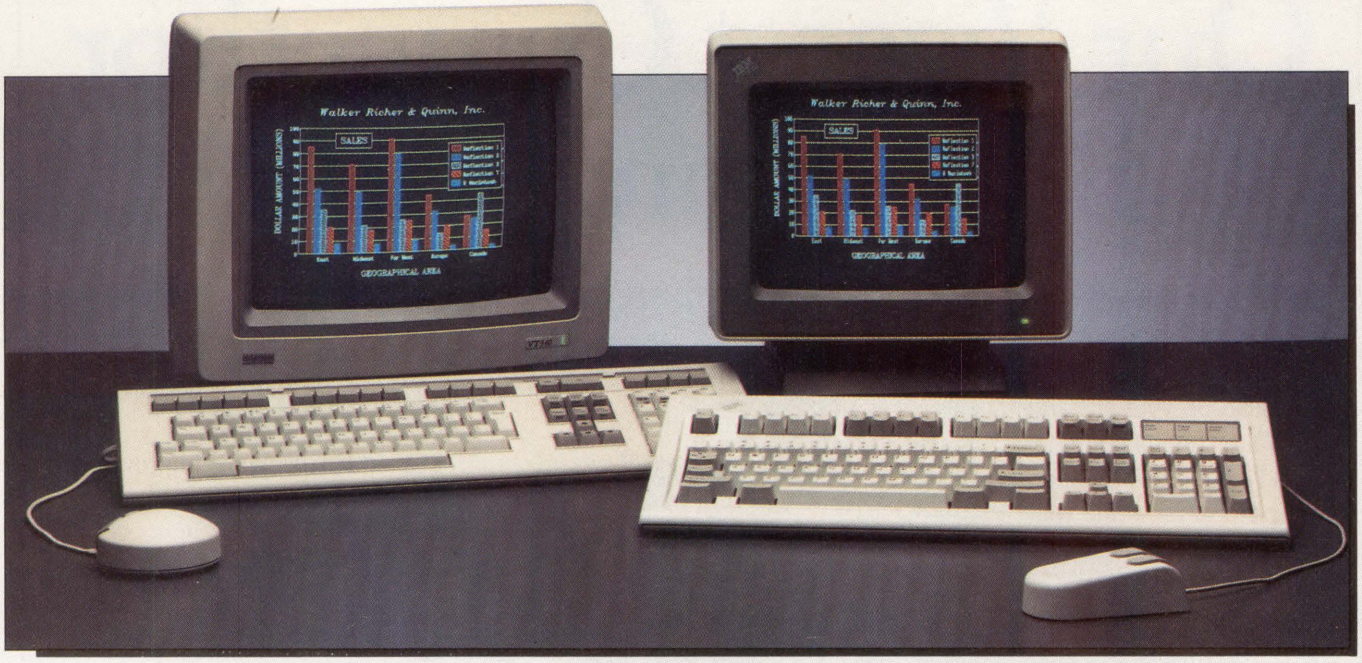


Reflection 4 ***software package supports all ReGIS graphics commands.***

Reflection 4 Supports ReGIS Graphics

Software Offers PC Users Accurate Emulation Of Graphic And Text VT Terminals

Reflection 4, a newly developed software package enables a PC to emulate the ReGIS color graphics of Digital's VT340 and VT241 terminals, and Tektronix's 4014 terminal. It supports all ReGIS graphics commands including polygon fill, curve fitting, circle drawing, macrographics command sequences, line shading, character shading, pattern-line drawing, rubberband cursors, rotated and italicized text, and mouse support. *Reflection 4* uses a scaled image to show the complete ReGIS screen, (800 x 480 pixels) and on the physical display, (640 x 350 with an EGA). It supports 16 colors from a palette of 64.

According to George Hubman, vice president of marketing, "ReGIS graphics is used in a rapidly growing number of VAX application packages." "With *Reflection 4* supporting ReGIS graphics, we can offer PC users accurate emulation of graphic and text VT terminals, combined with *Reflection's* features that enhance productivity."

With *Reflection 4*, users can adjust the amount of memory the program uses. It provides options to reduce memory requirements when the user's needs permit. For example, the number of colors, downloadable character-set storage and macrograph storage are configurable; each affects the amount of memory required by *Reflection 4*. In its smallest configuration, *Reflection 4* requires approximately 220K. With this setup, *Reflection 4* presents a scaled screen with 16-color capability, but doesn't save the screen when leaving ReGIS mode or when entering background mode. To save the graphics image, *Reflection* provides a table to determine additional memory requirements:

Number of colors:	0	4	8	16
Additional memory:	0K	50K	75K	100K

Reflection 4's small memory requirements and its ability to use expanded memory mean there is memory left in the PC to run other applications.

ReGIS graphs can be captured on a PC-disk file. For example, a user can set CAPTURE to YES on *Reflection's* command line and then receive a ReGIS graph. From there a user can save or make changes to that file and display it again, with or without a host connection.

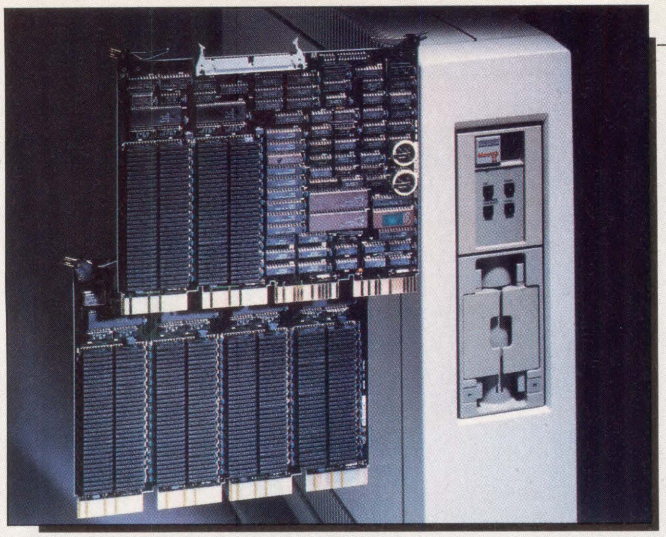
Graphics emulation is fully compatible with *Reflection's* background feature. While the host software is sending a complicated image to the graphics screen, *Reflection* may be popped into the background. Then a user may work on a PC-DOS application in the foreground, while images sent down from the host are drawn on the background screen.

Reflection 4 features multitasking, keyboard remapping, support for Digital's LK250 keyboard and LAT protocol under DECNET DOS, a structured command language and proprietary file transfer protocols to VMS and UNIX/ULTRIX hosts. The PLUS option of *Reflection 4* provides PC-to-host backup capability and additional LAN support.

Reflection 4 lists for $299; *Reflection 4 PLUS* for $349. For further information, contact Walker Richer & Quinn Inc., 2825 Eastlake Ave. E., Seattle, WA 98102; (206) 324-0350.

Enter 508 on reader card

—Suzanne Garr



RAM DISK features include mapping, software development, telecommunications and message switching.

RAM DISK Boosts Performance

See First Offers Controller Board

See First Technology Inc., of Santa Clara, California, designs and manufactures memory expansion boards for all Q-bus DEC-based systems. Now, MICROVAX users can improve performance by using See First's RAM DISK boards, which plug directly into the backplane of the system.

Users can start with a one-board system (RDC-16) that contains 16 MB of one megabit DRAMS plus an MSCP controller. An additional two boards (RD-32) that contain 32 MB of one megabit DRAMS each can be added into the backplane, providing users with up to 80 MB of RAM DISK for access of applications using graphics, image processing, simulation, transaction processing or database management.

The RAM DISK is accessed similar to a conventional MSCP device by means of a driver (MSCP firmware) and controller (hardware). The major difference between See First's solid-state RAM DISK board and the conventional disk drive is speed. Access time is the sum of driver overhead, seek time and rotational latency. The RAM DISK eliminates seek time and rotational latency because raw access time for a RAM DISK is 1/100 of the time of a conventional disk drive.

Because the RAM DISK has no moving parts it experiences virtually zero access time. Therefore, data is accessed at speeds approaching that of main memory. The I/O for both conventional and solid-state disks is burdened with software overhead required to set up the I/O. As a result, the RAM DISK can boost the performance of a MICROVAX system when users are running I/O intensive applications. The list price of the RDC-16 RAM DISK board is $12,000 and the RD-32 RAM DISK board is $18,000. For further information, contact See First Technology Inc., 3255-7 Scott Blvd., Suite 103, Santa Clara, CA 95054-3013; (408) 748-7717.

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EMC Readies Disk Emulator

Disk And Tape Emulating Options Available From Optical Storage Manufacturer

The optical storage industry has taken sides, debating the pros and cons of hosts' recognizing optical devices as tape drives or hard disks. There are advantages to each method, and neither can claim to be an unanimously accepted standard. It appears that both have become accepted in applications for which they're better suited.

In the VAX world, currently the most active arena for optical subsystem development, both methods have strong rates of growth. Sites choosing tape emulation generally are upgrading tape systems that were used for archiving. They want their new system to look and feel the same as the tape drive. Those choosing disk emulation are often looking to migrate back and forth between stored databases with ease, as they can with a hard disk.

"People with database management systems don't want to have to recreate their functionality for a tape emulation," justifies Brian Ratte, the Digital product manager at EMC Corporation. "Everyone wants to work with what he feels comfortable with." EMC, with its *Archeion* tape emulation subsystem out of Beta test and in real-world installations, is releasing a *Disk Emulator* version of *Archeion* as part of a strategy to accommodate each market.

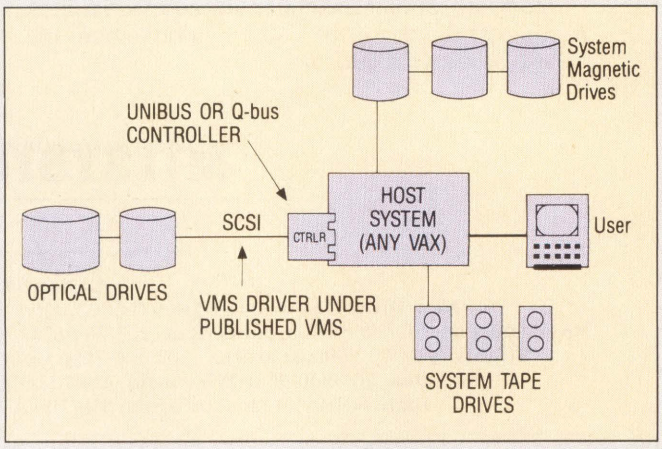
A handful of other major optical vendors also are developing different drive emulations that will be available soon.

The *Archeion* subsystem, which will store information at approximately half the speed of the 400 KB/sec., will allow users to access 56 online physical devices, up to 1 gigabyte each, from one controller. The device will emulate V4.4 of VAX/VMS.

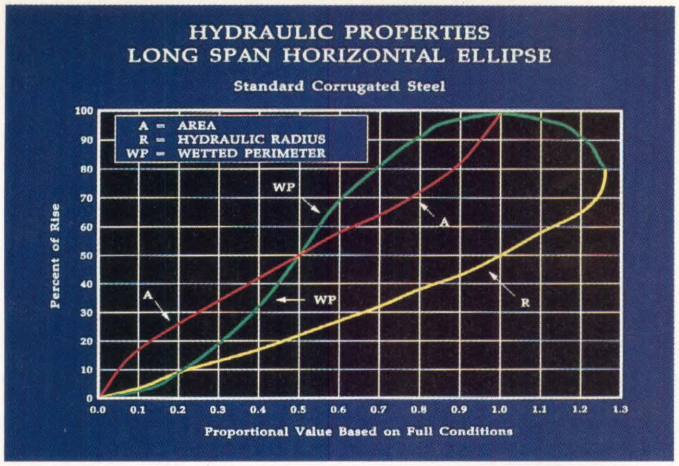
For more information, contact EMC Corporation, 128 South St., Hopkinton, MA 01748; (617) 435-2541.

Enter 560 on reader card

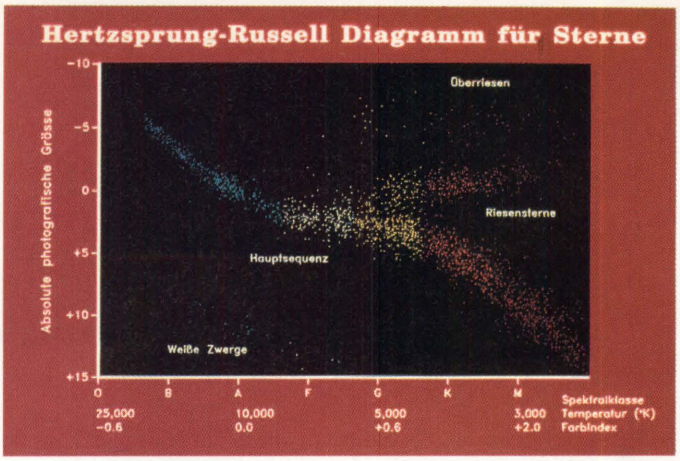
—Evan Birkhead



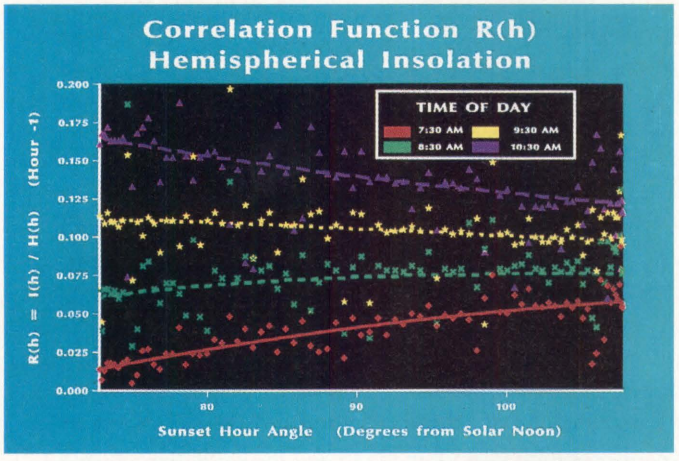
Archeion *disk emulator.*



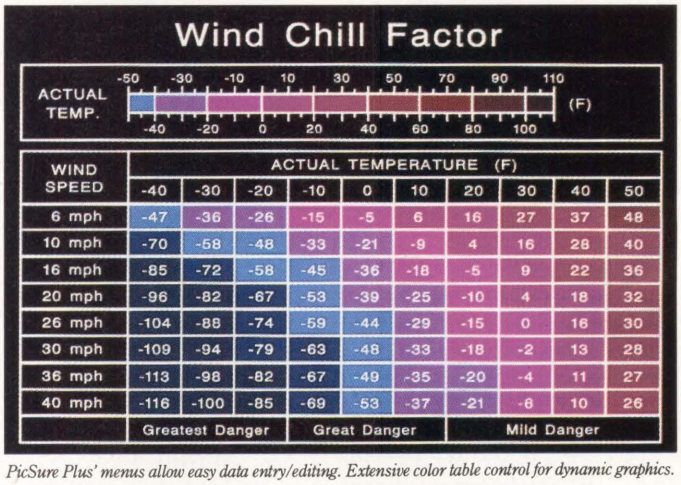
PicSure Plus' curve smoothing clarifies data representation. Shielding adds a professional look.



European text fonts offer a global graphics solution. Multiline annotations aid data interpretation.



Large datafiles can be read directly from disks. User retains complete control over all chart elements.



WIND SPEED	ACTUAL TEMPERATURE (F)									
	-40	-30	-20	-10	0	10	20	30	40	50
6 mph	-47	-36	-26	-15	-5	6	16	27	37	48
10 mph	-70	-58	-48	-33	-21	-9	4	16	28	40
16 mph	-85	-72	-58	-45	-36	-18	-5	9	22	36
20 mph	-96	-82	-67	-53	-39	-25	-10	4	18	32
26 mph	-104	-88	-74	-59	-44	-29	-15	0	16	30
30 mph	-109	-94	-79	-63	-48	-33	-18	-2	13	28
36 mph	-113	-98	-82	-67	-49	-35	-20	-4	11	27
40 mph	-116	-100	-85	-69	-53	-37	-21	-6	10	26
	Greatest Danger			Great Danger			Mild Danger			

PicSure Plus' menus allow easy data entry/editing. Extensive color table control for dynamic graphics.

Precision Visuals' PicSure Plus™

Practical Presentation Graphics for Your VAX

The Need

You need PicSure Plus™ if your work requires: ☐ Producing technical presentations or reviewing data ☐ Supporting a cross section of graphics users, from novice to expert ☐ Building custom user interfaces for specific applications ☐ Accessing and charting information from databases ☐ Pushbutton access to stored charts, datasets, command files, and metafiles ☐ Managing graphics production while maintaining device independence.

The Product

PicSure Plus is an interactive graphics system for producing charts and graphs. Prompting menus guide novice or occasional users in creating line, bar, scatter, pie, text, and table charts. Experienced users can access PicSure Plus features by entering commands, or building tailored menus for specific applications and environments. These user-interface options offer a flexible gateway to the most powerful set of charting functions available today.

The Features

☐ Powerful prompting menu interface speeds chart building for novice and occasional users ☐ Integrated command interface available for more advanced users ☐ Interactive positioning of all chart elements ☐ Directory keeps track of saved charts, datasets, command files, and metafiles—so users don't have to understand the computer's file system ☐ On-line tutorials and instant HELP facility for new users ☐ Easily combine multiple charts into a single image ☐ Draw charts simultaneously on multiple graphics devices for high production chart building ☐ Symbol creation for building flowcharts or illustrations ☐ Merge and annotate images created with other Precision Visuals products ☐ Read up to 10,000 datapoints from system files, or from other software packages ☐ Powerful numeric functions to perform arithmetic and statistical operations on your data ☐ Programmer's interface for accessing custom subroutines, databases, and the operating system ☐ Automatic layout and text sizing for word charts.

The User Interface

Users can move from prompting menu mode to command mode and back again, anytime. PicSure Plus also offers special commands for building prompting menu sessions. These user interface tools help you automate the production of frequently used charts, or design custom interfaces for end users.

The Environment

PicSure Plus runs on the entire VAX family, as well as a wide range of minicomputers and mainframes. Compose graphs on terminals and get hardcopies on laser printers, inkjet printers, pen plotters, and film recorders.

The Offer

PicSure Plus is the only graphics software solution with the range of features for even your most sophisticated charts, combined with user interfaces for the first-time user, occasional users, and experts. If you need functionality and ease-of-use in your graphics software, get the full story on PicSure Plus, and let us arrange a test drive.

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System 6400 Delivers Supercomputer Performance In A Minicomputer Package

The Supercomputer That Gives Users The Speed They Need To Respond To External Events In Real Time

The System 6400, from ELXSI of San Jose, California, incorporates a modular design that allows a system with one CPU, one I/O processor (IOP) and 16 MB of memory to expand to 12 CPUs, four IOPs and 2 GB of memory without modifying software, user environment or existing hardware. As users' needs grow, the System 6400's 320 MB/sec system bus, the Gigabus, allows for more processing, I/O and memory capacity to be plugged into the system.

ELXSI lets you choose your operating system, from UNIX System V and 4BSD, EMS (VAX/VMS-compatible environment) and the company's own message-based operating system. Users, therefore, can run a broad spectrum of applications, including the vast libraries of UNIX and VMS.

The System 6400 features a high-speed, 64-bit bus architecture. Multiple CPUs, IOPs and memory modules plug directly into the bus and communicate using microcoded messages. Modules, operating in parallel, perform processing, I/O and memory operations simultaneously.

The Service Processor (SVP), a central element of the System 6400 design, downloads microcode to the CPUs, IOPs and memory modules; boots the operating system; monitors performance; and performs diagnostic functions via the Gigabus. These advanced SVP features provide reliability and ease of repair.

Some of the diagnostic features include monitoring system performance and maintaining a permanent log of errors and operating conditions; checking power, cooling and thermal conditions automatically and margins clocks and power supplies while running diagnostics; and controlling emergency system shutdown if adequate power, cooling and thermal levels aren't maintained.

Multiple operating systems execute concurrently on the System 6400. Virtual-memory management, load balancing, process migration and resource management are provided. For these multiple concurrent environments, ELXSI features System Foundation. It provides a machine interface, manages processes, virtual memory and devices, passes messages between processes and schedules CPUs without high-level software intervention. Users can develop and execute standard applications using standard operating systems or customize the operating environment with System Foundation facilities that by-pass the operating system and communicate directly with the hardware.

The System Foundation also offers advanced real-time service accessible from any operating system. These services include a Real-Time Access Manager (RTAM) that lets real-time programs manage devices directly and control I/O system resources, super real-time priority that lets real-time programs preempt kernel and system processes, and special intrinsic commands that let programmers permanently assign CPU and memory resources to real-time processes.

For further information, contact ELXSI, 2334 Lundy Place, San Jose, CA 95131; (408) 942-0900.

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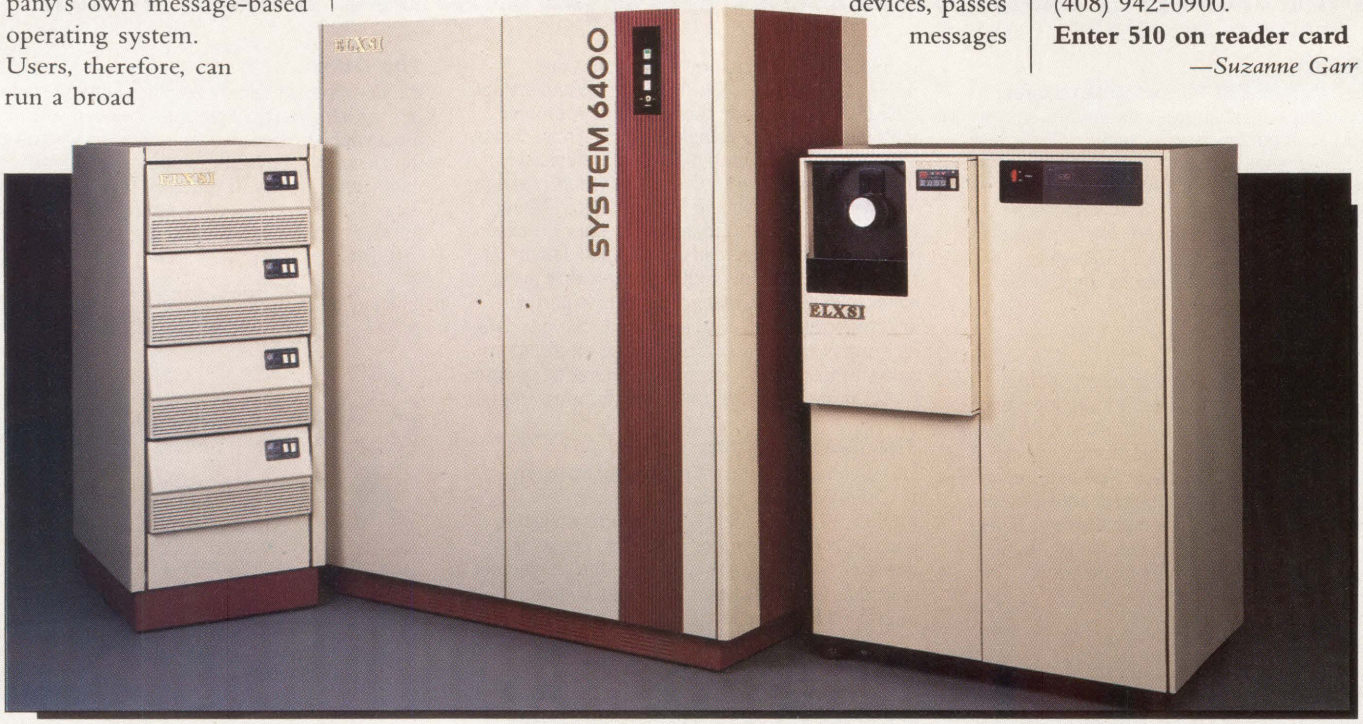
—Suzanne Garr



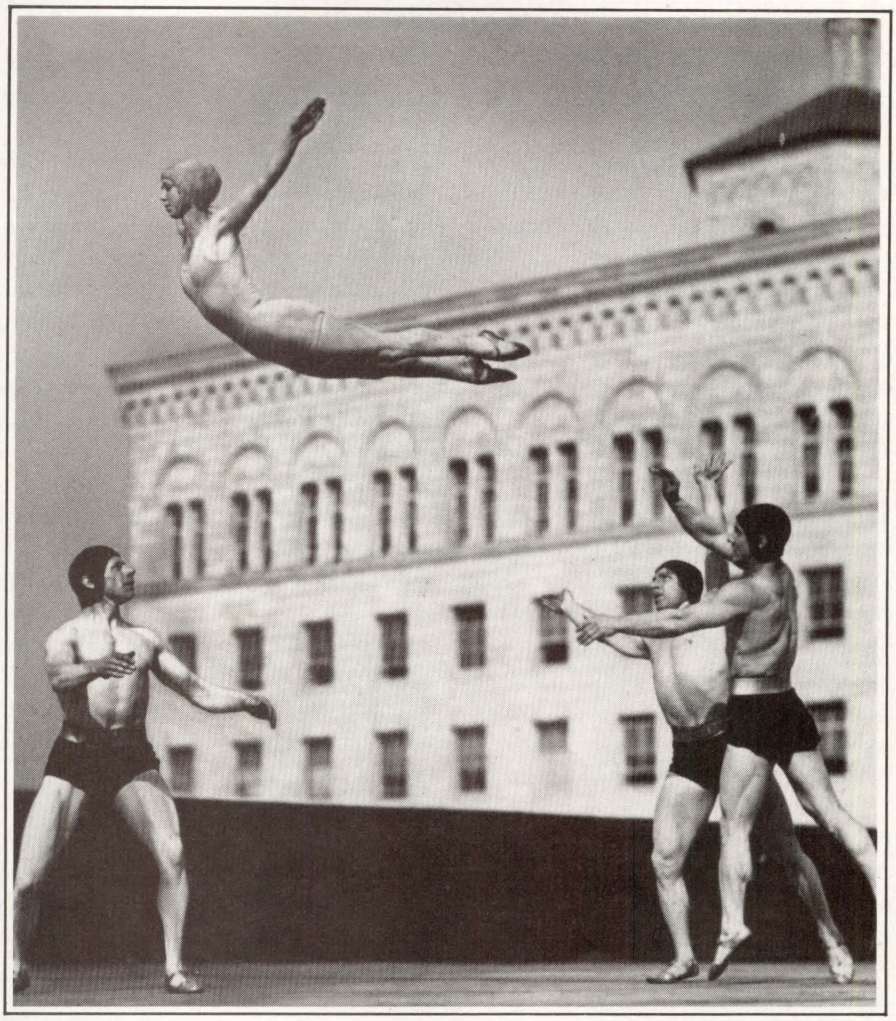
System 6400 ensures control of the resources necessary for real-time tasks.

A decision support system should handle whatever you throw at it.

If you ask some VAX-based decision support systems to work with a foreign database, they'll drop the ball. You'll have a huge job of transferring or re-keying data.

FOCUS, on the other hand, reads directly from any database on your VAX. Within minutes of installing FOCUS, you'll have your first report.

And with the added power of FOCNET, you can use data from any IBM mainframe database.



Transparent Join

If data is in two or more sources, FOCUS will perform a join transparently to the user. In fact, a FOCUS application is completely independent of the underlying database structure.

Data from Everywhere

FOCUS can read directly out of:

RMS	Oracle
Rdb	Ingres*
DBMS	Sybase*

Or, via FOCNET, a dozen different databases on an IBM mainframe, including DB2, VSAM, IMS and IDMS.

FOCUS is a complete, integrated, user-friendly decision support system, with the industry's premier report writer, a financial reporting language, graphics, statistics, and spread-sheet capabilities.

First-time users can access the full power of FOCUS without learning the FOCUS language. Through a point-and-pick windowed interface they can quickly and easily develop ad hoc queries, or even complex applications.

Database Optional

FOCUS is available with its own powerful DBM. Or, if you're planning to work with existing databases, you can get FOCUS without its DBM at a lower cost.

FOCUS offers a common language and user interface in DEC, IBM, Wang, UNIX, PC and PS/2 environments. So applications and skills are portable.

We back FOCUS with local help lines in 13 regional offices, a central hotline, and nationwide technical support and training.

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DEC, Evans & Sutherland Send Another Workstation Off To War

The VAXSTATION 8000, Based On An 8250 With A BI Backplane, Features Real-Time Manipulation And Anti-Aliasing

When Digital Equipment Corporation and Evans & Sutherland Computer Corporation debuted their co-produced VAXSTATION 8000 they didn't recite mips values, those frequently misinterpreted and misunderstood measurements of pure throughput that have served as the scoreboard during the workstation wars. Instead, company presidents Ken Olsen and David Evans emphasized the machine's image clarity (8,000 x 6,000 pixels per screen), its ability to rotate and shade objects in real time and its hardware-based anti-aliasing capability.

Based on the VAX 8250 processor, the 8000 uses three additional MICROVAX II processors that act as controllers for storage peripherals, network interfaces and input devices, and link the 8250 engine to a graphics subsystem. The graphics engine is powered by 50 custom-designed VLSI chips.

The 8000 was developed through a two-year joint effort between DEC and Evans & Sutherland. It will be sold by both companies, although Evans & Sutherland's OEM version will be enhanced with applications software packages. Historically, Evans & Sutherland's trademark in designing its high-end workstations have been accommodations for biochemists, mechanical engineers and other modelers confronting complex graphics problems. For Digital, the 8000 rounded off a triumverate of technical alliances that included Cray Research Inc. and Apple Computer.

"Virtually every part of the project, the hardware and the software pieces, was done together," stressed Evans. "Our people worked together as if they'd known each other forever."

"We've known them before they started," concurred Olsen, marking the beginning of the relationship at more than 20 years ago.

The standard workstation configuration will feature a 19-inch screen, 16 MB of memory, a 195-MB disk and a 95-MB tape drive, VAX BI-bus expansion slots and an Ethernet controller. An eight-dial box is provided as a supplement to the keyboard with a three-button mouse. This is the basic tool for interactive drawing and screen manipulation. Each dial can be programmed for object translation or axis rotation along either the x, y or z axes, or for mechanical functions such as scaling and clipping.

The standard configuration also includes 6 MB of frame buffer memory and 4 MB of display list memory.

Basic 3-D graphics functions of the workstation include depth-cueing, six-sided volume clipping and color mixing at line intersections. Real-time 3-D is expected to be appealing to applications in engineering design, molecular modeling and computational fluid dynamics.

Software protocols of the 8000 adhere to version 11 of the X Window windowing standard, the VAX/PHIGS graphics standard, and for now, VMS V4.4. An ULTRIX version is expected shortly.

The anti-aliasing facility, which is located in the hardware rather than in the software so not to impede the performance of the graphics processor, removes static lines and jagged edges that interfere with image quality, even at high-screen resolution.

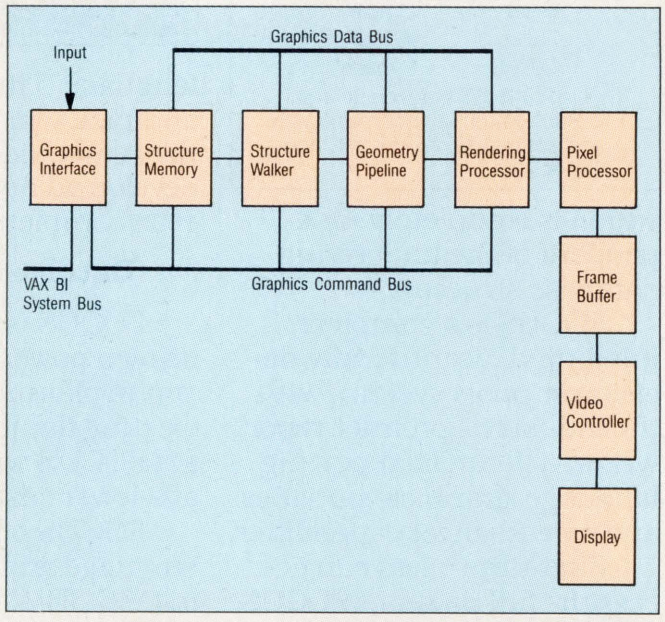
For the record, DEC and Evans & Sutherland broke the mips down into more tangible figures. According to Digital, complex mathematic calculations are performed by parallel processors that peak at 104 million operations per second (MOPS); 3-D polygons are modeled by a specialized 32-bit component at 40 MOPS; and the pixel processor responsible for anti-aliasing can reach a speed of 263 MOPS. The graphics bus operates at 10 MOPS.

The important number to remember, however, is that the VAXSTATION 8000 can process 500,000 anti-aliased vectors per second, which appears to be the equivalent of actual real time to the user.

A completely configured system plus one operating system license costs $87,710, and units are reportedly already shipping. For more information, contact either Digital Equipment Corporation, 146 Main St., Maynard, MA 01754-2571; (617) 897-5111, or Evans & Sutherland Computer Corporation, P.O. Box 8700, 580 Arapeen Dr., Salt Lake City, UT 84105; (801) 582-5847.

Enter 561 on reader card

—Evan Birkhead



VAXSTATION 8000 graphics system configuration.

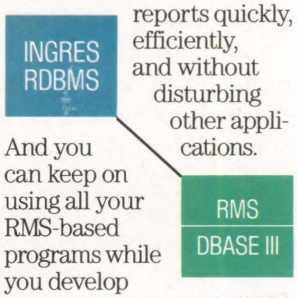
We've just cut five years off your relational DBMS conversion time.

To get the advanced capabilities of a relational database, you used to have to go through a lengthy, complicated, costly conversion.

Not anymore. Introducing the INGRES RMS Gateway—the first in a line of database links that let you apply relational DBMS power to older file management systems right now. Today. Without changing a thing.

The RMS Gateway makes RMS data appear as relational tables within an INGRES database. It lets you apply all the INGRES advantages—like easy user interfaces, industry-standard SQL, and powerful 4GL tools—while protecting your investment in data and applications.

Now you can generate all your decision-critical reports quickly, efficiently, and without disturbing other applications.



And you can keep on using all your RMS-based programs while you develop and implement new INGRES systems using the same data.

Best of all, the power of INGRES allows you to access RMS data across different hardware, networks, and operating systems—transparently—from anywhere in your organization. You can even combine INGRES and RMS data in any application.

What's more, an INGRES dBASE III Gateway is now available for data trapped in old PC files. And gateways to IBM's IMS, DB2 and SQL/DS are on the way.

No other relational database offers you these instant links to older data files—making INGRES the one relational DBMS you can put to work immediately. Which could help put you years ahead of the competition.

Get the INGRES advantage—call 1-800-4-INGRES for more information.

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Oracle Transaction Processing Promises 10-Fold Increase

Oracle TPSS *Addresses Transaction-Processing Applications And Relational Databases*

The latest release of the Oracle database management system attempts to reconcile two of computing's most mutually antagonistic concepts: transaction processing applications and relational databases.

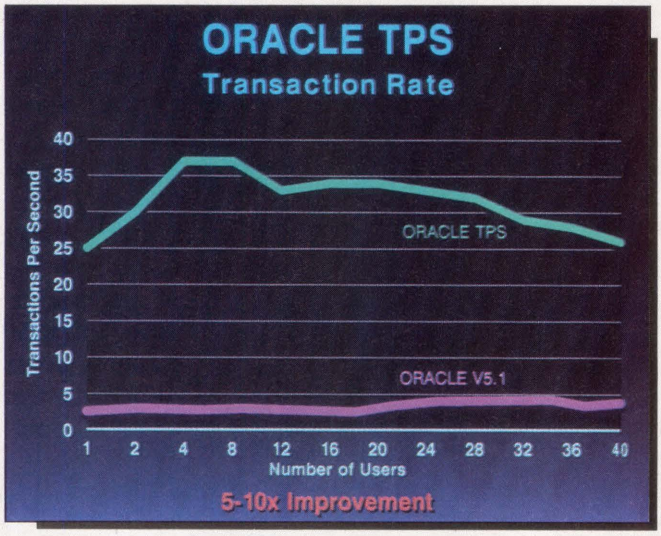
Corporate order processing and airline/hotel reservations jobs exemplify computer-based transaction processing. Such systems must accept a very large number of requests, usually submitted interactively from hundreds or even thousands of terminals, and then turn them around on a near-real-time basis. Squeezing every last cycle out of an available computer network and its related mass-storage peripherals is the essence of successful transaction processing.

On the other hand, relational databases address the problems of light departmental computing, decision support systems and ad hoc information retrieval. In these environments, few users will engage the database software in a long conversation, using a command language like SQL or a graphics-oriented front-end query tool like DEC's Teamdata. Relational database software uses large amounts of memory and plenty of CPU cycles to support the active, dynamic data dictionaries and user-friendly features that these kinds of problems require.

The sheer weight and drag associated with a relational database's "wonderfulness" often ensures that any ambitious transaction processing systems built on it will never get off the ground. For this reason, people who design online transaction processing (OLTP) systems usually shun them. Historically, in fact, OLTP programmers have been known to write their own disk-access software, by-passing not only databases but even native file systems. When the need to reserve a thousand cars or credit a million bank accounts occurs every day, the few milliseconds heroic programming can save on each transaction adds up.

So, how do you sell relational flexibility into the demanding world of transaction processing? For Oracle Corporation, the answer is *Transaction Processing SubSystem (TPSS)*, a newly engineered version of its popular Oracle relational database system.

According to the manufacturer, Oracle *TPSS* provides a 10-fold increase in transaction processing throughput over its present relational offering, Oracle V5. For the large computer configurations needed to support OLTP, this can add up to significant savings. For example, a VAX 8350 might perform as well with Oracle *TPSS* as an 8800 might with Oracle V5 for $750,000 less.



Oracle* TPSS *with a 10-fold increase.

To accomplish such dramatic performance improvements, Oracle *TPSS* buffers its output more cleverly to reduce physical disk writing on database commit operations. Its rewritten record-location software accelerates the search for data, and its new record-locking protocols reduce contention for records between database users. The product's improved interface with its internal, relational data dictionary reduces the likelihood that a transaction will be delayed by dictionary locking.

Other important changes include a new facility that allows entire or partial database back-ups to be written while the database is active, VAXCLUSTER-aware storage hardware failure recovery, and a 30 percent reduction in disk space needed for database overhead, such as recovery logs and logical reside left behind by deleted data structures.

From the OLTP designer/programmer's standpoint, Oracle *TPSS* provides a transaction processing-oriented version of the SQL relational database query language, PL/SQL. The PL/SQL language maintains compatibility with ANSI SQL and DB2, with special TP-oriented extensions. PL/SQL's procedural capabilities include IF/THEN and looping constructs, and allow references to host variables. A complete transaction, including conditional recovery from a variety of resulting logical conditions, can be expressed as a single PL/SQL procedure and handed off to Oracle *TPSS* for processing. Beyond Oracle's V5 ability to back a transaction out of the database, Oracle *TPSS* supports rollback on the effects of individual PL/SQL statements.

While the software design changes required to achieve such dramatic gains might have been straightforward, the coding involved to implement them was prodigious. Under development now for more than a year, the company doesn't expect to ship Oracle *TPSS* in volume until mid-1988. For further information, contact Oracle Corporation, 20 Davis Dr., Belmont, CA 94002; (415) 598-8000.

Enter 505 on reader card

—Al Cini

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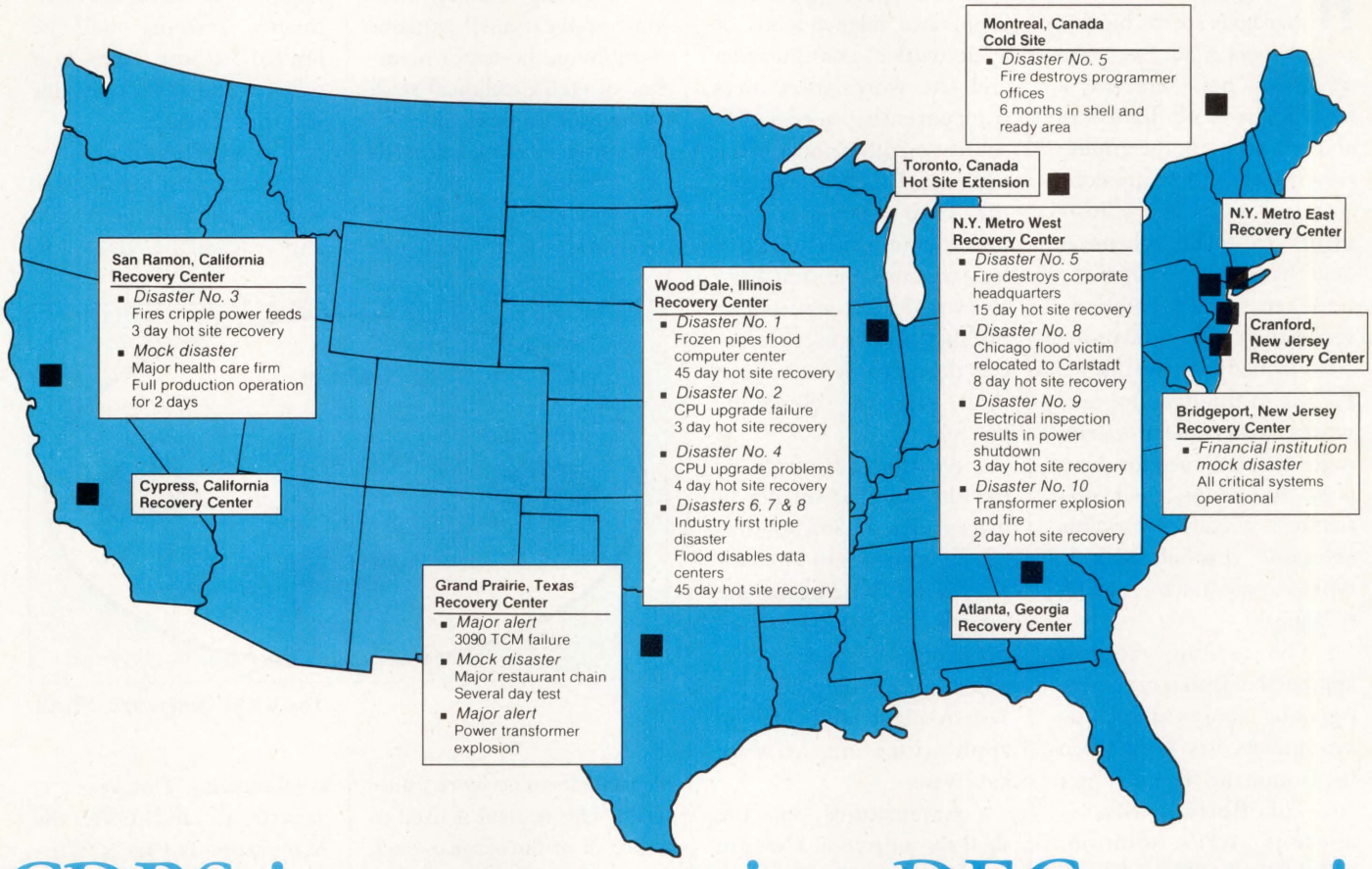

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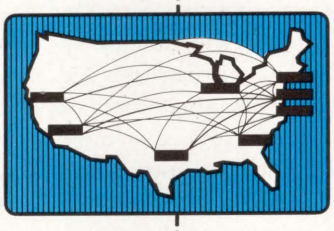

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Software Engine Links Dissimilar Devices And Applications

VXM *Lets Heterogeneous Network Nodes Speak ASCII To One Another*

Heterogeneous network managers are the biggest complainers of all. Everyone of them has selected a favorite network hardware and protocol, but the griping is perpetual. There are constant redesigns and adjustments to make whenever new hardware or applications are added. Nobody seems to get all of the problems ironed out. But, since the use of multivendor networks has become prevalent, more and more vendors have been addressing their difficulties. Finally, workable solutions that allow networks to expand are starting to appear.

One radically different approach to managing heterogenous workstation environments has been taken by Command Technologies Inc. of Boston, Massachusetts. CTI's solution, called the *VXM Network Shell*, lies on top of a network's operating system and functions as an application interface for every node. The primary advantage of this method is that it's a software engine that deals with the network on two levels: A front end that looks the same to every network user and a back end that addresses the operating system of each node.

VXM is believed to be the first commercially available network shell architecture for network and application developers.

Because the shell deals only with operating systems, it operates independently of a network's configuration and lets workstation users transparently access resources on other nodes in the network. The shell envelopes the entire network and makes commands and control structures the same from every node. CTI reports that the shell allows users to access the network virtually as if it were a standalone machine.

Another advantage of the shell is that intelligent macros called "SoftRobots" can be written into *VXM* applications. These agents are capable of making logical decisions autonomously, which means they help the system adapt to changes in applications or network hardware.

Applications for the shell are written in VXM, an object-oriented language designed specifically for application development in a multivendor environment. The new, software-driven method already has been receiving a positive response from the user community.

GTE Laboratories, one of the first test sites for *VXM*, is using the shell to look up information in databases and even for directing processor activities from a remote node. The installation at GTE basically is a small research environment, with a Compaq running MS-DOS talking to a VAX-11/785 running VMS. *VXM* is used as a logic translator for services stored on each system, and instructions are sent through a switching point created by the shell.

"On the VAX side, *VXM* is switching various real-time applications," explains Sam Fung, the senior member of GTE's technical staff. "On the Compaq side it's accessing customer records and services."

In GTE's configuration, network control remains separate from network transport. The control is used to store all of the services such as credit card checking, 800 number services and accounting records. *VXM* is used to implement the services stored in the control.

"So when we get a phone call, we find out what kind of service they need, then we check the database," says Fung. "The instructions are sent through the switching point, so there's a sort of back-and-forth between the two computers."

Fung adds that there are some interesting possibilities for large network-type installations. "In the future," he explains, "we could have the source for the program at one node and execute it on another, shipping commands as ASCII character strings."

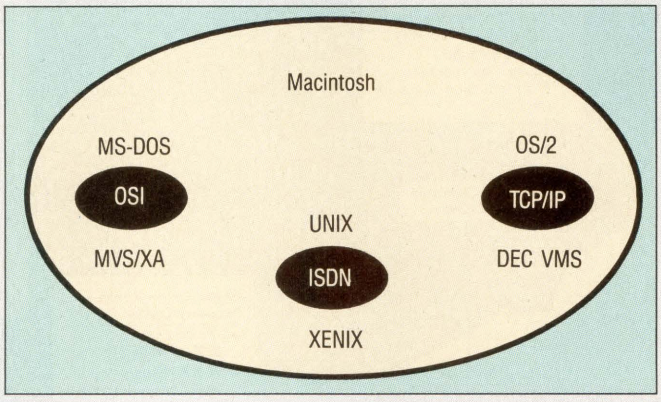
VXM has other long-term advantages. Workstations with DECNET, TCP/IP and NETBIOS facilities now will be able to operate in larger distributed environments. Training will be limited because every user will have to learn only one set of commands.

In addition to MS-DOS and VMS, versions of *VXM* are available for Sun, Apollo and XENIX/UNIX 286 workstations. This year CTI expects to add OS/2, the Macintosh, TCP/IP, X Window (Version 11, Release 2), 9370 VM and mainframe VM and MVS to its roster of compatible operating environments.

CTI also offers a five-day training course and telephone support for developers. *VXM* pricing for VAX hosts varies according to CPU size. To accommodate a MICROVAX II, the *VXM* starts at $2,495. For more information, contact Command Technologies Inc., 347 Congress St., Boston, MA 02210; (617) 451-5221.

Enter 511 on reader card

—Evan Birkhead



***The* VXM Network Shell.**

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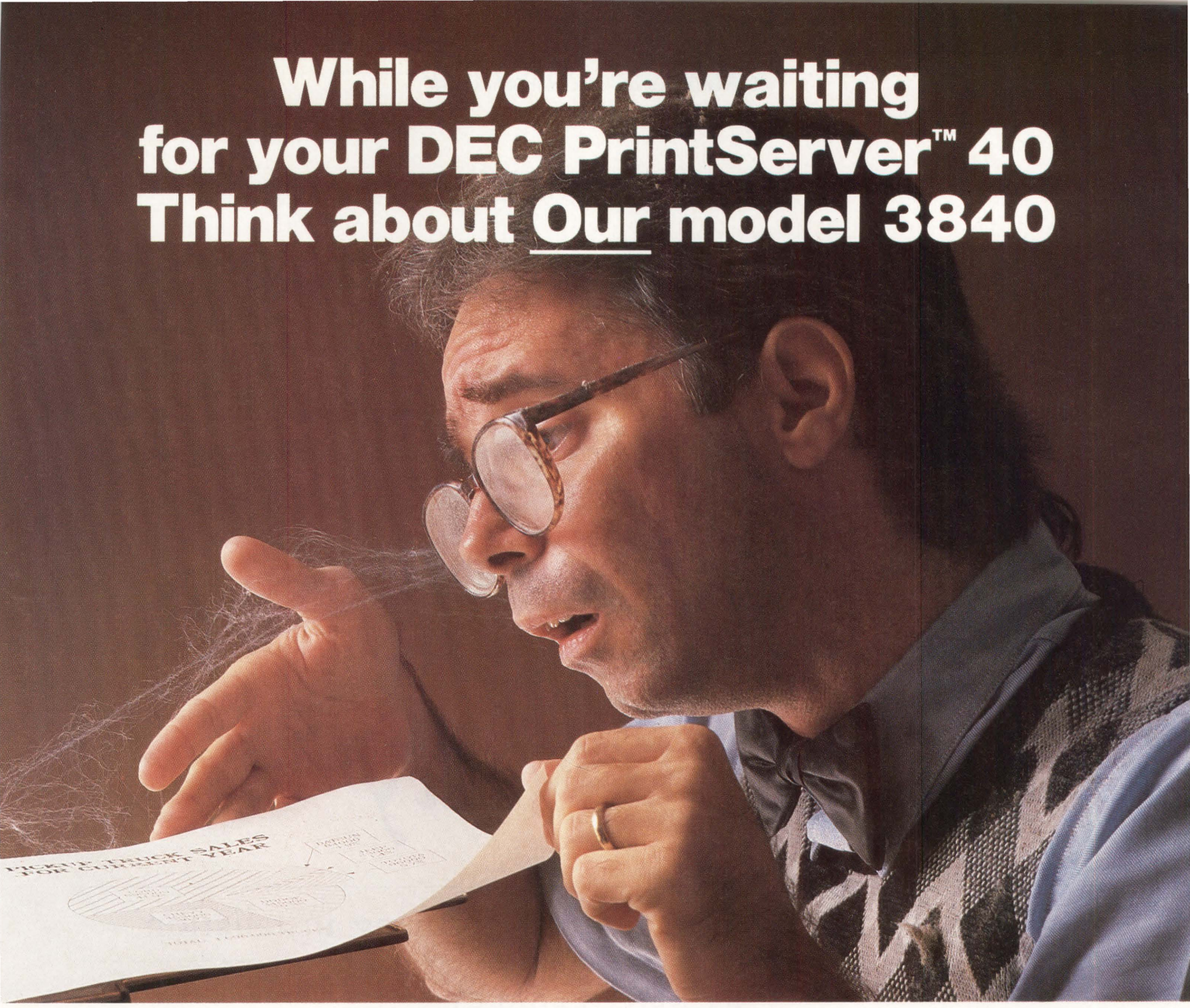

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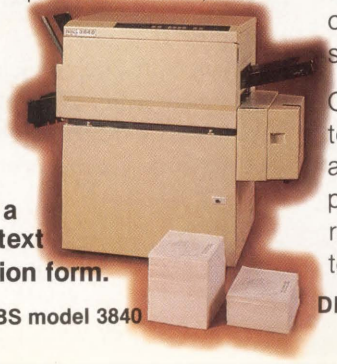


Typical one-hour output of a graphics/text combination form.

NBS model 3840

DEC PrintServer 40

NBS Southern, Inc.

ENTER 142 ON READER CARD

Crossing The DECNET/SNA Gateway

TECHNICAL ISSUES that arise during installation.

BY KENT CEARLEY

TECHNICAL CONCERNS of managing SNA gateways seldom are addressed in the sweeping coverage usually allotted these products. The reviews and sale packets present the pros and cons of different implementations, offer neat lists with bulleted features and sometimes even diagram a physical configuration, but this isn't enough. Such information becomes valuable only with an understanding of a specific product, not only with the conceptual ideas but with how they're implemented.

An awareness of issues that will arise during a typical installation adds resources for evaluating how a gateway will fit in a given environment. This awareness helps to cut through the technical hype and to anticipate what normally would become apparent only in retrospect.

This article will build perspective on a specific product: DEC's Ethernet-based DECNET/SNA Gateway (DECSA). The DECSA is introduced in the context of what gateways are, how they physically connect and the functionality they provide. Also considered are practical aspects of configuration, management and integration.

Although DECSA is discussed in particular, most of the issues will apply to any product that functions as an SNA gateway. The DECSA was selected as a good representative of this class of network products.

Gateways translate one network protocol to another. They allow network-to-network, rather than point-to-point, connections. Network-to-network means any node on one network can access, and be accessed by, any node on the other. True for DECSA, for example, it's not true for DEC's VMS/SNA software, which offers the same functionality as the DECSA but is linked directly from a single VAX to the SNA network. Consequently, only the

users logged on to that particular VAX have access to SNA.

By contrast, it's useful to think of the DECSA as a node that implements a primitive set of protocol functions for other DECNET nodes. These other nodes may build on these primitives with software of their own, but always use the DECSA as an underlying method to access the SNA network.

SNA GATEWAYS and their related software provide four major functions: terminal emulation, batch job submission, task-to-task communication and file transfer.

SNA gateways and their related software provide four major functions: terminal emulation, batch job submission, task-to-task communication and file transfer. Many vendors offer various flavors of these basic categories; for instance, DEC offers 13 software packages for the gateway. Often two or more packages are required to make a function symmetrical. For example, the Terminal Emulation routine that allows VT100/VT200 terminals to emulate IBM 3270 terminals is paired with the DHCF software, allowing IBM terminals to emulate hardcopy DEC terminals. As with many functions, the results often lack total symmetry.

A gateway has no standard physical configuration. It only requires interfaces to both networks. On the IBM side, it's connected in one of two ways: directly to a channel (a type of dedicated I/O processor) or to a front-end processor (like the 3725) that manages multiple terminal controllers and is attached to a channel.

By attaching directly to a channel, some gateways offer communication speeds of up to 800 kilobytes per second (the channel speed is typically 3 MB per second for IBM mainframes). Attached to front-end processors, the speed is typically between 9600 bytes per second and 56 KB per second.

To DECNET, the connection is with Ethernet taps (H4000 or DELNI) or line cards from a host processor; e.g., the VMS/SNA software mentioned earlier. The gateway can be a dedicated device or implemented in software with line drivers on multiuser systems.

A Dedicated Device

The DECSA is a dedicated device. Physically, it's a box about 3 x 3 feet. It houses a PDP-11/24 running RSX-11s and DECNET Phase IV. It has slots for up to two line cards for connection to IBM's front-end processor.

The line cards can be RS-232 or V.35 and run up to 19.2 bytes per second or 56 KB per second, respectively. Each line card requires a modem eliminator with built-in clocking if run locally; it needs two modems if the gateway will be remote to the IBM. The line cards are the same as those used in the DECNET Router and can be interchanged. Each line card can be defined as up to 32 logical units to the IBM. A logical unit maps to one physical device or application over DECNET. So, the DECSA could support up to 64 users accessing IBM via terminal emulation if both line cards were dedicated to this purpose.

Installing the gateway requires purchasing DEC's mandatory installation and orientation services. This, plus the software, costs $50,000. DEC service includes an on-site visit to make the gateway operational. There are a few prerequisites prior to this visit.

Field Service needs to check out the DECSA box. Get the Ethernet address from them, because it's not recorded anywhere on the box itself. You need to have all the necessary components: modems or modem eliminators, line cards, cables and slots available in the front-end processor. The IBM staff also must define new devices to SNA. These devices and their parameters are described thoroughly in preinstallation material supplied by DEC. Nothing must be done on the VMS side yet.

When the SNA technician arrives on-site, have a technical representative from the IBM staff on hand. The on-site visit is to install the gateway management software with any access routines you have selected and to test basic functionality. The magic of the on-site installation fades rapidly, however, and you should have a firm understanding of where things went and why before putting the gateway on autopilot.

Management Software

Of prime importance to system management is the gateway management software. It maintains the DECSA and basically provides executable code that's downloaded when the DECSA box is powered on, or when requested with the NCP TRIGGER NODE x VIA y. The management software also has tools to monitor, debug and assess performance on a limited basis. It resides on SYS$SYSROOT:[SNACSV].

Part of the data downloaded to the DECSA is the configuration file, nameSNA.CFG, where name is the node name of the DECSA. This file defines how the line cards are to be used and as sociates IBM logical units with access names used by the DECNET/SNA software. Reconfiguring gateway resources is easy; edit the file with the changes and trigger a download with NCP. One warning: If your Ethernet is used heavily or is running other protocols, such as TCP/IP which can issue a high volume of broadcast packets, you may not be able to download.

A symptom of this problem is when the DECSA hangs with an L40 frozen on its LED display. DECSA appears unable to recover from collisions

Table 1.

X'0801'	Request rejected, resource unavailable	Physical device or logical units not activated on IBM. Check modems to see if they're "polling." If not, reactivate lines from IBM and set circuit state on from NCP. For RJE, make sure the line has been started on IBM with no errors. If this is the first SNA RJE workstation defined on the IBM, ensure that IBM operations issued a start for LGN1. If all the line resources are OK on the IBM, see if the error LED is lit on the line card. If so, replace the line card.
X'0804'	Invalid password	If this occurs with RJE, check /DATA= assignment for RJE's reader. Make sure this is the same password assigned to the line by the IBM staff.
X'0805'	Session limit exceeded	This could be caused by users not logging out of IBM applications.
X'0806'	Resource unknown	Probably an error in the config file, specifically the parameter APPLICATION probably has an invalid or misspelled name.

This table contains IBM SNA codes, their probable causes and their resolution sense code meaning.

on Ethernet, and although DEC is aware of the problem, it hasn't offered a solution yet. Unfortunately, until it's resolved, there are only two options available:

1. Have the DECSA on a DELNI with the node managing the gateway; then you can switch the DELNI to local to download.
2. Partition the DECSA and managing node separate from the rest of the network using a bridge or a router.

Either way is inconvenient, if your network is susceptible to this problem.

Another function of the management software is to configure the DECSA as a node in NCP. This must be done before downloads will work. A file called SNACSVDEF.COM in SYS$MANAGER will prompt for node characteristics and build a file with the necessary NCP DEFINEs. It will give you an option of updating the network database or just saving the definitions. The definitions are similar to those of a terminal server.

When the managing host has downloaded the appropriate software, the DECSA is ready for access. This access can be by any node that has installed access software, like terminal emulation or application-to-application protocol (APPC). Typically each node requiring access to SNA must have a local copy of these routines. There are some exceptions like Remote Job Entry (RJE) that accepts node and file access parameters with the SUBMIT command. The two most popular routines are terminal emulation and RJE.

Terminal Emulator

The DECNET/SNA 3270 Terminal Emulator (TE) package is software that allows VT100/VT200 terminals to emulate an IBM 3270 terminal. It must be installed on each DECNET node that will use the gateway for terminal emulation. It uses about 250 blocks and is installed with VMSINSTAL in less than 15 minutes for most systems. Files making up the 3270 package include SNATERM.EXE found in SYS$SYSTEM and SNATERMSG.EXE found in SYS$MESSAGE. Assuming the gateway has been set up defining the appropriate access, TE is activated with the following command:

```
SET HOST/SNA gateway-node-
  name/ACCESS_NAME = access-name
```

The screen will clear and you'll see the logo of the IBM application you've accessed. The terminal now is emulating a 3270. After finishing the session on the IBM and logging out, press CTRL-Z to return to the $ prompt of VMS. Although the installation is simple, some troublesome issues exist; they're shared by all gateway TE packages. The first is keyboard mapping.

Depending on your environment, what you probably have is a map of a map of a territory. For example, if your users have PCs using VT220 emulation, you have the first level of translation: PC keyboard to VT220 keyboard. If these users also access the gateway with TE software, you have a second level: PC keyboard to VT220 to 3270.

Now which keys do what? A simple solution would appear to be to provide a quick reference, mapping the PC keyboard to the 3270. However, the flaw becomes apparent when you consider the many types of PC keyboards in use, assuming you haven't standardized which keyboards will be supported for gateway access.

The gateway management software provides a file of macro definitions in the SYS$LIBRARY called SNATRATBL.

MAR. You can edit this file and insert macro statements that can redefine any EBCDIC to ASCII translation or vice versa. Basically, the process entails editing, assembling and linking the template and copying the resulting task image to an accessible library. You can replace the default translation tables for TE or RJE or add a new one that can be specified by the option /CHARACTER_SET= when invoking these routines. These tables are specific to the node, and users of the node, on which they were created.

After keyboard mapping is addressed, you may want to monitor how the gateway is being used. Packaged with Gateway Management is a utility called SNAP. SNAP can provide information on how many terminals are using TE. It's invoked by entering:

```
SNAP gateway-node-name
```

A full-screen display is presented of resources on each line card. Active sessions are represented as diamonds and available resources are shown as dots. Also displayed is information on data and receive buffers and other performance data, which generally isn't much use. However, SNAP can indicate one problem that may arise as more TE users come on board.

SNAP, at times, shows active sessions when no one is accessing the gateway. This is symptomatic of another common problem, locking up terminal ports. If the TE user is logged into an IBM application (i.e., CICS), and doesn't perform the proper sequence to log out but instead uses CTRL-Z to exit TE, a hung session results. CTRL-Z on the DEC sends a SNA UNBIND requesting the session be freed.

IBM, however, has applications that implement its own teleprocessing monitors and aren't as well behaved as SNA protocol would presume. For example, CICS won't respond to the UNBIND unless first the user logs out of its application. Some database teleprocessing (TP) monitors do this as well. It's a good idea to test for this exposure on all the IBM applications a user will access before releasing TE to the general public. After testing, information can be distributed, preferably incorporated with the keyboard mappings, stressing the need to log out of IBM applications before using CTRL-Z. If this isn't made clear, the gateway gradually will fill up with unusable ports.

To the IBM, an RJE is a workstation, and an IBM workstation typically consists of a console, card reader, printer and card punch.

Remote Job Entry

The next popular application for the DECSA is RJE, software allowing a VAX/VMS DECNET node to submit batch jobs and receive output from jobs running on the IBM. The RJE software doesn't need to be installed on each node, as jobs from other nodes can be submitted by specifying node and file access parameters with SUBMIT.

RJE generally has its own line card on the DECSA. The software requires about 300 blocks and takes about the same amount of load time as the TE package. Images are placed in SYS$SYSTEM and a com file, SNARJEINI.COM in SYS$MANAGER. This com file starts a software multiplexer used for passing data streams to and from the DECSA and also initializes a batch queue. The procedure usually is added to SYSTARTUP.COM.

To the IBM, an RJE is a workstation, and an IBM workstation typically consists of four devices: a console, card reader, printer and card punch. The card reader spools jobs to the IBM. On VMS this is a batch queue and the jobs are text files written in a batch language called JCL, similar to a limited DCL. IBM directs output created by this job to the workstation's printer or punch.

Any job running on the IBM can direct output to these devices by coding the appropriate output destinations in the JCL. On VMS the print and punch are defined as node and directory parameters. The output is placed in a file under the directory assigned to the device. The maximum record size you can send to, or receive from, the IBM via RJE is 250 characters.

The console is an operator's console on the IBM. Here's an example of activating console mode on the VAX:

```
$ MC SNARJE
SNARJE> USE WORKSTATION name
SNARJE> SET CONSOLE
%SNARJE-I-CONSOLE, entering
  interactive console mode
```

In this mode, you have a variety of commands available to query the status of jobs in IBM queues. You also can initiate commands to hold jobs, purge output, etc. CTRL-Z returns you to VMS.

Mapping workstation devices to directories and the RJE reader to a batch queue is done with SNARJE. Here's an example of setting up an RJE workstation:

```
$ MC SNARJE
  USE RMT12
  SET WORKSTATION/GATE = gateway-
     node/ACCESS = RJE/DATA =
     "RMT12,pw,pw"
   ASSIGN SNARJE$READER RD1
  ASSIGN mynode"user
     password"::[directory] PR1
  ASSIGN mynode"user
     password"::[directory] PU1
  SET WORKSTATION/STATE = ON
```

Note: /ACCESS refers to an access name defined in the gateway configuration file, and /DATA is a line name and

password that may be required by IBM if the line is password protected. The reader is assigned to the default queue set up by SNARJEINI.COM, and the printer and punch are assigned to a specific user or a common directory.

Then, you can submit jobs to IBM by entering:

```
SUBMIT/SNA jcl-file-name
```

By default, output from any jobs submitted from an RJE workstation is returned to the RJE workstation. The JCL jobcard plays a key role in this. A jobcard will look like this:

```
//MYJOB JOB ACCT(9000003,36,P,'Run
  Reports'),MSGCLASS=A,CLASS=B
```

The jobcard must be the first record in a JCL file. There is one jobcard per batch job on the IBM. Using this example, output will come back as MYJOB.STD under the directory assigned to the output device. STD is the form type defined for the device on the IBM. On the IBM, a device is associated with one or more output classes.

MSGCLASS on the jobcard is the output class of the log file for the batch job. If it's the same class as a report's output, one output will be appended to the other in MYJOB.STD. If MSGCLASS is a different class from the report, but they use the same device, you'll end up with two versions of MYJOB.STD, one containing the log and one the output. This doesn't allow much flexibility and is constrained further by output being directed to a specific directory rather than back to the directory of whomever submitted the job.

There are ways to make this routing more flexible, but they require writing some DCL. The first technique is to write a LOGIN.COM for the directory assigned to the RJE device. This procedure can process incoming files and copy them to appropriate destinations.

This procedure can process incoming files and copy them to appropriate destinations.

If only a few people are using RJE, another technique is assigning devices to individual or group directories and directing output to these by use of appropriate classes in the JCL. A final option is to set up separate RJE workstations. Up to four workstations can be defined on a single DECSA line card. Each of these can have up to seven devices assigned and one console each.

SECURITY CAN be implemented on the IBM by requiring the user to supply a login with user and password following the jobcard.

Getting jobs to the IBM has its own issues. The only identification of whose job is being submitted is in the jobcard. Because this is created by the user, anyone with access to the gateway could use any jobcard identification he chooses, compromising chargeback and security schemes. Security can be implemented on the IBM by requiring the user to supply a login with user and password following the jobcard.

When jobs are submitted through RJE, the DECSA requires W:R access to these files or node and file access parameters, as in:

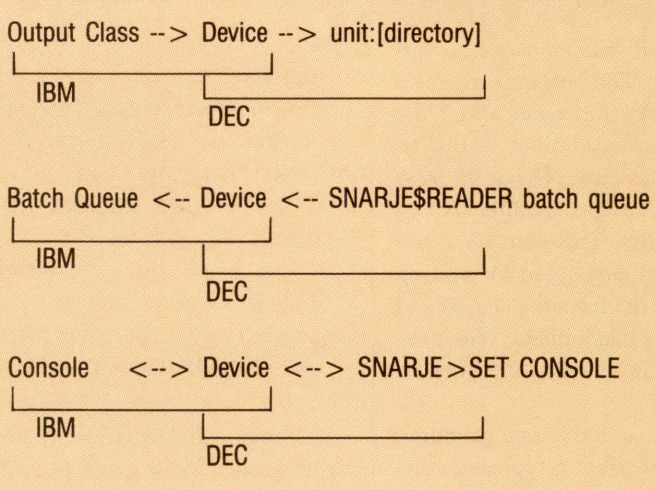
```
SUBMIT/SNA mynode'user password'
  ::filename
```

Obviously, the world read isn't an acceptable option if passwords are hard-coded in the files, and users probably should be taught to use SUBMIT with full file access parameters from the beginning to anticipate this exposure.

It's possible for jobs submitted from the IBM to initiate processes on the VAX. This can be done by adding logic to the LOGIN of output device directories, like the routing technique. The procedure would scan the incoming text

The gateway translates the I/O for one device into another.

Figure 1.



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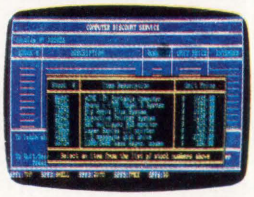

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Program 1.

```
$ ! -- Connect to SNA Gateway -- Called from ALLIN1
$ !    Checks for availability of access and exits if
$ !           link is down
$ !
$      text = "Connecting Now ... Please Wait. "
$      fail = "IBM is not available at this time ... Please try later."
$      write oamailbmX OA DISPLAY ''text'\FORCE"
$      @dclmailbox:
$ ! --- Check to see if SNA circuit is available
$      mc ncp
         tell hscsna show circuit lc-2 to sna_status.tmp
         exit
$      found = 0
$      open/read infile sna_status.tmp
$      r1:   read/end=finish infile record
$            record = f$edit(record,"COMPRESS,TRIM,UPCASE")
$            chk    = f$element(0," ",record)
$            state  = f$element(1," ",record)
$            if chk .eqs. "LC-2" .and. state .eqs. "ON" then -
                found = 1
$            goto r1
$      finish:
$      close infile
$      purge sna_status.tmp      ! -- Audit availability of last access
$      if found then goto process
$ !    else
$         write oamailbox "OA DISPLAY ''fail'"
$         @dclmailbox:
$         exit
$ process : ! -- connect to gateway
$      define/user_mode sys$input sys$command
$      set host/sna hscsna/acc=clmenu
$      write oamailbox "OA CLEAR"
$      @dclmailbox:
$      exit
```

for keywords or parameters and spin off batch jobs to run in VMS. The parameters could be generated by any application running on the IBM and directed to the appropriate RJE destination. This could form the basis of a simple electronic mail delivery platform for modular replacement by APPC when the prototype had been refined.

Devices are used to link functions in the RJE workstation. On DEC or IBM, the devices are defined as native entities. The gateway then translates the I/O for one device into another (see Figure 1).

As for troubleshooting, although the *DECNET/SNA Problem Determination* guide covers most operational problems that might arise, there's a class of problems that it passes over in a summary fashion. These are problems that terminate functions with a cryptic "rejected with sense code IBM X'nnnn' " where nnnn is a hexadecimal number. The four examples of these in the *Problem Determination* guide don't go into any detail. This is unfortunate, because some of them probably will be encountered shortly after installation. Table 1 lists the most common problems.

Other SNA codes may be be found in IBM's *System Network Architecture Reference Summary,* IBM Order No. GA27-3136. If the sense code doesn't appear in Table 1, contact either hotline support on the IBM specialist maintaining ACF/NCP and VTAM.

Specifics

Thus far, we have been taking a cookbook approach to various practical aspects of installing and maintaining DECSA gateways. Now, let's take a look at a more specific method of integrating its functions into other applications. This example assumes familiarity with modifying *ALL-IN-1* and shows how to use existing hooks to integrate terminal emulation seamlessly. To add TE as an option on *ALL-IN-1*'s COM menu, perform the following steps: First customize the form COM in OA$LIB:OAFORM, adding IBM to the screen menu, and:

```
IBM COMMAND SYS$MANAGER:
  SNALINK
```

to named data. Add the COM procedure in Program 1 to SYS$MANAGER and give it W:E. *ALL-IN-1* users now can make the transition from *ALL-IN-1* to terminal emulation on the IBM and press CTRL-Z after logging out to return to *ALL-IN-1*. General integration can be illustrated using RJE.

A basic scenario for integrating RJE is a report application that can extract data from either VAX or IBM that's transparent to the user. The application would solicit selection criteria from the user and build a batch job consisting of DCL commands for VAX or JCL for IBM.

If the job is routed to IBM with SUBMIT/SNA, the output class will be defined to trigger a LOGIN.COM file, which will spool output to a designated printer. The users would get their reports without knowing where data was being accessed. This allows queries to be redirected transparently from some central control point and extends the flexibility provided by a mechanism like the device to a network independence.

I've tried to describe the feel of managing a gateway and some of the more interesting ways of using its functions. The DECSA is about five years old and probably will be replaced by the DECMA, based on the MICROVAX rather than the PDP. For a manager, this will require minor adaptation.

The main advantage of SNA gateways, whatever immediate requirements they might fill, is their base for emerging products using SNA's application-to-application protocol. The DECSA is positioned to use this software as it becomes more available and will give new interpretations to the term distributed processing. *—Kent Cearley is senior software programmer in the office of University Management Systems, University of Colorado, Boulder, Colorado.*

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Netting DECNET System Services

COMBINING VAX SYSTEMS into an integrated computing environment.

BY JEFFREY SCHRIESHEIM

Editor's note: This article introduces a series on DECNET System Services. In future issues, West Coast Editor Philip A. Naecker will report on his in-depth testing of each of the four products contained in DSS.

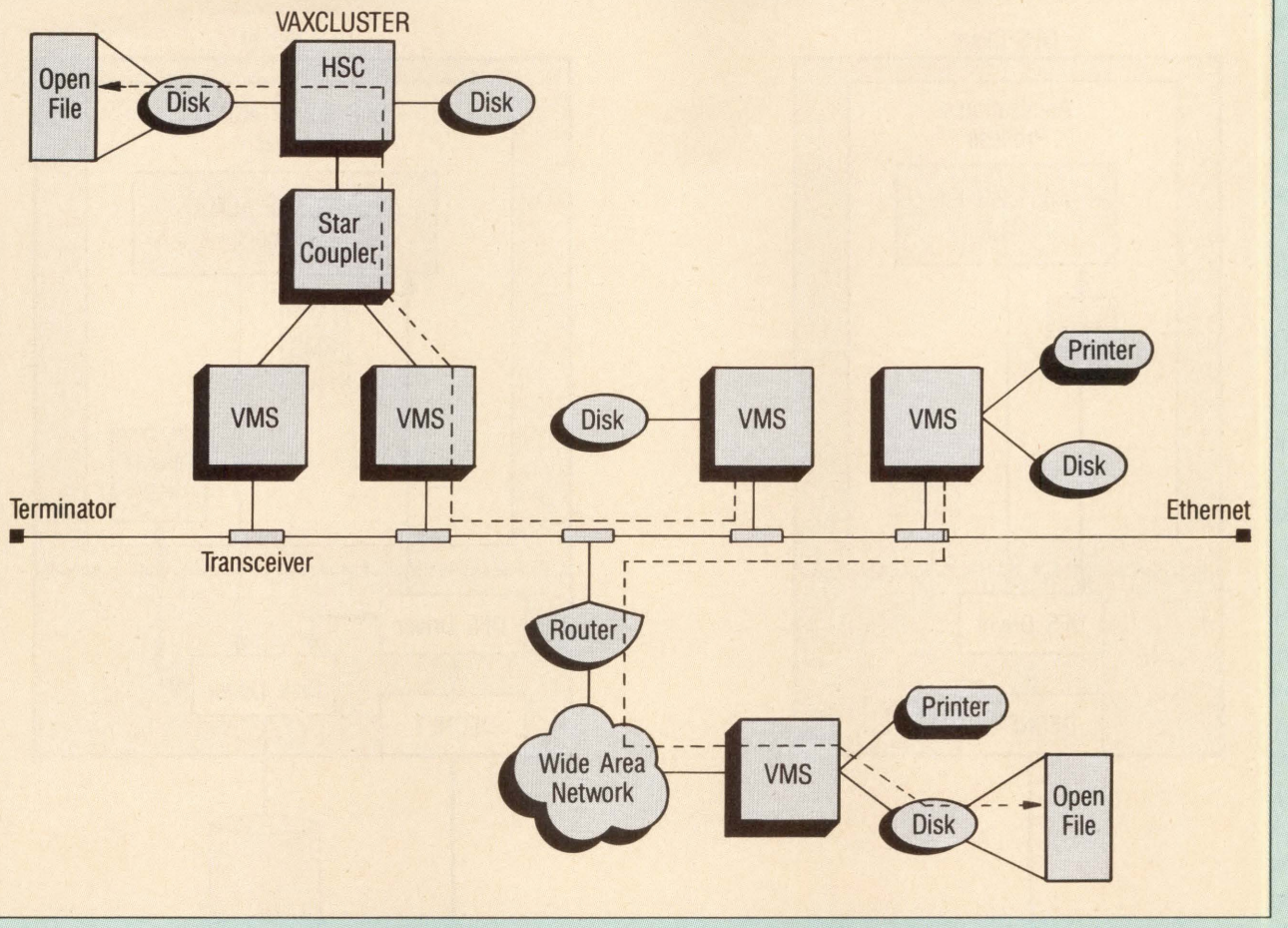
DECNET SYSTEM SERVICES (DSS) are new products from Digital that address the problems caused by the new computing environment, characterized by networking, diverse environments with less computer-literate users, more complex applications requiring additional computer resources and the proliferation of workstations with sophisticated user interfaces and high-quality graphics.

DSS products are layered on DECNET and make it possible to combine multiple VAX computer systems into a highly integrated, distributed computing environment. The initial DSS products consist of file access, printer access and system management services that can be used individually or jointly to combine multiple computers into an integrated computing environment. Specifically, they are the VAX Distributed File Service V1.0 (DFS), VAX Distributed Queueing Service V1.0 (DQS), VAX Distributed Name Service V1.0 (DNS) and Remote System Manager V2.0 (RSM).

DSS differs from other networking solutions, as it allows for different management styles to coexist, ranging from fully centralized to fully distributed. For example, VAXCLUSTERS and Local Area VAXCLUSTERS provide many of the benefits of DSS, but clusters are more restrictive in their application. DSS can be used over a wide area network and allows for a loosely coupled management domain, whereas a cluster must generally be managed as a unit. The use of DSS doesn't require a particular organizational structure or topology. A configuration can start using only required DSS services, and services and systems can be added without major reconfiguration.

For sharing and managing data be-

Figure 1.



DFS remote file access.

tween systems, VAX DFS provides high-performance file sharing between VMS systems. DFS features make remote files appear local by mounting a remote disk or a directory tree that's part of a disk.

With DFS, users on many VMS systems can directly and efficiently access remote groups of files (see Figure 1). They then will have access to identical information. As you need to keep only one copy of a file, the total file storage required to support a group of systems can be decreased.

DFS is implemented on the local system as a driver/ACP (see Figure 2) and it's completely transparent to applications. DFS can be used to read and write files and perform directory operations without users knowing that the actual file storage resides on another machine.

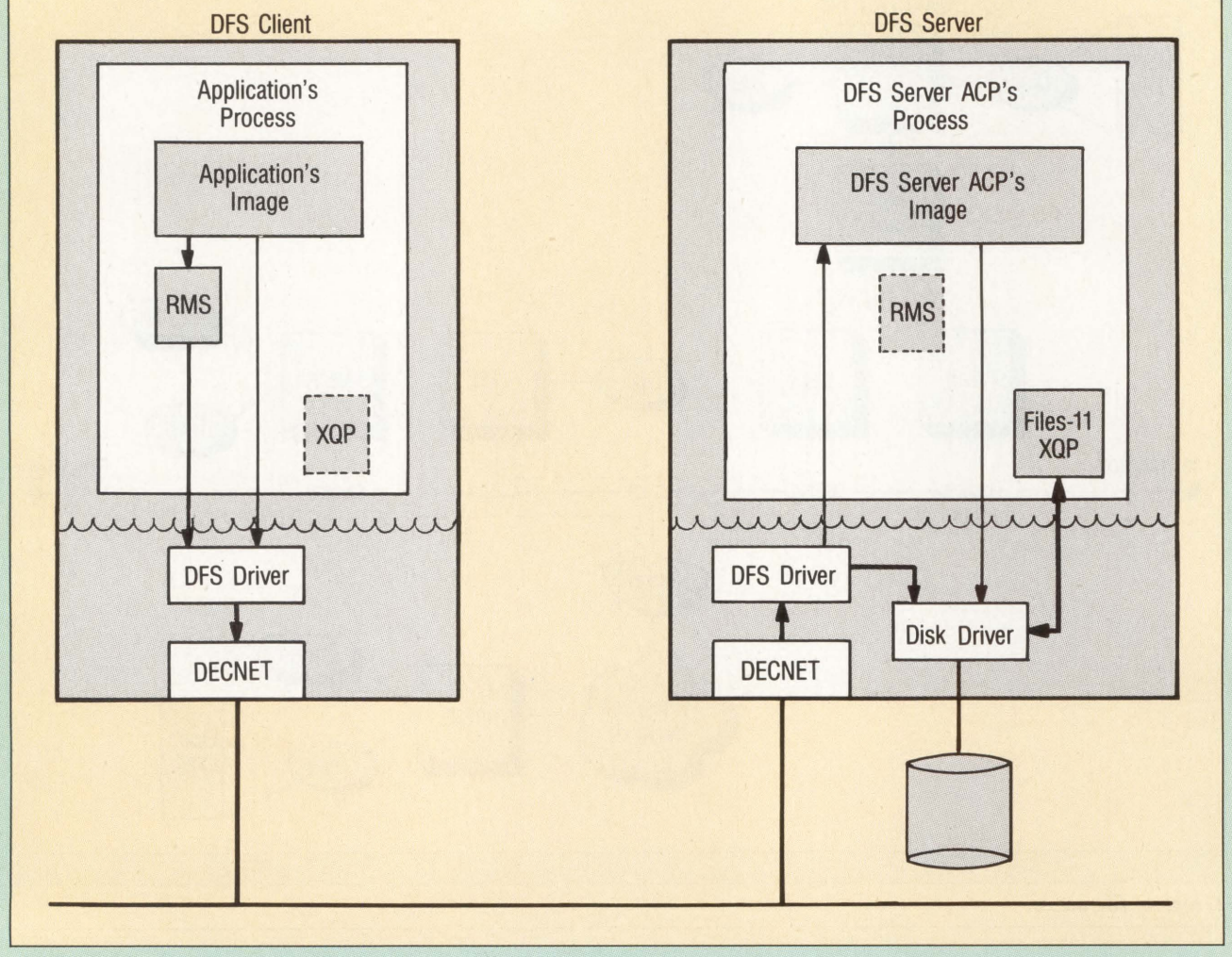
When accessing files using DFS, there's no need to use a DECNET node name, because DFS uses the VAX DNS to store information about the location of remote file storage. Using DNS provides location independence. Disk volumes can be moved from one system to another transparent to all users.

DFS offers excellent performance between systems connected by a LAN or high-speed wide area network connections. For wide area networks, the minimum recommended network bandwidth is 56 KB. DFS performance can be five to 10 times the performance of standard DECNET file access and is close to the performance of Local Area VAXCLUSTERS.

Distributed Queueing Services

For sharing and managing printing resources, VAX DQS enables VMS systems to access printers that are connected to other VMS systems. Thus, DQS offers an efficient way for systems to share printers (see Figure 3). DQS is implemented using the standard VMS print symbiont features, so you can print on printers connected to other VMS systems in a network using the same PRINT command and system service

Figure 2.



DFS block diagram.

calls as you use for local printing. DQS supports access to directly attached, LAT-attached and PrintServer40-style printers.

DQS provides commands for displaying the status of print jobs and deleting jobs from print queues. When printers are shared among systems using DQS, they become network-wide resources. DQS simplifies adding new systems, because it makes printing available without purchasing new printers.

DQS also supports report distribution, where one system sends jobs to multiple printers. Shared printers allow you to average the costs of high-speed or specialized printers, thereby making the printers more cost effective. Costs are reduced further, because DQS systems share printers and, therefore, require fewer of them. This reduces not only the initial investment but the overall resources required to manage those printers.

Remote System Manager

For sharing system management resources, Remote System Manager provides tools for managing a collection of systems in a distributed manner. RSM management tools assist a central system manager in loading software; managing user accounts, directories and proxies; and performing backups of remote disks. A system manager can use RSM to manage many systems, including systems distributed over a wide area network.

RSM frees users of workstations and systems from system management tasks. An RSM installation can support hundreds of systems through a single management interface. Remote (or

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client) systems can be collected into groups to be managed as a single entity. To coordinate the multiple server systems required to support a large site configuration, RSM stores some of its information through the VAX DNS. This allows RSM to be configured so that its services are available even if some of the server systems are down.

> RSM CAN perform initial system software loads or can load layered products on top of existing systems.

RSM provides consistent copies of software to systems and reduces intervention by users of those systems. Software installation can be offered to users by a site facility. RSM can perform initial system software loads or can load layered products on top of existing systems. An organization can build libraries of software configurations tailored to specific needs. Those libraries can be loaded automatically into systems upon user request.

Users know that they should back up their data for reliability, but they frequently fail to do so because of the time and effort involved. With RSM, users can back up files with a minimum of effort. RSM maintains a schedule of backup times and instructions, and it starts the desired operations without user intervention. Such automatic backup can increase the reliability of data stored on those systems. As with software distribution, backup can become a service that can be offered to a collection of systems by a site facility.

Distributed Name Service

VAX DNS provides a global naming service that stores certain types of information for DFS and RSM. DFS uses DNS to maintain information about the names and locations of remote file groups, and RSM uses DNS to store names and attributes of RSM server and client systems.

DNS can be configured to use multiple computer systems, each running server software, to implement a single name service. Each server holds only a portion of all the naming information that's available. Typically, information is stored closest to where it most frequently is read and modified, but all information can be accessed from any system in the network.

Information can be replicated on several systems, and the DNS automatically will update all copies of that information to reflect any changes. Having multiple copies of information enables the service to have higher reliability and better performance.

DNS can hold information about millions of entries and still provide efficient access and reliable operation. Thus, DNS can support very large networks with many different applications storing information.

DFS and RSM are the first Digital products to use DNS, but other products will follow. DNS is a cornerstone of future DECNET technology and will provide the basis for building larger, more manageable and more functional networks in the future.

Examples Of DSS Installations

In a typical office environment, computers frequently are used for word processing, running electronic spreadsheet programs on data and printing documents and reports. As an office outgrows the capabilities of its first computer system, additional ones are purchased. Users of these additional systems want to continue to have access to the same documents, data and printers. DSS provides benefits in this environment in the following ways:

1. It supports resource sharing between all VAX timesharing systems and workstations. New systems can have immediate access to the resources of existing systems, and vice versa. For example, by providing for shared use of printers, the purchase of high-quality laser printers is more cost effective.
2. It supports VAXMATE and other DOS systems through VAX/VMS Services for MS-DOS. Using DSS, DOS systems can use files and printers attached to any VAX in a network.
3. It allows word processing and spreadsheets to be run on shared files, making all documents and data accessible to users on all systems without having to create duplicate local copies.
4. It makes adding and maintaining workstations easy. Office users need not become system managers, and system managers can accomplish their jobs in less time.

As a business computing environment expands to include offices at remote sites, DSS can provide transparent shared access to the same resources regardless of their location.

Software Development

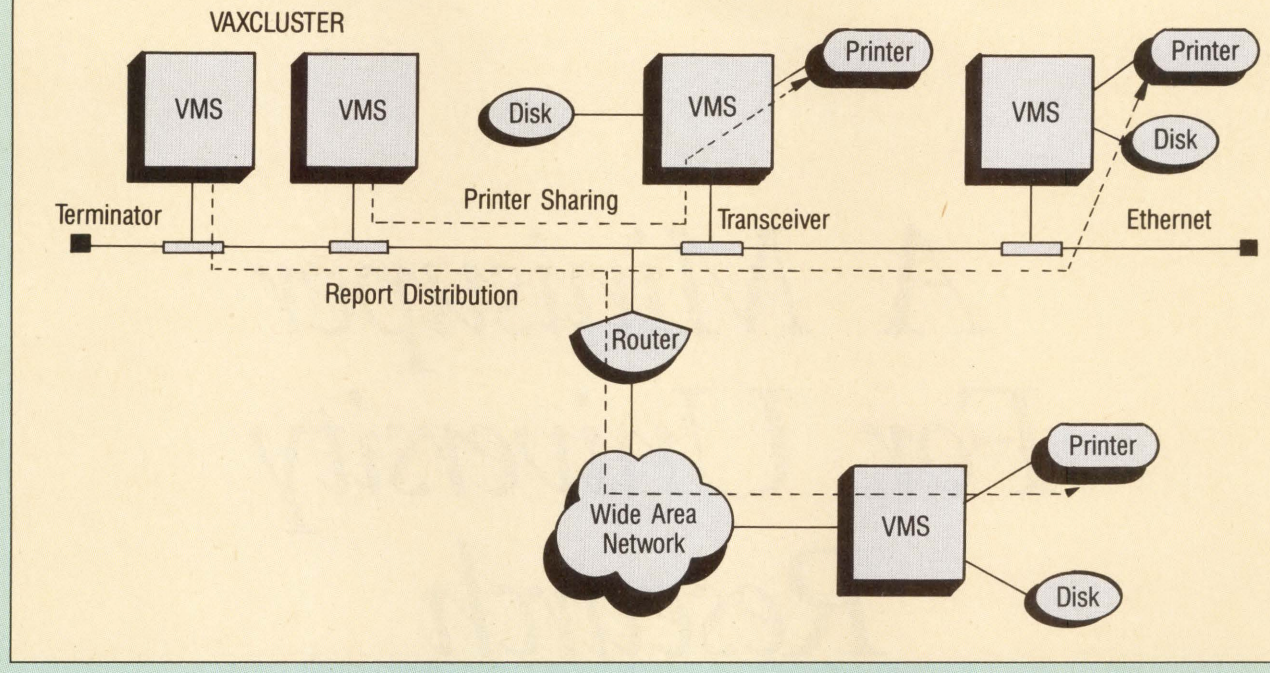
Engineers working on large software projects can use DSS to coordinate their work across a few or many computers. Source code can be managed in the usual way with Digital's VAX Code Management System (CMS). CMS ensures the consistency of the source code, even though several engineers are working on the same modules. With DSS, these developers can work on different computer systems and still use CMS to maintain a single current copy of the source files.

With DFS, all developers can access the latest copies of the object modules, libraries, compilers and other development tools. This not only allows all project members to access the same data but reduces the total disk space required for a project.

With DQS, workstation users can share high-speed printers, making them cost-effective. Each system doesn't need its own printer but can choose to use the printers connected to any other system in the network.

RSM can coordinate software for programmer workstations, making it easy to install additional systems and

Figure 3.



DQS provides access to remote printers.

simplifying software version updates. RSM's automated backup features will protect the project's valuable investment in work with a minimum of system management time.

Computer-aided Design

In a computer-aided design (CAD) environment, DFS allows multiple workstations access to shared copies of design databases. Used in this manner, version skew problems between designers can be eliminated. Changes in the database made by one engineer are visible automatically to all other engineers, regardless of which system they use. Large disks can be placed on a few systems and can be shared by many others, making large amounts of file storage available to relatively inexpensive workstations.

In addition, DQS in the CAD environment can provide workstation users with easy access to expensive plotters, and RSM can provide backup and software distribution services.

Because DSS is layered on DECNET, DSS products will benefit from the evolving capabilities of the Digital Networking Architecture (DNA). DNA is expanding to include the Open Systems Interconnect protocols, which will simplify cross-vendor operability. DNA also is addressing the needs of Digital customers to build even larger and more self-configuring networks, operating over a growing set of interconnects.

DSS provides easy ways for systems to easily share files, printers and management resources. The newly announced VAX Remote Procedure Call (RPC) facility will enable systems to share computing power in an equally transparent manner. Using VAX RPC, application programs can be distributed over several computers, so different procedures in a single program can execute on different processors. Each piece of a program can be placed where it will work most efficiently. VAX RPC can be used in conjunction with DSS to allow users to build flexible computing environments based on multiple networked computers.

DECNET System Services combines multiple computer systems into a single integrated computing environment. DSS provides seamless growth from a few to many systems sharing data, printers and management resources. It can be used within a local geographic area or across a wide area. It can reduce the total cost of owning multiple systems by sharing expensive hardware and human resources. Also, it can provide increased flexibility in reconfiguring systems to deal with changes in performance requirements and system availability. *—Jeffrey Schriesheim is a consulting engineer in the DECNET System Services Software Development Group at Digital Equipment Corporation, Boxborough, Massachusetts.*

A Minisuper For University Research

EVALUATING, INSTALLING, using a little big one.

BY PHILIP E. BOURNE, PH.D.

MORE THAN ONE year ago, we were faced with a problem that plagues all MIS directors: the need to enhance computing capability to satisfy the expanding needs of a growing user community. This community needed to process larger, more complex, and more CPU-intensive applications than were feasible on available VAX/VMS processors. Rather than acquire another VAX, we decided to add a minisupercomputer. This article describes the process that led to that decision and our experiences during the first eight months of minisupercomputer operation.

Our computing environment consisted of two VAX 11/780s, one VAX 11/750, one MICROVAX II and one ST-100 array processor from Star Technologies Inc., which was front-ended by one of the VAX 11/780s. The VAX processors were connected via an Ethernet local area network running the DDCMP/DECNET protocol.

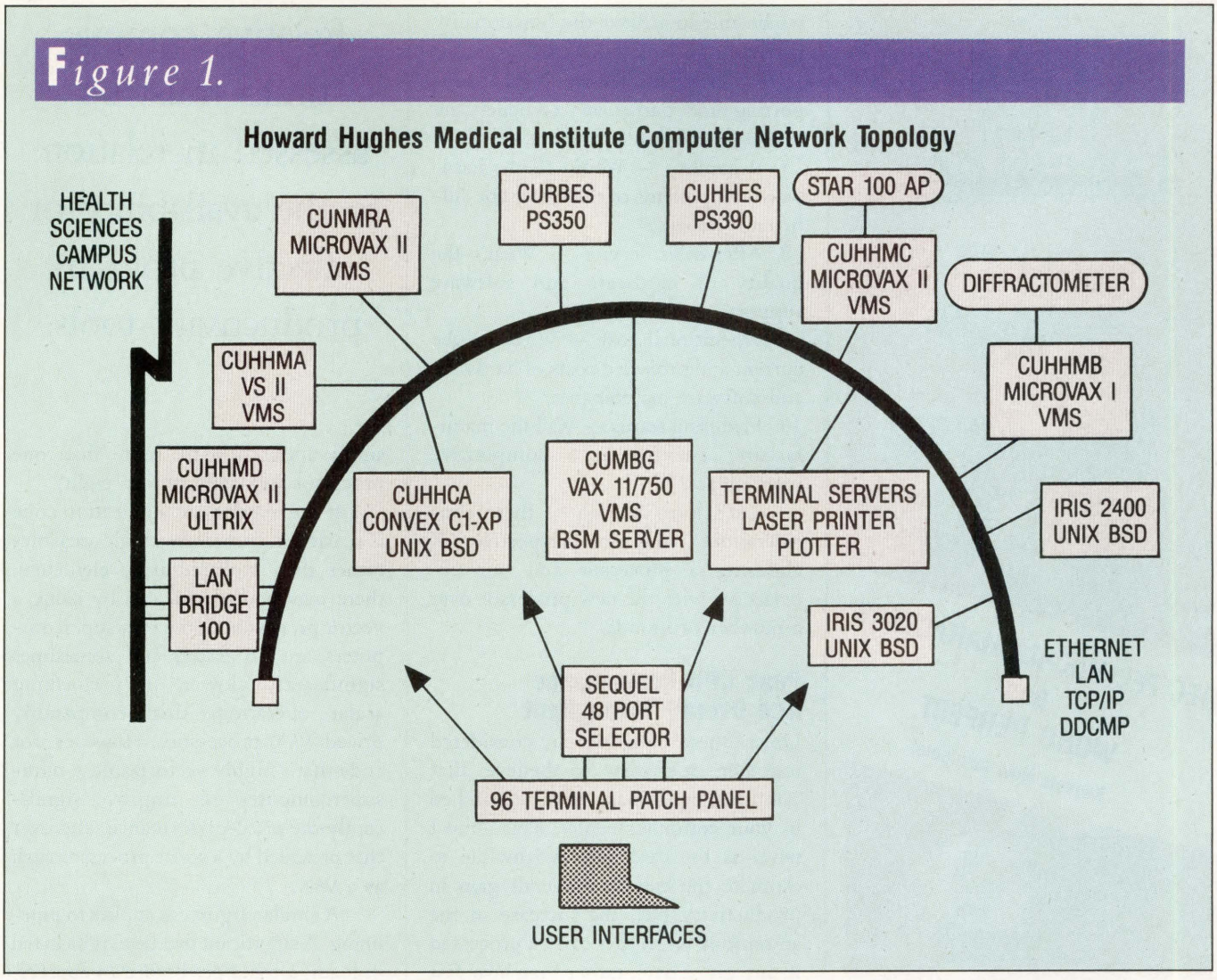
It's important to understand the nature of the computing environment beyond the available hardware and software. The user's adapability and his applications determine the success of migrating to a minisupercomputer system.

Our departmental computer facility is located in a large research-oriented university. The facility operates independently of the university's central computer center and limits its activities to molecular biology research by a small group of scientists and students who use their own codes or public domain software written in machine-independent, single-precision FORTRAN-77.

Because none of our applications was VAX specific, the prohibitive cost of redeveloping them for use on a different processor wasn't a factor in our decision. Nor were we dependent on VAX/VMS-specific commercial application software. Finally, we believed that our users could make the transition to a new computing environment without significant loss of productivity.

Although conditions for adopting a non-VAX processor were favorable, we wouldn't have considered minisupercomputer alternatives if we already had

Figure 1.



Computer network topology.

invested in VAXCLUSTER hardware. Most likely, the features available from clustering would have outweighed any performance improvement expected from a minisupercomputer.

Naturally, users were divided on which should be the processor of choice. Half thought the Cray-like architecture of many minisupercomputers offered the potential for significant increases in system performance. The time required to solve problems in the facility would be reduced, and the analysis of problems that previously only could have been addressed on shared supercomputer resources would become feasible.

The other users thought it wasn't worthwhile to exchange VMS on VAX systems for some unknown system. They weren't prepared to cope with the problems of hardware incompatibility and the traumas of learning a new operating system and converting existing applications to a new hardware type. These users also pointed out that it seemed foolhardy to accept a machine with a one-, two- or three-digit serial number from a company that was trying to survive with a single product line in a competitive market.

Decision Making In Theory And Practice

Given the divided opinions, it was essential to compare the VAX and minisupercomputer alternatives with particular care to determine the better option. The following questions were considered:

1. Overall throughput — Under normal working conditions, what is the maximum productivity of each system?
2. Peak CPU performance — What's the shortest time possible for processing a single application?
3. Capital cost — What's the capital outlay for the hardware and software components required to make the system function satisfactorily?
4. Operating system — What operating systems, including tools and utilities, are available to meet our needs? Are these systems easily manageable?
5. Network compatibility — Would

we be able to achieve the functionality currently possible with DECNET?

6. Application software — What supporting tools, particularly compilers, are available? How adequate are they?
7. Reliability — Would all the hardware components of the system be sufficiently reliable?
8. After-sales service — What's the quality of hardware and software support?
9. Operational cost — What are the current and projected costs of hardware and software maintenance?
10. Fledgling status — Will the manufacturer survive in a competitive marketplace?

Let's look at each of these considerations from the perspectives of choosing a processor and our experiences with the new processor over a number of months.

Peak CPU Performance And Overall Throughput

Unless these categories are considered together, it's easy to believe that published benchmarks will be matched in your computer center. This almost never is the case. It's worthwhile to estimate the expected overall gain in productivity (i.e., the increase in the amount of work that can be processed in any given day), rather than how fast a single application will run when it has the processor to itself.

This assessment is useful in the case of minisupercomputers, because they differ in the speed with which different types of calculations can be performed. To understand this point, consider the architectural features which, in principle, give these processors improved performance relative to a high-end VAX. Every minisupercomputer system uses one or more of the following techniques to achieve high processing speeds:

1. Vectorization — Processing multiple data elements by means of a single machine instruction. Each part of an instruction is performed sequentially.
2. Pipelining — Processing different parts of the instruction simultaneously.
3. Parallel Processing — Processing a single application by more than one processor (typically two to eight).

> Relative compile times must be assessed in relation to the availability of effective program productivity tools.

If the majority of application code is scalar (i.e., processes single variables rather than multiple array elements), there may be little to gain by using a vector processor. Some minisupercomputers are no faster, and sometimes significantly slower, in performing scalar operations than comparably priced VAX processors. However, for code that's highly vectorizable, a minisupercomputer can improve significantly the price-performance ratio over that provided by a scalar processor such as a VAX.

A similar argument applies to pipelining. A significant overhead is incurred in loading the pipes before an appreciable increment is gained in processing speed. This pipeline latency may negate any major gain in speed in certain applications.

If you wish to gain additional insight into these computer architectures, read "Advanced Computer Architectures" by G. Fox and P. Messina in the October 1987 issue of *Scientific American*.

Another major consideration is the precision required by the majority of applications. If they require double (64-bit) precision, special attention must be given to processors that perform calculations in double precision. When forced to process in double precision, processors designed for single (32-bit) precision suffer performance degradation of at least an order of two in some cases.

Each of these points illustrates the importance of running benchmarks representative of your intended applications. We prepared two benchmarks, one scalar and one vector, typical of our applications to be run on the proposed processor. There was little difficulty in persuading the vendors to run them.

It immediately was evident that there were discrepancies between the speeds with which our applications processed on the various processors compared with the published Linpack benchmarks quoted by the vendors of each minisupercomputer. In addition, by running our own benchmarks, we had access to relative compile times, an important issue in relation to vector and parallel processors not included in the published benchmarks.

The additional overhead in compiling code to take advantage of vectorization and parallelism makes compilation times much longer than for scalar processors like the VAX. Thus, in research and development, where much time is spent in compilation, the advantage of a faster processor for running applications is offset by longer compile times. Contrary to this argument, experience with the new processor demonstrated that useful program productivity tools that reduce the compile-time bottleneck are available. Therefore, relative compile times must be assessed in relation to the availability of effective program productivity tools.

As expected, when we compared the timings of the vector and scalar benchmarks from several minisupercomputer systems to the time they required on a scalar VAX 8700, the scalar benchmark was slower in most cases, and the vector benchmark showed a dramatic performance improvement. The question was, how much of our work would be vectorizable and how much would be scalar? In other words, would we improve our productivity by having a vector processor?

We attempted to answer this question with the help of image accounting, available using the VAX/VMS accounting utility. We monitored all executable im-

Pushing The Envelope

Convex has announced a new series of processors that take the maximum performance of its line into the Cray area.

Convex recently announced five new models, all based on the same processor. The lowest, a slowed-down uniprocessor called the C130, fills a niche above the C1 offering, now renamed C120. Starting with the C210, Convex adds a supercomputer processor to each model, ending with the quadratic C240. The C240 has an impressive 800-MB-per-second memory bandwidth and is into the Cray area.

One of the best features of Convex's Berkeley variation of the operating system is that it attempts to keep all processors busy, even on other tasks, by allocating them dynamically, like the way VMS allocates pages of memory.

No supercomputer is better than its compiler. A compiler for a Convex must excel both at vectorizing and threading, to maximize the use of those multiple processsors and their dynamic shareability.

The earliest planning documents for the C1 series stressed VAX compatibility as a goal. The true target of that compatibility was in compiler syntax. Other goals are the DCL shell, EDT and DECNET emulation. VAX coexistence is a simple fact of life if you're in the supercomputer business, because every customer has a large VAX.

Cluster connectivity is now the issue. The first level is DECNET over Ethernet.

Looming large on the horizon is the demand for some form of high bandwidth connectivity, similar to the Cray interconnect sold by DEC. This is a dedicated 82xx with a custom BI-based high-speed interconnect (a latter-day DR11W). The major use for such an interface, however, is high-volume file transfer, as the interactivity is well handled by the Ethernet connection.

In addition to DECNET emulation, Convex supplies TCP/IP and NFS for connection to most of the UNIX universe, including the world of workstations.

—Dave Mallery

ages (both user and operating system) accessed over a five-day period on one of our VAX 11/780s. By knowing whether they were predominantly scalar or vector, we were able to estimate what percentage of our total workload was scalar or vector. Using these percentages and the known speeds, relative to the VAX 11/780, of vector and scalar processing on the processors under consideration, we could estimate the time it would take to process the VAX 11/780 workload on each of these machines.

We estimated that 100 hours on a VAX 11/780 would take 18.7 hours on the scalar VAX 8700 and 28.6 hours on a Convex C1-XP vector processor, the machine we installed eventually, from Convex Computer Corporation of Richardson, Texas. Why did we buy a processor that's slower and incompatible with the existing environment, when a similarly priced VAX is faster and compatible? The answer lies in our estimate of future use patterns.

Neither machine would remain idle during the extra 70-80 percent of the total available computing time gained by replacing the VAX 11/780. The amount of work being done on each VAX 11/780 wasn't what needed to be done, but rather what could be done given the limitations of the computing environment. If a faster processor were available, we estimated a linear increase in the number of scalar applications, including compilations (the major bottleneck to a vector processor), and a far greater increase in vectorizable applications.

This latter assumption seemed valid because most of the major codes we had been running were vectorizable. Under those assumptions, the overall productivity of the Convex C1-XP vector processor was estimated at twice that of the VAX 8700.

Now that the Convex C1-XP has been in place for a number of months, it's difficult to say whether these assumptions were correct. The size and number of problems being solved has increased significantly. We can't say whether the same would have been true if a VAX 8700 had been installed.

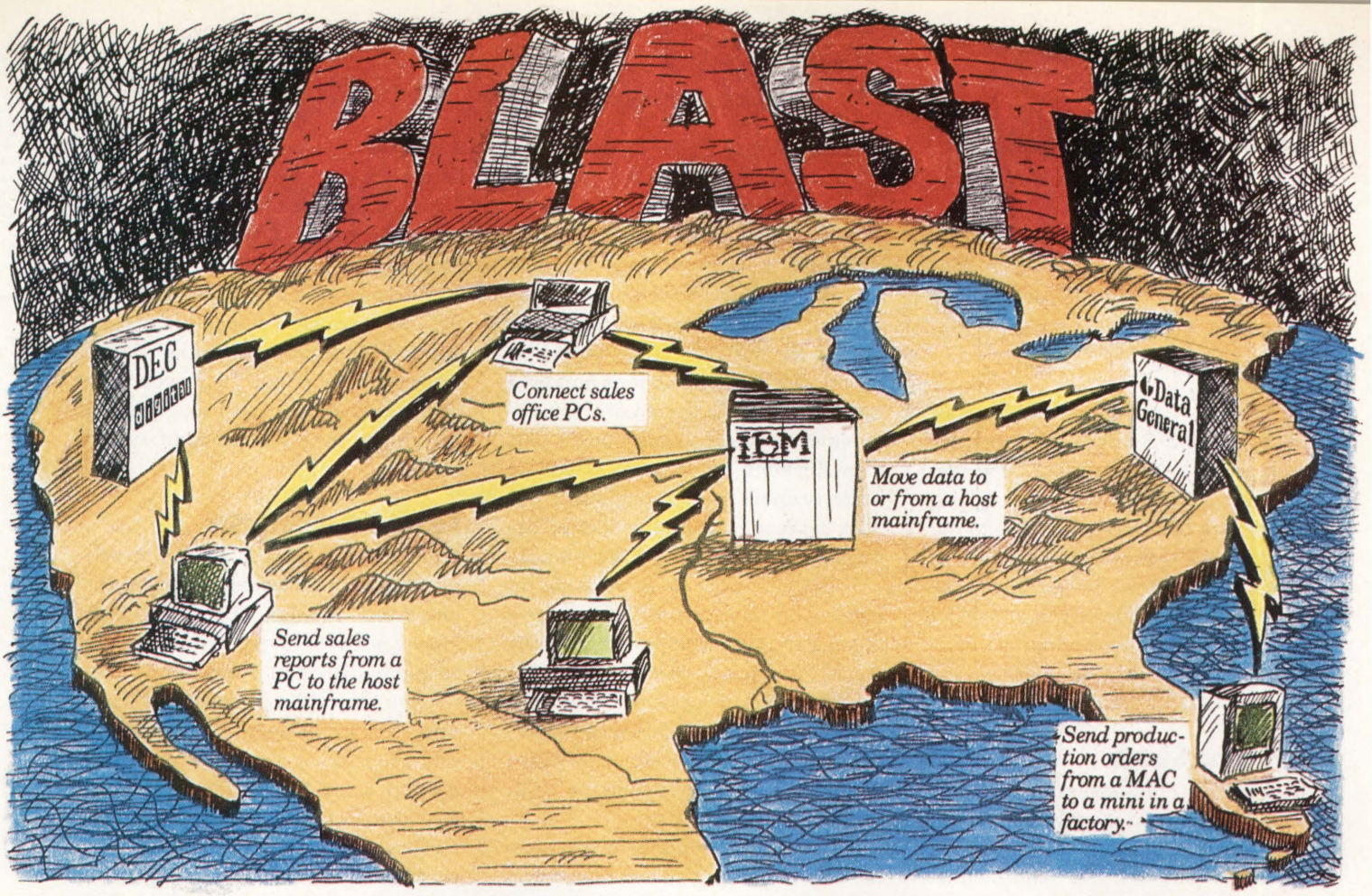
The observed improvement in performance of vectorizable applications is partially dependent on the amount of effort required to carry out the necessary modifications to the code. We found that a FORTRAN application written with little attention to the possibility of vectorization would run on the Convex C1-XP with little or no modification at five to six times the speed of a VAX 11/780; i.e., at about the speed of a VAX 8700.

With an afternoon's work for the average programmer, a 10- to 15-fold improvement over the VAX 11/780 is typical for vectorizable applications. With a more dedicated effort of one to two days, 20 to 30 times the speed of the VAX 11/780 is possible.

Why didn't we add an array processor, using an existing VAX as a front-end? Our bias was toward a general-purpose processor because we'd been using the ST-100 array processor for several years. Although fast for some specialized applications, the ST-100 had never been embraced by the majority of the users. It doesn't have a durable FORTRAN compiler, and the effort required to get an application to run in Array Processor Control Language (APCL) was more than most users were prepared to make. Perhaps this is a moot point, because good FORTRAN compilers were available for other array processor options.

Another concern was the fear of difficulty in scheduling jobs using a front-end VAX that already was overloaded. Again, this is a moot point, as we have since moved the ST-100 from a heavily used VAX 11/780 to a dedicated front-end MICROVAX II and have achieved better performance, if not in CPU time then in wall-clock time.

We didn't consider massively parallel machines, in which many (sometimes thousands of) processors are available to work on a single application; they arrived



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on the market too recently to allow us to obtain sufficient information as to their viability.

Since then, sufficient feedback has become available to warrant their consideration in any future decision-making process.

Cost

All vendors were prepared to lower list prices significantly and offer attractive packages incorporating future upgrades and software and hardware support. Incorporating the Convex C1-XP into our existing VAX/VMS environment entailed capital costs that we wouldn't have incurred if we had added a VAX 8700. Most significant was the addition of a MICROVAX II with an ULTRIX and DECNET/ULTRIX license.

Operating System

In adopting a minisupercomputer, our users were worried about learning a new operating system. This may seem a minor point to a computer professional, but to a scientist, whose major interest is in getting results rather than experimenting with different operating systems, this is a major issue. For users comfortable with VMS, the thought of learning some derivative of UNIX, the operating system found on all minisupercomputers considered, wasn't pleasant.

Our users were persuaded to make the shift, because by not learning UNIX, they would be postponing the inevitable. UNIX-based workstations already had started to appear, and their cost, performance and graphics capabilities made it likely that they would become popular. The potential for a common user interface using UNIX, on both the single-user workstation and a shared minisupercomputer, was attractive.

Users' success in making the transition from VMS to UNIX depends on their knowledge of computing, the availability of support personnel and local documentation. In our case, a series of lectures was given and supplemented by a 90-page manual. The manual attempted to teach the fundamentals of UNIX use from a VMS perspective. Updated and detailed documentation was distributed as the users became more adept with the new operating system.

The major market for minisupercomputers is potential high-end VAX customers, and, therefore, it's not surprising that many concessions have been made to the VAX/VMS user. Most vendors offer a VMS shell, which runs on top of UNIX, to create the illusion of a VMS environment. Convex offers Convex VMS User Environment (COVUE), which we made available to users. However, our users didn't embrace this product, preferring to learn UNIX using online tutorials.

COVUE would be more useful for users who intended to remain predominantly VMS users but occasionally would run applications under UNIX. For the application programmer, COVUE is inadequate. To be productive, programmers must take advantage of the many utilities and tools available in the UNIX environment.

Another issue relating to a move to the UNIX operating system was system management. We weren't well-versed in UNIX system management prior to the arrival of the Convex C1-XP. Convex offered excellent, well-documented courses at its headquarters to bring us up to speed; still, nothing could prepare us for the experience of starting a new system.

With VMS, the extensive document set is usually sufficient to help a system manager get the system up and available to users. The Convex UNIX system management documentation is sparse and inadequate. The ULTRIX document set filled in a few of the gaps. More important, we found the Convex hardware technicians responsible for the installation to be well versed in software installation and modification. Occasional telephone support from the Convex Technical Assistance Center (TAC) was, and still is, invaluable.

When the system was installed (which took less than one day), we decided not to make it available to users until we were satisfied completely that it was running properly. This lead time gave us the opportunity to write and test site-specific software; i.e., communications, daily backups, accounting and other housekeeping chores. This prevented later glitches that would have upset the user community and slowed the transition process.

Keeping extensive logs on all aspects of system management supplemented the sparse documentation. The logs still are maintained and not only provide a daily reference guide but can be expected to benefit the next generation of system managers.

Network Compatibility

Our users also were concerned with networking. In a distributed computer environment, network access is critical. How would a UNIX processor fit in with an existing DECNET network?

For the VAXs, a number of hardware/software solutions were available, solutions that would provide transparent network access between the TCP/IP protocol used by UNIX and the DDCMP protocol used by DECNET. Discussions with personnel at several sites, including Convex headquarters, convinced us that they worked well.

The problem with a number of VAXs requiring transparent access was the prohibitive cost of providing hardware/software solutions for each VAX/VMS system, so that it could emulate the TCP/IP protocol. We could have used an existing VAX as a gateway, but this wouldn't have been convenient and would have placed an additional burden on a heavily used processor.

We opted for a MICROVAX II running ULTRIX and DECNET/ULTRIX as a dedicated gateway. In retrospect, this has proved successful, even though it required a significant programming effort. Convex provided some templates, written in both DCL for the VMS side and shell scripts for the UNIX side of the gateway.

Still, significant programming was required to tailor these ideas to our own environment. Nevertheless, we now have a transparent networking environment comprising a diverse set of hardware and operating system types and permitting file and mail access, remote logins and shared printing resources (see Figure).

Another useful feature of the ULTRIX gateway is that it supports the Local Area Transport (LAT) protocol used by the DECSERVER terminal servers. Users already connected to terminal servers could toggle between multiple terminal sessions easily on both UNIX- and VMS-based processors. The terminal servers later were supplemented with a port selector, as shown in the Figure.

Support of the TCP/IP protocol opened up a new dimension in wide area networking. We now have transparent access to Internet, a conglomeration of TCP/IP-based networks including Arpanet and NSFnet, important to our users. Access to UNIX-to-UNIX copy (UUCP) for communications to UNIX hosts not reachable on Internet also is possible using telephone dialup lines. Our main use of UUCP is for communicating with Convex support personnel, both at the local office and at Convex headquarters.

At the time of this writing, Sun Microsystems proprietary Network File System (NFS), the last piece of the current network puzzle, is being put into place. Convex UNIX supports NFS, providing transparent file access in a manner similar to a VAXCLUSTER running VMS. The Convex C1-XP will act as a file server for a growing number of UNIX workstations.

Application Software

One advantage of the VMS operating system is the large number of available Digital and third-party application software products. In our case, such software wasn't critical to our major applications and yet was used widely for ancillary tasks, such as word processing and graphics.

If we had given up our VAX/VMS environment completely to UNIX-based hardware, our productivity would have been affected adversely. With VMS available on MICROVAX and VAXSTATION computers, we were able to move the ancillary applications to relatively low-cost processors, reserving the minisupercomputer for more CPU-intensive applications.

Nevertheless, the relative lack of good commercial application software for the UNIX environment has some disadvantages. For example, a problem was encountered while attaching a Talaris T1500 laser printer to the Convex C1-XP. Under UNIX, appropriate queue and font management software, including filters for Tektronix emulation mode, had to be written. Also, LASERPLOT, a set of FORTRAN plotting routines from Talaris, required modification to get them to compile and run with Convex FORTRAN. What had taken several hours using VMS took more than a week using Convex UNIX.

Regarding compilers, minisupercomputer manufacturers intent on capturing a slice of the engineering and scientific market provide a sturdy FORTRAN compiler. All the manufacturers we considered, including Convex, had highly capable FORTRAN compilers. A

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fast syntax checker is available and has proved useful for the early stages of program development.

Good profiling and debugging tools are available as part of the standard Convex UNIX distribution and are invaluable in vectorizing code. All of the considered compilers ran standard FORTRAN-77 code, and many, including Convex, could handle some VAX FORTRAN enhancements. At least one (not Convex) supports an identical run-time library.

The quality of software received from Convex has been good. Convex has a Contact Report system, like the Software Performance Report (SPR) used by Digital, and hence, reported errors get fixed in subsequent software releases. However, because the Convex user base is much smaller, the quantity of available feedback is small, and problems do slip through the Beta test phase. For instance, an upgrade to the COVUE software didn't work when we first received it. Convex TAC claimed the problem was related to peculiarities in our hardware configuration, which would be fixed in the next release of the product.

When the next release didn't solve the problem, further analysis revealed the problem was caused by a blank line in a system file read when COVUE is invoked. This problem should have been found before the product was released. In the meantime, we had been without use of the product for a few months.

Hardware Reliability

Like benchmarks, reported figures on mean time between failures are merely useful guides. We talked with personnel at sites with installed machines to estimate their reliability, and received favorable reports. Our Convex C1-XP has been very reliable, although no exact figures have been kept.

This is surprising, as the machine is located in temporary space with little air circulation and an average temperature of 82° F. A VAX 11/750 and a MICROVAX II operate under the same conditions with estimated equal or better reliability.

After-sales Service

Minisupercomputer manufacturers, like other computer manufacturers, need to maintain a good reputation for after-sales service to help promote their products. Convex has proved no exception. Our hardware technician regularly dials into the system without being asked, and scouts for potential problems; genuine preventive maintenance. Salespeople and software technicians keep us updated regarding product developments and announcements.

We feel that we are valuable customers. The relatively small size of the company and a low turnover of per-

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sonnel provide continuity in after-sales service. We don't need to familiarize new personnel with the various aspects of our computer operation.

Operational Costs

The desire for these companies to sell computers means that software and hardware maintenance costs are negotiable. Obviously, bargaining must be done at the time of purchase, while leverage is available. For software, both the license and maintenance costs should be negotiated.

Hardware upgrades, at least in the case of the Convex C1-XP, can be expensive. For example, the per megabyte cost of physical memory purchased from Convex isn't in line with the equivalent Digital cost because there's no third-party source of memory to offer an alternative and help control prices.

We were able to budget for our anticipated hardware needs for the next two years, and to get a better deal by bundling future upgrades into the initial purchase at a reduced cost. If this isn't possible, negotiate the pricing of future upgrades at the time of purchase.

Fledgling Status

Although minisupercomputer manufacturers have grown quickly, driven by a demand for high-end processors to fill the gap in Digital's product line, the bubble may burst. Analysts predict that this segment of the market is becoming saturated. If so, a shake out may take place, and companies with the most diverse product line and with the largest number of software products will survive.

Potential purchasers need to consider the expected lifetime of an installed minisupercomputer system. If more than five years, careful thought must be given to the choice of processor, as some companies may not survive.

Digital eventually will introduce a product to supplement its high-end VAX and VAXCLUSTER products. It will use some form of supercomputer architecture, even if it involves a departure from vanilla VMS. Any Digital announcement can perturb minisupercomputer market conditions. In the meantime, potential and existing customers can benefit from a competitive market.

We estimated that the lifetime of our processor would be no more than three years. The viability of Convex Computer Corporation during the lifetime of our processor wasn't an issue. Any technological improvements leading to significantly faster general-purpose processors, from Digital or any other manufacturer, still would be within our reach.

The choices in upgrading any computing environment are many and varied. Often, insufficient consideration is given to the complete set of options available, with preference to the simplest solution: an upgrade from the vendor whose product already has been installed. But this approach should be governed by an estimate of future productivity rather than by the reluctance of system personnel or management to change their ways.

Our decision-making process began with the user community and a good understanding of the applications that needed to be performed. We explored as many options, within our budget, as a reasonable time frame permitted. Even so, there was an unresolvable division of opinion as to whether we should stay with the proven formula of VMS on VAX processors or invest in some potentially more productive but unproven computer resource.

With our selection of a Convex C1-XP minisupercomputer, the processor became as much an experiment as a tool. Proof that the experiment was successful comes from the usage statistics calculated since the computer was installed. During the first month, we observed a 45 percent use rate, indicating little resistance to an alternative computing environment. Thereafter, use climbed steadily to full capacilty after eight months.

Our satisfaction with the minisupercomputer experience is best expressed by our plans. We plan to upgrade to the next generation of minisupercomputer or massively parallel machine within the next 12 months. We can expect a two- to three-fold improvement in performance for both scalar and vector operations. — *Philip E. Bourne, Ph.D., is a research scientist in the Department of Biochemistry and Molecular Biophysics at Columbia University and a senior associate of the Howard Hughes Medical Institute, New York, New York.*

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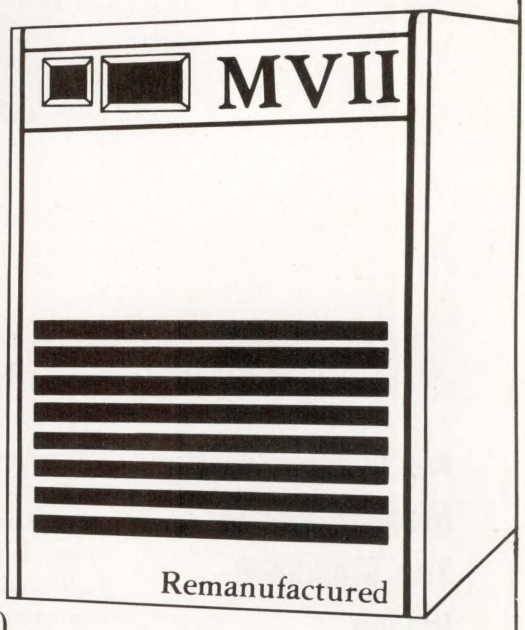

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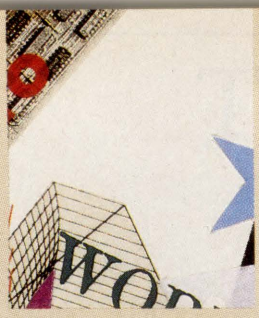

VAX

VAX/SMP

By Kathleen D. Morse and Rodney N. Gamache

Key Synchronization Mechanisms In The VMS/SMP Design.

When the VAX architecture first was implemented, the VAX 11/780 CPU consisted of 22 hex boards (16 x 12 inches each). The power and packaging requirements for such a system — large cabinets, noisy fans, machine-room cooling — made connecting multiple CPUs a challenge. Today, with single board CPUs, technology improvements have redirected the multiprocessing challenge at the software implementers to determine the best way to use systems with six, eight or even more CPUs.

The first multiprocessing VAX, the 11/782, consisted of two VAX 11/780s connected with a multiported memory, the MA780. This memory provided two crucial features necessary to VMS multiprocessing: common memory, shared by both CPUs, and an interprocessor interrupt capability. The other hardware feature crucial to VMS is the set of interlocked instructions, part of the VAX architecture and in every VAX.

The original VMS multiprocessing code was asymmetric, matching the asymmetry of the first multiprocessing hardware (see Figure). Although memory was common to both CPUs, nothing else was. Most important, the I/O subsystem was accessible only to the primary processor. This asymmetry resulted in the following design:

1. All kernel-mode code executed on the primary processor, including I/O requests, device interrupt handling, booting, shutdown, paging, swapping, etc.
2. Executive, supervisor and user-mode code executed on either CPU.

This design was elegantly simple, as the VAX architecture specifies that all kernel-mode exceptions are vectored through a System Control Block (SCB); i.e., one or more pages of main memory accessed by hardware via the System Control Block Base register. By creating a different SCB for the secondary processor, any kernel-mode exception occurring on the secondary processor could be folded up and given to the primary processor for handling. This design was so simple that a breadboard was implemented in a single weekend, although bringing it to product quality with integrated error handling, automatic system reboot, system shutdown and installation procedures, took another year.

The system performance for asymmetric VAX/VMS varied, based on the characteristics of the application workload. Compute-bound workloads get the best system use. For example, building the VMS sources into executable binaries required 22 hours elapsed time on a single VAX 11/780 but only 12 hours on a VAX 11/782. Conversely, as expected, I/O-bound applications receive no performance boost by increasing the computational powers of a system.

The design of the later VAX systems removed the hardware asymmetry, limiting the VAX 11/782 by the new BI bus and its peripherals. The BI architecture provides a protocol that allows multiple processors to issue device requests and operating system software to specify which processors a device controller will interrupt.

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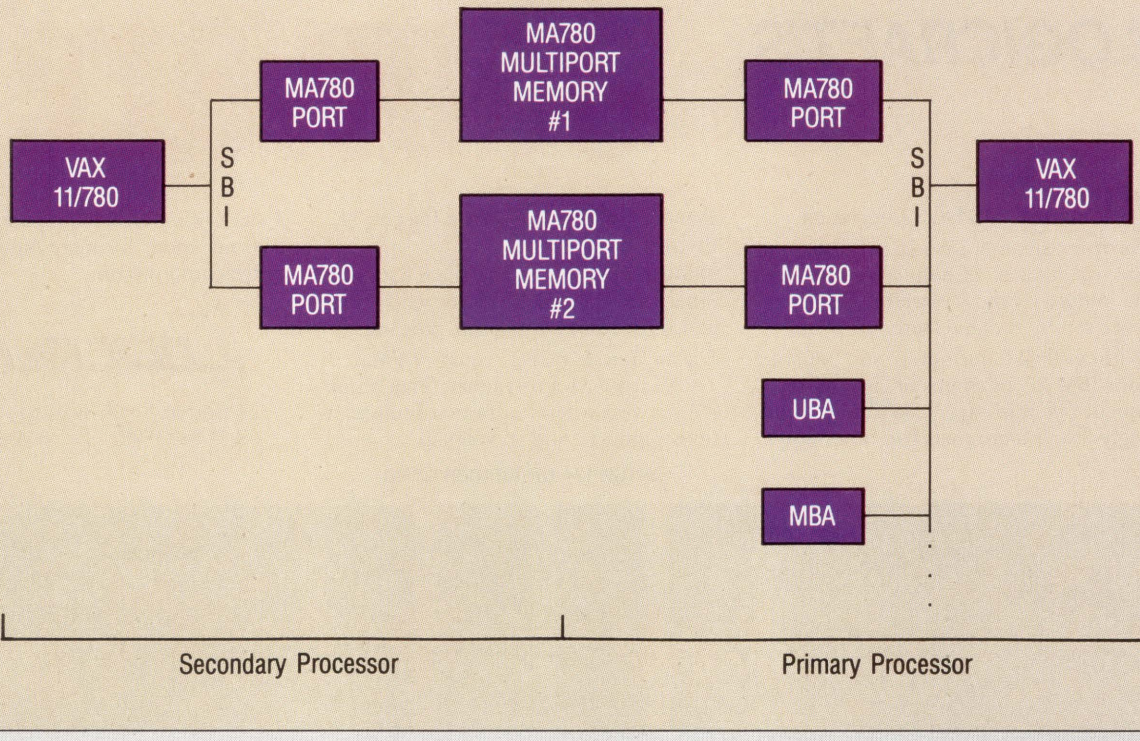
FIGURE 1.



VAX 11/782 system block diagram.

mature operating system be modified to include symmetric multiprocessing while undergoing active development in many different areas by more than 100 software engineers?"

The Development Of SMP

A team of five senior VMS software engineers, members of Digital's VMS Engineering Group, met weekly for three months to produce a symmetric multiprocessing (SMP) design. They consulted with the hardware engineers for the VAX 8800, 8300 and other VAX systems and with the TOPS-10 and RSX operating system designers who had experience in adding multiprocessing capabilities to those systems.

A working design document was developed and updated regularly to record the pros and cons of various ideas, preserving the rationale for the various design decisions. This type document is invaluable for re-evaluating ideas rejected once, because the evolving design might have solved a technical problem that previously prevented an idea from being usable. The SMP working design document also would be valuable as a guide for future enhancements to SMP.

Critical to SMP was the requirement for a new type of synchronization method throughout the VMS kernel that would synchronize multiple processors. In a sense, the asymmetric multiprocessing (ASMP) VMS design merely had put a lock on kernel mode and allowed only the primary processor to acquire that lock. It would have been possible to use the same strategy under SMP; i.e., having a lock on kernel mode but allowing any processor to acquire that lock.

However, the VMS engineers believed that such a design wouldn't have provided performance much better than that of ASMP. They had plans to provide a high level of parallelism, allowing processors to execute different portions of the executive at the same time. For example, a process adding a system-wide logical name should be able to execute on one CPU, while another CPU handled a device interrupt for completion of a disk I/O request.

Synchronization In VMS

The original VMS V1.0 design used two types of synchronization: raising interrupt priority level (IPL) and mutexes.

The VAX architecture provides 31 IPLs; 1 through 15 are dedicated for use by software, and 16 through 31 are reserved for hardware. IPL 0 isn't really an IPL; rather, it's the level at which user, supervisor and executive mode programs execute.

VMS blocked different types of system events by raising IPL above the level at which that event occurred. For example, process rescheduling was done via an IPL 3 software interrupt. Code threads that modified a process' context always executed at IPL 3 (or higher) to prevent a reschedule. Another example is the manipulation of device controller registers, done at the device's hardware interrupt level, thus blocking out less important system activity, while the time-critical code path was executed.

The second type of synchronization method, mutexes, was used to lock software constructs, such as global section descriptors. Mutexes provided a mechanism for defining many locks without assigning a unique software IPL to each one. A mutex was acquired by the operating system on behalf of a process and was owned by that process. Rescheduling could occur while a process owned a mutex, but process deletion couldn't. Deadlocks, where a process of higher priority attempted to acquire an owned mutex, were avoided by making the second lock request put the requesting process into a wait state.

In a multiprocessing system, each VAX CPU has its own interrupt priority level, independent from that of the others. Thus, raising IPL would synchronize on a single CPU but not across the entire system. Mutexes were not viable because they could be used only within process context and at low IPLs. The SMP team created a new VMS mechanism that it named a spinlock. Places that VMS previously synchronized by raising IPL would have to be changed to acquire a spinlock; places where VMS lowered IPL now would release a spinlock.

The design for spinlocks included some critical concepts:

1. The spinlock would have to be owned by a CPU, not by a process as mutexes are.
2. Each spinlock would be acquired and released at a particular IPL that's associated with that spinlock. This would block other activities from interrupting time-critical code.
3. CPUs would spin-wait when they blocked for a spinlock resource held by another CPU, because spinlocks would be assigned to time-critical resources

that couldn't be locked for long periods of time.

4. The design of spinlocks must include a mechanism for deadlock detection, because the debugging of hung systems would be too costly during the development cycle. Therefore, each spinlock was assigned a rank. Spinlocks have to be acquired in order of rank, making deadlock detection simple.

Another debugging aid was built into the spinlock design: A part of each spinlock data structure was set aside to hold the last eight PCs that acquired or released each spinlock. These consistency checks proved invaluable in determining interactions between different components in the VMS kernel, such as memory management and scheduling.

The actual locking of a spinlock is accomplished with an interlocked test-and-set memory operation, the Branch on Bit Set and Set Interlocked (BBSSI) instruction. The spinlock interlock bit is contained in a separate byte within the spinlock structure. The unlocking of a spinlock is done with the inverse Branch on Bit Clear and Clear Interlocked (BBCCI) instruction. These interlock operations are atomic memory transactions for all processors in a VAX multiprocessor configuration. Because memory is common to all processors, the interlocked memory test-and-set operations provided a sufficient method of extending synchronization to all processors within a multiprocessor system.

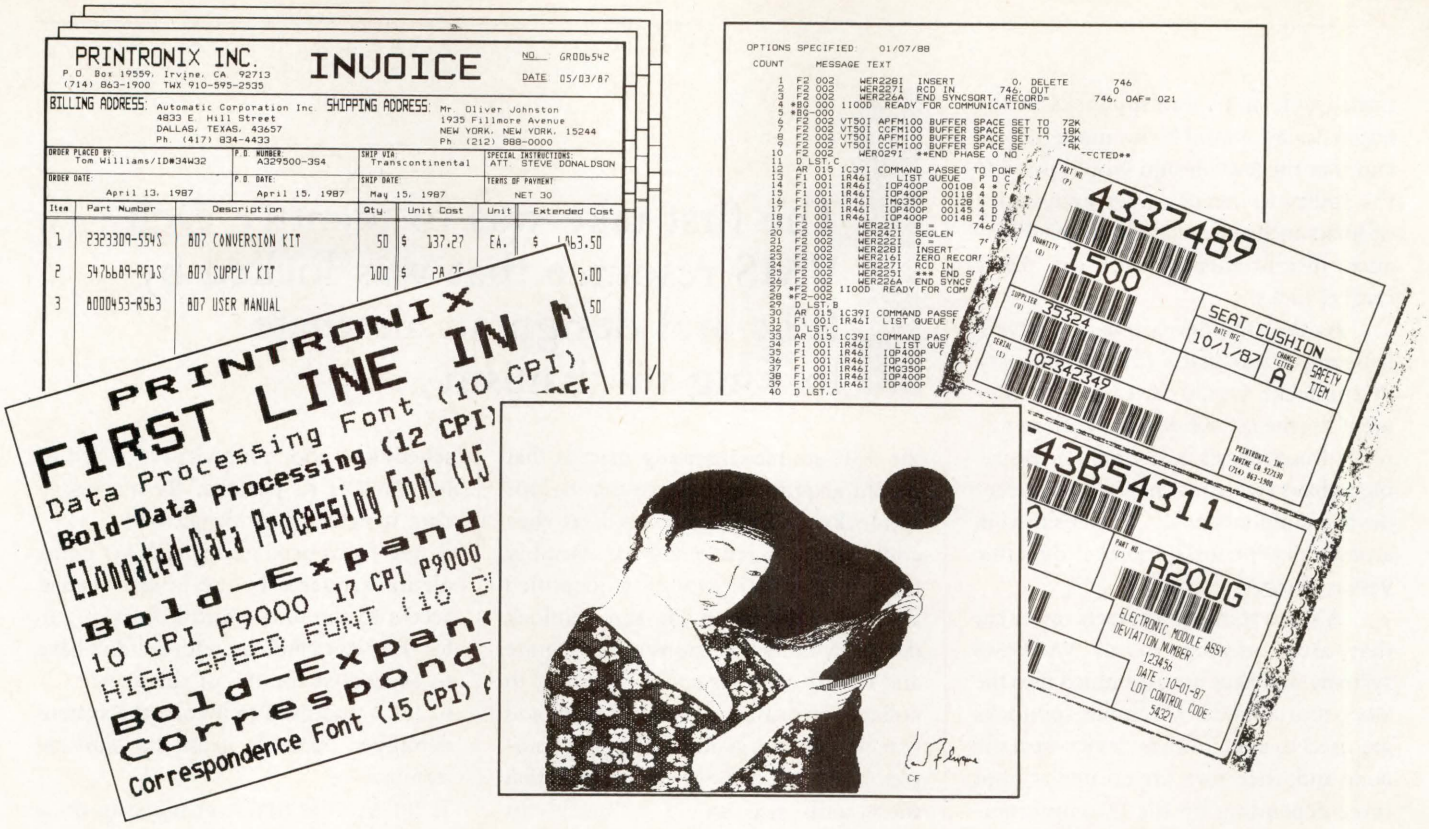
The SMP design also allows for optimizing the routines that acquire and release spinlocks for systems that are single CPUs. On a single CPU system, the spinlock acquire and release routines never are called; instead, only a move to process register (MTPR) instruction is executed to raise IPL. System performance of a single CPU has been measured as only a tiny percentage different from that of VMS V4.x.

The mutex synchronization method still was needed for locks that would be held for long periods of time and for when IPL had to be lowered. Mutexes still would be owned by processes, not by CPUs.

Granularity Of Spinlocks And Devicelocks

One of the aspects of the SMP design that would have direct impact on the performance of the system was the granularity of the spinlocks. A coarser granularity (fewer spinlocks) would be easier to implement and debug; however, it would provide fewer synchronization points with longer blocking of the processors. A finer granularity (more spinlocks) would provide more parallelism and shorter blocking times; however, it would be more complicated to design and implement and would require more synchronization points.

The SMP team decided that a



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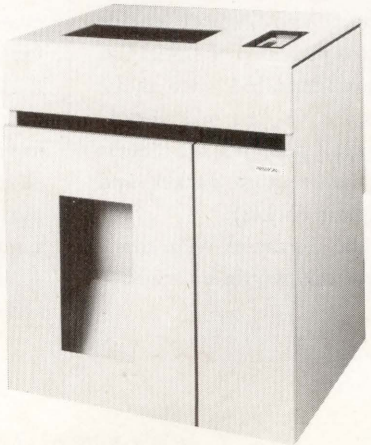

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manageable number of spinlocks for the initial design would be no more than 32 and that the SMP design would provide the ability to create a finer granularity of locks in future releases, as performance measurements identified time-critical locks.

As the SMP development evolved, it became clear that a finer granularity of spinlocks would be easy to implement for the I/O subsystem. With multiple BI buses possible, it would be possible to have two CPUs handling different devices simultaneously. This resulted in a new concept for spinlocks: dynamic versus static.

A static spinlock protects resources that are common to all VAX/VMS systems, and thus are assembled into the VMS source code. Dynamic spinlocks are used to synchronize device-specific code and, therefore, are created at boot time, depending on the I/O configuration of the particular system.

In other words, the number of dynamic spinlocks varies from system to system, while the number of static spinlocks is consistent across all systems. The dynamic spinlocks used to lock particular devices were named device-locks by the SMP team to differentiate them from the static spinlocks. A DEVICELOCK is used wherever device-specific code previously raised IPL to a device's IPL to block interrupts.

Converting To The New Synchronization Design

The first task was to identify each VMS resource that was locked by IPLs and design an alternate locking mechanism; i.e., spinlock, mutex, interlocked queue, etc. Scanning the VMS sources for all references to the SETIPL, DSBINT (disable interrupt), and ENBINT (enable interrupt) macros provided an initial list. All queues were identified, such as the packet queues for various size allocations of non-paged pool (IRP, I/O request packet; SRP, small request packet; and LRP, large request packet).

After all the resources were identified, modifications would be made to the VMS sources inserting macros that would acquire and release the various spinlocks. Macros were used, as they could be changed easily at assembly time, if the SMP evolution identified other enhancements to the spinlock design. Modified versions of the acquire and release routines could be loaded to collect performance statistics or to add consistency checks for debugging complex problems. The SMP team noted that these tools also would be useful for customers debugging user-written device drivers.

The first take was to identify each VMS resource that was locked by IPLs and design an alternate locking mechanism . . .

IPL Usage

In trying to determine what spinlocks were required, the SMP team first examined the IPL usage for synchronization in VMS. Here's how VMS used the various IPLs:

1. IPL 0 was used by kernel-mode programs that needed to access data structures readable only in kernel mode, such as the MONITOR performance measurement utility.
2. IPL 1 wasn't used.
3. IPL 2 was used for delivery of asynchronous system traps (ASTs) to a process. Code that had to examine the current process' structure, namely the process control block (PCB), executed at or above this IPL; the process could not be deleted, because process deletion occurs via an AST. Page faults can be taken at IPL 2; thus, code that examined pageable data structures had to execute at IPL 2 (or lower) to be able to take page faults. The allocation of paged pool is one example; it would have to be protected with a mutex.
4. IPL 3 was used to request a process schedule or reschedule event. The scheduling code immediately raised to IPL SYNCH to perform the necessary data structure synchronization.
5. IPL 4 was used to dispatch I/O completion requests that no longer needed access to the unit control block (UCB) for the device and, therefore, didn't have to execute at the IPL of the device.
6. IPL 5 was used to invoke the system debugger, XDELTA, from the console terminal.
7. IPL SYNCH (IPL 7, changed to IPL 8 in VMS V4.0) was used to synchronize most of the VMS data structures, such as the memory management database.
8. IPLs 6, 8, 9, 10 and 11 were the fork IPLs. I/O completion work was broken into two pieces: device handling that had to be done at device IPL (20 to 23) to correctly lock out other device activity, and post processing that was less time critical and could be done at a lower IPL. Fork IPLs were used for the second half of the I/O completion work.
9. IPL 14 was used on the ASMP system for XDELTA instead of IPL 5.
10. IPLs 16 through 31 are the ones assigned by the VAX architecture to hardware. Devices interrupt at IPL 20, 21, 22 or 23, depending on the particular device. Power fail interrupts occur at IPL 30; thus, some VMS code executes at IPL 31 to block powerfail interrupts.

Static Spinlocks

The next step was to determine the databases in VMS and the resources that they locked: memory management, scheduling, non-paged pool, the I/O database, the file system, the timer queue, etc. The list quickly grew larger than the number

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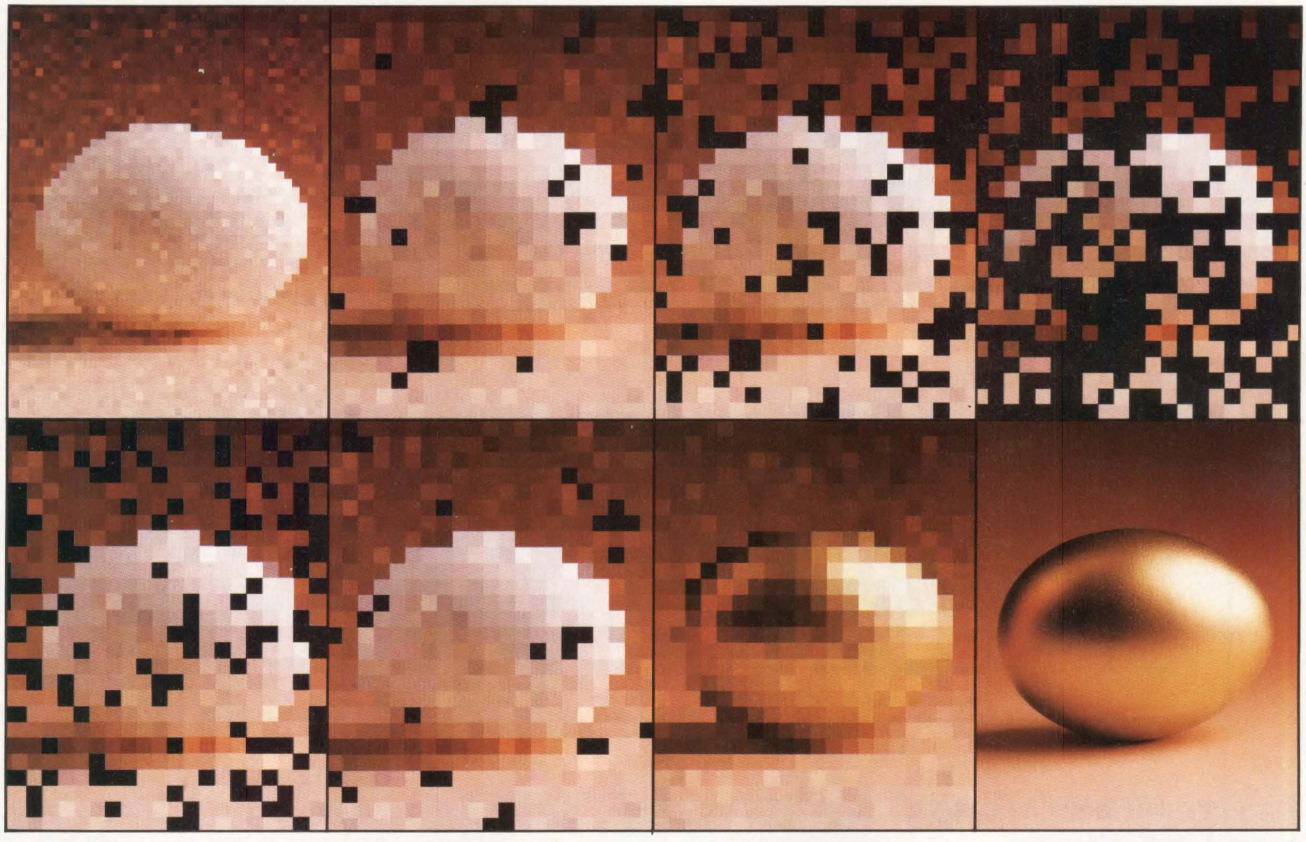

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of software IPLs available, making it clear that a number of spinlocks would have the same IPL.

IPL SYNCH had protected a large number of resources and would be a good candidate for a finer granularity of spinlocks. Where VMS code previously had raised IPL to SYNCH, the SMP team would have to determine if one or multiple spinlocks needed to be acquired.

In summary, IPL SYNCH became the following spinlocks:

1. FILSYS — File system structures (such as FCBs and WCBs).
2. IOLOCK8 or SCS — Fork IPL 8 (including SCS-related code such as the cluster connection manager, lock manager, etc., and map registers, datapaths and BDTs).
3. TIMER — Timer queue entries.
4. MMG — Memory management, PFN database, swapper, modified page writer.
5. JIB — Portions of the job information block (JIB).
6. SCHED — Process control blocks, scheduling database, acquisition/release of mutexes.

Each fork level also had its own spinlock: QUEUEAST (for IPL 6), IOLOCK8 (for IPL 8), IOLOCK9, IOLOCK10 and IOLOCK11. Other IPL 11 spinlocks were created for non-paged pool acquisition and release (POOL) and sending messages to mailboxes, such as for operator communication (MAILBOX).

System time was a tricky area that took much design. It was implemented through a hardware clock spinlock (HWCLK) that protected the system time quadword and the first timer queue entry, in addition to the TIMER spinlock that protected the timer queue. (This queue couldn't be implemented as an interlocked queue, because entries only can be inserted at the head or tail of an interlocked queue, and the timer queue is ordered by expiration time.)

The HWCLK spinlock is unique because it's the only static spinlock whose IPL is assigned at boot time. This is because different VAX processors have implemented the hardware clock at different IPLs, some at 22, others at 24.

A few other spinlocks were created, as other areas requiring locking were identified. Two examples are INVALIDATE for translation buffer invalidation and EMB for error logging buffers.

I/O Subsystem Synchronization

The original VMS I/O subsystem design used two main concepts for synchronization: device IPL and fork IPL. The device IPL is the level at which the device interrupts occur. To synchronize access to the device controller registers, VMS device driver code raised IPL or executed at the device IPL to block out

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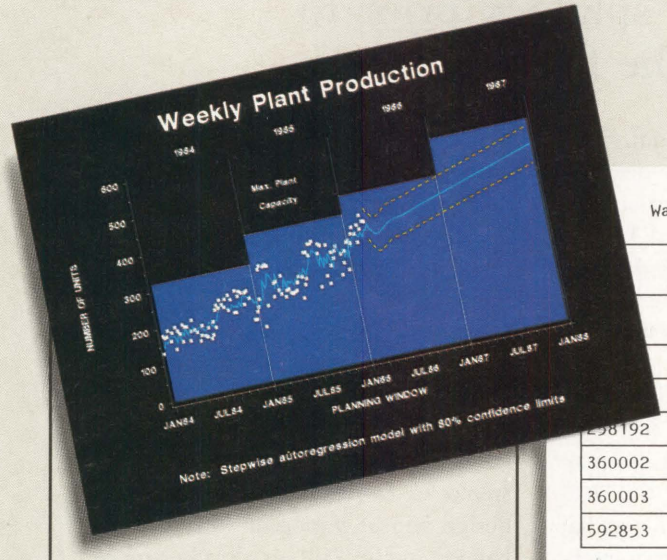

Warehouse Inventory Report - 16JAN87

	Quantity on Hand	Quantity on Order	Projected Reorder Date
	123980	10000	THU, FEB 12, 87
	89450	5000	FRI, FEB 20, 87
298192	20110	1000	MON, MAR 30, 87
360002	8585	0	TUE, FEB 10, 87
360003	15985	500	TUE, FEB 10, 87
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* Computer Intelligence, January 1986.

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other device activity. Executing at such a high IPL blocks almost all other system activity too, so high-IPL code must be kept to a minimum for optimal system performance. The process of forking solved this problem.

Only a few VAX instructions need to be executed at device IPL during I/O completion. The rest of the code can be executed at a much lower IPL, allowing time-critical device interrupts to be handled for other devices. Forking is the process by which a code thread saves a small amount of context in a block of memory and places that block on a queue for further execution at a lower IPL. This fork process also provides a mechanism for synchronizing with other code that executes at the lower fork IPL.

Under SMP, both device IPL and fork IPL execution still are needed. However, because IPL doesn't provide synchronization across CPUs, spinlocks would be required. The behavior of the VMS device drivers was investigated to identify other design requirements.

Three cases were identified where a VMS driver must execute at device IPL:

1. In its interrupt service routine, when completing an I/O request.
2. In the fork thread raising from its fork IPL, to synchronize with the interrupt service routine, when initiating an I/O request.
3. During a device timeout, to synchronize with the interrupt service routine.

From these three cases, it became clear that two categories of spinlocks would be required: for device and for fork levels. The design would have to allow acquistion of a device spinlock (devicelock) while holding a fork spinlock (forklock), to provide synchronization between fork threads and interrupt service routines. An interrupt service routine usually doesn't need to hold a forklock. However, it may have preempted a thread holding the forklock, or a fork thread may be running in parallel on another CPU. Therefore, the interrupt routine may not modify any field in the VMS I/O subsystem database for that device, called the unit control block (UCB), that's protected by the forklock. If modification of any database protected by a lower IPL is necessary, the interrupt service routine must fork first.

Forklocks provide a mechanism for the fork dispatcher to implicitly acquire the spinlock prior to executing the fork thread.

A devicelock primarily synchronizes the access to the device or adapter registers. However, it also may synchronize some storage in the UCB (or some other data structure) for special devices. The first action in every interrupt service routine must be to acquire the appropriate devicelock. Devicelocks are dynamic spinlocks created for each channel request block (CRB) at boot time. By creating a unique spinlock for each CRB, VMS can use the multiple processors to execute interrupt service routines for different controllers in parallel.

Forklocks provide a mechanism for the fork dispatcher to acquire implicitly the spinlock prior to executing the fork thread. This synchronizes fork threads and device timeout routines with each other.

Other VMS SMP Changes

Many other aspects of VMS had to be changed to handle the new SMP functionality, including:

1. Booting and startup of secondary processors.
2. Powerfail recovery procedures.
3. Shutdown and bug check.
4. XDELTA, the system debugger.
5. CPU data structures.
6. Console terminal synchronization (device affinity).
7. VMS executive coding mechanisms that locked pageable code in memory (also known as poor man's lockdown).
8. Error logging.
9. Scheduling and process affinity.

The list is tantalizing. If you'd like more information on SMP, attend a DECUS symposium. VMS SMP designers will be doing several presentations on various aspects of SMP.

The key to the VMS SMP design is the new synchronization primitives; i.e., spinlocks. The flexibility of the spinlock design will be important in future enhancements to SMP, as already proved in the evolution from static to dynamic spinlocks.

Granularity is an attribute of spinlocks (serialization points) that must be factored into the design of any multiprocessor system. Each spinlock represents, at most, a single thread of execution.

In other words, each section of code protected by a spinlock can be executed by only one processor at a time. If two processors attempt to access the same section of code (critical region), only one processor will proceed while the other(s) spin wait. The ability to increase the number of spinlocks will prove invaluable in future enhancements to SMP, as performance measurements indicate ways to improve the current granularity of spinlocks. *—Kathleen D. Morse and Rodney N. Gamache are consulting software engineers for Digital Equipment Corporation, Nashua, New Hampshire.*

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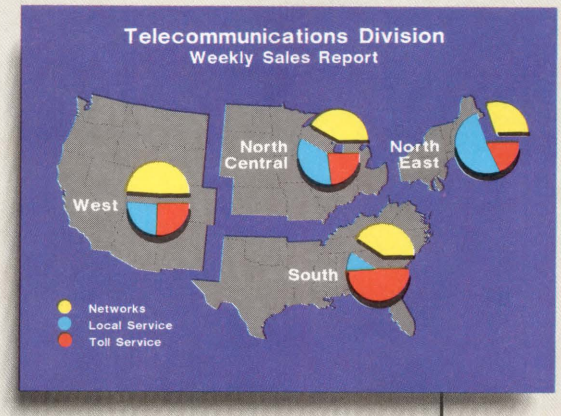

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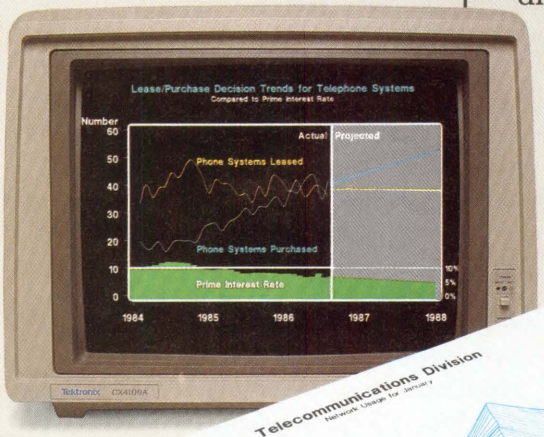

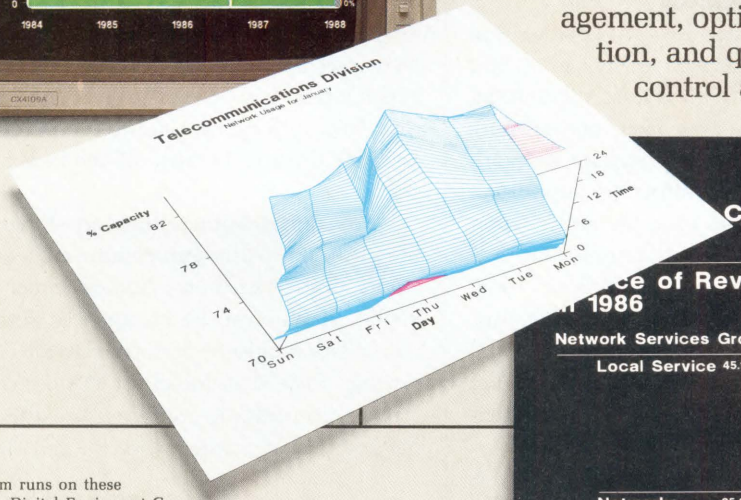

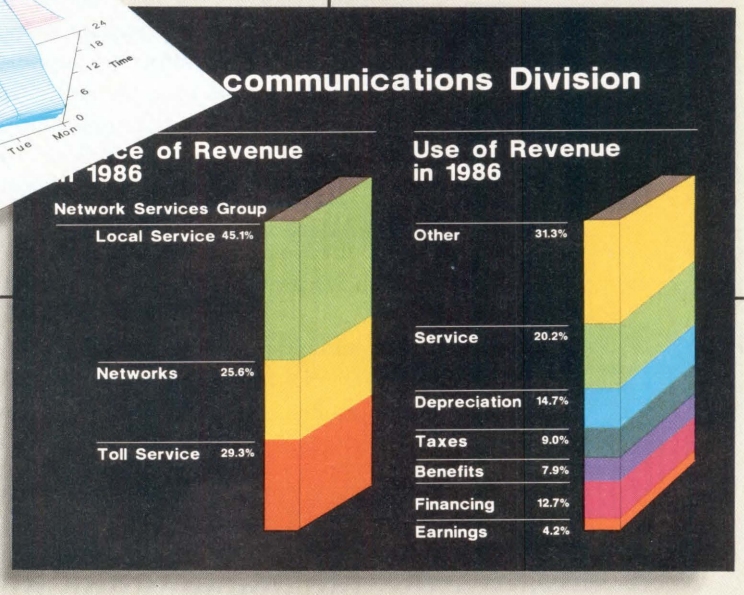

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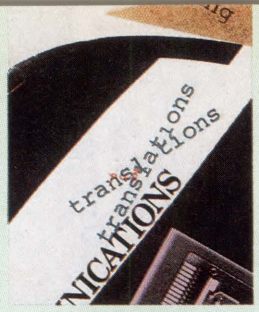

COMMUNICATIONS

Poly-STAR/240

By David B. Miller

PC-To-VAX Communications With Polygon's *Poly-STAR/240*.

Poly-STAR/240, from Polygon Inc. of St. Louis, Missouri, allows PC-to-VAX communications by emulating DEC VT52, VT102, VT125, VT220 and VT240 terminals. Also, it provides facilities for both text and non-text file transfers as well as the following features:

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6. VT240 ReGIS graphics emulation.
7. Multiple sessions.
8. Script files to perform activities automatically.
9. LAT support for network activities.

Installation And Setup

For this review, I tested *poly-STAR/240* version 1.1. Hardware requirements include an IBM PC XT/AT or compatible with at least 512 KB RAM, PC MS-DOS version 2.0 or later, one or more serial ports and/or an appropriate network card. CGA and EGA monitors are supported. An IBM monochrome monitor and adapter may be used if graphics aren't important. Additionally, an UltraPAK board from Tseng Laboratories of Newtown, Pennsylvania, allowing 132 columns can be installed. Installation required establishing appropriate hard drive subdirectories and following the installation menu.

Communications support includes drivers for Hayes and compatible modems, DF03s, Scholar modems and DEC's MiniExchange. Also, you may define your own modem settings. Keyboard support defaults to standard U.S. layouts. Other hardware support settings primarily refer to monitor-type and keyboard-type determination. PC, PC/AT and enhanced PC multiple COM ports can be configured. Color mapping setup allows definition of background, foreground, border colors, etc. Attributes for reverse, blinking and boldface characters are established from the emulator attributes menu. Hotkey sequences can be customized to permit fast exit to DOS and *poly-STAR*. *Poly-STAR* needs to know the level of help to include and the number of multiple sessions allowed at any one time. If you don't have network support, a COM port is required to handle each session.

If you're a member of the "deprived of hard disk set," installing the program on floppies may present a challenge. The installation instructions had a definite hard disk tone and were unclear about floppy systems; a little experimentation is needed to get it right. You may have to forget installing the online help and LAT features because of the lack of disk space.

All configuration settings are stored in the file STAR.CFG. Although parameters for menu colors, display attributes, hotkey sequence and keyboard type can be changed as desired, a reinstallation must be performed to affect other settings. *Poly-STAR* looks for STAR.CFG upon startup, so multiple configuration files must have different names and be renamed to

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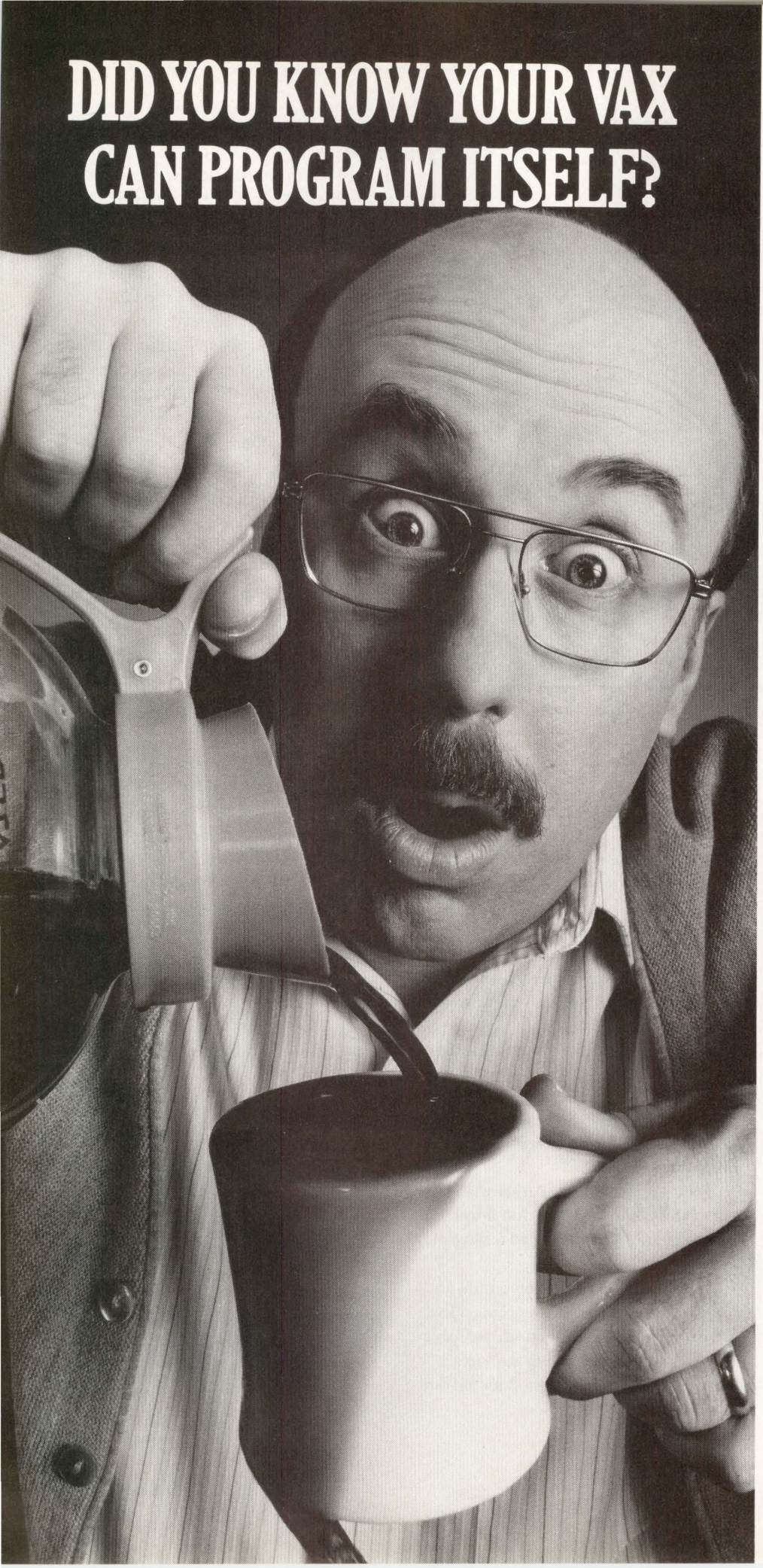

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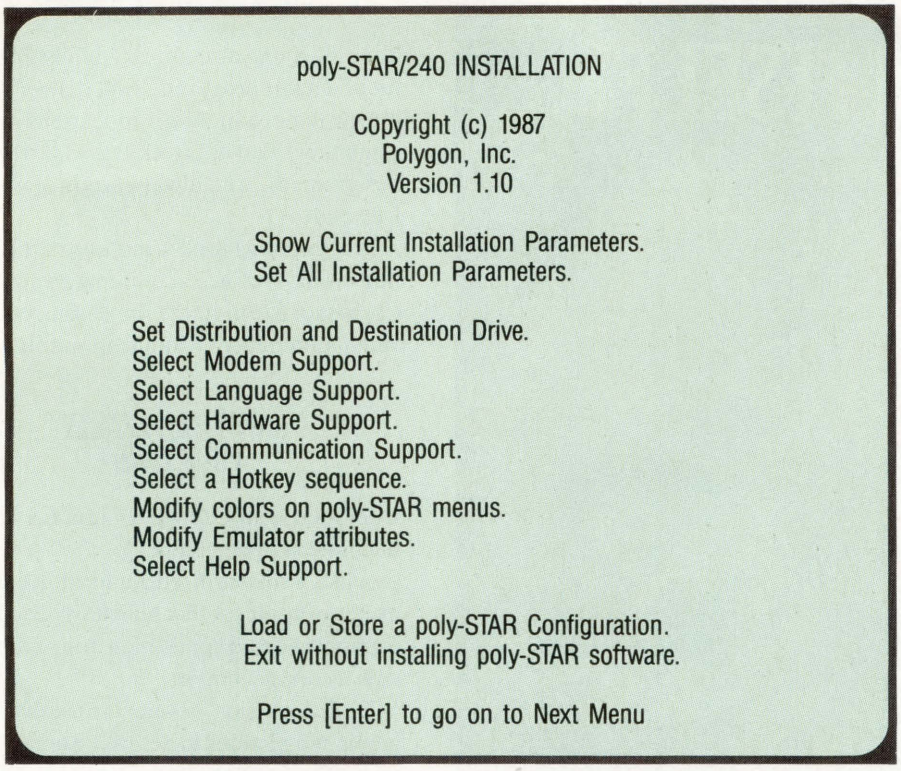

Screen 1:The Installation menu displays a variety of changeable initial parameters.

STAR.CFG should you need a different set of initial parameters.

Because only one configuration file is allowed, *poly-STAR* permits multiple setup files to be defined and stored on the disk. Before beginning a session, you may wish to invoke a setup created during a prior session. Setup files govern such items as communications, file transfer and printer parameters as well as key definition and emulations options. Before exiting STAR, the current setup, if not already saved can be stored to disk, making it convenient to get started in future sessions with less hassle.

Emulation

Typing STAR<CR> or STAR/s<setup file name><CR> at the DOS prompt gets things going and displays the main Activity menu.

As packaged, *poly-STAR* comes ready to communicate with a VAX through the COM1 port and assumes no modem.

As you make choices from Activity menus, *poly-STAR* uses windows to display them. The windowing system seemed clumsy to me. For example, to connect to my host VAX by modem:

1. I chose the Dial/Connect menu from the main menu. A second window appeared on the screen.
2. I chose "Dial the number shown above." I had this set up in a setup file, so it was already there; otherwise at that point, I would have had to go back and load a setup file or enter the phone number.
3. The VAX was dialed. Rather than being dumped into emulation mode, a third window was displayed telling me to press any key.
4. I still wasn't in emulation but instead back in the Dial/Connect menu. How to get out? The only exit choice available was, "Exit without taking any action." That didn't make sense, but it let me out of the current window with no major problems.
5. Still not in emulation, I was returned to the Main Activity menu. I moved the cursor back up to Terminal Emulation, which gave me the familiar almost-blank screen with status line. A couple of RETURN keys later and the familiar Username: prompt appeared.

This is too many steps. I found the same pattern of slight inconvenience surfaced for other activities such as file transfer. Some of these steps can be eliminated, or mouse support can be included. Pulling down and clicking is easier than repeatedly tapping the cursor keys.

As an alternative to the windowing system, a Command Window can be displayed where commands that perform the same functions available through the regular windowing system can be entered. If you can remember the essential commands or can read the manual quickly, this method will save time.

Once emulation started, *poly-STAR* performed well. The documentation contains tables of keys to help you find your way around the PC keyboard. The keyboard resembles the VT220 in regard to physical key placement. This means that two keys identically labeled between the two keyboards (e.g., F1) can't perform the same function. VT220 users may be thrilled, PC keyboard users may find it confusing.

If Polygon's keyboard layout doesn't suit your needs, the program KTEDIT, supplied with the distribution, can be used to redefine it. All keys, ex-

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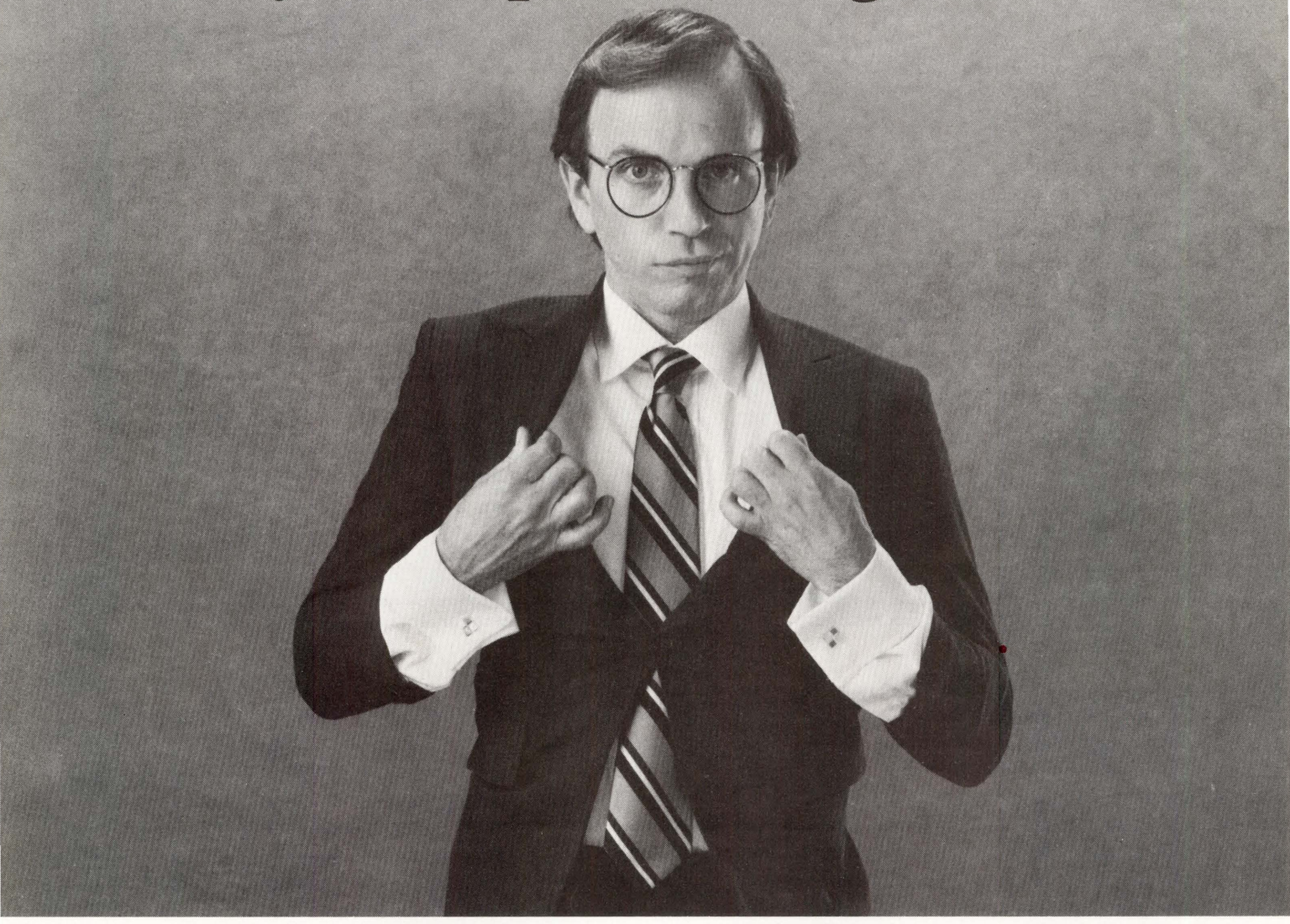

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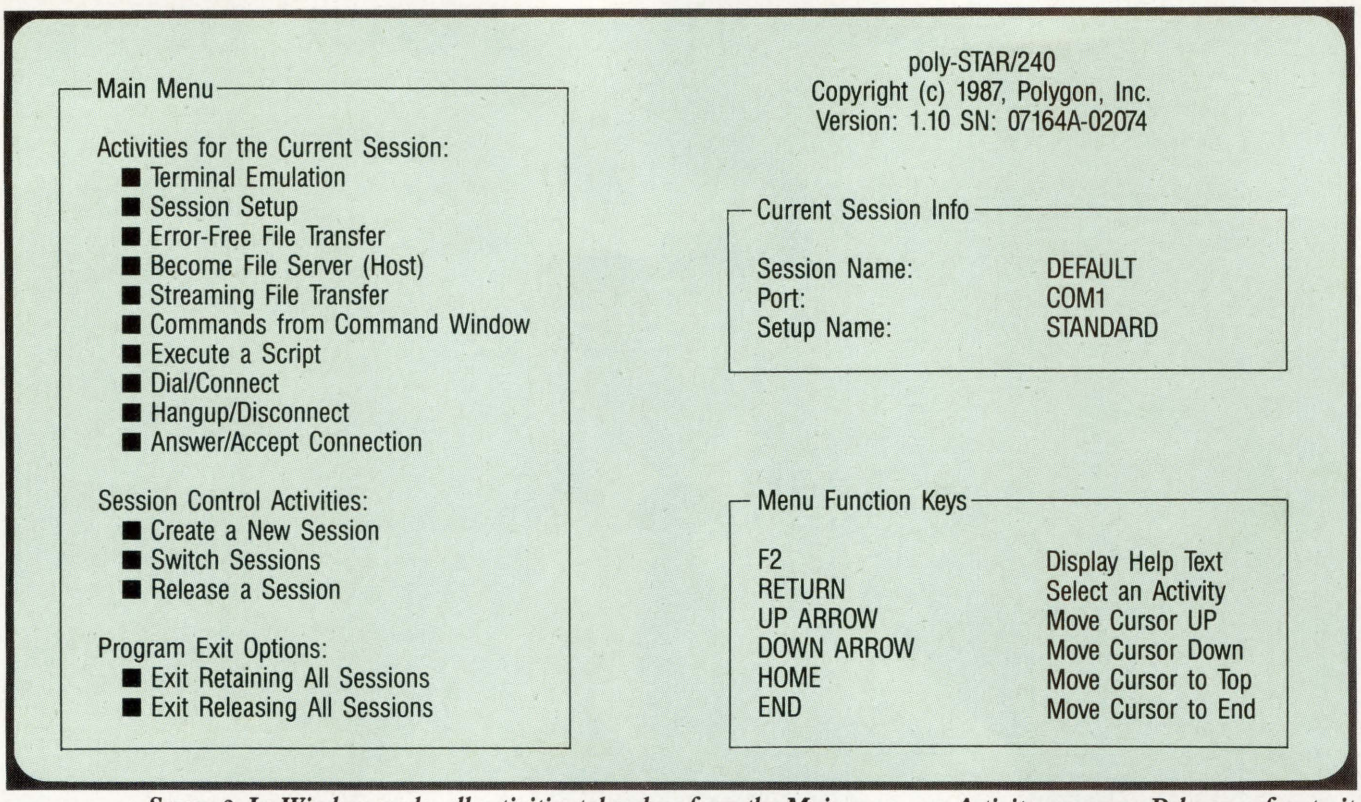

Screen 2: In Window mode, all activities take place from the Main menu, or Activity menu as Polygon refers to it.

cept SHIFT, CTRL, ALT and CAPS LOCK, can be redefined. Keys can be defined to represent single or multiple keystroke combinations. Key definition files then are saved to the disk. Before STAR uses the file, it must be renamed to the file designation recognized by the program. For example, the standard English keyboard initially is called ST_ENGUS.KBD.

A few display differences also exist. In regard to text, STAR will use color to indicate certain combinations of attributes such as bold, underline and blinking characters. Rather than jump and smooth scrolling, STAR provides fast and slow jump scroll. User-defined characters must be viewed in text and graphics mode rather than text mode only. Double-high and double-wide characters are displayed as normal characters with one space after and one blank line below.

In regard to graphics, images may not appear exactly the same between a VT240 and a PC. Images won't scroll off the screen. Normally, oversized text cells are filled with the background color, but may sometimes be filled with the foreground color in that row if the leftmost pixel is on. ReGIS error reports and Tektronix emulation aren't supported by STAR. Other features not supported include the ReGIS Polygon fill command, color graphics printing or the expansion, and compression or rotation of printed output.

Because an entire VT240 graphics screen won't fit on a PC screen, *poly-STAR* provides key combinations to shift the display to different sides and/or quarters. For example, ALT-F8 in text mode shifts the PC screen between column 1 to 80 display and column 53 to 132 display. More options are provided in Graphics mode, allowing for screen shifting to top and bottom, left and right or up and down, and left and right shifting.

File Transfer

Streaming file transfer requires logging onto the host; opening an empty file; choosing the direction, either Transmit or Capture; entering an appropriate file name and beginning the action. Again, I feel there are some intermediate keystrokes such as exiting the transfer menus to start the transfer that could be eliminated. But overall, the transfers went smoothly.

To transfer non-text files, Polygon's HST program, which responds to STAR

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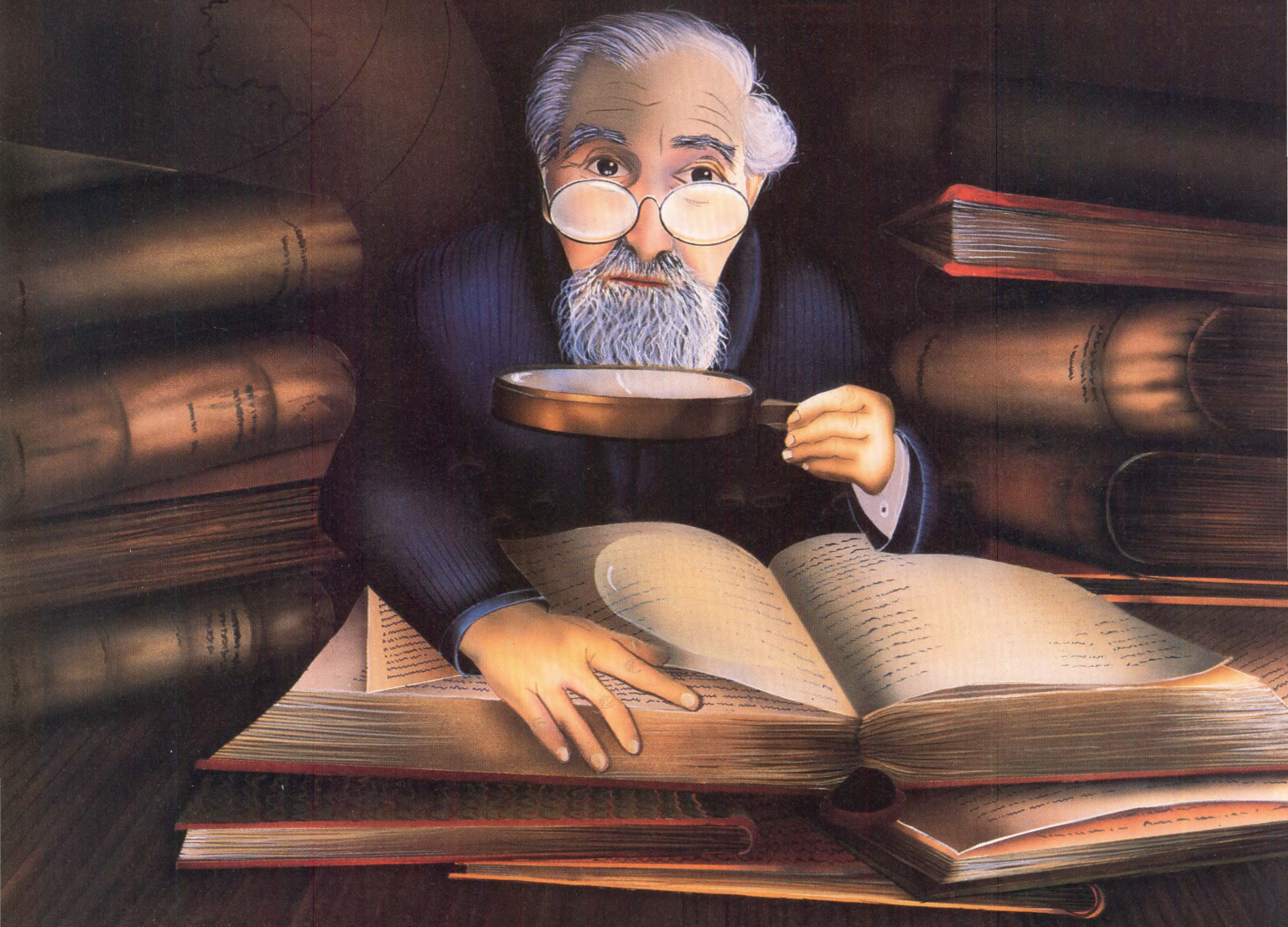

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STATUS

You Have It Or You Don't

Commands are available to support looping, decision making and subroutine-like calls, and specialized commands that check for character strings on the currently displayed screen . . .

transfer commands, must be installed and activated on the host machine. This also went smoothly. It would be nice though, to include some support for XMODEM and KERMIT protocols, because they're so widely used. Granted, there are a lot of KERMITs out there, but settling on a standard format, shipping it with the software and making it a part of the program would be a nice touch.

Script Files

To avoid repeating commands, Polygon supplies a programming capability to create script files. These may be executed to perform such tasks as logging onto a host computer or performing unattended operations such as file transfers.

Commands are available to support looping, decision making and subroutine-like calls, and specialized commands that check for character strings on the currently displayed screen, network connections, create log files, connect, dial, etc. Script files also may be nested. The VAXLOG.SCR script file distributed with the software is shown in Program 1.

LAT Support

With LAT support and an Etherlink board from 3Com of Santa Clara, California, or DECNET-DOS and appropriate Ethernet board, the network world opens up. *Poly-STAR* allows you to connect to any available service using the same menu as dialup connection.

Poly-STAR listens to the Ethernet line and builds up a directory of services to which you can connect. One disconcerting feature is that nodes and services are displayed on a menu whether they are available or not. I knew that two out of three nodes on my network weren't available, but the LAT option displayed them as possible connections anyway. I tried to connect to them from *poly-STAR*'s command window but didn't get the bad news until trying to log on. An update of the available services would help.

With all things being equal, if a node is available, LAT support works fine and I experienced no problems with it.

Documentation

The D-ring-bound documentation is written clearly, although it pays to look for and read any Readme files on the distribution, because they contain some corrections to errors in the documentation.

Supplied appendixes include an extensive troubleshooting list and technical notes describing procedures for using attached printers, requirements for printing DEC-line drawing characters and miscellaneous information on modems, keyboards, etc. Another appendix describes differences between VT220/240 terminals and the emulation. Last, Polygon-specific escape sequences are listed.

For new users, a helpful glossary of STAR program and general communications terms is included.

The user interface could use some streamlining and XMODEM and/or KERMIT support should be included, and perhaps PC disk-on-a-VAX capability, but *poly-STAR* performed well in regard to emulation, file transfer and network support. If you're shopping for VT terminal emulators, *poly-STAR* deserves a second look. *—David B. Miller is associate director of computer services at Beaver College in Glenside, Pennsylvania.*

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PROGRAM 1.

```
SET SCRIPT AUTO                          /* Remove these two commands to see the */
LOG SCREEN OFF                           /* script commands as they are executed */
UPDATE COMMAND DISPLAY ONLY              /* display the command window only */
FOR 3                                    /* make 3 attempts to log on */
  SEND "^M"                              /* send 1 carriage return */
  IF RECEIVE "Username:" THEN NEXT AFTER 0:0:20 DO RETRY
                                         /* wait 20 seconds for the Username prompt */
DISPLAY "Username:"
SEND INPUT()                             /* type login name */
SEND "^M"                                /* send carriage return after name */
IF RECEIVE "Password:" THEN NEXT AFTER 0:0:20 DO RETRY
                                         /* wait 20 seconds for the Password prompt */
DISPLAY "Password:"
SEND INVINPUT()                          /* type invisible password */
SEND "^M"                                /* send carriage return after password */
IF RECEIVE "$$" THEN LEAD AFTER 0:0:20 DO RETRY
                                         /* wait 20 seconds for the DCL prompt */
  RETRY:
ENDFOR
DISPLAY "LOGIN FAILED"                   /* display on screen */
DISPLAY "PRESS [RETURN] TO CONTINUE"
DISPLAY INPUT()
RELEASE ALL SESSIONS
BYE                                      /* exit program */
LEAD: DISPLAY "LOGIN COMPLETED"
EXIT                                     /* exit script */
B>
```

VAXLOG.SCR - Login script for a VAX/VMS host computer.

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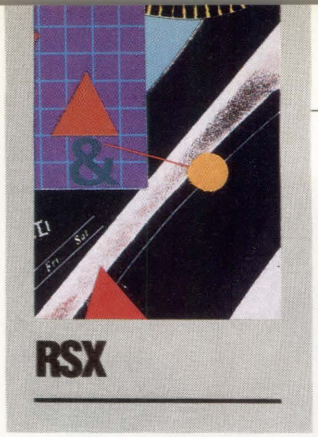

RSX

PLAY BALL!

By John Bredesen and Randall Newcomb

Task-To-Task Communications Between Processes On The Same Or Different Nodes Is Under The Guidance Of The 'Umpires.'

Departmental computing and its distributed data requirements increase the need for program-to-program communication between multiple network nodes. Unfortunately, it can be difficult finding programmers who have experience in DECNET programming. Also, there's a lot of maintenance and performance overhead for each application. This article will discuss the consequences of one solution to this problem: a message bus system, called BALLGAME, that has a simple programming interface.

Functional Software, of Minneapolis, Minnesota, has three clients, each with substantially different hardware and applications, but with similar DECNET communications problems.

Client A markets and supports systems for optimized data storage and retrieval. Its application is written in MACRO-11 and runs on PDP-11s running RSX-11M+. It uses a non-RMS indexed file system layered on top of FILES-11. Each system supports approximately 70 users. When the number of users increases beyond 70, the system is configured to run on a small DECNET network (fewer than 10 nodes).

Client B has a very large, diversified manufacturing company with a sophisticated engineering information service organization that uses several large VAXCLUSTERs, a Local Area VAXCLUSTER and dozens of departmental MICROVAXs. All systems run VMS and DECNET with *Rdb* as the database system, and all databases reside on one of the central VAXCLUSTERs.

Client C is a manufacturer of durable goods. It uses a combination of PDP-11s and VAXs running RSX-11M+ and VMS. Its applications, written in FORTRAN, are used to track work-in-progress (WIP) in one of the manufacturing facilities. Each PDP supports approximately 40 users. The VAXs have a small number of users and are used to generate hard-copy reports.

A Common Problem

Before the development of BALLGAME, all clients wrote DECNET-specific code into applications. Most of the DECNET code was for file access. With the advent of distributed processing, each client found a need to have programs running on one system pass information to programs running on another system.

In client A's network, the data on each system in the network had to be identical; any data entered into one system had to be propagated to the other systems. The client needed a way to perform this information exchange in real time and with minimal changes to the existing single-system code. One approach was to implement a master/slave system; i.e., it would have different distributions for networked and single-processor systems, an expensive prospect in terms of support. A simple intertask communications system to coordinate data on the various nodes in a peer-to-peer implementation would provide a more supportable and cost effective solution.

Client B used *Rdb* to access databases on the central cluster. This, however, had the disadvantage of requiring a DECNET link for each process. Because management was committed to the concept of distributed processing, the number of applications requiring data access across the network was going to increase; network saturation was inevitable us-

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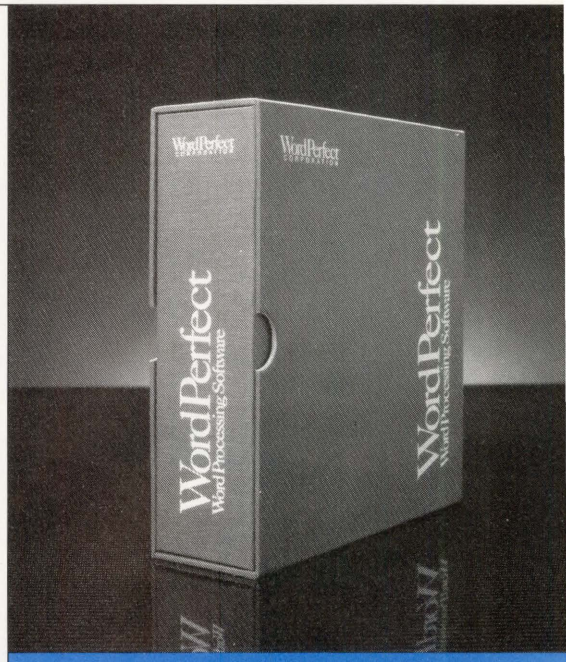

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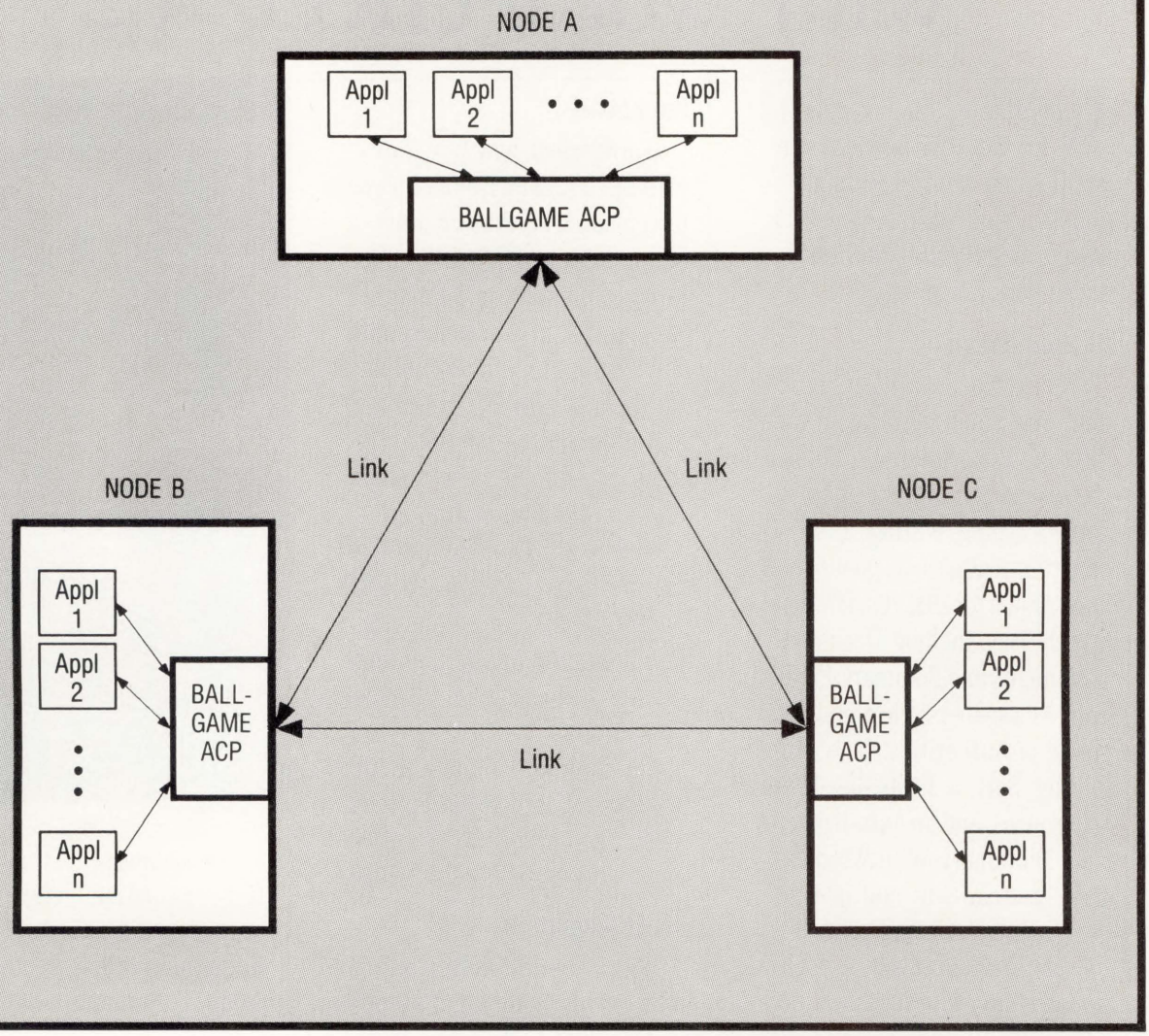
FIGURE 1.



Network communication between the Umpires.

ing this approach. Also, with as many as 100 users concurrently accessing a database, the *Rdb* code, with its many checks for locks and errors, was complex to write and support. Finding contractors and consultants with the necessary *Rdb* experience was difficult.

Client B's central cluster also had special accounts, some with proxy access, specifically for network access to the database. Therefore, all database activity appeared to be coming from one user account. The proxy accounts had the potential to compromise security and made it difficult to track who was accessing and modifying data in the databases. The concept of user programs communicating via a simple intertask communications system with database servers would minimize the number of network links and tighten database security by allowing individual accountability.

Client C used the PDP-11s for data input. The VAXs used data received every half-hour from the PDPs to generate reports. The PDP application was very I/O bound. Because of POOL limitations, each of the 40 users ran a copy of the input program which opened, wrote to and then closed the

> BALLGAME is derived from the concept of messages being *pitched* and *caught* by programs. *Play* between these programs is under the guidance of the *umpires.*

data collection files for each transaction. They planned to migrate the data input program to also run on the VAXs. They required an operating system-independent task-to-task communications facility.

BALLGAME Overview

Each client's application software required a message bus to allow tasks on different nodes to communicate. This facility needed to be callable from programs written in MACRO-11, MACRO-32, FORTRAN, BASIC or PASCAL, because the clients all wanted to do additional application development using the message bus facility.

BALLGAME was developed by each client as a general-purpose message bus to allow a task, or process in VMS terminology, to communicate with a task on any node in the network, including the same node as the caller. The name BALLGAME is derived from the concept of messages being *pitched* and *caught* by programs. *Play* between these programs is under the guidance of the *umpires*. The programmer has the option of making synchronous or asynchronous calls to BALLGAME.

Each client wrote a unique version of BALLGAME to optimize performance and supportability for his hardware and/or software environments. Though the implementations of BALLGAME are different, the basic concepts and benefits have been similar for all clients. We will focus on the RSX version in this article. For a discussion of a VMS approach to developing a message bus, read Glen Macko's article titled "Developing a Message Bus for Integrating VMS High-Speed Task-to-Task Communications" in the 1986 *Proceedings of the Digital Equipment Computer Users Society* (DECUS).

How BALLGAME Works

The basic concept of BALLGAME is that rather than having tasks on different nodes talk directly to each other, the task

FIGURE 2.

```
LOA ZZ:/PAR=GEN/HIGH    ! Loads the device driver
CON ONL ZZA,ZZ:         ! Adds it into the configuration
INS BALLGAME            ! Installs the ACP
ENA ZZ:/ACP=BALLGAME    ! Enables the driver
```

The driver is loaded into the system using MCR commands.

sends the message to an intermediate program known as the UMPIRE. The UMPIRE talks to the UMPIRE on the other node, and then the receiving UMPIRE forwards the message to the target task.

This means that regardless of the number of tasks communicating with each other, only one network link is required between any two nodes, because network communication is only between the UMPIRES as shown in Figure 1.

The RSX flavor of BALLGAME is implemented via the QIO executive directive and BALLGAME, an ancillary control program (ACP) that functions as the UMPIRE. The ACP talks with its counterparts on other nodes with DECNET. RSX BALLGAME consists of the application, the driver and the ancillary control program (ACP).

In RSX the application issues a QIO executive directive to read or write messages to the network using the logical unit number (LUN) of the BALLGAME device. The parameter list of the QIO contains the node and target task. These calls are passed to the driver.

The driver relocates the buffer addresses from the application's virtual address space (16 bits), to physical addresses (22 bits). Then, it passes the request to the ACP by placing the request in the receive queue listhead of the ACP. The driver activates the ACP if it's stopped or not executing. The driver is loaded into the system using the commands found in Figure 2.

The ACP

The ACP has three queue listheads that represent work left by the driver for the ACP to perform: the receive queue listhead; the write (WLB) listhead, referred to as WLBLHD; and the read (RLB) listhead, referred to as RLBLHD.

These are outstanding I/O requests from the application programs. When the driver passes a request to the ACP, the I/O packet is placed on the receive queue listhead. These are new requests to the ACP. When the ACP is activated by the executive, it checks the receive queue for new requests. If any are found, it processes them according to the associated function code. Table 1 contains a list of the modules in the ACP, along with a brief functional description for those who wish to write their own version of BALLGAME. The "Guide to Writing an I/O Driver" in the RSX documentation set it may help explain these actions.

Development Methods

The most fundamental change in program development since BALLGAME's inception has been the server/client con-

TABLE 1.

MODULE LIST	ACTION
SERVER	Main module. Dequeues packets from the driver. Calls other routines based on the function code.
SRVAST	AST to receive network control messages.
SRVCLN	Processes IO.CLN requests.
SRVCLR	Called by SRVAST to process network control messages.
SRVCON	Confirms a message when read by a local task.
SRVDAT	Data structures for entire program.
SRVDMO	Processes IO.DMO requests.
SRVDON	Completes an I/O request. Decrements data structures, call $IOIFIN, etc.
SRVERR	Prints status messages on console.
SRVINI	Initialization routine called at program start.
SRVMOU	Processes IO.MOU request.
SRVPCF	Called by SRVCON to issue a message to confirm a pitch locally.
SRVREC	AST called when network read completes.
SRVRLB	Processes IO.RLB requests.
SRVSND	AST called when network write completes.
SRVWLB	Processes IO.WLB requests.

A list of the modules in the ACP along with a brief functional description of how to write your own version of BALLGAME.

cept. The user program, referred to as the client, controls the user interface and talks to a server program that services the client's request and performs the requested task. Many clients can talk to one or more servers, and servers can talk to other servers. These applications can be thought of as being made up of two or more distinct parts operating in harmony. The client program can be doing something, such as displaying a form on a screen, while the server program is satisfying the client's database request. This rudimentary form of parallel processing may be effective in making the application appear faster.

With all the database-specific code located in the server, a non-database programmer can write the client code with database access provided through subroutine calls. A database programmer writes the server program and the subroutines that are used in the client program. In the event of a change in the structure of a database, the required code changes are isolated to the server. The client code doesn't need be changed as long as the subroutine interface is stable.

Because access to a resource occurs through a single server, the code in that server may be simpler to write, because many of the checks for resource locks are no longer necessary. Under some circumstances, such as fault tolerance requirements, this lock checking is left in to allow servers on separate nodes of a cluster to operate simultaneously.

In addition to the possibility of having more than one server running at a time, a decision needs to made regarding how quickly requests must be handled. A single-threaded server will process one request completely before servicing the next. The multithreaded server, on the other hand, processes many requests concurrently.

Single-threaded servers are the easiest to write and are best used when the requests can be satisfied quickly. Requests can queue up, so you must be careful to ensure that the requests can be handled in a timely fashion. Because most single-threaded servers function similarly, much of the code can be reused in future servers. All of the RSX client's servers are single threaded as are the majority of the VMS client's servers.

Multithreaded servers are more complicated because of the requirement of processing several requests simultaneously. These servers are used to process requests that may take longer to fulfill. They usually require the server to wait for an outside event such as communication with a foreign computer system or database requests that are large or complex.

By using BALLGAME asynchronously, you can increase the throughput of the server by servicing multiple requests simultaneously, even though the time to complete each re-

Subroutines Are Shareable With BALLGAME

BALLGAME allows subroutines to be shared by many applications on different nodes in the network. This reduces code maintenance by allowing these subroutines to be modified without relinking the applications themselves. The following example will make things more clear.

Assume that there's a routine that does some long, complex calculation on a large quantity of data based on two parameters that are passed to it.

```
CALL CALC (A, B, C)
        PRINT A;"*";B;" = ";C
    .
    .
    .
SUBROUTINE CALC ( X, Y, Z)
  ...
  long complex calculation possibly using remote data files ...
  ...
Z = result
RETURN
```

If this routine is needed by other systems and the developer has any interest in writing maintainable code, this subroutine CALC will be in a separate file and will be linked with the main program. Other applications that require this function link in CALC. Now suppose CALC needs to be changed because of either a bug or enhancement request. To get the benefits of this change, the developer must relink all applications and redistribute them to all machines. The developer could place the routine into a shareable image to remove the relink requirement, but it still must be redistributed to all nodes.

However, if CALC were part of a server on a central node, the change could be made and the new code distributed to one location, and all applications immediately would see the change. The application programs might access this routine as follows:

on the client node ...

```
CALL CALC (A, B, C)
PRINT A;"*";B;" = ";C
    .
    .
    .
SUBROUTINE CALC (X, Y, Z)
! Routine to load x, y, and z into msgblk along with instruction
CALL MSG_LOAD ("CALC", X, Y, Z, MSGBLK, MSGSIZ)
PITCH ("OTHER::", "CALC_PROCESS", MSGBLK, MSGSIZ)
CATCH ("OTHER::", "CALC_PROCESS", MSGBLK, MSGSIZ)
! Routine to unload x,y, and z from msgblk
CALL MSG_UNLOAD (command, X, Y, Z, MSGBLK, MSGSIZ)
RETURN
```

and on the server node ...

```
CATCH ("CALLER::", "CLIENT", MSGBLK, MSGSIZ)
! Routine to unload x, y, and z from msgblk
CALL MSG_UNLOAD (command, IN1, IN2, OUT, MSGBLK, MSGSIZ)
IF command = "CALC" THEN
    CALL CALC(IN1, IN2, OUT)
ELSE
    ...
END IF
! Routine to load x, y, and z into msgblk along with instruction
CALL MSG_LOAD (command, IN1, IN2, OUT, MSGBLK, MSGSIZ)
PITCH ("CALLER::", "CLIENT", MSGBLK, MSGSIZ) ! send reply back

SUBROUTINE CALC(R, S, T)
  ...
  long complex calculation on (R, S) using LOCAL data files ...
  ...
T = result
RETURN
```

Not only does this have maintenance benefits, but there may be some performance gains. The server can run on a faster machine, such as a VAX 8800, while the client runs on a PDP-11/23. Also, the server can buffer some of the data, reducing disk I/O for subsequent calls. The server will keep the files open all the time to avoid the overhead incurred there. Results can be cached and only recalculated when the input changes.

quest remains constant. It's essentially the same approach that RSX takes toward I/O. Each request is assigned a context that's maintained from the time the request arrives (usually from an asynchronous CATCH) until the time the result is PITCHed back to the client. The server will spend no time waiting if requests are queued up from clients. The multithreaded design also implies that the server mostly will be AST (event) driven, which makes for interesting debugging sessions.

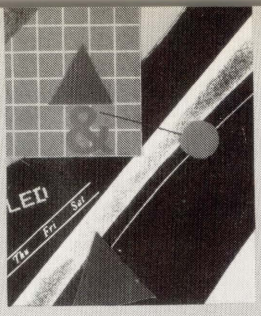
Security

By using a server to access a resource, such as a database, access can be controlled and logged if desired. Access to the resource can be denied to anyone except the server itself. The server then can log the information it receives from BALLGAME (node, task name, etc.) about the client it's talking to. Thus, all or part of the activity on the database can be logged. For example, all changes to the salary field of an employee database are logged. The server can restrict further activity, so that the change can occur only during normal business hours and when requested by a task BRUNO on node DOLLAR.

With a message bus at their disposal, developers have greater flexibility with the design and implementation of an application.

With a message bus at their disposal, developers have greater flexibility with the design and implementation of an application. Form (client) and function (server) are separated and may be assigned to different developers. As long as the message format and content are defined clearly, each group can write, test, and debug their sections independently. Bugs in the server may be fixed without changing the client and vice versa. *—John Bredesen is an analyst with 3M Company, St. Paul, Minnesota, and Randall Newcomb is an independent consultant with Functional Software Inc., also in St. Paul.*

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 521 Medium 522 Low 523



RSTS

IBM TAPES UNDER RSTS/E

By Laurence F. Koolkin

Utilities To Read And Write IBM Tapes With Your PDP-11 RSTS/E System.

Have you ever wished that you could exchange IBM EBCDIC-formatted magnetic tapes with your PDP-11 RSTS/E system? We've been using the two utilities described here for five years, and they allow you either to read or write IBM unlabelled tapes, whether EBCDIC or ASCII, with no additional hardware or software.

The programs are coded in BASIC PLUS but can be compiled easily under BP2, if additional speed or very large tape block sizes are required. Each is a free-standing utility, and both use the same conversion function for EBCDIC to ASCII or the reverse. This function may be lifted and used in any other application requiring this type of data format conversion.

Use IBMWRT (see Program 1) to write tapes and IBMRD (see Program 2) to read them. Tapes for either can be 800 or 1600 bpi, IBM unlabelled format, and fixed tape block size (the tape's block size must be an even multiple of the logical record size). The maximum logical records per tape block when writing is 300, and there's a maximum tape block size; it can't be determined easily but must be decreased if a maximum memory error occurs when trying to write a tape. There usually aren't problems if tape block size is kept below 10,000-12,000 bytes. But, if larger block size is required, change CVT$$(... functions to EDIT$(... functions, and compile the utilities under BP2.

When using IBMWRT, specify both the tape block size to use and the logical record size of the data records in the disk file being transferred. Data records are padded or truncated to this length before being written to tape. The logical record size can't be larger than the tape block size, and the tape's block size must be an even multiple (greater than or equal to 300) of the logical record size chosen.

These programs are designed to write or read a single file to or from the tape. Multiple input files either must be put on separate tapes or combined into a single file first before writing. Files being written in IBM tape format must be ASCII disk files. The file can be written to the tape either in ASCII or EBCDIC format. When reading a tape file with IBMRD, either ASCII or EBCDIC tapes can be read, and the output always is an ASCII file.

To write tapes, first zero the tape to be used, then RUN IBMWRT, and answer the following prompts:

1. TAPE DENSITY 800/1600 <1600> — Enter either 800 or 1600; the default is 1600 bpi.
2. TAPE BLOCKSIZE, LOGICAL RECORDSIZE — Enter the tape block size, comma and the logical record size (both in bytes) of records in ASCII disk file to be written on the tape. If the file contains records of different length, use the length of the longest record. All records will be padded to that length on the tape. The tape block size must be an even multiple of the logical record size.
3. TAPE DRIVE MS0: — Enter the tape drive mnemonic. It must be four characters starting

PROGRAM 1.

```
1   ! IBMWRT.BAS -  UTILITY TO WRITE 800/1600 BPI, UNLABELLED, 9 TRACK,  &
    !               ASCII OR EBCDIC MAGNETIC TAPES. LOGICAL RECORDS ARE  &
    !               ARE READ FROM AN ASCII DISK FILE                     &
    !
10      ON ERROR GOTO 20000                                              &
        ! Set error handling                                             &
        !
20      ESC$ = CHR$(27%+128%)                                            &
        \ CLEAR.SCR$= ESC$+"[2J"                                         &
        \ HOME$     = ESC$+"[1;1H"                                       &
        \ VT100$    = ESC$+"<"                                           &
        \ WIDTH.80$ = ESC$+"[?3l"                                        &
        \ BELL$     = CHR$(7%)                                           &
        ! VT-100 Line and Screen Attributes                              &
        !
30      print vt100$+clear.scr$+home$+width.80$;                         &
        ! Set terminal in VT100 mode, 80 col. mode, erase screen         &
        !
40      DIM IMAGES$(300%)                                                &
        ! Up to 300 logical data records per tape record                 &
        !
50      PRINT                                                            &
        \ PRINT bell$+"** Utility To Write IBM (Unlabelled) 800/1600     &
            bpi Tapes,  EBCDIC/ASCII **"                                 &
        !
100     PRINT                                                            &
        \ OUTCNT%,DONE%=0%                                               &
        \ INPUT "Tape Density 800/1600 <1600>"; dens1%                   &
        \ DENS1%=1600% IF DENS1%=0%                                      &
        \ DENS2%=256%  IF DENS1%=1600%                                   &
        \ DENS2%=12%   IF DENS1%=800%                                    &
        \       IF (DENS1% <> 800% AND DENS1% <> 1600%)                  &
                THEN PRINT BELL$+"* 800 or 1600 Only *"                  &
        \       GOTO 100                                                 &
        ! Input Magtape Density, must be 800 or 1600                     &
        !
110     PRINT                                                            &
        \ INPUT "Tape Blocksize, Logical Recordsize";BLKSIZ%,LRECL%      &
        ! Input Tape Blocksize and Logical Recordsize                    &
        !
120             IF (BLKSIZ% / LRECL% > 300%) OR (LRECL% > BLKSIZ%)       &
                THEN PRINT bell$+"* Adjust Tape Blocksize for <= 300     &
                  Records/Tape Block *"                                  &
                \ GOTO 110                                               &
                ! Do not allow logical recordsize larger than tape       &
                ! blocksize or logical recordsize greater than tape      &
                ! blocksize                                              &
                !
130                     bl=blksiz%                                       &
                \       ll=lrecl%                                        &
                \       if (bl/ll) <> (blksiz%/lrecl%)                   &
                        then print BELL$+"* Tape Blocksize Must be Even   &
                          Multiple of Recordsize *"                      &
                \ goto 110                                               &
                ! Tape blocksize must be an even multiple of            &
                ! logical recordsize                                    &
                !
135     PRINT                                                            &
        \ INPUT "Tape Drive <MS0:>"; tp$                                 &
        \ TP$=cvt$$(TP$,-1%)                                             &
        \ TP$="MS0:" IF TP$=""                                           &
        \    IF LEN(TP$)<>4% OR LEFT(TP$,1%)<>"M" OR RIGHT(TP$,4%)<>":"  &
               THEN PRINT BELL$+"* Invalid Tape Drive Mnemonic *"        &
        \ GOTO 135                                                       &
        ! Get Tape Drive Specification                                   &
        !
140     OPEN TP$ FOR OUTPUT AS FILE 1%,                                  &
                RECORDSIZE BLKSIZ%,                                      &
                MODE DENS2%                                              &
        ! OPEN THE MAGTAPE NON-STRUCTERED W/BLOCKSIZE SPECIFIED          &
        ! Odd Parity, Value NOT Retained After CLOSE                     &
        !
144     JUNK%=MAGTAPE(9%,0%,1%)                                          &
        ! Rewind the Magtape upon CLOSE                                  &
        !
150     PRINT                                                            &
        \ PRINT "Filename with ASCII data";                              &
        \ INPUT LINE OUTFILE$                                            &
        \       OUTFILE$=cvt$$(OUTFILE$,-1%)                             &
        \       OPEN OUTFILE$ FOR INPUT AS FILE 5%                       &
        ! Open the data file to write to tape                           &
        !
160     PRINT                                                            &
        \ PRINT "Convert to EBCDIC <Y>";                                 &
        \ input line ae$                                                 &
        \ ae$=cvt$$(left(ae$,1%),-1%)                                    &
        \ ae$="Y" if ae$ <> "N"                                          &
        \ print "[Converting to EBCDIC]" if ae$="Y"                      &
        ! Do EBCDIC conversion ?                                        &
        !
177     FOR JJ%=1% TO (BLKSIZ% / LRECL%)                                 &
        ! Read enough ASCII records to fill one tape buffer             &
        !
178             INPUT LINE #5%,JJ$                                       &
        \       JJ$=cvt$$(JJ$,5%)                                        &
        \       JJ$=LEFT(JJ$,LRECL%)                                     &
        \       JJ$=JJ$+SPACE$(LRECL%-LEN(JJ$)) IF LEN(JJ$) < LRECL%     &
        !       Strip off CR/LF and pad ASCII records to fixed           &
        !       length specified or truncate if longer than specified    &
        !
179             IMAGES$(JJ%)=JJ$                                         &
        \       IMAGECOUNT=IMAGECOUNT + 1                                &
        \       NEXT JJ%                                                 &
        !       Accumulate logical records until enough for a tape block&
        !
180             FIELD #1%, BLKSIZ% AS JUNK$                              &
        \       LSET JUNK$=""                                            &
        !       Clear the tape buffer                                    &
        !
190             FOR KK%=1% TO (BLKSIZ%/LRECL%)                           &
        \         FIELD #1%,((KK%-1%)*LRECL%) AS JUNK$,LRECL% AS JUNK1$  &
        \         LSET JUNK1$=fnansi$(IMAGES$(KK%),2%) if ae$="Y"        &
        \         LSET JUNK1$=IMAGES$(KK%) if ae$<>"Y"                   &
        \       NEXT KK%                                                 &
        \       PUT #1%                                                  &
        \       OUTCNT%=OUTCNT% + 1%                                     &
        \       PRINT "Tape Block "+num1$(outcnt%)+" written at          &
                  "+time$(0%)                                            &
        \       GOTO 177 IF DONE%<>1%                                    &
        !       Write the tape record, then go back for more ASCII       &
        !       input records unless done                                &
        !
200     i%=magtape(2%,0%,1%) for j%=1% to 4%                             &
        ! Write 4 tape marks at end of tape when done                    &
        !
300     PRINT                                                            &
        \ PRINT IMAGECOUNT;" Records Written to Tape in ";OUTCNT%;"      &
            Tape Blocks"                                                 &
        \ PRINT                                                          &
        !
8000    GOTO 32767                                                       &
        !                                                                &
        ! <><><><><><><><><>  END OF MAINLINE  <><><><><><><><><>        &
        !
9999 ! &
    !*************************************************************** &
    !
11000   DEF* FNANSI$(X1$,X0%)                                            &
        ! ASCII to EBCDIC or EBCDIC to ASCII Conversion Function:        &
        ! X1$=String to Convert, X0%=1 for E->A, or 2 for A->E           &
        !
11010   DIM E%(256%),E1%(128%)
11015   RESTORE
11020   E%(0%)=256%\ E1%(0%)=128%                                        &
        \       IF LEN(X8$)=0% THEN READ E%(I9%) FOR I9%=1% TO 256%      &
        \                           READ E1%(I9%) FOR I9%=1% TO 128%     &
        \       CHANGE E% TO X8$                                         &
        \       CHANGE E1% TO X9$                                        &
        !
11030   FNANSI$=XLATE(X1$,X8$) IF X0%=1%                                 &
        \ FNANSI$=XLATE(X1$,X9$) IF X0%=2%                               &
        !
11033   FNEND
11035 !
11040   !CONVERSION DATA TO TRANSLATE EBCDIC TO ASCII &
        !
13020 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,                              &
          0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,                               &
          0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
13023 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,                              &
          32,0,0,0,0,0,0,0,0,0,0,46,60,40,43,124,                        &
          38,0,0,0,0,0,0,0,0,0,33,36,42,41,59,94
13026 DATA 45,47,0,0,0,0,0,0,0,0,44,37,95,62,63,                        &
          0,0,0,0,0,0,0,0,96,58,35,64,39,61,34,                          &
          0,97,98,99,100,101,102,103,104,105,0,0,0,0,0,0
13029 DATA 0,106,107,108,109,110,111,112,113,114,0,0,0,0,0,0,            &
          0,126,115,116,117,118,119,120,121,122,0,0,0,0,0,0,             &
          0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
13032 DATA 123,65,66,67,68,69,70,71,72,73,0,0,0,0,0,0,                   &
          125,74,75,76,77,78,79,80,81,82,0,0,0,0,0,0,                    &
          92,0,83,84,85,86,87,88,89,90,0,0,0,0,0,0
13035 DATA 48,49,50,51,52,53,54,55,56,57,0,0,0,0,0,0
14000 !
14040 ! &
        ! DATA TO CONVERT ASCII TO EBCDIC                                &
        !
15000 DATA 0,255,255,255,255,255,255,255,255,255
15010 DATA 255,255,255,255,255,255,255,255,255,255
15020 DATA 255,255,255,255,255,255,255,255,255,255
15030 DATA 255,255,255,64,90,127,123,91,108,80
15040 DATA 125,77,93,92,78,107,96,75,97,240
15050 DATA 241,242,243,244,245,246,247,248,249,122
15060 DATA 94,76,126,110,111,124,193,194,195,196
15070 DATA 197,198,199,200,201,209,210,211,212,213
15080 DATA 214,215,216,217,226,227,228,229,230,231
15090 DATA 232,233,255,224,255,95,109,121,129,130
15100 DATA 131,132,133,134,135,136,137,145,146,147
15110 DATA 148,149,150,151,152,153,162,163,164,165
15120 DATA 166,167,168,169,192,79,208,161,255
16000 !
20000 ! &
        ! <><><><< ERROR HANDLING >><><><>                              &
        !
20001   if err=28% then resume 300                                       &
        ! CTRL/C                                                         &
        !
20004   if erl=150 and err=5%                                            &
        then PRINT BELL$+"* Cannot Find/Open That File *"                &
        \ print                                                          &
        \ resume 150                                                     &
        ! Cannot open ASCII input file                                   &
        !
20005   IF ERL=140 THEN                                                  &
        PRINT BELL$+"* Cannot access " + TP$ + " to WRITE *"             &
        \ RESUME 32000                                                   &
        !
20007   IF ERR=11% AND ERL=178 &
        THEN IMAGES$(KK%) = STRING$(LRECL%,32%) FOR KK% = JJ%            &
            TO (BLKSIZ% / LRECL%)                                        &
        \       IMAGECOUNT% = IMAGECOUNT% + JJ% - 1%                     &
        \       DONE%=1%                                                 &
        \       RESUME 180                                               &
        ! Upon end of ASCII file, fill remaining tape block with blanks,&
        ! then update the input record count before proceeding           &
        !
20010   IF ERR=11% OR ERR=14%                                            &
        THEN RESUME 32767                                                &
        ! Bail out if EOT is detected                                    &
        !
20020   resume 100 if erl=100                                            &
        \ resume 110 if erl=110                                          &
        \ resume 135 if erl=135                                          &
        \ resume 150 if erl=150                                          &
        \ resume 160 if erl=160                                          &
        ! KB Inputs                                                      &
        !
21000   PRINT                                                            &
        \ PRINT BELL$+"* Unexpected ERROR #"+NUM1$(ERR)+" at             &
            LINE #"+NUM1$(ERL)                                           &
        \ SLEEP 5%                                                       &
        ! Unexpected errors                                             &
        !
32000   !
32767   CLOSE 1%,5%                                                      &
        \ END                                                            &
        !
```

PROGRAM 2.

```
1   ! IBMRD.BAS - UTILITY TO READ 800/1600 BPI, UNLABELLED, 9 TRACK          &
    !             MAGNETIC TAPES. LOGICAL RECORDS ARE WRITTEN                &
    !             INTO ASCII DISK FILE OR KB:                                &
    !
10      ON ERROR GOTO 20000                                                  &
        ! Error handling                                                     &
        !
20      ESC$ = CHR$(27%+128%)                                                &
        \ NORMAL$    = ESC$+"[0m"                                            &
        \ CLEAR.SCR$= ESC$+"[2J"                                             &
        \ HOME$      = ESC$+"[1;1H"                                          &
        \ VT100$     = ESC$+"<"                                              &
        \ WIDTH.80$  = ESC$+"[?3l"                                           &
        \ WIDTH.132$= ESC$+"[?3h"                                            &
        \ BELL$      = CHR$(7%)                                              &
        ! VT-100 line and screen attributes                                  &
        !
30      print vt100$+clear.scr$+home$+width.80$                              &
        \ EOFC% = 0%                                                         &
        ! Set terminal in VT100 mode, 80 columns, clear screen              &
        !
40      PRINT                                                                &
        \ PRINT BELL$+"** Utility for Reading 1600 bpi IBM                   &
            (Unlabelled) Tapes, ASCII or EBCDIC **"                          &
        \ PRINT                                                              &
        !
100     s$=sys(chr$(6%)+chr$(-7%))                                           &
        ! CTRL/C Trapping                                                    &
        !
110     PRINT                                                                &
        \ INPUT "Tape Density 800/1600 <1600>"; DENS1%                       &
        \ DENS1%=1600% IF DENS1%=0%                                          &
        \ DENS2%=256% IF DENS1%=1600%                                        &
        \ DENS2%=12%  IF DENS1%=800%                                         &
        \       IF (DENS1% <> 800% AND DENS1% <> 1600%)                      &
                THEN PRINT BELL$+"* Only 800 or 1600 *"                      &
        \       GOTO 110                                                     &
        ! Solicit Tape Density, 800 or 1600 bpi                             &
        !
120     PRINT                                                                &
        \ INPUT "Tape Blocksize, Logical Recordsize"; BLKSIZ%, LRECL%        &
        ! Solicit Tape Blocksize and Logical Recordsize                      &
        !
130     b1=blksiz%                                                           &
        \ l1=lrecl%                                                          &
        \       if (b1 / l1) <> (blksiz% / lrecl%)                           &
                or (lrecl% > blksiz%)                                        &
                then print bell$+"* Tape Blocksize Must be Even              &
                  Multiple of Recordsize *"                                  &
        \ goto 120                                                           &
        ! Tape Blocksize must be smaller than and an even multiple of       &
        ! Logical Recordsize                                                &
        !
135     PRINT                                                                &
        \ INPUT "Tape Drive <MS0:>"; TP$                                     &
        \ TP$ = cvt$$(TP$,-1%)                                               &
        \ TP$ = "MS0:" IF TP$=""                                             &
        \       IF LEN(TP$) <> 4% OR LEFT(TP$,1%)<>"M" OR                    &
                  RIGHT(TP$,4%)<>":"                                         &
                THEN PRINT BELL$+"* Invalid Tape Drive Specification *"      &
        \       GOTO 135                                                     &
        !
140     OPEN TP$ FOR INPUT AS FILE 1%, RECORDSIZE BLKSIZ%                    &
        ! OPEN THE MAGTAPE NON-STRUCTERED W/BLOCKSIZE & DENSITY              &
        ! SPECIFIED, NO PARITY                                               &
        !
142     PRINT                                                                &
        \ INPUT "Rewind Tape Before Starting <Y>";REWIND$                    &
        \ GOTO 144 IF LEFT(REWIND$,1%)="N"                                   &
        \ JUNK%=MAGTAPE(3%,0%,1%)                                            &
        ! REWIND THE TAPE IF REQUESTED                                      &
        !
144     JUNK%=MAGTAPE(9%,0%,1%)                                              &
        ! REWIND TAPE AGAIN UPON CLOSE                                       &
        !
150     EOFCOUNT%=0%                                                         &
        ! COUNT OF TAPE EOFS ENCOUNTERED                                     &
        !
160     BLKSINFILE%=32766%                                                   &
        ! Assume this many tape blocks on tape, try to read them all        &
        ! until Tape EOF encountered                                         &
        !
170     PRINT                                                                &
        \ PRINT "Filename/Device For Output <KB:>";                          &
        \ INPUT LINE OUTFILE$                                                &
        \ OUTFILE$=cvt$$(OUTFILE$,-1%)                                       &
        \ OUTFILE$="KB:" IF LEN(OUTFILE$)=0%                                 &
        \       OPEN OUTFILE$ FOR OUTPUT AS FILE 5%                          &
        ! Output File/Device for data read from tape                        &
        !
172     PRINT                                                                &
        \ INPUT "Convert From EBCDIC To ASCII <Y>";AE$                       &
        \ AE$=LEFT(cvt$$(AE$,-1%),1%)                                        &
        \ AE$="Y" IF AE$ = ""                                                &
        ! Is Conversion being requested?                                    &
        !
174             PRINT CLEAR.SCR$+HOME$;                                      &
        \       IF LRECL% > 80% THEN PRINT #WIDTH.132$                       &
                ELSE PRINT                                                   &
        ! Clear screen, set into 132 mode if logical record length > 80     &
        !
177     IMAGECOUNT=0%                                                        &
        ! # OF FINAL ASCII RECORDS WRITTEN                                   &
        !
178     FOR X%=1% TO BLKSINFILE%                                             &
        ! LOOP THROUGH TAPE BLOCKS                                           &
        !
180             FIELD #1%, BLKSIZ% AS JUNK$                                  &
        \       LSET JUNK$=""                                                &
        \       GET #1%                                                      &
        !       NULL OUT THE TAPE BUFFER, THEN GET A TAPE RECORD             &
        !
220             goto 221 if ae$<>"Y"                                         &
        \       FOR X1%=1% TO (BLKSIZ% / LRECL%)                             &
        \       xxx$ = ""                                                    &
        \       xxx$=cvt$$(fnansi$(MID(junk$,LRECL%*(x1%-1%)+1%,             &
                  LRECL%),1%),1%+128%)+""                                    &
        \       print #5%,xxx$                                               &
        \       next x1%                                                     &
        \       goto 225                                                     &
        !       PRINT THE OUTPUT DATA WITH ebcdic to ASCII conversion        &
        !
221             for x1%=1% to (blksiz%/lrecl%)                               &
        \       xxx$=""                                                      &
        \       xxx$=cvt$$(MID(junk$,LRECL%*(x1%-1%)+1%,LRECL%),             &
                  1%+128%)+""                                                &
        \       print #5%,xxx$                                               &
        \       next x1%                                                     &
        !       PRINT THE OUTPUT DATA  WITH no conversion                    &
        !
225             IMAGECOUNT = IMAGECOUNT + (BLKSIZ% / LRECL%)                 &
        !       INCREMENT THE ASCII OUTPUT RECORD COUNT                      &
        !
230     NEXT X%                                                              &
        ! Next Tape Block                                                    &
        !
300     PRINT                                                                &
        \ PRINT IMAGECOUNT;" Records Written to ";OUTFILE$                   &
        \ PRINT                                                              &
        !
8000    GOTO 32767                                                           &
        ! &
        ! <><><><><><><><><><>  END OF MAINLINE  <><><><><><><><><><>        &
        !
9999 ! &
    !*************************************************************** &
    !
11000   DEF* FNANSI$(X1$,X0%)                                                &
        ! EBCDIC to ASCII Conversion Function                                &
        ! X1$=STRING to CONVERT, X0%=1 for E->A, or 2 for A->E               &
        !
11010   DIM E%(256%),E1%(128%)
11015           RESTORE
11020   E%(0%)=256%\ E1%(0%)=128%                                            &
        \       IF LEN(X8$)=0% THEN READ E%(I9%) FOR I9%=1% TO 256%          &
        \                           READ E1%(I9%) FOR I9%=1% TO 128%         &
        \       CHANGE E% TO X8$                                             &
        \       CHANGE E1% TO X9$                                            &
        !
11030   FNANSI$=XLATE(X1$,X8$) IF X0%=1%                                     &
        \ FNANSI$=XLATE(X1$,X9$) IF X0%=2%                                   &
        !
11033   FNEND
11035 !
11040   !CONVERSION DATA TO TRANSLATE EBCDIC TO ASCII &
        !
13020 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,                                  &
          0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
          0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
13023 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,                                  &
          32,0,0,0,0,0,0,0,0,0,0,46,60,40,43,124,                            &
          38,0,0,0,0,0,0,0,0,0,0,33,36,42,41,59,94
13026 DATA 45,47,0,0,0,0,0,0,0,0,0,44,37,95,62,63,                          &
          0,0,0,0,0,0,0,0,0,96,58,35,64,39,61,34,
          0,97,98,99,100,101,102,103,104,105,0,0,0,0,0,0
13029 DATA 0,106,107,108,109,110,111,112,113,114,0,0,0,0,0,0,                &
          0,126,115,116,117,118,119,120,121,122,0,0,0,0,0,0,
          0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
13032 DATA 123,65,66,67,68,69,70,71,72,73,0,0,0,0,0,0,                      &
          125,74,75,76,77,78,79,80,81,82,0,0,0,0,0,0,
          92,0,83,84,85,86,87,88,89,90,0,0,0,0,0,0
13035 DATA 48,49,50,51,52,53,54,55,56,57,0,0,0,0,0,0
14000 !
14040 ! &
        ! DATA TO CONVERT ASCII TO EBCDIC &
        !
15000 DATA 0,255,255,255,255,255,255,255,255
15010 DATA 255,255,255,255,255,255,255,255,255,255
15020 DATA 255,255,255,255,255,255,255,255,255,255
15030 DATA 255,255,255,64,90,127,123,91,108,80
15040 DATA 125,77,93,92,78,107,96,75,97,240
15050 DATA 241,242,243,244,245,246,247,248,249,122
15060 DATA 94,76,126,110,111,124,193,194,195,196
15070 DATA 197,198,199,200,201,209,210,211,212,213
15080 DATA 214,215,216,217,226,227,228,229,230,231
15090 DATA 232,233,256,224,255,95,109,121,129,130
15100 DATA 131,132,133,134,135,136,137,145,146,147
15110 DATA 148,149,150,151,152,153,162,163,164,165
15120 DATA 166,167,168,169,192,79,208,161,255
16000 !
20000 ! &
        ! <><><><><><><><><>      ERROR HANDLING      <><><><><><><><><> &
        !
20001   if err=28% then resume 300                                           &
        ! CTRL/C Trap                                                        &
        !
20002   if err=11 and erl=180
        then eofc% = eofc% + 1%                                              &
        \ resume 230 if eofc% = 1%                                           &
        ! EOF on Tape                                                       &
        !
20010   IF ERR=11% OR ERR=14%                                                &
        THEN RESUME 300                                                      &
        ! TAPE EOT IS DETECTED                                               &
        !
20012   if err=180 and erl=13                                                &
        then print bell$+"* Bad Tape Record, #"+num1$(x%)+",                 &
          Trying to Continue... *"                                           &
        \ resume 180                                                         &
        ! Bad Tape Record                                                   &
        !
20020   if err=180 then resume 300                                           &
        ! Unexpected Tape Read Errors                                        &
        !
20030   resume 110 if erl=110                                                &
        \ resume 120 if erl=120                                              &
        \ resume 135 if erl=135                                              &
        \ resume 142 if erl=142                                              &
        \ resume 170 if erl=170                                              &
        \ resume 175 if erl=175                                              &
        ! KB inputs                                                         &
        !
21000   print "Unexpected error #"+num1$(err)+" at line "+num1$(erl)        &
        \ sleep 5%                                                           &
        \ resume 300                                                         &
        ! HALT ON MISC./UNEXPECTED ERRORS &
        !
32767   CLOSE 1%,5%                                                          &
        \ END                                                                &
        !
```

with an M and ending with :. Default is MS0:.

4. FILENAME WITH ASCII DATA — Enter the device: filename to write to tape.

5. CONVERT TO EBCDIC Y — Enter Y or N. Default is Yes.

Messages are printed as each tape block is written. When complete, a final message indicates how many total tape blocks were written and how many total logical records they contain. The final tape block will be padded out with blanks.

To read tapes, RUN IBMRD and answer the following prompts:

1. TAPE DENSITY 800/1600 <1600> — Enter either 800 or 1600; the default is 1600 bpi.

2. TAPE BLOCKSIZE, LOGICAL RECORDSIZE — Enter the tape block size, comma and the logical record size (both in bytes) of the records in the ASCII disk file to be written on the tape. If the file contains records of different length, use the length of the longest record. All records will be padded to that length on the tape. The tape block size must be an even multiple of the logical record size.

3. TAPE DRIVE MS0: — Enter the tape drive mnemonic. It must be four characters starting with an M and ending with :. Default is MS0:.

4. REWIND TAPE BEFORE STARTING Y — Enter Y or N. Default is Yes.

5. FILENAME/DEVICE FOR OUTPUT KB: — Enter the output filename or device for the data read and converted from the tape. Default is on your screen. If a filename is used, it will be an ASCII disk file, with all records the same length as specified.

6. CONVERT FROM EBCDIC TO ASCII Y — Enter Y or N. Default is Yes. If the tape is written in EBCDIC, you must specify Y to this prompt.

That's all there is to it. —*Laurence F. Koolkin is president of Systems Alternatives Inc., Montpelier, Vermont.*

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LET'S C NOW

Function Prototypes, Part 2

Rex Jaeschke

Editor's note: In this issue, Mr. Jaeschke completes his two-part series on function prototypes. Part 1 appeared in February.

Prototype naming conventions allow for the specification of the leading part of an argument list. This is useful with functions that have a variable number of arguments such as the **printf** and **scanf** families declared in stdio.h.

```
int fscanf (FILE *file_ptr, const char *format_spec, ...);
int scanf  (const char *format_spec, ...);
int sscanf (char *str, const char *format_spec, ...);
int fprintf (FILE *file_ptr, const char *format_spec, ...);
int printf  (const char *format_spec, ...);
int sprintf (char *str, const char *format_spec, ...);
```

Here, all the known (guaranteed) arguments are declared, and this list is followed by a comma and an ellipsis, indicating that there may be more arguments, but no information is known about their type or number. This format also can be used with fixed type and size argument lists, but it serves no purpose and, in fact, reduces the ability of the compiler to diagnose argument list mismatches. Besides supporting these library functions, the Standard provides a portable way of writing and calling your own C functions from C using variable argument lists. This requires use of the header stdarg.h that defines the macros **va__start**, **va__end** and **va__arg** and the type of **va__list**.

Given that the ellipsis notation disables argument list checking, you might think that the following declarations are identical because neither provides any argument information.

```
int f();
int f(...);
```

As it happens, the second declaration is illegal, according to the draft ANSI Standard. The ellipsis only can follow a comma and because there's no first argument, a comma would be illegal.

Functions Without Arguments

Because prototypes were invented by the ANSI Committee, most existing C code doesn't use them. Therefore, new-style function declarations must coexist with old-style declarations, if existing code isn't to be broken immediately. An old-style function declaration is considered to be a prototype without

> ***"Because prototypes were invented by the ANSI Committee, most existing C code doesn't use them."***

an argument list. For example, **int f( );** declares that function f has return type **int** and that no information is known about the argument list, so the compiler can't perform checking. To indicate that a function has no arguments and to allow the compiler to police this, the format **int f(void);** should be used instead. For example:

```
void sub2(void);

test()
{
        sub2();
        sub2(10);       /* error */
}
```

produces the message:

```
%CC-W-MISARGNUMBER
```

The number of arguments passed to the function doesn't match the number declared in a previous function prototype.

The keyword **void** has three possible uses (i.e., it's overloaded) as a function type, a pointer type and in function prototypes as shown here.

Now that we've seen the new-style function definitions, we can look at the way in which a new-style function without arguments should be defined. It is:

```
type sub(void) {...}
```

The keyword **void** goes in place of the argument list, just as it does in the corresponding prototype.

Prototypes And Argument Widening

Another potential benefit of prototypes is that they may be used to bypass the default widening rules when dealing with function arguments. Whether a prototype allows the default-

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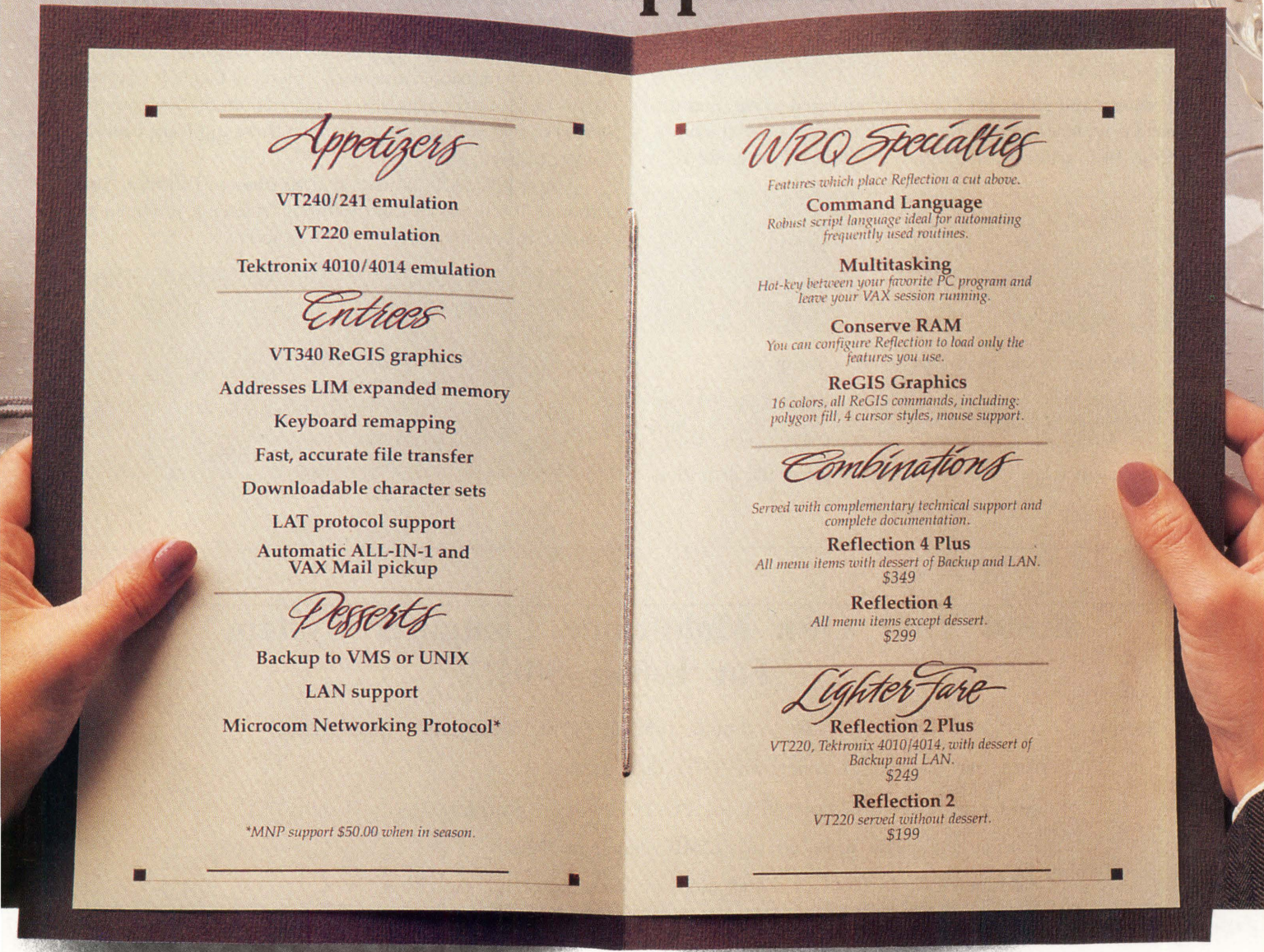

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widening rules to be overridden is implementation-defined. In the following example:

```
f()
{
        extern void g();
        char c;
        short s;
        float f;

        ...
        g(c, s, f);
}
```

the **char c** and **short int s** are both widened to **int**, and the **float f** is widened to **double** before being passed to the function **g**. In function **g**, the argument declarations could be:

```
void g(c, s, f)
char c;
short s;
float f;
{
        ...
}
```

However, if the prototype for function **g** was:

```
void g(char c, short s, float f);
```

and it was in scope for both the calls to **g** and the definition of **g**, the compiler could bypass the default argument widening rules allowing the conversion overhead to be omitted. This is useful to programmers who use **float** instead of **double** and on systems where a subroutine call is needed for argument widening and eliminating widening. They no longer need to pay the price of **float/double/float** conversions.

Note that the current math.h routines still require double arguments though, because all existing code expects widening to occur during function calls. However, the set of math library function names with a prefix of **f** and **l** is reserved for future use by the Standard, so that versions of these routines can be provided that take and return **float** and **long double** values, respectively.

Currently, VAX C always widens **char** and **short** to **int**, although it will pass a **float** without widening, provided an appropriate prototype is in scope as follows:

```
void sub(float f, char c);
void suby(float f, char c, ...);

test()
{
        float f1 = 1.234;
        char c1 = 'a';

        sub(f1, c1);
        subx(f1, c1);
        suby(f1, c1, f1);
}
```

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The call to **sub** passes **f1** as a **float** because that's specified in the prototype. However, there's no prototype for **subx**, so **f1** is widened to **double** in that call. In both cases, **c1** is widened to **int**.

While it can be messy, it's possible to have some arguments in a list widened, while others in that same list aren't, by using the ellipsis specifier. The ellipsis notation causes argument type checking to cease, such that any arguments that actually follow will go unchecked. These unchecked arguments are widened as if no prototype were currently in scope.

An example of this is the call to **suby** above. The first argument, **f1**, is passed as a **float** as requested by the prototype, whereas the third argument, **f1**, is passed as a **double** because type checking is enabled only for the first two arguments.

Can VAX C ever pass **char** and **short** arguments without widening? If this were done, it wouldn't mean that these arguments would be represented as a byte and word, respectively. The VAX architecture calling sequence requires each call argument to occupy a longword on the call stack, so each byte and word argument must occupy its own longword. Actually, VAX C already violates the VAX calling sequence by allowing **double**s and structures to be passed by value, so it could pack **char** and **short** arguments into the same longword, although this isn't likely to happen.

New-style Function Definitions

Consider the following program where **main** calls **test**:

```
#include <stdio.h>

main()
{
        double test(int i, double d);

        printf("%f\n", test(10, 10.4));
}

double test(i, d)
int i;
double d;
{
        return (i * d);
}
```

Although the function definition for **test** is correct, it's made obsolescent by the Standard. Obsolescent features are ones that are currently common practice but for which an alternate (replacement) mechanism has been provided. The new-style format is:

```
double test(int i, double d)
{
        return (i * d);
}
```

This new-style function definition format combines the argument list names and their declarations in a PASCAL-like manner. The reason for this is uniformity: The definition matches that of the corresponding prototype. Note that:

```
int test1(int i, int j) {...}
```

can't be written as:

```
int test1(int i, j) {...}
```

because argument declarations may not be combined, even if they have exactly the same type, as shown.

Similarly, the use of function declarations without argument lists is obsolescent requiring that the special keyword void, or some other prototype format, be used to ensure conformance with future versions of the Standard.

Note that a prototype is terminated with a semicolon. Except for the fact that there's no function body (within {...}), a function prototype looks like a new-style function definition, hence the name prototype. And because we require identifier names in the argument list of new-style function definitions, we allow them in prototypes, so that a prototype easily can be constructed from the definition. Simply take the first part of the definition and add a semicolon.

Function Main

There can be no arguments in a prototype for function **main** because the Standard permits **main** to have either no arguments or two arguments. Given that it's unlikely for a user program to call **main**, this isn't a problem, just an idiosyncrasy of the Standard. Of course, the meaning of, and type of any arguments beyond the first two, is implementation-defined. A common third argument is **envp**, the environment pointer. This is an array of pointers to **char**, where each pointer points to some environment string. Numerous C compilers implement this capability, although to be strictly conforming, you should use the library function **getenv** instead.

The ANSI Rationale

The following statements are taken from the Rationale Document which accompanies the ANSI C Standard. This document explains some of the rationale that went into the Standard-making process. Section 3.9.3 (Function declarators) states, "The characterization of the use of the 'old-style' function declarations and definitions — that is, the traditional style not using prototypes — signals the Committee's intent that the new prototype style should eventually replace the old style.

"The case for the prototype style ... is that the new syntax addresses some of the most glaring weaknesses of the language ... , that the new style is superior to the old style on every count.

"It was obviously out of the question to remove syntax used in the overwhelming majority of extant C code, so the Standard specifies two ways of writing function declarations and definitions. Characterizing the old style as obsolescent is meant to discourage its use, and to serve as a strong endorsement by the Committee of the new style. It confidently expects that approval and adoption of the prototype style will make it feasible for some future C Standard to remove the old style syntax."

Declaring something as obsolescent is the first step necessary to drop support for something in a future version of the Standard. However, my personal opinion is that although a new function definition format is now largely available, the old-style format never will be dropped, unless a group of heretics works on future C standards.

To Convert Or Not To Convert?

If you have a significant investment in C code already, should you upgrade to a new (and ANSI-like) C compiler? The answer to that question can vary considerably. However, because the correct use of prototypes can add a significant amount of reliability to your compilations, getting that capability alone may justify the conversion. However, you should note that newer compilers have changed in subtle ways and when ANSI-conforming compilers become available, the conversion effort may be even greater. The good news, though, is that most compiler vendors will continue to support many of their old habits in the interim. But, yes, you will have to answer that question eventually.

Many compilers supporting prototypes for library routines have both the old-style and the new-style declarations in their headers. The new-style declarations are included if a special macro name is defined at compile time. VAX C doesn't provide this capability. When you include a VAX C-supplied header, prototype checking is forced on you — at least for the run-time library calls. Whether or not you use prototypes for your own functions is up to you, but in most cases, it's hard to conceive why you wouldn't.

VAX C Header Time Bombs

While I was researching the section on macro expansion (in Part 1), I decided to play devil's advocate on the rest of the compiler's headers, and I came up with the following contrived, yet valid, example. It adequately demonstrates the need to enclose formal arguments in macro definitions in parentheses.

```
#include <stdio.h>

test()
{
        FILE *fp1, *fp2;
        int fn;

        fp1 = fopen("test.dat", "r");

        if (feof(fp2 = fp1))
                ;

        if (ferror(fp2 = fp1))
                ;

        clearerr(fp2 = fp1);

        fn = fileno(fp2 = fp1);
}
```

The four functions **feof**, **ferror**, **clearerr** and **fileno** take one argument, of type **FILE ***. Because **(fp2 = fp1)** is an expression of this type, it results in a valid and potentially useful call. Although you can argue that embedding assignments

within expressions potentially is misleading, or at least confusing, the technique is well established. As it happens, VAX C implements these four "functions" as macros and when expanded, the above program produces the following:

```
if (feof(fp2 = fp1))
if ((((*fp2 = fp1)->_flag&0x10)!=0))

if (ferror(fp2 = fp1))
if ((((*fp2 = fp1)->_flag&0x20)!=0))

clearerr(fp2 = fp1);
((*fp2 = fp1)->_flag &= ~(0x20|0x10));

fn = fileno(fp2 = fp1);
fn = ((*fp2 = fp1)->_file);
```

In each case, the problem expression is ***fp2 = fp1** which, under strict ANSI-type checking rules, would produce an error because **fp2** and **fp1** have the same type and ***fp2** indicates the **FILE** object being pointed to while **fp1** is a **FILE** pointer. On many implementations, a **FILE** object is a structure. Therefore, such an expression would try to assign a pointer to a structure into a structure, and this should fail on any compiler that supports structure assignment. As it happens, VAX C won't complain about this expression because **FILE** is defined as follows:

```
typedef struct _iobuf*  FILE;
```

FILE is a pointer to a **struct** rather than a **struct** itself. Therefore, the type **FILE *** (that of **fp1** and **fp2**) is a pointer to a pointer to a **struct**, and the assignment tries to assign a pointer to a pointer to a **struct** into a pointer to a **struct**.

Because VAX C treats all pointers as being compatible, it permits the erroneous copy resulting in a trashed **FILE** object. Probably, all operations on the file supposedly being pointed to by **fp2** will fail, although this fact may not be obvious. By failure, I mean that the wrong area of memory will be interpreted as the file's I/O context table and eventually, with the right kind of operation, some random area of memory will get trashed.

If you haven't spotted the error yet, it's simple. The correct macro expansion for the offending expression should be:

```
*(fp2 = fp1)
```

because the contents-of operator ***** has higher precedence than assignment. In fact, except for the comma operator, assignment operators have the lowest precedence. The correct definition for the four macros in stdio.h should be:

```
#define feof(p)         (((*(p))->_flag&_IOEOF)!=0)
#define ferror(p)       (((*(p))->_flag&_IOERR)!=0)
#define fileno(p)       ((*(p))->_file)
#define clearerr(p)     ((*(p))->_flag &= ~(_IOERR|_IOEOF))
```

The subtle difference is that ***p** has been replaced by ***(p)** in each case. Because these macro definitions in VAX C V2.3 can fail, I suggest you correct them if this is likely to cause you grief. I have reported these problems to the VAX C development group who agree they should be fixed and are getting VAX C V2.4 ready for field testing. This is a maintenance release only and contains no new functionality. However, it's quite possible these macros won't be fixed in that release; in that case, you also should fix the macros when you install V2.4.

Many other valid expressions using operators other than assignment can cause these macros to expand incorrectly; however, they all should generate syntax errors.

Continuing my witch hunt, I came across curses.h, containing macro definitions like the following:

```
# define clearok(win, bf)       (win->_clear = bf)
# define leaveok(win, bf)       (win->_leave = bf)
# define scrollok(win, bf)      (win->_scroll = bf)
# define wrapok(win, bf)        (win->_wrap = bf)
```

Again the problem has to do with order-of operator precedence, particularly with the argument **bf**. In each case, **bf** is assigned to an expression. However, if the user calls **clearok**, for example, as follows:

```
clearok(w, b1, b2)
```

in theory, the macro would be expanded to:

```
(w->_clear = b1, b2)
```

and the assignment would take precedence over the comma operator producing a result other than what was intended. What really happens is the compiler sees a call to a macro with three arguments, while the macro definition contains only two and an error message results. The correct macro call should be:

```
clearok(w, (b1, b2))
```

It expands to:

```
(w->_clear = (b1, b2))
```

Therefore, the macro definitions are correct and can't be expanded incorrectly when given valid C expressions as arguments. As we often find with witch hunts, the problems are more imaginary than real. *—Rex Jaeschke is an independent consultant, author and lecturer. He is the C language editor of* DEC PROFESSIONAL, *and our representative on the ANSI C Standards Committee.*

Readers are encouraged to submit any C-related comments and suggestions to Rex Jaeschke, 2051 Swans Neck Way, Reston, VA 22091.

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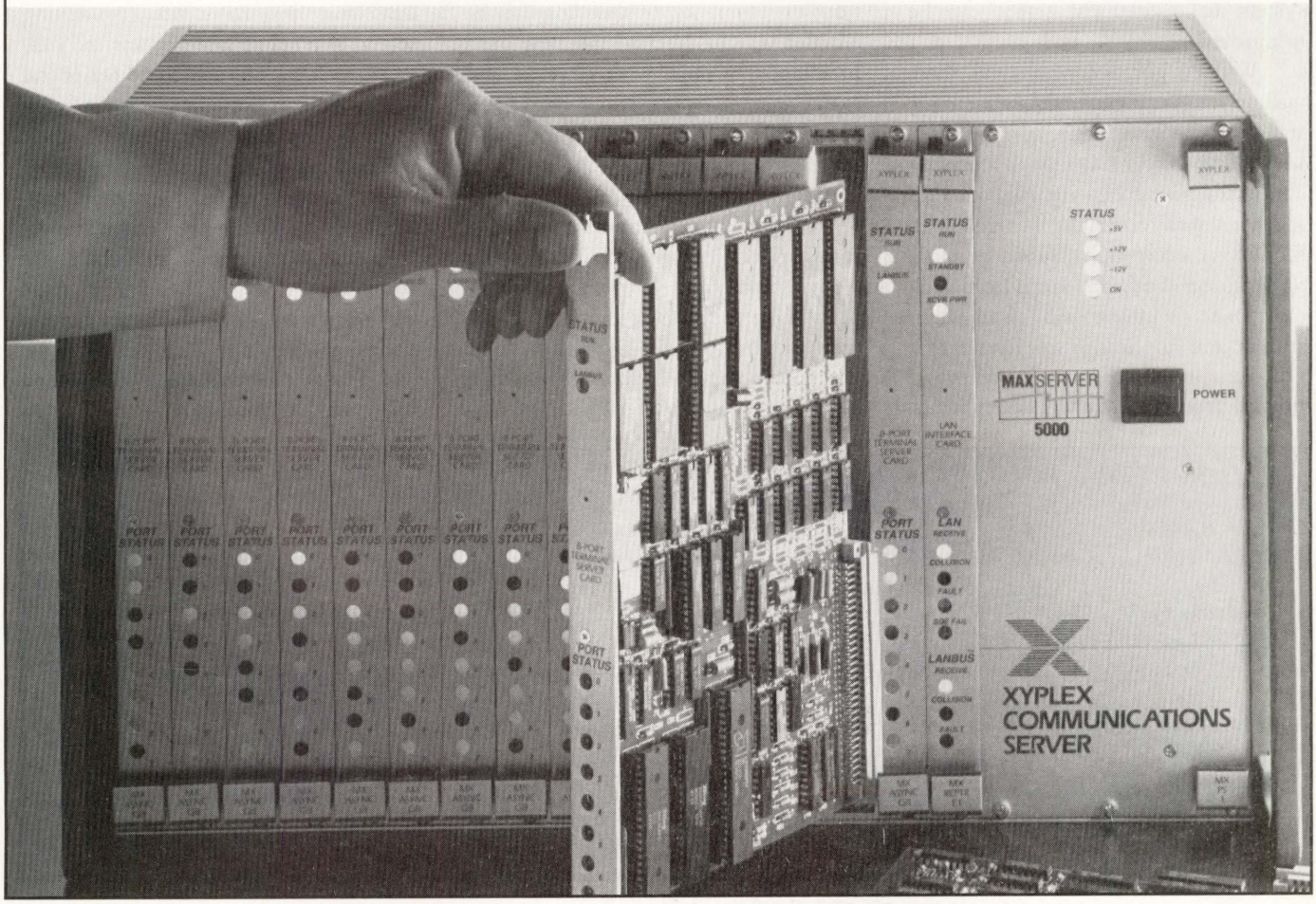

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FIELD SERVICE

Obtaining Full-Service Maintenance

Ron Levine

Corporate Connectivity is becoming a reality this year. Extensive multivendor LANs wiring up corporate computer users in what's becoming known as Worknet environments eventually will push the single-vendor system from the scene. As full-system integration takes hold, it will become mandatory for the various major computer equipment vendors to work together and learn to coexist. Also, it will become mandatory for MIS managers to obtain competent multivendor equipment maintenance services, so that delays in troubleshooting, equipment repair and returning a downed system to operational status can be minimized.

With corporate connectivity, there will no longer be pure DEC-system installations. More likely, we will see something like DEC-IBM processing connections with PCs and Macintoshes as distributed terminals; workstations, file servers, network hardware, graphics processors and other add-ons from various OEM vendors and third-party system and applications software that will run on any connected station or provide access to all system components.

For the field service vendor, this means he must be able to provide complete support in this new, complex environment. Special problems exist in servicing multivendor installations; MIS managers need to evaluate corporate DP maintenance and service needs and the capabilities of the field vendor before entering into a service contract. The time may have come to rethink the old OEM service standard and consider switching to a third-party service provider.

Selecting A Field Service Vendor

With full-system integration on the way, it's probably more important than ever to orient service toward a one-call solution; a supermarket of servicing may be a better way to describe this new need to effectively cope with physical and logical connectively across vendor lines. Having one vendor provide total systems service versus multivendor service could mean the elimination of delays in returning a downed system to an online status, especially those delays that result from competing service vendors' finger pointing, troubleshooting unfamiliar components and the inability to look past specific hardware boundries when attempting to locate faults.

On the user's end, don't forget that when using more than one service vendor, it becomes the customer's responsibility to determine which service vendor to contact. The user is put in the position of doing preliminary troubleshooting/guessing as to what/where the problem area is so that the right service vendor can be notified.

When obtaining service for a mixed-vendor installation, the first decision for MIS managers is whether to contract for one-source service or go with multiple vendors. Let's look at a scenario that demonstrates why, with corporate connectivity as the new goal, this becomes an important decision.

Let's suppose you have a combined DEC and IBM DP center containing several IBM mainframe systems and DEC VAXs, each with its associated peripheral equipment. At present, service is being provided by IBM and DEC on their systems respectively. This means that when service is required you must contact the correct service vendor. However, normally this isn't a problem as the equipment is well defined and it's usually known which machines are experiencing problems.

You've probably been approached for years by third-party maintenance

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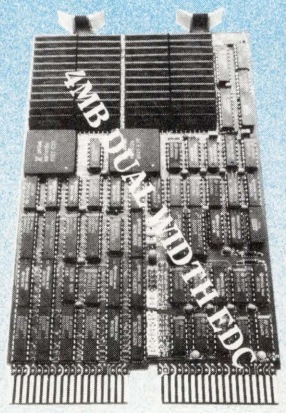

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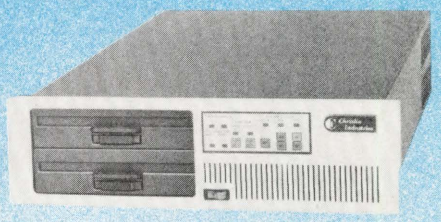

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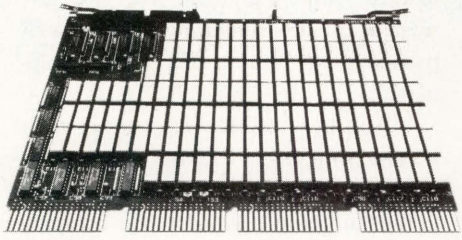

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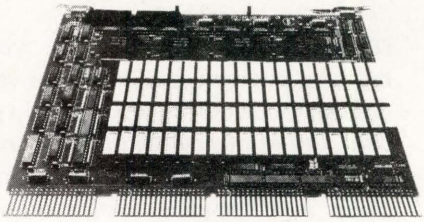

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* Service incentive: revenues from present system and future sales.

Minuses

1. Less flexible service contracts.
2. May charge more for service than independents.
3. Limited service on other vendors' products.
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TPM Service

Pluses

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3. Usually less expensive than equal service from OEM and provides for extended service at no extra charge.
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* Service incentive: revenues derived from maintenance business.

Minuses

1. Technicians may or may not be factory trained.
2. Parts may or may not be from the manufacturer.
3. Equipment warranty doesn't allow for outside service.

(TPM) companies wanting your business, but with only two major vendors and independent operational systems, one-stop service just didn't seem that important. And although the price break on maintaining a larger amount of equipment combined with lower rates would save your budget dollars, you worried about whether switching would alienate the OEM vendor, affect the quality of service or if independents could provide parts availability in a timely manner. And because you've never dealt with TPM before, you decided to play it safe and stay with the present multivendor service formula.

Now, let's change the scenario to reflect the new corporate approach to computing. The IBM and DEC systems in the DP center are being joined together via a network; and not only can these systems communicate with each other and use all peripherals on the new network, but users throughout the corporation can access either system from their own workstations. This change in DP operations greatly impacts the service situation.

Under this new integrated systems setup, a problem arises; some users can't access the laser printer through the network. This problem concerns a joint peripheral, the printer, that runs off all processors. Who do you turn to? Is it IBM's, DEC's or another vendor's problem; maybe it's the Megatek Graphics Processor that's not able to access? The ball is now in your court, not the service vendor's. You must determine which service organization to call. Initial troubleshooting responsibility has been shifted to you, and away from the maintenance company.

With mixed-vendor systems all fully connected and integrated, it's not easy to pinpoint the fault. It may require several calls to each service vendor, because each is responsible only for its specific equipment. If the vendor's troubleshooting doesn't produce results, finger pointing begins, and when each service vendor is brought in, the fault isolation procedure begins again. As this process continues, the delay in returning the system to full operating status mounts. The customer is the loser in this type of service situation.

The best way to alleviate this problem is to have one service vendor responsible for the entire installation, and there are several options available.

One option is to pursuade one OEM to provide the complete service package. For instance, in the previous example, let's say you're happy with the IBM maintenance people. You can ask IBM to maintain the complete system based on the fact that all components are connected to an IBM processor. This may or may not be accepted by the OEM.

Some, like IBM, will service outside products only to a limited extent. Also ask yourself, "Do I want a competing vendor servicing the whole environment? Is it in that vendor's best interest to keep competing products up and running as quickly as its own? How well trained are the CEs in these other products?"

Another option is to contract with a TPM company. I equate these service vendors with the independent garages in the automobile industry that compete against the dealer's service departments. They provide maintenance on many brands and types of equipment. Yet many are factory trained, use OEM parts and provide excellent support at comparable or lower prices than the dealer's service departments.

The TPMs

There are two main types of TPM companies: manufacturer owned or affiliated, and independents. Service vendors, like Control Data Engineering Services and Unisys Customcare, are divisions of computer equipment manufacturers that also service equipment other than their own. With these com-

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panies, TPM is a separate business and not related to its sales and service.

The independents, on the other hand, are service vendors only. Sorbus, TRW Customer Service and Maintech are examples of service vendors who maintain various systems and components and who don't manufacture their own computer systems. Third-party maintenance is their main business.

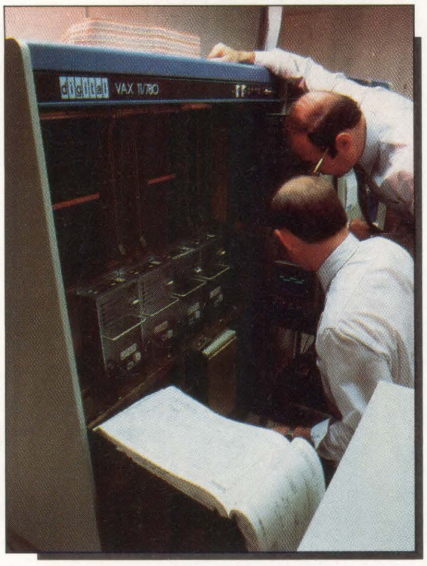
TPM companies have gained acceptance over the last few years, because they've shown that they can provide a good, quality service product. And indeed, with the advent of network connectivity and increasing mixed-vendor environments, they actually may offer advantages over OEMs in many service-related areas. It's estimated that TPM companies accounted for approximately $2 billion of the $18 billion service industry revenues last year. This percentage is expected to increase greatly over the next few years as the service industry approaches $40 billion in total revenues. TPM companies offer some valuable alternatives to users when compared to OEM maintenance in the mixed-vendor computer environments.

Servicing Problems

Let's depict some of the unique problems encountered in maintaining and servicing mixed-vendor equipment sites.

Who's at fault? This is the first question that must be answered in a mixed-equipment, multiservice vendor situation before problem solving can begin. Add the various levels of software support, which also may be part of the maintenance package, to the hardware support assignments and this could become a complex issue.

Finger pointing begins when no agreement is reached among the service providers. As an example, suppose there's a problem with your DEC PDP-11/24 equipped with a 7250 Graphic Processor from Megatek. If your DEC FE is responsible only for the 11/24 and its associated DEC components, how will this cabinet be tested? According to



TRW FEs apply TRW's own diagnostics and training expertise for support.

Derek Mendel, a West Coast field service consultant specializing in DEC mixed-vendor CAD/CAM environments, the 7250, most likely, will be disconnected before testing. If the PDP-11/24 successfully runs the tests, the FE considers it operational. When Megatek tests its graphics processor, it too successfully runs the diagnostics. Yet, when connected back into the PDP-11/24, the system still fails. Who is at fault? And more important, how do you get it resolved?

Training of the FEs is another major consideration when dealing with a variety of equipment brands. An OEM field representative is factory trained on his company's own equipment. Usually, they'll have a good working knowledge of the peripherals associated with their computers, but what about the network, off brands and competitor's components running as part of the LAN? Would you take your Chevy to a Toyota mechanic for repairs?

Cross-vendor training is essential in providing quality service at mixed-vendor sites. FEs, or CEs if you prefer, whether product specialists or system oriented, must have a working knowledge of all major products in the integrated systems environment.

Parts inventory also presents unique problems at mixed-vendor installations. Every OEM and supplier of equipment will have its own part numbers and ordering systems. The service provider must be able to track down the needed part immediately, regardless of what the OEM calls it or what order numbering system defines it.

And what about obtaining parts in a timely manner? Can Sorbus or CDC get their hands on a vital DEC part as quickly as a DEC FE? Can Unisys get that IBM part quickly? And as the user, can you?

Attitudes also play an important, if intangible, role in mixed-vendor equipment servicing. If your DEC FE is working on an IBM PC, is he as eager to get it up and running as he would be if the equipment in question were a VT220? Has IBM spent as much time and money training the CE on a competitor's product as on its own? If additional OEM support were needed, for example, on an Emulex PCB, would the OEM be as open in disclosing data to DEC, a possible competitor, as it would to Maintech, a non-seller of competitive products?

Do the diagnostics available check out the entire system with all vendor products being exercised? And what about the roadblocks put up by OEMs to prevent competitors from using their diagnostics? Do they impede the non-OEMs' service ability?

With test equipment how much is necessary to troubleshoot, test and adjust the many types and brands of OEM components now linked to the computing network? Will a moving van be required to carry the exercisers, testers, boards and cables and tools required? Can one FE possibly know how to use and interpret all of the gadgets? And most important, whose wallet will pay for all this, the user or the service vendor?

As you can see, mixed-vendor equipment, all operating together in an integrated corporate computing environment brings many substantial problems and challenges to the field ser-

vice endeavor. I'm sure as you read over the list above, other questions, and possible problem areas, come to mind depending on your situation. By now, no one can blame you if you're thinking, "How did I get into this anyway?" "Can my equipment ever be serviced effectively and efficiently under these complex conditions?"

Well, thankfully, the answer is yes! These mixed-equipment servicing problems can be handled. And now we'll take a peek at how some TPM providers are addressing the task.

Handling The Problems

I have talked extensively with a few third-party maintenance providers over the last few months collecting firsthand data on how they're addressing the complex issues involved with mixed-vendor equipment servicing and how these TPM organizations are meeting the challenges of maintaining DEC equipment combined with other hardware on a day-to-day basis.

Of course, all of the TPM firms contacted believe their industry provides the best answer to the "Who's at fault?" question. By providing a one-stop, supermarket of service for all user equipment and system needs, this problem, along with all finger-pointing, is eliminated. The TPM vendor takes responsibility for almost all of your maintenance and servicing needs. The user is relieved of determining what piece of equipment or which component is failing; it doesn't matter. You make one call to get it fixed. This returns the user to the same situation that existed in preconnectivity/pre-LAN days.

However, common sense reminds us that, although the larger TPM companies claim total service ability, with the hundreds of brands available today, both foreign and domestic, no one company can guarantee a customer that it can maintain and properly support every piece of hardware. But they can support the hardware supplied by the larger OEMs and many of the smaller ones with their one-call approach. Of course, occasionally a second call to another party may be necessary. This was true even on the standard DEC-based systems.

As John Zarzano, director of Strategic and Business Planning for Sorbus, commented, "Minimizing the vendors who handle account servicing is very beneficial from an end user's viewpoint. Having only one number to call for almost any type of service problem results in a closer working relationship and better response between the service provider and the user responsible for obtaining service."

All of the major TPM firms contacted spend considerable time and effort in cross training FEs to work on a variety of hardware makes and models.

Digital NEWS & digital review

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Sorbus, which maintains over 400 different brands of computers and related equipment, feels that maintenance is their only business, and therefore, they must perform better than OEM service organizations. Thomas Hodge, product manager in charge of DEC-related service, states, "The customer is paying for uptime, not the time that the FE is out there. Therefore, it's to our benefit as well as the customer's to have the FE in and out of the site as quickly as possible."

The parts availability and locating issues also are being addressed successfully by the TPM companies. For example, TRW's automated-parts cross-referencing system can track and order any part from its 10 million plus item inventory within minutes. And it doesn't matter what part number designation the manufacturer assigns, it can be cross referenced quickly, even to locate a duplicate part by another manufacturer. Sorbus and Maintech each employ similar parts referencing and locating systems.

TPM firms are geared to support customer requirements for both parts and service. "When servicing mixed-vendor systems, the array of products maintained is current with customer needs and not based on the needs of the manufacturer of the basic processing components," according to Larry Feld, project manager at TRW's Customer Service Division.

When maintenance is the primary business of the service vendor, flexibility on service agreements also is improved. For example, the user can continue with DEC-supplied service and just buy TRW's diagnostics or training services, or continue with IBM maintenance while turning over printer service to TRW.

Sorbus will take on a contract to support only one OEM CPU in a mixed-vendor CPU site, but won't accept a peripherals only situation. Sorbus, working with another Bell Atlantic company, will provide a multiyear fixed-price service contract as part of a sales or lease package, if desired.

Maintech, the TPM arm of Volt Delta Resources Inc., will provide design engineering to solve integration or compatibility problems on mixed-vendor systems with or without a service commitment. They also will bundle equipment sales into maintenance contracts, freeing the customer from capital investment situations.

Maintech is an interesting entity unfamiliar to many MIS managers. They have been in the business of maintaining DEC-based mixed-vendor systems since 1971, but have kept a low profile. Yet, according to Frank D'Alessio, vice president of Maintech, last year's revenues of $16 million plus were derived almost exclusively from servicing DEC-based mixed-vendor systems.

None of the TPM vendors interviewed felt that the restrictions from Digital Equipment Corporation on using DEC Diagnostics has hurt them. Most either write their own, purchase packages from outside vendors, such as TRW, or do a combination of both. The same applies to documentation, engineering drawings and other items needed for servicing the equipment. The bigger third- and fourth-party organizations produce their own and do sell them on the open market.

One of the most impressive items I came across while researching this article involved a piece of test equipment that, in my opinion, demonstrates the commitment the TPM industry is making to mixed-vendor servicing.

At TRW's Fairfield, New Jersey, facility, I was introduced to Sleuth, a proprietary tester designed specifically for the mixed-vendor system's servicing environment. The use of this versatile, suitcase-size tester is now in the implementation phase. Sleuth is capable of running remote diagnostics on, or troubleshooting just about any system component, by any manufacturer, under a service agreement with TRW. The tester works by attaching custom-made pods containing the correct circuitry for the device under test, and inserting a diskette into the tester. This diskette holds proprietary routines to exercise and test the target device. New pods and diskettes continually are added as new units and modules are placed under the TRW service umbrella.

TPM And Mixed-Vendor Environments

With system integration and LAN fever sweeping through corporate computing centers, it's time to take a fresh look at the purchasing and obtaining of maintenance services. It's a new ballgame. Connectivity has changed the rules, and maybe also changed the field service players who are best able to provide the types of support needed.

While OEM vendors grudgingly take on non-brand products to support their installed systems and service add-ons on a limited, authorized basis, TPM providers are interested in maintaining the whole installation. For most TPMs, maintenance is their main business. And because it is, their concept of customer support isn't based on possible future equipment sales, but is oriented toward total customer care. Hardware maintenance; hardware, software and operational support; training services; etc., are how they make their money. They have the incentive to perform and meet current site needs, regardless of equipment mix or operating environment.

While it's generally accepted that OEM service departments are well-trained and experienced in their own product lines, their training and experience with other products probably is less intense because of the occasional call type of situation that arises. On the other hand, a typical TPM FE is cross-trained and constantly is exposed to working on a variety of product mixes serviced by the company.

TPM companies now are recognized as quality maintenance providers. They may or may not be less expensive than other service providers, but they're capable of delivering an excellent service product, with national coverage quickly. And in a mixed-vendor systems situation they may provide a superior service product, and be more suited to this type of environment. ■

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X WINDOW

The Emerging X Window System

Evan Birkhead

Editor's note: This is the first in a series that will address the emerging X Window System. Known as X by its developers at MIT's Laboratory for Computer Science (LCS) and Project Athena, X Window is a machine-independent, network-transparent graphics interface protocol that was introduced in January 1987. Its source code was made accessible to various hardware vendors, so they would adapt it to their specific platforms.

Last year, 11 companies made a financial commitment to evolving the standard: Apollo, Apple, AT&T, CalComp, Digital, Hewlett-Packard, Sequent Computer Systems, Sony, Sun Microsystems, Tektronix and Xerox. Primarily because of this united support, X has gathered a great deal of momentum and, in some circles, is accepted as a de facto standard. X currently is preferred by software developers who require a common windowing system and by multivendor network managers who oversee shared workstations, which explains Digital's keen interest.

Consortium Adds New Members

In January, one year after the debut of the X Window System, MIT announced the MIT X Consortium, a group of companies devoted to supporting and pushing the X standard. Each of the 11 companies that lent support during the first year will pay a total of $150,000 over the next three years to fund development. They also agreed verbally to support internally and lead the further evolution of X, according to MIT's Bob Scheifler, the principal architect of X. "Each will be expected to make a substantial time commitment among their own personnel," said Scheifler.

MIT will act as a broker in the consortium, a foundation for guidance and cooperation. Scheifler was excited, because the consortium marked the first time MIT gained control of a standard after it left the academic environment and moved into the real world.

> ***". . . success will be measured by the number of third-party software applications that implement X in the coming year."***

In addition, IBM, Bull and Fujitsu America became full consortium members. Companies such as Stellar Computer Inc., Evans & Sutherland and Software Productivity have become affiliate members for $15,000 apiece. MIT is expecting others to join.

In return, the university delivered an upgraded development platform and planned new initiatives in other areas.

In addition to a lot of bug fixes, Release 2 of version 11, available at the end of February, includes added color support for IBM and Apollo machines and improved toolkits, according to Scheifler. As for contents of future releases, Schiefler said, "We gave developers a page of issues, and they wanted to address all of them this year." Among these were added 3-D graphics functionality, PHIGS capability, *PostScript* and image processing.

Having established his plans, Scheifler told the consortium members, "It's time for vendors to build applications."

Popular Among Software Developers

With the support of both IBM and Digital, X has it made. But, success will be measured by the number of third-party software applications that implement X in the coming year. The steadily growing consortium of hardware vendors certainly should increase the probability of more software.

Already, X appears to have been a catalyst to some software developers:

1. Adobe Systems has released a version of its *PostScript* electronic publishing package called *Display PostScript* using X Window.
2. CASE vendor Interactive Development Environments has announced X implementations of its system.
3. Index Technology, another multiplatform CASE manufacturer, also has endorsed it.
4. *X-Pression* application development tool system from Cognition Inc., a UNIX specialist, is based on X.
5. X has been adopted by Polygen Corporation and used in its *Centrum* technical information management system and its *Quanta* molecular modeling program.
6. Locus Computing Corporation has debuted an enhanced version of X Window, based on System V UNIX. One of the many others is Applix Inc. Undeniably, X is popular at Applix. John Butler, Applix's marketing vice president, urges developers to support X with their products rather than with

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their mouths. "X is a giant step forward," he explained. "Now software developers don't have to start from scratch on each port."

The Disappearing Operating System

For more than a year, Applix has been using X to port its *Alis* office automation software to different workstation platforms. Noting that today's applications are more visual, allowing the user to worry less about the operating system, Butler said that with X the software developer "doesn't have to deal with the physical characteristics of a device we're transporting to. It's a straightforward and workable approach."

According to Charles Foundyller of Daratech, a market research firm, the user will win with the increasing acceptance of X Window. Foundyller says the user will have access to more applications, and the price for software will drop, because the developers will see a larger market. He believes that the multiple hardware platforms will spur competition and drive prices down.

Additionally, Foundyller says the operating system market will undergo an interesting transformation. "Operating environments such as IBM's MVS, VM, AIX and MS-DOS; DEC's VMS; and Apollo's AEGIS," he concludes, "are going away due to developments like this."

The Most Hard-Core Supporter

After the release of X Window, Digital came out with DECWINDOWS, a windowing and graphics interface for network users running VMS, ULTRIX and MS-DOS. "We can think of no stronger endorsement than a public commitment to the development of an architecture based on this standard," explained Richard Treadway, Digital's VMS product manager. "Our customers have indicated they would prefer an open windowing system across multiple hardware and software architectures."

Without question, Digital intends to make X, in the guise of DECWINDOWS, the standard windowing system on all of its future workstations. Its in-house development of DECWINDOWS reportedly has improved upon the original X in the following areas: a wider range of toolkits for building screen management devices, support for more international character sets, and the optimization of X code for VMS, ULTRIX and MS-DOS.

At the consortium announcement, Digital's Scott MacGregor echoed Treadway's comments from a year earlier. Noting that X works in TCP/IP and DECNET settings, MacGregor said, "X is a good integrating vehicle for various heterogeneous networks and, we believe, in integrating networks."

He added that the next version of DECWINDOWS "will have a particular 'look', which is how we will encourage applications developers to design their user interface." MacGregor says that X helps the most important interface in computing environments: the user's interaction with the software application.

IBM Makes Its Move

IBM's entry into consortium is more important to the future of IBM than the future of X. Gig Graham, an analyst

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with Gartner Group, said that in commercial data processing sites, System 370s that each require a dedicated console for traffic monitoring will be able to share one console among 30 computers using X. In addition to reducing the cost for users, this will help synchronize messages and optimize the network's operating performance.

In the long term, Graham sees fewer system managers governing each 370 network and more efficient message processing, resulting in lower costs and better performance.

For IBM, the inevitable OS/2 also will play a major role. An official statement from IBM said that "IBM already has shown its support of the X Window System as a windowing standard through the implementation of X version 10.4 on the IBM RT PC and the recent announcement of X version 11 of the IBM RT PC. We also intend to support it for the IBM Personal System/2." Indeed, much of the PS/2's acceptance in the ever-increasing multivendor environments may hinge on the PS/2 running its own version of X.

IBM was reluctant to participate in the initial backing for X, because "the timing wasn't right," explained Dick Verburg of IBM's UNIX Project shop in Austin, Texas. "Version 11 was better for us. But we never were opposed to X.

"X isn't a closed door," he added. "It's always extendable. Things can be added to it."

For its part, Apple said that it will run X on A/UX, its proprietary version of UNIX for the Macintosh II.

Behind Digital in terms of X support are workstation vendors Sun, Apollo and a few supercomputer vendors who, like IBM, seem to be acknowledgeing that networked multivendor workstation environments are the inevitable wave of the future. In other words, if you can't beat 'em, join 'em.

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FROM THE LAB

David W. Bynon

MDB TURBOMUX

The MDB TURBOMUX communications subsystem from MDB Systems Inc. of Orange, California, is an efficient alternative to the Digital DHV11 and many third-party DHV11 emulators. The MDB approach is what makes it unique.

The TURBOMUX is designed around two basic components, a DHU microprocessor module and a terminal adapter unit. The microprocessor module is a controller that plugs directly into your host machines' UNIBUS or Q-bus. The Q-bus version was used for this lab review. The terminal adapter unit is a 32-port asynchronous multiplexer in self-contained housing. You have your choice of a rackmount or tabletop unit. As many as eight terminal adapter units can be cascaded together to provide up to 256 ports from the same microprocessor module.

Each port supports full modem control and 16 baud rates, from 50 to 38.4K baud. Additionally, the transmit and receive speeds may be different. Signal compatibility includes RS232-C and RS423-A. Cable length between the microprocessor module, computer system, and the terminal adapter units is 10 to 1,000 feet.

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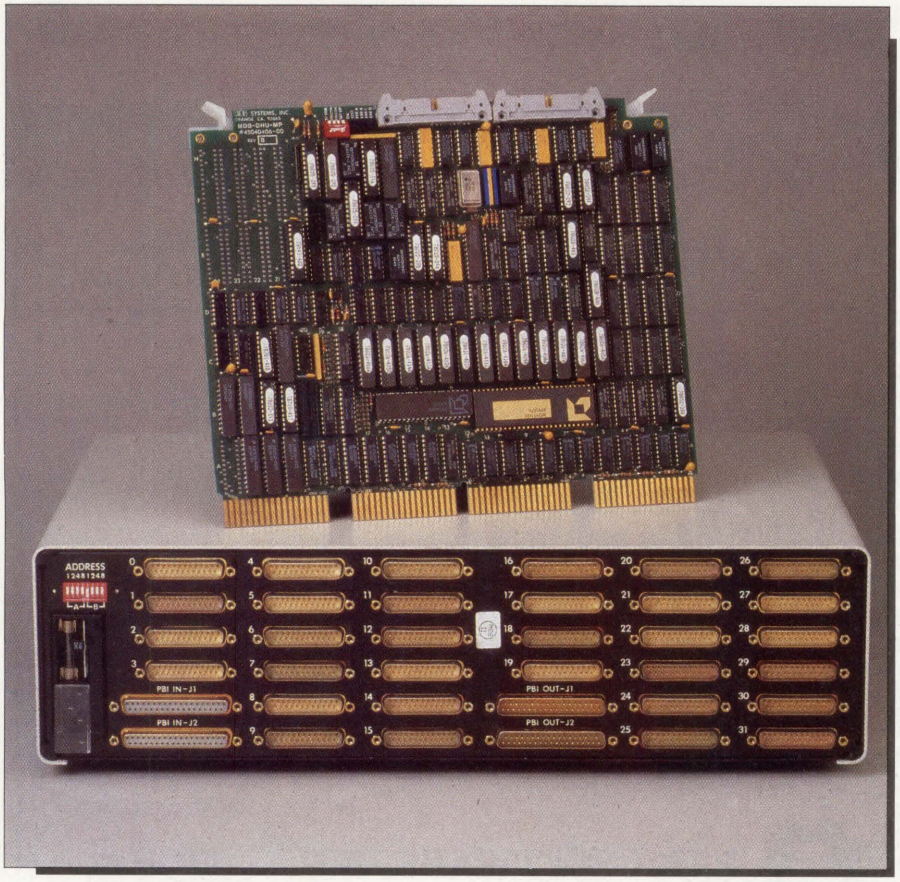

The MDB TURBOMUX, Q-bus version, is a high-performance communications subsystem.

Installation was quick and easy. Like many controller manufacturers, MDB has chosen to use non-volatile RAM (NOVRAM) to store the microprocessor's configuration parameters. To configure the TURBOMUX processor, plug the board into an empty slot, connect a terminal to port 0 of the terminal adapter, bring the system back up and enter a few commands at the terminal. Once the configuration has been written to NOVRAM, the system is rebooted, and then, you have 32 more ports. There's no software to install, no drivers to patch and no parameter changes to make. Just slip it in and go. TURBOMUX uses the standard DHU/DHV driver YFDRIVER.EXE under VMS. The VMS SYSGEN utility is used to determine the correct CSR and vector.

Testing TURBOMUX wasn't easy. It required presenting a known load to the communication subsystem and measuring the results against that of another. The problem I faced was not having another system with as many ports; the second lab system, a MICROVAX II, has a single DHV11.

What I came up with involved connecting eight lines between the

MICROVAX with the Digital DHV11 and the MICROVAX with the TURBOMUX. Then, I wrote the following two programs:

```
$! Read port program
$!
$ OPEN/READ PORT 'P1'
$ READ_LOOP:
$ READ PORT INPUT
$ GOTO READ_LOOP

$! Write port program
$!
$ OPEN/WRITE PORT 'P1'
$ WRITE_LOOP:
$ WRITE PORT "QWERTYUIOP"
$ WRITE PORT "QWERTYUIOPASDFGHJKLZXCVBN
    MQWERTYUIOPASDFGHJKLZXCVBNM"
$ WRITE PORT "QWERTY"
$ WRITE PORT "QWERTYUIOPZXCVBNMAS"
$ WRITE PORT "QWER"
$ GOTO WRITE_LOOP
```

The read port program was used to read data coming into a port, while the write port program was used to put data out to a port. I started four processes on each machine executing the read port program (i.e., $SPAWN/NOWAIT @READ_PORT TXA1:, $SPAWN/NOWAIT @READ_PORT TXA3:, etc.) and four processes on each running the write port program. Next, I started the monitor program $MONITOR IO to watch the results. They were interesting.

The buffered I/O rate reading on each system was approximately the same; the DHV11 system ran at an average of 46.1 buffered I/Os per second, while the TURBOMUX system hung in there at an average of 52.6. Clearly, the TURBOMUX was processing more data. However, it's difficult to tell the true throughput difference, as the DHV11 could be holding the TURBOMUX back.

The big surprise came when I switched from monitoring I/O to monitoring the system, $MONITOR SYSTEM. The DVH11 system's CPU usage was tracked at 99 percent, while the TURBOMUX system loafed along at approximately 75 percent.

What Makes The Difference?

The TURBOMUX processor emulates a DHU11, not a DHV11. A DHU11 has several high-performance features not found on the DHV11, such as a programmable delay timer and DMA first in first out (FIFO) buffers. The programmable delay timer allows characters to collect in the buffer, known as a silo, and be sent to the CPU via a single interrupt. A DHV11, on the other hand, interrupts the CPU for every character transmitted or received. So, you can see that the CPU in the DHV11 system spends a great deal of its time servicing interrupts rather than computing.

The MDB TURBOMUX is a high-performance terminal communications subsystem alternative for single VAX systems. Its design, performance, packaging and expandability make it first rate. ■

FROM THE LAB

David B. Miller

The Link MC3 Terminal

The Link MC3 (MC for Multiple Concept) terminal from Link Technologies of Freemont, California, emulates a VT100, an IBM PC or a host of other models.

Ergonomically, the Link is a comfortable terminal with which to work. The screen can be tilted and swiveled to any angle. Its small footprint (12 x 10 inches) ensures that it will fit in many tight places where other terminals won't.

The keyboard is noticeably shorter in length (17 inches) than the VT220. I like the touch of the keys; they have a positive response, and the J and F keys contain tabs to keep you on the home row. Shift, Return, Escape, Caps Lock and Tab all are within easy reach and are the appropriate size. The 16 function keys are labeled clearly and spread across the top of the board. To the right are the Scroll Lock and Set Up keys. Directional arrows are located in a similar fashion to the VT220, to the right of the main key bank and toward the bottom. A keypad to the right emulates the VT100 edit keypad, as you would expect. Color coding in grey and white distinguishes the standard keys from the special-purpose ones.

I'm not a fan of green monitors, but if I had to use one, the Link's would be a fine choice. Resolution is excellent; characters can be displayed in fine or bold fonts. I found both fonts easy on the eyes and pleasant in appearance, whether the display was set for 24 lines or the compressed 42 line mode.

At the rear of the unit are three ports, two serial and one parallel. The parallel port can be joined to any parallel printer with a standard IBM PC male to Centronix cable. This beats worrying about serial port pin assignments. The auxiliary serial port may be used to connect another printer or to another host computer if Virtual Terminal mode is selected.

Link MC3 terminal emulates a VT100 and other models.

Setup

Upon startup, Link checks itself out and displays the results with a list of any options installed, such as a different keyboard or RS422 interface.

Three setup screens display the available parameters. Instructions at the bottom of the display are the same for all three screens. Current settings may be changed and saved in Link's non-volatile memory, factory settings may be re-established and the last set of saved settings may be restored if desired. The keyboard's Function keys may be set to emulate the current emulation mode. Using the Function keys 1 to 3 moves the terminal through the three screens; F4 invokes the Desk Accessory option. Directional arrow keys permit movement from setting to setting on the display and through all the options for any one particular parameter.

Screen 1 displays current settings for the ports at the rear of the unit. Parameters for each port may be set independently. In terms of communications parameters, currently available settings are baud rates of 110, 300, 600, 1200, 2400, 4800, 9600, 19.2K and 38.4K; seven- or eight-bit words with one or two stop bits; even, odd, mark, space or no parity; and either of the handshake protocols, XON/XOFF and DTR.

Next on this screen, the Host is set. This allows either the main or auxiliary port to connect to the host computer as the online connection. This has particular significance in terms of setting up virtual terminals.

Available communication modes are Full and Half Duplex, Block in which blocks of data rather than individual characters are sent, Local where data isn't transmitted to the host machine and Monitor where control

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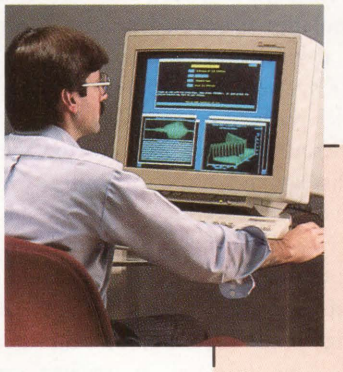

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characters are displayed mnemonically rather than hidden. This has particular value in debugging. If a status line is displayed on the screen, the designations, FDX, HDX, BLK, LOC or MON, indicate the current setting.

Moving along on Screen 1, selecting an emulation mode means choosing between VT100, VT52, Link 125, Wyse 50, Televideo 910/925, ADM 3A, ADDS Viewpoint/Viewpoint 60 and IBM PC (PC scan codes and the IBM character set are emulated). After choosing an emulation mode, you can move to Setup Screen 3 and reset the function key definitions.

Finishing the left column, you can choose 80- or 132-column mode, the number of display lines (24, 25, 42 or 43) and display pages, which forces the terminal to work in 80-column mode only, allowing six pages of available memory as opposed to two pages in 80- or 132-column mode.

Autopage mode, if set ON, treats all display memory as one contiguous block. The default is OFF, which cuts display memory into individual pages of 24 or 25 lines depending on the current setting for page length. Display memory is designated as individual pages of a certain length, depending on your choice from the submenu. A standard virtual page is 24 lines long.

Scroll mode can be set for Smooth Slow (two scan lines per second), Smooth Fast (four scan lines per second) and Jump (12 scan lines per second). The Smooth settings weren't as smooth as I'm used to on DEC terminals.

The Virtual Terminal parameter allows the Link to be configured as two entirely different terminals using the main and auxiliary ports independently of each other. The active port determines the configuration in force at that time. By choosing Virtual Terminal/Split, the screen is divided into two independent sections with the main port displaying 24 lines of data and the auxillary port, 17. Without Split, the terminal's first page of display memory is for the main port, the second for the auxillary. Depressing CTRL-BREAK or CTRL-SysReq, depending on the keyboard emulation you choose, will cause the terminal to toggle between the virtual terminals.

> ***"Two character sets are supported under VT100 emulation as are all VT100 screen and character attributes for reverse video, blinking characters, split screen and the like."***

The last two concerns are Auto Font load which ensures that a particular character font is loaded correctly when an emulation is enabled, and the Printer Port designation which allows the choice between the serial or Centronix parallel ports.

Setup Screen 2 provides for altering display and audio attributes. I like to have the status line ON at the top of the screen that displays the communications mode, video pages used and/or available and the current time. Other settings made here include brightness, video type (normal or reverse) and keyclick ON/OFF.

You can set cursor style to blocks or underlines, in the steady or blinking flavors, or turn it off altogether. The tone and volume of the bell may be changed, although I found the lower volume setting to emulate noiselessness. Those accustomed to the very obvious VT220 screech or a VT100's machine gun sound effect will find even the higher volume setting on the Link to be a little low in volume.

Lines may be wrapped or set to overwrite the last character by changing the Auto Newline setting; the Return key can be defined to send a plain CR or CR/LF pair; you can choose end-of-line and end-of-block terminator characters as well.

A nice feature built into the terminal is the ability to display the time on the status line and to set its internal clock to the current date and time. The clock isn't battery powered and must be reset if the terminal is turned off.

Setup Screen 3 deals primarily with the keyboard. The Link's 16 function keys automatically take on the characteristics of the chosen emulation unless specified otherwise. The F keys can be programmed to your liking, and the settings can be saved permanantly for future use. Also on this screen, the type of keyboard codes (PC scan codes for PC mode and ASCII for everyone else) can be set. In addition to configuring the keyboard shipped with the terminal, PC/AT and PC/RT styles are available that can be configured for use on a DEC system in VT100 mode.

The Desk Accessory option can be accessed on any setup screen by pressing the F4 key. Presently, this feature is a calendar. Using the arrow keys increments or decrements the months and years. Three months of data can be displayed on the screen at one time. The manual hints that custom firmware could be developed to include a calculator and rolodex.

Graphics, Screen Attributes And Fonts

Two character sets (one of which could be DEC graphics) are supported under VT100 emulation as are all VT100 screen

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and character attributes for reverse video, blinking characters, split screen and the like. An added feature, Protect Mode, allows you to designate parts of the screen as untouchable; the cursor will skip over protected characters to the next unprotected field.

Eight-character font banks are available, of which two at any one time may be active. If Virtual Terminal is ON, both may have two fonts loaded independently of each other. Characters also may be composed by inputting a hex escape sequence into the font library. It then is available for future use.

Printing Functions

Supported printing modes include a screen dump and transparent printing which directs all output to the printer rather than the screen. I found it helpful to program some of the function keys to turn these features on and off.

Documentation

Documentation consists of a thin, terse manual that briefly describes the setup features and basic operation. It also supplies numerous appendices and charts for port pinouts, escape sequences and font designations. I found that Setup Screen 3 and the documentation didn't agree totally in appearance, but it didn't cause any major confusion. In general, for a manual this size, it describes the essential features of the terminal well.

Glitches

During my test, I encountered two areas that deserve comment. The manual indicates that the function and editing keys should be reset upon powerup or changing from one emulation mode to another. I found this to be true. When

I invoked EDT and retrieved a file, the directional arrows did nothing until I entered Setup Screen 1 and pressed F to reset the function and editing keys. Of course, this means that any keys that had been programmed prior to this were set back to their default values, meaning another trip to Setup Screen 3 and restoring the last saved setup.

> ***"Supported printing modes include a screen dump and transparent printing which directs all output to the printer, rather than the screen."***

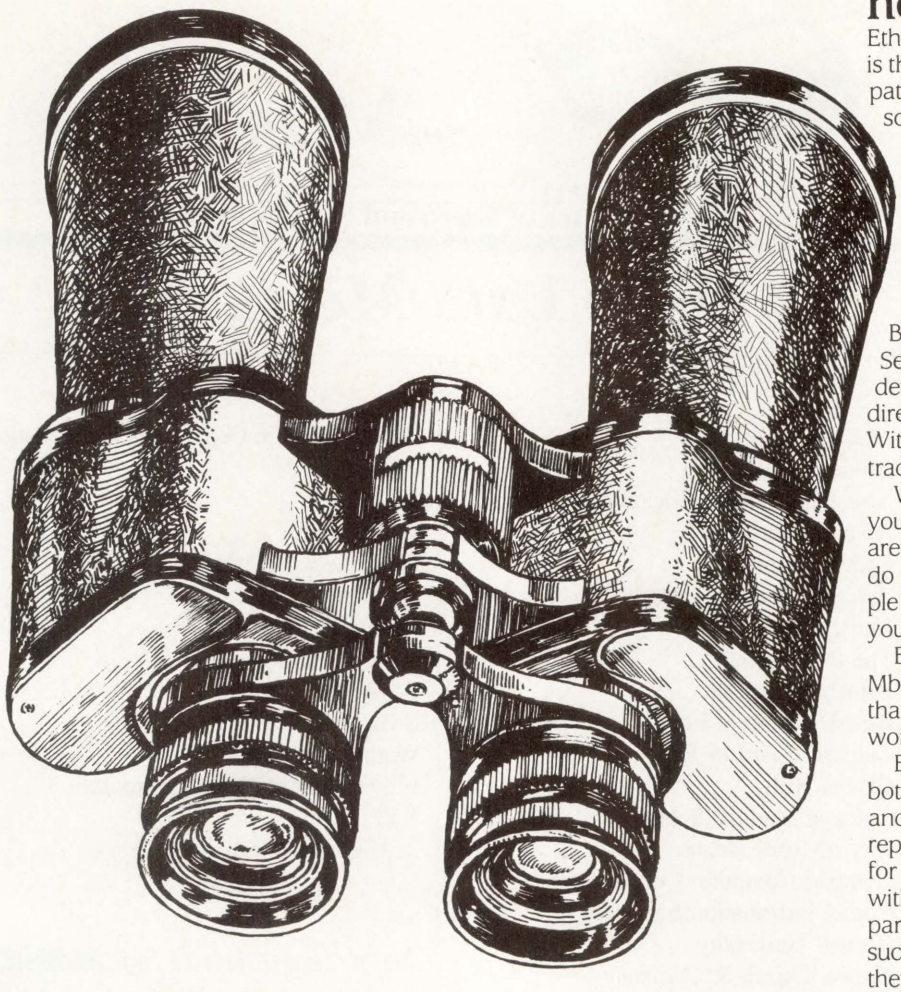
The other glitch I discovered was that the keyclick suddenly disappeared for no apparent reason. It seemed that whenever Help was invoked at the DCL prompt, the keyclick went to lunch. The setting for this option confirmed that keyclick had been turned off. I tried to find other combinations of commands and sequences to simulate it, but couldn't find any.

Service, Repair, Warranty

The Link is warranted for three years from date of purchase, indicating the confidence the company has in its product. In addition, on-site, walk-in and extended repair-by-mail service plans are available at very reasonable costs.

The technical staff at Link Technologies was friendly and helpful although small. The person with whom I spoke indicated he was *the* technical staff at the current moment, so it may be difficult to get immediate phone support.

Overall, I like using the Link MC3 particularly for its superior display and keyboard touch. Link Technologies also offers a VT220 emulator, LINK 220, and a recently announced full-featured ASCII and DEC-compatible terminal, the MC10. ■



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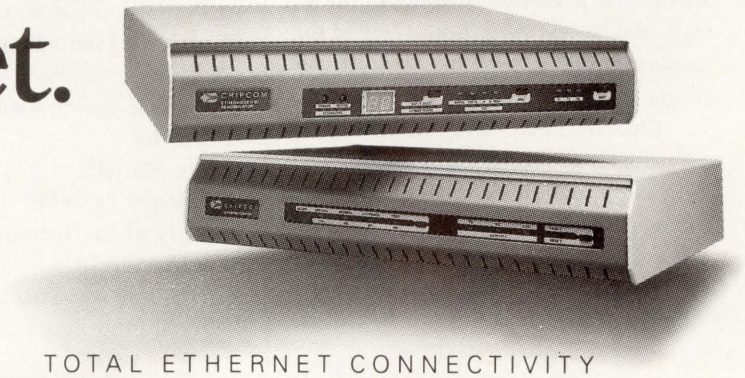

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Dave Mallery

FRODO Meets BILBO And Joins GOLLUM

To build an LAVC, you need DECNET. (You can't bring up a cluster without DECNET, because the boot request from a member over the Ethernet is a DECNET message.) In an Ethernet-based LAVC, you only need end node licenses (cheaper) unless you're planning something like asynch DECNET or leased lines, for which you need a router. Also, note that any DECNET license is cheaper on a MICROVAX II than on a 750. In our case, the router we bought for the MICROVAX II was about half the cost of a router on the 750.

A single end node of DECNET installs right out of the box with almost no complexities. When you've installed DECNET, your mail messages will include the node name. This was the first inkling our users had that changes were coming: "Who's BILBO::?" It was also the start of their mass education. It's amazing how concerned otherwise calm VAXMAIL users become when anything as radical as a node name appears.

How To Become A Cluster Of One

When making the transition from a single VAX to a cluster, we recommend that you bring up the original machine as a cluster of one. This allows you to make the transition to the physical names of the devices as they'll be known under the cluster, before you actually cluster two or more machines. Remember, you have to wring out your existing software to get it to run in your brave new world.

Becoming a VAXCLUSTER is simply a matter of SYSGEN parameters, after you have DECNET up. The first parameters (DECNET related) are SCSNODE and SCSSYSTEMID. SCSNODE becomes your DECNET node name, and SCSSYSTEMID becomes:

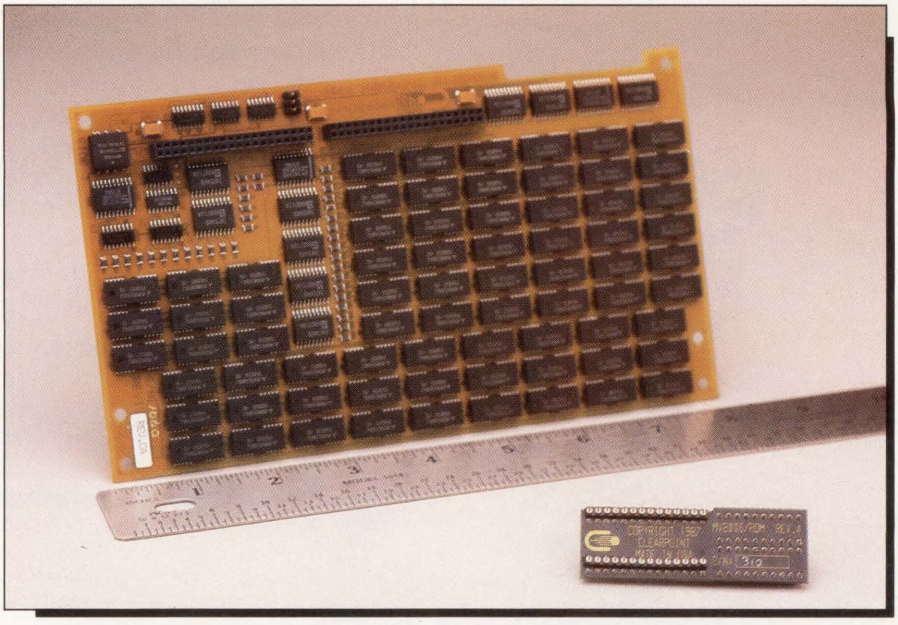
```
DECNET area*1024 + node#.
```

Then you change the following SYSGEN parameters as indicated in the Table.

It shows that we've declared a quorum of two, identified the 750's system disk as a quorum disk (one vote) and given a single additional vote to the 750 itself. This adds up to two, and when there's a quorum of two, clustering can occur. When you reboot, your VAX is a cluster with one member.

The only thing that has changed is the device names for the disks. In our case, the system disk DRA0: is now BILBO$DRA0:. Becoming a cluster of two or more involves more effort, but for now, this will let you fix all your logical device name assignments. We operated this way for several weeks, because we were waiting for things like late device-driver patches. In retrospect, it was a healthy delay, as quite a few programs (the kind that only run once a week) showed up as needing logicals. This way, those changes were behind us by the time we added the second node, and we were free to concentrate on a new set of problems.

Much of what you hear about clusters is hearsay. While planning, we consulted our gurus and got a different opinion from each. Several things, supposedly impossible, proved easy, while others were big let-downs. For example, try as we may, we were unable to convince the 750 to let the other nodes boot from its MSCP-served system disk. The restriction about needing a true



Clearpoint makes the smallest 16 MB in the DEC universe. There are 8 MBs of surface mount 1-MB chips per side. The ROM socket daughterboard is on the right.

MSCP controller in the boot node holds true. Fortunately, FRODO:: (the MICROVAX II) has its own system disk on an Emulex QD33, so it became the boot node. We arranged to have only one SYS$COMMON directory on BILBO:: (the 750), so there's no double software maintenance problem.

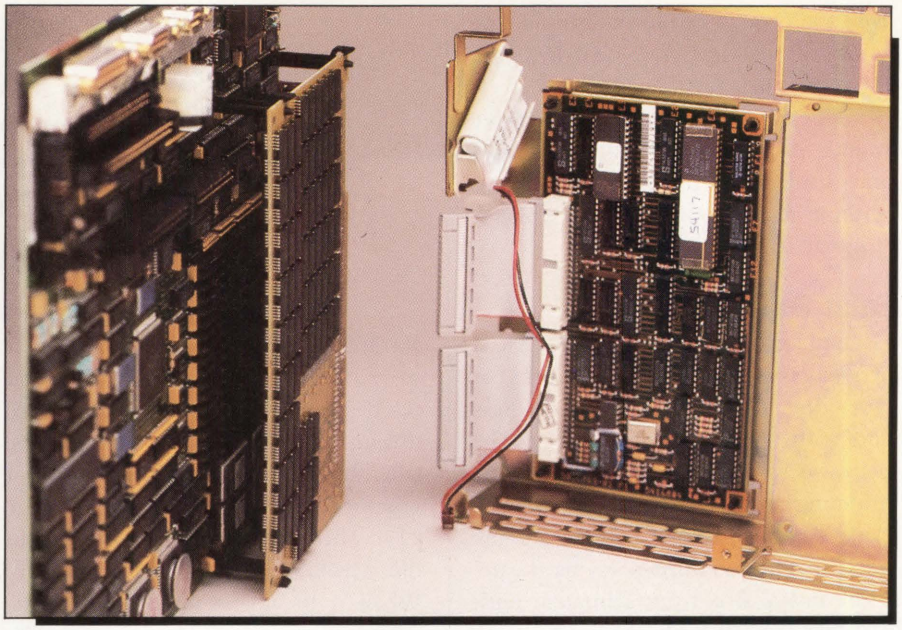
Why Bother?

The 750 was there. It was paid for. It has a huge 2.4 gigabyte disk farm, connected with reliable SI controllers to a fast (5 MB per second) CMI bus (also paid for). Now that we're running, it's clear that our longshot has paid off; BILBO:: had enough CPU power to be an MSCP server. It has enough power to be a superb batch engine as well. This keeps the I/O from our batch jobs off the Ethernet. I note in passing that 750s currently are a glut on the market, and the quoted retail price runs in the low $7,000s. Also, BILBO:: has been running continuously for three years. In that time, it has had only one service call, a regulator.

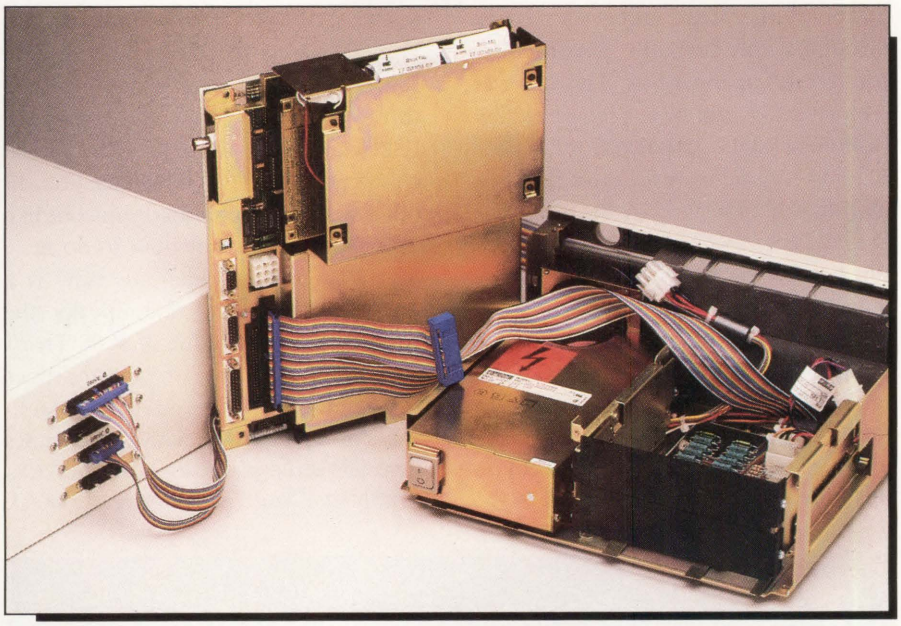
Becoming A Cluster Of Two

Now the fun begins. In short, you become a cluster of two by letting the VMS update procedure modify your on-disk structure for clustering and allowing the second node to show up on the Ethernet requesting membership. Our timing was perfect, because the V4.6 upgrade was waiting to go in when those DRDRIVER patches arrived. On a busy Saturday, we did a fresh V4.6 upgrade, requested cluster modifications on both nodes and watched the two nodes join.

As soon as the second cluster was running, we had to cope with the startup files and getting the single SYS$COMMON. The easiest way to get it is to have VMSINSTAL make it for you during the system upgrade. It will ask you if you want a single rooted common. This results in each node's SYSn containing a directory that's an alias for the common root (V4COMMON). For more information, read the *Guide to VAXCLUSTERS* (AA-Y513A-TE), Section



Here's the 16 MB installed on stand-offs over the motherboard.



The cable supplied by Trimarchi connects to the motherboard (center) and exits through the bottom (right). The extra connector is for a floppy. The E-Z Box is on the far left.

2-4. It allows you to have a single UAF file with NETUAF, VMSMAIL.DAT and RIGHTSLIST.DAT.

There's another "magic" logical we found: MAIL$SYSTEMFLAGS. Set it to 7 and mail goes through the cluster without regard to the node on which it originated.

Enter Gollum::

Gollum:: is our first MICROVAX 2000. It arrived after the first few weeks of clustering. GOLLUM:: arrived diskless and with only 4 MB of memory. The plan was to give it to our busiest programmer and see what happened. Because I'm incapable of owning a computer that has no third-party hardware, I got an E-Z Box from Trimarchi with a single 160-MB look-alike. The drive installation was uneventful and only took a few minutes.

Trimarchi gives you a cable that connects to the 60-pin Berg connector on the motherboard and exits the box through a hole that DEC puts there to connect its expander box. The disk was preformatted and was recognized by Gollum as GOLLUM$DUA0:. It has been running continuously for more than one month, is used heavily by the programmer and is backed up over the Ethernet. We decided to capitalize on this disk by putting the programmer's directory out there, thus keeping all of her programming I/O off the Ethernet.

The key to performance in MICROVAX 2000s is to keep the swapping and paging off the Ethernet. To do this inexpensively, buy a Seagate ST251 (40 MB) at your neighborhood computer store for about $400. It's an RD32 and can be formatted by the MICROVAX 2000 through its ROM-based diagnostics. DEC supplies you the cable to install it when you buy the diskless MICROVAX 2000. The formatting is documented in the MICROVAX 2000 documentation. When it breaks in about four years, throw it away! Note: This is hearsay. We haven't done it in our lab yet, but we have all the parts and will try it soon.

> ***"You can recoup in programmer productivity the cost of each VAXSTATION twice within the warranty period."***

The next question that arises is, "How do I put a second disk onto my MICROVAX 2000?" That's more difficult. Digital has caused the signals for the second small ST506 cable to be routed through the SCSI connector. They have to be converted back to ST506 by special circuitry in the DEC expander box. In other words, forget it until someone like Trimarchi figures out how to do it.

What this world needs now is a good MSCP driver that speaks the MICROVAX 2000 kludge of SCSI. That's a real SCSI bus, and it has many times the bandwidth of the ST506 interface.

Another MICROVAX 2000 news item has serial ports, even on the VAXSTATION. You possibly can sneak another user in through that back door. Of course, you could never get away with that with a busy programmer on a 4-MB system, but if you add memory, you could.

We installed the Clearpoint 16 MB add-in board. This entails a fair amount of surgery on the box that is well described in the manual. Clearpoint

TABLE 1.

Parameter Name	Current	Default	Minimum	Maximum	Unit
VAXCLUSTER	2	1	0	2	Coded-value
QUORUM	2	1	1	32767	Votes
VOTES	1	1	0	127	Votes
DISK_QUORUM	"DRA0"	""	""	"ZZZZ"	ASCII
QDSKVOTES	1	1	0	127	Votes

Changes to SYSGEN parameters to become a VAXCLUSTER.

Companies Mentioned In This Article

Clearpoint Inc.
99 South St.
Hopkinton, MA 01748
(617) 435-5395
ENTER 572 ON READER CARD

Logicraft
22 Cotton Rd.
Nashua, NH 03063
(603) 880-0300
ENTER 450 ON READER CARD

Polygon Inc.
1024 Executive Pkwy.
St. Louis, MO 63141
(314) 576-7709
ENTER 573 ON READER CARD

3Com Corporation
3165 Kifer Rd.
Santa Clara, CA 95052
(408) 562-6400
ENTER 574 ON READER CARD

Trimarchi & Associates Inc.
139 N. Gill St.
State College, PA
16801 (814) 234-5659
ENTER 575 ON READER CARD

supplies a little daughterboard that plugs into the socket of one of the DEC ROMs, which then plugs into the daughterboard. This handles the decoding problems for so much memory. The memory is flawless but perhaps only cost effective for users running software with massive memory demands (or, for users sneaking dozens of users in through the other back door). Market pressure will bring the price down soon enough, and there's also an 8-MB board available.

What's the other back door? LAT, of course. LAT seems to have been cast into stone, concerning the way it appears on the Ethernet. Given that stability and a good Ethernet analyzer, cracking LAT is a computer science term project. It has been done up and down the block. We found no roadblocks in our way when we came in via the Ethernet from our AT equipped with Polygon's *poly-STAR*, which speaks LAT, and a 3Com Etherlink Ethernet board. I'm sure we could get there with RAF and others.

You enable LAT on an MICROVAX 2000 by setting a single logical:

```
LAT$DEVICE = ESA0:
```

This logical exists thanks to the folks who brought us multiple Ethernets on the BI bus. You use it there to declare which one carries the LAT.

A word to the wise. After you give a programmer a MICROVAX 2000 with a big screen and a mouse, forget about ever getting him to work on a single terminal again. It takes about a week for the most skeptical person to become a believer. You can recoup in programmer productivity the cost of each VAXSTATION twice within the warranty period.

Next month, we'll explore other devices, including the Logicraft 386ware. There were a few problems with it on an LAVC that were fixed rapidly. By then, we'll have lots of real work running on it. We're also planning to get all the interactive users off BILBO::, retuning it to excel as a file and batch server.

ARTICLE INTEREST QUOTIENT
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High 569 Medium 570 Low 571

RSX CLINIC

By James A. McGlinchey

I respond to those questions that are interesting and applicable to the general RSX user. Please mail your questions to: RSX Clinic, *DEC PROFESSIONAL*, P.O. Box 503, Spring House, PA 19477-0503. Questions also can be submitted through ARIS.

RESUSCITATING CPR

QUESTION: *How come you never write anything about VAX-11/RSX?*

REPLY: If I can't say anything good about a subject, I'd rather not say anything at all. VAX-11/RSX, formerly called the Application Migration Executive (AME), is a way of running a semblance of RSX on a VAX/VMS system.

I can't really call it an emulator because VAX-11/RSX isn't a complete implementation of either an RSX-11M or an RSX-11M-PLUS system. Therefore, VAX-11/RSX isn't a suitable platform for running established RSX applications, nor was it ever intended to be.

The performance of VAX-11/RSX is slow. The more recent the vintage of your VAX, the slower VAX-11/RSX will run, yielding performance roughly equivalent to a PDP-11/23 while running on a MICROVAX II. In my experience, VAX-11/RSX is enough of an RSX system to run the RSX utilities, enabling you to use a VAX to develop software to run on RSX systems.

Close on the horizon, however, is a new product. CoProcessor RSX (CPR/RSX) isn't an emulator but a real RSX system running in a real PDP-11 installed as a VAX coprocessor. This is a software/hardware addition to your MICROVAX, using the KXJ-11/CA PDP-11 coprocessor board plugged into your Q-bus VAX. The software is a modified version of the current release of RSX-11M-PLUS.

It's not clear whether multiple CPR/RSX systems will be able to run in the same VAX. The possibilities are intriguing. Digital is touting CPR/RSX as a migration path for your RSX applications.

When viewed as an integrated architecture, though, it seems to be a combination of the best of both worlds: a VAX, with its development tools, security and networking, combined with a PDP-11 doing serious real-time work. CoProcessor RSX is in field testing right now. I'm sure I'll have more to say about CoProcessor RSX, as it becomes a reality. I wonder if CoProcessor RSX ever could have an RSX host?

RSX TO VMS

QUESTION: *My company is installing more and more VAXs, and I'm wondering how much of my 12 years of RSX experience can be used on the VAX. I'm a system programmer and have written RSX device drivers, ACPS and privileged tasks. How should I learn VMS?*

ANSWER: My RSX experience serves me well in dealing with the various VAXs. VMS has an equivalent for every RSX facility, whether it be an MCR command, a utility or a subsystem option. If you're looking for a direct match of an RSX facility, you won't find it, but

that's the wrong mindset anyway.

Consider the facility you're dealing with on RSX and its intrinsic function. It may be called by a different name in VMS and be grouped into a different subsystem, but it will be there. Keep looking.

For instance, because device drivers in VMS and RSX are similar (despite what the VMS folks say), an equivalent of the RSX LOAD command should be hiding in VMS somewhere. The corresponding facility in VMS for loading device drivers is the LOAD and CONNECT commands in the SYSGEN utility, and it wasn't difficult to find. You'll find VMS contains equivalents for most RSX executive directives and utilities.

If you have MCR commands burned into your nervous system, as a lot of us veteran RSXers do, you'll have to learn the DCL commands. Then, it's time to learn the VMS idiosyncrasies.

Given the length of your experience with RSX, reading the manuals will be more efficient than going to training courses. Things like clustering, system tuning and system management are best learned by going to DECUS symposium sessions or one-day seminars. When you get to the hard-core system programming and real-time stuff, you'll find a lot of similarities.

As you get closer to the bare metal, however, the VAX and VMS architectures become an important factor in your thinking. You may want to take a VMS Internals course and become conversant with the VMS hardware architecture. Get the *VMS Internals and Data Structures* book.

You can make the transition to VMS smoothly and without losing what you've invested in learning RSX.

TIMING IDLE TIME

QUESTION: *How can I measure the idle CPU time on my system? The Zero CPU Ticks statistic from RMDEMO doesn't seem to be accurate.*

REPLY: The Zero CPU Intervals statistic is simply a count of the number of times the CPU has been found to be idle at the beginning and end of a clock tick. A CPU tick occurs when a task is running when the clock ticks every 1/60th of a second. A Zero CPU Interval occurs when a task runs and exits between ticks. The task runs for less than a clock tick interval, and the CPU is found to be idle at both the start and finish of the clock tick.

Because a clock tick is a long time in the CPU's view, knowing the CPU was idle at the start and end of the tick doesn't tell very much about what happened during the interval. You can't conclude that the CPU was idle during the entire interval.

I measure idle CPU time with the following program:

```
START:  MOV     #COUNT,R0
        ADD     #1,(R0)+
        ADC     (R0)+
        ADC     (R0)+
        ADC     (R0)
        BR      START
COUNT:  .WORD   0,0,0,0
        .END    START
```

For you MACRO-11 hackers, the ADD _#1,COUNT is correct rather than INC COUNT. INC doesn't generate a CARRY bit.

Run this program at priority 1, making sure that no other program is running at the same priority. The program will sit running in a hard loop, using all the remaining CPU. Because it runs at the lowest priority, it can't affect any other program. I have a more elaborate version of this program that contains a Mark Time AST routine to display the count every 10 seconds, but the essential part is shown above. Run the program for a timed interval, such as 10 or 15 minutes. Using the MCR OPE command or a debugger, read out the contents of COUNT and, after some octal arithmetic, you'll have the number of iterations this loop performed. Use the timing data in the PDP-11 processor handbook to calculate the time duration of each loop (7.65 microseconds on an 11/70) and, thereby, assess the idle CPU time on your system. ■

PRODUCTS

BBC Delivers Enhanced Version Of VCL

Boston Business Computing Ltd. is delivering VCL 2.0, an updated version of its VMS emulator for MS-DOS and UNIX systems. By implementing DEC's DCL, VCL 2.0 offers a VMS-like environment on non-DEC machines.

VCL 2.0 adds 30 new commands, such as DIFFERENCES and MAIL, lexical functions, flow control of command files, an updated manual, and a customizable HELP facility. The lexical functions allow access to system variables, conversion of data types, and character string manipulation. VCL 2.0 supports all of the VMS flow control commands used in command files. With command files, users can create batch processes that run after hours and provide results the next day.

Licenses for VCL 2.0 start at $195.
To learn more, contact Boston Business Computer Ltd., Riverwalk Center, 360 Merrimack St., Lawrence, MA 01843; (617) 683-7920.

Enter 400 on reader card

PostScript Has DEC LN03 Emulation

AST Camintonn Digital Division announced the AST TurboLaser/PS, an eight-page per minute laser printer with a resident PostScript controller and an optional board for LN03, Diablo 630 ECS and HP LaserJet Plus emulation. AST TurboLaser/PS has DEC LN03 emulation with RS232-C connectivity, and a choice between a Data-Products or Centronics parallel interface for compatibility with this environment. This board is a field upgrade for the AST TurboLaser/PS and has an add-in option already installed. With this upgrade, the printer provides PostScript, DEC, Diablo ECS 630, and HP LaserJet Plus compatibility. The AST TurboLaser/PS also has an RS-422/AppleTalk port, making it compatible with Apple, IBM and DEC environments.

The AST TurboLaser/PS costs $4,595. The emulation upgrade costs $595.
To find out more, contact AST Camintonn, 2121 Alton Ave., Irvine, CA 92714-4992; (714) 553-0247.

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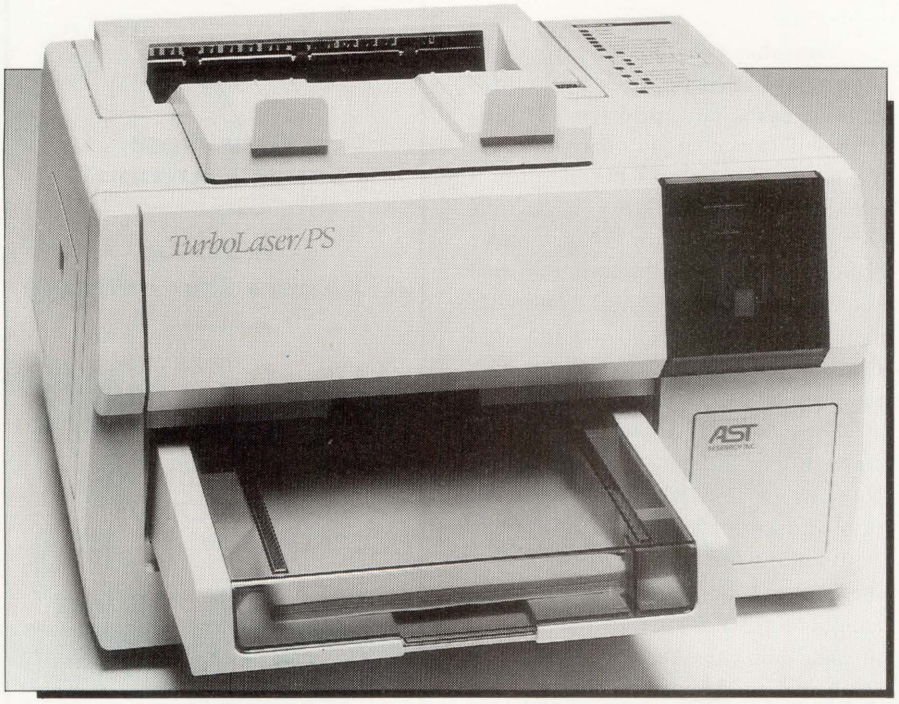

The AST TurboLaser/PS eight-page-per-minute laser printer.

FORTRAN-Verifier Saves CPU Time

Professional Software Tools Inc. announced FORTRAN-Verifier for VAX/VMS systems. FORTRAN-Verifier is a Computer-Aided Software Testing (CAST) tool that measures program logic coverage. It improves the quality of software by showing exactly which portions of program logic haven't been tested. FORTRAN-Verifier can save CPU time by finding the smallest set of test cases that will cover program logic.

FORTRAN-Verifier also reports the portions of code that are most often executed. This information can be used to improve program performance.

Prices start at $2,450 for a single MicroVAX.
For more information, contact Professional Software Tools Inc., 1260 Oxton Dr., San Jose, CA 95121; (408) 281-4551.

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Bridge Connects VAXs, MVs On TCP/IP LAN

Bridge Communications Inc. has announced a communication software package that connects VAX and MicroVAX systems on a TCP/IP protocol-based Ethernet or bridge 5-megabit-per-second broadband LAN. It provides full terminal connectivity and file transfer without the addition of non-DEC hardware. The V/IP software lets any VAX system running VMS achieve multivendor connectivity over a LAN through the DoD TCP/IP protocol set. Users on the LAN can make virtual terminal connections to VAX hosts running V/IP using the TCP/IP Telnet protocol, and can transfer files between hosts using the FTP protocol. The V/IP software is compatible with Bridge's line of communications servers, internetwork gateways

and bridges, and network control services.

Prices range from $8,000 for the MicroVAX to $20,000 for the VAX 8800. To learn more, contact Bridge Communications Inc., 2081 Stierlin Rd., Mountain View, CA 94043; (415) 969-4400.

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CQD-300 Compatible With DEC MSCP

The CQD-300, from CMD Technology Inc., is a high-speed dual-wide ESDI disk controller that's compatible with the DEC Mass Storage Control Protocol (MSCP). The CQD-300 can be used with LSI-11/23, LSI-11/23+, LSI-11/53, LSI-11/73, LSI-11/83, Micro/PDP-11, and MicroVAX II. It supports RT-11, TSX+, RSX, RSTS, MicroVMS, VAXELN and other operating systems that use the DU driver.

The CQD-300 supports normal and adaptive block mode DMA with Q-bus transfer rate up to 3.2 MB/sec. It has a 64K bytes sector buffer that allows the CQD-300 to control high-speed 10 MHz and 15 MHz ESDI disk drives with 1 to 1 sector interleave.

Two models are available. The CQD-300/10 with transfer rate at 10 MHz is priced at $1,150. The CQD-300/15 with transfer rate from 15 MHz to 20 MHz is priced at $1,250.

For further information, contact CMD Technology Inc., 3851 S. Main St., Santa Ana, CA 92707; (714) 549-4422, FAX: (714) 549-4468.

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PASSPORT Boosts Application Performance

Version 4.7 of PASSPORT, an SQL application development environment recently was introduced by FORTEX Corporation. An integrated development toolset, PASSPORT provides the extensive non-procedural and procedural capabilities necessary to build and maintain powerful industrial applications. Introduced with PASSPORT is the Forms Builder option, allowing the painting of screens and menus for rapid application development.

PASSPORT is transportable across different operating systems and SQL RDBMSs and across hardware environments. PASSPORT can "snap on" to any SQL RDBMS, using the installed database as the PASSPORT database. PASSPORT applications, which are automatically generated in C code, are portable to different IBM or DEC environments.

For further information, contact FORTEX Corporation, 125 Wilbur Pl., Bohemia, NY 11716; (516) 567-2003.

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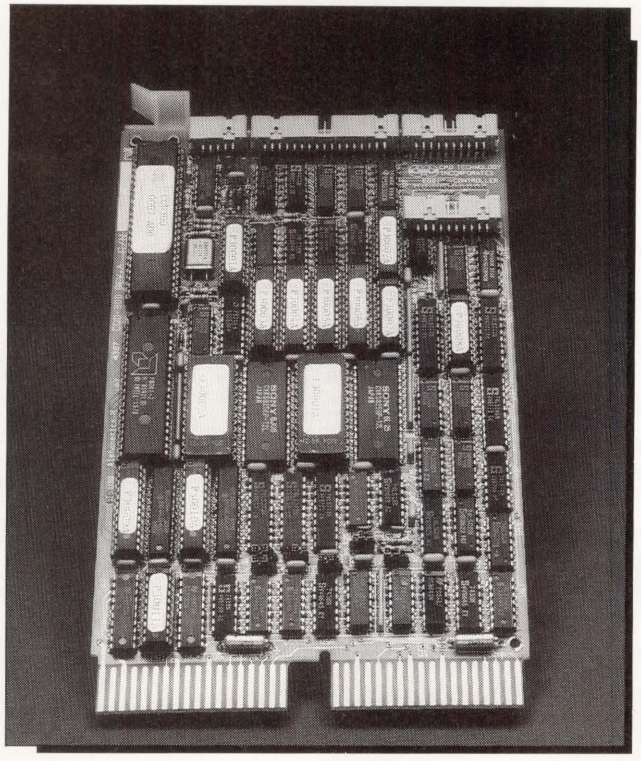

The CQD-300 disk controller from CMD Technology.

SOLO Talks Users Through Training

Advanced Micro Technology Inc. has introduced a system for developing computer-based training (CBT) for VAX, PDP-11, UNIX and PC software applications. The SOLO Talking Software Trainer uses an "Audio/Sync" device that connects to the printer port of a standard terminal or PC. The SOLO software synchronizes an instructor's voice from cassette to hands-on interactive application software training.

With SOLO, a human voice describes each operation as the system demonstrates step by step. The instructor then asks the student to perform the operation. The voice stops automatically to wait for the student response. If mistakes are made, a helping message appears on the screen.

The basic SOLO Authoring System is $6,000.

For more information, contact Rich McMahon, Advanced Micro Technology Inc., 183 Guggins St., Boxboro, MA 01719; (617) 263-3030.

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Clustering PDP-11s Now Possible With The LINK

The LINK from Northwest Digital Software Inc., provides a means to cluster PDP-11s into one powerful system. The LINK V2.1 offers multinode capabilities with full bidirectional disk access.

The LINK V2.1 allows up to five PDP-11s running RSTS/E to be clustered forming one multinode system, more powerful than a VAXcluster of three VAX 8200s. It needs no application program changes. The LINK provides full file protection and privilege enforcement, record locking, RMS support and data caching.

The LINK software package begins at $10,000.

For more information, contact Northwest Digital Software Inc., Box 1797, W. 405 Walnut, Newport, WA 99156; (509) 447-5631.

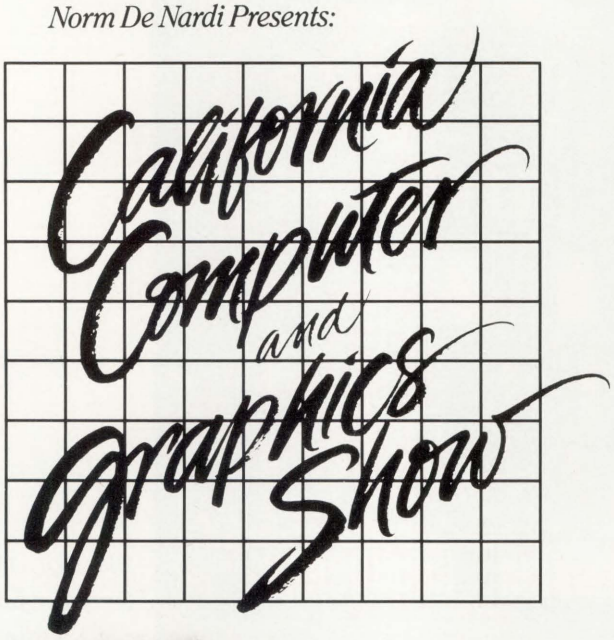
Enter 409 on reader card

350 Combines Bridge And Router Functions

Vitalink Communications Corporation introduced the TransLAN 350 with Distributed Load Sharing (DLS). The DLS function lets wide area network managers design and operate an extended Ethernet network with more than one route between LANs, while using virtually all the routes for carrying traffic. This capability combines the path-control functions of a router with the protocol transparency of a data-link-layer bridge.

This capability extends the Spanning Tree Protocol (STP) and allows virtually all links to carry production traffic — even those

Norm De Nardi Presents:



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Los Altos, CA 94022 (415) 941-8440

that the STP assigns as backup links. The 802 WAN now can be designed with alternate paths between locations; automatic, dynamic alternate routing; and no single points of failure.

The TransLAN 350 sells for $18,500, including software.

To obtain further information, contact Vitalink Communications Corp., 6607 Kaiser Dr., Fremont, CA 94555; (415) 795-6130.

Enter 407 on reader card

Water Detector Provides Early Warning Signal

Dorlen Products introduces its newest version, the Model SS-3(T). The SS-3(T) like other Water Alerts provides early warning of leakage in computer room subfloor wiring areas, etc., where undetected water accumulation could cause down time, damage or financial loss. The SS-3(T) is used with Dorlen's PS-3(T) Power Supply/Tester.

The SS-3(T) doesn't need batteries, and can be tested remotely from the PS-3(T) location. Double-pole double-throw relay contacts are provided, making the detector ideal for interfacing with existing alarm/security systems as well as Dorlen's AD-5 Auto-Dialer. Sixteen SS-3(T) detectors can be connected to a single PS-3(T).

For complete information, contact Dorlen Products, 7424 W. Layton Ave., Milwaukee, WI 53220; (414) 282-4840.

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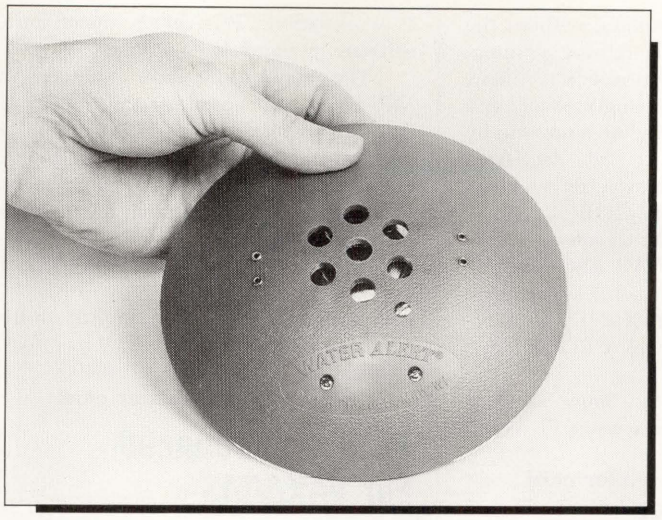


The Model SS-3(T) water detector gives early warning of computer room leaks.

It's Snow For UNIX, XENIX, ULTRIX Systems

Snow Software has announced the release of its Snow Report Writer for UNIX, XENIX and ULTRIX operating systems. This Report Writer is used to create customized reports,

forms and business graphics, without the time and expense of custom programming. One hundred different spreadsheet, database, accounting, word processing packages and languages can be read and/or written to by Snow Report Writer; e.g., file data from Lotus 1-2-3, dBase, Wordstar, several kinds of BASIC, ASCII, many COBOLs, etc.

The Snow Report Writer software packages run on the MicroVAX among others. 384K memory and a fixed-disk are required.

Suggested list for XENIX is $995, UNIX costs $1,195 and ULTRIX costs $1,295.

To find out more, contact Snow Software, 2360 Congress Ave., Clearwater, FL 34621; (813) 784-8899.

Enter 410 on reader card

VAX Version Of MRM Introduced

The Atrium Information Group has introduced the Micro Resource Manager (MRM), a VAX/VMS version of its computer tracking and support software. MRM is a program for managing, supporting and analyzing the use of computer resources, such as workstations, PCs, minis, mainframes, software, peripherals or services.

The major functions included in MRM/VAX are inventory tracking, configuration management, maintenance management, purchasing and receiving, online tech notes, network management, problem and support tracking, and management reporting.

MRM/VAX pricing begins at $4,995 for the MicroVAX.

Learn more by contacting The Atrium Information Group Inc., 200 W. Lowe Ave., Fairfield, IA 52556; (515) 472-6400.

Enter 411 on reader card

TPTool Announced For VAX/VMS

GrayMatter Software & Consulting Inc. has announced the release of TPTool, a text processing and printing tool for VAX/VMS systems that provides 80 percent of standard word processing capabilities on VAX 11/780 CPUs.

TPTool allows users to create complex memos, correspondence and documents while still using their favorite VMS text editor. Documents can be previewed on the screen to view the effects of pagination, headers, footers, hyphenation, justification, etc.

TPTool supports all major VMS filetypes, including RUNOFF files, for printing on the full DEC line of printers. Printers can be on standard VMS queues, attached to a VAX terminal port, attached to a terminal's auxiliary port, or to PC printers attached to the PC's printer port.

For further information, contact GrayMatter Software & Consulting Inc., 1300 Dexter Ave. N., Seattle, WA 98109; (206) 285-7414.

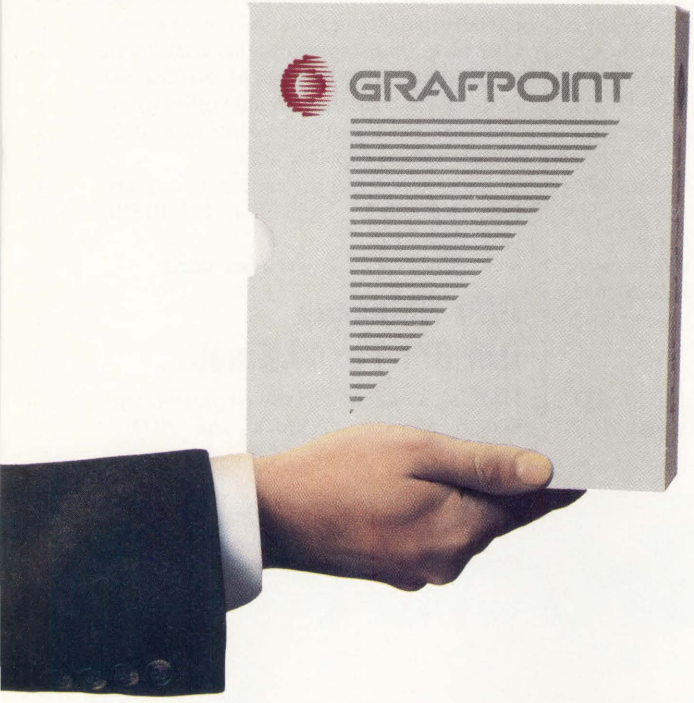
Enter 412 on reader card

Touchstone 1.6 Improves Linear Simulation

EEsof Inc. has introduced Touchstone 1.6, the newest generation of its linear simulation program for the design, analysis and optimization of microwave/RF circuits. Touchstone 1.6 features a new sparse admittance matrix reduction capability, full-feature screen editor commands, increased variable and equation faculties, etc.

The user interface has been enhanced

Choosing The Right Tool For The Job



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Buy your terminal emulation from the proven leader. To hear about our latest generation of products, or arrange for a demonstration call today 1-800-426-2230/ (in California 1-408-446-1919).

Picking a high-performance graphics terminal emulation package is easy. Consider the following and you won't get stuck with the wrong tool for your job.

A large installed base indicates widespread customer acceptance. Grafpoint has the largest installed base of 4105, 4107, and 4115 Tektronix™ emulation products.

A flexible product will operate in a number of environments. Grafpoint's products also provide DEC VT100™ and VT200 emulation, operate in asynchronous as well as networked environments, and support the broadest possible range of graphics boards for your IBM PC™, XT™, AT™, PS/2™, or compatible.

A partial emulator may work today, but not fill your future requirements. Grafpoint's third generation of Tektronix emulation products stand up to the most rigorous compatibility testing in the industry; the others don't.

Quality technical support protects your productivity as well as your investment. By offering a 30-day money back warranty, a year of free technical support from a readily available team of emulation experts, a year of free software updates, and a generous upgrade policy that protects your investment, Grafpoint sets the standard in customer support.

Yes, I want to learn more about the leader in Tektronix emulation. Send me your **FREE** pamphlet "Spend Less on a Graphics Terminal..."

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with full-screen editor commands, including search and replace; repeat find command; file read/insert; and select, delete, move, copy, and undo block. These features simplify the preparation of circuit files, especially large circuit files where sections of code are repeated and/or available to be read from separate files.

For further information, contact EEsof Inc., 5795 Lindero Canyon Rd., Westlake Village, CA 91362; (818) 991-7530.

Enter 413 on reader card

SMS Announces Its SMS 1000 Model 38

Scientific Micro Systems Inc. announced its SMS 1000 Model 38 system compatible with the DEC LSI-11 computer. This is a complete microcomputer system based on DEC's Q-bus architecture. The Model 38 is a powerful tabletop computer that has a Winchester hard disk drive, an LSI-11/23 or LSI-11/73 CPU, four or eight serial ports, a selection of removable media, and a five-slot quad-height Q-bus backplane. The system supports both high-performance real-time operating systems such as RT-11, RSX-11M and RSX-11M-PLUS, and timesharing operating systems such as RSTS/E, UNIX and TSX-PLUS.

SMS 1000 Model 38 is priced between $3,000 and $17,000. To find out more, contact Scientific Micro Systems Inc., 339 N. Bernardo Ave., Mountain View, CA 94043; (415) 964-5700.

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DEC Extends Electronic Mail Capabilities

DEC has extended its electronic mail capabilities with the new VAX Message Router/P Gateway. This allows IBM PROFS mail users to connect with DEC's MAILbus to exchange mail or documents with DEC's electronic mail system users in a global electronic messaging network.

DEC also is enhancing its DECnet/SNA Gateway capability by adding support for VM and DOS/VSE operating systems.

The VAX Message Router/P Gateway is priced from $3,000 for a MicroVAX 2000 to $36,000 for a VAX 8800. The DECnet/SNA Gateway is available for $16,500.

For more information, contact DEC, Maynard, MA 01754-2571; (800) DEC-INFO.

Enter 415 on reader card

Clearpoint Updates Free Designer's Guide

An expanded 1988 edition of the 80-page *Designer's Guide to Add-In Memory* is available from Clearpoint Inc. The text is written for the very technical to the management-oriented.

The updated edition includes new information on the buses appearing today: the proliferation of new DEC machines; where to find the best price/performance for memory; an expanded survey of the performance and memory options available in the IBM line, from the PS/2 Micro Channel to the 9370; what the HP 9000 offers users; and mips and megabytes for the new SUN 4/2XX and Apollo DN 4000.

To receive a free copy, contact Clearpoint Inc., 99 South St., Hopkinton, MA 01748; (617) 435-5395.

Enter 422 on reader card

DMI Releases DM 371 For VAXmate

DMI Inc. announced its newest portable tape system for the VAXmate and AT/XT-

compatible PCs. The DM 371 operates with the DMI DM 300 and the DEC RCD Expansion Systems for the VAXmate, and the IBM AT/XT-compatible PCs. The DM 371 uses a ruggedized 3½-inch streaming cartridge tape drive with the newest high-density/high-speed CD-2000 mini data cartridge that provides data reliability 100 times greater than previous larger cartridge backup systems. The required cables, controllers, and easy-to-use proprietary software are supplied by DMI based on the system configuration it's backing up.

The 60-MB portable tape system is priced at $995.

To obtain additional information, contact DMI Inc., 1 Hughes, Irvine, CA 92677; (714) 583-1800.

Enter 414 on reader card

SNITCH Informs System Managers

Jager Computer Systems has announced SNITCH, a VAX/VMS utility that lets system managers find out when anything "interesting" happens on their systems. Every minute it checks whether any defined events have occurred.

SNITCH detects a user logging on or off. The operator can specify either a username or a UIC. Wildcards are allowed. It can detect activity on a specified terminal and detect when anyone runs a specified image or when a specific user runs an image.

Users establish how often SNITCH is to test for the condition and report. Events can be reported every time they are seen up to three times. Users establish up to 64 events in each category. Events can be added or removed from the list at any time.

SNITCH sells for $495.

To learn more, contact Jager Computer Systems, 8835 MacLeod Trail SW, Calgary, AB Canada T2H OM3; (403) 259-0700.

Enter 417 on reader card

IIS/DESTINY Enhanced With Version 2.2

Intelligent Information Systems (IIS) has announced version 2.2 of IIS/DESTINY, a full-featured 4GL/DBMS on VAX/VMS and a new price structure regardless of VAX model.

IIS/DESTINY provides a total environment for information management, transaction processing, and application development. Its DBMS accommodates hierarchical, network and relational technology and includes security, online recovery, and transaction roll-back. It provides features such as field arrays and key arrays with variable occurrences. It also supports data sorting and online access of existing RMS files. IIS/DESTINY has a dictionary combining a conventional live data dictionary and program library.

Learn more by contacting Intelligent Information Systems, 503 Broadway, Ste. 500, New York, NY 10012; (212) 966-4468.

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RDM Provides Read/Write Support For RMS Files

Interactive Technology Inc. has announced an extension to RDM, which allows RMS data files to be accessed by RDM applications. The RDM Gateway Dictionary allows a user to define an access path to non-RDM files. RDM's access extensions also will permit other software to access data files created for RDM applications transparently.

RDM provides a wide range of integration and extension capabilities for RMS file users. From added input screens or transac-

tion processes to complex reports, RDM will support quick development of extensions to an RMS-based application. Its files may be related dynamically one to another or to RDM files based on data content of the files involved.

More information can be obtained by contacting Interactive Technology Inc., 460 Park Plaza West, 10700 S.W. Beaverton-Hillsdale Hwy., Beaverton, OR 97005; (503) 644-0111 or (800) 362-6203.

Enter 418 on reader card

Visual 630 Intended For Business Graphics

Visual Technology Inc. has a new Visual 630 processing terminal, a VT220-compatible high-resolution video display terminal, which integrates text and graphics displays. Its processing capabilities include the execution of down-line-loaded applications at the display terminal level and the ability to locally configure a RAM disk for local applications processing. It also includes user-friendly pull-down menus and a built-in mouse.

The Visual 630, intended for business graphics applications, offers benefits in installed applications such as UNIX environments, because C call routines and I/O transfer utilities can be incorporated. Developers and systems integrators also can add value by adding plug-in personality modules.

For more information, contact Visual Technology Inc., 1703 Middlesex St., Lowell, MA 01851; (617) 459-4903. FAX: 452-0402.

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InterCAP Ports Illustrator I To DEC

InterCAP Graphics Systems has ported Illustrator I technical illustrating software to VAXstations II/GPX and 2000. This is available on Apollo's Series 3000 and 4000 personal workstations. The Apollo personal workstations and VAXstations have compatible databases, enabling them to coexist within the same network.

With the Illustrator I, artwork can be input from a variety of sources, including CAD/CAM systems and scanners. Artwork then can be modified and output to devices, such as laser printers and phototypesetters.

The DEC version of Illustrator I is offered as a complete system with input and output devices, and as unbundled software to customers who already own compatible systems. It runs under VMS.

Learn more by contacting InterCAP Graphics Systems, 2525 Riva Rd., Annapolis, MD 21401; (301) 224-2926.

Enter 419 on reader card

Visual Technology's 630 processing display terminal.

WordPerfect Office Is OA Package For The VAX

WordPerfect Corporation has released WordPerfect Office. The package includes a shell menu program that lets the user access WordPerfect or any one of the office programs from the shell with one keystroke. The Notebook program is an online database that allows the user to organize information into individual records that have the on-screen appearance of a business card file. The Mail program has a simple screen approach to creating and sending messages, letters or files to connected network users. The Calendar program helps users organize and keep track of time schedules. The Scheduler uses features from the Mail and Calendar programs to coordinate the schedules of users and resources.

Cost varies from $1,000 on a VAXstation to $29,000 on the VAX 8978.

For more information about WordPerfect Office, contact WordPerfect Corp., 266 West Center St., Orem, UT 84057; (801) 227-4020.

Enter 421 on reader card

EnQuery Report Writer Migrates To VAX

Datamate Company has developed a version of its popular English-language report generator and file extracter for the VAX under VMS. EnQuery is a simple-to-operate report and query processor that allows users to generate formatted reports from simple English words and phrases, such as PRINT ACCOUNT NAME BALANCE END.

EnQuery uses its own data dictionary structure to describe existing data files. It also extracts data from existing files and reformats it as comma-separated values that can be read into Lotus 1-2-3 and similar PC products, allowing the user to define what data he desires and easily move it to PC-application software. All of EnQuery's features are available to the non-technical user through its simple statement syntax.

For a demo tape and more information, contact Datamate Co., 4135 S. 100th East Ave., Ste. 128, Tulsa, OK 74146; (800) 262-7276.

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Persoft Announces WordPerfect Support

Persoft recently displayed its WordPerfect keyboard driver. The driver is necessary for many users because the VAX version of WordPerfect assumes that the user is using a DEC terminal, and thus assigns its command keys to DEC VT terminal keys. The new SmarTerm driver lets users have their familiar PC keyboard template while using WordPerfect on the VAX.

The SmarTerm keyboard driver emulates all keystrokes and multikeystroke sequences of the PC version of the WordPerfect template while using WordPerfect on the VAX.

The WordPerfect support is available in SmarTerm 240 release 2.0b at no extra charge. The price of SmarTerm 240 is $345.
For more information, contact Persoft Inc., 465 Science Dr., Madison, WI 53711; (608) 273-6000.

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SM600 Compatible With DEC's DSA Controllers

Emulex recently announced the SM600, a removable, 5¼-inch ESDI disk subsystem that's compatible with all of DEC's DSA controllers. Designed to be part of Emulex's Storage Module Disk Interconnect (SMDI) family, the SM600 takes advantage of full DSA functionality while providing all the security and high-capacity data interchange features of removable storage modules.

A two-drive standalone SM600 costs $26,000.
Find out more by contacting Emulex Corp., 3545 Harbor Blvd., Costa Mesa, CA 92626; (800) 854-7112, ext. 2252 (outside CA) or (714) 662-5600, ext. 2252.

Enter 426 on reader card

WARPspeed II Available From Fedmark

Fedmark has introduced the WARPspeed II line of MicroVAX-based workstations for engineering and scientific applications. The WARPspeed concept brings a new level of computational and graphics performance to the VAX-based workstation field. Performance enhancements are accomplished by the integration of powerful concurrent processors (CP), and graphics engines (GE), with standard MicroVAX systems. Full compatibility with all DEC hardware and software (and compatible third-party) products is maintained.

WARPspeed workstations are priced from $50,000 for a basic system to $140,000 for a system with four each CPs and GEs. The basic system includes MicroVAX CPU, 5M RAM, RD53, TK50, CP, GE with keyboard-monitor mouse, VMS and choice of compiler.
For further information, contact Fedmark, 3720 Farragut Ave., Kensington, MD 20895; (301) 946-1474.

Enter 427 on reader card

Laticorp Releases CONTEXT 1.0

Laticorp Inc. has announced CONTEXT 1.0, a knowledge access system that delivers the precise information people need to work more productively, as individuals or as a team.

CONTEXT allows any text — ASCII files, C sources, (text, strings, and comment fields), and formatted word processing documents — to be searched without structuring and defining fields in advance. CONTEXT uses the inverted indexing method. Searches may use Boolean, proximity, limiting and ranging operators, a synonym thesaurus and a stop list. Dates, values, and user-defined fields also may be searched.

CONTEXT is for the VAX line running under ULTRIX 2.0.

More information is available from Laticorp Inc., 185 Berry St., San Francisco, CA 94107; (415) 543-1199.

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ITRON Releases Network Software

ITRON, a division of Infotron, has introduced Commix Network Software to control the Commix 32. The CNS is designed

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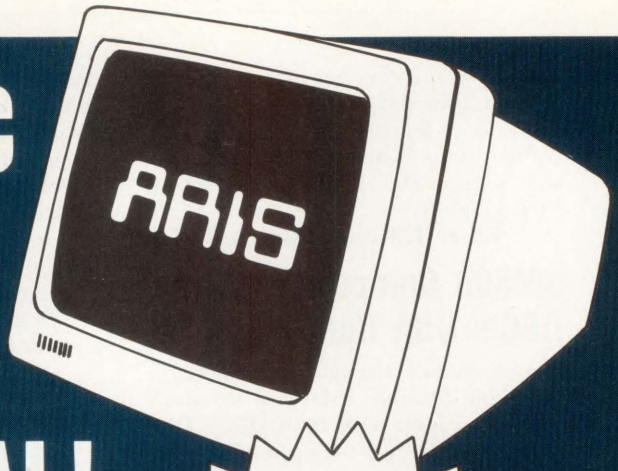

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WHAT: It's an online electronic bulletin board called ARIS (Automated Reader Information Service), "talk" to our editors, advertisers, other readers.

YOU GET:

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- **FUN** doing it!

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2. Dial (215) 542-9458.
3. ARIS asks for your name and subscriber number (the number is on your mailing label).

That's all it takes to use our electronic bulletin board.

GET ONLINE! DIAL IN NOW! IT'S FREE!

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for OA-type users who want the communications aspect of networking to be transparent but don't want the complexities attached to communications software. CNS works in the background while menus with highlighted selections automate the communications process. These menus pop up whenever needed via a hot key and are used to transfer files, access network printer/plotters and send/receive electronic mail.

The Commix 32 can be expanded to more than 8,000 I/Os via an Ethernet link module and has the advantage of putting the I/Os where the users are located, doing away with long and costly cable runs.

The Commix sells for less than $125 per port.

If you need more information, contact ITRON, 130 Gaither Dr., Bldg. 116, Mt. Laurel, NJ 08054.

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AMNET Releases Version 2.10

AMNET Inc. has announced software version 2.10 for the Nucleus 7400 Network Switching Node. Version 2.10 has the latest features of the CCITT's 1984 specification for X.25. It also supports hunt groups, which allow a network manager to define a group of X.25 ports to be called by the same name. Another CCITT 1984 feature includes extended frame numbering from 0 to 127 as opposed to the older 0 to 7 numbering scheme.

Version 2.10 adds increased reliability plus the capability to have hot standby nodes that are activated automatically or by operator command from the network manager. It also increases the largest network configuration possible to 250 nodes with 264 virtual circuits per node.

Version 2.10 is VAX compatible.

To learn more, contact AMNET Inc., 1881 Worcester Rd., Framingham, MA 01701; (617) 879-6306.

Enter 431 on reader card

CLUSTOR Extends MV Clustering Capabilities

System Industries Inc. (OTC-SYSM) has a new family of fully integrated data storage systems, the CLUSTOR Series. These systems have large disk storage capacity, multiprocessor connectivity and other powerful features and options, including cache processing, performance monitoring, removable Winchester chassis, patch panel switching, drive status and long line connections.

MicroVAX users can benefit by deploying the CLUSTOR products in Local Area VAXcluster configurations because they provide a measurable increase in performance and facilitate cost-effective implementation of Q-bus devices rather than expensive BI devices.

The first two products are CLUSTOR 3 and CLUSTOR 5. Minimum configurations include cabinet, integral disk server, two Winchester disk drives, interfaces, computer port adapter and clustering software. The CLUSTOR 5 optimizes data utilization through dynamic caching functionality as a standard feature.

Find out more information, by contacting System Industries Inc., 560 Cottonwood Dr., Milpitas, CA 95035; (408) 432-1212.

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Datability Introduces RAF Print Server Software

Datability Software Systems Inc. recently announced a PC software package that allows PC printers to be configured as VAX/VMS system printers, as if connected through a DEC Terminal Server.

Using Datability's reverse-LAT-compatible technology, RAF Print Server is implemented as 5 KB of memory-resident software on the PC. Once installed, a VAX system manager can define a VAX print queue that automatically prints on a PC-based printer exactly as a print job now prints through a DEC Terminal Server.

The cost for RAF Print Server is $495 for each PC chosen to act as a print server. The cost for RAF is $395 per PC and $395 per host/user, or sites have the option of purchasing a BULK PC License and/or an unlimited Host Master License.

For further information, contact Datability Software Systems Inc., 322 8th Ave., New York, NY 10001; (800) 342-5377 or (212) 807-7800.

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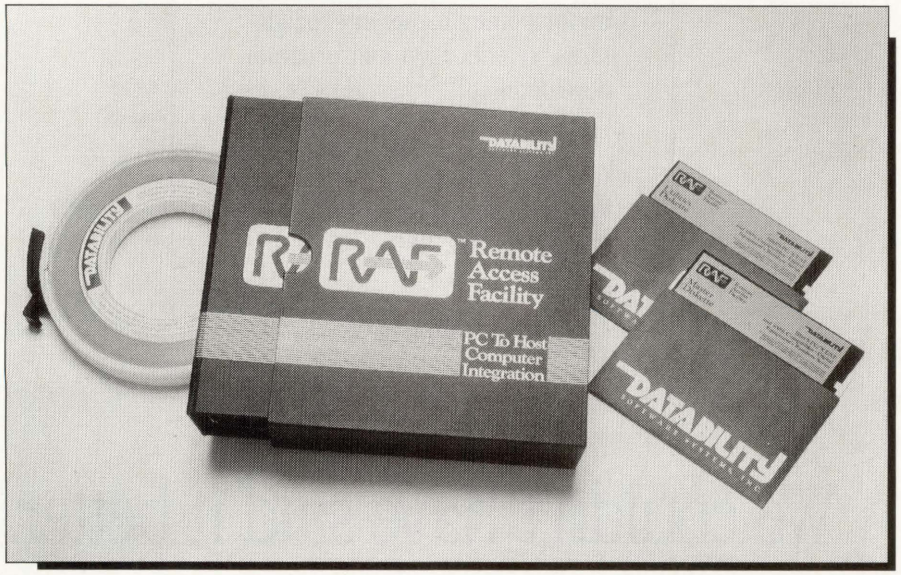

RAF print server software from Datability Software Systems.

LEVEL5 Expert System Released For The VAX

Information Builders Inc. recently introduced the LEVEL5 expert system tool for the VAX. LEVEL5 VAX is a powerful expert system tool that interfaces to a variety of databases and application programs.

LEVEL5 allows companies to manage their most critical resource, employee expertise. LEVEL5 knowledge bases can be developed by domain experts familiar with the problem or knowledge engineering professionals. LEVEL5's design aids assist the developer in coding the expert system application, testing its functionality and validating the expertise it contains.

Prices for LEVEL5 for the VAX range from $4,000 on the MicroVAX 2000 to $36,000 on the VAX 8800, 8900. Run-only versions are available from $1,600 to $14,400. Learn more by contacting Information Builders Inc., 1250 Broadway, New York, NY 10001; (212) 736-4433.

Enter 436 on reader card

EXOS Is Well Suited For VAX 8000s

Excelan Inc. recently introduced a high-performance Intelligent Ethernet controller for UNIBUS-based computers. Excelan also reduced the price of its current UNIBUS board.

The EXOS 304 is the second in Excelan's new 300 Series of controllers that uses Intel's 80286 microprocessor as an on-board CPU. Using this chip improved performance up to 75 percent.

The EXOS 34 is well suited for VAX 8000 systems, which support UNIBUS peripherals. The 304 also offers performance advantages for VAX 750, 780, and 785 Series systems when they're used as network servers or are running distributed file systems and applications that require a high number of network connections or high data throughput rates.

The EXOS 304 is available for $3,520. The EXOS 204 was reduced by 25 percent to $2,120.

Learn more by contacting Excelan Inc., 2180 Fortune Dr., San Jose, CA 95131; (408) 434-2226.

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LinkLoc Available For VAXs And MicroVAXs

Phar Lap Software Inc. has released its LinkLoc software package. LinkLoc is a linker plus locater utility for the Intel 8086/286/386 family of microprocessors. It's used for the development of ROM-based software for embedded systems and controllers. LinkLoc is available for the VAX and MicroVAX systems.

LinkLoc is used by a programmer or engineer to link ROM- based software written in assembly language or in high-level languages such as C and PASCAL. It produces executable image files that can be downloaded to many targets, including in-circuit emulators, ROM-based debuggers and PROM programmers.

The VAX/VMS and VAX/ULTRIX versions start at $1,495.

Find out more by contacting Phar Lap Software Inc., 60 Aberdeen Ave., Cambridge, MA 02138; (617) 661-1510.

Enter 432 on reader card

Talaris 1590 Designed For Shared Printers

Talaris Systems has announced a network protocol for shared printers. The new protocol, called LAP (Local Area Printstation) Protocol, is a set of rules and conventions to oversee the flow of network traffic to and from a Talaris 1590 Printstation residing on a LAN.

The architecture is compatible with many LANs. The first implementation is on Ethernet for VAX/VMS systems. The LAP protocol is a low-level protocol that sits on top of the data link layer used by any network adhering to the ISO Open Systems Interconnect Network Model. The LAP Protocol simultaneously can coexist with different network protocols, including DECnet, LAT, TCP/IP, and AppleTalk on standard Ethernet cabling. Talaris also will use the protocol for developing additional network interfaces for the Talaris 1590 Printstation.

More information is available through Talaris Systems Inc., 6059 Cornerstone Ct. West, Box 261580, San Diego, CA 92126; (619) 587-0787.

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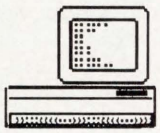
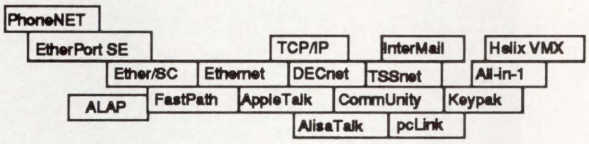
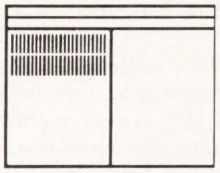
The only thing you'll ever need between your Macintosh and your VAX is... Us.







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Afterward, we can help you install your network, show you how to use it effectively, even help you write custom VAX server software. Friends for life.

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End User Facility Gives Programmer Relief

CompuServe Data Technologies recently unveiled an information and report facility. The System 1032 End-User Facility is an add-on module to CompuServe's System 1032 4GL/DBMS. It supports data access and reporting by end users, relieving programmers of building applications for many information needs. It also fully integrates System 1032 data with RMS and other VAX data.

Security is fully addressed in the End-User Facility. Access may be controlled down to the field level, by password, username or work group using the screen-based Administration module. This module quickly defines data files and sets up views of data to the facility's data dictionary.

More information can be provided by contacting CompuServe Data Technologies, 1000 Massachusetts Ave., Cambridge, MA 02138; (617) 661-9440.

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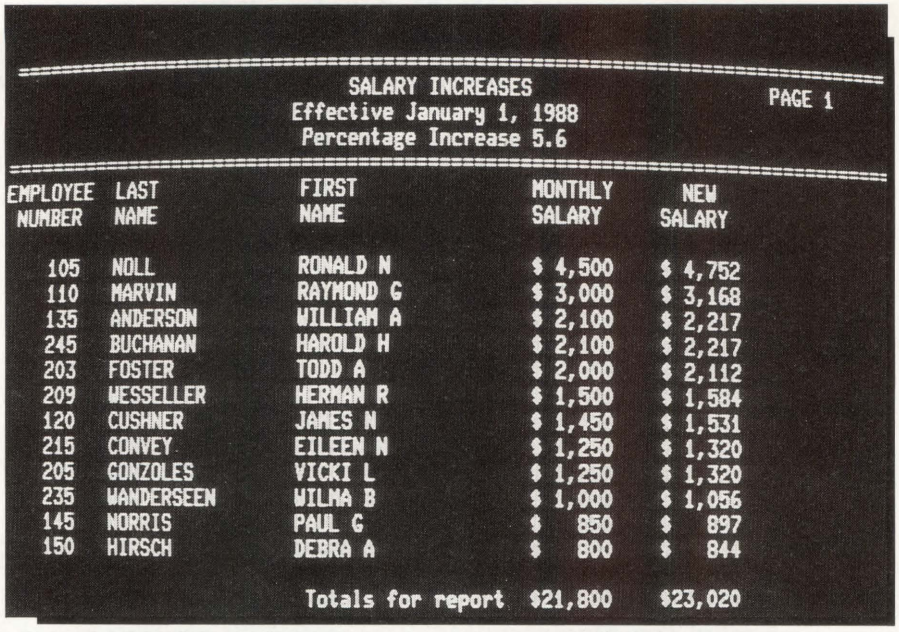

SALARY INCREASES
Effective January 1, 1988
Percentage Increase 5.6

PAGE 1

EMPLOYEE NUMBER	LAST NAME	FIRST NAME	MONTHLY SALARY	NEW SALARY
105	NOLL	RONALD N	$ 4,500	$ 4,752
110	MARVIN	RAYMOND G	$ 3,000	$ 3,168
135	ANDERSON	WILLIAM A	$ 2,100	$ 2,217
245	BUCHANAN	HAROLD H	$ 2,100	$ 2,217
203	FOSTER	TODD A	$ 2,000	$ 2,112
209	WESSELLER	HERMAN R	$ 1,500	$ 1,584
120	CUSHNER	JAMES N	$ 1,450	$ 1,531
215	CONVEY	EILEEN N	$ 1,250	$ 1,320
205	GONZOLES	VICKI L	$ 1,250	$ 1,320
235	WANDERSEEN	WILMA B	$ 1,000	$ 1,056
145	NORRIS	PAUL G	$ 850	$ 897
150	HIRSCH	DEBRA A	$ 800	$ 844
		Totals for report	$21,800	$23,020

The System 1032 End-User Facility, from CompuServe, lets non-programmers design sophisticated reports.

Softstar Systems Announces V2.00 Of Costar

Softstar Systems has released Version 2.00 of Costar, an interactive software cost estimation tool. Version 2.00's new features include a new screen-based user interface that features menus, color, context-sensitive help, and full-screen editing. New commands make Costar more powerful, and the new user interface makes Costar easier to use.

The package is for software managers who need reliable estimates of a software project's duration, staffing and cost. It lets them make preliminary estimates during a project's initial definition, and then produce more accurate forecasts as the project's definition is refined.

The VAX/VMS version of Costar costs $1,500.

For more information, contact Softstar Systems, 28 Ponemah Rd., Amherst, NH 03031; (603) 672-0987.

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3.5 Mip Attached Processor Is For VAXs

Computer Maximizers Inc. (CoMAX) announces the release of V/MAX, a simple-to-use, attached processor for VAX end users, VARs and OEMs. V/MAX increases the processing power of heavily compute-bound systems, relieving the VAX of extensive processing loads. This is accomplished by running specific CPU-bound programs on the V/MAX attached processor instead of the host (VAX) CPU.

V/MAX is ideal for computation-intensive programs such as circuit simulators and other number crunchers. It runs at 3.5 to 4 millions instructions per second and isn't affected by the load on the host VAX. The floating point multiply time is 437 nanoseconds. One or more V/MAX-attached processor boards may be added to any VAX system to multiply the total system throughput.

For further information, contact CoMAX Inc., 15187 Springdale St., Huntington Beach, CA 92649; (714) 897-5096.

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New Standards Set With 8500 Series

Versatec has announced the 8500 series of electrostatic monochrome plotting systems. The new product line accepts 906/907 and HPGL data formats. The 8500 series is expected to replace pen plotters in applications requiring high throughput or fast turnaround and is targeted at workstations and PCs used in microCAD applications.

Two models are available. The 8524 plots on 24-inch wide media and the 8536 on 36-inch wide media. Both plot with 200-ppi resolution at 1 ips. An E-size drawing (34 inches x 44 inches) can be plotted in less than 45 seconds.

Versatec's RS-232C serial interface accepts vector data up to 38.4K baud transfer rate. Both allow easy connectivity to workstation platforms such as Sun, IBM, DEC or Apollo.

The 8524 is priced at $19,900 and the 8536 at $24,900.

For more details, contact Versatec, 2710 Walsh Ave., Santa Clara, CA 95051; (800) 538-6477, in CA (800) 341-6060.

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UDMS Supports INGRES DBMS For VAX/VMS

Interactive Software Systems Inc. has announced that its UDMS data management and retrieval product supports the INGRES database management system for the VAX/VMS environment.

UDMS has a clean pick and choose, window-based approach to reporting, exporting, querying and updating. Initially designed to work exclusively with RMS and the CDD, UDMS now is capable of accessing/joining up to 32 INGRES, System 1032 and/or RMS files in a relational data view, complete with inner and outer joins. C was used to build the interfaces and perform the direct I/O. Performance feedback indicates that not only does the UDMS interface to INGRES work effectively (almost transparently to users), but that it provides great response times.

Pricing for the UDMS system ranges from $2,950 to $15,300.

Interested persons can contact Interactive Software Systems Inc., 7175 West Jefferson Ave., Ste. 2125, Denver, CO 80235; (800) 962-UDMS.

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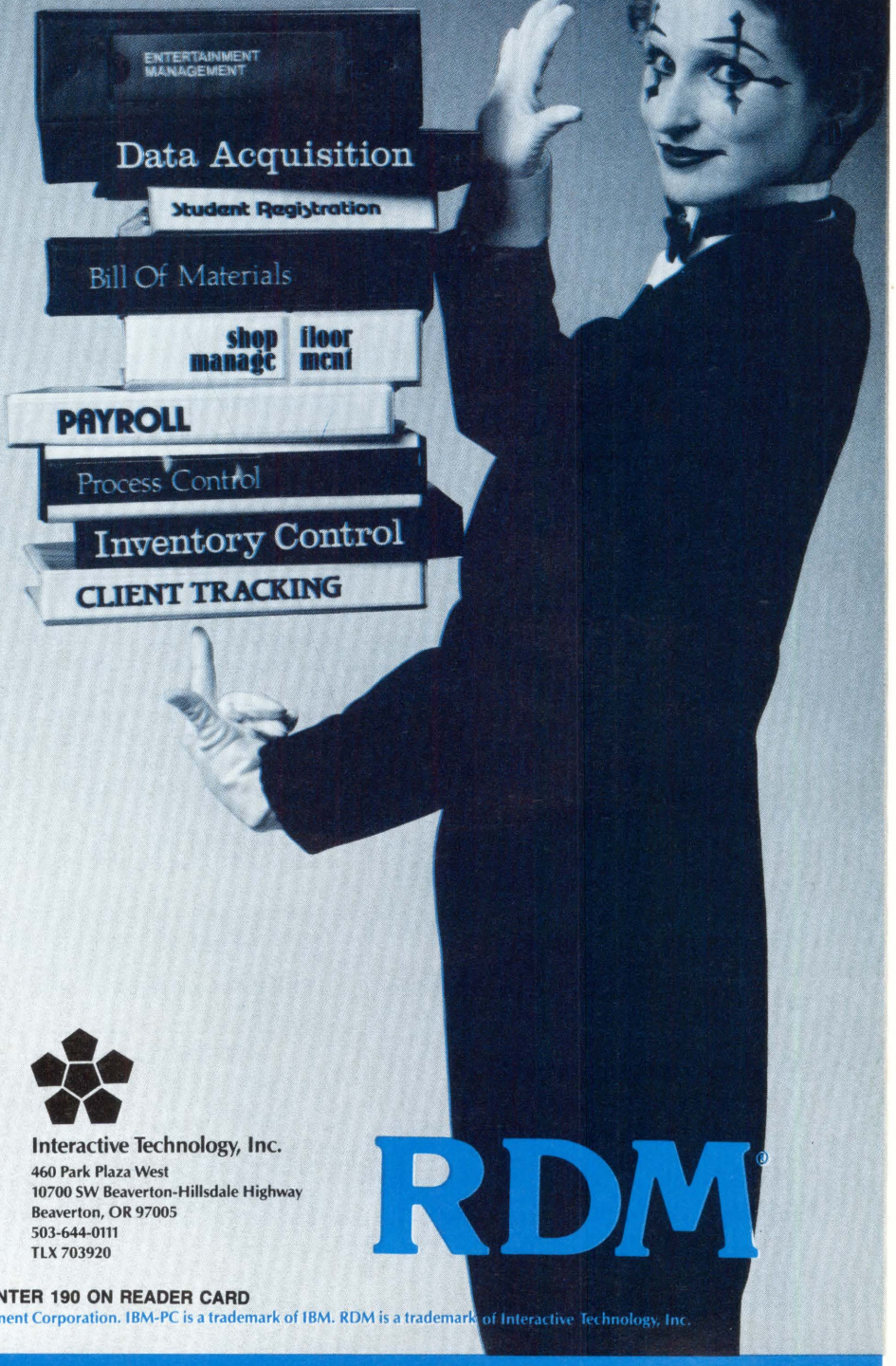

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InterOFFICE Integrates ALL-IN-1 And OFFICE

The Boston Software Works Inc. has released InterOFFICE, a transparent electronic mail gateway that integrates Wang's OFFICE and DEC's ALL-IN-1. InterOFFICE is transparent to end users. It automatically enters all ALL-IN-1 users in the Wang OFFICE user directory, and enters all OFFICE users in the ALL-IN-1 user profile. OFFICE users can send mail to ALL-IN-1 users as if they were local OFFICE users, and vice versa. No foreign addressing formats are required.

InterOFFICE operates over a serial line, so any system with a spare serial line can run InterOFFICE. By using modems, the Wang and DEC systems can be connected across the ocean.

Find out more information by contacting The Boston Software Works Inc., 120 Fulton St., 2nd Flr., Boston, MA 02109; (617) 367-6846.

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Archive 2000 Solves File Archiving Dilemma

The new release of Archive 2000 (V3.1) from Software Techniques Inc. and UIS Ltd. ends offline file storage problems.

Archive 2000 allows a user to archive a file with a SAVE command. It manages the process from there, queuing requests throughout the system and allowing the operator to perform SAVES for the entire system at the same time. Version 3.1 provides an optional cache that allows files to be maintained on the system for longer periods of time.

Security of archived files is bolstered with the implementation of offline Access Control Lists (ACLs), allowing the system manager control over the level of user access to archived files. Archive 2000 takes advantage of the powerful offline media management capabilities of Media/Schedule/Vault.

Archive 2000 is available for all VAX/VMS systems. Prices range from $1,600 for a MicroVAX II to $10,000 for a VAX 8800.

To learn more, contact Software Techniques Inc., 6600 Katella Ave., Cypress, CA 90630; (714) 895-1633.

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ATTENTION VENDORS

The *DEC PROFESSIONAL* magazine will consider DEC-specific hardware and software products for review. We do not endorse or guarantee any products reviewed or discussed. For further information contact:

The Editorial Department, Professional Press, 921 Bethlehem Pike, Spring House, PA 19477.

REB Combines Mac Bridge & Router Characteristics

RAD Network Devices has combined remote Mac bridge and router performance characteristics under a single device. The Remote Ethernet Bridge (REB), the "brouter" (bridge + router), combines the best attributes of two widely used network devices to form a building block for organizations that require an Ethernet-based wide area network.

The REB's speed is attributable to its high-packet transfer rate. By using proprietary algorithms, RND's product allows both multiple paths between networks and internetwork, node-to-node data security.

The bridge monitors data traffic continuously and uses alternate routing as needed to increase data transmittal over all links. Redundancy capabilities are made available through point-to-point, inter-bridge multiple links. During normal operation, the REB recognizes the redundancy provided by active loops and selects the fastest data path.

The REB supports any inter-LAN topology and is transparent to all higher level protocols such as TCP/IP, DECnet, XNS and ISO.

For more information, contact RAD Network Devices, 151 West Passaic St., Rochelle Park, NJ 07662; (201) 587-8822.

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ANSI LOCATOR Adds Mouse Power To ANSIs

Applied Business Systems has announced the ANSI LOCATOR. It adds the functionality of a pointing device to a range of standard ANSI terminals.

The ANSI LOCATOR is connected between the host and the terminal, using the existing cable and adding another short cable. The mouse is connected to a third port on the ANSI LOCATOR unit.

The ANSI LOCATOR functions in two basic modes, non-interrupt mode and arrow-key simulation mode. In the first mode, as the mouse is moved, the screen cursor moves accordingly. The cursor can be moved as much as desired without disturbing the host. The host, meanwhile, maintains a logical cursor.

In the second mode, the mouse movements are translated to sequences identical to those sent by repeated pressing of the arrow keys. The host echo in return moves the screen's cursor.

The ANSI LOCATOR sells for $299. Learn more by contacting Applied Business Systems, 12141 Candy Lane, Saratoga, CA 95070; (408) 446-9464.

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Registration fees must be in U.S. funds. All foreign mail orders, except Canada, must be received by May 13, and such badges will not be sent by return mail, but held at the "Pre-registered attendee" counter for pick-up on arrival. All registrations are non-refundable. Confirmation for all registrations will be sent by PC EXPO upon receipt of your registration form and payment.

Mail check payable to PC EXPO with completed registration form to: PC EXPO, P.O. Box 1026, Englewood Cliffs, NJ 07632. **Incomplete or improperly completed forms will be returned. PC EXPO attendees must be qualified. Minors under 18 may not register.**

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BACK END

John C. Dvorak

The Machine Makes The Man

The notion that the machine makes the man always has intrigued me. However, I never took the idea to the limit until recently, when I was in Hawaii having a drink with a well-known Japanese architect. We were talking about spatial relationships and the differences in visual perception between the Japanese and the Americans. When the subject turned to automobiles, he remarked that big American cars aren't safer because they're bigger, they're safer because people drive them differently. "When you're in a Japanese car," he commented, "you drive like a Japanese!"

I touched on this concept last year in an article for *PC Magazine* titled "Spreadsheets, Just Say No!" In that piece, I suggested that the use of spreadsheets slowly turns your mind into that of an accountant. It affects the way you look at the world. In other words, to be able to use the spreadsheet at all, you have to alter the way your brain sees patterns and makes decisions.

Until now, I haven't taken this idea to its maximum. If the theory that driving a Japanese car turns you into a Japanese driver is true, this means that living in a Japanese house makes you adapt certain Japanese traits, which aren't Japanese at all but are a function of the house.

Marshall McLuhan first discussed notions like this, when he determined that watching TV makes you think differently than you do when reading a book. One patterns thoughts in a nonlinear manner; the other, in a linear fashion. The linear thinker approaches a problem differently than the nonlinear thinker.

This theory also has been touched on in science fiction, where visitors to Mars slowly evolved into Martians because of their environment. The notion that physical characteristics may be altered by the environment to the extent that the person becomes an alien may not be too far from the truth, if we look at our computer scene as a microcosm of society.

Take the UNIX user, for example. UNIX users have peculiar characteristics, like wearing idiotic buttons all over their shirts.

Operating systems (OS) have distinct characteristics. To be successful, they must have enough personality to affect the user and make him loyal to the system; so loyal that he might resort to fisticuffs if his pet OS is insulted by another.

The operating system, in most instances, is the theme behind the environment of any computer system. More than just a file loader, it limits what you can do and how you can do it. A noncomputer user easily can sense the difference between an Apollo, Sun, DEC running VMS, Macintosh and a Xerox Star, even if all the systems are running similar applications.

More important, the users of these various systems will have distinct personalities. I always assumed that the personality of a user predisposed him to adopting a certain system. The arrogant Mac user is a yuppie with a Mac as a status symbol. The boring IBM user is a guy too sheepish to choose anything but IBM products for fear of losing his job.

The new notion, though, may indicate that the opposite is true. The IBM user may become sheepish and boring because he uses an IBM. It's a computer designed after much committee work and plenty of meetings. The final product is a predigested pablum machine turning the user's brain to mush. "Driving a Japanese car turns you into a Japanese driver!"

The ultimate hacker nerd system is UNIX running on a DEC. Nobody is attracted to this combination by free will. The kids in universities are forced to use it until they slowly turn into UNIX nerds, Data General despots or any number of things, depending on where they get jobs. Until that happens, they're loyal to the UNIX machine.

The machine makes the man.

If these assertions are true (as they appear to be), the societal implications are colossal. Modern sociology is based on the concept that people are influenced by their environment, specifically peer pressure. You are what your peers say you are.

Unfortunately, there are so many anomalies to this simple notion that sociologists spend all their time studying the exceptions in a vain effort to pigeonhole the results into the main theory. Newton meets a quark.

If there's any proof that the peer group is affected by inanimate objects such as car interiors, hanging wall art, even indoor plumbing, we may be barking up the wrong tree in our efforts to figure out why people act the way they do.

If using a computer for a few hours a day significantly can affect a user's personality and thought patterns, one only can speculate what the complex interaction of Japanese cars, Italian suits and Russian vodka might have on a person, especially a UNIX lover.

Whatever the case, there's something we computer users now should consider when discussing our likes and dislikes toward a particular machine, software package or operating system. Is it our opinion or the machine's, making us think this way? In other words, who (or what) really is talking?

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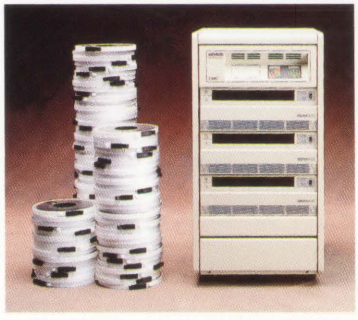

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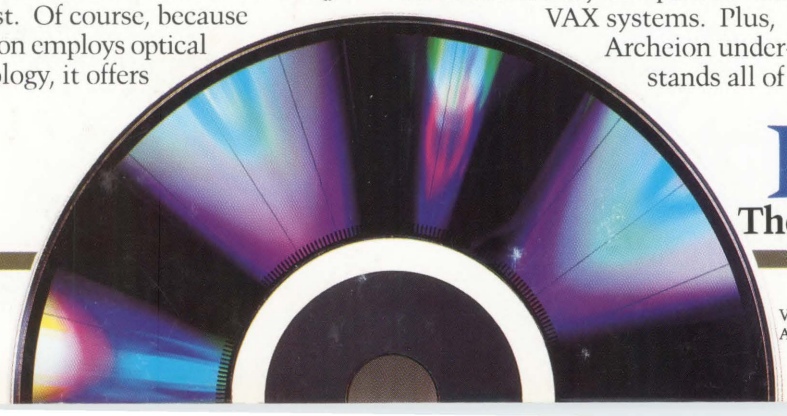
The end result of all of this is simple: you can't find a better way of storing and retrieving tremendous amounts of data than with Archeion Optical Disk Subsystem. For more information, call 1-800-222-EMC2 (In Mass, 617-435-1000). EMC Corporation, 171 South Street, Hopkinton, Massachusetts 01748-9103.



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