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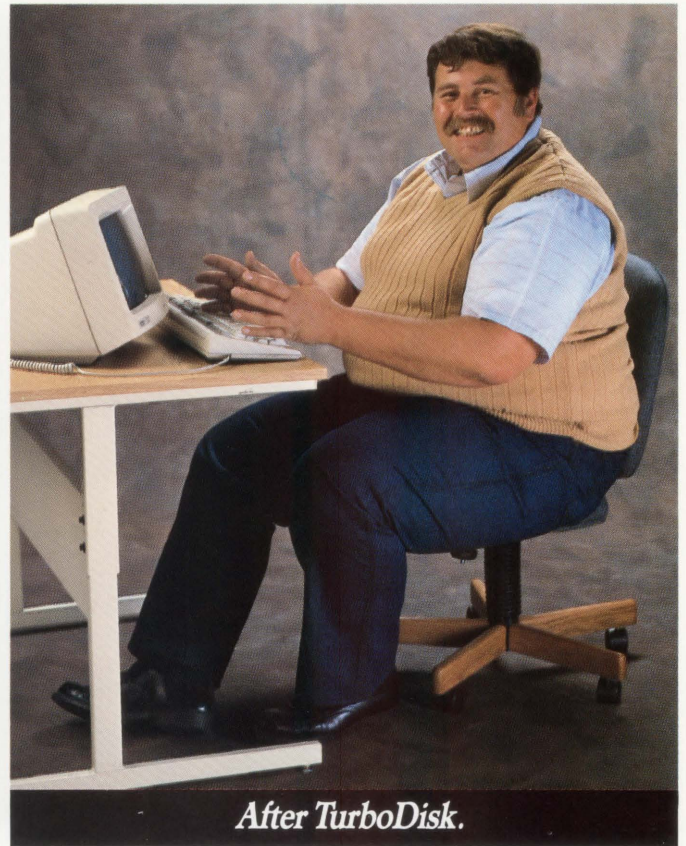
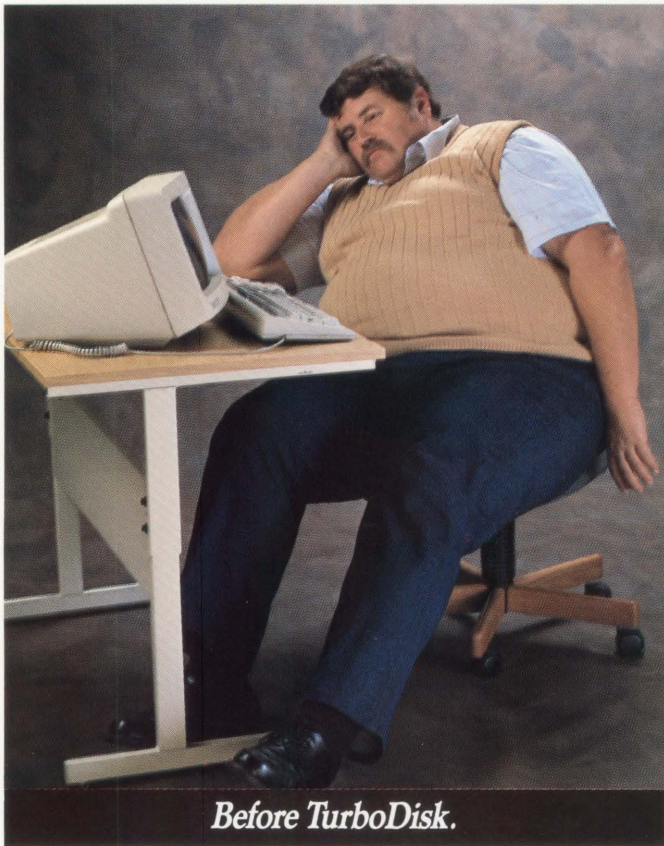


Online Transaction Processing

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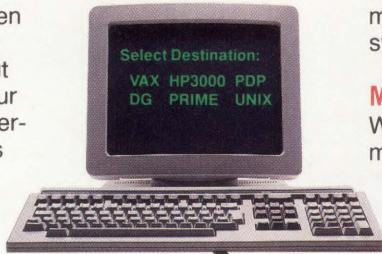
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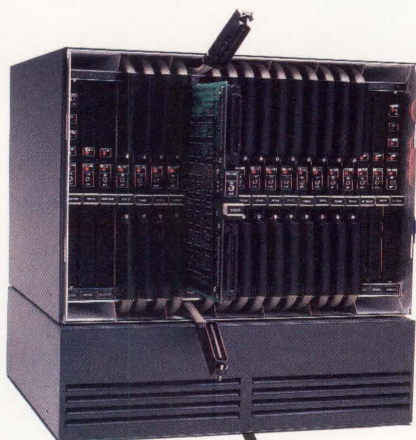
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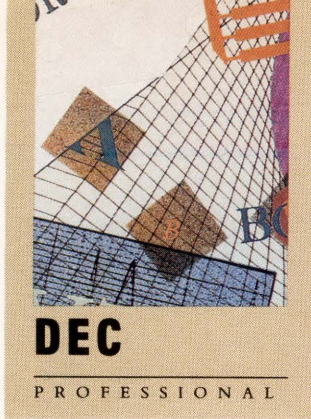
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The lab seal indicates that the product reviewed has been tested by one of our experts in our Laboratory and Testing Center.

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This month's cover is the work of Pennsylvania-based airbrush artist Jim Serfass.



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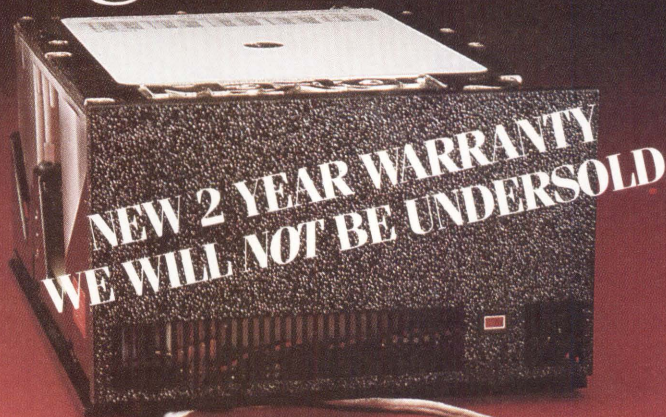
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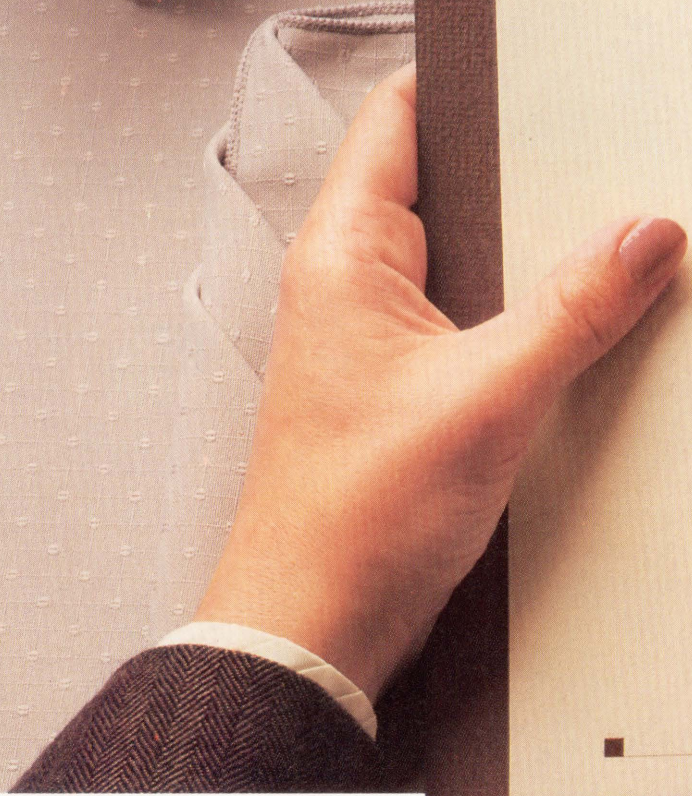
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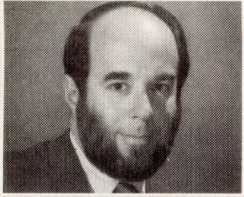
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Carl B. Marbach

Identifying Your Weaknesses

As the inevitable comparisons between the two leading computer companies, Digital and IBM, get more attention, DEC's inferiority in Online Transaction Processing (OLTP) is mentioned more and more. In this issue, we concentrate on many facets of OLTP.

In the middle '70s, DEC's PDP-11/70 was a fast growing commercial computer system supported by both the RSTS and RSX operating systems. Then, as now, it was recognized that neither of these two fine operating systems made a platform for transaction processing. It must have occurred to someone at DEC that this was an area where DEC could make some inroads in the commercial computing space. A group was set up, funding provided and a new PDP-11 operating system appeared, TRAX.

TRAX was, by all measures, a failure. At a New York LUG meeting one night, I was told about a burdened PDP-11/70 running TRAX, that was about to have the number of terminals attached doubled. "What will happen to our response time?" I was asked. At the time, I managed my own 11/70 with about 60 terminals, knew several others with even more and had confidence in the venerable '70's ability to handle work.

"How long is your response time now?" I asked. "About 20 to 30 seconds to update a screen," they replied. Now I *was* concerned about what the doubling of terminals would do to response time. "How many terminals do you have now?" I continued. "Four," they said.

TRAX was abandoned quickly and most people have never heard about it. One of my early teachers told me that "Experience teaches: Even bad experiences are opportunities to learn." The TRAX experience could/should have been one from which DEC learns.

There are three major areas that DEC needs to address as soon as possible: low-end software for the desktop, high-end very powerful (50 MIP minimum, hundreds of gigabyte disks with the bandwidth to match) VAXs and software to drive high-volume transaction processing. If Digital wants to keep invading the areas that IBM traditionally has held, it must compete in large database, online systems. At this point, DEC has neither a powerful enough VAX, nor the software to drive efficient transaction processing.

At DECWORLD, a talented DEC developer named Kerby T. Altmann gave a seminar about transaction processing. Mostly he talked about fundamentals and futures; that is, what transaction processing is and what DEC hopes to do about it in the future. Knowing that Altmann has something to do with Digital's internal transaction processing force is good news for those who are hoping for a winner instead of a TRAX.

DEC could use a third member for its powerful team of VAX hardware and networking: a fine, powerful and efficient (fast) transaction processing system. Put that to work with some new high-performance VAXs, and yet another of IBM's strongholds will be breached.

Carl B. Marbach



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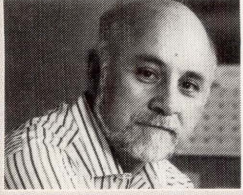
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is expandable. As my company grows, the printing system can grow with it. So once again the MIS is a hit with the users. And that's what makes my job worthwhile.



EDITORIAL

Dave Mallery

1988: The Year Of The Desktop

Welcome to the promised land! Step right up to get your guided tour. But wait a minute, there's trouble in paradise! There are so many platforms fighting to mount my desktop, it's hard to tell which one is going to win. Over there, wearing the blue chips, is a 386 at 20 MHz clock.

It can really whip out the mips. Not only that, but now it seems to be running the first release of a true multitasking operating system that isn't UNIX! Too bad the OS/2 presentation manager isn't due until the end of the year.

Next, we have the MAC-II. It features a sizzling CPU, perfectly marvelous color, a full user interface that works, and a large complement of packages. Not only that, but it connects right into my Thinwire and is basically at peace with all the devices that live there! Too bad it's so fiendishly difficult to program that wonderful user interface.

Sitting on, or should I say clinging to my desktop is a VAXSTATION 2000. It's winning right now because it runs VMS. I can import PC functionality through the Thinwire. The price is right up there with the other two contenders. The reason that it's clinging, rather than squatting happily is the great software gap. If I want a WYSIWYG desktop publisher for my newsletter, it lists for under a grand on the MAC-II or the 386. Anything similar on the VAX costs as much as three or more VAXSTATIONS for the program alone! I could go on endlessly because the problem exists in every area of software. Another problem is that the MV 2000 CPU barely whips out a single mip. In the raw mip department it's outgunned solidly by both the MAC-II and 386.

During 1988, the 386 will become very common and will be totally cloned, dragging the price down to absurd levels. The 20 MHz versions that are top of the line today will be eclipsed by faster chip sets tomorrow. Meanwhile, the MAC won't be seen standing still. As Apple starts to sell large volumes of units, the price of a MAC will come down and the speed will go up. There's a new chip from Motorola, the 68030, waiting in the wings that will inject new speed enhancements and production economies.

Of course, we are forbidden from seeing the next workstation from Digital. All we can do is visualize that wonderful new chip set that's the heart of the 3xxx transposed into the VAXSTATION desktop format. It's a shame that software pricing is such a large issue, and one that spans the entire market, rather than simply being DEC's problem. If you study the PC world, you'll come back convinced that many of the newest wave of PC software really require 2-plus mips to operate even in a single user configuration, and that those mips are well spent indeed!

Wouldn't it be nice if we could pick the platform best suited to the job at hand and have it join the DECNET network for mail and file serving? Nineteen eighty-eight may be a wonderful year!

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LETTERS

ACMS UPDATE

This is in response to John Biazzo's article "Transaction Processing, Part 4" (October 1987).

I found Mr. Biazzo's description of Rdb's capabilities inaccurate as well as misleading. He stated, "...specifying the RESERVING option, selected records are locked from other users until the update operation is completed." While this is ostensibly correct, Mr. Biazzo failed to note that a relation can be opened for SHARED READ, MODIFY, or WRITE. In addition, in a given transaction, several relations might have been invoked, with only one being opened for update processing. In a shared environment, the relation opened for updating still would be available for concurrent read and update access. In an ACMS environment, this is particularly important in that by

using ACMS, it is implied that several users might wish to access a record at the same time. If lock contention were a problem, it would defeat the purpose of using ACMS.

Finally, Mr. Biazzo states that "...Rdb/VMS doesn't use a UWA."

This is true, but as the article supposedly was discussing Rdb and its relationship with ACMS, Mr. Biazzo's rationale does not apply.

In ACMS, a record could be modified by invoking an ACMS "task," which in turn could retrieve the specified records by calling a COBOL program with embedded RDO statements, and then performing terminal I/O via a TDMS request. The TDMS request would store the data in a "workspace"

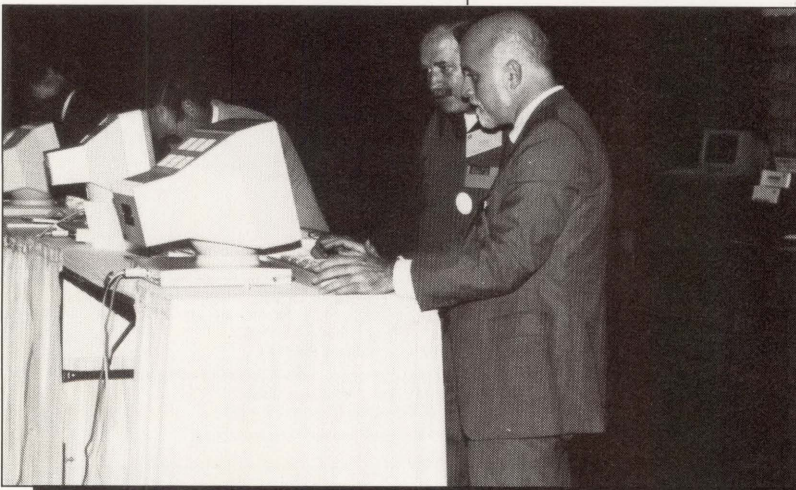
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record defined in the Common Data Dictionary (CDD), which would then be used for terminal I/O. In this scenario, once the records have been written to the workspace, the locks are released. Then, updating can be done on the terminal, within the same task, which then would invoke a request to perform the terminal I/O to retrieve the updated information, and finally, call the high-level

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CORRECTION: In December Letters, there was an error in "HELPFUL INFORMATION." The second sentence of the second paragraph should read, "Instead of using SYSS\$LOGIN, ... I used the logical variable SYSS\$SYLOGIN in its place."

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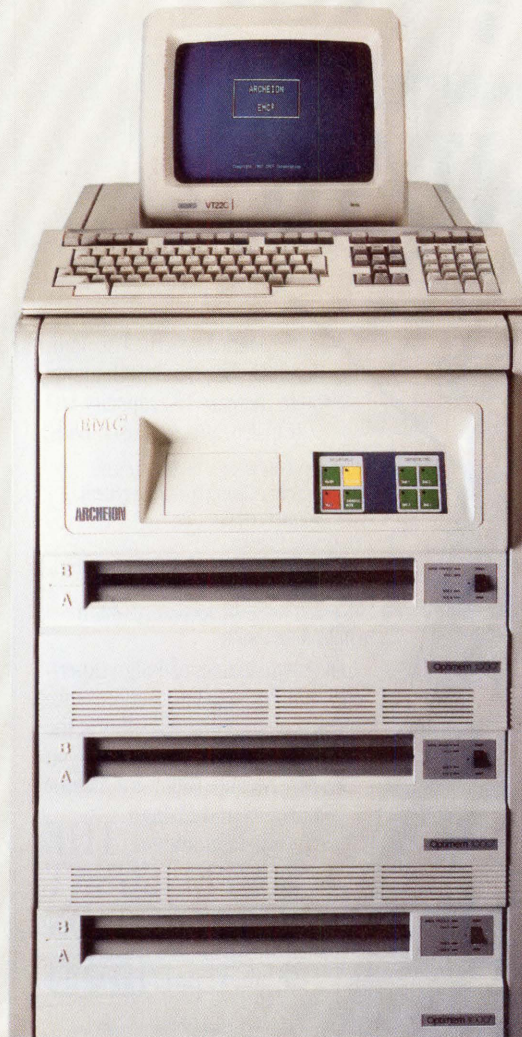
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language program used to perform the actual update to the database.

The result is minimal lock contention problems. In fact, in most applications, a user is only going to want to update one record at a time anyway; consequently, any limitations associated with a record stream would be eliminated with a properly written record selection expression (RSE). It would be wiser to use RDO or DATATRIEVE procedures for mass database updates.

Robert A. Frasca
Cellular One
Greenbelt, Maryland

COULD BE BETTER

This letter is in reference to David Bynon's article on *ALL-IN-1* in your October issue (see *BOIS*, page 98). I work in an *ALL-IN-1* shop and have found the package to have many of the advantages in terms of application development that Mr. Bynon describes.

However, I also have found that *ALL-IN-1* could be better in certain areas. First of all, there currently are no software control tools available that work well with *ALL-IN-1*, though I understand future versions of CMS or MMS will remedy that.

Second, though the script facility makes it easier to put *ALL-IN-1* commands together, more versatile script directives than just .IF and .GOTO are needed to make it a good programming tool. I've found that at times, I need to pass control to a more traditional language like FORTRAN in order to accomplish a complex task.

Finally, because *ALL-IN-1* is so flexible, you have to be careful that programmers don't get carried away. One application that I'm currently supporting was developed using COBOL, FORTRAN, DCL and DATATRIEVE all tied together by *ALL-IN-1*. It's not an easy task.

ALL-IN-1 is a good product and I'm looking forward to Digital making it even better in the future.

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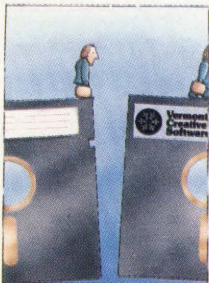
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... SAME ISSUE, DIFFERENT SIG ...

QUERY:

John Astarita (SIG 12/MESS 128): I've been experiencing ongoing errors while using my TU78 drive. The technician who investigated the problem couldn't find an answer. But he noticed an excessive amount of dirt because of the tapes we use. Does anyone out there know of a vendor who carries a tape cleaner so we can at least eliminate the dirt? We use 6250 bpi tapes.

REPLIES:

Joy Veronneau (SIG 12/MESS 129): At a recent DECUS LUG meeting here in Vermont, the same question about clean tapes came up. Someone from a very large site said that they used to clean tapes, even new ones, before using them. But they found that Black Watch tapes were so clean when purchased that they don't bother cleaning them anymore. Hope that helps you out.

Karl Stippick (SIG 12/MESS 130): Regular tape cleaning and verification could spell the end of your problems with tape errors. I'd recommend a tape cleaner with a verifier, however.

Are you using back-coated tapes? For the past several years, DEC has included a paragraph in its tape user guides stating that, to date, there are no back-coated tapes that meet its specifications. 3M's Black Watch is the most famous of the back-coated variety, but there are several others. The back coating leaves a residue on the tape handling surfaces in the tape unit; i.e., capstan, BOT sensor, air bearings and

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buffer box. This back coating may be helpful for pinch rollers or friction capstans, but isn't helpful for TU78s. Also, if you add back coating, something else has to give, either oxide or mylar.

Try cleaning the entire tape path

with Texpads, followed by tape cleaner solution on linen pads at least once a day, and the capstan at least once a week. Pay particular attention to the buffer door and the area just above the head called the "pucker pocket."

Alan Alto (SIG 12/MESS 141): John, I've found that using the Black Watch tape on both TU77 and TU78 tape drives produces lots of errors. Try to stay away from them. As for a tape cleaner, find a vendor who sells Computer-Link. I've used this for years, and it seems to be reliable and effective.

Also, on the tape drive there are small blades to scrape the dirt off the tape and suck it into a filter. Get your gizmo-tech to take these off and clean them often, or you can do it yourself. There's a small plate above the read/write head held on by two small screws. Remove the plate and the "tape cleaner" will come off. Soak it in a cleaning solution for a couple of minutes.

Another hint might be to get DEC to replace the filters from that tape cleaning blade. There's a filter canister in the back of the drive. It should be white. If it appears dirty, call DEC.

TARTAN TAPE TALK

QUERY:

Dave Campen (SIG 22/MESS 44): I'm currently using 3M No. 777 mag tape. I've heard of users experiencing problems with this tape. Does anyone have problems with this tape?

REPLIES:

Z.G. Wiedemann (SIG 22/MESS 46): I've been using nothing but Black Watch for some 18 to 24 months. The only prob-

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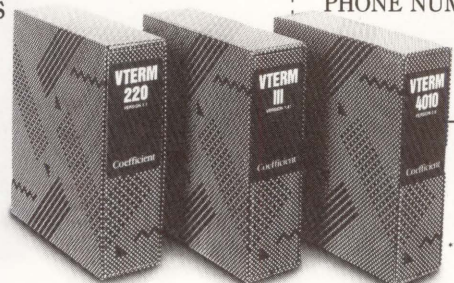
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DP188

lem I've found is that it sheds more than the 700 series; you have to clean the tape drive more often. We run three reels of backup every day, and seven on weekends.

We use a Kennedy 9100 1600 bpi tape drive with an Emulex TC-12 controller, on our VAX-11/750. The soft error rate is higher than with the 700 series tapes, but we find it acceptable (no lost data yet).

David Palmerston (SIG 22/MESS 47): We've been using 3M Black Watch tapes of 600, 1200, 2400 and 3600 feet for more than eight years now, on TU10, TE16 and now TU80 drives, with no unusual problems. The tapes seem well adjusted to the DEC drives and have worked with both RSTS/E and VMS during that time. I currently use tapes of from 450 to 3600 feet in my backup farm, and regularly retire them after about 60 to 70 full uses (about 24-30 months).

Andrew Duggan (SIG 22/MESS 48): I have a Cypher tape drive with autoloader that won't autoloader a Black Watch tape. My other drive, a DEC TU80, usually works OK with them, but the tapes hang that drive more often than others. I stick to the 3M No. 777 series, which isn't Black Watch.

A MATTER OF RESPONSE TIME

QUERY:

Brad Campbell (SIG 12/MESS 188): I'm interested in whether anyone has experience with a large number of users (well, not too large: 20 to 25 users logged in over a DECNET comm session). The users will be logging in on an 11/750 running ULTRIX, to an 11/780 running VMS. Both machines will be running DECNET. My question is what kind of load can I expect on the 750 and the 780? What type of response time can I expect to receive for the users on the 750? The users will be logged in remotely on a single 9600 baud telephone line.

Kitty George (SIG 12/MESS): Brad, if you haven't hooked up the DECNET be-

tween the 750/ULTRIX and the 780/VMS combo, forget it!

I assume you're using an asynch line at 9600. (You didn't specify whether or not it's over a phone line, but it doesn't matter.) You indicated a possible load of 20 to 25 users. My comments are based on experience with three VAX 780 sites linked by 9600 baud direct phone lines using DECNET. The first user logged in across the net will get semi-decent response time, except when processing many single-byte messages, for example, passing keystrokes from EDT or another interactive editor session, in which case response time is five seconds or so.

As more users get on line, they have to share the same physical link, which means that when one dunderhead does a DIR [*..]*;* on a RA81, all the other users hooked up via DECNET will soon nod off to sleep while that DIRECTORY scrolls on the screen!

After you get about three users logged in, you've maxed out on that 9600 baud line. Twenty users? No way! Other considerations: DECNET generates lots of interrupts, which in turn is dandy for eating up CPU time on both the 750 and the 780. Having interactive users makes it worse because most of the message traffic will be single byte messages. These generate a lot of overhead because DECNET affixes and strips off a lot of extra bytes to each message for routing and error checking purposes.

So, I suggest you look into a mux hookup, instead, for this type of linkage, in which case you'll need more DZ/DHU/DMF ports on both machines, or DECSERVERS/Ethernet, or DECSERVERS/muxes. In other words, don't spend money on DECNET software, spend it on hardware to solve the problem. ■

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The *Autobank* software is installed on a VAX 8500 at the Cresvale London office and linked via satellite to a VAX 8250 in New York and a VAX 8250 in Hong Kong.

Autobank features efficient settlement, multicurrency and multibranch accounting, management reporting, back office operations and networked communications.

It ensures that every deal made today is confirmed today, and that settlement takes place according to the in-

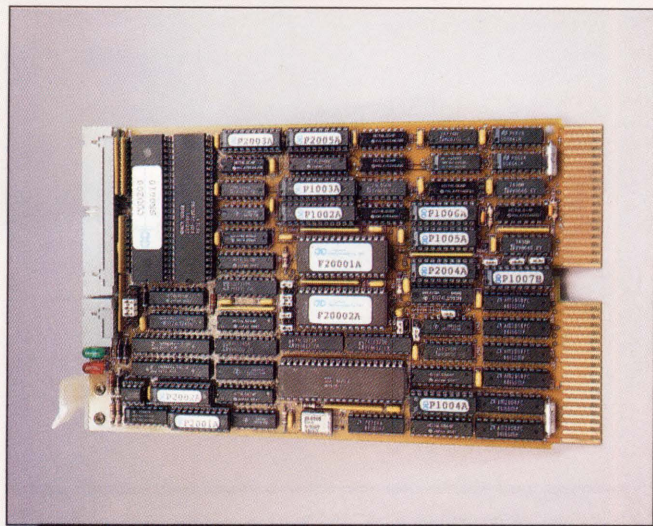
structions associated with each type of instrument. Dealers and depot positions, counterparty ledgers and the funds diary are updated as soon as deals are verified. Automatic transmission of closing positions is sent to offices anywhere in the world.

To simplify communications, *Autobank* routes messages in the most cost-effective way, whether locally, nationally or internationally. Users can link into a variety of communications sources including any Telex network in the world, any national packet switching network, electronic mail, and any number of private message switches, and external communications systems, like Reuters or Telerate.

The *Autobank* system is available on the entire VAX range: the MICROVAX II at entry level, the VAX 8200 and 8300 for departmental systems, the VAX 8500 and 8550 for mid-range systems, the VAX 8700 and 8800 for top-end systems and VAX-CLUSTERS for unlimited systems growth.

The *Autobank* software package ranges in price from \$225,000 to \$325,000. To obtain further information, contact Wilco International Inc., 61 Broadway, New York, NY 10006; (212) 269-3970.

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CMD's CQD-200 SCSI host adapter offers an upgrade path to SCSI optical disk and magnetic tape products.

SCSI Host Adaptor Bridges The Gap

Q-bus SCSI Host Adaptor Supports Disconnect/Reconnect Capability

The CQD-200, from CMD Technology Inc., is an intelligent dual-wide Q-bus SCSI host adaptor that's fully compatible with the DEC Mass Storage Control Protocol (MSCP) drivers.

The adaptor can be used with the LSI-11/23, 23+, 73, 83, MICRO/PDP-11, and other MICROVAX II CPUs. It supports RT-11, TSX+, RSX, RSTS, MICROVMS and other operating systems that use the DU driver, in addition to 18-bit or 22-bit Q-bus addressing, block mode DMA transfer, 16 KB sector, command queuing, seek optimization, standard SCSI bus arbitration, disconnect/reconnect, and all required SCSI commands. Up to seven SCSI target devices (magnetic or optical) can be connected to the CQD-200 with SCSI

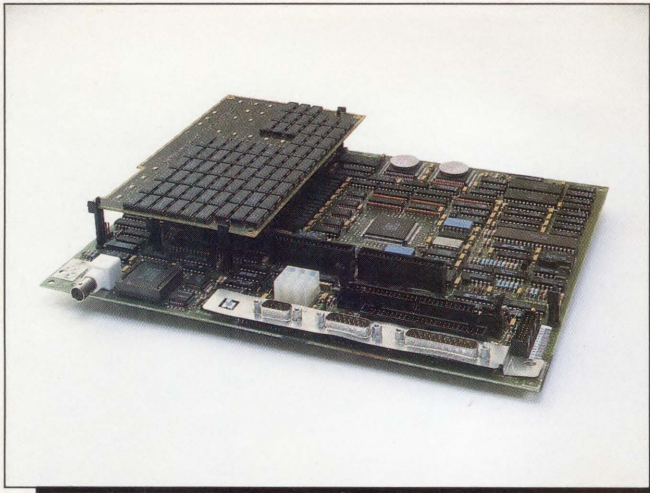
bus data transfer rate to 2 MB per second.

With an on-board utility for users to configure and format drives, the adaptor also can scan bad blocks and replace them automatically. The drive configuration is stored in an on-board non-volatile RAM (NOVARAM). It contains a user selectable automatic bootstrap option that can boot up the system on power up.

The CQD-200 SCSI host adaptor lists for \$1,250. For more information, contact CMD Technology Inc., 3851 S. Main St., Santa Ana, CA 92707; (714) 549-4422.

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—Suzanne Garr



Clearpoint's MV2000 memory card provides greater density, performance and reliability.

Clearpoint Expands To A 16-MB Card For The MICROVAX 2000

Memory Access And Cycle Times Are Unchanged By The Increase In Capacity

A new 16-MB memory card for the MICROVAX 2000 and VAXSTATION 2000 is available from Clearpoint Inc. The MV2000 allows users to achieve identical processor and memory performance to the full configuration MICROVAX IIs at approximately half the price. According to John Stadler, executive vice president of Clearpoint Inc., "The key feature about this product is that the MICROVAX 2000 and the VAXSTATION 2000 can be brought up to the same memory as the MICROVAX II. It was the memory capacity that we addressed in our development of the 16-MB memory card."

The MV2000 replaces the 2- or 4-MB daughter card

that comes with the original system and brings it to a full memory complement of 16 MB. Memory access and cycle times are unchanged by the increase in capacity. The board uses surface mount megabit DRAM technology.

Stadler stated, "The memory card is targeted toward two markets: universities because it gives them the option to expand their memory capacity on the MICROVAX 2000, and CAD companies.

The MV2000 comes with a lifetime warranty and a 24-hour before-repair replacement policy.

List price for the MV2000 is \$7,450 in single quantities. For more information, contact Clearpoint Inc., 99 South St., Hopkinton, MA 01748; (617) 435-5395.

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Access Technology And Relational Technology Unlock Hidden Data

The Database Connection and RMS Gateway Share A Common Theme

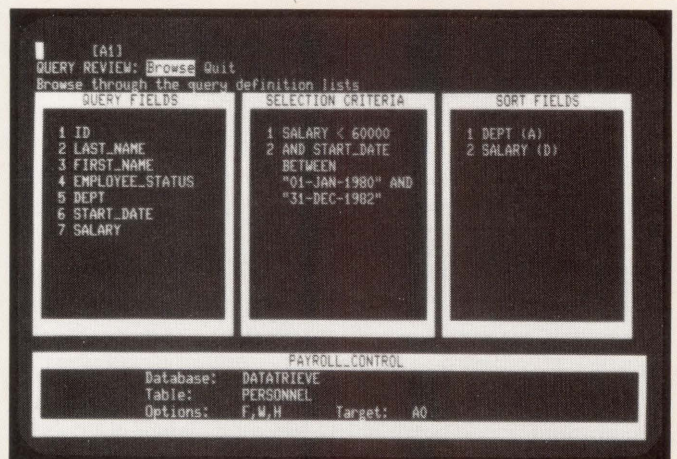
One of the most frustrating problems of the computer age is incompatible data. This problem crops up constantly, in fact so much so, that we take it for granted.

An example: A brokerage house has an application that keeps track of customers' portfolios. When account managers write to their clients, however, they can't access portfolio data from the word processing software. They frequently must exit from the word processor, enter the portfolio application, write down some facts, then type them into the letter. The information they want is there, but they can't get to it easily from within the word processor.

Both Access Technol-

ogy of South Natick, Massachusetts, and Relational Technology of Alameda, California, have recently announced products that address this kind of problem. Also, both companies' products are extensions to their existing products. The *Database Connection* from Access lets users bring data from VMS databases into their 20/20 spreadsheets. *RMS Gateway* from Relational Technology allows users to read VMS files from their Ingres database systems.

The *Database Connection* is a menu-driven query system that lets 20/20 users access data stored in VAX Rdb, VAX DBMS and VAX RMS files. When you install the *Database Connection* it becomes a part of the 20/20 software, and is one of the



Screen 1: The 20/20 Database Connection allows you to select external files and fields, query fields and sort methods.

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With so much going for it, plus support and service that sets an industry standard all by itself, it's no wonder so many top DEC customers like GE, Kodak, and Citicorp depend on INGRES. To find out how to put INGRES solutions to work in your VAXcluster, just send in the coupon and we'll mail you a free information-packed report entitled "Maximizing Vaxcluster Productivity with INGRES." Or for even faster action, call 1-800-4-INGRES.

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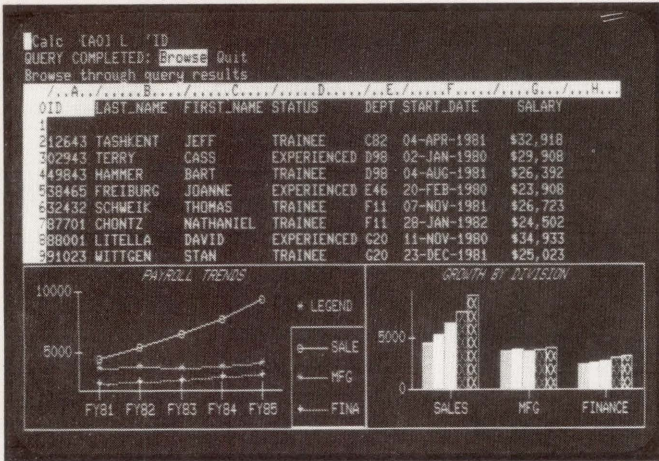
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Screen 2: Once the query is completed, the 20/20 Database Connection brings the retrieved data in 20/20, at a defined target.

options available as you use 20/20. When you select the Database Connection, you are presented with a screen of menus that help you write the query you have in mind (see Screens 1 and 2.) It then searches the database or file you have chosen, retrieves data that matches your query and puts it into your spreadsheet. It also has an expert mode for users who know one of the DEC native query languages.

RMS Gateway operates on a very similar principle. Ingres is a full-function relational database system. Data that wasn't stored in an Ingres-controlled file, however, has been inaccessible to an Ingres user. RMS Gateway provides Ingres users with a way to get at RMS files.

After RMS Gateway is installed, an Ingres user can enter the structure of an RMS file in the Ingres data dictionary. He also can define multiple views of a single file. The RMS file then can be

read from Ingres just as if it were a relational table. The RMS file can be accessed interactively from Ingres's SQL query language, from embedded SQL in a programming language and from the Ingres report writer.

Both of these products have a common limitation: They give you read-only access to data that is stored in places outside 20/20 or Ingres.

This is both a curse and a blessing. It can be a curse because, at some point, you will want to modify data you bring into your spreadsheet or database. Suppose you discover an erroneous assumption in some numerical data you put into a 20/20 spreadsheet, an error that could lead to incorrect results. If the assumption is contained in data that you imported with the Database Connection, you won't be able to fix it from within 20/20. You'll have to find whatever program maintains the data, and use it to fix the problem. Of course, you may not be able to find this other program or know how to use it if you find it. It's easy to imagine a similar example for RMS data that you bring into an Ingres application with RMS Gateway.

However, the read-only nature of these products also is a blessing. Usually, you don't want people to modify data when they import it to

a spreadsheet or database from an outside source. Un-supervised data modification causes far more problems than it solves. In the long run, you are better off to have crucial data controlled by just one program.

The Database Connection is priced as an add-on product to 20/20. Prices range from \$1,200 for a MICROVAX II to \$5,000 for a VAX 8800.

RMS Gateway is also an add-on product, priced from \$450 for a VAXSTATION to \$24,000 for a VAX 8978 cluster. For more information, contact:

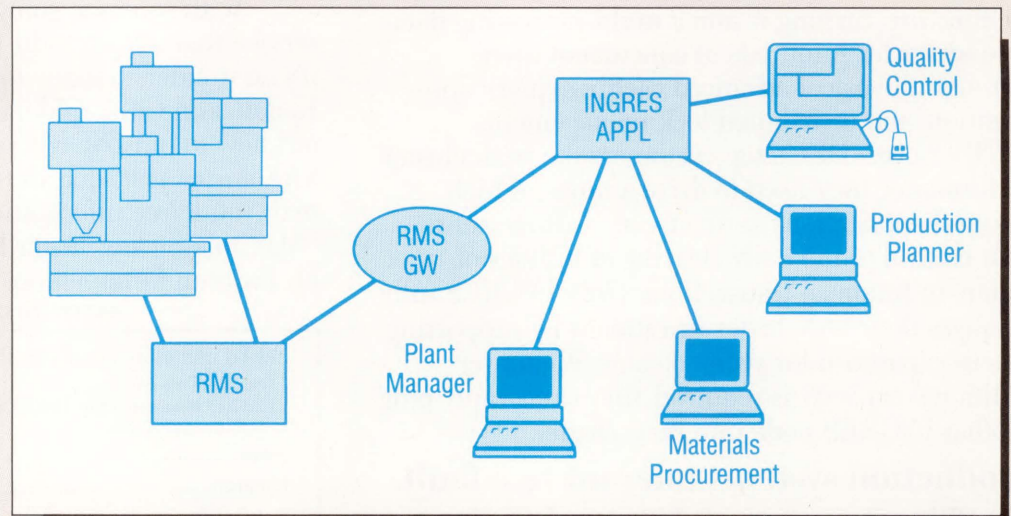
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Alameda, CA 94501
(800) 446-4737

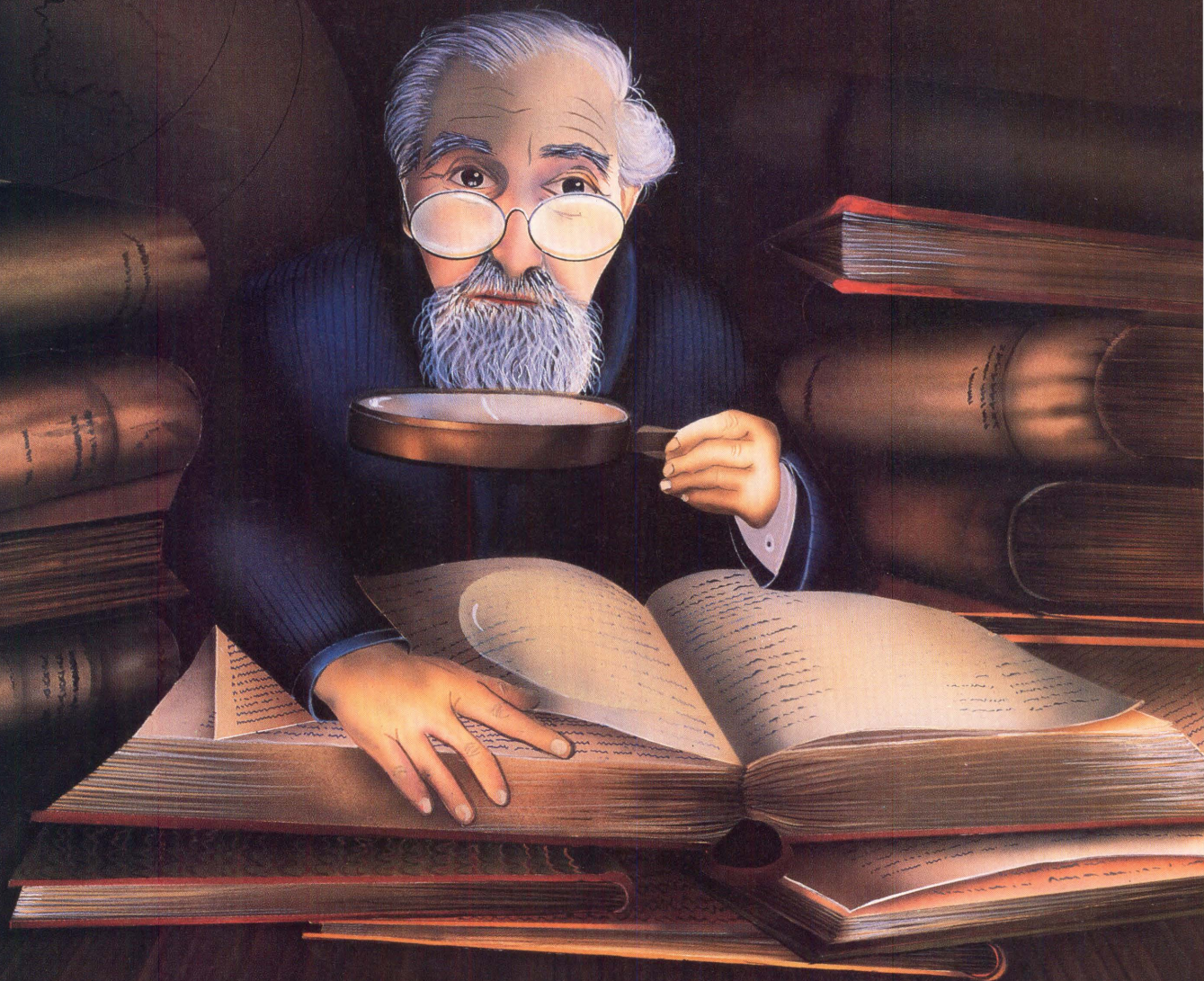
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—Charles Connell



Ingres Gateway products allow the Ingres relational database to read files that aren't part of the database system. In this diagram, a manufacturing application stores data in VAX RMS files. The Ingres RMS Gateway lets Ingres users access the data that previously was unavailable to them.

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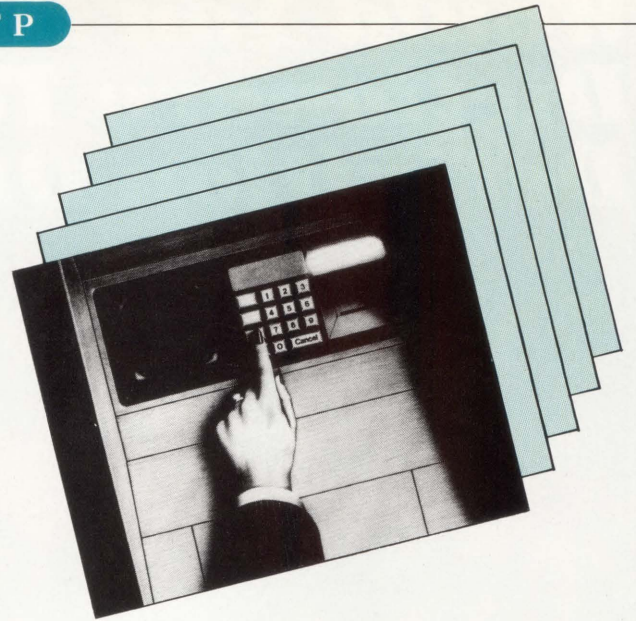
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You Have It Or You Don't



Online Transaction Processing

WHAT is it? And should I care? BY PHILIP A. NAECKER

ONE OF THE differences between DEC and IBM is that IBM systems are thought to provide superior performance for Online Transaction Processing (OLTP) applications. Because DEC systems have evolved from an online (interactive) environment while IBM systems have evolved from a batch-oriented environment, that statement may seem surprising to the average DEC user.

Many DEC watchers have been saying that OLTP is DEC's soft underbelly in the battle with IBM and the rest of the mainframe vendors, but it's clear that DEC now is moving to address its weaknesses in the OLTP arena. DEC's advances in OLTP application performance will come on several fronts, some very

specific to OLTP applications and some that will reap rewards for a much broader class of applications, probably including yours.

What Is OLTP?

OLTP applications typically involve the interactive update of large or complex databases by many users simultaneously. Good examples include airline reservation systems, teller systems at banks, securities trading systems, order entry systems like those used to order from catalogs, and even many of the components of a modern Computer Integrated Manufacturing (CIM) system. An exact definition is hard to come by, but most OLTP systems have some or all

of the following attributes:

1. Interactive update of large or complex databases.
2. Tight response-time goals.
3. Sophisticated systems for assuring reliability and availability.
4. Simultaneous access by many users.
5. Excellent provisions for ensuring that entered transactions are completely executed.

The largest OLTP applications are at the high end of all of these requirements: multigigabyte databases, subsecond response times, at least 99 percent uptime, hundreds or even thousands of simultaneous users, and transaction safeguards suitable for activities involving millions of dollars.

Table 1.

Component	Function
VAX processors	CPU
CI	High-speed, high-reliability Computer Interconnect
Cluster hardware	High-availability access to CPUs and mass storage
HSC	Storage controllers to provide high-availability access to disks even when some processors fail
Terminal Servers	Allow connection to multiple processors so that the failure of a single processor will not prevent any users from getting access to the application
Ethernet	Services terminal servers and workstations

The hardware components of a VAX-based OLTP system.

Table 2.

Component	Function
VMS	Operating system
Shadowing	Works with HSC to provide improved performance and protection against failure of a single disk
TDMS	Terminal Data Management System — supports screen forms and data validation and editing
ACMS	Application Control and Management System, the central component of a DEC OLTP system - provides the means to create and manage complex OLTP applications and interfaces those applications with TDMS, Rdb, DBMS and DECNET
Rdb	DEC's relational database product
DBMS	DEC's CODASYL-compliant (network) database product
DECNET	Supports the distribution of OLTP applications to multiple nodes in a network

The software components of a VAX-based OLTP system.

What is a Transaction?

Central to understanding OLTP and its effect on the DEC marketplace is a good understanding of the *T* in OLTP—transaction. In its simplest form, a transaction is a series of actions in a computer that are treated as a single entity. In database parlance, transactions are “atomic.” That means they cannot (or at least should not) be divided into smaller parts; all of the parts of the transaction must take place, or none of them take place.

The purpose of an atomic transaction model is to preserve database consistency by ensuring that database update operations never are partially completed. Although this definition of a transaction may seem simple and reasonable, in practice it varies widely from application to application.

At a DEC-hosted roundtable at the DECUS Convention in San Francisco last year, several DEC database gurus asked users the seemingly simple question, “What is a transaction?” The dozen experienced users present gave eight different answers.

One reason for so many different views has to do with the variety of applications using databases and, similarly, the wide variety of applications performing OLTP. Perhaps the simplest and most familiar transaction system is the personal checkbook. A checkbook application is a good example of a transaction processing system with a transaction file (the check register) and a master file (our balance). There typically are three types of checkbook transactions:

1. Write a check or transfer money from the account.
2. Make a deposit or transfer money into the account.
3. Make an adjustment.

In recording each of these transactions, there are two separate actions taken: Create the transaction record (write an entry in the check register) and update the master record (the account balance). In a manual system like the checkbook, you also write the check or give the deposit to the teller. But in an automated system, simply writing the entry in the log and updating your balance is enough to cause a transaction.

Obviously, to transfer money in or out of an account, there must be a corresponding entry on the other side of the balance sheet because you’re putting the money in another account. Therefore, if this system were put online, there would be transactions to the other account. A deposit record would be written and the other account’s balance would be updated. On the other hand, an adjustment transaction is single-sided; there’s no other side, and you simply write the transaction in the transaction file and update the master file (your balance).

We now have a very good model for a simple online transaction. When transferring money online between two accounts, there are four parts to the transaction:

1. Create the outgoing transaction record.
2. Update the account balance of the account to receive the debit.
3. Create the incoming transaction record.
4. Update the account balance of the account to receive the credit.

Obviously, if this system is to function in an online environment, you want to ensure that there are no partial transactions; e.g., either all four steps or none are done. You don’t want money transferred out of your account (steps 1 and 2) and not transferred into the other party’s account (steps 3 and 4); you’d still owe the money because it wouldn’t have received your payment.

In a batch environment, you can construct batch totals and special programs to verify that the entire transaction has completed, and then correct those transactions in error. But in an online environment, the time constraints mean that you must design the entire system from the ground up with guarantees that the transaction will take place immediately and as an atomic unit.

The *T* in OLTP stands for transaction, a series of actions in a computer, like updating various files, that are treated as a single entity. A simple transaction may involve just a few operations; e.g., writing a couple of log records and updating a couple of master files.

Complex Transactions

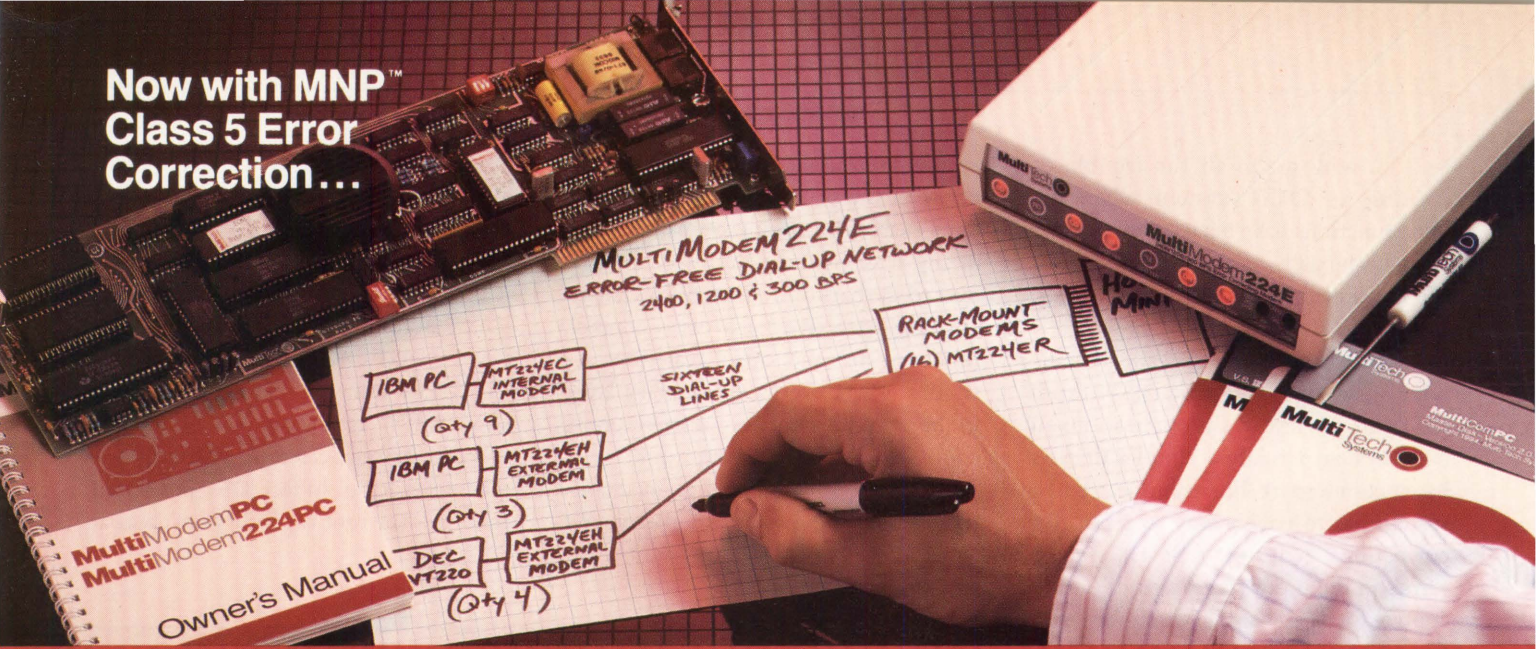
Most OLTP systems are far more complex and may involve hundreds of look-ups and dozens of updates to master files and logs. These all must take place either as an atomic unit or not take place at all. Consider the following archetypical OLTP applications and some simplified views of their transaction definitions:

1. Airline Reservations — A reservation system must allow the agent to handle your entire trip as a unit, including stopovers, transfers to another plane, connections, and so on. If you pay by credit card, the system must be able to verify your credit card number online. There must be adjustments to your Frequent Flyer records, requests for special meals sent to vendors at airports along the trip, and credit made to your travel agent for booking the flight. Obviously, if you later cancel your trip, these activities must be rolled back as a single transaction so the agent doesn’t have to search for all the components and explicitly remove them.

2. Credit Card Adjustment — In this application, each transaction has a debit and credit side. When you call your credit card company to eliminate a charge, some other account must pick up that charge (probably the merchant who charged you in the first place). But the transaction also becomes more complex: An investigation of the charge might be instigated, the magazine might be notified that you’re cancelling your subscription, or any number of other records might be created, all as part of the same transaction.

3. Inventory Applications — On a factory floor, transaction control helps to ensure that the same part isn’t reserved for use by more than one process and that unused parts are returned to the storehouse.

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So, why go to all the trouble of creating an OLTP system when the same functions have been performed for years with batch-oriented programs for keeping and correcting financial records, for example?

There are both internal and system-wide advantages for using OLTP. From the point of view of the application, an OLTP system actually is simpler than its batch counterpart. For example, a batch system has to have a way to report on corrections (control reports), report errors in the input (verification), verify control totals and similar functions. Just the act of dealing with bad input data, for instance, is much easier in an online system than in a batch system. The system simply tells the operator not to proceed until valid input is provided, instead of providing a means to correct erroneous data already entered.

The external advantages for OLTP basically are competitive. When you make a telephone call to a package delivery service, you want to know what time your package will be picked up, when it will be delivered, and make adjustments to your account for billing errors. The delivery service that can provide this capability to its customers (for instance, even when you don't remember your account number) will have a competitive advantage over the service that requires you to write a letter to request a change in your billing.

Fault Tolerance And Availability

The *OL* part of OLTP implies that the reliability and availability of an OLTP system are critical factors in its success. Reliability describes the susceptibility of the system to errors and failures, and availability describes the overall uptime characteristics of the system.

Some computers achieve high reliability by means of a fault-tolerant design. The computer manufacturers with the highest level of fault tolerance (notably Tandem and Stratus) include special-purpose hardware and software included in their systems.

In these systems, the entire data

path is duplicated, and hardware checks between the primary and backup systems enable the instantaneous detection of any errors and the automatic switch-over to the backup system. Such systems are very attractive for process control, fund transfer and other real-time activities where even a momentary lapse in the availability of computer response could cause serious disruptions.

DEC's approach to high availability is a notch below these fault-tolerant

systems. DEC's high-availability systems are VAXCLUSTERS running VMS with multiple disk controllers (HSCs), multiple processors, reliable interconnections (CI), independent terminal controllers (DECSEVERES) and shadowed disks.

In DEC's VAX architecture, VAXCLUSTERS and symmetric multiprocessors (SMPs) aren't capable of instantaneous error detection with instantaneous failover. In fact, DEC has stated that fault tolerant capability isn't a goal

ACMS

The Application Control and Management System (ACMS) was introduced by DEC in 1983. The ACMS layered software product consists both of development and run-time components that let professional software engineers (*not* end users) develop and manage complex OLTP applications.

ACMS is a high-end product, targeted at those OLTP applications that take three or more programmer-years to develop. ACMS applications are highly structured, and modules and entire subsystems of an ACMS system (called tasks and applications in ACMS lingo) can be changed, started or stopped in a very controlled process without adversely affecting any active ACMS users.

ACMS applications are developed as two independent parts, application development and application control. The development of an ACMS application can proceed without knowing exactly how it will be used and what the user menus will look like, and without concern for the access control (security) aspects. These control tasks are handled in a separate (and possibly parallel) phase of the application development process.

For a major OLTP application, ACMS has considerable advantages over standard programming methods under VMS because many fewer VMS processes are required to support a given number of users. In a standard programming approach, each OLTP user would have his own VMS process and typically would run the same or similar programs, each program containing all the code and data to display screen forms, retrieve information from the user and update databases.

In the ACMS approach, one VMS process controls a great many terminals, all performing standard ACMS data display and retrieval operations. Generically, this is called the *exchange step* because data is exchanged with the user. The exchange step uses ACMS menus to control program flow, TDMS screens and TDMS requests to control the input to the TDMS screen. The data retrieved from the user is placed into special buffers called *workspaces*. These buffers are transferred to separate processes called *servers*, which handle the processing step.

The processing step can execute a standalone program (such as DATATRIEVE), a DCL command procedure, a non-ACMS program, or special ACMS programs that the task developer constructs. A server can execute a program on behalf of many users, all from the context of a single process. This approach has many advantages over the standard VMS programming approach:

1. A single process services many terminal users, thus conserving computer resources. Further, the exchange step (terminal display) is handled on the local node while the processing tasks may be handled on one or more remote nodes.
2. Server processes can be started (performing initialization activities like opening files or databases only once) and then left dormant, available to service requests from any

for its clusters and SMPs. As of this writing, DEC offers only one system with significant fault-tolerant capability. The MIRA system consists of two MICROVAXs with special hardware and software for switching peripherals if one of the two systems fails, but the user must develop the software to detect the need for failover.

DEC's high-availability offerings protect against the failure of any one component. If one HSC goes down, the

disks still are available via another HSC. If a disk fails, disk shadowing can protect the data and keep the system running. If a processor fails, the users can connect to another processor via the terminal server.

Compared to the fault-tolerant systems, though, DEC's architecture has one serious limitation: All system context is lost if a processor goes down. That is, unless the application program keeps a great deal of user context on disk

(a very difficult and resource-intensive operation), there's no way to pick up where you left off and have the users return to processing at exactly the same point but running on another processor. And, for certain operations like access to allocated devices such as tape drives, there's no way to fail over the device from one processor to another under the VMS architecture without losing critical context information such as tape position.

Another problem is the cluster reconfiguration time (anywhere from several seconds to more than one minute, depending on the characteristics of the cluster), when one cluster member enters or leaves a cluster. During cluster reconfiguration, all processing on all the cluster members must halt. For some OLTP applications, this interruption simply is too great.

Other problems are less severe but appear in various specialized OLTP applications. Because of the interrupt handling and other involvement of the CPU in terminal I/O, the overhead of terminal work can be a source of performance problems in VMS OLTP applications. Image and process activation overhead (the resources required to start a VMS process or a program) also are potentially serious limitations to certain kinds of OLTP applications. Also, in some cases, the way the VMS scheduler works (round-robin scheduling for CPU time) makes elapsed time response too dependent upon system load.

The DEC OLTP Solution

The Digital solution to OLTP systems consists of a number of hardware and software products; it's a far cry from "Here is a complete OLTP system in one nice neat package." Table 1 lists the hardware components of a VAX-based OLTP system from DEC, and Table 2 lists the software components.

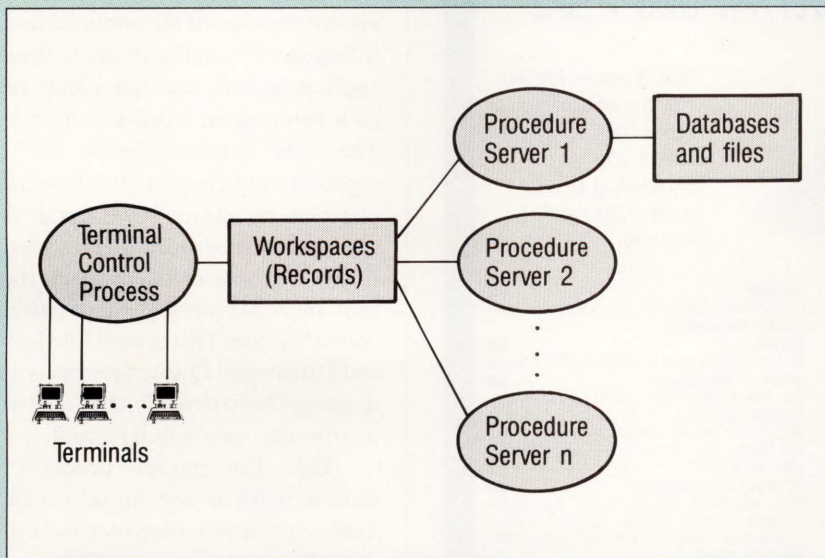
The Digital approach is to build an OLTP solution from this menu, adding the components required to meet the specific needs of the OLTP application. For example, if the advantages of highly reliable and high-speed computer inter-

of the terminal users. Because a server can be preactivated, response to a processing request can be much faster than using standard programming techniques.

3. If the database being updated is updated only by a single server process, update requests will be single-threaded through that server, thus avoiding the need for complex and high-overhead locking. There also are ACMS language elements to control database transactions for rollback and commit.

4. Server processes can be started and stopped cleanly, therefore effectively controlling the corresponding processing steps. As a result, it's possible to shut down an application without banishing the users. Similarly, new versions of applications can be brought up without doing anything to the users.

An entire ACMS application and its component tasks are defined using the highly structured languages built to define the application in a top-down, outside-in methodology. The actual processing steps can be written in standard VMS languages nearly independently of the application control or management environment.



ACMS uses one process to control many terminals and many procedure servers to respond to requests for processing. Each procedure server may do a different function, or there may be more than one server available for certain very busy functions. Servers may also reside on remote nodes.

connect and HSC aren't required in your application, you might not select the clustering hardware approach. Similarly, you could choose either a CODASYL-compliant database (DBMS) or a relational database (Rdb) or no database at all and simply use VAX RMS for managing your application's data.

Throughput

The unit of measure for an OLTP system is the number of transactions per second (TPS). There's a standard benchmark that many OLTP vendors use (TP1), but as in other kinds of benchmarks, throughput benchmarks generally aren't comparable from one machine to another or one software system to another. The only truly useful benchmark is one based on the characteristics of the application of interest. Generalization from a standard benchmark is both naive and risky.

Common wisdom holds that most OLTP systems require only about five to

10 TPS at peak load, although there are certainly applications that would exceed the 200-400 TPS of the largest transaction-oriented computer systems if more capacity were available. Before you ask, "Only five transactions per second?", remember that these are complete transactions, not just individual I/Os or computation steps, and may include numerous lookups, modification to several database relations and considerable other processing in the area of database integrity and concurrency.

Transaction rates of a few-per-second are within the realm of reasonably sized VAXCLUSTERS, but VAXs using DEC's hardware and software solutions likely will have problems satisfying the load when the transaction volume reaches the hundreds. The reasons for this are many, including limitations in the cluster architecture, performance problems with individual layered software products, and the general time-

sharing nature of VMS. Yet, to compete with Big Blue in OLTP, Digital must be able to deliver a solution capable of running a large-scale OLTP application like an airline reservation system.

Several articles in the trade press have indicated that Symmetric Multi-Processor VAXs (SMPs) will be the solution to DEC's OLTP throughput worries. Certainly SMPs will help increase the number of transactions that a VAX can handle because they'll greatly increase the compute available and reduce the dollars-per-mips factor. And, because SMPs will support simultaneous I/O activity from multiple processors, there's no inherent architectural limitation in using that compute resource for OLTP applications.


But just because the resource is there doesn't mean that the OLTP applications will be able to use it. There's a good deal of software development to be done to use multiple processors effectively in an OLTP environment on VAXs. This is true both in VMS and in the layered products, and it probably will be at least a couple of years before we see the fruits of that labor.

Certainly, one way that DEC is addressing the OLTP throughput issue is via distribution of the application. Distribution refers to the ability to break an application into multiple components, each running on a different processor. The ACMS product already has some capability to help you distribute an application by running the terminal I/O (exchange) steps on a different machine than the processing steps. And, the recent announcement of the Distributed Name Services, Distributed File Services and Distributed Queue Services is an indicator of how strongly DEC feels about distribution as a solution tool.

DEC has enough products and tools to make its systems robust entries in the OLTP arena. However, the real test of DEC's OLTP prowess will be success in the marketplace, and Digital has yet to demonstrate a solid foothold there.

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The Touch Tone Telephone As A Terminal

BY DAVID W. BYNON

HAVE YOU EVER noticed how some of the most difficult problems are resolved with a simple tool that's right under our noses: the telephone system? We use the phone system daily for business, personal calls, emergencies and transmitting data among computers. It's inexpensive and always there when you need it. But, many of us have overlooked the obvious: touch tone telephones as terminals.

The majority of all businesses and households in the United States have, or have access to, a touch tone phone. The ability of the touch tone phone to generate audible tones of variable pitch makes it a useful computer terminal. This simple, but powerful, capability should not be overlooked.

To use a touch tone phone as a terminal requires a special piece of equipment that can decode the users input from the telephone keyboard, and present information back to the user, through speech, on the telephone headset. One such device is Digital's DECTALK, a speech synthesizer with extensible touch tone phone capabilities. Other systems, with similar capabilities, are available.

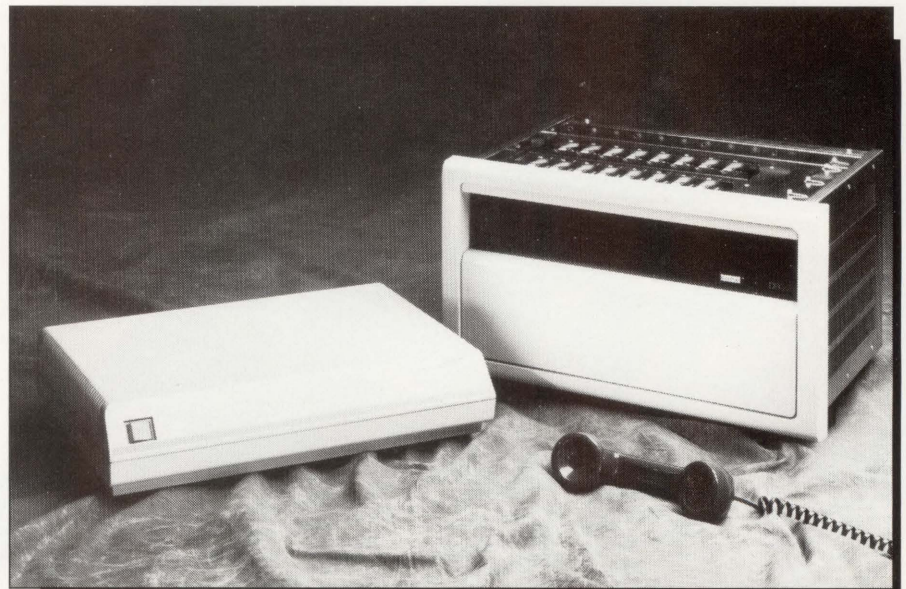
DECTALK easily can solve many problems. For example, school registration, telephone surveys, catalogue orders, electronic mail and message ac-

cess, banking and more. To give you an idea of how functions work, here's several scenarios.

A cost effective use of the telephone terminal is for catalogue orders.

Imagine replacing a \$10,000- to \$16,000-a-year employee with a \$3,000 DECTALK that's on the job 24 hours a day, seven days a week. Here's how it works. When a customer calls, a friendly voice presents him with a menu. The menu instructs him to choose from

several functions, including HELP for first time users. When the Place Order choice is selected, the system shifts from a menu mode to a query mode. DECTALK begins the order process by requesting a payment number or customer ID number. In a case where the system has too little information about the customer, a telephone operator would have to call the customer back at a phone number left during the order process.



DECTALK features a choice of 10 voices, speaking rates from 120 to 350 words-per-minute and a virtually unlimited vocabulary.

On-the-go professionals can make excellent use of the telephone terminal to access their electronic mail, any time, any where. By assigning an account user code and password to each user, an elec-

THE TELEPHONE terminal has a myriad of possibilities, limited only by our imaginations . . .

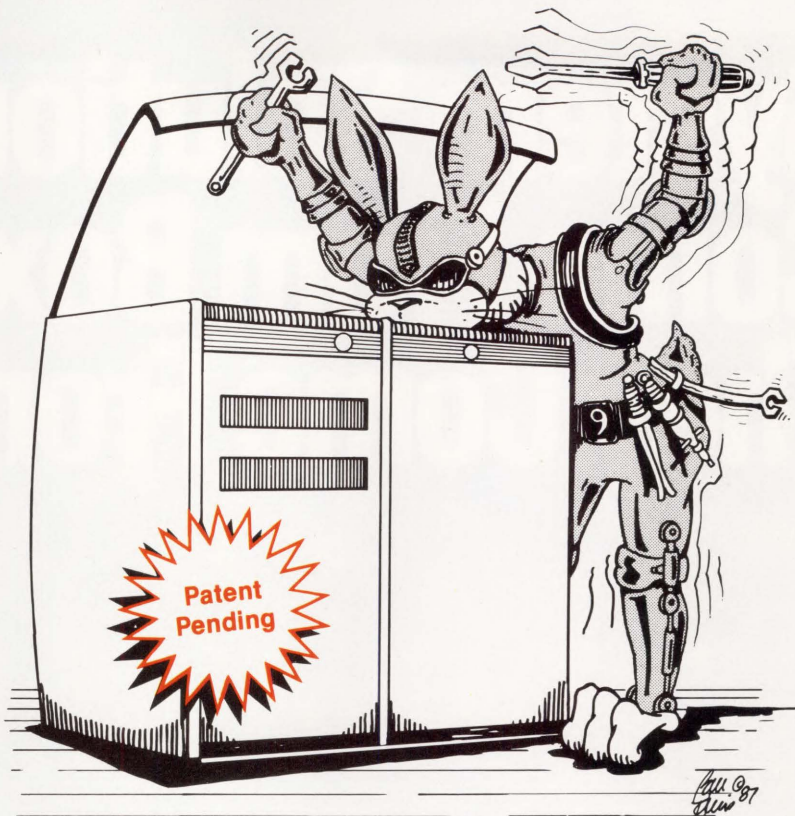
tronic mail system could read users' mail to them over the phone. A menu presenting the From and Subject lines allows users to select the message they want to read. Users can then reply to the electronic mail with simple Yes, No, or Phone number responses.

Any college student can tell you the benefits of not having to stand in long lines to register for classes. With having a class schedule catalogue prior to registration, half the work already is completed. By assigning classes a numeric identification, registration becomes a simple process of entering a student ID number and intended class identification numbers. Then, the computer system immediately informs the student if the class has seats open and if prerequisites are met. As a result, registration lines are reduced to new students and special cases.

System managers can make use of the telephone terminal for emergency or critical situations, such as fire, flood, unauthorized access, equipment failure, etc. By implementing a system watchdog, DECTALK can be instructed to call one or more numbers, present the situation, and list choices available to correct the problem.

The telephone terminal has a myriad of possibilities, limited only by our imaginations and willingness to use them. ■

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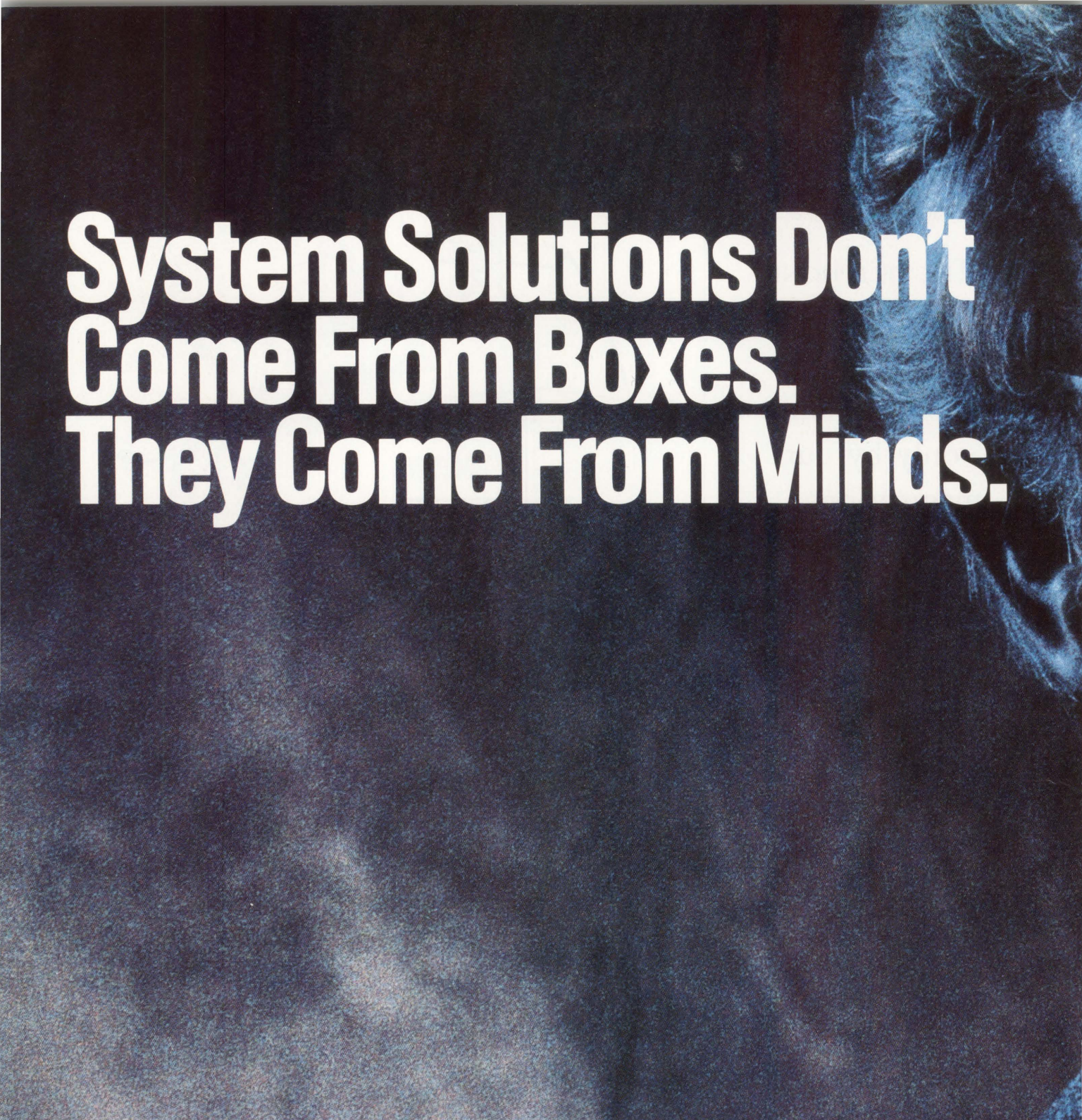
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OLTP On The VAXCLUSTER

APPLICATION software can eliminate the overhead penalty of the VAXCLUSTER's Distributed Lock Manager.

BY BERL HARTMAN

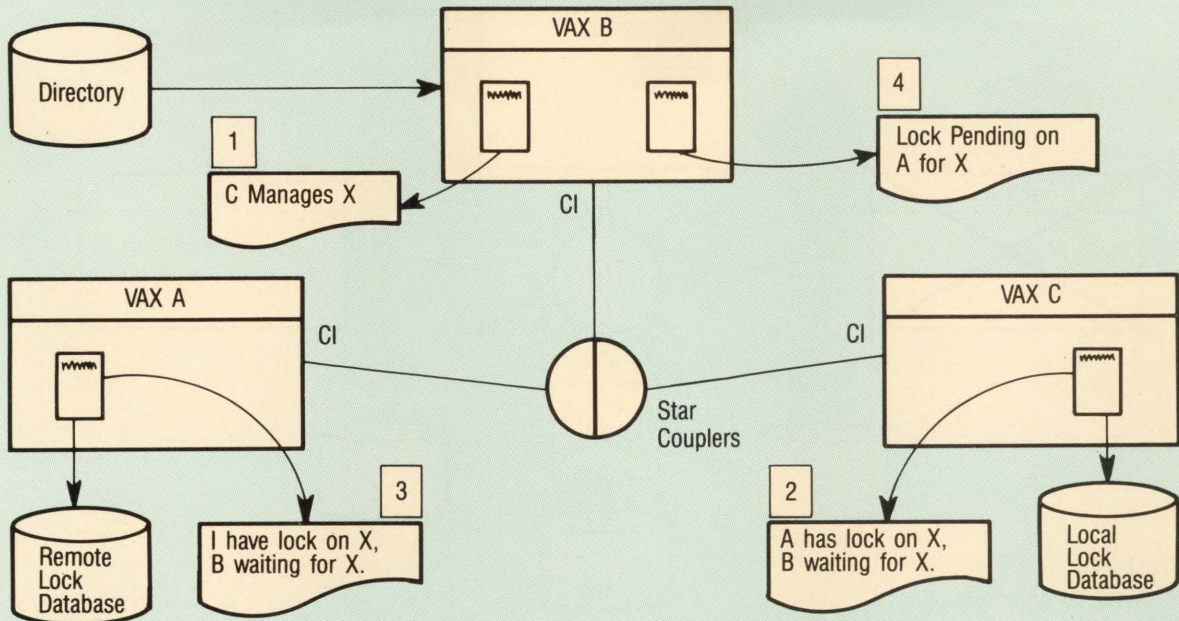
DIGITAL OFFERS THE VAXCLUSTER as an easily managed computing environment that gives incremental expandability, extensive and flexible resource sharing, highly available resources, extensive data storage, flexible configurations and support for balanced interactive workloads. However, the cluster's Distributed Lock Manager introduces overhead that can make this environment unsuitable for high-volume online transaction processing. It's possible for application software to eliminate this overhead penalty and permit the successful implementation of

online transaction applications on the VAXCLUSTER.

The most attractive benefit of a VAXCLUSTER environment probably is incremental expandability that allows a system to keep pace with growing resource demands without interruption of normal operations. The VAXCLUSTER offers the potential for gradually accumulating the processing power, data resources and storage capabilities generally associated with mainframe systems, by allowing the addition of processors to an installation as needed.

The benefit of expandability, however, is offset substantially by the overhead imposed by the cluster itself. The process of locking a resource is complex and may require up to six sequenced messages on the CI bus (see Figure 1 for an illustration of the Distributed Lock Manager). Lock management overhead may be as much as 20 percent for each processor in the cluster, reducing the actual throughput achieved to approximately 80 percent for each additional cluster member. For online transaction processing, where a large

Figure 1.



• B wants a lock on Resource X:

1. Find location of VMS Resource Manager in Directory.
2. Lookup availability of resource as maintained by VMS Resource Manager. Mark "B waiting for X" at local lock database.
3. Mark "B waiting for X" at remote lock database.

4. Mark "lock pending on A for X" at requestor site B.

Requires 0 to 6 messages on the CI bus per lock!

Typical performance:

- 2 nodes = 1.5 — 1.8 x single node
- 3 nodes = 2.3 — 2.5 x single node

The VAXCLUSTER's Distributed Lock Manager.

number of concurrent users must be serialized, this overhead may be prohibitive.

The growth potential of a cluster also is affected by the way in which application software uses the Distributed Lock Manager. One RDBMS vendor estimates that its VAXCLUSTER software, using the Lock Manager for all remote locks in a two-CPU cluster, might achieve a throughput gain of 1.8 for a select transaction and only 1.3 for a short update transaction over that of a single CPU. Throughput would degrade further with data management distributed over the three processors.

One way to avoid declining throughput would be to keep DBMS operations on one processor. However, architectural characteristics may make

this impossible. For example, DBMSs that create a copy of code and a backend process for each user quickly require additional processors to handle the memory and CPU requirements of a growing user base.

Resource Availability In A VAXCLUSTER

Another important benefit of the VAXCLUSTER is redundant hardware features and VMS support for automatic failover of redundant elements. Lock management overhead, however, makes recovery unacceptably lengthy for applications requiring high system availability.

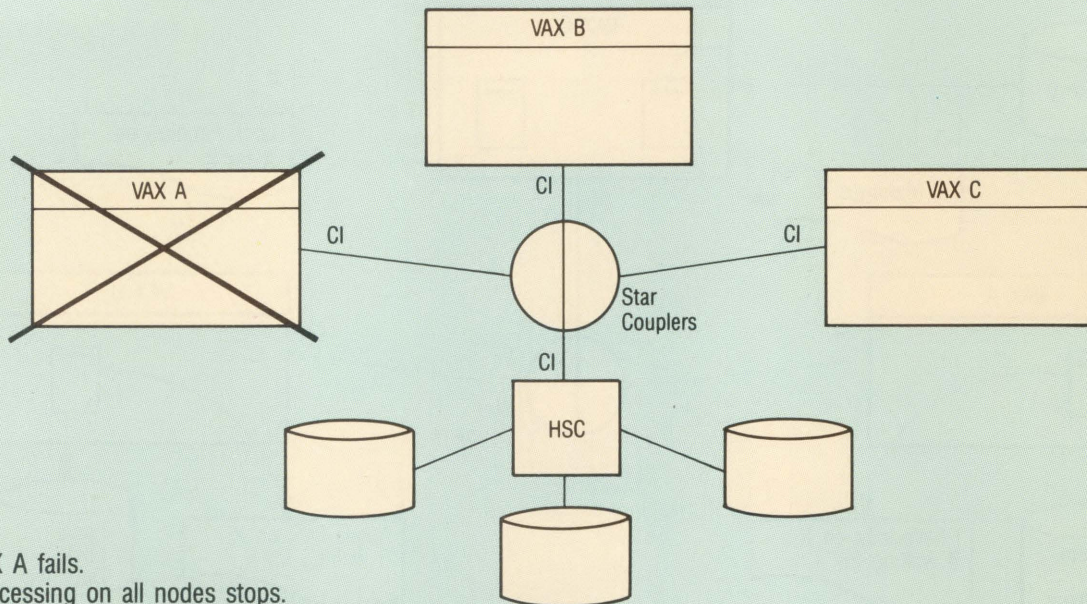
When a cluster node fails, processing on all nodes stops until the VMS Connection Manager re-establishes a

quorum. Then, the Distributed Lock Manager must release all locks held by the failed process, re-establish the Resource Manager for all resources held by the failed processor, and re-establish the local and remote lock databases for each resource in use at the time of the failure. While this activity is in progress, all nodes in the cluster are unavailable (see Figure 2).

Recovery time for the cluster is proportional to the number of locks in use and may take five to eight minutes or longer. In an online transaction application with hundreds of users and locks at any one time, recovery can be lengthy. Only after the cluster becomes operational again can application recovery begin.

With traditional cluster architec-

Figure 2.



1. VAX A fails.
2. Processing on all nodes stops.
3. VMS Connection Manager re-establishes quorum.
4. VMS Distributed Lock Manager:
 - Releases all locks held by failed processor.
 - Releases local and remote lock databases for each resource in use at time of failure.
 - Re-establishes VMS Resource Manager for all resources held by failed processor.
5. Processing continues on remaining nodes.

Recovery time for cluster proportional to number of locks in use. Typically 5-8 minutes or more.

The Distributed Lock Manager activity when a cluster node fails.

ture, both declining per-processor-throughput as a cluster expands and cluster recovery, measured in minutes, diminish the value of the VAXCLUSTER for applications requiring virtually continuous availability and subsecond response time. Because the Lock Manager is responsible for these drawbacks, application software that reduces its overhead to an absolute minimum enables the VAXCLUSTER to provide a flexible long-term computing environment for online transaction processing.

A DBMS that in effect can run as an efficient database machine on one processor in a cluster would eliminate a great deal of overhead. This would require requester/server architecture. The server would have to run as a single process on a dedicated processor with its own

memory management and memory resident locking mechanism. In addition, it would have to manage data for all users with one dedicated image and one shared data cache so hundreds of users could be handled in 4 to 6 MB of memory. Applications would run on other processors.

This architecture has several advantages that are particularly important in a VAXCLUSTER. A server running as a single process doesn't require context switching. Its own memory management eliminates frequent page faults. A shared data cache minimizes disk I/O. The efficient use of CPU and memory by the server slows the demand for additional resources by the DBMS and shifts it to application tasks. This strategy allows upward scaling without

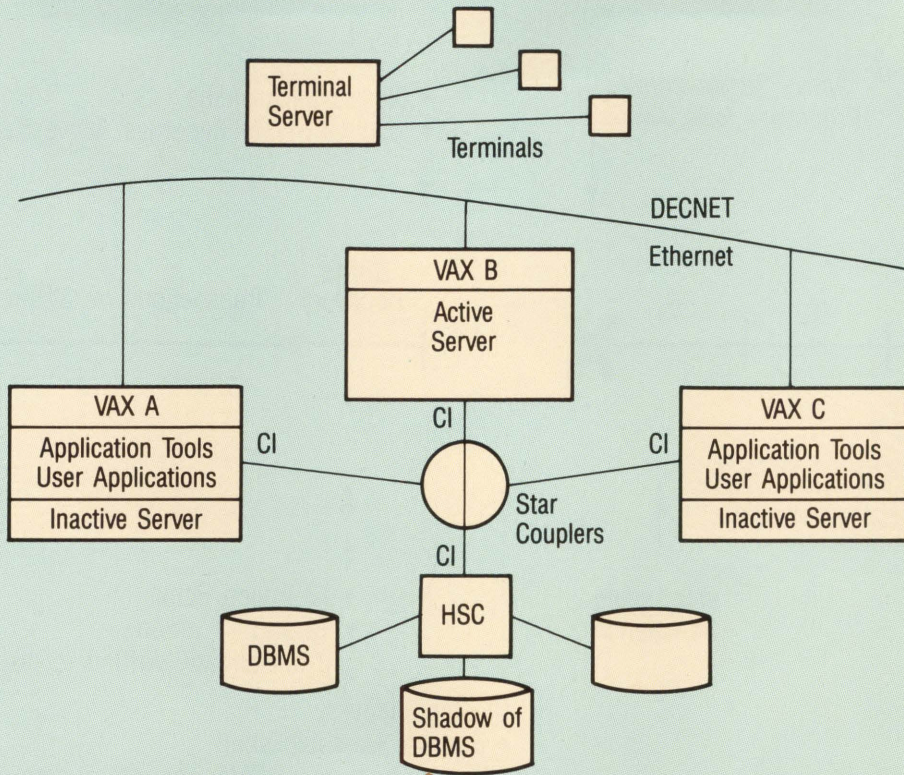
any additional overhead imposed by the DBMS.

In addition, because all data is managed by a single server on one processor, locking can be handled simply by reading and updating a memory resident table. This can be an extremely fast operation taking only microseconds on a VAX 8700. Memory resident lock management also eliminates the VMS locks that the Lock Manager would have to establish for concurrent users.

OLTP Server Recovery

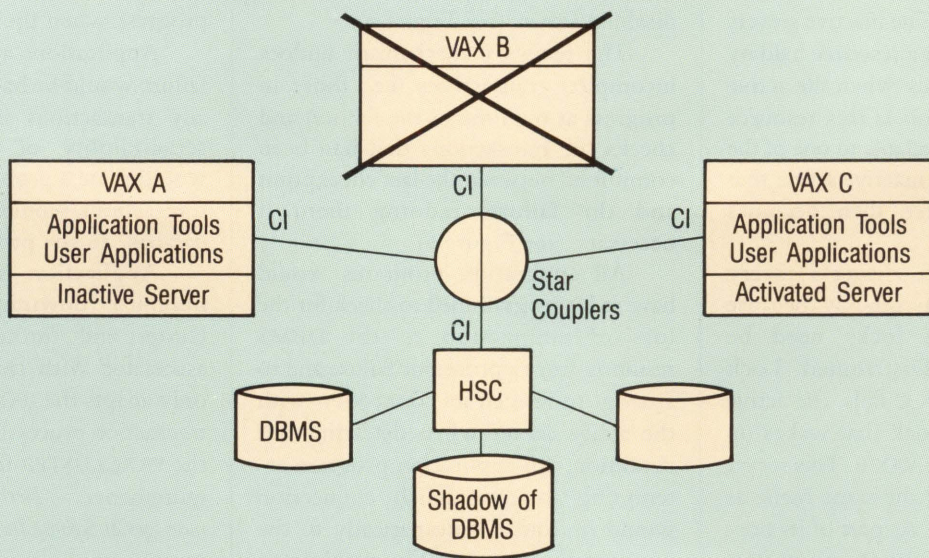
To illustrate the functioning of such a DBMS in a cluster, assume that three VAXs are running in a cluster: VAX A and VAX B are running applications and VAX C is running the server. In addition, inactive servers are installed on VAXs A

Figure 3.



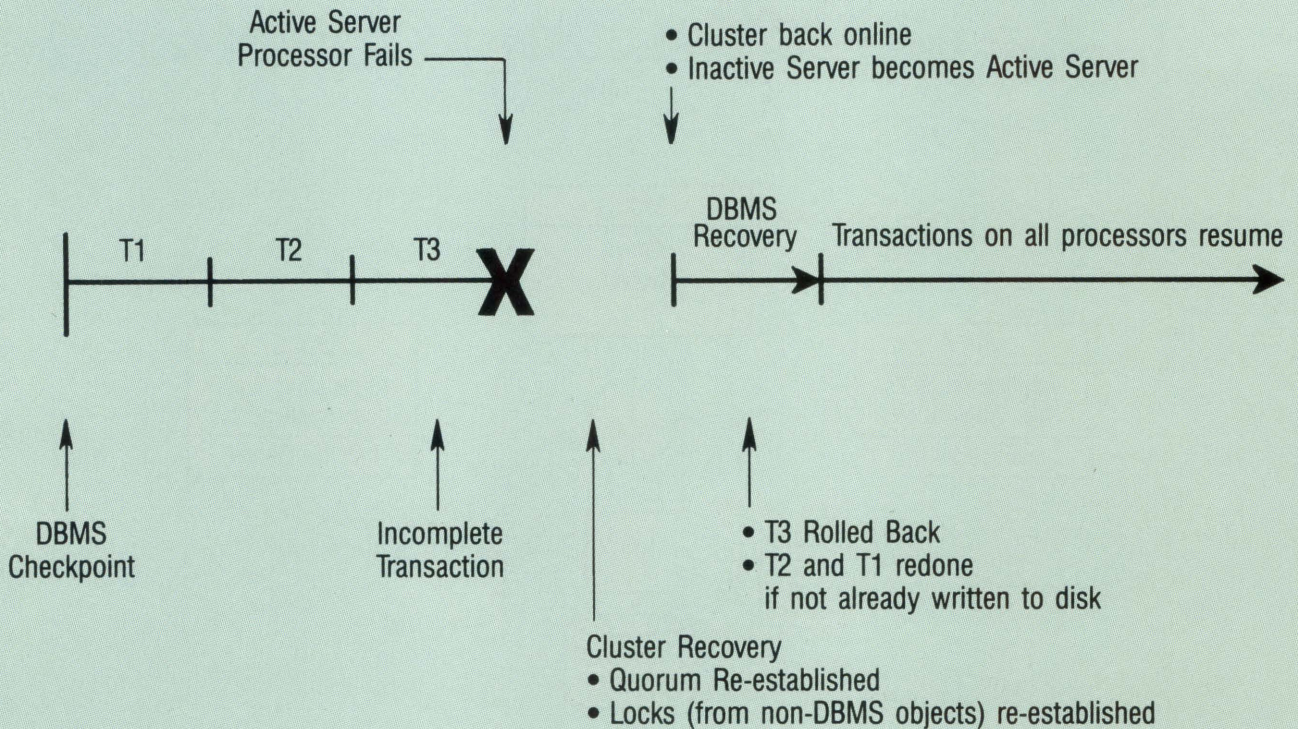
The functioning of a DBMS in a cluster.

Figure 4.



The server on VAX B recovers the application using the transaction log from the server on the disabled server.

Figure 5.



The recovery mechanism undoes incomplete transactions as one of its functions.

and B (see Figure 3). The inactive servers continuously request a resource held by the active server. Only when the active server's processor fails is this resource released and made available to one of the inactive servers. The inactive server that receives the resource then becomes active.

In this scenario, cluster recovery could occur relatively quickly, because only non-database locks need be restored by the Distributed Lock Manager. When VAX C fails, the active server releases the lock that wakes up the inactive server on VAX B. This server activates itself using the same name as the server on VAX C. As part of its normal startup activity, the server on VAX B recovers the application using the transaction log from the server on the

disabled server (see Figure 4).

The recovery mechanism undoes incomplete transactions (i.e., those in progress at the time of the failure) and checks the transactions that had been committed between the last checkpoint and the failure, redoing them if necessary (see Figure 5).

All application programs would have to be programmed to check for the loss of connection to the DBMS resulting from a processor failure and to attempt to reopen its connection with the active server when detecting this condition. An application program attempting to re-establish connection would be routed automatically to the new active server. After establishing connection, the application program then would resubmit the transaction in

progress when the processor failed.

Applications active at the time of failure would be backed out if they had any transactions in progress, so the serializability of these transactions wouldn't be a problem. All committed transactions would be restored to the database in the process of recovery.

Application software that can minimize downtime for the entire cluster and throughput degradation associated with cluster expansion not only adapts the VAXCLUSTER to online transaction processing but adds value to the VAXCLUSTER for all processing requirements. —Berl Hartman is product manager at Sybase Inc., Berkeley, California.

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VMS V5.0

The DEC PRO Staff

Many Expected Changes Are In The Wind.

VMS V5.0 is a major upgrade to the VMS operating system. It comprises a rewrite of how the executive works and its supporting features. Basic current functionality isn't compromised, but the ability of the operating system to perform more features and allow additional future capabilities is improved markedly. This required extensive changes to the VMS exec and supporting utilities.

Most programs that call system features in a "generic" way will work properly under version 5.0 once they've been recompiled and relinked. This means that any call to a specific point in the exec that doesn't use standard, recommended symbolic representations will fail.

The upgrade has two major goals:

1. To modify the operating system so that future additions can be added in a predictable way, with minimal current system impact.
2. To make the operating system as portable as possible.

Additions to the operating system under version 4.0 and earlier relied heavily on the system loader (VMB.EXE). As the needs of the systems being supported increased, the loader became equally complex and difficult to expand and maintain. The new loading mechanisms of version 5.0 changed that.

Portability is an issue because the operating system must be able to port to new VAX environments as they appear. Because VMS is tough to port to a new hardware architecture, it's been modified to support them through simple modifications of load files at

boot time. This feature also may allow VMS to port in the future to non-DEC processors.

Device drivers are another issue. Because of modifications to the executive and other structures, drivers may require extensive modifications before they work properly. This may mean complete recoding of device drivers in some instances. User-written drivers should be examined carefully before inclusion into version 5.0.

In summary, the changes are plentiful and extensive. DEC knows that there's more income in software than in hardware and will strive to make its software work in more environments than previously expected.

VMS Executive Modifications

Modification to the VMS executive is the most important area of modification in the entire upgrade procedure. VMS is being split into approximately 20 different special images that take up approximately three disk blocks worth of storage. Each image takes up two System Page Table Entries (SPTE) in virtual memory and approximately one physical page of memory each.

The images are loaded by various parent images at system boot and in an order prescribed by hard-coded lists in SYSBOOT and SYSINIT. This hard-coded list will change after the initial release of VMS V5.0 to allow the user to specify (probably via SYSGEN parameters) which modules to load and in what order, depending on system configuration and job needs.

There are six different types of modules loaded, and they look a lot like a standard VMS image. Each type of image has a new data structure called an Image Section Descriptor

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(ISD) that allows the various loadable images to look like standard shareable libraries. There are four ISDs classified for Code or Data (read only, writable, resident, loadable section attributes). ISD

tor will be NOPed rather than deleted or reassigned. Master vectors in the SYS.EXE file point to transfer vectors in the image files, which may point to other vectors or possibly code. Following ex-

5. SYSINIT runs as a process (first to run as mapped) and uses the virtual BOOT driver to load the SWAPPER and other required code.

6. SWAPPER runs, using the MMG\$ "backdoor" (similar to inswap of working set pages), and sets up the mini-file system.

7. SWAPPER runs, and the startup process is created to load other images and run the startup command file.

At the top is SYS.EXE which will contain more than 1,000 vectors, each of which points to particular offsets in particular images.

number five is for .ADDRESS fixups, and ISD number six is used to point to image initialization routines to be executed during load but before any in-image executable code.

All loadable image sections of the executive (approximately 20) are grouped together in a manner conducive to the common sense placement of capabilities. In areas where images communicate extensively with each other (one image calling routines in another image), interimage calling has been simplified and made fast. Also, DEC will re-evaluate image placement as time evolves to ensure that speed isn't compromised. Images may be grouped as:

1. Logical names
2. Image activation
3. Security
4. RMS
5. I/O subsystem
6. Memory management
7. Image primitives (a catch-all for those that don't belong anywhere else).

Images are controlled in a structure that's similar to a disk volume directory structure. At the top is SYS.EXE which will contain more than 1,000 vectors, each of which points to particular offsets in particular images. Vectors in SYS.EXE never will be modified. If the code pointed to from a vector should become obsolete in the future, the vec-

tion of code, an exit vector is pointed to and the operation is finished. SYS.EXE is referred to as the base image and all other images are subordinate to it.

The benefit of the loadable scenario is obvious: Pieces of VMS can be modified, reloaded, unloaded, etc., on the fly while the operating system is running. It also allows for better use of VMS and memory addressing schemes.

When an image is loaded, the sequence of events is as follows:

1. The image file is opened.
2. The image header is read.
3. The image sections are mapped to virtual memory.
4. The fixup vectors are run and patched.
5. The image specific load code (ISD 6) is run.

To provide this capability, the entire bootstrap subsystem has been recoded. It's much simpler because some of the normal bootstrap functions have been moved to individual images rather than including the code in the bootstrap procedure (hence, the ISD 6 image init option). In version 5.0, system boot resembles the following:

1. VMB.EXE executes from ROM or floppy.
2. VMB loads SYSBOOT.EXE.
3. SYSBOOT uses the new boot driver to load the SYS.EXE base image.
4. SYSBOOT loads SYSINIT and the memory mapping facilities.

To accomplish this, extensive changes to the change mode dispatcher, image activator, and many other executive areas were required. Performance is approximately the same as in version 4.0.

Image files won't be located in [SYS0.SYSEX]. Instead, a new directory parallel with SYSEX will be created called [SYS0.SYS\$LDR]. This name could change in the production release. The reason is speed: By having fewer directory entries, there is less burden placed on the startup file system because it doesn't have to map the entire directory before RMS.EXE is loaded along with the other files.

Other features such as being able to load XDELTA on the fly are possible. Currently, the system must be configured at boot for XDELTA execution. With the new setup, XDELTA could run whenever desired. Also, tailored VMS systems could be configured to allow optimal use of resources.

While many features have been included in version 5.0, some won't be supported until later. "Not supported" is Digital's way of saying that the way to use the feature may not be fully implemented or documented, or that the feature hasn't been fully tested and blessed as safe for customer use.

Other possible features include:

1. Multithreaded modified page writing.
2. More than one page file support for a single process.
3. Improved SWAPPER facilities:

a. Excessive page reclamation will be avoided.

b. No longer will the system be required to trim working sets before a swap.

c. Larger swap and page I/Os will be allowed.

d. Page lists won't necessarily be purged any longer.

VMS vs. MICROVMS

As of version 4.6, VMS and MICROVMS are one kit. Both have been substantially similar for a while, but in the version 4.6 release there's one distribution kit for all VMS-based systems. This move not only simplifies management for system managers of multiVAX sites, but also simplifies distribution for Digital. Another reason is to allow a uniform tailoring of operating system features to all VAX families.

In version 5.0, some additional changes will occur. The operating system will be loaded in three savesets with options for "unloading" (the new term is to "tailor off") parts of the operating system that aren't required. Rather than burden the installer with selecting desired features, the system basically will load most of the operating system and allow the user to "unload" pieces that aren't required. Should the pieces be required in the future, they may be restored as needed.

Templates, such as SYSTARTUP.COM and LOGIN.COM on MICROVMS also will appear on the regular distribution kit to satisfy the needs of newcomers to VMS.

FILES-11

FILES-11 get needed enhancements and bug fixes; e.g., highwater marking now will work properly. Another fix is to make multiple directory entries (file aliases) work properly so that when a particular file is referenced from multiple directories, periodic problems cease to occur (such as when ANALYZE/DISK_STRUCTURE finds a bad file that's defined in multiple directories).

VERIFY will receive needed enhancements, and a new utility, SALVAGE,

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may appear. SALVAGE will be used to rebuild failed/corrupted volumes.

BACKUP

Many bug fixes and enhancements are being added, including some safety features. In the current version, the input specification, a disk or tape, for example, accidentally could be initialized if the BACKUP command were typed improperly. Version 5.0 will remedy this. BACKUP also is being modified to work properly with the \$MOUNT system service to handle multivolume sets properly.

Standalone BACKUP is improved as well. The working set will be locked down to help improve performance, and various problems that cause failures on multiaction backups will be fixed.

Note: There's a rumor that BACKUP will support network access for backups across DECNET, for example, but this hasn't been substantiated yet.

ANALYZE/DISK

In the current version, ANALYZE/DISK puts recovered files in a directory called [SYSLOST]. In the new version, recovered files will be allowed to be placed in a specified directory. Files won't be able to be recovered to original directories because of file version issues that may cause problems with version number highwater markings imposed by system managers. Other issues also make the action impractical for most users and system managers.

MOUNT

A new qualifier is added, /MULTI-VOLUME, that tells MOUNT that the set being mounted consists of multiple volumes. This was done to alleviate problems where tapes get into a run-away condition and go off the end of the reel and other related problems.

Terminal Fallback Facility

On foreign language systems that don't use the standard international character set, characters such as the German

umlaut may be used, causing problems with VAX MAIL because they may not be displayed properly on non-foreign character-set terminals. The terminal fallback facility provides a way for foreign characters to be supported by all terminals.

Basically, a table of replacement characters is provided to the system by the system manager. The system manager then may enable or disable the set on a terminal-by-terminal basis. A set of management tools also will be provided to allow the creation of the tables and manage the terminal environments.

VAXCLUSTERS And LAVC

Quite a few enhancements are available in the VAXCLUSTER environment including:

1. Failover of Non-HSC Disks — Consideration is being given to failover facilities for UDA, BDA and KDA types of disks, in addition to enhanced HSC failover capabilities.
2. LAVC — LAVC becomes part of the VMS V4.6 distribution kit. A key, similar to the type used for DECNET, will be used to enable LAVC on a particular system.
3. Mixed Clusters — CI-based and LAVC-based clusters will be supported interchangeably. In the future, boot nodes may be either CI-based or LAVC based or both for LAVC clusters.
4. Additional Satellite Nodes — These (26 plus) will be available beginning with version 4.6.
5. Shadow Sets — These sets will be increased from two to three.
6. Volume Shadowing — This feature will be supported only on HSCs for the foreseeable future. It's not known if it ever will be supported on non-HSC disks because the HSC does most of the work, and the overhead imposed on locally connected systems (disks connected to a system that doesn't have an HSC) is extreme.
7. Multiple VMS Version Support — Support for multiple versions of VMS in the same cluster is viewed as an assistance move and not a commitment to support more than one previous ver-

sion simultaneously. Users still are urged to get all cluster members up to the same version number as soon as possible.

8. Continuous Run — This feature, which would allow the cluster to run continuously during an upgrade, also is being considered. Instead of having to shut down a node and perform an update on a quiescent system, the upgrade to a cluster member could progress while the cluster is in operation.

RMS And RMS Journaling

Formerly a separate product, RMS Journaling will be merged into VMS and will use a key facility like DECNET. Overall features aren't well known, but recovery and rollback facilities may be included.

RMS will see the following enhancements:

1. Collating Sequence Changes — The sequence changes for file keys may be determined by the file creator. Currently it's ascending.
2. Better performance — With sequential GET operations on ISAM files, you'll see increased performance.
3. A New Command — SET FILE/STATISTICS will be added. Through this facility, system managers may collect information about selected files and get summaries through the MONITOR command and possibly other facilities.
4. An Extra XAB — This will be added to files to support DAP enhancements (for protection codes) and the statistics-gathering facility.
5. COPY Commands — These commands between FILES-11 nodes on a DECNET network will be enhanced to move data between files in block mode rather than the current record mode copy.

These are also several other VMS V5.0 expected enhancements worth noting.

AUTOGEN

A new facility called AUTOGEN Feedback will allow system managers to let

Many enhancements are being made to date and time to allow formatting for countries that use formats other than the current ISO standard . . .

AUTOGEN adjust certain VMS SYSGEN parameters, such as PAGEFILE size, SWAPFILE size, and NPAGEDYN, based on statistics generated by VMS as the system is running. The statistics are reported to AUTOGEN when it's run and the adjustments are made. If the system is running a typical load over a period of time, AUTOGEN will be able to make some reasonable estimates on how to adjust certain key parameters so that systems personnel won't have to monitor the machine as closely as before.

DEBUG

MACRO will get some enhancements, such as an improved register display and the ability to examine operands like those offered in high-level languages. Fixes to items, such as SET ESCAPE and multiple image setting, will be done to ensure proper functionality.

An additional enhancement is the ability to use windows for applications written with routines like SMG. If an application uses SMG and is run with DEBUG, there are serious problems. DEBUG thinks it owns the screen and SMG thinks the same. The result is chaos. The enhancement allows DEBUG to direct output from code into a window that the code thinks is the screen. This way applications using screen-generator routines may be monitored properly and debugged without conflict.

BATCH/PRINT

Some serious enhancements to queue management are implemented that help

the system manager in various ways:

1. JBCSYSQUE.DAT is being reformatted. When jobs are queued up, they're placed in this file in a sequential manner. As a result, when the job list gets large (over 100 jobs queued), the access time degrades significantly.

In version 5.0 the JBCSYSQUE.DAT is being reformatted to look like the following:

```
QUEUE__NAME
JOB
JOB
JOB
QUEUE__NAME
JOB
JOB
JOB
etc. ...
```

This way a particular job may be found quickly and queues are easier to manage internally.

2. You'll be able to add ACLs to queues.
3. The F\$GETQUI lexical function is added. It will provide the same functions as the counterpart system service. Also, a new RTL routine, LIB\$GETQUI, will allow access to enhanced information about queues.
4. New item codes will be added to the job controller of the program interface.
5. Printing algorithm changes will include features to allow more "fairness" in printing order so that large jobs get a more equal chance to print.

Run-Time Library (RTL)

Many enhancements are being made to date and time to allow formatting for countries that use formats other than the current ISO standard (which is used in

VMS). Also, delta timers will get enhancements to allow multiplication of a delta time by a constant, and to extract time in various formats and ways.

It's also expected that RTL support libraries for parallel processing (PPL\$) will be included. Modules would allow for interprocess communications and data sharing facilities.

Screen Management Routines (SMG)

SMG\$ routines will be greatly enhanced and are generally viewed as being impressive. A new concept, a *viewport*, will be introduced. A viewport is a virtual look of a section of the pasteboard that can be modified and shrunk/expanded dynamically. Such a feature is very useful for dynamic window creation and other such niceties.

SMG also will be able to control I/O on a particular subprocess it controls. You'll be able to direct I/O from the subprocess to a particular window in the viewing area. This is useful when several programs must run simultaneously.

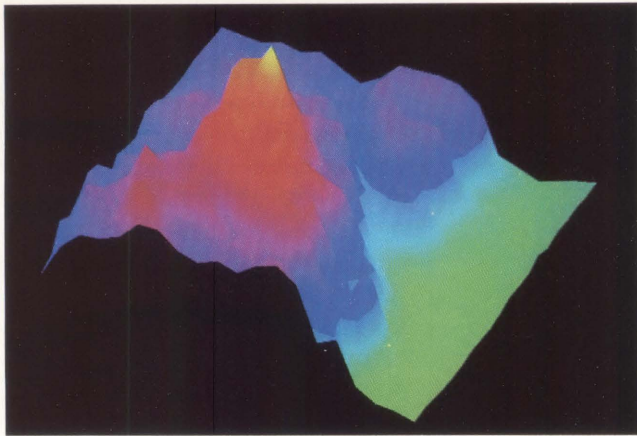
Menu facilities also will be added, similar to the ones on a VT200 SETUP display; e.g., vertical (pull down) and horizontal. Additionally, different types of rendition will be supported such as bold, etc., for menu options. The programmer also may supply up to eight different rendition tables to allow support of specialized color terminals and ANSI rendition types, such as double underline.

LAT

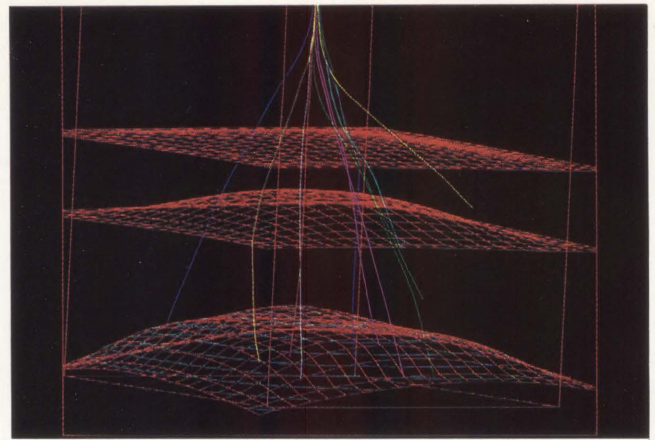
Capabilities to support two Ethernets on the same host system will be included as well as inclusion of LAT-Plus in a manner similar to LAVC and DECNET (both are software on the distribution kit and enabled by a key).

LTDRIVER.EXE will support direct QIOs to ports and allow dynamic connection to specific ports on specific servers under program control.

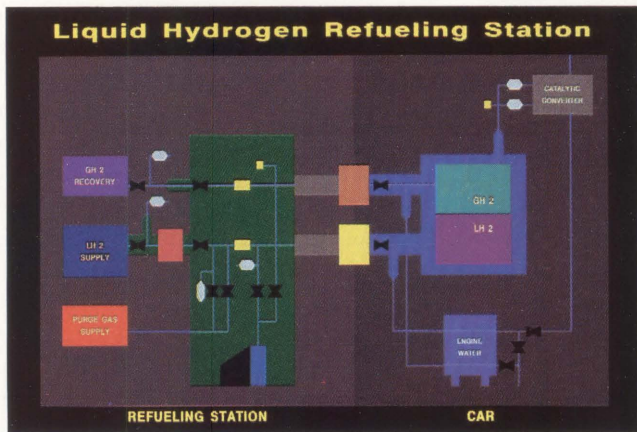
DEC SERVER-200 systems will be



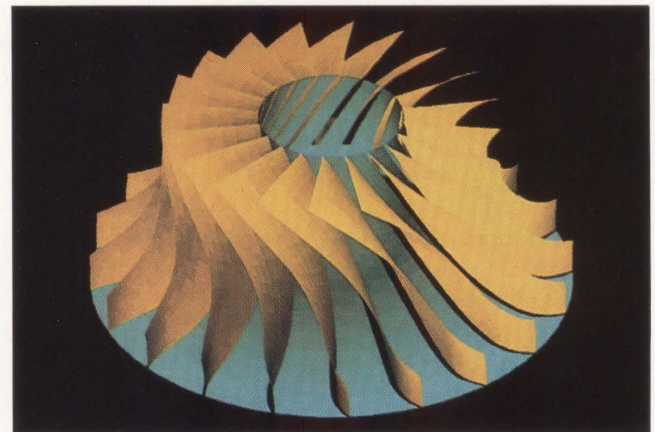
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able to specify a specific break key by defining TT\$M_BREAK.

\$GETDVI system service will be enhanced to allow programmers and system managers (this affects the lexical function as well) to find information about a particular LAT link (including server and port number).

Finally, LATSYSM will be enhanced to support 32 queues per symbiont instead of the current one symbiont per queue.

DCL

DCL will be enhanced to include an IF-THEN-ELSE capability, new DCL commands and a RECALL/ERASE command to erase the content of the command recall buffer. There also are many DCL enhancements planned in usability features such as menus, etc.

TPU

The section file facility is being revamped so it isn't as vulnerable to

operating system version changes. TPU also will receive a WPS keypad facility, a starting position qualifier for file access, and improved word wrap capabilities. The EDT emulator won't be included (its functions will be merged into EVE), and mouse support also will be added.

MAIL

VAX MAIL will have a fully supported callable interface that will allow all functions in VAX MAIL to be accessed from program control. Currently, this may be accessed through the foreign command facility, but this is non-supported and tedious.

System Management

DEC is looking into the adoption of a system management architecture rather than simple fixes or tools. As a result, the overall system management look and feel of the operating system will change. Tools such as cluster-wide com-

mand execution (a command is typed on one node and is repeated automatically on other nodes) will be included, as well as a "superior management tool" for which there is little information available. Indications are, however, that the tool will assume some functions, such as DISKQUOTA.

License Management

A new facility, the Digital Software License Architecture, will be included to help customers manage their software licenses. Software licenses are expected to be on a customer-by-customer basis and not on a CPU basis.

Symmetrical Multiprocessing (SMP)

It's expected that symmetrical multiprocessing will make its debut in version 5.0. This feature allows multiprocessor systems to function as peer-to-peer processors rather than in the master/slave arrangement currently supported in the

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There's some speculation on how the SMP modifications will be implemented.

asymmetrical multiprocessing (ASMP) facility. This should provide needed performance enhancements for multi-CPU systems such as the 8300 series. There's still some speculation on how the SMP modifications will be implemented because there are a great many options to be decided.

Other SMP changes include:

1. Support of large multiprocessor VAXs (up to 32 processors per system).
2. A semaphore locking mechanism (spinlocks).
3. Support for multiple I/O streams.
4. Possible nonsupport of ASMP
5. Fault-tolerance — not immediately supported but possible in the future.

DECNET Phase V

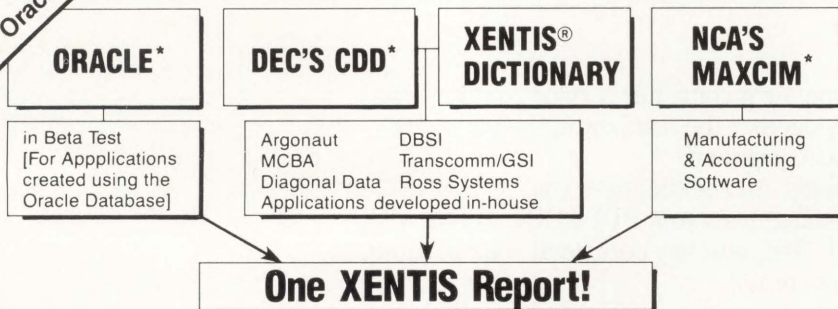
If the enhancements to VMS weren't enough, DECNET Phase V encompasses a practical, complete rewrite of the DECNET-to-VAX product set to support the beginnings of OSI networks and features like X.400 mail, distributed name service, distributed print queues and distributed file access facilities. Other expected features include link-level Ethernet data packet encryption, "image" architecture and more network-related enhancements.

Perhaps not all of these features will appear in the initial release of version 5.0, but it's expected that more will than won't. Some features, because of their inherent complexity, may not be implemented totally or ever released.

Nonetheless, there will be many changes to look forward to. ■

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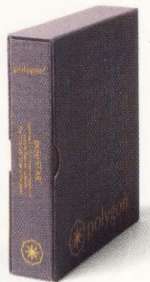
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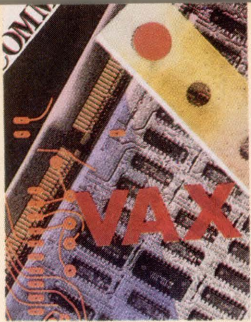


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VAX

S WITCH ON YOUR PRODUCTIVITY

By Lawrence L. Baldwin

Software development on a VAX has its problems.

Even if you're dealing with small files, constantly reactivating the editor is distracting. This can be alleviated by spawning a VAX TPU-based editor and then using the TPU ATTACH command (see pages 3-27 in the *Users Guide to EVE*).

The ATTACH command suspends your current editing session and resumes your top-level DCL process. Then, you can compile, link and run your program. When you're ready to continue editing, issue the DCL ATTACH PROCESS_NAME command. This will resume your editing session, and your cursor will be exactly where it was when you left the editor. The DCL procedure SWITCHER makes the switching back and forth between the subprocess and parent process easier and more transparent (see Program 1).

The SWITCHER.TPU procedure (see Program 2) defines the following editor commands:

GOLD-D — Switch to DCL (attach to parent process).

GOLD-W — Write out current buffer.

GOLD-N — Replace current buffer with new file.

To use switcher with a VAX TPU editor, set up a symbol as follows:

```
SPAWN_EDIT := @SWITCHER
EDIT/TPU/COMMAND = SWITCHER.TPU EVE
```

The first time you enter SPAWN_EDIT, an editor process is created invoking the EVE editor (use /SECTION=EDTSECINI if you want to invoke the EDT simulator). When you want to compile the buffer that you're working on, type <GOLD-W> to write the current buffer and <GOLD-D> to return to DCL. Once at DCL, compile, link and run the program.

When you want to return to the editor, enter SPAWN_EDIT. Because the subprocess will still be there, SWITCHER attaches you directly to that subprocess, the screen refreshes and you'll be exactly where you left off before you used the <GOLD-D> command.

SWITCHER isn't limited to use with TPU editors; it works with any application program having the facility to attach to your parent process. For example, in VAX LISP, ATTACH 0 will attach to your parent process.

ARTICLE INTEREST QUOTIENT
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High 444 Medium 445 Low 446

A

... SWITCHER makes the switching back and forth between the subprocess and parent process easier and more transparent ...

PROGRAM 1.

```

$! SWITCHER.COM
$! SWITCHER, V1.0
$! By Lawrence L. Baldwin
$! Created: 17-JUN-1987
$! Revised: 17-JUN-1987
$!
$! This procedure is adapted from the BLISS version of MUF, a program
$! written at Yale University, New Haven, CT.
$!
$! This command procedure takes two parameters. The first is a DCL command
$! line, and the second is a name tag to associate with the command line.
$! The first time SWITCHER is executed with a given name tag, a subprocess is
$! spawned and the command line passed to the subprocess. Subsequent execution
$! of SWITCHER with the same name tag will attach to the subprocess that was
$! initially created.
$!
$! Expect an error message on Spawn if process already exists
$!
$! on error then goto already_exists
$! set on
$!
$! Build process name of form: name-tag_process-id (ie EDT_00000090)
$!
$! proc_name = "'P2'_'$getjpi(0,'pid')'"
$!
$! Allow input to come from keyboard
$!
$! deassign sys$input
$!
$! Spawn process, passing command line P1
$!
$! spawn/proc:'proc_name' 'P1'
$! goto done
$!
$! Handle case where process already exists
$!
$! already_exists:
$!
$! Re-attach to process
$!
$! attach 'proc_name'
$! done:
$! exit

```

PROGRAM 2.

```

| SWITCHER.TPU
| By Lawrence L. Baldwin
| Created: 17-JUN-1987
| Revised: 17-JUN-1987
|
| The following routines allow you to read a file, write a file, and
| attach to parent process with a single key sequence.
|
procedure swi$rd_newfile
  file_name := read_line('File name: ');
  erase(current_buffer);
  read_file(file_name);
  set(output_file, current_buffer, file_name);
endprocedure

procedure swi$attach
  attach;
endprocedure;

procedure swi$wrt_current
  write_file(current_buffer)
endprocedure;

define_key("swi$attach",key_name('D',shift_key),"attach");
define_key("swi$wrt_current",key_name('W',shift_key),"wrt_curr");
define_key("swi$rd_newfile",key_name('N',shift_key),"rd_newfile");

```

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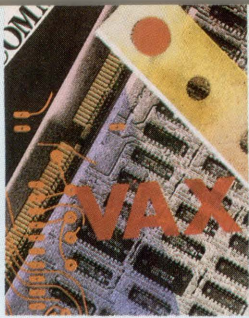
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VAX

WHO'S ON FIRST?

By Mitchell Kaufman
and William Ellis

You Can't Tell The Players Without A (Cluster-Wide SHOW USERS Command) Program!

Once a line in a famous comedy act, "Who's On First?" is bringing fewer laughs these days to VAXCLUSTER users. If you're on Second (or any other node) and someone asks you who's on First, or where's user FOOBAR, what do you do? You could use the PHONE utility to go across the network, but that's slow. You could, alternatively, SET HOST to the other nodes, but that's also time consuming and becomes even more so as your cluster grows larger.

Our CLUSTER USERS command solves our problem in an efficient, convenient manner. CLUSTER USERS uses system services, the Command Definition Utility (CDU) and the help of a subordinate process on each cluster node. CLUSTER USERS can display information about a single node or any combination of nodes (including the cluster as a whole).

If you request information about the entire cluster, you'll also get a cluster user total (see Screen 1). CLUSTER USERS also allows you to search the entire cluster for a particular user in the same way that SHOW USERS/NAME= allows you to search the local node for a user.

How It Works

On each node of the cluster, a process is created that regularly updates a USERS file on a common disk once every 30 seconds. It does this by using the GETJPI system service as well

as executing a macro program that reads location SYSS\$GW_IOJOBcnt to find the number of interactive users on the machine (see Programs 1 and 2). The CDU is used to create a command that has two qualifiers — NODE and USER (see Program 3 for the command definition file). Invocation of this command executes the CLUSTER image.

Program 2 uses GETSYI to determine what nodes currently are members of the cluster and makes successive calls to CLI\$PRESENT to retrieve the value of the command qualifiers. The USER files created by the subordinate process on each node then are opened and read. The information finally is directed to the screen (via QIOs, to help approach the response time of the SHOW USERS command).

A help file describing the CLUSTER command can be added to the SYSS\$HELP library HELPLIB so that the command appears to your system users as just another bundled VMS command.

The overhead of the information collecting process running on each node is about six hundredths of a second for an 8800, and three tenths of a second for a 780 (for each collection of names). If this overhead seems too severe, you can put the image to sleep for 60 seconds rather than 30. (Remember, however, that resource savings from decreased DECNET activity likely will outweigh such minor costs.) The CLUSTER USERS image executed by the command definition file (see Program 3) should be installed on each machine in the cluster with OPEN/SHARED/HEADER_

A

RESIDENT qualifiers, to achieve the quickest response time.

This technique to list the users on every node also can be used to list the system processes on every node, much like the SHOW SYSTEM command for a single node. Our experience indicates that the command is received enthusiastically by systems staff and

users alike. — *Mitchell Kaufman is an electrical engineer with the U.S. Army Research and Development Center in Dover, Delaware; William Ellis is a systems analyst at Chase Manhattan Bank in New York City.*

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 447 Medium 448 Low 449

VAX/VMS Interactive Users on VAX80A			
17-MAR-1987 15:33:28.11			
Total number of interactive users = 3			
Username	Process Name	PID	Terminal
USER1	N.Y. GIANTS	206002A1	LTA37:
USER24	..NESSA..	206002A0	LTA36:
USER74	MON SYS	20600294	LTA35:
VAX/VMS Interactive Users on VAX80B			
17-MAR-1987 15:34:02.44			
Total number of interactive users = 7			
Username	Process Name	PID	Terminal
USER4	USER4	208001A4	TTB0:
USER54	IROCZ28	208001A3	TTA0:
USER610	USER610	208001A6	TTB1:
USER655	USER655	20800196	TTB3:
USER681	BIG NITE	208001A8	RTA1:
USER703	I WANT KIRBY	208001A7	TTA2:
USER707	N.Y. METS	2080018D	TTA1:
VAX/VMS Interactive Users on VAX88A			
17-MAR-1987 15:34:40.51			
Total number of interactive users = 7			
Username	Process Name	PID	Terminal
USER19	USER19	202002A8	LTA218:
USER59	USER59	2020029F	LTA211:
USER72	USER72	202002A6	LTA216:
USER215	USER215	202002A9	RTA1:
USER412	USER412	20200267	LTA171:
USER574	SUNY	20200276	LTA183:
USER741	VA. TECH GRAD	202002A2	LTA213:
VAX/VMS Interavtice Users on VAX88B			
17-MAR-1987 15:35:18.71			
Total number of interactive users = 11			
Username	Process Name	PID	Terminal
USER11	USER11	20400178	LTA51:
USER91	USER91	2040020E	LTA92:
USER199	USER199	20400202	LTA91:
USER241	USER241	204001E8	LTA86:
USER573	USER573	204001ED	LTA88:
USER811	USER811	20400136	LTA9:
USER812	USER812	204001BE	LTA76:
USER979	USER979	2040020F	RTA1:
USER1000	USER1000	204001EF	LTA90:
USER1010	USER1010	204001E9	LTA87:
USER1202	USER1202	204001CA	LTA78:
Total number of interactive cluster users = 28			

Screen 1: A display of the total cluster users.

PROGRAM 1.

```

program shousers

! This process runs every 30 seconds and records the interactive
! users on the system.

* Include file(s):
  include '$SSDEF',           ! include system values
  include '$JPIDEF',

* Equivalence(s):
*-< Get user-name.
  equivalence( buffer(0), length_1 ) !
  equivalence( buffer(2), code_1 )   !
  equivalence( buffer(4), addr_1 )   !
  equivalence( buffer(8), ret_1 )    !
*-< Get process-id.
  equivalence( buffer(12), length_4 ) !
  equivalence( buffer(14), code_4 )   !
  equivalence( buffer(16), addr_4 )   !
  equivalence( buffer(20), ret_4 )    !
*-< Get terminal name.
  equivalence( buffer(24), length_5 ) !
  equivalence( buffer(26), code_5 )   !
  equivalence( buffer(28), addr_5 )   !
  equivalence( buffer(32), ret_5 )    !
*-< Get process mode.
  equivalence( buffer(36), length_6 ) !
  equivalence( buffer(38), code_6 )   !
  equivalence( buffer(40), addr_6 )   !
  equivalence( buffer(44), ret_6 )    !
*-< Get PID.
  equivalence( buffer(48), length_7 ) !
  equivalence( buffer(50), code_7 )   !
  equivalence( buffer(52), addr_7 )   !
  equivalence( buffer(56), ret_7 )    !
*-< Get OWNER.
  equivalence( buffer(60), length_8 ) !
  equivalence( buffer(62), code_8 )   !
  equivalence( buffer(64), addr_8 )   !
  equivalence( buffer(68), ret_8 )    !
*-< Get IMAGENAME.
  equivalence( buffer(72), length_9 ) !
  equivalence( buffer(74), code_9 )   !
  equivalence( buffer(76), addr_9 )   !
  equivalence( buffer(80), ret_9 )    !

* <>
  equivalence( buffer(84), end_list ) ! end of list

* Local variable(s):
  byte    buffer(0:84)
  character dayt*23
  character imagename*39
  character username*12
  character process*15
  character terminal*7
  integer mode, pid, end
  integer sys$bintim, sys$schdwk, sys$shiber, lib$delete_file
  character node*15, query*8
  logical*1 file_still_there
  integer wild
  integer number_of_users
  integer status
  integer last
  logical found
  character time*16
  integer binary(2)
  integer lib$sys_trnlog
  integer owner

*..... Address, code and length field storage.
  integer*2 length_1/12/, length_4
  integer*2 length_5, length_5/4/, length_7/4/, length_8/4/
  integer*2 length_9/39/

  integer*2 code_1, code_2, code_3, code_4, code_5, code_6
  integer*2 code_7, code_8, code_9

  integer  addr_1, addr_2, addr_3, addr_4, addr_5, addr_6
  integer  addr_7, addr_8, addr_9

  integer  ret_1, ret_2, ret_3, ret_4, ret_5, ret_6, ret_7
  integer  ret_8, ret_9

  integer  return_length      ! return length longword
  integer  end_list/0/       ! end of list value

* Function(s):
  integer  sys$getjpiw        ! Job/Process Information..
*.....

*..... Assign address fields the with address of the associated variable
  addr_1 = %loc( username )
  addr_4 = %loc( terminal )
  addr_5 = %loc( process )
  addr_6 = %loc( mode )
  addr_7 = %loc( pid )
  addr_8 = %loc( owner )
  addr_9 = %loc( imagename )

*..... Address of return length.
  ret_1 = %loc( return_length )
  ret_4 = %loc( return_length )
  ret_5 = %loc( return_length )
  ret_6 = %loc( return_length )
  ret_7 = %loc( return_length )
  ret_8 = %loc( return_length )
  ret_9 = %loc( return_length )

*..... Assign the length of the buffers for the descriptors.
  length_1 = len( username )
  length_4 = len( terminal )
  length_5 = len( process )

*..... Assign the code values.
  code_1 = JPI$ USERNAME           ! Item codes for retrieving the
  code_4 = JPI$ TERMINAL           ! system call.
  code_5 = JPI$ PRCNAM
  code_6 = JPI$ MODE
  code_7 = JPI$ PID
  code_8 = JPI$ DWNER
  code_9 = JPI$ IMAGENAME

! set up for next wake-up
  time = '0000 00:00:30.00'
  status = sys$bintim( time, binary)
  status = sys$schdwk( , , binary, binary)

do while (.true.)
  status = sys$shiber()
  call users(number_of_users)
  query(1:8) = 'SYS$NODE'
  status = lib$sys_trnlog(%DESCR(QUERY), , %descr(node))
  if (.not. status) call lib$signal(%val(status))
999 1  open(unit=10, name='SYS$CLUSTER: '// 'USERS '
      // node(2:7) // '.DAT', STATUS='UNKNOWN', ERR = 999)
888 1  open(unit=11, name='SYS$CLUSTER: '// 'SYSTEM '
      // node(2:7) // '.DAT', STATUS='UNKNOWN', ERR = 888)
  status = lib$date_time(%descr(dayt))
77   write(10,055,err=77) node(2:7)
055  format(' VAX/VMS Interactive Users on ',a6)
78   write(10,045,err=78) dayt
045  format(11x,a23)
79   write(10, 600, err=79) number_of_users
600  format(4x, 'Total number of interactive users = ',i2)

  write(10,046)

80   write(10, 050, err=80)
050  format(' Username      Process Name      PID      Terminal')

*..... Loop forever.
  wild = -1
  status = SS$ NORMAL
  do while( status .ne. SS$ NDMOREPROC)

*..... Get the job process information of all processes.
  status = sys$getjpiw( , wild, buffer, , )

! Make sure the process is interactive and not a subprocess.

! Write out the interactive users to the USER file for
! the node
  1   if((status .eq. ss$ normal) .AND.
      (mode .eq. JPI$K_INTERACTIVE) .AND.
      (owner .eq. 0)) then
      2   do ind = 1, 15
          if (process(ind:ind) .ge. ' ') end = ind
      end do
81   write(10,500, err=81) username, process(1:end), pid, terminal
500  format(t2, a12, t15, a<end>, t31, Z8, t41, a7)

      write(11,800) PROCESS, mode, imagename

! If the process is NOT interactive, then put it in a file
! that records the system processes.
  1   else if ((status .eq. ss$ normal) .and.
      (mode .ne. JPI$K_INTERACTIVE)) then
      800  write(11,800) PROCESS, mode, imagename
          format(1x, A15, 3x, i4, 3x, a39)
          end if
      end do
      write (10,046)
046  format(5x, ' ')
      close(unit=11)
      close(unit=10)
  end do
end

```

Continued.

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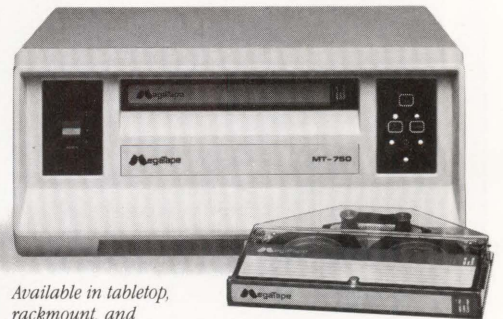


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PROGRAM 2.

```

PROGRAM CLUSTER

! This image is executed by the command CLUSTER. It
! formats the output to the screen

! There are 3 major choices the user can make with this
! command:
! 1. Look for a particular user on the cluster.
! 2. Look at all of the users on the cluster.
! 3. Look at all of the users on any node or combination of nodes.

! Define variables...
character node=4
integer status,cli$present,cli$get_value
integer sys$assign,sys$qio
integer func
integer cluster_total
character=4 cls_users
character name=4, username=12
character=15 value
character=5 param
character=6 tipe
character=55 record
character crlf=2
character error=70
logical=1 found
external cli$_absent

! Variables for GETSYI
character=15 names(20)
integer mem_stat(20)
integer num_nodes

include '$s$def'
include '$i$def'

node(1:4) = 'node'
name(1:4) = 'name'
param(1:5) = 'users'

! Start code...

iunit = 9

status = sys$assign('tb:',ichan,,)
func = io$_writeblk
status = cli$present(%descr(param))
status = cli$get_value(%descr(param), tipe)
crlf = char(13)//char(10)
if (tipe(1:1) .eq. 'u') then
    status = cli$get_value(name, username)

! If the command is looking for a particular user on the cluster
! then enter this IF section
    if (status) then
        found = .false.

! Find out what nodes are up in the cluster
        call syitest(names, mem_stat, num_nodes)

! Scan through all the nodes and look for the user.
        do j = 1, num_nodes
            call check_user(names(j), ichan, 10, username, found)
        end do

! If the user is not on the cluster, then output the
! proper error message.
        if (.not.(found)) then
            length = index(username, ' ')
            ERROR = '%CLUSTER-I-NDSUCHUSER, user '//USERNAME(1:LENGTH)//
            'not currently logged in'
            1
            status = sys$qio(, %val(ichan), %val(func),,,,
                %ref(error), %val(70),,,, )
            1
        end if
    
```

```

! If all the nodes in the cluster have to be displayed then
! enter this section.

else
    status = cli$get_value(node, value)
    if ((value .eq. 'all') .or. (value(1:1) .eq. ' ')) then
        call syitest(names, mem_stat, num_nodes)
        cluster_total = 0
        do j = 1, num_nodes
            call list_user(names(j), ichan, 9, number_users)
            cluster_total = cluster_total + number_users
        end do
        encode(4,444,cls_users) cluster_total
        444
        format(i4)
        RECORD = 'Total number of interactive cluster users
            1 = '//CLS_USERS(2:4)
            status = sys$qio(, %val(ichan), %val(func),,,,
                %ref(record), %val(55),,,, )
        else
            ! If the command is looking for the users on a particular node,
            ! then enter this section.

! Make sure the node is a member of the cluster.
            call node_there(value, member)
            if (member .eq. 1) then

! If it is, then list the users.
            do while (status .ne. %loc(cli$_absent))
                999
                1
                2
                open(iunit=iunit, names='sys$cluster://
                    'users '//value(1:5)//'.dat', shared,
                    status='old', err=999)
                do while (.true.)
                    20
                    read(iunit, 500, end=777, err=20) record
                    record = record(1:53)//crlf
                    1
                    status = sys$qio(, %val(ichan), %val(func),,,,
                        %ref(record), %val(55),,,, )
                    end do
                    777
                    1
                    status = sys$qio(, %val(ichan), %val(func),,,,
                        %ref(crlf), %val(2),,,, )
                    iunit = iunit + 1

! See if there is another node to list.
                    status = cli$get_value(node, value)
                    end do
                else
                    ! If the node is not up, then output the proper message.
                    1
                    ERROR = '%CLUSTER-I-NODENOTUP Node '//value(1:6)//
                        'not currently available'
                    1
                    status = sys$qio(, %val(ichan), %val(func),,,,
                        %ref(error), %val(60),,,, )
                    end if
                    end if
                    end if
                    500
                    format(a80)
                    end
            
```

PROGRAM 3.

```

! This file defines the CLUSTER command. The command has two
! valid qualifiers and a default prompt of "What:". The
! two qualifiers, NODE and NAME, cannot be on the command
! line at the same time. This command could easily be expanded
! to show the system information (much like SHOW SYSTEM).

! This verb is added to the system dcltables in sys$library.

DEFINE VERB CLUSTER
IMAGE "SYS2:[CLUSTER]CLUSTER"
PARAMETER P1, LABEL=USERS, PROMPT="What", VALUE(REQUIRED, TYPE=KNOWN_PARAMS)
QUALIFIER NODE VALUE(LIST, TYPE=KNOWN_NODES)

```

```

QUALIFIER NAME VALUE(LIST)
DISALLOW NAME AND NODE
DEFINE TYPE KNOWN_PARAMS
KEYWORD USERS
DEFINE TYPE KNOWN_NODES
KEYWORD ALL, DEFAULT
KEYWORD VAX80A
KEYWORD VAX80B
KEYWORD VAX88A
KEYWORD VAX88B

```

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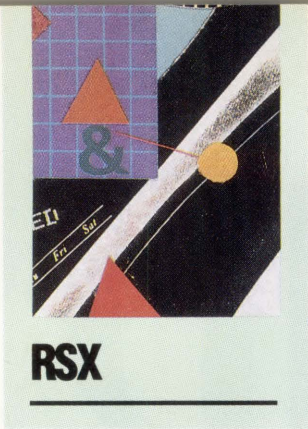
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ENTER 174 ON READER CARD



TAMING A BRU(te)

By G. Ronald Dalton
and James Ogles

The Backup And Restore Utility From DEC.

Digital Equipment Corporation has provided a powerful Backup and Restore Utility (BRU) for use in backing up copies of files and recovering them back to disk when needed. However, BRU is less than user friendly! In fact, it will crunch up your files in the blink of an eye if you're not careful. Here's how to avoid some of the pitfalls (all of which we've experienced) and help you tame the BRU(te) so you can have it eating out of your file space without costing you an arm and a leg or all of last week's work!

Backup and recovery of files is a must for serious computer users in order to secure files against loss or corruption on most multiuser systems. Although the system manager periodically may archive old files to a recoverable medium in order to clean out the system, you'd better not rely on this if your files are important to you.

The most commonly available means for copying and removing files from most systems is the tape drive. The tape drive usually is in use only a small percentage of the time and, therefore, can be allocated to a single user when convenient. Tape also is inexpensive, approximately one dollar per megabyte, and typically has a capacity of nearly 20 MB on a 1,200-foot tape. Thus, a user can mount a private tape, backup or recover all files cur-

rently on the computer, and keep the tape in a safe place.

Although there is a commercial program available to help you carry out the backup and restore operations (TAPESYS by Software Partners/32 of Boxford, Massachusetts), we here at the University of Florida wrote a command program that provides convenient, menu driven, safe storage to tape by the average user. This allows safe backup and recovery of files at a convenient time. The command program uses BRU via a series of easy-to-use and safe menus.

General Theory

In the command program, a main or upper-level menu divides the BRU functions into four classes (see Screen 1). Three are for common, non-privileged user functions such as listing, backing up and recovering files. The fourth class has more powerful options useful to the system manager.

Within the inner menu, the program prompts you for the necessary information and builds the BRU command strings. The command language lends itself to the task of displaying menus and prompts. Because many of the prompts were repeated, it makes sense to write the messages and prompts as sub-routines. A user might reply to a prompt in lowercase, so lowercase letters were disabled for the command file. This causes the command interpreter to treat all letters as uppercase. The lower-level menus serve to break down a class of BRU tasks into individual tasks. Not every conceivable task was included

A

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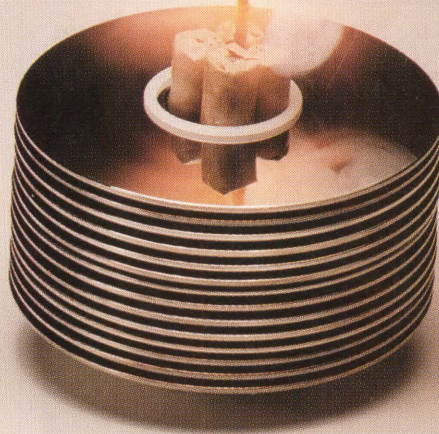
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The Main Menu

L (LIST)	LIST THE CONTENTS OF A BRU CREATED TAPE
B (BACKUP)	BACK UP FILES FROM DISK TO TAPE
R (RECOVER)	RECOVER FILES FROM TAPE TO DISK
S (SUPER USER)	SYSTEM MANAGER OPTIONS
E (EXIT)	EXIT FROM THIS COMMAND FILE

ENTER YOUR CHOICE . . .

Screen 1: The Main Menu divides the BRU functions into four classes.

The Listing Menu

B (BACKUP SETS)	LIST THE BACKUP SET NAMES ON YOUR TAPE
F (FILES)	LIST THE FILES FOR YOUR TAPE AND BACKUP SET
E (EXIT)	RETURN TO THE MAIN MENU

What is the BACKUP SET name you want to use?
(The BACKUP SET is limited to 12 characters)
Enter the BACKUP SET name...

Screen 2: The LIST option supports only two listing tasks.

The Backup Menu

D (DIRECTORY)	BACK UP YOUR ENTIRE DIRECTORY TO TAPE
F (FILES)	BACK UP SPECIFIED FILES TO TAPE
E (EXIT)	RETURN TO THE MAIN MENU

The BACKUP SET names are requested here just as in the List Menu. In addition you are asked:

What FILE SPECIFICATION do you want to use?

A FILE SPEC has the form: NAME.EXT;VER.

An "*" can be used as a WILDCARD to replace WHOLE WORDS.
Examples: NAME.FTN;* or NAME.*;* or *.FTN;*

You may leave off parts of the FILE SPEC starting from the right. BRU treats any OMITTED part as a WILDCARD.

Thus NAME.FTN = NAME.FTN;* and NAME = NAME.*;* and NO FILE SPEC AT ALL is the same as *.*;*

Enter the FILE SPECIFICATION...

Screen 3: The Backup Menu breaks down the backup function into the two tasks most often needed by a non-privileged user.

in this command file; they're limited to the options most likely needed by the common user and the system manager.

The List option supports only two listing tasks. The first is a listing of all of the backup set names on a tape. The second is a listing of the files in a user-specified backup set. Both of these options will be needed by a common user. If the backup set qualifier is omitted, then BRU lists the backup set names on the tape. If the qualifier is included, then BRU lists the files in the specified backup set. Therefore, the first option doesn't require any user response and the second requires only the backup set name. The List Menu is shown in Screen 2.

BACKUP

The Backup Menu breaks down the backup function of BRU into the two tasks most often needed by a non-privileged user. The first choice allows you to back up your entire directory into a specified backup dataset. This is helpful for those who periodically want to make protective copies of all their files. The second option allows you to back up to a backup set all of the files covered by a single file specification. A file specification has the form FILENAME.EXT;VER. An asterisk can replace as a wildcard any or all of the words in the file specification. The Backup Menu is shown in Screen 3.

The user's default device and directory are obtained automatically from special strings within the command interpreter. Both options of the Backup Menu require the tape label and the backup set name in the command string. As a result, subroutines are called to print out explanatory messages and prompt the user to type in these items.

The DEC BRU utility was designed with the system manager in mind. Thus, BRU will initialize a tape unless the append qualifier is added to the command string. In this case, the new backup set

is appended to the tape after the existing backup sets. This makes sense for the system user, who would, most likely, back up large volumes, probably taking up most of a tape for each backup set.

As a result, each backup operation must initialize a new tape. However, the tasks most likely needed by a common user will be backing up and recovering smaller volumes like directories. Many of these volumes will fit on a tape, so the non-privileged user would be appending more often than initializing. The command file inverts the normal order by automatically including the append qualifier. To initialize a tape, the user must be a privileged user and answer yes to the initialization question. Then, the command file will omit the append qualifier.

The Recover Menu breaks the recover function of BRU into the two tasks most often needed by a non-privileged user. The first task allows you to recover an entire backup set of files to your directory. The second option allows you to recover all of the files covered by a single file specification, including the use of the wildcards. This option is useful because it allows recovery of a few files (e.g., *.FTN) from a backup set without forcing you to recover all of the files from the backup set (see Screen 4 for the Recover Menu).

The BRU utility won't allow a user to recover files to a directory different from the one of origin. Therefore, a non-privileged user cannot recover files to another user's directory. To prevent this from being attempted, the command file doesn't ask you for directory or device information. Instead, the default device and directory are obtained from special strings in the command interpreter.

Both options of the Backup Menu require the tape label and the BACKUP_SET name in the command string. For these, subroutines are called to print out explanatory messages and prompt the user for the items.

Just as BRU would initialize a tape unless told otherwise, BRU also would initialize the receiving disk unless the

The Recover Menu

- B (BACKUP SET) RECOVER ALL FILES FROM A BACKUP SET
- F (FILES) RECOVER SPECIFIED FILES FROM A BACKUP SET
- E (EXIT) RETURN TO THE MAIN MENU

Here the TAPE LABEL, BACKUP SET and FILES SPECIFICATION are requested as they were in the Backup Menu.

Screen 4: The Recover Menu breaks the recover function into the two tasks most often needed by a non-privileged user.

The Super User Menu

- A EXIT TO THE MAIN MENU
- B BACK UP AN ENTIRE DISK TO TAPE
- C BACK UP ACCORDING TO CREATION DATE SPECIFICATION
- D BACK UP ACCORDING TO DIRECTORY SPECIFICATION
- E BACK UP ACCORDING TO FILE SPECIFICATION
- F RECOVER AN ENTIRE BACKUP SET
- G RECOVER ACCORDING TO DIRECTORY SPECIFICATION
- H RECOVER ACCORDING TO FILE SPECIFICATION

What USER DIRECTORY are you transferring TO/FROM?
The DIRECTORY must be entered in the form: [□,□]
The "*" can be used as a WILDCARD to replace a "□"

Enter the DIRECTORY...

What REFERENCE DATE do you want to use?
The DATE must be entered in the form: DD-MMM-YY

Enter the DATE...

Are you transferring files created BEFORE or AFTER the REFERENCE DATE? This command file assumes you mean files created BEFORE the REFERENCE DATE, unless you answer "Y" for YES below.

Backup files created AFTER the REFERENCE DATE

Are you APPENDING to a tape or INITIALIZING it?
This command file assumes you are APPENDING, unless you answer "Y" for YES below.

INITIALIZE the tape...

Screen 5: The Super User Menu doesn't separate the BRU functions into classes.

non-initialize qualifier is included. A non-privileged user doesn't need to initialize system disks, so the command file automatically includes the qualifier in both options.

Super User

The Super User Menu doesn't separate the BRU functions into classes. Both the Backup and Recover commands are included in the same menu. It would have added too much to the complexity of the command file to add a third level of menus within the Super User Menu. Also, a little more knowledge can be assumed for a super user compared to an average user, so it's less necessary to logically divide the functions in menus.

Additional major operations provided for the super user are backing up an entire disk and backing up by creation date.

The Super User Menu is shown in Screen 5.

The Super User Menu duplicates the options of the Backup and Recover Menus with an important difference. A super user has the privilege of recovering files to directories other than his

own. A system manager might need to do this. You're prompted for the device and directory specifications. Because the wildcard can be used in the directory specification (e.g., DL1:[100;*]), more than one directory can be referenced that way. Additionally, an option to recover by directory specification is included. This would be useful in recovering a single user's directory from a backup tape.

Additional major options provided for the super user are backing up an entire disk and backing up by creation date. These features easily accomplish tasks a system manager often is required to perform. Old files are archived periodically and then deleted to make room on the system disks. It therefore makes sense to support these tasks in this command file. Alternatively, you can back up all files to tape and then recover to a freshly initialized disk only those files created after a certain date.

The single line command string limitation also limits the Backup By Creation Date option. This option is called by including the creation date qualifier in the BRU command string. This doesn't prevent the user from also including other specifications; e.g., file specifications. However, if this has been done, the command string easily can exceed a single line. Because the operating system restricts the command string to one line, you can't include other options with the Creation Date option.

Overall, this command file has built-in limitations because of the limited time available for writing it. For

T A B L E 1 .

BACOPT	String symbol containing the selected option from the backup menu.
BNAME	String symbol containing the backup set name.
BORA	Logical symbol used to set the contents of TEMP. If BORA is true, then TEMP is set to "BEFORE".
DATE	String symbol containing the reference date.
DEV	String symbol containing the default device of the user running the command file.
LISOPT	String symbol containing the selected option from the listing menu.
NEW	Logical symbol used to set the contents of QUAL. If NEW is true, then the string "/APP" is dropped from QUAL to direct BRU to initialize the tape.
OPTION	String symbol containing the selected option from the main menu.
QUAL	String symbol containing those qualifiers that don't have options.
SDEV	String symbol containing the specified device for command strings in the super user section.
SPEC	String symbol containing the file specification.
SUFD	String symbol containing the specified directory for command strings in the super user section.
SUPOPT	String symbol containing the selected option from the Super User Menu.
TEMP	String symbol containing the option or condition for the /DATE qualifier.
TNAME	String symbol containing the tape label.
UFD	String symbol containing the default directory of the user running the command file.

Directory of command file variables.



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example, a system manager might want to initialize a disk as part of his duties. He has the required privilege and BRU supports the task; however, the required qualifiers are complex and would have been time consuming to include in this command file. Therefore, this command file doesn't address the task of initializing a disk at all. Perhaps this feature could be added later.

If the operating system is upgraded to RSX-11M+, then the command string length limitation goes away. The improved operating system supports the continuation feature in the BRU command string. This means that an acceptable BRU command string could be spread over many lines and be as long as necessary.

This removes the necessity of limiting the user to a single file specification

The command file has proved very useful to both the general user and to the system manager.

and allows the use of up to 16 file specifications in one command string. Also, the file specification can be combined with the creation date qualifier to produce new options.

There's a qualifier that specifically allows the user to exclude files from consideration by BRU. This feature was ignored because of the command string limitation. Under the new operating

system, it would be a full capability to add to existing features. It might be easier on the super user if the listing functions also were duplicated in that menu. As it stands, the super user has to leave his menu and go to the listing menu to get directory information.

In addition to the structure of the command language and the BRU command strings, a couple of other MCR commands were used in the command file. The CLR for clear command was used to clear the terminal screen before the display of menus. Also, the ALLOCATE and DEALLOCATE commands were used to restrict the use of the tape drive to the terminal executing the command file, while the command file is running. This attempts to minimize the chance of user conflict over the use of the tape drive. Hopefully, it will prevent such accidents as the overwriting of another user's tape.

Table 1 shows a directory of the variables used in the command file, Table 2 lists the subroutines and Program 1 provides a complete listing of the command file.

The command file has proved very useful to both the general user and to the system manager. It allows BRU to safely backup and recover many files to and from tape. —G. Ronald Dalton is professor of nuclear engineering science at the University of Florida, Gainesville; James Ogles is system manager at the department of nuclear engineering sciences.

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TABLE 2.

800	Prints out a warning message saying the user has made an invalid choice from the last menu.
801	Prompts the user for the tape label and then reads the response into the symbol TNAME.
802	Prompts the user for the backup set name and then reads the response into the symbol BNAME.
803	Prompts the user for the file specification and then reads the response into the symbol SPEC.
804	Prompts the super user for a device code and then reads the response into the symbol SDEV.
805	Prompts the super user for a directory and then reads the response into the symbol SUFD.
806	Prompts the super user for a reference date and then reads the response into the symbol DATE. The desired time direction is established and the appropriate string loaded into the symbol TEMP.
807	Collects all of the necessary input for a regular user backup operation, uses subroutines 801 and 802 to get the tape label and backup set name, establishes whether the tape is initialized or appended and makes the appropriate assignment to the symbol QUAL.
808	Collects all of the necessary input for a regular user recover operation. Uses subroutines 801 and 802 to get the tape label and backup set name, assigns the proper string to the symbol QUAL.

List of command file subroutines.

PROGRAM 1.

```
BRUWORK.CMD
-----
ALLOCATE MS:
;
; This is BRUWORK.CMD. Please insure that a tape is installed on
; the system tape drive. If a tape is not installed, and you run
; this command file, the system may lock up. If the system locks
; up it will have to be crashed and rebooted
;
.ASK NULL Is a tape installed on the tape drive...
.IFF NULL .GOTO 999
ENABLE SUBSTITUTION
DISABLE LOWERCASE
SETS UFD "'<UIC>'"
SETS DEV "'<SYDISK>'<SYUNIT>':"
.001:
CLR
.002:
;
; THIS IS THE MAIN MENU
; CHOOSE ONE OF THE FOLLOWING OPTIONS:
;
L (LIST) LIST THE CONTENTS OF A BRU CREATED TAPE
B (BACKUP) BACKUP FILES FROM DISK TO TAPE
R (RECOVER) RECOVER FILES FROM TAPE TO DISK
S (SUPERUSER) SYSTEM MANAGER OPTIONS
E (EXIT) EXIT FROM THIS COMMAND FILE
;
.ASKS OPTION ENTER YOUR CHOICE...
.IF OPTION = "E" .GOTO 999
.IF OPTION <> "L" .GOTO 200
.100:
CLR
.101:
;
; THIS IS THE LISTING SUB-MENU
; CHOOSE ONE OF THE FOLLOWING OPTIONS:
;
B (BACKUP SETS) LIST THE BACKUP SET NAMES ON YOUR TAPE
F (FILES) LIST THE FILES FOR YOUR TAPE AND BACKUP SET
E (EXIT) RETURN TO THE MAIN MENU
;
.ASKS LISOPT ENTER YOUR CHOICE...
.IF LISOPT = "E" .GOTO 001
.IF LISOPT <> "B" .GOTO 120
CLR
BRU /REW/DIR MS:
.GOTO 101
.120:
.IF LISOPT <> "F" .GOTO 130
.GOSUB 802 ! GETS BNAME
CLR
BRU /REW/BAC:'BNAME'/DIR MS:
.GOTO 101
.130:
.GOSUB 800 ! DOES MISTAKE MSG
.GOTO 101
.200:
.IF OPTION <> "B" .GOTO 300
CLR
.201:
;
; THIS IS THE BACKUP SUB-MENU
; CHOOSE ONE OF THE FOLLOWING OPTIONS:
;
D (DIRECTORY) BACKUP YOUR ENTIRE DIRECTORY TO TAPE
F (FILES) BACKUP SPECIFIED FILES TO TAPE
E (EXIT) RETURN TO THE MAIN MENU
;
.ASKS BACOPT ENTER YOUR CHOICE...
.IF BACOPT = "E" .GOTO 001
.IF BACOPT <> "D" .GOTO 220
.GOSUB 807 ! GETS TNAME,BNAME,QUAL
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' 'DEV' 'UFD' MS:
.GOTO 200
.220:
.IF BACOPT <> "F" .GOTO 230
.GOSUB 807 ! GETS TNAME,BNAME,QUAL
.GOSUB 803 ! GETS SPEC
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' 'DEV' 'UFD' 'SPEC' MS:
.GOTO 200
.230:
.GOSUB 800 ! DOES MISTAKE MSG
.GOTO 201
.300:
.IF OPTION <> "R" .GOTO 400
CLR
.301:
;
; THIS IS THE RECOVER SUB-MENU
; CHOOSE ONE OF THE FOLLOWING OPTIONS:
;
B (BACKUP SET) RECOVER ALL FILES FROM A BACKUP SET
F (FILES) RECOVER SPECIFIED FILES FROM A BACKUP SET
E (EXIT) RETURN TO THE MAIN MENU
;
.ASKS RECOPT ENTER YOUR CHOICE...
.IF RECOPT = "E" .GOTO 001
.IF RECOPT <> "B" .GOTO 320
.GOSUB 808 ! GETS TNAME,BNAME,QUAL
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' MS: 'DEV' 'UFD'
.GOTO 300
.320:
```

Continued.

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PROGRAM 1... continued

```

;IF RECOPT <> "F" .GOTO 330
.GOSUB 808 ! GETS TNAME,BNAME,QUAL
.GOSUB 803 ! GETS SPEC
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' MS: 'DEV''UFD''SPEC'
.GOTO 300
.330:
.GOSUB 800 ! DOES MISTAKE MSG
.GOTO 301
.400:
;IF OPTION <> "S" .GOTO 500
CLR
.401:
;
THIS IS THE SUPERUSER SUB-MENU
CHOOSE ONE OF THE FOLLOWING OPTIONS
;
A EXIT TO THE MAIN MENU
B BACKUP AN ENTIRE DISK TO TAPE
C BACKUP ACCORDING TO CREATION DATE SPECIFICATION
D BACKUP ACCORDING TO DIRECTORY SPECIFICATION
E BACKUP ACCORDING TO FILE SPECIFICATION
F RECOVER AN ENTIRE BACKUP SET
G RECOVER ACCORDING TO DIRECTORY SPECIFICATION
H RECOVER ACCORDING TO FILE SPECIFICATION
;
;ASKS SUPOPT ENTER YOUR CHOICE...
;IF SUPOPT = "A" .GOTO 001
;IF SUPOPT <> "B" .GOTO 420
.GOSUB 807 ! GETS TNAME,BNAME,QUAL
.GOSUB 804 ! GETS SDEV
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' 'SDEV' MS:
.GOTO 400
.420:
;IF SUPOPT <> "C" .GOTO 430
.GOSUB 807 ! GETS TNAME,BNAME,QUAL
.GOSUB 806 ! GETS DATE,TEMP
.GOSUB 804 ! GETS SDEV
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' /CRE:'TEMP' 'DATE' 'SDEV' MS:
.GOTO 400
.430:
;IF SUPOPT <> "D" .GOTO 440
.GOSUB 807 ! GETS TNAME,BNAME,QUAL
.GOSUB 804 ! GETS SDEV
.GOSUB 805 ! GETS SUFD
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' 'SDEV''SUFD' MS:
.GOTO 400
.440:
;IF SUPOPT <> "E" .GOTO 450
.GOSUB 807 ! GETS TNAME,BNAME,QUAL
.GOSUB 804 ! GETS SDEV
.GOSUB 805 ! GETS SUFD
.GOSUB 803 ! GETS SPEC
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' 'SDEV''SUFD''SPEC' MS:
.GOTO 400
.450:
;IF SUPOPT <> "F" .GOTO 460
.GOSUB 808 ! GETS TNAME,BNAME,QUAL
.GOSUB 804 ! GETS SDEV
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' MS: 'SDEV'
.GOTO 400
.460:
;IF SUPOPT <> "G" .GOTO 470
.GOSUB 808 ! GETS TNAME,BNAME,QUAL
.GOSUB 804 ! GETS SDEV
.GOSUB 805 ! GETS SUFD
.GOSUB 803 ! GETS SPEC
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' MS: 'SDEV''SUFD''SPEC'
.GOTO 400
.470:
;IF SUPOPT <> "H" .GOTO 480
.GOSUB 808 ! GETS TNAME,BNAME,QUAL
.GOSUB 804 ! GETS SDEV
.GOSUB 805 ! GETS SUFD
.GOSUB 803 ! GETS SPEC
BRU 'QUAL'/TAP:'TNAME'/BAC:'BNAME' MS: 'SDEV''SUFD''SPEC'
.GOTO 400
.480:
.GOSUB 800 ! DOES MISTAKE MSG
.GOTO 401
.500:
.GOSUB 800 ! DOES MISTAKE MSG
.GOTO 002
.800:
CLR
;
YOU HAVE MADE AN INVALID CHOICE, TRY AGAIN.
;
;RETURN
.801:
;
; What is the TAPE LABEL of your tape?
; (The TAPE LABEL is limited to 6 characters)

```

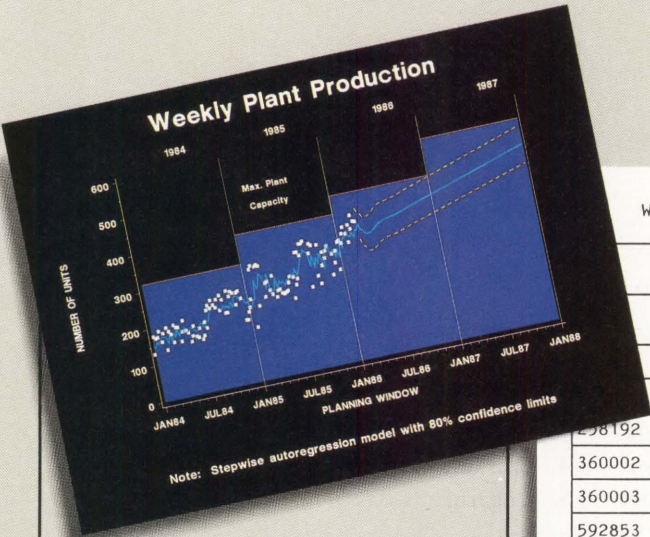
```

;ASKS TNAME Enter the TAPE LABEL...
;RETURN
.802:
;
; What is the BACKUP SET name you want to use?
; (The BACKUP SET is limited to 12 characters)
;
;ASKS BNAME Enter the BACKUP SET name...
;RETURN
.803:
CLR
;
; What FILE SPECIFICATION do you want to use?
;
; A FILE SPEC has the form: NAME.EXT;VER.
;
; An '*' can be used as a WILDCARD to replace WHOLE WORDS.
; Examples: NAME.FTN;* or NAME.*;* or *.FTN;*
;
; You may leave off parts of the FILE SPEC starting from
; the right. BRU treats any OMITTED part as a WILDCARD.
;
; Thus NAME.FTN = NAME.FTN;* and NAME = NAME.*;*
; and NO FILE SPEC AT ALL is the same as *.*;*
;
;ASKS SPEC Enter the FILE SPECIFICATION...
;RETURN
.804:
;
; What DISK are you transferring TO/FROM?
; The DISK DEVICE CODE has the form: DL#:
;
;ASKS SDEV Enter the DISK DEVICE CODE...
;RETURN
.805:
;
; What USER DIRECTORY are you transferring TO/FROM?
; The DIRECTORY must be entered in the form: [#;#]
; The "*" can be used as a WILDCARD to replace a "#"
;
;ASKS SUFD Enter the DIRECTORY...
;RETURN
.806:
;
; What REFERENCE DATE do you want to use?
; The DATE must be entered in the form: DD-MMM-YY
;
;ASKS DATE Enter the DATE...
;SETS TEMP "BEFORE:"
;
; Are you transferring files created BEFORE or AFTER the
; REFERENCE DATE? This command file assumes you mean
; files created BEFORE the REFERENCE DATE, unless you
; answer "Y" for YES below.
;
;ASK BORA Backup files created AFTER the REFERENCE DATE...
;IFT BORA .SETS TEMP "AFTER:"
;RETURN
.807:
.GOSUB 801 ! GETS TNAME
.GOSUB 802 ! GETS BNAME
;SETS QUAL "/REW/MOU/APP"
;
; Are you APPENDING to a tape or INITIALIZING it?
; This command file assumes you are APPENDING,
; unless you answer "Y" for YES below.
;
;ASK NEW INITIALIZE the tape...
;IFT NEW .SETS QUAL "/REW/MOU"
;RETURN
.808:
.GOSUB 801 ! GETS TNAME
.GOSUB 802 ! GETS BNAME
;SETS QUAL "/REW/MOU/NOI"
;RETURN
.999:
DEALLOCATE MS:
;
Note that CLR is a local assembly language utility. It can be
replaced with the line
; <ESC>[P2J
;
which is the DEC VT100 Erase Display escape sequence of characters.
;
>bye
>
HAVE A GOOD AFTERNOON
06-JAN-87 13:55 TT7: LOGGED OFF
>

```

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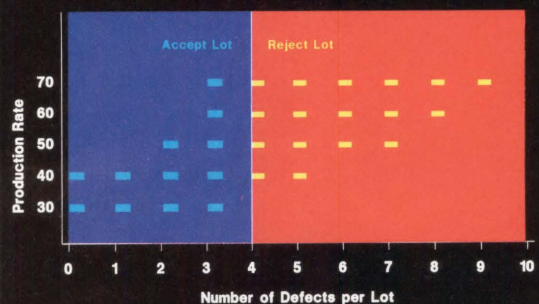
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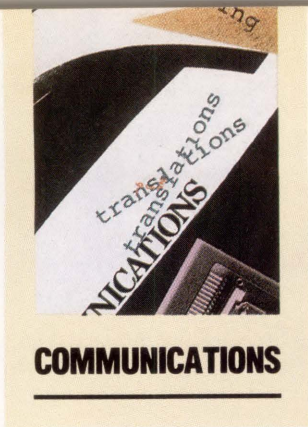
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60	6	4	9	6.5	83
70	7	4	10	7.0	85



RAF

By Carl B. Marbach

A Full-Function PC-To-VAX Integration Tool.

The *Remote Access Facility (RAF)* is a PC-to-VAX communications package from Datability Software Systems Inc. of New York City, that uses either simple RS232 connections or the more robust Ethernet network, now rapidly becoming the connection of choice to VAX computers. Most VAX installations are installing Ethernet to connect terminals, other host VAXs and personal workstations. *RAF* supplies the PC and VAX software allowing the PCs' full connection to the Ethernet network.

Although all the facilities of *RAF* also are available to the serial port user, the Ethernet version offers the fastest connection as well as some multihost capabilities that can't exist with a hard-wired solution. Using the high bandwidth of the Ethernet allows *RAF* to be extremely fast and by using the standard DEC Local Area Terminal (LAT) server that comes with VMS, *RAF* also is very efficient with critical computer resources.

RAF is a full-function communications package that allows the VAX to act as a PC file server, defining VAX print queues to be accessed from the PC, making VAX applications available to PC users from MS-DOS, delivering a language to make automatic connections and finally providing high-level language support to allow programs on the PC to interact with programs on the VAX.

Setting Up *RAF*

To physically connect a PC to the Ethernet requires an add-in Ethernet card for the PC. The

- following currently are supported by *RAF*:
1. 3COM's 3C501 (IE4) card
 2. 3COM's 3C505 (IE3) high-performance card
 3. MICOM's NI5010-1 (or -2) card
 4. Excelan's 205 card
 5. Ungermann-Bass's NIC card

If you have Digital Equipment Corporation's VAXMATE, the card is built in.

On the rear of these cards is an Ethernet connector ready to be attached to the cable.

If you're going to use asynchronous communications (RS232), *RAF* will use either the COM1 or COM2 communication ports on the PC.

The instructions for installing *RAF* are shown in Figure 1. The *RAF* distribution diskette is copy protected and will allow two installations of *RAF*. The distribution also can be used to deinstall *RAF* allowing for yet another INSTALL.

Using *RAF*

Once installed, *RAF* operates in Combined, Terminal or Suspended modes. In Combined mode, the PC and the VAX are linked via a VMS process, RAFFPC, which serves as a file server. In Combined mode, VMS files are accessible as if they were on a PC disk.

In Combined mode from the PC, a DIRECTORY of F: is really my VMS root directory (see Figure 2). Changing directories in MS-DOS (CD) is equivalent to SET DEF [directory] on the VAX. Directories also can be created (MKDIR) from the PC. Combined mode treats the VAX like another hard PC disk.

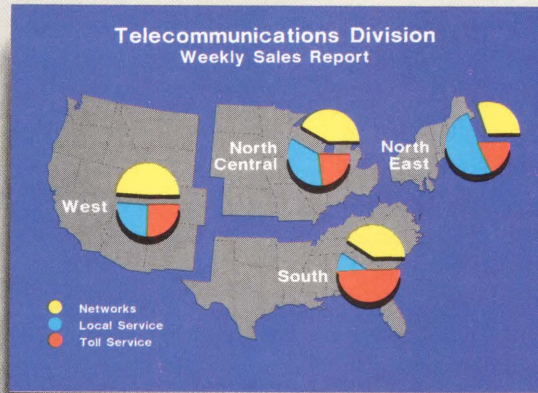
Terminal mode is *RAF*'s terminal



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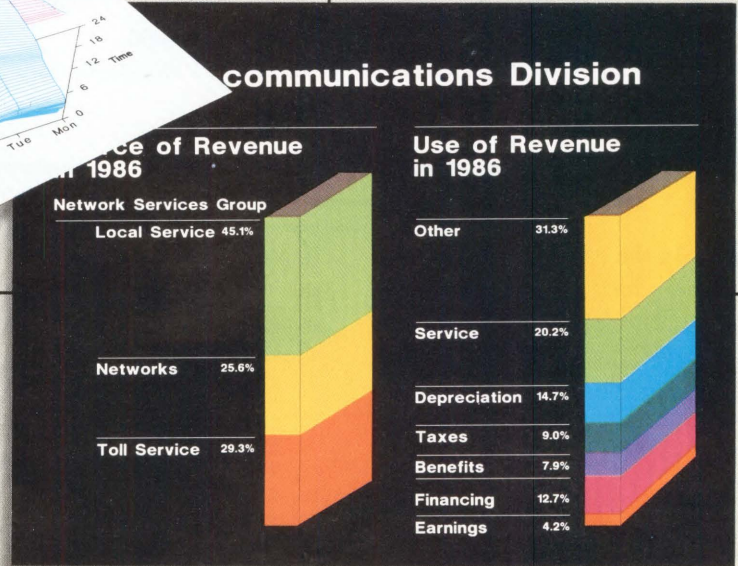
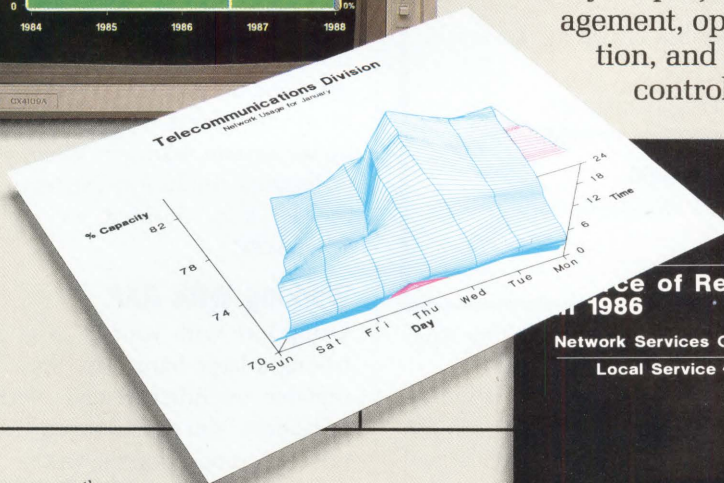
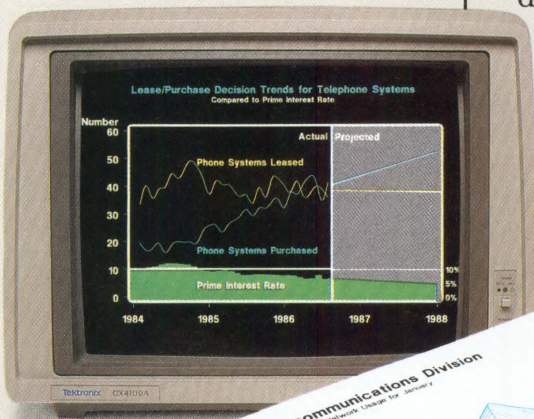
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F I G U R E 1 .

The following parameters are necessary for correct operation of RAF. Please consult either the documentation that came with your Ethernet card or your systems administrator/dealer for assistance in determining the correct settings.

I/O Base address of the Card (standard is 300): 330
Interrupt level to be used (standard is 3): 5
DMA channel to be used (standard is 1): 5

Please specify the maximum number of services or hosts to be accessed on your network. It is advisable to keep this number small to conserve PC memory (default is 4): 3

If the total number of services available on your network exceeds three, please specify the names of the services or hosts that you wish to access. Separate each name with a comma.

TIC,TAC,TOE

Please specify a preferred service (Default is NONE): TAC

How many simultaneous sessions would you like to be able to maintain (Default is 4): <CR>

Please specify your personal network user name (Default is RAF): <CR>

Please specify the control character to use to interrupt a session and return to the RAF terminal command level (Default is CONTROL-BREAK): <CR>

Please specify the control character to use top backup to a previous session (Default is disabled): <CR>

Please specify the control character to use to advance to a session (Default is disabled): P <CR>

Currently supported Terminal Emulations are:

- | | |
|----------|--|
| A) VT52 | C) VT220 7-bit control codes |
| B) VT100 | D) VT220 8-bit control codes (Default) |

What type of terminal emulation is desired: D

Please type the device designation for the disk or diskette on which RAF should be installed: B

RAF Remote Access Facility has been installed.
RAF will be available after the system is reloaded.

Your RAF ID number is 123456.

This number must be noted on your registration form.

C>

Instructions for installing RAF.

emulator. In the INSTALL process, you can decide which DEC terminal you wish to emulate. In addition to emulating the VT220, RAF has a terminal customizing facility that allows you to customize the terminal keyboard emula-

tion to set up the proper emulation for the IBM keyboard. If you're using a non-standard keyboard, this facility will allow you to customize it.

Terminal emulation, the bugaboo for early designers, has been mastered

RAF

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by RAF, and it performed as a perfect VT220 during our tests. The only problem was that although the MICROVAX on the network *knew* that the PC was a VT220, the other VAX on the network didn't know until I ran "SHOW TERM/INQ". If your LOGIN.COM file contains this sequence, it will recognize the terminal type.

Suspended mode allows you to connect to the VAX via terminal emulation while running in Combined mode. When the RAFPC process is running on the VAX, you can connect via terminal mode SUSPENDING the RAFPC process. Suspended mode is a good way to get to the VAX after RAFPC has been started; it obviates the need to connect and then stop RAFPC simply to do a small VAX command.

RAF requires no real setup for the PC. After RAF is INSTALLED, it can be activated by typing the "attention connect" sequence, set to be CTRL-SHIFT-D. On the VAX side, installation is accomplished via the VAX INSTALL program and the process RAFPC will be set up to run from directory RAF:, defined by the system manager. When you are in Terminal mode, RAF can be run with the F9 key, defined to say RUN RAF:RAFPC.

Working With RAF

Using RAF with your PC is as easy as having a large hard disk. Speed is acceptable on Ethernet and average on serial lines. You should set up some PC-oriented accounts on the VAX and allow access to these by more than one per-

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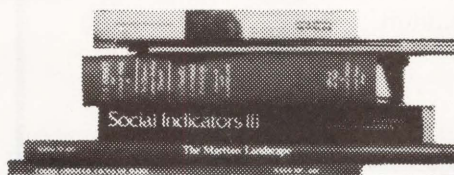
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son. The effect is that everyone can share software distributions and data files through the clever use of subdirectories, like [.PC] for general use, [.PC.BACKUP] for backing up, etc.

If you're using the Ethernet version and there are multiple hosts on the network, switching between sessions on each host is easy. A user-defined key allows moving forward (CTRL-F), or backward (CTRL-B) between sessions that are active. During active sessions, returning to the Ethernet menu screen

is as easy as typing the "attention" key (CTRL-A).

VAX As A Printer

Using the VAX to print PC files or output from a PC program is complicated but easy to accomplish after you understand it. The printer first is defined at the PC level with a command:

```
REMOTE/PRINT=1 PC.OUT
```

This sets the PC's LPT1 to be de-

finied as a file on the VAX PC.OUT that will be spooled to the printer and deleted. Unfortunately, the VAX can't tell when the PC is finished outputting to the pseudo printer, so the print queue must be closed with the REMOTE/CLOSE command.

If you wish to print to a file that won't be spooled or deleted, use the command:

```
REMOTE/PRINT=1 @PC.OUT
```

This will create a file PC.OUT that will contain the printed output of the PC.

RAF Utilities

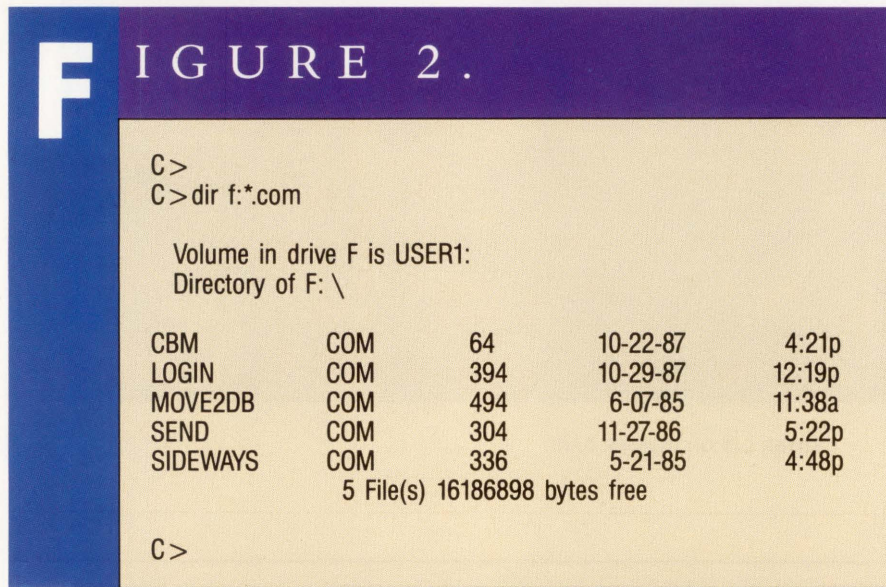
Several utilities are included with RAF to make the job of integrating PCs and VAXs more functional. The REMOTE program allows you to build a PC command that when invoked runs a VMS process or executes a VMS command. It then places you into Terminal mode that allows you to interact with the process you have invoked. After you exit, control returns immediately to MS-DOS.

The effect is that you have executed the process on the PC without ever really being on the VAX; in fact, PC users with no knowledge of VAX can run such programs as MAIL, Word Processing or other utilities without realizing that they reside on the VAX. For example:

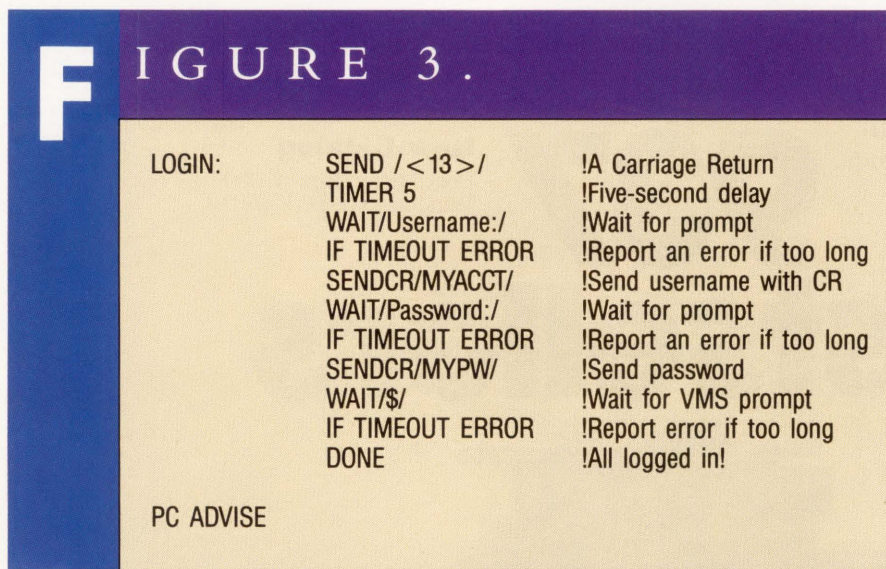
```
REMOTE MAIL "MAIL"
```

will create a PC program MAIL that will put you directly on the VAX running the VMS MAIL utility. The program assumes that you are in Combined mode.

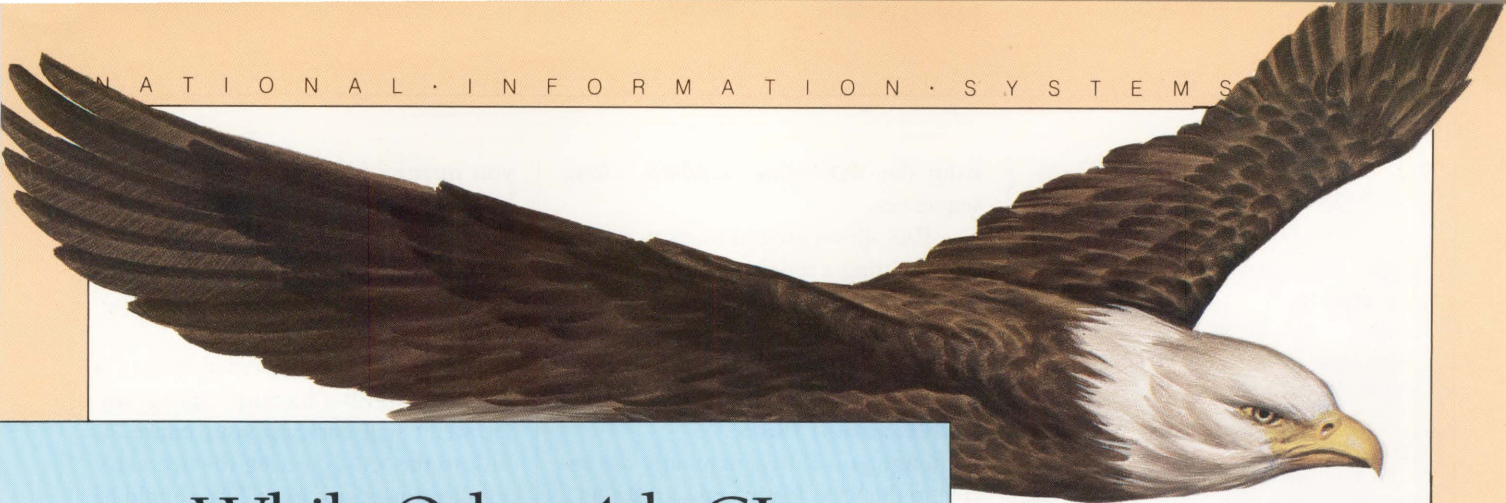
Programmers can build PC applications that are integrated with the VAX's capabilities. PC programs can read and write VAX files, but more important, they can call and execute VAX subroutines as if they were a part of the PC program. PC program subroutine calls can pass data to and receive data



VMS root directory in Combined mode from the PC.



CONVERSATION files interact with RAF on a VAX.



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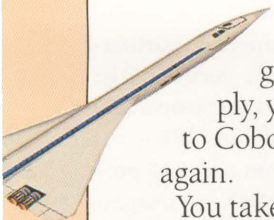
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from the VAX using standard calling sequences.

RAF allows programmers to do this by providing a series of subroutines on the utility diskette that allow programmers to add this functionality to their PC programs.

Conversation Files

Although you always manually can attach to the VAX, log in and start RAFPC, sometimes it's desirable to do this automatically. For naive users, or if you want something to happen automatically, RAF provides a language for automatic CONVERSATION. This language allows you to SEND text to the VAX, WAIT until certain text is received, PRINT on the PC screen or use many other commands that can be put together into a command file that, when invoked, interacts with RAF on the VAX.

Using CONVERSATION files, you can attach to the VAX, log on and execute any series of VAX or RAF commands. If you have a Hayes-compatible modem, you can use CONVERSATION files to dial out and attach to a remote computer (see Figure 3).

If you're using an Ethernet version, RAF can allow you to link together with another user on the same network. Using PC ADVISE, the advisor's screen is updated to show exactly what is on the advisee's screen. In this manner, you can watch what someone else is doing, and

you instruct him or understand what he's doing. Technical support over the Ethernet network is possible using this interesting feature.

Backup

One of the utilities provided by RAF is the DUMPER backup program. DUMPER will back up your entire PC disk to the VAX, creating the necessary subdirectories as it goes. You should be sure to start with the default directory on the VAX set to [PC] and all the PC's subdirectories will be created under that.

DUMPER is deceptively simple to use; with its command, you can start a backup, which in my case exceeded 25 MB (50,000 blocks). At 40,000 bytes/second, this backup on an UNLOADED system would take approximately 12 minutes; on a loaded system, it will take much longer.

Speed

How fast is RAF? Can the VAX really be used efficiently as a disk for a PC? The answer to these questions is that RAF is extremely fast over the Ethernet. In some cases, it rivals a floppy disk in wall time required to copy files to or from the device. Some representative times are given in Figure 4.

On an unloaded MICROVAX II, I could copy the 800-block, 400,000-byte file either to or from the VAX in 10 wall seconds. This yields an effective throughput of approximately 40,000 bytes/second; more than four times as fast as a 9600 baud line.

RAF is fast and efficient, particularly with the Ethernet version. The overhead using Ethernet is considerably less than with a serial line. Whatever connection modality you use, RAF provides a full-functioned VAX-PC integration tool. There are many unique features of RAF itself and Datability has supported the product with continued updates.

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 377 Medium 378 Low 379

F I G U R E 4 .

	Buffered I/O	Directory I/O	CPU Time
COPY 800 Blocks 400,000 Bytes to the VAX	700	34	6.3 Sec
From the VAX	740	330	5.3 Sec
Saving a LOTUS Worksheet	2500	1100	40.0
Restoring a LOTUS Worksheet	2400	600	27.7

Representative times for performing RAF functions over Ethernet.

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System Performance And *ALL-IN-1*, Part 2

BOIS

David W. Bynon

ALL-IN-1 system a performance problem (see "System Performance And *ALL-IN-1*, Part 1," December 1987). A number of *ALL-IN-1* management tips were presented that, at a minimum, should be on the *ALL-IN-1* manager's list of things to do. This month I will take you deeper into VMS and *ALL-IN-1* internals, providing you with advanced tuning information, load balancing techniques and upgrade paths.

Warning: This article contains information culminated over years of work and experience with VAX/VMS and *ALL-IN-1* systems. Some of the information presented suggests changes that should be made only by an experienced VAX system manager who understands the internals of VMS. Be safe; if you don't know what something does, don't mess with it. And, always record your changes and their effect on the system.

What's The Problem?

If your system provides poor performance when users are running *ALL-IN-1*, it has one of two possible problems: resource limitations or misuse. Determining the problem is, in most cases, quite simple. There's no magic involved, just a time-consuming process of elimination.

To start the elimination process, you first must know what the available resources are. A VAX/VMS system has three major resources to investigate: CPU, memory and I/O.

The preliminary investigation process determines resource limitations. What may appear to be one problem

could be a combination of problems. The *Guide to VAX/VMS Performance Management* has a series of logical checks, in flowchart format, to help you determine if you have one or more major resource limitations. Use it to get started.

ALL-IN-1 Memories

VMS is primarily a memory-driven operating system; memory controls, to a great extent, the overall capability of a VAX/VMS system. Without sufficient memory, the capability of a VAX/VMS system is a trade-off between the CPU's performance and disk I/O.

Processes running *ALL-IN-1* require lots of memory, primarily because of the size of the task. The *ALL-IN-1* image and its form libraries are so large that a user's process must hard page fault heavily just to get the first screen displayed. This will be true regardless of the amount of memory available to the system or a process' working set.

The difference will be in how hard the VMS system has to work at accomplishing the same task. The key lies in the process working set quotas, the process working set growth rate and the size of the free page list. If a process has large working set quotas and the system allocates memory in larger portions, the process will perform better because of less memory management overhead.

With this in mind, the primary tool for controlling process performance (maximum performance for the CPU) is the VMS AUTHORIZE utility and the process working set quotas. I've seen various claims to the correct *ALL-IN-1* user working set size, but, believe me, there's no such thing as typical or standard. Every system manager must investigate his own requirements. Here are

a couple of tips that have worked well for me:

1. Set WSQUOTA to the typical working set size to which an *ALL-IN-1* user process, on your system, normally would grow.
2. Set WSEXTENT to a value 15 to 25 percent larger than WSQUOTA. Use the VMS command \$SHOW PROCESS/CONTINUOUS/ID to monitor an active process.

Dynamic vs. Static

The second tool for controlling process performance is the Automatic Working Set Adjustment (AWSA) parameters, a very delicate part of the VMS memory management scheme. If the memory management parameters are handled improperly, you'll do more harm than good. So record initial settings and measure system performance before and after making any adjustments.

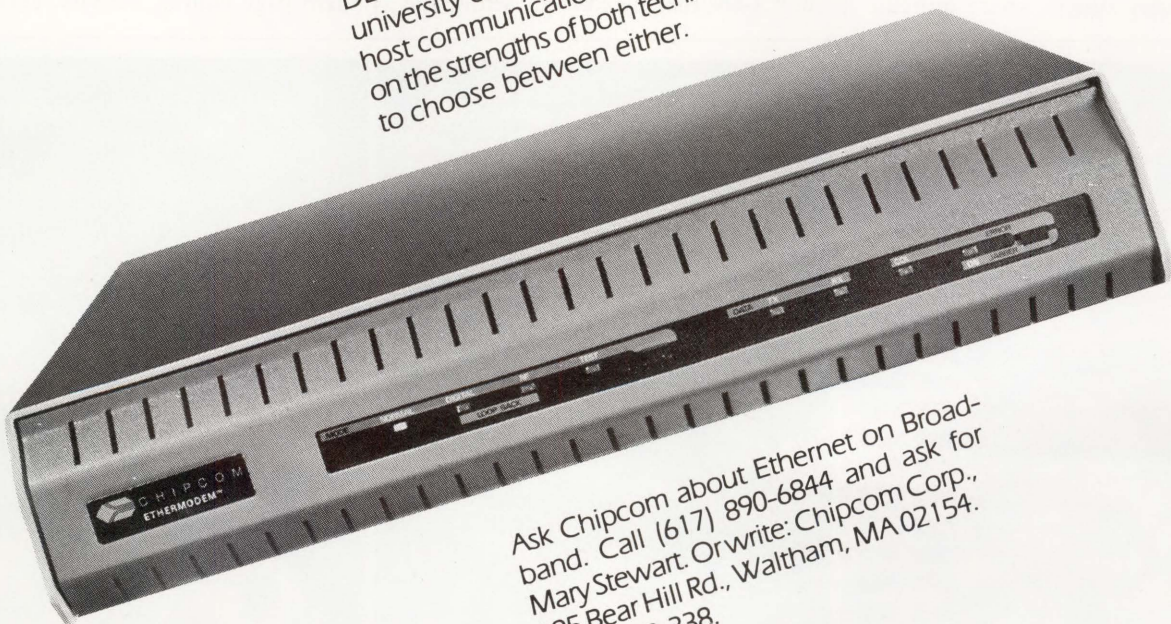
Next, I should answer the question of why you would want to change AWSA. The answer is simple: AWSA allows the VAX to be dynamic, robbing Peter to pay Paul. This is important if physical memory is a limited resource. (If you don't have excess memory, leave AWSA alone.) One of the features of AWSA is to trim working set sizes when memory isn't actively in use by a process. This usage is determined by a process' page faulting activity. Trimming an *ALL-IN-1* user's process working set isn't desirable because of the page faulting activity required to get the memory back again.

There are two AWSA parameters that control working set incrementing and decrementing: PFRATL (page fault rate low) and PFRATH (page fault rate high). To keep VMS from trimming working sets, set the VMS SYSGEN parameters PFRATL and WSDEC (work-

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ing set decrement) to zero. This, in essence, turns off AWSA and allows processes to maintain their working set size.

Other parameter changes that I have found to be helpful involve the growth of a working set. When a process page faulting activity reaches or exceeds the value of PFRATH, VMS allocates additional memory to that process. The additional growth is added in increments defined by WSINC. Because ALL-IN-1 causes excessive page faulting activity, it makes sense to adjust these parameters to accommodate ALL-IN-1's growth needs. By lowering the value of PFRATH page faulting, processes will receive a memory increase sooner. By increasing the value of WSINC, a page faulting process will require fewer working set increments. Warning: If your system isn't memory rich, making these types of adjustments will induce swapping.

Page Faulting

Page faulting, or the page fault rate, varies on every system, so it's difficult

to say one is high and another is low. However, there are some indicators of when paging on an ALL-IN-1 system is too high. For example, is Kernel Mode greater than User Mode (\$MONITOR MODES)? Are global page faults greater than 35 to 40 percent of the total fault rate (\$MONITOR PAGE)? Are there excessive processes in the page fault wait state; i.e., state = PFW (\$MONITOR PROCESS)? If you experience any of these conditions, you should take steps to reduce page faulting.

When investigating a system that page faults excessively, determine if the faulting activity is hard or soft. Paging from disk is called hard faulting, while soft paging refers to paging from the page cache. Hard page faults are the less desirable of the two. The type of excessive page faulting will determine your tuning solutions.

If your overall paging activity is low while hard faults are high, the page cache is inefficient. This problem is rare but can be fixed easily by running AUTOGEN, thereby correctly setting the

values for MPW_LOLIMIT, MPW_THRESH, FREELIM and FREEGOAL.

If you're experiencing a combination of high hard page faulting with high overall faulting, you're probably experiencing a saturated disk (I/O bottleneck). This is a common problem with large ALL-IN-1 systems where the users are very active or when working set sizes are too small. If the working set sizes are appropriate and memory isn't a limitation, the solution to this problem is to add another page file on another disk or to reduce the demand (number of ALL-IN-1 users).

If you detect hard page faults or swapping on your system, in conjunction with poor performance, investigate a memory resource problem. If you observe little free memory (\$SHOW MEMORY) with this paging and swapping activity, you've reached a memory limitation. Your only recourse will be to decrease the number of interactive users or to install more memory. If you observe plenty of free memory with hard page faulting activity, you prob-



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ably have a memory management (tuning) problem.

I/O, I/O, It's Off To Disk We Go

Without a doubt, *ALL-IN-1* is an I/O hog. It earns this reputation from its menu-driven interface, fantastic electronic mail capabilities and the file cabinet system. Of the many *ALL-IN-1* systems I have evaluated and tuned, only twice have I found systems where the CPU was pushed to the limit. In most cases, the I/O is kissing the red line. Excessive I/O stems from a very basic problem: Devices such as disk drives, printers, tape drives and terminals are much slower than the CPU. There are several alternatives to I/O bottleneck problems.

First, let memory and the CPU take some of the burden. Spend a little time tuning, balancing and maintaining the file system. There are three important aspects to your file system: the number of spindles (disk drives) and controllers, contiguous storage and buffering and caching.

The number of spindles and con-

trollers on your system will determine its I/O throughput. This makes sense because two drives can read and write twice as much data as one; the average access time of two drives is potentially twice that of a single drive. So, the first rule to better disk I/O performance, on an *ALL-IN-1* system, is to spread the load evenly over multiple disk volumes. The same holds true for the disk controllers; a controller managing two drives will perform better than the same controller with four drives. HSC-based systems (VAXCLUSTERS) should have their drives evenly balanced among the available HSCs.

Second comes the issue of contiguous storage or lack of it, called fragmentation. It's the bane of every *ALL-IN-1* system. A fragmented file system is detrimental to the system's performance. You can't prevent it, but you can fix it.

There are three parts to the fragmentation problem:

1. File fragmentation — Files with multiple non-contiguous file extensions.

2. Record fragmentation — Dead space, called empty buckets, left in an indexed file when records are deleted.
3. Page file fragmentation.

The *ALL-IN-1* system manager menu provides a function to reorganize *ALL-IN-1* data files. The function invokes the VAX/VMS CONVERT/RECLAIM utility to rebuild the files. The File Definition Language (FDL) files that define the data file structures are in OASLIB.

Page file fragmentation comes about when your system's page files are too small. System performance degradation will occur when page usage exceeds 50 percent. The size of a system's page files is dependent on the number of users and their applications. Here are a few guidelines: Use multiple page files of equal size. Locate page files on low usage disks. Always make page files contiguous.

In the case of a pure *ALL-IN-1* system, the page file size can be computed using: $\text{PAGEFILE SIZE} = (\text{MAX-PROCESSCNT} * \text{WSMAX})$. The number



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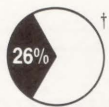
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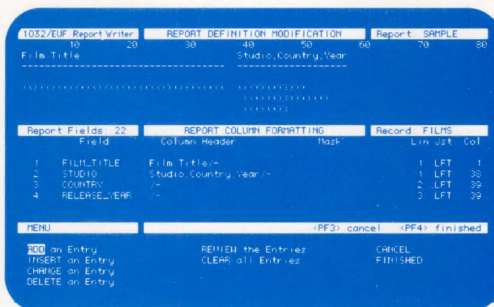
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F**FIGURE 1.**

```

PENDING.DAT — Global buffer = No. concurrent users + 1
ATTENDEE.DAT “
PROFILE.DAT “
NETWORK.DAT “

TIMEZONE.DAT — Global buffer = 1
MEETING.DAT — Global buffer = 5

DAF.DAT — Global buffer = ((No. concurrent users)/2)+1

```

Guidelines for ALL-IN-1 data files.

of system page files is controlled by the system parameter PAGFILCNT.

You're on your own to solve the disk fragmentation problem. I recommend the use of *Diskeeper* from Executive Software Inc., an online disk defragmentation utility. Another product, *Diskit 2000* from Software Techniques Inc., is about to be released at the time of this writing.

Finally, we have RMS buffering and ACP caches. Buffering, or more precisely global buffering, defines the number of buffers that can be shared by multiple processes accessing a file. Buffering is defined on a file-by-file basis, using the \$SET FILE/GLOBAL_BUFFER command or through the use of the FDL utility. Guidelines in Figure 1 should be considered.

Ancillary control process (ACP) caches are portions of paged dynamic memory used to buffer or cache directories, file headers, file IDs and so on. The ACP maintains the following caches: quota, extent, directory, file header and file ID. Of these, the directory and file header caches are the most important to file system performance.

Directory And File Caches

The directory cache is memory allocated by the XQP to cache directory file information. This cache permits the XQP

to perform directory searches without reading the disk. On volumes with multiple subdirectory levels and many files in a single directory, such as *ALL-IN-1* disks, the directory cache will play an important role in overall file system performance.

Directory searching, during a file open operation, represents a substantial amount of system overhead. On an active *ALL-IN-1* system with many users, the file open rate easily will exceed eight to 10 file opens per second. If directory information isn't cached properly, these file opens will incur many additional direct file I/O operations.

There are three system parameters that affect directory caching: ACP_DIRCACHE, ACP_MAXREAD and ACP_DINDXCACHE.

The parameter ACP_DIRCACHE defines the number of directory blocks for each volume that can be cached by the XQP. Each block consumes 512 bytes from paged dynamic memory. The ACP_DIRCACHE should be large enough to hold all of the most commonly used directory files.

The ACP_DINDXCACHE parameter defines the number of file control blocks that can be maintained by the XQP for directory files. This cache is used to keep open as many directory files as possible, so make the parameter large enough for that purpose. Each directory entry requires 180 bytes of non-paged dynamic memory.

The parameter ACP_MAXREAD controls the maximum number of blocks that will read into the directory cache. This parameter should be set slightly larger than the average directory file size in blocks.

Now let's consider the file header cache. It's used by the XQP to eliminate having to read a file header from disk when either the file is opened or a window control block needs to be updated. This cache has a significant impact on system performance.

The file header cache is controlled by the system parameter ACP_HDRCACHE. Each entry in the cache requires 512 bytes of paged dynamic memory. The size of the cache will determine the number of file headers that can be cached. It should be large enough so that all of the commonly accessed files can have their headers cached, plus 32 to 40 for miscellaneous file opens.

A final note on ACP caching: Because file header and directory caching is performed in paged dynamic memory, you must ensure that there's enough memory from which to allocate the cache. The size of paged dynamic memory is controlled by the system parameter PAGEDYN. If PAGEDYN is too small, the cache will be set very small. The result of this error effectively will be no caching at all. To monitor caching activity, use the DCL command \$MONITOR/FILE_SYSTEM_CACHE.

The Great ALL-IN-1 Balancing Act

When efforts to tune an *ALL-IN-1* system fail, your next resort will be to balance the load of the system or to offload some of the work. Let's discuss some of the possibilities.

First, if it can be done without user interaction during off hours, schedule it that way. Examples include large print jobs, backups, database sorting and maintenance activities, mail delivery and file transfers.

If you operate with multiple systems, consider allowing mail delivery to



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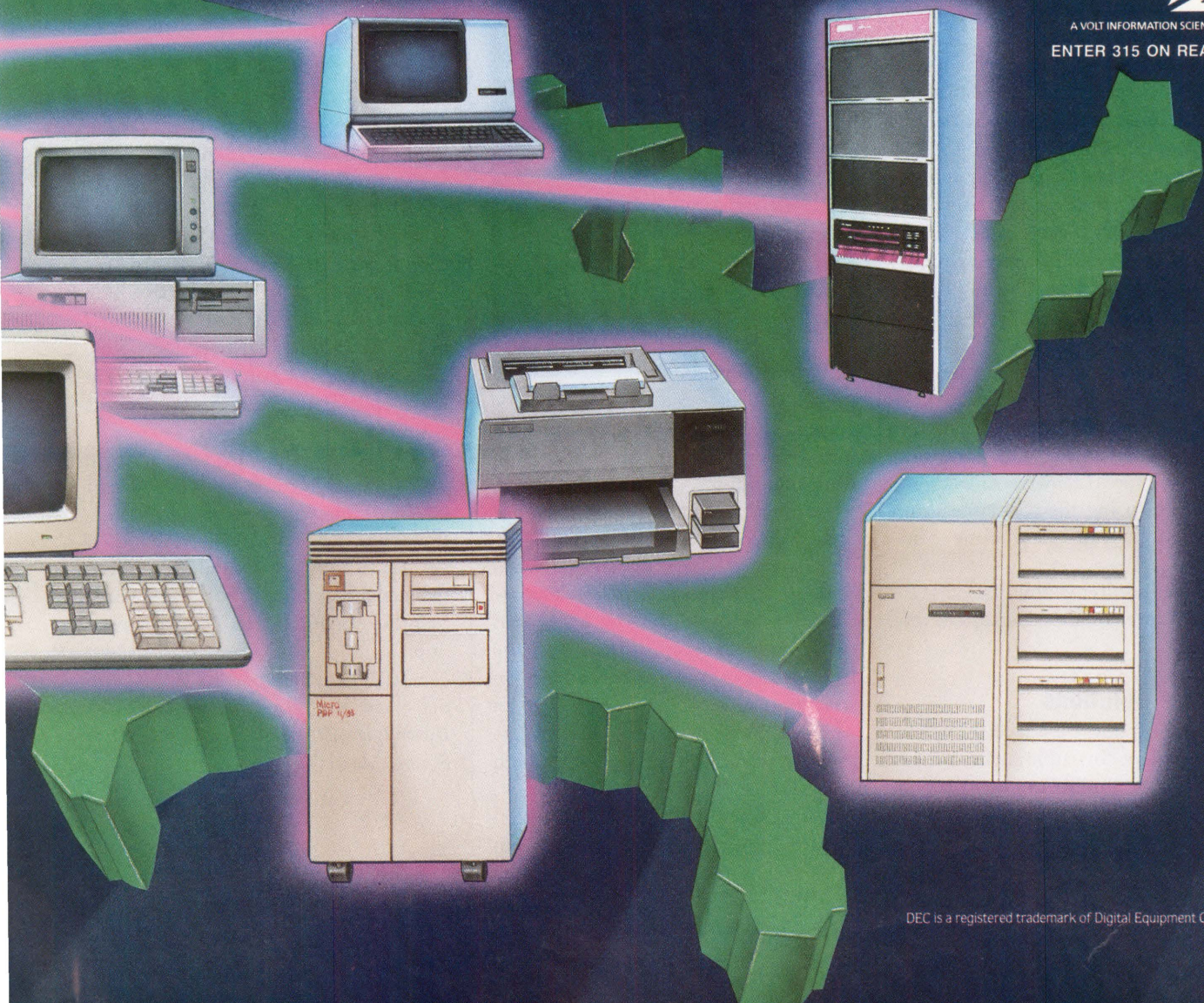
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occur only at specific times during the day. You can implement this feature by setting up Message Router as a recurring batch job.

If you have lazy users who stay logged in all day whether they're using the computer or not, implement a computer watch dog to bump them off. The watch dog can monitor CPU and I/O usage to determine if the user is active. Remember, even if a user isn't doing anything, he's still consuming memory.

Make sure you have users evenly distributed among the available disk volumes. Putting all users on a single volume will create a bottleneck at that spindle.

For some reason, *ALL-IN-1* managers and programmers like to clutter *ALL-IN-1* menus and screens with junk, like double high, bolding, reverse video, etc. Doing so only creates more work for the CPU. Keep screens simple. The less you have on an FMS screen, the faster it will display.

ALL-IN-1 is a repository for a lot of miscellaneous bells and whistles that are never used. Computer Based Instruction (CBI) is a good example. CBI uses *ALL-IN-1* scripts and FMS forms. The scripts aren't hurting performance, but the forms are. The CBI feature has a large number of FMS forms that take up room and search time in the form library OAFORM.FLB. If you don't use it, get rid of it.

DATATRIEVE is another feature that people like to link with *ALL-IN-1*, then never use. Products linked to *ALL-IN-1*, such as DATATRIEVE, WPS-Plus and ACMS, make the *ALL-IN-1* image larger. If you're not using them, they're simply wasting your CPU time and memory.

Before modifying any part of *ALL-IN-1*, make sure you have backups of the original.

Hardware Solutions

There's an old hot rod adage: "There's no replacement for cubic inches." The same certainly applies to the *ALL-IN-1*

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system: There's no replacement for more mips, more disks, more memory and, well, you know!

Sometimes, though, it's just not feasible or cost effective to replace an entire system for better performance when there are so many performance alternatives. For example, did you know that terminal servers, such as the DEC SERVER 200, perform better than serial port multiplexers? This is true in *ALL-IN-1* environments, because terminal servers perform best with high activity.

If you're bumping up against a memory limitation, and your system

will handle more memory, add more. It's dirt cheap these days. The additional memory will allow you to add more concurrent users or to increase the working set sizes of your present users.

If you have a storage limitation or a disk I/O bottleneck, consider upgrading with two smaller drives instead of a single large drive. The biggest delay in all drives is the seek time.

If more storage also means a new controller, consider one that employs caching. MICROVAX owners should avoid ST506 drive technology. You will find your best price/performance alternative with ESDI subsystems or SCSI subsystems. Storage systems from vendors such as U.S. Design Corporation, Emulex and System Industries Inc. offer incredible performance.

If you have a system that has memory to spare, consider a product such as *TurboDisk* from EEC Systems Inc. I installed *ALL-IN-1* on *TurboDisk Plus* with good results. Using *TurboDisk*, I was able to double my effective I/O rate to *ALL-IN-1* files. Eight megabytes of memory were all that were needed to hold the *ALL-IN-1* files and directories. It was quick and easy.

If you are a MICROVAX user and you need more CPU power, help is as easy as installing Ethernet. Local Area VAXCLUSTERS make very effective *ALL-IN-1* systems. The best results are found in configurations that have local page and swap file disks on the satellites and no interactive users on the Boot node.

MAKING AN *ALL-IN-1* SYSTEM perform well isn't easy. You'll have to work at it. A VAX mip will support 16 to 20 *ALL-IN-1* users, up to 24 if you're good. If you let an *ALL-IN-1* system go without maintenance, tuning or balancing, you'd be lucky to run 10 *ALL-IN-1* users per mip.

Results will come to those who persevere and use finesse.—David W. Bynon is a VAX systems consultant in Silver Spring, Maryland.

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RSX CLINIC

R

By James A. McGlinchey

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QUESTION: *We've been trying to add an additional DZQ-11 to our PDP-11/73 but can't seem to get MICRO/RSX to recognize it. Do you know the secret?*

REPLY: It's not a secret, but it does require a little explanation. The DZQ and, for that matter, the DZV, DHV and DLV, are terminal interface boards whose CSR (Command and Status Register) addresses are located in the floating address area of the PDP-11 I/O page. Devices whose registers lie in this area don't have fixed CSR addresses. The address is calculated by a formula that takes into consideration all the devices whose CSRs may lie in the floating area. This formula is complicated. I've used the one printed in the *DHV-11 Technical Manual* but now have a better way.

The address of your DZQ must be set according to this formula if the Autoconfigure Task (ACFPRE) in MICRO/RSX is to find your device and configure it into the system when MICRO/RSX boots. It's more complicated than that because *all* of the

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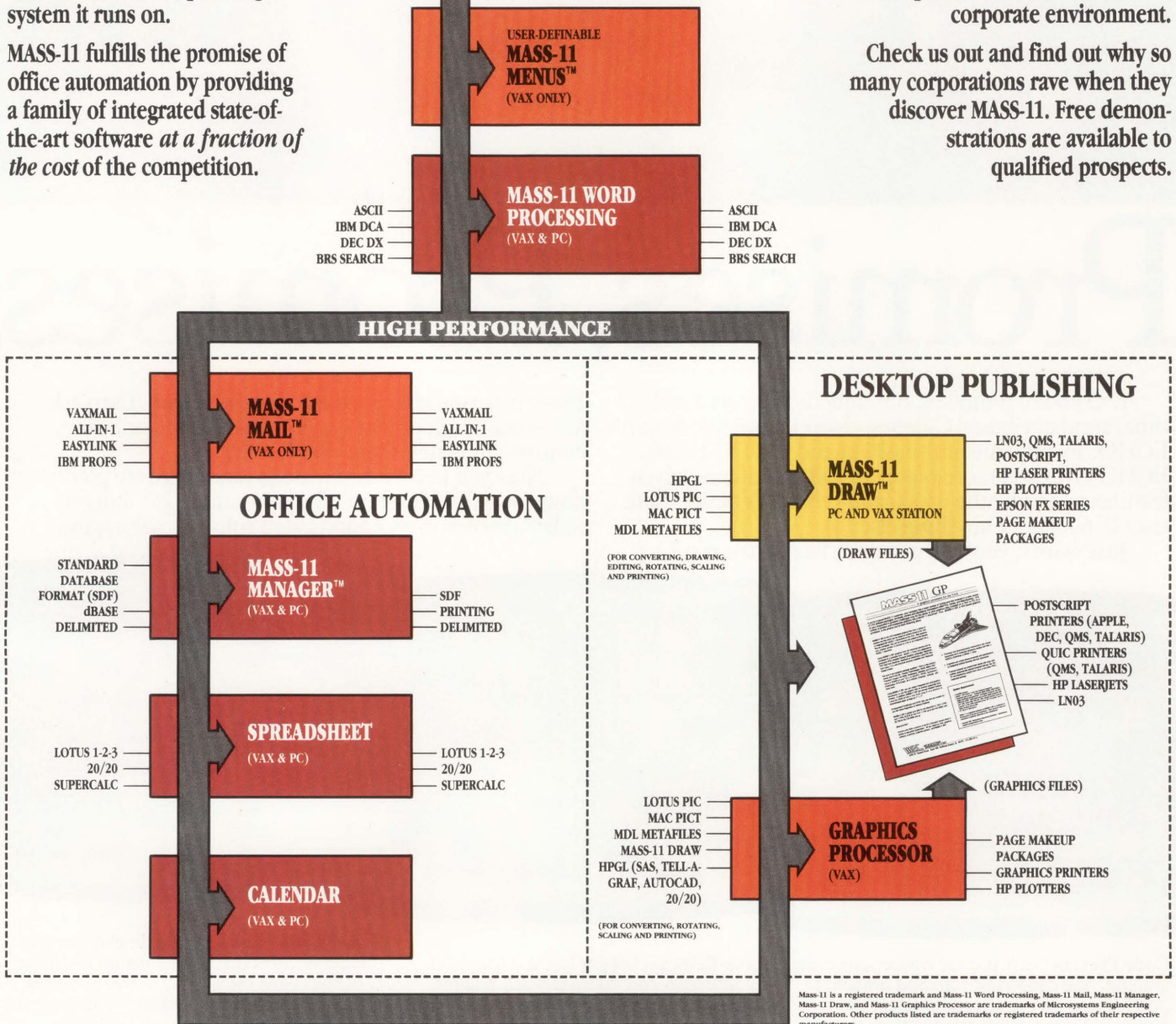
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Ron Levine

Disaster Recovery In Banking Environments

Remember the headlines from last year: "Earthquake Shakes California," "Floods Close Chicago," "Hurricane Hammers Florida"?

Imagine reading this headline: "Fire Levels Downtown Business Center." If a disaster hits an ill-prepared data processing center, the whole business can be shut down.

The October 1, 1987, earthquake in Southern California caused a power failure that wiped out California Federal Savings and Loan's computer database operation in Rosemead. For 24 hours, the data center's computer couldn't access California Federal's branches throughout Orange County.

TRW Credit Data's Van Nuys operation also was hit by a quake-related power loss, knocking out subscriber service for a few hours for customers, such as Chase Manhattan Bank in New York.

At the Bank of America, a backup system successfully went online at its data processing center in Los Angeles within seconds after the earthquake knocked out its main system. Without this backup capability, Bank of America's computers throughout Southern California would have been stalled.

To deal successfully with possible disasters, an effective disaster recovery plan is mandatory. California Federal Savings and Loan's disaster team was activated immediately. They packed up thousands of tapes and files and flew them to the company's backup com-

puter centers in Phoenix, Arizona, and Rancho Bernardo, California.

Nowhere is a viable backup plan to cope with disasters, both large and small, more necessary than in the data processing-dependent banking industry

**“
Banks and other financial
institutions are required by
federal regulations to have
a disaster recovery plan
on file for inspection
by federal auditors.
”**

where any interruption of computer services can become a catastrophic event. To protect against possible data processing losses, interruptions, and/or complete shut-downs, banks and other financial institutions are required by federal regulations to have a disaster recovery plan on file for inspection by federal auditors.

This plan can designate either an internal, off-site backup mode of operation (to be activated during emergencies) or an outside service that can provide full operational functioning upon the occurrence of a covered event; e.g., data processing interruption or shutdown.

Services For DEC Equipment Users

There are a number of disaster recovery services available to users of DEC systems. One such service, employed by First National Bank of Chicago, is ABS Associates Inc. of Arlington Heights, Illinois.

ABS specializes in providing

backup to DEC VAX systems for clients in the Chicago Metropolitan area. An exact duplicate of the subscriber's system configuration is maintained and ready for use should a computer shut-down occur at a customer's site.

Subscriber firms can move their computer operation directly to ABS headquarters to conduct business as usual, or they may choose to operate remotely via modems. ABS supports peripherals, modems, telephones, data lines and multiplexers from various manufacturers (including DEC) as needed, in order to duplicate customer setups. According to Rosemarie Mitchell, ABS President, VMS, operational and hardware technical support also are provided during system use.

Two operational divisions within First National Bank of Chicago currently are contracting with ABS for emergency services: Documentary Products, responsible for the bank's international lines of credit; and Remittance Banking, the lock box service group.

To test ABS's capabilities, 16 of the bank's internal auditors and data processing staff brought the bank's software to the ABS facility and ran through a typical day's data processing activities. Another group of bank staff members simultaneously were online at the company's major New York City site, testing ABS communications links.

When testing was completed, the bank was confident in the viability of its disaster recovery plan. In the event of an emergency, defined by the bank as any event that knocks out the computer center for 24 hours, backup tapes maintained in an off-site vault will be retrieved and run at ABS.

An alternate phone number, for the ABS site, also is activated for branch use by First National of Chicago during a disaster. This ensures that the communications link among branches in Chicago, New York, Los Angeles, Dallas, North Carolina and other sites remains intact.

ABS provides its disaster recovery service on a contractual basis. Limits of five customers per hardware configuration and a minimum five-mile radius between customers have been established to prevent overburdening ABS facilities in the event of widespread data center outages.

Another emergency backup vendor is Comdisco Disaster Recovery Services Inc. of Carlstadt, New Jersey. It's the largest disaster recovery firm in the country with billings of \$60 million a year.

Comdisco is new to servicing the DEC world, operating exclusively as an IBM user emergency services vendor prior to this year. However, it now supports DEC machines and is the only firm we found that offers PDP and VAX system support on a national and international basis. It's also the only specialized disaster recovery services provider that operates nationwide through a network of hot sites and communications links.

According to Comdisco spokesman John Pennington, most other companies are regional service bureaus or manufacturers or are other types of DP vendors with a sideline in disaster recovery.

Comdisco's dedicated DEC computer systems' hot site, located in Cranford, New Jersey, is available to subscribers via a telecommunications interface. Or, clients may operate directly from the facility during disasters that disrupt or interrupt their own DP centers. Pennington says that the site is capable of providing almost immediate support to users after notification that a disaster recovery plan is being activated.

Comdisco claims more than 750 subscribers to its worldwide service. However, the company wouldn't

disclose client names or provide the number of DEC users currently under contract.

Smaller Scale Disasters

Natural disasters like fires, floods, earthquakes and mud slides occur less frequently than man-made disasters. And,

the man-made problems for data processing centers often are overlooked when formulating disaster recovery plans. For example:

1. A disk drive crashes ruining the operating disk. No backup pack exists.
2. An operator, working late one night, gets a disk read error that stops the pro-

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Selecting Help For Emergencies

It's wise for the MIS director and other system support management to be prepared with contingency plans for bringing in outside help during a catastrophic event. When selecting a disaster recovery service or data retrieval vendor, ask the following questions:

Disaster Recovery

1. Can the firm provide full duplication of your system configuration?
2. How long will it take for its backup system to be operational?
3. Can you operate from its site? Can you operate remotely from telecommunication lines?
4. Is it located far enough away from you to avoid being caught in a common widespread outage?
5. How long has this company been in business? What's its reputation? Who are its customers?

Data Retrieval

1. How long does it take the company to respond after it has received the damaged media?
2. Will the media be head tested before it's returned?
3. Is on-site support available, if requested?
4. How much does the service cost?
5. How long has the company been in the data recovery business?

cessing; he turns to the backup disk and restarts the computer only to have the same error occur. Next day, FEs determine that a malfunctioning drive caused the problem and both disk packs are destroyed.

3. Airborne smoke, dirt or dust particles contaminate the tape media; the data is vital and must be recovered.

Man-made disasters, usually caused by a lack of backup media, human error in handling the database, accidents occurring in the normal operating environment, or negligence within the computer center, are far more common than natural disasters when it comes to shutting down data processing operations.

A disaster recovery plan calling for backup media stored offsite helps to

minimize the damage. So does a structured program of preventive maintenance, which ensures that disk drives, tape transports, etc., are properly aligned and inspected for wear.

Unfortunately, no amount of planning can foresee every possible tragedy that may occur. Media may be dropped during handling, crushed in shipping or contaminated by coffee spills. Even with the best plans, there will be times when unduplicated data will be lost on-site, and this data will have to be recovered from the damaged media.

Disaster recovery plans usually are aimed at the big, natural disasters, but rarely take into account these more common, small-scale emergencies. Well thought out plans also must be formulated and in place prior to these more mundane events.

In these situations, the disaster recovery team's main goal is data

recovery done by repairing the damaged media to the point where a copy can be produced. Several methods are employed to accomplish this, such as removing contaminants, cleaning, polishing or even rebuilding the media. In almost all cases, data recovery is far less expensive and time consuming than recreating the data.

Data recovery or media maintenance services may be in-house or purchased from outside vendors. Whichever method is selected, it should be in place and ready to go in an emergency. The middle of a crisis isn't the time to try out untested procedures or to look around for outside help. The best way to avoid the need for a data retrieval team is to implement an effective data backup scheme within the disaster recovery plan ahead of time. This plan should depict the persons and departments responsible for action during an emergency and outline the operations to be performed and the procedures to be followed.

The recovery plan should include establishment of an off-site storage facility for daily data processing backups (preferably miles away from the main site), and a contingency plan for off-site extended computer operations. Off-site data storage and daily data duplication is the most often neglected aspect of DP

Companies In This Article

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operations. This is a critical step and must be followed to avert major disasters. Any disk or tape without backup becomes a candidate for trouble if the media becomes damaged.

In the event of fire, flood or other catastrophe, it doesn't do any good to have backups at the same location as the main media. Having the duplicated data off-site also protects against its accidental destruction through improper use by data center personnel.

The plan also should name outside personnel and firms authorized to be brought in for disaster recovery operations. Remember that time is of the essence. When water, smoke and other contaminants are involved, the faster the media can be cleaned up, the better the chances are for success.

Ready-Made Planning Kit

A complete DEC-user specific Disaster Recovery Planning Kit is available from Business Recovery Systems Inc. of Lakewood, Colorado. Designed to aid in the quick development of a complete disaster recovery plan, it consists of a 400-page manual and a set of diskettes or magnetic tape compatible with most standard word processing packages for easy editing. The kit includes a prototype plan requiring the user to fill in the blanks, step-by-step instructions, a maintenance guide, a work schedule to plan and manage the job and a sample executive summary.

According to Business Recovery Systems, the kit is the result of approximately 5,000 hours of work and reflects its extensive experience within the disaster recovery business. The company lists such financial institutions as Chase Manhattan Bank, Chemical Bank, Lloyds Bank, Merrill Lynch & Company, Prudential Bache, and Smith Barney Harris & Upham among its many clients.

Tom Mitchell, chief executive officer of ABS, summed it up: "If computers are down for prolonged periods of time, a company is in big trouble. Corporate America is being pressured by auditors, insurers and, in the case of

the banking industry, federal regulations to have contingency plans for disaster recovery." Nowhere in the business community is the need to guard against data processing disasters more relevant than in the banking and financial industry.

The purpose of a Disaster Recovery

Plan is to prepare for potential interruption of daily financial processing activities. The objective is to provide for continued operation of your data processing department(s) during emergency situations with the least amount of disruption. The goal of the plan is to ensure your company's survival. ■



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A

LET'S C NOW

Rex Jaeschke

Arrays And Subscript Zero

Editor's note: Detractors of C and C novices have complained about C's usage of array subscripts beginning at zero rather than one. Although this is a different approach from that used by other popular languages, there are good technical reasons for it. Also, this isn't a restriction when you understand the relationship between arrays and pointers.

Although we've touched on this topic in previous columns, the following reader letter encouraged me to address it again, this time with extra information:

Dear Mr. Jaeschke,

What's the best way to deal with the zero value index for mathematical matrices? Most FORTRAN compilers don't allow them and, of course, mathematical matrices don't use them. The fact that C automatically sets aside memory for the zero subscript causes some peculiar problems, especially when using plotting packages that transfer doubly subscripted arrays as singly subscripted arrays (supposedly to make the programming easier). Converting such packages to C causes some headaches.

Array Definitions

The definition of an array has the following general format:

```
[class] [type] identifier[i][j]...[n];
```

The following program defines several arrays of different dimensions. One array is initialized explicitly and its members are displayed individually.

```
#include <stdio.h>
int i[5] = {0, 10, 20, 30, 40};
double d[4][6];
char *p[3][4][5][6];

main()
{
    int j;

    printf("# elements in i = %3u\n",
           sizeof(i)/sizeof(int));
    printf("# elements in d = %3u\n",
           sizeof(d)/sizeof(double));
    printf("# elements in p = %3u\n",
           sizeof(p)/sizeof(char *));

    for (j = 0; j < 5; ++j)
        printf("i[%d] = %2d\n", j, i[j]);
}

# elements in i = 5
# elements in d = 24
# elements in p = 360
```

```
i[0] = 0
i[1] = 10
i[2] = 20
i[3] = 30
i[4] = 40
```

The expression used inside [] in an array dimension in a definition must be a compile-time constant expression that has a positive value. (Some compilers also have allowed zero-

“
**Various dialects of BASIC and FORTRAN
(and possibly other languages) allow
arrays to begin at zero instead of one.**

”
sized arrays that have no space allocated but still represent an address. This won't be discussed here.)

The value represents the number of elements in that particular dimension, not the maximum meaningful value for a subscript of that dimension as is common in other languages. Specifically, the range of meaningful subscripts for that dimension is zero through value - 1. For example, in the array **i** above, **i** can be accessed meaningfully using **i[0]**, **i[1]**, ..., **i[4]**.

I've chosen the word meaningful rather than legal because C provides no array bounds checking. It's not a syntax error to have expressions such as **i[5]**, **i[234]** or even **i[-23]** in your program. However, whether such expressions have any useful value is another matter. Not only could they give useless results, they even might cause a fatal run-time error such as VAX/VMS's "access violation."

Various dialects of BASIC and FORTRAN (and possibly other languages) allow arrays to begin at zero instead of one. However, in those cases, the zero element doesn't replace the previous maximum subscript value; it's an extra element. In other words, **DIM A(10)** would contain 11 elements with subscripts 0-10, not 10 using 0-9 (as is the case with C, and is demonstrated by the program above).

Assuming you don't use zero-based arrays in other

languages, C provides the same number of elements; they're numbered 0 through n-1. Therefore, you still can implement exactly the same algorithms in C as in other languages and you still should be able to pass arrays (including multidimensional ones) to library routines. The only problem is that when translating an algorithm from some language to C, you'll need to subtract one from row and column references as appropriate.

The primary bug that occurs with using a base of zero is in forgetting to start at zero and/or stop at n-1 when looping through an array's elements as follows:

```

...
for (j = 1; j <= 5; ++j)
    printf("i[%d] = %2d\n", j, i[j]);
...

i [1] = 10
i [2] = 20
i [3] = 30
i [4] = 40
i [5] = 4

```

In this case, referencing `i[5]` gave us some garbage value that happened to be in the next `int` in memory beyond the end of the space allocated for the array `i`.

The other problem with zero-based arrays is psychological. Because C requires that all arrays begin at subscript zero, many C programmers are content to leave it at that. However, as we shall see, this rule need not restrict us.

Why A Base Of Zero?

Array references are really pointer expressions and if you want to master C, you must realize and understand that `a[i]` is equivalent to `*(a + i)`. Either can be used in place of the other:

```

int a[5] = {0, 10, 20, 30, 40};
-----
| 0 | 10 | 20 | 30 | 40 |
-----
^ 0  1  2  3  4
a

```

Clearly, `a[3]` has the value 30. Let's look at `*(a + 3)`. When the name of an array is used in an expression, it's interpreted as being equivalent to the address of the first element of that array. Therefore, `*(a + i)` is the same as `*(&a[0] + i)`. When an integer expression is added to or subtracted from a pointer expression, the integer expression first is scaled by the size of the object being pointed to by the pointer expression.

In other words, `&a[0] + 3` results in an address three `ints` beyond `&a[0]`, namely, `&a[3]`. The expression finally reduces to `*(&a[3])` which is `a[3]` whose value is 30. (Note that even though `a` behaves like a pointer in this expression, it's not a pointer. Pointers are variables and the address of an array isn't a variable.)

The subscript/pointer identity can be proven for any subscript `n`, including the case of `n = 0`. In other words, `a[0]`

is equivalent to `*(a + 0)` which reduces to `*a`. Using the diagram above, it's clear that the content of the zero subscript is synonymous with `*a` (because we've just acknowledged that `a` behaves like `&a[0]`). An interesting thing we've learned is that anytime we have a pointer to an object, `*ptr` and `ptr[0]` both can be used interchangeably to refer to it.

If arrays weren't zero-based, the identity wouldn't work and we wouldn't have such a close and convenient tie between arrays and pointers. If arrays began at subscript one, the identity would have to be "`a[i]` is equivalent to `*(a + i - 1)`" so that the element 1 would have offset zero from the start of the array.

Now you have to pay the price of the extra scaling and subtraction, something contrary to C's terse philosophy. Also, keep in mind that C was designed originally as an alternative to assembly language (and that's where its strengths still lie) and in assembler, arrays begin with zero bases.

Using Different Array Bases

Although some languages use a keyword to specify array bases, in C it's much more subtle. The base of an array actually declared to be an array is required to be zero. If you define or declare an array in C, the first meaningful subscript is zero. However, because you arbitrarily can subscript any pointer, you can get around this limitation. For example:

```

#include <stdio.h>

int k[] = {1, 2, 3, 4, 5};

main()
{
    int *p1 = &k[0];
    int *p2 = &k[2];
    int *p3 = &k[4];

    printf("array k = %d %d %d %d %d\n",
           k[0], k[1], k[2], k[3], k[4]);

    printf("array p1 = %d %d %d %d %d\n",
           p1[0], p1[1], p1[2], p1[3], p1[4]);

    printf("array p2 = %d %d %d %d %d\n",
           p2[-2], p2[-1], p2[0], p2[1], p2[2]);

    printf("array p3 = %d %d %d %d %d\n",
           p3[-4], p3[-3], p3[-2], p3[-1], p3[0]);
}

array k = 1 2 3 4 5
array p1 = 1 2 3 4 5
array p2 = 1 2 3 4 5
array p3 = 1 2 3 4 5

```

Because `k` is defined as an array of dimension 5, valid subscripts are 0-4. As `k` is an array with space allocated for five elements, by using pointers into that array, we can map into those five elements in a number of different ways as is demonstrated by the use of `p1`, `p2` and `p3`. We have seen numerous examples of the ability to subscript any pointer, and

using this technique we meaningfully can subscript **p1**, **p2** and **p3** using subscript ranges of 0 to 4, -2 to 3, and -4 to 0, respectively. Note that all of these mappings are - to those five elements allocated for array **k**. We always map into space that we own and that is predictable.

The use of negative subscripts is worth a comment. That the identity **a[i]** is equivalent to ***(a + i)** holds true for any value of **i**, even a negative one. Thus, **a[-n]** is equivalent to ***(a - n)**, and using the same procedure as described earlier, we find that **a - n** results in an address **n** objects prior to that of **a**. C places no constraint on the range of subscripts permitted in an array expression, only on an array declaration.

It's important to understand that you can have array expressions in a program that has no arrays declared, simply by subscripting a pointer. For example:

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

#define NUMELEM 5

main()
{
    char *malloc();
    double *pd;
    int i;

    pd = (double *) malloc(NUMELEM);

    /* ignore NULL ptr checking */

    for (i = 0; i < NUMELEM; ++i) {
        pd[i] = sqrt((double) i);
        printf("pd[%d] = %f\n", i, pd[i]);
    }
}

pd[0] = 0.000000
pd[1] = 1.000000
pd[2] = 1.414214
pd[3] = 1.732051
pd[4] = 2.000000
```

Here, no arrays are declared, yet **pd** is subscripted from 0 to 4 meaningfully. In fact, you have to adopt this approach if you wish to treat dynamically allocated space as an array.

That seems to work fine for mappings of pointers into one of these five elements, but what about mapping these elements as subscripts 1 to 5?

```
#include <stdio.h>

int k[] = {1, 2, 3, 4, 5};

main()
{
    int *p4 = &k[-1];
    int *year = &k[-1983];

    printf("array p4 = %d %d %d %d %d\n",
        p4[1], p4[2], p4[3], p4[4], p4[5]);

    printf("array year = %d %d %d %d %d\n",
        year[1983], year[1984], year[1985],
        year[1986], year[1987]);
}

array p4 = 1 2 3 4 5
array year = 1 2 3 4 5
```

No problem there either. We simply make **p4** point to **&k[-1]** and now **p4** has subscripts 1 to 5. It's irrelevant that no space has been allocated for the element **k[-1]** because we never try to access that element. All we have done is invent a pointer expression that points to the location where **k[-1]** would be if it had existed. Then when we have an expression **p4[1]**, using the identity, we get ***(p4 + 1)** or ***(&k[-1] + 1)**. This equals ***(&k[k - 1] + 1)**, ***(k - 1 + 1)** and finally ***k**, which is the same as **k[0]**. In other words, **p4[1]** and **k[0]** are interchangeable and **p4[1]** through **p4[5]** map into the array **k**.

The use of the pointer **year** takes the same idea further and allows **year** to be used like an array with subscripts ranging from 1983 to 1987. The same idea would allow an array to have subscripts -1004 to -1000, simply by initializing a pointer to **&k[1004]**. The following example takes the idea to the extreme.

```
#include <stdio.h>

int k[] = {1, 2, 3, 4, 5};

main()
{
    int *p5 = &k[-1000000];

    printf("array p5 = %d %d %d %d %d\n",
        p5[1000000], p5[1000001],
        p5[1000002], p5[1000003],
        p5[1000004]);
}

array p5 = 1 2 3 4 5
```

The last two examples initialize pointers to addresses outside the range of actual elements; in the last one, we are one million elements outside the array **k**. Not only is this location outside our program's address space, but it may be outside the machine's address space (at least for some 16-bit systems).

Is this approach portable? My feeling is that it is, at least for well-behaved machines such as 16- and 32-bit 2's complement CPUs. Here, address arithmetic is unsigned such that subtracting 10 from address 6 gives, not -4, but a very large unsigned address. The address arithmetic wraps around at both the high and low end.

In the case of **p5** above, we don't care to what address **&k[-1000000]** corresponds as long as when 1000000 is added to it, we get **&k[0]**. While this may not be the case on every conceivable machine (segmented architectures may cause problems), it works well on many common ones and I would be happy to hear from you if you can show me a system where it fails.

The rule to remember here is that a pointer expression

can contain any valid address for a machine's address space. Whether that memory location physically exists or you have access to it is irrelevant unless you want to access it. (In ANSI C parlance, we call accessing the location pointed to as dereferencing the pointer expression.)

Multidimensional Arrays

C places no limit on the number of dimensions (or their size) an array can have; it's simply a matter of available memory. In C, a multidimensional array is stored in row-major order. For example, `a[2][3][2]` is stored as a list of 12 elements in the subscript order 0/0/0, 0/0/1, 0/1/0, 0/1/1, 0/2/0, 0/2/1, 1/0/0, 1/0/1, 1/1/0, 1/1/1, 1/2/0 and 1/2/1.

In all cases, the name of an array is treated as the address of the first element, when used in an expression. Because an n-dimensional array is an array of arrays of arrays . . . etc., there's nothing special about them versus arrays of one dimension.

Note that the identity allows us to arbitrarily subscript a pointer to one level. For any given pointer, we only can add one dimension reference to that pointer, no more.

```
#include <stdio.h>

main()
{
    static int a1[] = {3, 4, 5, 6};
```

```
static int a2[] = {1, 7};
static int a3[] = {0};
static int a4[] = {2, 8, 9};

static int *pa[] = {a1, a2, a3, a4};

printf("(pa[0])[2] = %d\n", (pa[0])[2]);
printf(" pa[0][2] = %d\n", pa[0][2]);
printf(" pa[1][0] = %d\n", pa[1][0]);
printf(" pa[3][0] = %d\n", pa[3][0]);
printf(" pa[3][2] = %d\n", pa[3][2]);
}
```

```
(pa[0])[2] = 5
pa[0][2] = 5
pa[1][0] = 1
pa[3][0] = 2
pa[3][2] = 9
```

The expressions `(pa[0])[2]` and `pa[0][2]` have the same effect because according to the precedence table, multiple `[]` operators associate left to right. This is the same order forced by adding the grouping parentheses. (Note that `[]` is an operator and as such, has precedence. As a matter of interest, is this a unary or a binary operator? Also note, that the `()` listed at the top of the precedence table represent the function call operator as used in `f()`. They aren't grouping parentheses.)

The array `pa` is an array of pointers; therefore, `pa[m]` is a pointer, and according to our identity, pointers can be subscripted to one level. The pointer `pa[m]` can be subscripted giving `pa[m][n]`. In the case of `pa[3][2]`, this translates to `a4[2]`, which is 9, because `pa[3]` points to the start of the ar-

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“

C requires that arrays be passed by address. The address of the first element is passed by value such that the called function can map into the array.

”

ray **a4**. Now we have two-dimensional array references when no such array has been declared.

While we're dissecting multidimensional arrays, let's take a look at a program that calculates the size of each dimension of an array by knowing only the number of dimensions and the type of the array's elements.

```
#include <stdio.h>

main()
{
    int i[2][3][4];
    unsigned dim1, dim2, dim3;

    dim3 = sizeof(i[0][0])/sizeof(int);
    printf("dim3 = %u\n", dim3);

    dim2 = sizeof(i[0])/(dim3 * sizeof(int));
    printf("dim2 = %u\n", dim2);

    dim1 = sizeof(i)/(dim2 * dim3 * sizeof(int));
    printf("dim1 = %u\n", dim1);
}

dim3 = 4
dim2 = 3
dim1 = 2
```

And, **i[0][0]** is an array of four elements, so **sizeof(i[0][0]) / sizeof(int)** is 4. Note that the type of **i[0][0]** isn't **int ***; it's **int (*p)[4]**. In other words, **p** is a pointer to an array of 4 **ints** and **sizeof(*p)** is **4 * sizeof(int)**.

Similarly, **i[0]** is an array of three elements, each of which is an array of four **ints**. Finally, **i** is an array of two elements, each of which is an array of three elements, each of which is an array of four **ints**.

Note that **dim1**, **dim2** and **dim3** are **unsigned ints**. Is this necessary? Could an array dimension be larger than the largest possible signed **int**? Could it be negative? What's the type of a **sizeof** expression and shouldn't the library function **strlen** return the same type? These questions are related closely and are left as a reader exercise. Perhaps we'll get to them in a future column.

Passing Arrays To Functions

C requires that arrays be passed by address. The address of the first element is passed by value such that the called function can map into the array. Getting back to the reader's let-

ter, this is the same approach taken by FORTRAN; it too passes arrays by address (sometimes called "by reference"). Let's look at some examples.

```
main()
{
    int i[5];
    int j[2][3];

    f(i);
    g(j);
}
```

Here, function **f** is passed the address of **i[0]**. Whether **f** is a C or FORTRAN routine is irrelevant. If **f** is written in C, both **main** and **f** can use array subscripts of 0 through 4. If **f** is written in FORTRAN, it will use subscripts 1 through 5. If the array formal parameter is declared as **INTEGER I(5)** inside **f**, **I(1)** will map into the same location as **i[0]**; you don't have to do anything special for the zero element because it's the first element in FORTRAN.

The call to **g** isn't so simple if **g** is written in FORTRAN. If **j** is declared with the same dimensions in both **main** and **f**, then both functions will deal with it using the correct size, type and number of elements. However, the two functions will map into the array differently. The reason for this has nothing to do with the fact that C starts arrays at subscript zero; it's simply because FORTRAN stores multidimensional arrays in column-major order, while C uses row-major order. For example, C stores **j**'s elements in the order:

```
0/0, 0/1, 0/2, 1/0, 1/1, 1/2
```

while FORTRAN would interpret them as:

```
0/0, 1/0, 0/1, 1/1, 0/2, 1/2
```

(using corresponding C subscripts for the FORTRAN mapping). Clearly, an array reference of **J(1,1)** in FORTRAN maps into **j[0][0]** because both represent the first element in the array. **J(2,3)** also maps into **j[1][2]**, because they both map into the last element. However, all other references don't match as you might wish. There's no way to pass multidimensional arrays to FORTRAN by reference and have it work correctly, unless the FORTRAN routine copies the array into a local array in a different order, processes it and copies it back again. The same is true when calling FORTRAN from COBOL; COBOL, like C, stores arrays in row-major order.

We've discussed array definitions at length in this article. Array declarations, as used in a function's formal argument list, are another matter because they define the mapping to be used with an array passed in by reference. Although they're identical to that of the array's definition, they are independent from it. In fact, C allows the first dimension in such declarations to be omitted, but that's another story.

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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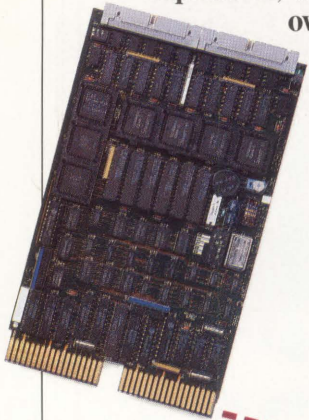
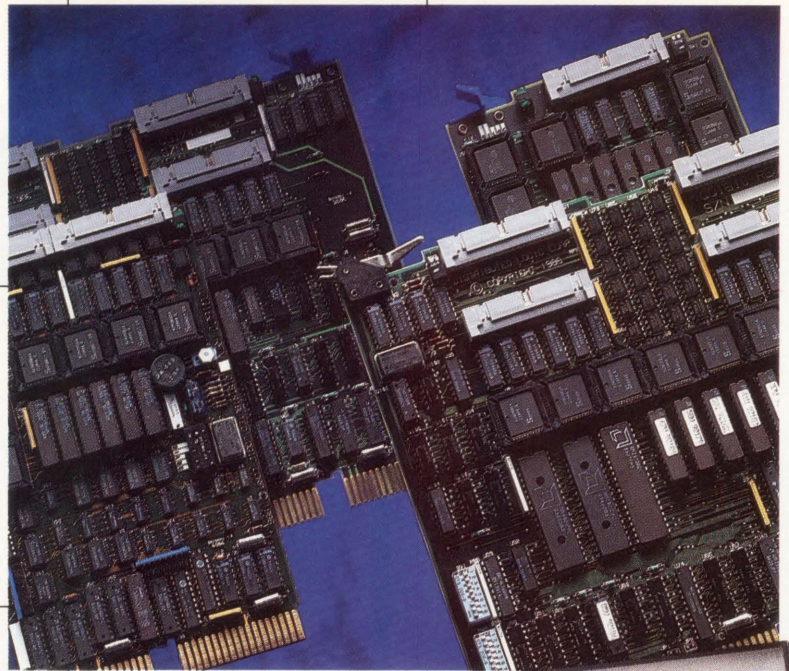
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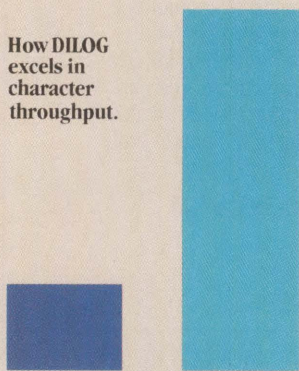
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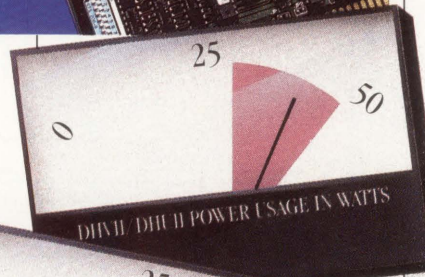
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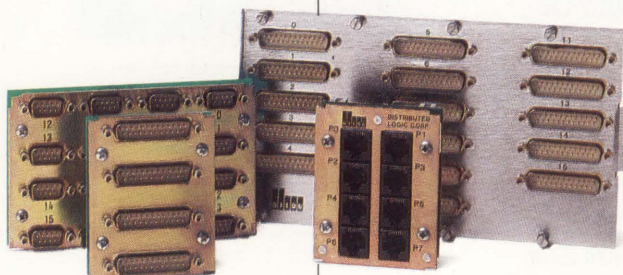
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FROM THE LAB

Dave Mallery

Time Source

What time *is* it? Pardon me, Sir, but *when* did you want an answer? Time has an annoying quality: The closer you look, the faster it goes. Did you want that answer in seconds, milliseconds, microseconds, nanoseconds or picoseconds? Do you care?

People around the globe have cared for more than 60 years. The National Bureau of Standards has been transmitting standardized time signals on precise frequencies for all that time. The technologies have changed, however. Several years ago, we reviewed a clock from Heathkit (see "The 'Ultimate' ASCII Clock," July 1984), and described the NBS coding conventions. However, we were frustrated in actually using the data from that clock by a lack of any software interface to our machine.

Precision Standard Time Inc. (PST), Fremont, California, has changed that. Its Time Source is a two-part product: an integrated time source (radio receiver, logic, display) and a full-featured VMS support suite (system services, DCL level support and monitoring program).

It's hard to write about this product without getting a little philosophical. When we talk about time in the context of this device, we really are talking about seeing exactly the same set of numbers on the face of our display as are appearing on the cesium primary standard that is driving the WWV transmitter in either Fort Collins or Hawaii. Now, that is actually impossible; you can only get close. But, there is an uncertainty factor due to the fact that you're here and it's there and there are many paths over which the information can travel between you and the standard.

You can compensate by program-

ming in a delay time based on the great circle distance between your computer room and each of the two standards, but that's just an approximation, and only available to the nearest millisecond. (To get a very accurate measurement, find a friend with a LORAN either in his airplane or boat.) Those of you who have studied high-frequency propagation know how much of an approximation that number is. The clock will do a yeoman job of synching itself to the received encoded data. The great circle distance is a good minimum offset, but not the maximum. So before we begin to examine the process of getting the "time" into our VAX, we are looking at a number source that is probably synched to the standard with an uncertainty in the tens of milliseconds. What that means is that you are in the right second about 97 percent of the time! Remember, "right" means only that which is on the display at the standard! You can do better by buying your own standard, but that will cost a lot more than your VAX.

But where is this right number in the unit we just hooked up to our VAX? It is in a set of hardware registers that are being decoded and displayed on the

Time Source

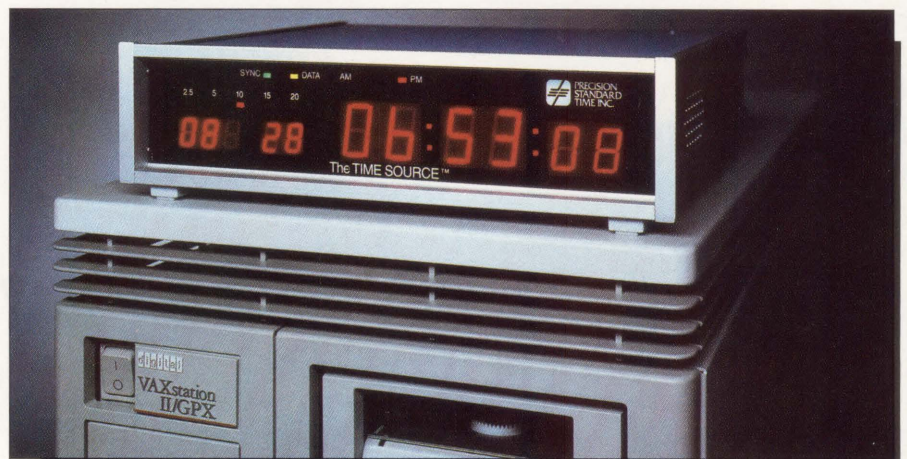
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panel display. The CPU of the clock is a very simple beast. The time required to retrieve the time, convert it to ASCII and ship it out the RS-232 port at a given baud rate is measurable to a much higher accuracy than the deviation of the clock from the standard. So, the delay (say, one millisecond per character) can be added to the number originally in the register to compensate. That is, the time shipped out in response to your query is forward corrected to show the time its terminating carriage return will be presented to the UART on whatever serial interface board you happen to have on your VAX. This, unfortunately, is where we bid farewell to precision.

The only way to solidify the highly



The Integrated Time Source unit can sit astride your VAX and double as your computer room clock!

variable delays available on a busy commercial or scientific VAX is to raise the priority of your task requesting the time to a full-blown real-time process for the duration of the request and response. The system clock monitoring utility supplied by PST does just that.

What I am leading to is that to maintain anything near the accuracy displayed on the face of the PST unit in a time stamp that are given to your program, you must take all the VMS-related latencies into consideration before you announce that you now have WWV accurate time inside your data!

Our Test Unit

The unit itself is quite well built. The quality inside is obvious to the casual inspector. The receiver and the synching algorithm are far superior to the earlier Heathkit clock. We are using an indoor antenna that clamps to a window about 15 feet away from the computer room. Our building is a classic worst case, as outlined in the manual: mostly metal with a power line right outside the window. In spite of these insuperable conditions, the clock does synch up within a few hours. We now have a battery backup connected that is absolutely necessary.

The clock is connected to a DHU port on our MV2 node, FRODO::: Any user on FRODO::: can get the accurate time by simply typing:

```
$ time
```

There is a full set of options for the time command that mirror all the functions in the documentation. Some are restricted to privilege and others, like requesting military time or a given offset from UTC, are freely given.

The full set of commands is available in a run-time library that you can link. You can get the time into your program simply by issuing a call. Remember priority if you want real precision.

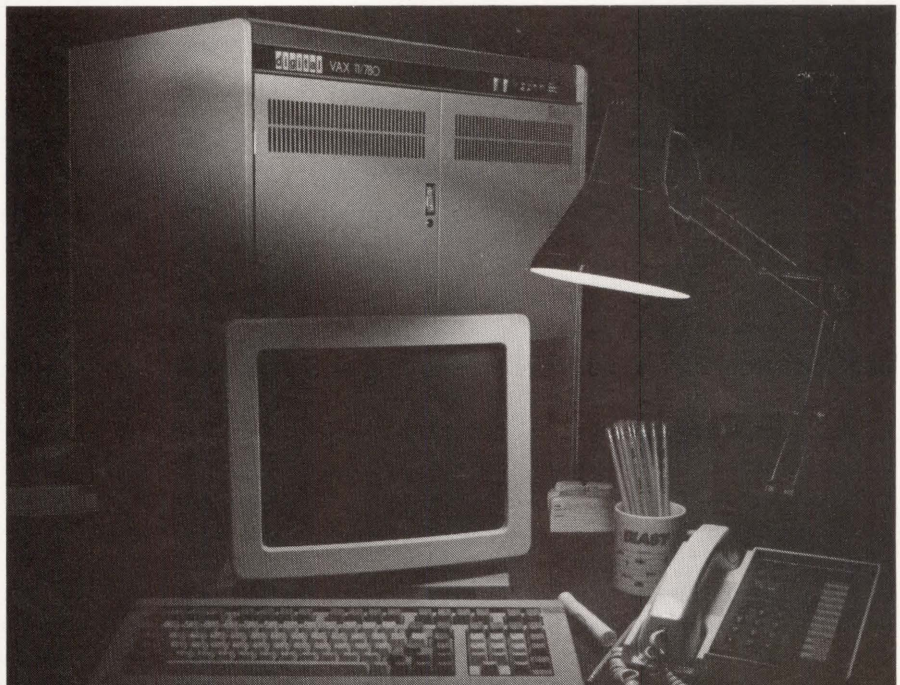
To further expand the utility of our clock, we installed West Coast Editor Phil Naecker's TELL.COM (*VAX PROFESSIONAL*, June 1987, available on ARIS).

Now, any user on another node can simply type:

```
$ TELL FRODO TIME
```

and get the time stamp DECNETed back to him.

The final icing will be a networked clock setting program that will get the time from FRODO and set that node's system clock. This is a truly hi-tech, hi-fun product. I suspect that the need for it is a lot greater than the builders suspect. ■



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FROM THE LAB

David W. Bynon

20/20 Focus For ALL-IN-1

has long been known for its excellent spreadsheet system, 20/20. What makes 20/20 special is that it runs on many different operating systems, including VAX/VMS and MS-DOS.

The company now has taken 20/20 one step further by integrating it into ALL-IN-1, Digital's flagship office system. The 20/20 to ALL-IN-1 integration is seamless, providing all of the integrated functions you'd expect from an ALL-IN-1 product.

Hard-core ALL-IN-1 users will appreciate the GOLD key compatibility and standard menus. VAX/VMS users will like knowing that 20/20 still is accessible from outside ALL-IN-1. And, a new Access product, *The Database Connection*, lets users bring data from VMS databases into their 20/20 spreadsheets (see this month's Product Watch).

ALL-IN-1's interface to 20/20 is implemented using standard FMS forms,

Access Technology Inc., South Natick, Massachusetts,

ALL-IN-1 scripts and DCL command procedures. After installing 20/20 by using the VMSINSTAL command procedure, the ALL-IN-1 integration is performed with another command procedure. The 20/20 to ALL-IN-1 installation is a simple matter of adding new forms to the form library OAFORM.FLB and recompiling the ALL-IN-1 TXLs.

The greatest benefit of the 20/20 to ALL-IN-1 integration is the use of ALL-IN-1's file storage mechanism. This file cabinet is an organization and compatibility tool: files are organized by folder, document and type. The document type is important because it tells the file cabinet how to handle and convert the file.

Because of Access Technology's file-cabinet-level integration, 20/20 spreadsheets can be mailed between ALL-IN-1 users, imported to WPS-PLUS or EDT files, converted to and from VAX/VMS 20/20 spreadsheet files, etc. All of these functions are available from the 20/20 ALL-IN-1 menu (see Screen 1).

The 20/20 to ALL-IN-1 integration

incorporates the ALL-IN-1 GOLD key functions. For example, while you're creating or editing a 20/20 spreadsheet you can use the GOLD-I key sequence to get to the ALL-IN-1 interrupt menu. Other familiar GOLD key sequences include GOLD-F to file, GOLD-K to quit, GOLD-* to display the Scratch Pad Menu and GOLD-H for 20/20 Help.

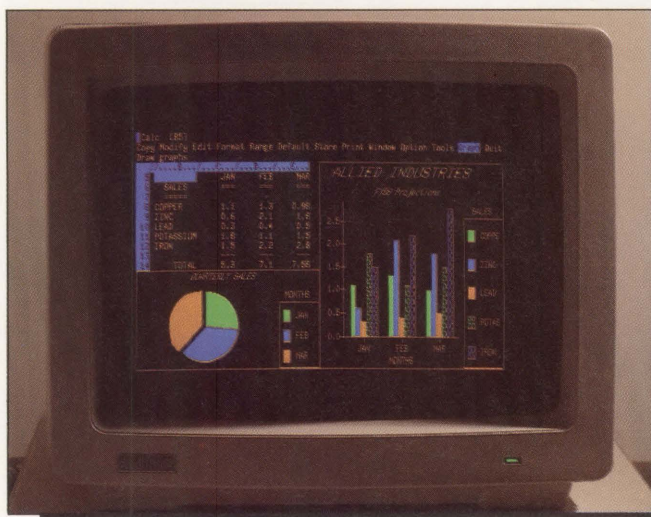
Access Technology's product integration is a fine example of how file-based products like word processors, spreadsheets and database managers can be pulled into Digital's menu system, ALL-IN-1. Bravissimo!

20/20

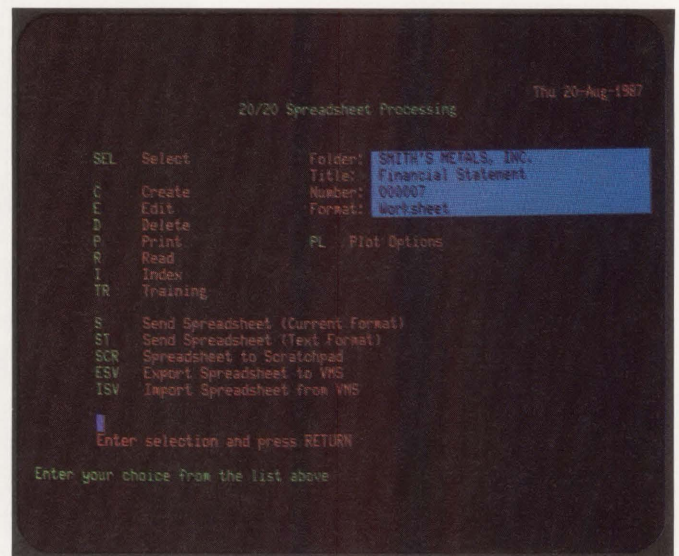
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6 Pleasant Street
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Price: \$300 for the MICROVAX 2000 to \$2,500 for the VAX 8800. Maintenance is free for the first six months; 15 percent of current list price per year thereafter. Quantity discounts available.

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The spreadsheet system, 20/20 enables you to draw graphs, charts, and more.

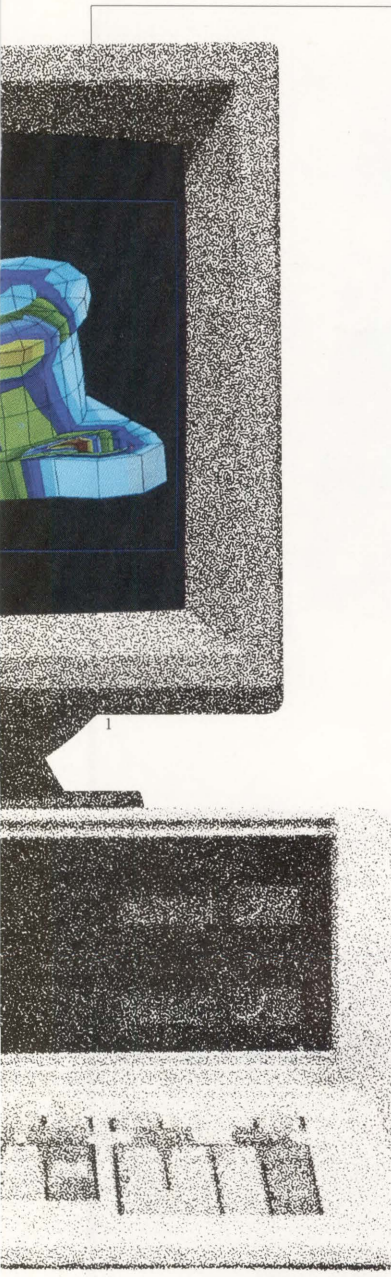


Screen 1: The 20/20 ALL-IN-1 Menu.

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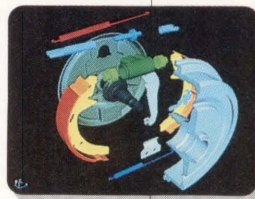
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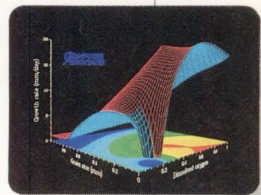
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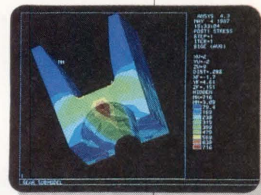
2



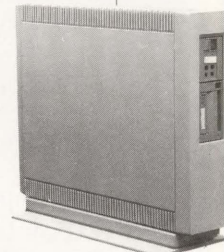
3



4



5



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**FROM
THE LAB**

Dave Mallery

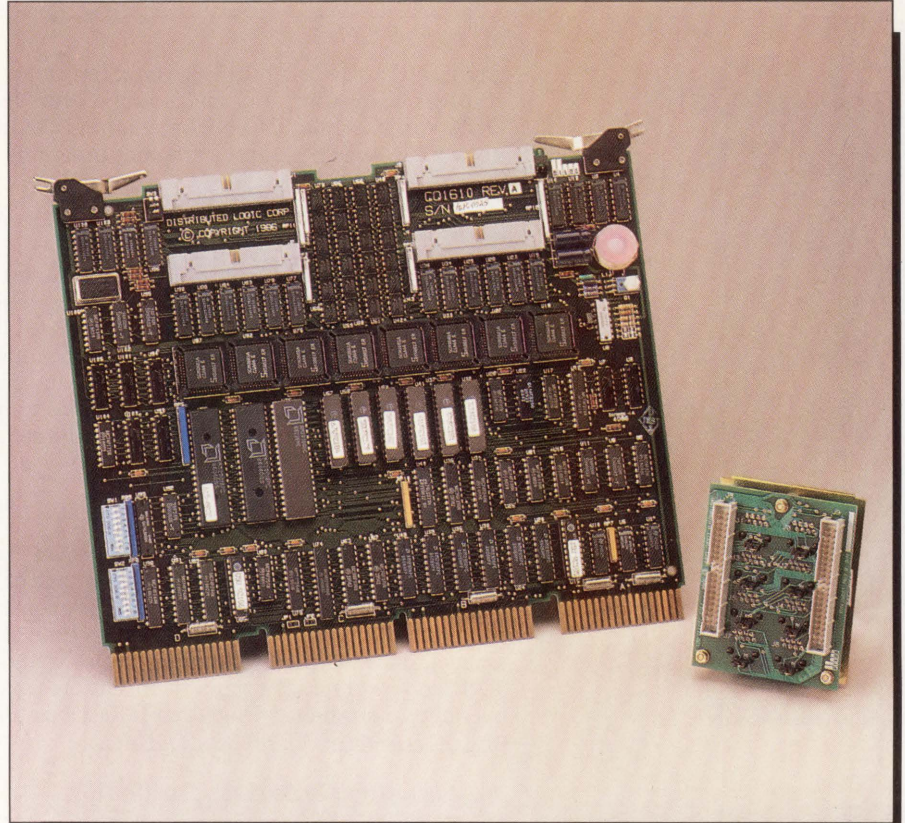
The DILOG Model CQ1610 Controller

The CQ1610 is a dual DHV Q-bus emulation controller from

Distributed Logic Corporation of Anaheim, California. It provides 16 RS232 or RS423 ports that can operate from 50 to 38,400 baud with full modem control on all channels. The card is capable of out-performing the standard DHV because each transmit channel has a 32-character buffer for DMA transfers. When operating, you'll find devices TXA0-7 and TXB0-7 if this is the only such device on your machine.

One feature that appeals to me is the optional, highly compact modular distribution panels. These are compatible with our Modtap building wiring system and all the connectors in the house. Other distribution panels are available.

Configuration required changing the base address and vectors to compensate for existing conflicts. The second UDA controller had a vector at 300. When I asked SYSGEN to configure, it ordered up the secondary address pair:



The Dilog model CQ1610 Communications Controller features an eight-part modular distribution panel.

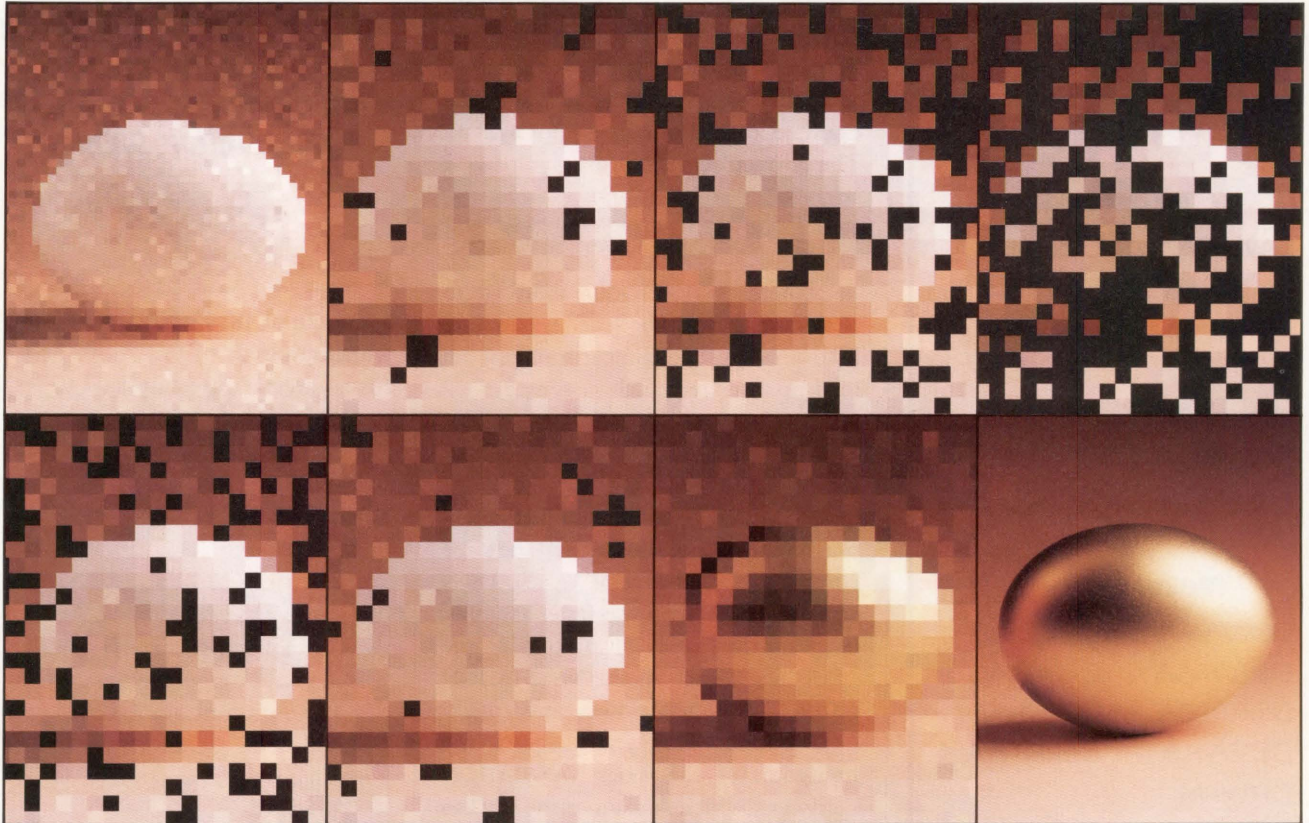
FIGURE 1.

```
$ RUN SYSGEN
SYSGEN > CONFIGURE
DEVICE > uda,2
DEVICE > dhv11,2
DEVICE > <CRTL/Z>
```

Device: UDA	Name: PUA	CSR: 772150	Vector: 154	Support: yes
Device: UDA	Name: PUB	CSR: 760334*	Vector: 300*	Support: yes
Device: DHV11	Name: TXA	CSR: 760500*	Vector: 310*	Support: yes
Device: DHV11	Name: TXB	CSR: 760520*	Vector: 320*	Support: yes
SYSGEN > EXIT				

Configuring the CQ1610 Q-bus multiplexer using SYSGEN.

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760500 and the 310 vector. This is a matter of changing two switches and is well documented (see Figure 1).

What else can you say about a simple device that works? I'd always wanted to try 38.4K operation, but VMS doesn't support it explicitly. All attempts to change the speed to 38.4K failed. DILOG has rigged the device to accept a sneaky combination — 134.5 baud from the host and 4800 baud from the terminal — as a signal to set the beast to 38.4K. The example in the book uses poor syntax. The correct expression is:

```
$SET TERM TXAN:/SPEED=(134,4800)/PERM
```

Then, you set your terminal to 38.4K, and presto! The speed is blinding. I did an interesting comparison. You can load up your terminal by typing:

```
$TYPE *.COM
```

in SYS\$MANAGER. This floods the terminal with output. I compared the same command issued on my VAXSTATION screen. The terminal was faster and only used approximately 10 percent of the CPU. The dump to the VAXSTATION screen was much slower and totally CPU bound. This really shows the limitation of the older VAXSTATION hardware, which consumes the CPU to do the screen. I compared a \$MONITOR SYSTEM/ALL between the two (see Table 1).

It's clear that you pay a lot for that

big screen. Later VAXSTATIONS do more of the work in hardware, liberating the CPU for useful work.

There's something else to remem-

“ One feature that appeals to me is the optional, highly compact modular distribution panels. ”

ber about 38.4K. Don't depend on it to work hundreds of feet from the CPU. Also, you can't use autobaud to set the custom speed.

The DILOG CQ1610 is an inexpensive way to add 16 ports to your MICROVAX II.

Model CQ1610/DHV Communications Controller

Distributed Logic Corporation
 1555 South Sinclair Street
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 (714) 937-5700

Price: \$1,450 for the controller only.
 Quantity discounts available.

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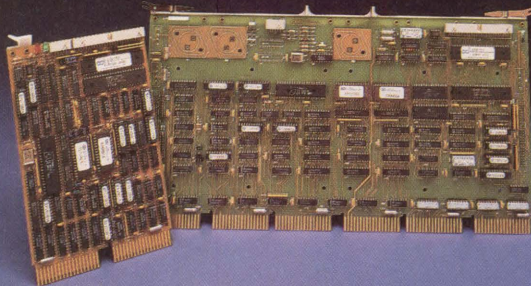
TABLE 1.

Mode	DILOG	VAXSTATION
Interrupt	5%	2%
Kernel	11%	90%
Executive	5%	5%
User	3%	3%

A comparison of the CQ1610 Q-bus multiplexer on a VAX and a VAXSTATION using data from the MONITOR SYSTEM/ALL command.

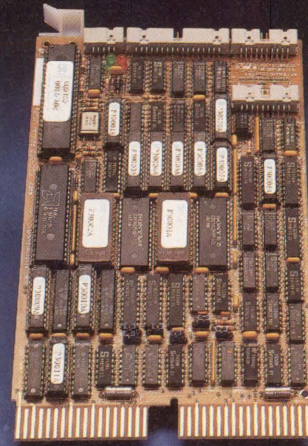
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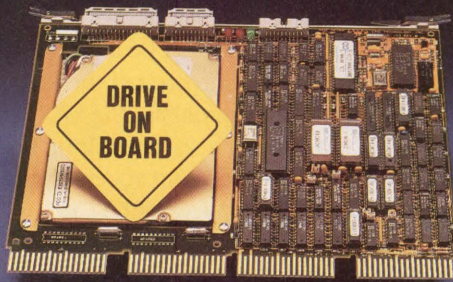
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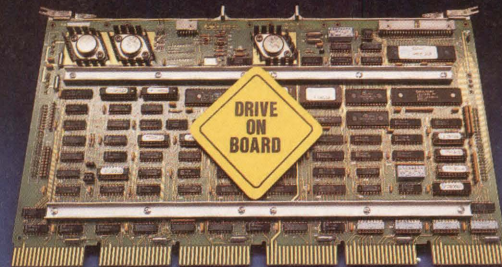
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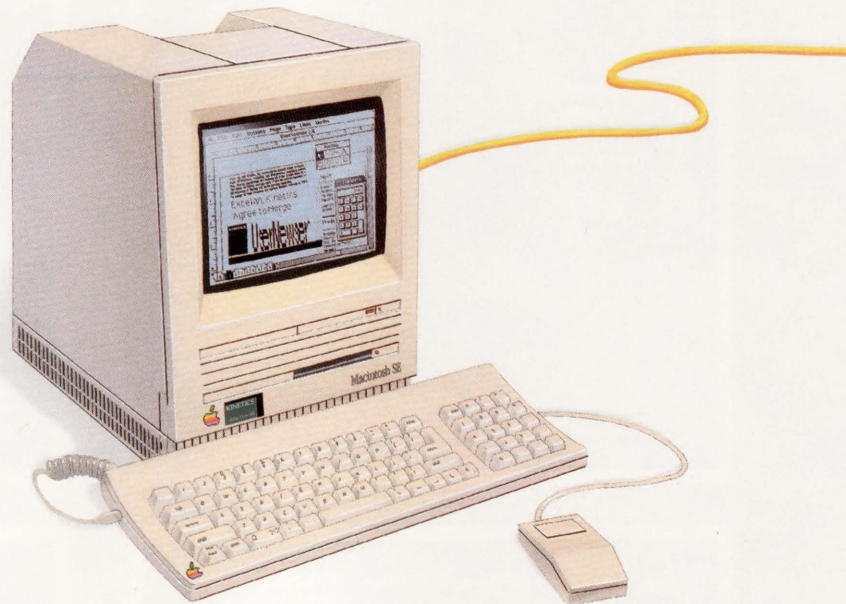
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Mac to Mac



Kinetics advances the connectivity frontier with Ethernet for the Macintosh. Now you get truly faster AppleTalk so your Macintoshes can communicate as high-speed personal workstations. And because we're compatible with the new EtherTalk standard, you can use your standard AppleTalk software packages including file and disk servers, multi-user database systems, and electronic mail.

Enter the high-end of AppleTalk networking with the Kinetics EtherPort SE. With this internal Ethernet option card for the Macintosh SE, choosing Ethernet for applications networking is as easy as clicking a control panel selection.

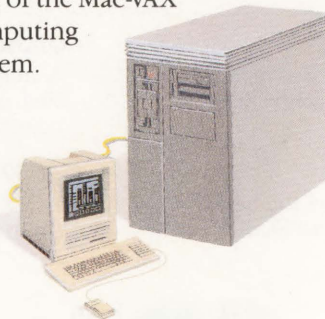
For the SCSI-based Macintosh, including the Macintosh Plus, you can have direct access to Ethernet through the SCSI device chain. Just add on the Kinetics EtherSC, our outboard Ethernet controller.

And to mix-and-match Macintoshes on Ethernet with Macin-

toshes on AppleTalk Personal Network cabling, the Kinetics FastPath AppleTalk-Ethernet gateway connects the two networks. The FastPath acts as a bridge between networks, providing full support for AppleTalk zones.

Mac to VAX

Ethernet is the network of choice in the DEC world. And the Macintosh fits naturally into the DEC world with Kinetics products for the Apple-DEC connection. Your Macintosh on an AppleTalk network, or connected directly to Ethernet, now becomes a vital part of the Mac-VAX computing system.



Let the VAX be a file server for the Macintosh. Let the Macintosh be a terminal for the VAX. Share printing resources along both networks. And access the worldwide services of DECnet.

Kinetics products provide the foundation for the best third party packages adding network values and building on AppleTalk, DECnet, and TCP/IP.

Mac to UNIX



Put together the versatility of the Macintosh and the portable, programmable power of UNIX, and you have an ideal network team. Kinetics unites the two with K-Talk, Kinetics' own AppleTalk for UNIX.

Macintoshes Begin Here. . .

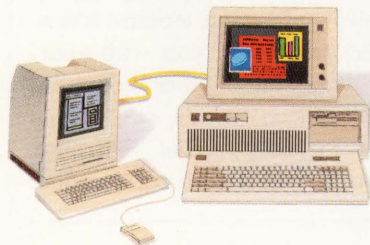


Or simply use TCP/IP on the Macintosh.

Kinetics and our third-party partners offer seamless software built on AppleTalk or TCP/IP to bring the UNIX and Macintosh worlds together. AppleTalk development tools are also available from Kinetics for UNIX programmers who wish to develop custom UNIX-Macintosh solutions. In addition, UNIX system vendors offer special UNIX-Macintosh packages.

Mac to PC

And of course the well-connected Macintosh cannot ignore the IBM PC and compatibles. Whether the PC is on an AppleTalk Personal



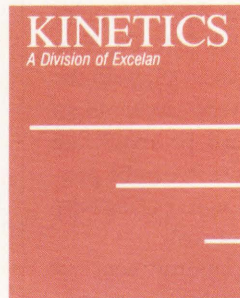
Network connected through the FastPath to Ethernet, or whether the Macintosh shares Ethernet with a PC, the Kinetics open-system family of products ensures high performance and optimum communications.

Mac to Everything

Kinetics already offers Macintosh networking to more systems than anyone else. And now, as part of Excelan, we're united with the leader in TCP/IP-based heterogeneous networking. Together we offer high-performance, host-to-host communication among the broadest range of systems in the LAN industry — VAXes, PCs, UNIX, micros, minis, Macs and mainframes.

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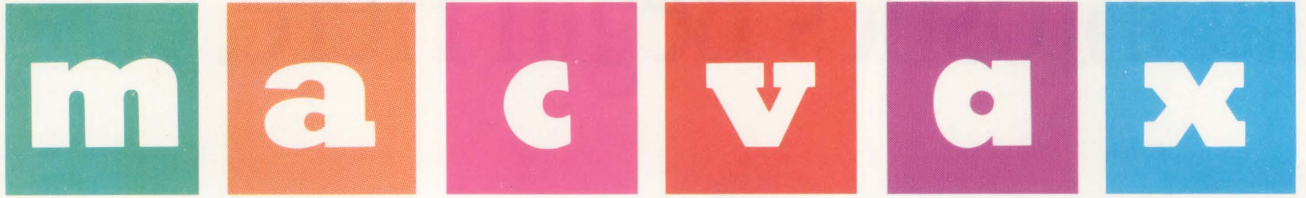
third-party solutions, or the name of the dealer nearest you, please contact Kinetics or Excelan.



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TSSNET

DECNET On The Macintosh.

BY AL CINI

THERE ARE THREE basic ways to network a Macintosh with a VAX/VMS computer: A VAX/VMS system can be programmed to speak Apple's AppleTalk protocol (see "A Tale Of Two Protocols," November 1987); both the Macintosh and the VAX can speak an independent, standard protocol like TCP/IP; or the Macintosh can be programmed to speak Digital's DECNET communications protocol.

Sites with a commitment to DECNET-style networking can consider TSSNET, from Alisa Systems in Pasadena, California. Originally developed by Bill Thursby of Thursby Software Systems, and now marketed by Alisa, TSSNET allows a Macintosh to emulate a DECNET Phase IV end node, either over an asynchronous line or through Ethernet. The product supports both inbound and outbound file transfer and electronic mail operations and an outbound CTERM remote terminal facility. To handle inbound

requests, TSSNET runs in the background behind normal Macintosh applications.

Unlike most Macintosh applications, TSSNET can't be used casually. Some familiarity with elementary DECNET terms and concepts is required.

DECNET: A QUICK REVIEW

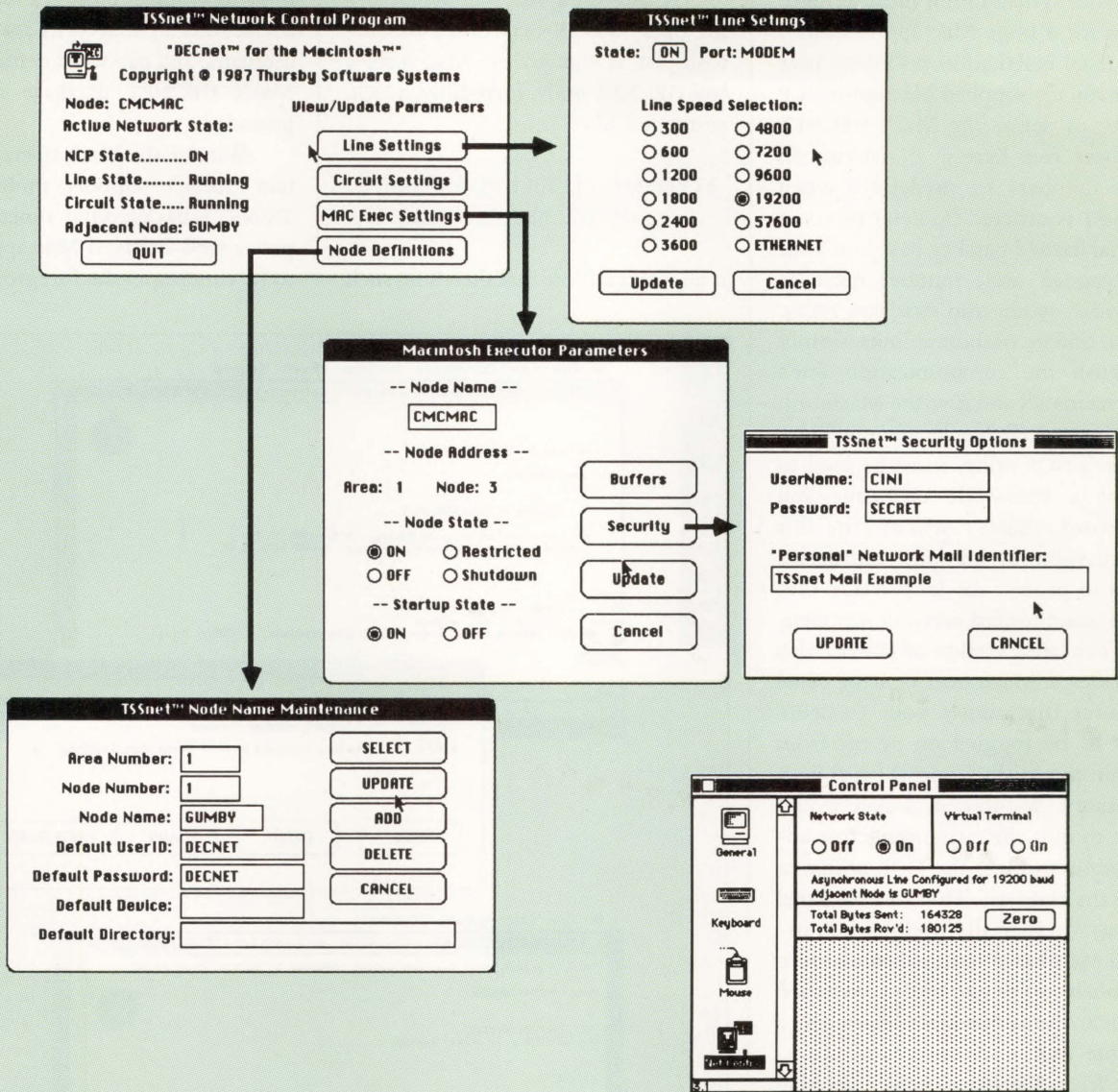
DECNET IS DIGITAL'S standard peer-to-peer networking protocol. Using DECNET, a VMS process that needs something elsewhere in the network (like an RMS file, for example), can connect to a corresponding process running on a remote VAX system (node) to obtain it. The initiating process sometimes is referred to as the *client*, while the responding process is the *server*. To the client system, the DECNET transaction is an outbound link, while the server system sees it as inbound. A multiprocessing VAX

node simultaneously can support a large number of both outbound (client) and inbound (server) links over a single communications line.

DECNET systems are identified uniquely with the network by their 16-bit node numbers. Because numbers are difficult to remember, most DECNET systems also maintain a node directory that equates a six-character name with the numbers of the other nodes in their networks.

When you type a DCL command like `$SET HOST ZEPP0::`, the program you're running on your local machine uses DECNET to establish a link with a process running on the remote node ZEPP0. The remote process, in turn, runs the DECNET object program associated with remote terminal access (CTERM) to provide you with your terminal session. Other common DECNET objects include: MAIL, supporting the exchange of electronic mail messages between users in the

SCREEN 1.



Screen 1. The TSSNET Menu Control Program, showing progression through some related DECNET parameter settings. The Control Panel (lower right) can be selected from within a Macintosh application to monitor DECNET traffic or to toggle the communication line on/off.

network; and the File Access Listener (FAL), allowing access to remote RMS files.

Before DECNET links can be formed, DECNET nodes must know each other's names and numbers. For security reasons, they also may require the exchange of special preassigned passwords to deter impostors. On VAX/VMS systems, the Network Con-

trol Program (NCP) is used by the system manager to define this and other DECNET control information in the local node's DECNET database.

GETTING STARTED WITH TSSNET

TSSNET IS INSTALLED simply by copying three files from its distribution diskette into your Mac's system folder

and then rebooting. The TSSNET init file in your system folder automatically will load ever-present DECNET code into your Mac's heap memory space, occupying approximately 100K of RAM. While TSSNET will work on a 512K Macintosh, 1 MB is a realistic minimum configuration. Even in a megabyte, you might need to use your Mac's control panel to reduce or dis-

able your system's RAM cache to make room for a large Mac application.

After installation, a TSSNET user must run the supplied Macintosh NCP utility to define the Mac's DECNET database (see Screen 1). Macintosh node numbers are predefined when TSSNET is ordered (to deter piracy, a special hashed passkey based on your preassigned node number must be provided when you first run NCP). So, to initiate outbound links, simply establish the communication line's characteristics and give the Macintosh a node name. To handle inbound links, a Mac's NCP utility must be used to define a VMS-style username and password. TSSNET will require this information in inbound file access links to protect the local Mac's files from unauthorized network intruders.

The latest version of TSSNET also provides a Macintosh control panel resource that allows your DECNET state to be toggled on or off from within the Mac's Control Panel desk accessory. Without it, a user would have to quit the currently active application and run the NCP utility to turn the state off. This control panel facility is especially useful when using a Mac-based terminal emulator to establish a dynamically switched asynchronous connection with a remote VAX.

When TSSNET is enabled, its Mail and FAL object software monitor the communication line looking for inbound connect requests, even while you're simultaneously running a Macintosh application. You'll be notified of incoming electronic mail with a Mac-beep, while remote access to your Mac's files will be satisfied invisibly.

Incoming mail messages may be directed either to the username you specified to TSSNET's NCP utility or to the username SYSTEM. Received mail automatically is stored in special folders corresponding to those found in VMS Mail.

A user on a VAX can access any file on a TSSNET-networked Macintosh just as though the Mac were a real DECNET node. Incredibly, a DCL command like:

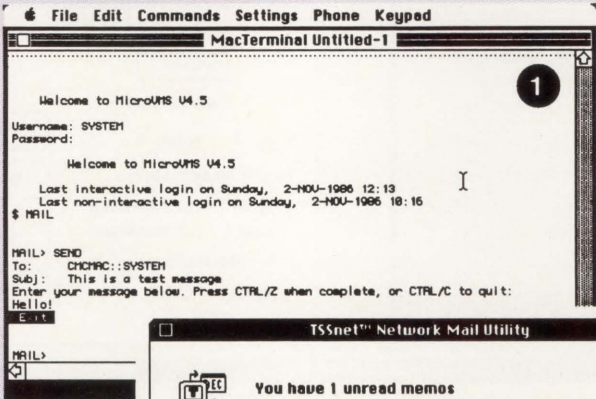
```
$TYPE MAC"USER PWD":DISK:
[FOLDER.FOLDER]FILENAME
```

is all it takes. Note that there's no such


thing as a default DECNET account on a Macintosh. For security reasons, the username and password defined in the Mac's DECNET database must be provided.

Because the Mac's operating system doesn't support multitasking, TSSNET's background functions expect a well-behaved Mac application to be running in the foreground. For

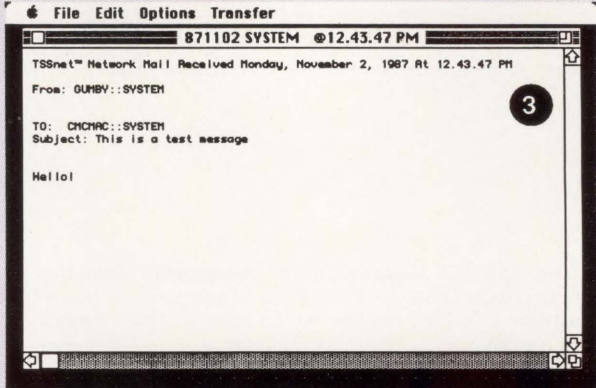
SCREEN 2.



MacTerminal window showing a login session. The text includes: 'Welcome to MicroVMS V4.5', 'Username: SYSTEM', 'Password:', 'Welcome to MicroVMS V4.5', 'Last interactive login on Sunday, 2-NOV-1986 12:13', 'Last non-interactive login on Sunday, 2-NOV-1986 18:16', '\$ MAIL', 'MAIL> SEND', 'To: CHICAC::SYSTEM', 'Subj: This is a test message', 'Enter your message below. Press CTRL/Z when complete, or CTRL/C to quit:', 'Hello!', 'E I T'. A circled '1' is in the top right corner.



TSSnet Network Mail Utility window. Text: 'You have 1 unread memos and you have no unsent messages pending.' Buttons: READ, CREATE, SEND, NEW FOLDER. A circled '2' is in the top right corner.



TSSnet Network Mail Received window. Text: 'TSSnet Network Mail Received Monday, November 2, 1987 At 12.43.47 PM', 'From: GUMBY::SYSTEM', 'TO: CHICAC::SYSTEM', 'Subject: This is a test message', 'Hello!'. A circled '3' is in the top right corner.

Screen 2. An example of TSSNET electronic mail. Logged in on the VAX through MacTerminal (1), a user sends VMS mail addressed to the Macintosh. A Macintosh "Beep" signals receipt of MAIL (2) and the TSSNET NETMAIL utility offers a READ option. The received mail message appears in a TSSNET EDIT window (3), from which it can be modified, forwarded, deleted or stored in a MAIL folder. Note that TSSNET mail messages can be prepared off-line and sent later in batches.

TSSNET's purposes, "well-behaved" means written as an event loop with frequent calls to the Mac operating system's "system task." A CPU-intensive application can block TSSNET, delaying mail and file access operations, until it's completed.

TSSNET provides two mouse-launched Macintosh network access programs: NETMAIL and NETCOPY.

NETMAIL can be used either to send or read electronic mail (see Screen 2). NETMAIL also supports mailing lists and message forwarding. Mail messages are exchanged as text-only character streams; no graphics or composite documents are allowed. A supplied TSSNET EDIT utility automatically is invoked by NETMAIL to read, create and modify mail messages. The EDIT utility also can be used separately as a general editor for any text-only Macintosh files.

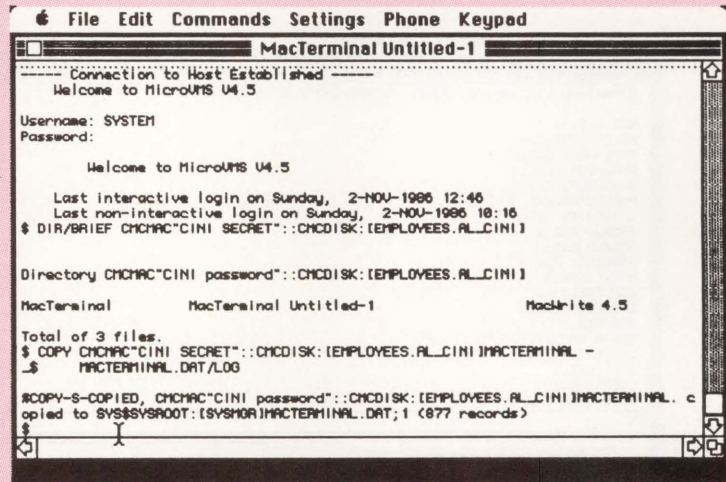
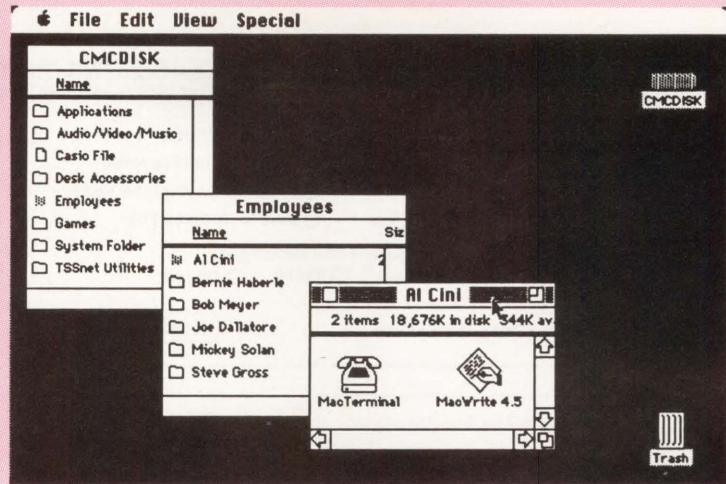
The NETCOPY program allows the Macintosh user to initiate DECNET file transfer and directory operations (see Screens 3a and 3b). Files may be copied to or from a remote VAX. Incoming VAX-based RMS sequential text files automatically are converted to text-only Macintosh documents and vice versa. Standard text editors or word processors can be used at either end to read and edit them.

Binary files on the Macintosh are stored in MacBinary format on the VAX as RMS sequential files with fixed-length, 128-byte records. Similarly, files in this format transferred from the VAX to a Macintosh will be converted to a standard Macintosh file, resource fork and all. Thus, a VAX may be used as an intermediate storage location for files of any type exchanged between TSSNETworked Macintosh systems.

Other NETCOPY options include printing text files on remote system printers and submitting text files as remotely executed batch jobs.

A third TSSNET facility transparently supersedes standard

SCREEN 3a.



Screen 3a. Macintosh folder organization (top) translates to VAX/VMS DEV:[DIRECTORY] syntax (bottom).

Macintosh serial port driver logic with a DECNET heterogeneous command terminal (CTERM) packet-handling module (see Screen 4).

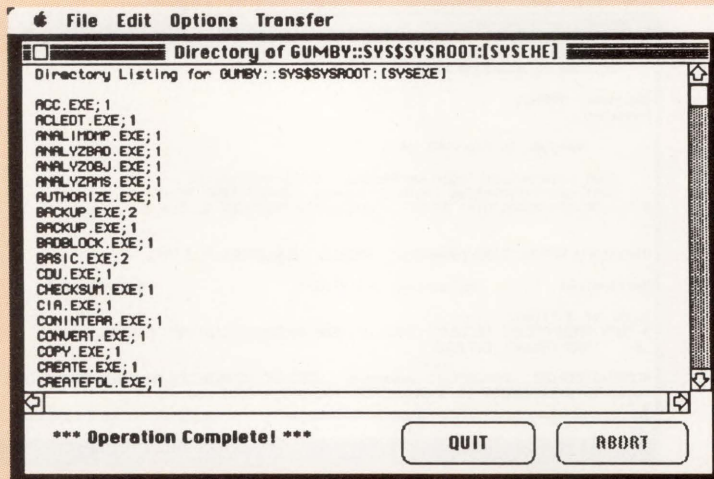
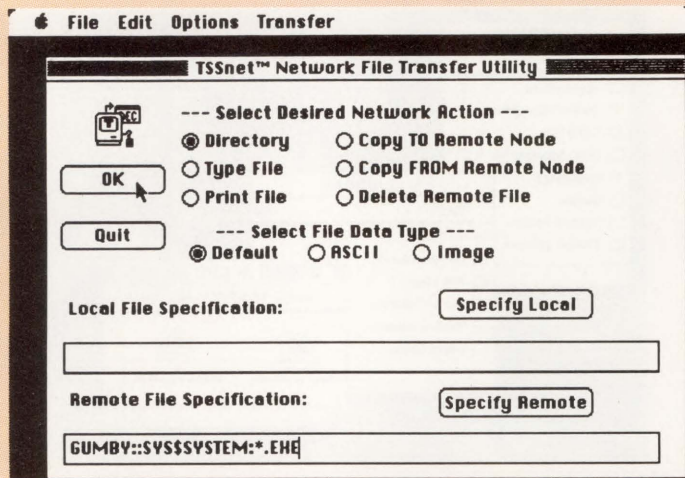
TSSNET WILL WORK through Ethernet or over an asynchronous twisted-pair connection.

Supported Ethernet equipment includes Kinetics' EtherPort SE card for the Macintosh SE and the Ether/SC SCSI-to-Ethernet communications controller. At press time, Apple's EtherTalk card for the Macintosh II

wouldn't support TSSNET, because the card's driver didn't provide the program-controlled Ethernet address assignment and multicasting capabilities that DECNET requires.

TSSNET also will work asynchronously through either of your Mac's serial ports, at speeds from 300 to 19,200 baud. The corresponding VAX/VMS asynchronous port either can be statically allocated or dynamically switched. Keep in mind that DEC presently doesn't support asynchronous DECNET through DEC

SCREEN 3b.



Screen 3b. The TSSNET NETCOPY utility (top) is used to produce a brief VAX/VMS directory (bottom).

Companies Mentioned In This Article

Alisa Systems Inc.
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Apple Computer Inc.
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Cupertino, CA 95014
(408) 996-1010
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Computer Methods Corporation
525 Route 73 South
Marlton, NJ 08053
(609) 596-4360
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Kinetics Inc.
2500 Camino Diablo
Walnut Creek, CA 94596
(415) 947-0998
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easily can cause confusion. A few more examples would help, particularly of VAX/VMS commands accessing Macintosh files.

I used a beta-test release of TSSNET V1.2 to write this article. Problems with earlier versions, including node and executor database corruption, DECNET "DAP" file transfer failures and Macintosh hang/crash conditions, appeared to be resolved in TSSNET's latest release. Despite an occasional CTERM crash under MacTerminal, TSSNET performed very nicely.

It takes quite a bit of planning to use TSSNET in a DECNET network, but this is the fault of DECNET and not TSSNET. Despite its complexities, TSSNET/DECNET offers the advantage of easy integration into an existing DECNET network. It also opens the door for VAX/VMS-initiated file access to your networked Macintosh

terminal servers or LAT devices.

It doesn't take in-depth DECNET knowledge to establish your Macintosh as a TSSNET node, but some general familiarity is required. Mac users with no DEC background will need help getting started, so if you're planning an extensive commitment to TSSNET, include user training and support in your network plans.

Don't underestimate the work required on the VAX end, either. Node names/numbers for your networked Macs will have to be added to your DECNET database, and any asyn-

chronous communication ports will have to be defined and enabled.

The TSSNET manual is well organized and easy to follow. If you can type a DECNET NODE::USER specification, the product's Mail and CTERM functions can be applied with almost no reference to the manuals at all.

File transfer functions, on the other hand, can be a little tricky. Despite the close correspondence between Macintosh folders/filenames and VMS directories/filenames, slight differences in semantics and syntax

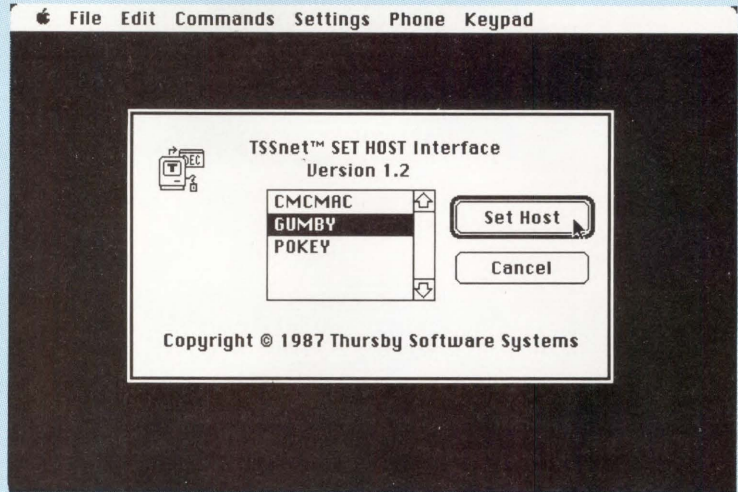
systems. Imagine a VAX batch job running periodically, automatically backing up your critical Macintosh files to a VAX/VMS disk.

TSSNET also can be used in conjunction with other VAX/VMS networking products on the same Macintosh, such as Alisa's AppleTalk-based AlisaTalk (the complementary nature of their products prompted Alisa's joint venture with Thursby), offering the best of both protocols. Just make sure your Mac has enough memory.

To DECNET or not to DECNET, that is the question. If you decide to DECNET your Macintoshes, you should take a good look at TSSNET.

Editor's note: A special thank you to Computer Methods Corporation and Kinetics Inc. for supplying the necessary equipment to prepare this series of articles on MAC/VAX connectivity. ■

SCREEN 4.



Screen 4. TSSNET's CTERM facility transparently front-ends the standard Macintosh serial driver to provide DECNET \$SET HOST -style remote terminal services. TSSNET automatically displays a selection dialog (shown above as MacTerminal is launched), requesting the name of the target DECNET host system.

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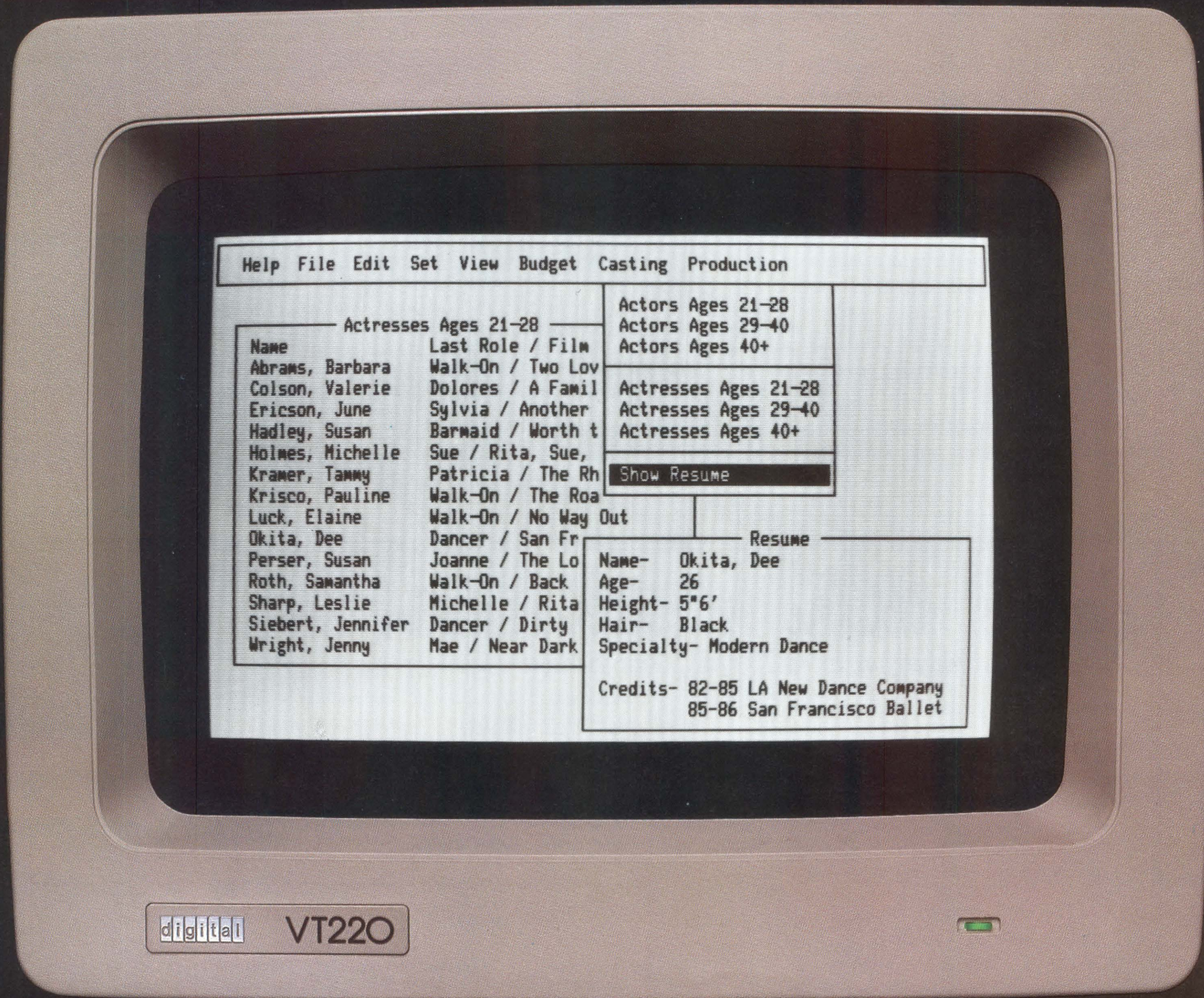
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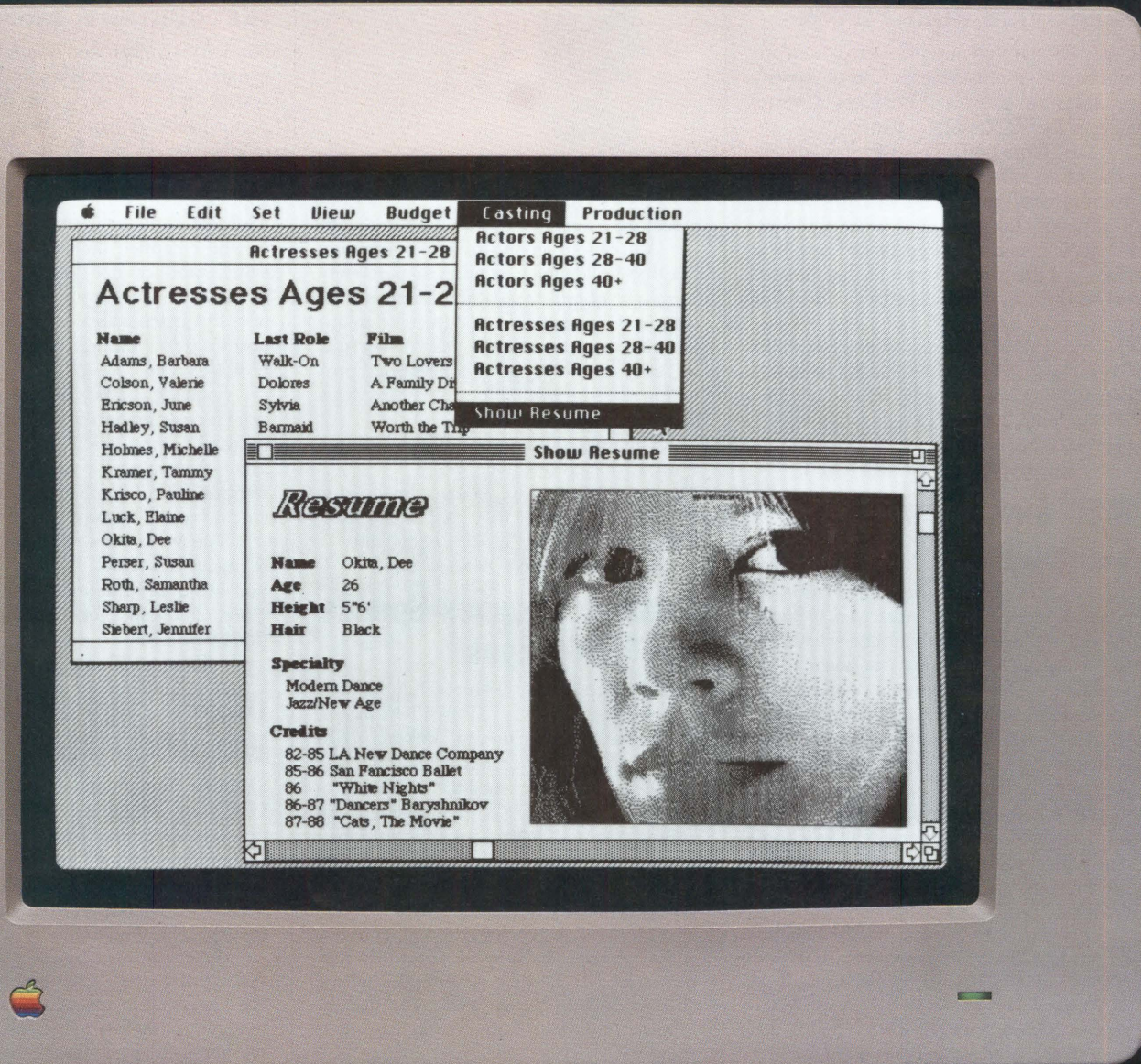
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Clyde Digital And Dial-Guard Join Forces

Clyde Digital Systems and Dial-Guard announced a joint marketing effort of security products to provide an Access Control System for VAX/VMS systems.

Dial-Guard offers a device that authenticates host system access by inputting the user password and ID and inserting a Dial-Key identity token into the device at the terminal. It generates an encrypted one-time password that authenticates the user's identity to the host interface software furnished by Clyde.

To obtain more information, contact either Clyde, Inc., 371 East 800 South, Orem, UT 84058; (801) 224-5306, or Dial-Guard, Inc., 55 Koch Rd., Corte Madera, CA 94825; (415) 927-2232.

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MEC Simplifies Scheduling

Microsystems Engineering Corporation has released MASS-11 Calendar Management. Instead of playing telephone and scheduling tag, users can find a time slot when all invitees are available. Any number of users can access MASS-11 Calendar on a VAXcluster.

Calendar users can prioritize their schedules by labeling appointments as major, routine, tentative, or personal. Daily, weekly and monthly repetitive appointments can be added to the user's schedule automatically. Continuous reminders can be set up and past calendar information can be archived.

Pricing is \$5,750 for VAX 8500s and larger; \$2,875 for VAXs between 11/780 and 8300, and \$1,850 for the MicroVAX II, 11/730 and 11/750. Software for the VAXstation 2000 is priced at \$995. The PC version of the product sells for \$195.

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

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OPS83 Offers Speed And Flexibility

Production Systems Technologies Inc. recently announced OPS83, an expert system programming language. It's available in versions compatible with MS-DOS, 68000-

based, supermini and mainframe computers.

All versions are the full implementation of OPS83, allowing easy program portability from one system to another. Because it's a compiled language, the code size of an application program is small. It's written in C and conforms to C calling conventions, providing easy interfacing to programs written in other languages.

The OPS83 software package is priced from \$2,000 to \$30,000.

For more information, contact Production Systems Technologies Inc., 5001 Baum Blvd., Pittsburgh, PA 15213; (412) 683-4000.

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Gateway Reaches Speeds Up To 800 kpbs

Interlink Computer Sciences Inc. has announced a 32-bit, MicroVAX-based, channel-attached gateway linking IBM mainframes and DECnet networks. The gateway is capable of data throughput rates of approximately 800 kbps and supporting approximately 128 simultaneous sessions.

The 3732 Gateway (model 400) is based on DEC's MicroVAX II CPU and uses DEC's MicroVMS operating system.

The 3732 is a combination of hardware and software. The network controller may be attached to a block or byte multiplexer channel and on the network side may be Ethernet, asynchronous or synchronous protocols.

The 3732 Network Controller features task-to-task communications, network management and a variety of DECnet hardware interfaces, an English-like operator interface, a MicroVAX hardware and software base and an internal architecture conducive to future growth.

Price for the network controller and master Interlink software is \$69,950.

To learn more, contact Interlink Computer Sciences Inc., 47370 Fremont Blvd., Fremont, CA 94538; (415) 657-9800.

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Numerix Introduces IVP Software System

Numerix Corporation announced the Integrated Vector Processing (IVP) software system for its family of 32-bit, high-performance Attached Vector Processors (AVPs).

From the implementation point of view, application programs that contain character variables, read, write and format statements can be compiled directly using IVP. This system produces one executable file that runs in the AVP. During program execution the host I/O statements are mapped back to the host via jacket routines, which then evoke the host I/O calls.

Some of the key features of IVP software include support of the Digital integrated network, compilation of application programs containing almost any FORTRAN 77 features or VAX/VMS extensions, and simultaneous use of the host and AVP debuggers.

The Model 4541 IVP software system is priced at \$4,500.

For more information, contact Numerix Corp., 20 Ossipee Rd., Newton, MA 02164; (617) 964-2500.

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DISKIT 2000 Defragments VAX/VMS Disks

Software Techniques Inc. and UIS of the U.K. have introduced the next generation disk structuring software that features fully automatic operation and new levels of performance and security. DISKIT 2000 gives VAX system managers freedom from file and free space fragmentation problems.

Automatic operation is achieved through the use of a flexible integral scheduler that lets the system manager set daily or weekly operations, run intervals and start/stop times without using batch files. DISKIT 2000 runs as a spawned background process that restructures mounted disks in harmony with normal user and VMS operations.

Learn more by contacting Software Techniques Inc., 6600 Katella Ave., Cypress, CA 90630; (714) 895-1633.

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Network Innovations Introduces Multiplex/XL

Network Innovations has introduced Multiplex/XL. With Multiplex/XL, a Micro-

soft Excel user requests host application data by entering industry-standard SQL queries directly into the spreadsheet. Alternatively, the user can select from a pull-down menu containing a list of predefined host database requests. After the query has completed execution, Multiplex/XL creates a new Microsoft Excel document containing the query results, or query results can be brought directly into the current spreadsheet.

Multiplex/XL is list priced at \$99 per PC. It works with the Multiplex host software, available on a variety of multiuser host systems for license fees ranging from \$3,000 to \$18,000.

Additional information can be obtained from Network Innovations, 20863 Stevens Creek Blvd., Cupertino, CA 95014; (408) 257-6800.

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MATRIX 1 Performs 3-D Analysis

Saxpy Computer Corporation has announced the sale of a MATRIX 1 supercomputer to Pulsonic Geophysical Ltd. of Calgary, Alberta. The MATRIX 1/250 provides a peak performance of 250 million floating point operations per second (MFLOPS). It also offers a familiar user interface because it operates in the VAX/VMS environment.

The SIMD (single-instruction, multiple-data) system architecture of the MATRIX 1 reduces the I/O bottlenecks characteristic of previous generations of supercomputers, thereby permitting higher sustained levels of performance. The system's sustained running rate is approximately 200 MFLOPS.

The MATRIX 1 is priced from \$896,000 to \$1.8 million. A fully outfitted configuration, including a MATRIX 1/1000, costs approximately \$4 million.

To obtain more information, contact Saxpy Computer Corp., 255 San Geronimo Way, Sunnyvale, CA 94086; (408) 732-6700.

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GEN/COMP's Model 2142 Now Available

A DMA interface and interprocessor link that provides hardware parity with 18- or 22-bit addressing and switch-adjustable DMA pacing has been introduced by GEN/COMP Inc.

The Model 2142 DMA interface and interprocessor link emulates the DEC DR11-W, DR11-B and DA11-B and connects a high-speed digital I/O device to the Q-bus linking two Q-bus computers. Featuring 18- or 22-bit addressing and complete software compatibility, it provides two means of accessing the Bus Address Extension Register and uses DIP switches for ease of setup.

Model 2142 provides switch-selectable DMA pacing and one- to four-cycle burst lengths to improve system performance by conserving the UNIBUS bandwidth. Hardware parity and optional on-board optoisolators provide error-free, long-line data transmission.

The GEN/COMP Model 2142 DMA interface and interprocessor link costs \$850. For more information, contact GEN/COMP Inc., Six Algonquin Rd., Canton, MA 02021; (617) 828-2008.

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Teradata Interfaces To VAX/VMS Systems

Teradata Corporation announced a version of its host software, the VAX Interface, that allows a broad range of VAX systems to access a DBC/1012 Data Base Computer System across an Ethernet local area network. Multiple IBM and DEC hosts can access and manipulate the same data concurrently, and at the same time, offload a large amount of the database management system processing overhead.

The VAX Interface allows users and applications, running on VAX/VMS systems, to take advantage of the power of the DBC/1012's high-performance SQL RDMS. Teradata's VAX Interface runs on any VAX processor that supports the VMS or MicroVMS operating system release 4.4 or higher.

Pricing for all 8000-series VAX systems

is \$10,000, and \$4,000 for all other VAX products.

To learn more, contact Teradata Corp., 12945 Jefferson Blvd., P.O. Box 92117, Los Angeles, CA 90009; (213) 827-8777.

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VAX/Mini Market Opening For Resellers

A new PC-style communications software package for minicomputers recently has been announced. VAX BLAST II, from Communications Research Group, lets VAXs dial out to PCs and control the total session: dialing out, logging on, accessing and manipulating files, executing commands and transferring data error-free. BLAST II lets the VAX follow a script of macro instructions and access other computers on a peer basis. It also automatically can retrieve selected files or distribute data to remote sites.

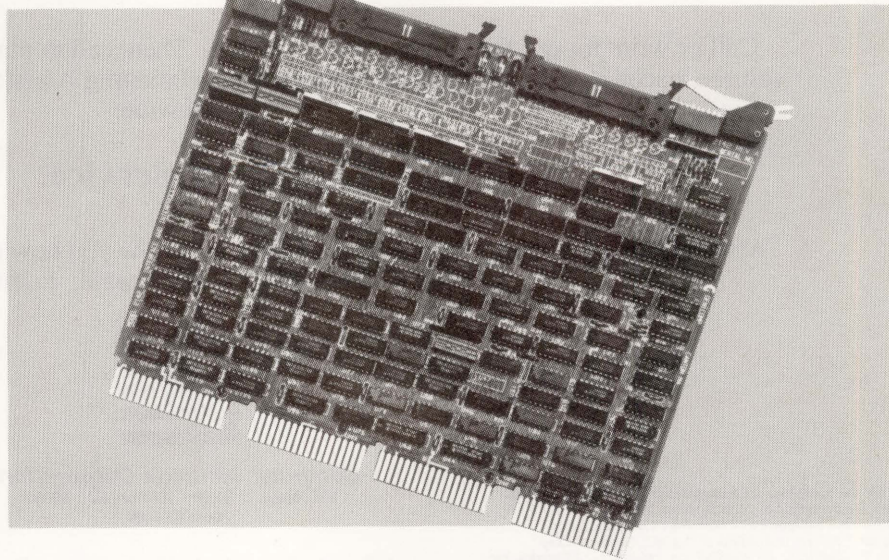
Find out more by contacting Communications Research Group, 5615 Corporate Blvd., Baton Rouge, LA 70808; (504) 923-0888. TELEX: 759985.

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SmartNet 376 Introduced By PCI

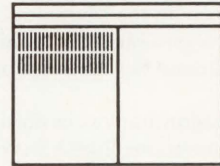
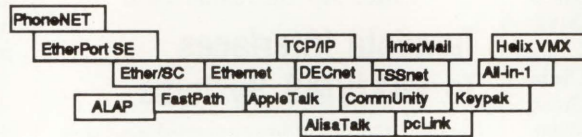
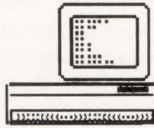
Protocol Computers Inc. (PCI) has announced SmartNet 376, an easy-to-use, high-performance networking tool that provides ASCII-to-SNA/SDLC communications through an X.25 network.

SmartNet 376 allows users quickly and easily to connect most ASCII displays, such as VT100/50 and IBM 3101. The SmartNet



The DMA interface and interprocessor link from GEN/COMP provides hardware parity with 18 or 22 bit addressing and switch adjustable DMA pacing.

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376 offers four levels of security, including auto callback and auto logon/logoff. Nine national character sets are supported and up to 32 user profiles can be identified. All configuration parameters are stored in non-volatile EEPROM.

SmartNet 376 comes with eight asynchronous ports and one X.25 link, and is single-unit priced at \$4,875.

To learn more, contact Protocol Computers Inc., 26630 Agoura Rd., Calabasas, CA 91301-1988.

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GigaMos Announces New Hardware Platforms

GigaMos Systems Inc. has announced its real-time interface, RTIME, on hardware platforms. RTIME is a gateway designed to provide a real-time interface between GigaMos's PICON and external process control systems, factory networks or other sources of dynamic data. It provides a connection between an expert system and an external processing system, RTIME selectively accesses the data needed for inferencing and decision-making.

With the availability of RTIME on the IBM/AT and VAX, the system has become hardware independent and accessible on platforms that are used for distributed processes. RTIME can interface approximately 10 external systems, allow interprocess communications, perform preprocessing functions and incorporate customer-developed algorithms.

RTIME is priced at \$12,000.

To learn more, contact GigaMos Systems Inc., 650 Suffolk St., Lowell, MA 01854; (617) 458-9100.

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Time Source Offers Precision Timing

Precision Standard Time Inc. has announced Time Source, a precision timing device with host-resident software that synchronizes the calendar clocks of networked VAXs. The Time Source also can be used as a time reference in standalone applications where coordination or monitoring of activities is critical.

To maintain the VAX calendar clock, the Time Source generates a signal that's within 10 milliseconds of the international time standard, Coordinated Universal Time. The Time Source runs unattended and sets itself when turned on. It can't be set or adjusted by hand.

Single-unit price, including required VMS host software on a nine-track tape, is \$1,495. A component-level model which can be incorporated into the design of computers

and instruments is \$695.

For further information, contact Precision Standard Time Inc., 105 Fourier Ave., Fremont, CA 94539; (415) 656-4447.

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Scan-Graphics Develops Rave

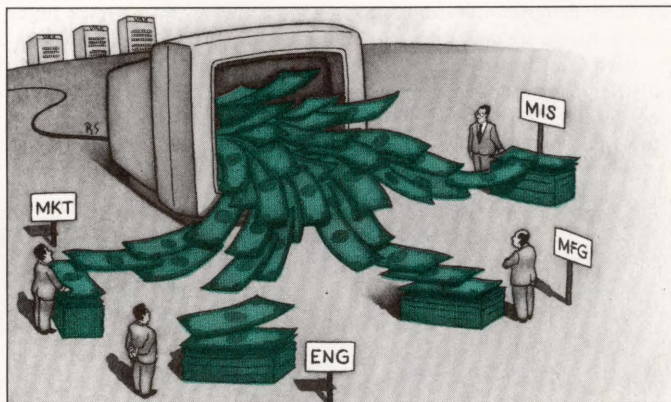
The new Scan-Graphics drawing conversion system, Rave, automatically converts, pro-

cesses and transfers raster (scanned) data from documents, drawings, maps and aperture cards directly to CAD system applications. All conversion (raster to vector) is accomplished automatically in batch mode for efficient use of CPU resources and to permit previously vectorized data to be edited simultaneously.

Rave software is compatible with VAX/MicroVAX and IBM 43XX and 30XX computer systems. Rave interactive software

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CXDB Available For Motorola MC68000/10/20

Whitesmiths Ltd. recently announced CXDB, its interactive C source-level cross debugger for the Motorola MC68000/10/20 family of processors. CXDB is a host-resident debugger available for the VAX and IBM PC, that allows embedded 68K programs to be debugged in terms of the original C source code.

CXDB is a non-intrusive debugger, which means more users can PROM their debugged code without recompiling. On a multiuser system like VMS, CXDB can be used by many programmers, thus saving investment in hardware debuggers. Users can switch between debugging in C or in assembly language to give complete control over the debugging process.

The CXDB allows users to execute host

system commands, print the contents of C variable function or file with or without assembly language display, create log output for later examinations, etc.

Whitesmiths' CXDB is hosted under VMS, PC-DOS, and a number of UNIX-based workstations. Prices for CXDB range from \$1,800 to \$7,000.

Find out more by contacting Whitesmiths Ltd., at 59 Power Rd., Westford, MA 01886; (617) 692-7800 or (800) 225-1030. TELEX: 750246.

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Band Printers Integrate With DEC Systems

Interscience has announced a new family of band printers, 1500 and 2000 LPM, fully plug-compatible with DEC systems. The printers are manufactured by Dataproducts and they use Interscience proprietary interfaces. They offer excellent print quality at heavy-duty cycles. Setup and operation are quick and easy. A swing open gate facilitates paper, ribbon and steel print band changing.

The paper routing system, with four tractors and paper puller, assures reliable unattended operation. A touch-sensitive con-

trol panel including a built-in self-test unit with switch selectable 80- or 132-column multiple pattern program. A built-in self-diagnostic display monitors all electronics and system interlocks.

The 1500 LPM and 2000 LPM printer cost \$20,031 and \$25,431 respectively. For more information, contact Interscience Computer Services Inc., 5171 Clareton Dr., Agoura Hills, CA 91301; (818) 707-2000. TELEX: 183628.

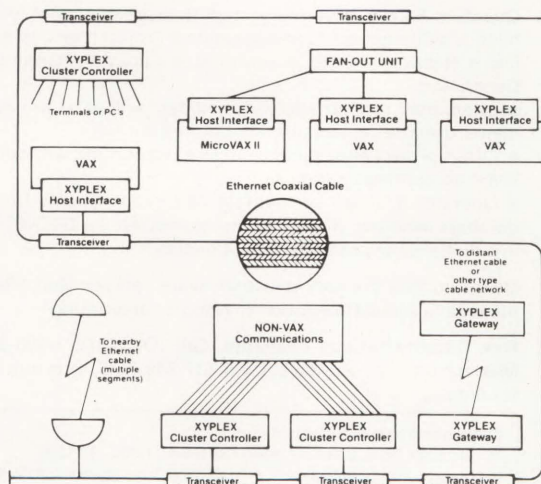
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SHAREplus V2.2 Has Four New Features

Hammond Software announced the release of V2.2 of SHAREplus. Four new features are included in this release.

SEARCH is used to search one or more files for specified strings. Wildcard operations are supported on RT-11 directories, allowing users to search through entire directories. SHUT informs all interactive processes in the system that shutdown procedures have begun and how much time is left before shutdown begins. The BATCH queue uses a BATCH process to execute command files. The addition of the OPEN LOG and CLOSE LOG

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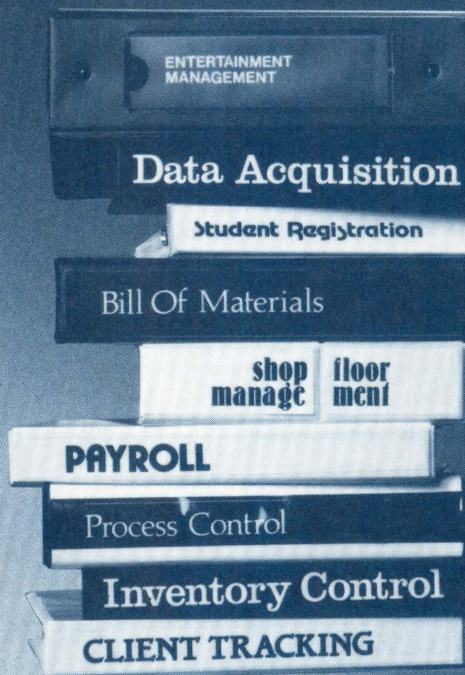
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commands enables users to store their terminal dialogue and output in a file. V2.2 also includes basic emulators for the RSX and TSX operating systems.

SHAREplus is compatible with DEC's RT-11 V5.4 single-user operating system. Together with VAMP and SHAREnet users can build networks with PDP-11 and VAX/VMS systems.

Contact Christine Wilke, Hammond Software, Stiegbreite 1, D-3400 Gottingen, West Germany; +49 (551) 21044.

Enter 340 on reader card

CIS Introduces Quantum PM For VAXs

Computer Information Systems Inc. (CIS) introduces Quantum PM. This product offers real-time VAX system software that collects and reports configuration, CPU, I/O and memory statistics for performance analysis, system tuning and capacity planning. The user decides what statistics to collect and which nodes, devices, SCS nodes and processes to include in any collection.

Quantum PM also gives you the ability to archive, filter and merge data collection files. Quantum PM allows for investiga-

tion into greater levels of detail in any area desired.

For further information, contact Computer Information Systems Inc., 165 Bay State Dr., Braintree, MA; (800) 232-5215. In MA or outside the U.S., (617) 848-7515. TELEX: 4996932.

Enter 342 on reader card

Star Enhances Memory Capability

Star Technologies Inc. has announced significant enhancements to the memory capacity of its ST-100 and ST-50 families of array processors. The expanded memory includes a two-fold increase in main memory and four-fold increase in the data cache and program memories. The memory enhancements are available as standard options on new orders of the ST-100 and the ST-50, and are available as field upgrades. (The expanded data cache is not available for the ST-50.)

The memory enhancements will allow Star array processors to solve larger and previously unsolvable problems, reduce the need for costly external storage devices and permit the systems to be used for new and complex applications. Star supports complete

VAX family with Star's full line of high-performance array processors.

To find out more, contact Star Technologies Inc., 515 Shaw Rd., Sterling, VA 22170; (703) 689-4400.

Enter 343 on reader card

BSW-Make For MS-DOS And VAX/VMS

The Boston Software Works Inc. announced a new release of its BSW-Make software configuration management utility, patterned after the UNIX make utility. With the release of version 6, BSW-Make is faster and more powerful, providing assistance in managing the construction and maintenance of software programs.

BSW-Make automatically constructs program executables using information stored in a makefile. With this tool, software developers are assured that only those files that have been modified since the program was last built will be compiled or assembled and linked into a new program executable.

BSW-Make Version 6 is available for personal computers running MS-DOS/PC-DOS and for VAXs running VAX/VMS.

The new release of BSW-Make costs

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If you are interested in learning more, contact The Boston Software Works Inc., 120 Fulton St., 2nd Fl., Boston, MA 02109; (617) 367-6846.

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AISwitch Series 180 Announced

Applied Innovation Inc. announced the AISwitch Series 180. The Series 180 is commonly referred to as a data PBX for ASCII asynchronous environments. It is a functional upgrade to the AISwitch Series 170. The Series 180 addresses configurations requiring 20 to 256 asynchronous connections. The Series 180 now incorporates such architecture as full internal redundancy, an X.25 PAD on an interface card that allows access to synchronous packet switch networks and fits into any of the switch's bus slots, and a new 16-port asynchronous interface card (module) #AI185 for denser configurations. Learn more by contacting Applied Innovation Inc., 651 Lakeview Plaza Blvd., Suite C, Columbus, OH 43085; (614) 846-9000.

Enter 341 on reader card

Multiware Unveils Phantom

Multiware Inc. has unveiled Phantom, a performance enhancement package for systems running VMS, RT-11 or TSX-Plus. It combines the features of a virtual disk drive with the efficiency of direct memory access, data transfer via two serial ports and a 16-bit bidirectional parallel port, and 64KB of on-board memory.

Phantom uses its on-board DMA engine to transfer data, freeing the CPU for other operations. Overall system response is not degraded, allowing computer-bound programs to run normally during data transfer.

Phantom is priced at \$3,500. To learn more, contact Multiware Inc., 2121 Second St., Bldg. B, Ste. 107, Davis, CA 95616; (916) 756-3291.

Enter 348 on reader card

EES Announces PRECISE ASD 2.2

Electrical Engineering Software Inc. (EES) announced PRECISE ASD (analog systems design) 2.2. This powerful analysis tool meets

the specific needs of the analog or analog/digital printed circuit board systems-level (PCB) designer. With PRECISE ASD 2.2, analog engineers can simulate complex PCB circuits to determine the circuits' operating electrical characteristics.

PRECISE ASD 2.2 lets the engineer simulate the design in various domains such as time, frequency, temperature and parametric. It runs on VAX-based computers, among others.

PRECISE ASD 2.2 is priced starting at \$9,500.

For further information, contact Electrical Engineering Software, 4675 Stevens Creek Blvd., Ste. 101, Santa Clara, CA 95051; (408) 296-8151.

Enter 345 on reader card

PMC Upgrades The ESDX Series

PMC Associates announced an upgraded version of the ESDX series 5¼-inch Winchester subsystem for PDP-11/23, 11/73, 11/83, 11/84, 11/24, 11/34, 11/44, VAX-11/750, 11/780, 11/785, 8600 and MICROVAX II. The high-performance ESDI subsystem has one or two drives

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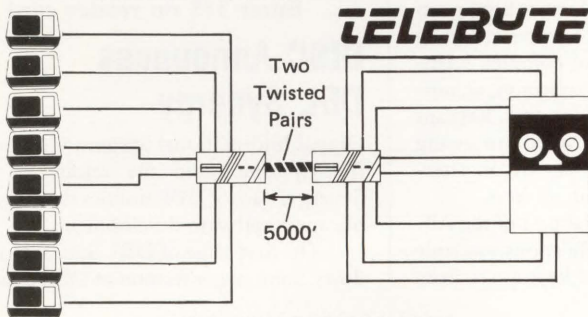
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Diagnostic features of the QUICK MUX include displays of Receive Data and Transmit Data for each port, Data Error and Data Loss Indicators for the composite link. Switches provide a local loopback or remote multiplexer test.

The Model 570 QUICK MUX with 8-25' cables sells for \$548 in single quantity.

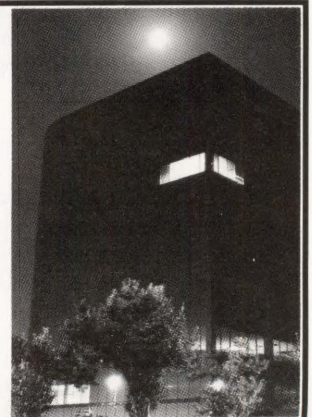
Contact us today at Telebyte Technology Inc., 270 E. Pulasky Road, Greenlawn, New York 11740, 800-835-3298 or (516) 423-3232.



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featuring average access times of 16.5 milliseconds. The UNIBUS or quad-wide Q-bus controller supports four drives. Some standard performance features include 1-MB cache memory, 3MB/sec. (maximum) data transfer rate, dynamic bad block replacement and error correction, formatter and self diagnostics.

A new controller I/O panel allows switch-selectable configuration of single- or dual-controller operation. This feature allows two host computer systems to have access to one dual-drive subsystem.

Pricing starts at \$5,566 for the 182-MB (unformatted) single drive version. For further information, contact PMC Associates, 74 North Central Ave., Ramsey, NJ 07446; (201) 934-1835.

Enter 346 on reader card

Powerful Graphics Tool Introduced

Qwiknet Graphics is a flexible new tool for Project Software & Development's PC/VAX-mate project management software, Qwiknet Professional. Qwiknet Graphics allows users of Qwiknet Professional to transform data into three visuals — histograms, network diagrams and bar charts — to gauge and plan the progress of up to 250 projects. The graphs can be customized through scaling, coloring and zoning options and exported to freelance and other free-form graphics software programs to add logos and other symbols.

Qwiknet Graphics can print up to 256 colors in sizes up to 27 feet square. Managers can use the same drawing in an 8-inch x 10-inch version, and then blow it up to 80 inches x 100 inches. Qwiknet Graphics requires MS/PC-DOS 3.0 or higher and a supported graphics card and an IBM PC/XT, AT or PS/2, or compatible.

Cost is \$645 (or \$495 to subscribers of Qwiknet Professional customer service). For more information, contact Project Software & Development Inc., 20 University Rd., Cambridge, MA 02138; (617) 661-1444.

Enter 347 on reader card

Waters Has Networking Computer System

A powerful networking computer system enabling fast repossessing and storage of large amounts of chromatographic data recently was introduced by Waters Chromatography Division, Millipore Corporation. The Waters 860 Networking Computer System and Waters VAX Reprocess Software allow the PC-based Waters 810, 820 and 840 data stations to have virtually instantaneous full LC and GPC data reduction and archiving to a MICROVAX 2000 computer using

DECnet/Ethernet local area networks. A backup tape cartridge stores 95 MB of data in 20 minutes, or data can be archived over the network to a larger capacity VAX computer. Data can be processed at the rate of 10 to 15 chromatograms per minute, and rapidly printed using a DEC LNO3 laser printer.

With the Waters 840 Data Chromatography Control Station running Waters Expert Chromatography Software (Rev. 6), data can be sent directly to the MICROVAX 2000 while being acquired. Waters VAX Reprocess Software also can convert files to RS-1, 20/20 and Lotus 1-2-3 software formats automatically.

For more information, contact Kevin Rudden, Waters Chromatography Division, 34 Maple St., Milford, MA 01757; (617) 478-2000.

Enter 350 on reader card

Free LAN Support Offered With PLUS

LAN support now is included free with every PLUS version of Reflection Series Software, announced Walker Richer & Quinn. PLUS allows the PC user connected to a DEC, HP or UNIX host computer to back up PC files to the host computer's disk. Backup can occur in background, unattended, and be initiated either by the host or the PC.

Support for these LANs also is included with PLUS: Bridge's Token Ring and 3Com supplements, Ungermaun-Bass, Nestar, Syntax, HP's AdvanceNet, and DEC's LAT protocol under DECnet DOS. The Reflection user also can write a custom LAN driver to access a particular LAN environment.

If more information is needed, contact Walker Richer & Quinn Inc., 2825 Eastlake Ave. E., Seattle, WA 98102; (206) 324-0350.

Enter 351 on reader card

Keypcaps Available From GraphOn

Keypcaps supporting MASS-11 and WPS PLUS are available for installation on all GraphOn alphanumeric/graphics terminals. MASS-11, from Microsystems Engineering Corporation, is a powerful word processing program designed for VAX users. It supports a full range of professional features including the creation and editing of complex scientific equations, super- and subscript, columnar mathematics and line drawing. Keypcaps imprinted with MASS-11 word processing and EDT editing commands are an alternative to the use of keycap stickers.

WPS Plus is an integral part of the All-In-One set of integrated applications available to VAX users. The special keycap set from

GraphOn provides the editing commands on the front surface of the keycaps.

To find out more, contact GraphOn Corp., Tower One, Fifth Fl., 1901 S. Bascom Ave., Campbell, CA 95008; (408) 371-8500.

Enter 352 on reader card

AutoEase Introduces TABLET/SCREEN Menu

AutoEase Inc. has created a TABLET/SCREEN menu system to run on DEC's version of AutoCAD.

The AutoMASTER series increases the user's speed, accuracy and productivity. AutoMASTER can be customized two ways. Each template contains user-defined areas, left open and ready for the user to create commands to fit his needs. Second, each AutoMASTER template has modular sub-templates programs to modify and specialize the system to fit the user's situation. Currently, there are subtemplates for Plan, Elevation, and Landscape with mechanical, and facility planning on the horizon.

The product costs \$295 for the MASTER series and \$199 for each subtemplate.

Reach AutoEase at 1325 South 800 East #315, Orem, UT 84058; (801) 224-8833.

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120 MB DM 360 Released For VAXmate

Dmi has announced its newest base expansion system for the VAXmate. The DM 360 consists of an integrated external cabinet with a 60-MB hard disk and controller, power subsystem and quiet cooling system.

The system design includes user features such as a single power on switch along with the flexibility to add additional peripherals and dmi-certified board enhancements in the three AT-compatible slots.

By adding an additional 60-MB hard disk to the DM 360, the user will have 120 MB of formatted high-speed disk (28 ms access time). In addition, the user also can add external portable tape backup, EGA, memory, and other AT-compatible enhancements.

For further information, contact dmi, 1 Hughes, Irvine, CA 92718; (714) 583-1800.

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DISC Announces DBL Synergy

Digital Informational Systems Corporation (DISC) announced the release of DBL Synergy, a set of DBL utilities that aid in application software development.

The first stage of DBL Synergy is windows. Some major features of DBL Synergy's

window tool include portability among operating systems, field definitions that simplify menu selections, multiple window displays, ability to save and restore windows, and a prototyping utility.

The window tool makes terminal displays more attractive and user friendly. It also simplifies the display of menus and help windows and it provides a consistent appearance in applications.

For more information, contact Michele Wong, Digital Information Systems Corp., 11070 White Rock Rd., Rancho Cordova, CA 95670; (916) 635-7300.

Enter 356 on reader card

JAM Builds Better Applications

JYACC Inc. has announced the introduction of JYACC Application Manager (JAM), an interactive user interface management system that allows application developers to customize and standardize user interfaces for a variety of software applications. JAM allows application developers to design and automatically link together the screens that comprise the user interface for any application, without programming or coding.

JAM includes a range of powerful screen painting facilities, including support for windows, menus and color. JAM also offers extensive context-sensitive help, full testing capabilities, and is self-documenting. JAM includes JYACC FORMAKER, a screen and window manager that allows users to design, develop, test and document screens.

For further information, contact JYACC, 116 John St., New York, NY 10038; (212) 267-7722.

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SPSS Introduces SPSS-X Trends

SPSS Inc. has introduced SPSS-X Trends, a forecasting and time series analysis option to SPSS-X for mainframes and minicomputers. SPSS-X Trends is available under the VAX/VMS and IBM CMS operating systems.

The Trends option provides comprehensive modeling and forecasting capabilities. It also has more than 10 different curve fitting methods and 12 different smoothing models. It includes three methods for estimating autoregressive functions, two-stage and weighted least-squares regression, univariate and bivariate spectral analysis, Box-Jenkins analysis using state-of-the-art ARIMA algorithms, full diagnostic plotting, etc. In addition, numerous methods of isolating seasonality in a series are provided.

To find out more, contact SPSS Inc., 444 N. Michigan Ave., Chicago, IL 60611; (312) 329-3500.

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DEC Extends Terminal Server Capabilities

Digital Equipment Corporation recently introduced the DECserver 500, a network terminal server that lets users in large office environments connect from 16 to 128 asynchronous terminals, printers and personal computers to DEC's industry-standard Ethernet local area network. Digital also an-

nounced its new Single Port Ethernet Repeater, called DESPR, for users who require a low-cost, single line Thinwire Ethernet connection to the desktop.

The price for DECserver 500 is \$15,250. The DESPR is priced at \$875.

Learn more by contacting Digital Equipment Corp., Maynard, MA 01754-2571; (800) DEC-INFO.

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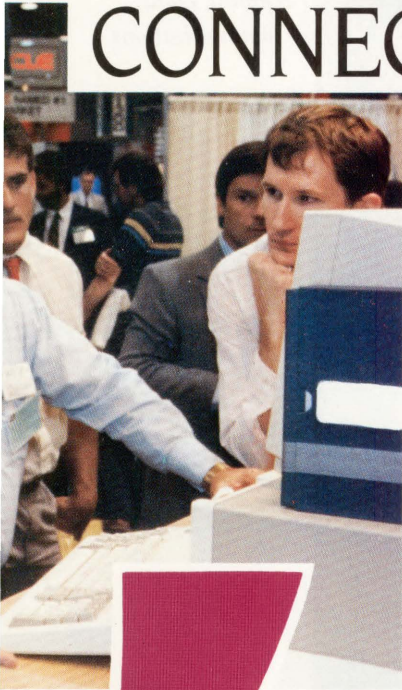
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ADC Expands Standards, Formats

Applied Data Communications Inc. (ADC) has expanded the number of standards and formats supported by its CD-2500 high-speed tape duplication system to include additional 1/4-inch and 1/2-inch tape formats and any SCSI-compatible tape or optical drive.

The CD-2500 now supports DEC's TK50 1/2-inch cartridge tape drive. Depending on the length of the image and the tape format used, the CD-2500 can make as many as 960 copies per hour of a 5-MB tape, or 80 copies per hour of a 60-MB program.

CD-2500 is priced at \$39,950 including a monitor and four QIC-11 or QIC-24 drives.

To obtain more information, contact Applied Data Communications, 14272 Chambers Rd., Tustin, CA 92680-6998; (714) 731-9000. Telex: 183823 ADC TSTN.

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ACC's 1200 And 1230 Connect To DEC Computers

With the introduction of two new Ethernet LAN products, the 1200 and 1230, Advanced Computer Communications (ACC) brings users network cost reduction and versatility.

ACC's 1200 is an asynchronous terminal server that offers IBM 3270 emulation and can cluster up to eight low-cost ASCII terminals to access DEC and IBM computers through a single line to an Ethernet. ACC's 1230, when used in conjunction with a 1200, performs X.25/SNA gateway functions that allow connection of IBM SNA host computers or other PAD protocol devices on an Ethernet.

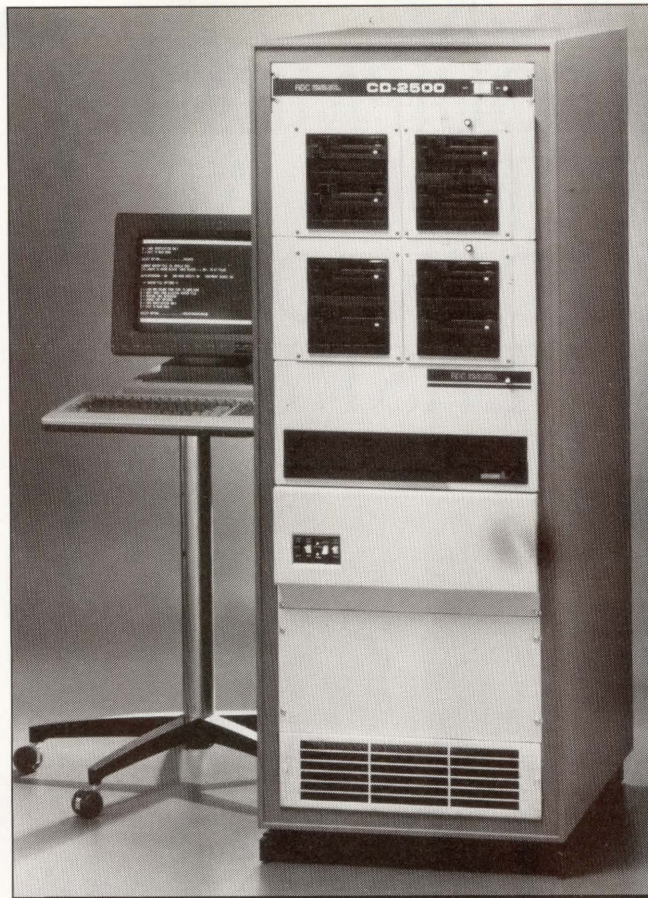
To learn more, contact Advanced Computer Communications, 720 Santa Barbara St., Santa Barbara, CA 93101; (805) 963-9431. TWX (910) 334-4907.

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ditroff Runs Under VAX/VMS Systems

Talaris Systems has developed a support package for running AT&T's *ditroff* under VAX/VMS. DITROFFsupport-VMS lets VAX/VMS users print documents typeset using *ditroff* on Talaris QUIC-based laser printers.

DITROFFsupport-VMS includes the *ditroff* software sublicensed from AT&T, the *pic*, *eqn*, and *tbl* preprocessors, the Documenter's Workbench and *mm* macros, 120 *ditroff* fonts in portrait and landscape orientation, documentation, and the Talaris postprocessor for printing *ditroff* documents



CD-2500 tape duplication system from Applied Data Communications.

on the Talaris family of QUIC-based laser printers.

DITROFFsupport-VMS is priced at \$1,950.

Complete information is available from Talaris Systems Inc., 6059 Cornerstone Court West, P.O. Box 261580, San Diego, CA 92126; (619) 587-0787.

Enter 363 on reader card

MTI Offers MSV25 Q-bus Tape Coupler

Micro Technology Inc. announced the availability of an upgradable high-performance 1/2-inch tape coupler. The MSV25 is a dual-wide board supporting DEC's TSV05/TS11 tape emulation in the standard configuration. Allowing you the ability to remain absolutely current with the latest releases of DEC's operating systems, the MSV25 may be upgraded by a firmware change to support TMSCP.

Compatible with all Q-bus processors, the MSV25 requires no jumpers or switches to set various options, which are selected by a configuration word. The MSV25 supports tape speeds up to 125 IPS at 6250 BPI, by making efficient use of an on-board 64 KB buffer.

The MSV25 is priced at \$1,295 with OEM discounts available for quantity purchases.

More information may be obtained by contacting Micro Technology Inc., 1620 Miraloma Ave., Placentia, CA 92670; (714) 632-7580.

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ESS Releases Capabilities Brochure

Electronic Service Specialists Ltd., has a new brochure available to self-maintainers and third-party maintenance companies interested in depot repair support services for DEC equipment and peripherals.

A Dozen Reasons to Choose Electronic Service Specialists Ltd. describes the company's repair and refurbishment services. These services include five-day turnaround for repair, circuit board swap program, quality control measures, 120-day warranty, and an inventory in excess of 100,000 parts.

For a complimentary copy of *A Dozen Reasons to Choose Electronic Service Specialists Ltd.*, contact Electronic Service Specialists Ltd., N92 W14612 Anthony Ave., Menomonee Falls, WI 53051; (414) 255-4634.

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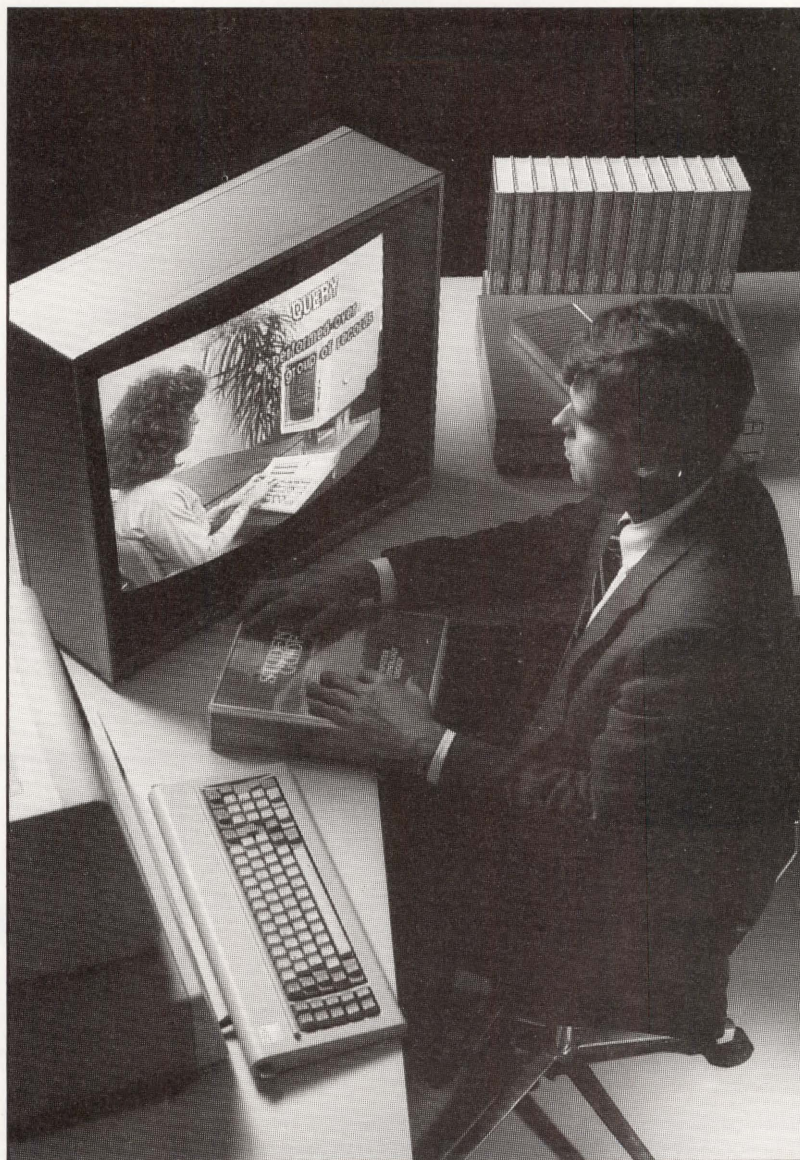
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Transitional Technology Has 8 mm VAX Cartridge

Transitional Technology Inc. (TTI) announces the availability of the CTS-8 family of high-capacity tape subsystems for the VAX and MicroVAX.

The CTS-8 employs the latest helical scan technology, allowing up to 2.3 gigabytes of data to be stored on an inexpensive, readily available 8 mm videocassette. It appears as a standard magtape and is fully compatible with VMS BACKUP and COPY.

Pricing starts at \$5,995 for an internal mount Q-bus system in unit quantities, with substantial OEM discounts available.

Learn more by contacting Transitional Technology Inc., 1401 N. Batavia, Ste. 204, Orange, CA 92667; (714) 744-1030.

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TCP/IP For StarLAN, Ethernet Available

Western Digital Corporation and FTP Software Inc. announced the availability of PC/TCP, or Personal Computer/Transmission Control Protocol for Western Digital's

StarLAN and Ethernet adapters.

PC/TCP implements the Transmission Control Protocol/Internet Protocol (TCP/IP) and allows users of Western Digital's WD8003E EtherCard PLUS and WD8003S StarCard PLUS adapters to communicate from their PCs with TCP/IP host systems on local or wide area networks. PC/TCP also provides the capability for file transfer, electronic mail and login to a remote host.

PC/TCP allows PCs to communicate with systems that include UNIX 4.2 and 4.3, System V UNIX, XENIX, ULTRIX, VMS and TOPS-20.

For further information, contact FTP Software, P.O. Box 150, Kendall Square Branch, Boston, MA 02142; (617) 868-4878.

Enter 367 on reader card

DayTracker Replaces Appointment Books

Gray Technologies announced the second release of its DayTracker software. DayTracker is an advanced appointment scheduler that administers, locates and displays personal and corporate commitments. DayTracker also can be used to maintain and profile daily expense

reports. It's easy to use and has a consistent interface to help budget and manage time more efficiently.

Some features of the DayTracker system include the ability to schedule equipment or facilities, search for forgotten appointments based on a name or description of the meeting, viewing daily, weekly and monthly calendars, viewing the calendars of other personnel in your office (provided user access is allowed), viewing participants and subject matter on appointments, scrolling forward and backward through appointment lists and interfacing with other vendor's sales and marketing applications.

DayTracker is available through Gray Technologies, 111 Brigham St., Ste. 3D, Hudson, MA 01749; (617) 562-4393.

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Parrot Creates Custom Training Diskettes

MicroProducts recently announced Parrot version 2.0, a terminal emulator and application for the creation of customized training and demonstration diskettes.

Parrot creates on any IBM PC or com-

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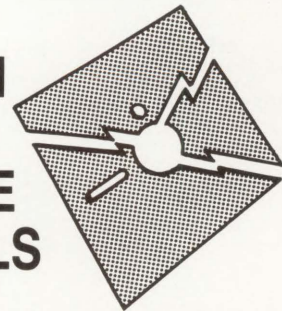
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Parrot is priced at \$195 with volume discounts available.

For more information, contact Micro-Products, 370 W. Camino Gardens Blvd., Boca Raton, FL 33432; (800) 553-0777.

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Dyna Five Introduces Two New Enclosures

Dyna Five Corporation recently introduced two new enclosures. The SE105 System Enclosure provides an alternative to the DEC BA123 enclosure for system integrators and OEMs. The enclosure furnishes 12 slots of backplane, 750 watts of power, mounting for four 5¼-inch peripherals and supports either MicroVAX II or MicroPDP-11 processors and memory.

The PE103P Peripheral Enclosure is a free-standing pedestal that provides power and mounting for one to four eight-inch Fujitsu Winchester disk drives.

The enclosure supports 2311, 2312, 2322, 2333, and 2344 eight-inch Fujitsu Winchester drives and furnishes up to 2.4 gigabytes of storage in a single pedestal. To find out more, contact, Dyna Five Corporation, 3421 W. Segerstrom Ave., Santa Ana, CA 92704; (714) 751-0133. Telex: 559508.

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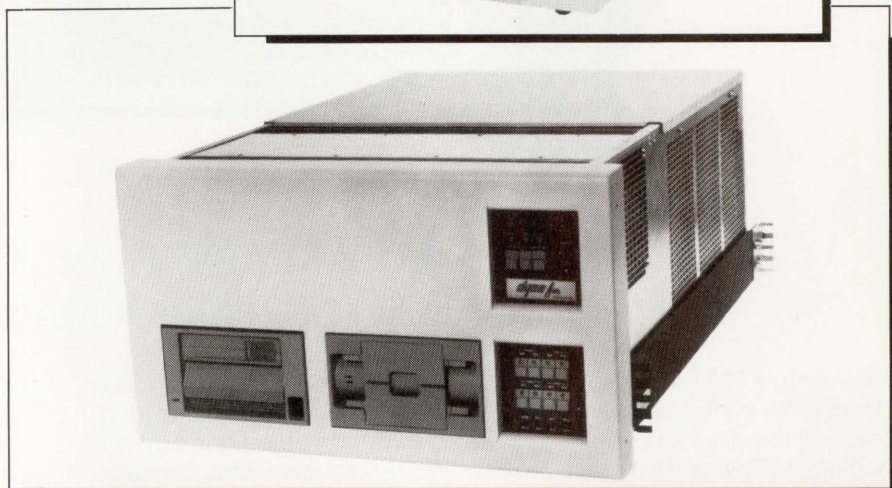
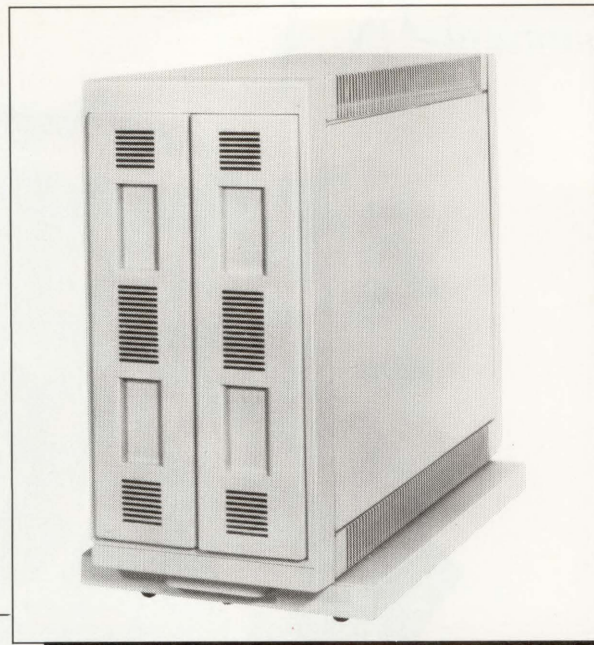
ILS Software Performs Four Times Faster

Digital's new VAXstation 3200/3500 and MicroVAX 3500/3600 performed approximately four times faster than the old VAXstation and MicroVAX II according to Signal Technology Inc. Using the FFT capability of the company's Interactive Laboratory System (ILS), Signal also found that the new VAXstation and MicroVAX outperformed the VAX 780 approximately three times as fast.

ILS, a menu-driven software system for digital signal processing, is available for the MicroVAX 3500/3600 and VAXstation 3200/3500 machines. ILS runs on the complete line of VAXs.

Prices for ILS distribution are the same as those for the MicroVAX II, ranging from \$5,100 to \$7,500 for image distribution, and

SE105 System Enclosure and PE103P Peripheral Enclosure from Dyna Five Corporation.



\$8,500 to \$12,000 for source distribution. Learn more from Signal Technology, 5951 Encina Rd., Goleta, CA 93117-2274; (800) 235-5787.

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Aviv Releases Model TFC 935

Aviv Corporation has announced a full performance magnetic tape controller, with SCSI, StorageTek and Pertec interfaces. Using these three interfaces, TFC 935 can operate with any GCR tape drive.

During Write, TFC 935 can be programmed to delay tape acceleration until a preset amount of data is transferred into the data buffer. This feature allows better matching between computer system and tape drive throughput, particularly when multiporting high-speed drives among computers with different throughputs.

The controller can be programmed to

generate completion interrupt as soon as the record is contained in the buffer on the controller.

For further information on Aviv's products, contact Aviv Corp., 26 Cummings Park, Woburn, MA 01810; (617) 933-1165.

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RABBIT-8 Report Architecture Is Fast

RAXCO Inc. recently unveiled RABBIT-8 Report Architect (R-8), a powerful report production tool available for VAX/VMS computers using CDD (common data dictionary) and RMS files.

R-8's menu control lets programmers design customized reports in less time than it now takes them to program code for reports. R-8's first level of report definition lets users swiftly build reports by easily defining parameters for a Report Specification File, which is how R-8 generates com-

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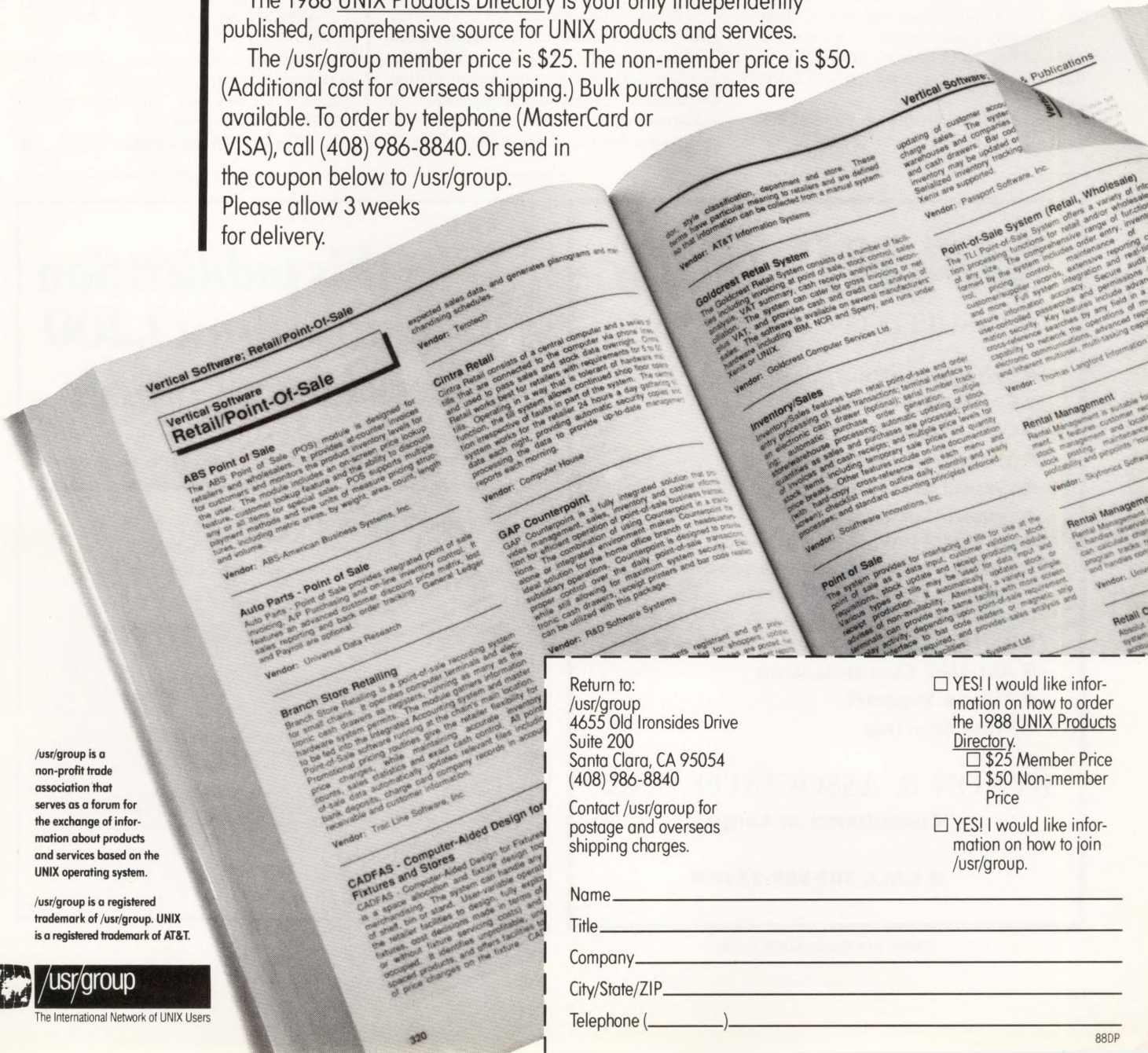
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pilable source code. R-8 can deliver reports of any complexity quickly because it easily and accurately produces optimized FORTRAN, COBOL or BASIC source code while directly accessing the CDD.

For further information, contact RAXCO Rabbit Software, 1370 Piccard Dr., Rockville, MD 20850; (301) 258-2620. TWX: (810) 766-2256.

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EEC Enhances TurboDisk

EEC Systems Inc. announced the release of version 2.2 of TurboDisk and TurboDisk Plus for MicroVMS and VMS, version 4.2 onward. Both products feature an approximate 10 to 15 percent performance improvement over version 2.1. Version 2.2 is realizing access time improvements up to 140 times that of conventional mechanical disks.

The major enhancement in version 2.2 is the ability to "Shadow" TurboDisk or TurboDisk Plus onto a file on any VAX/VMS disk.

TurboDisk ranges in price from \$1,250 on the MicroVAX 2000 to \$9,500 on the

VAX 8700. The price for TurboDisk Plus is \$2,500 with memory priced at \$2,000 for 4 MB.

For more information, contact EEC Systems Inc., Millbrook Park 327/E Boston Post Rd., Sudbury, MA 01776; (617) 443-5106/6376.

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Palette Wins Contracts

Palette Systems Inc. recently won new contracts from Harris, Honeywell, Litton Industries and Northrop for its modular, multipurpose Palette graphics software system operating on VAXs.

Palette software operates on VAX, VAXstation and MicroVAX computers. Palette also moved its software to complete operation on the VT300 series terminals and laser printers.

Palette provides integrated modules for two- and three-dimensional computer-aided drafting, a spatial database for storing design graphics, text and graphic documentation preparation, programming interfaces to industry-specific applications, and system interfaces for file transfers to other worksta-

tions and graphic software systems.

To learn more, contact Palette Systems Inc., Northwood Executive Park, 10 Northern Blvd., Unit 6, Amherst, NH 03031; (603) 882-9242.

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INSYTE Has VISION

Innovative Systems Techniques Inc. has introduced VISION, a database management system using object-oriented techniques.

The VISION application platform allows users to work selectively with databases, using the services and application methodologies best-suited to their needs.

VISION can access an unlimited number and variety of external databases, as well as various sources of economic data. VISION also can incorporate a firm's internal data.

VISION runs on the VAX line under VMS and on the HP 9000.

For additional information, contact Innovative Systems Techniques Inc., One Gateway Center, Ste. 910, Newton, MA 02158; (617) 965-8450.

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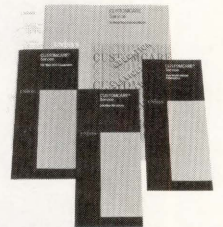
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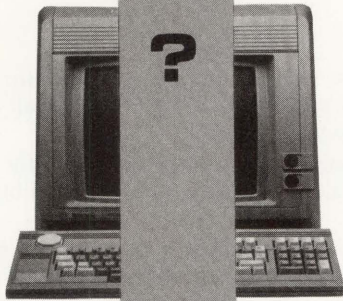
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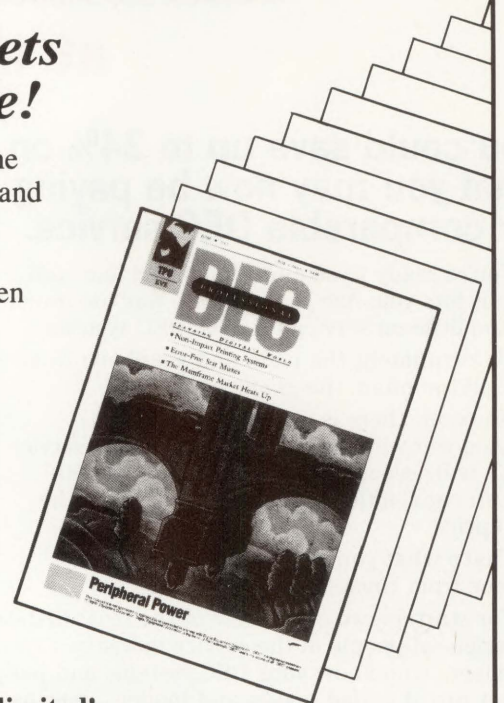
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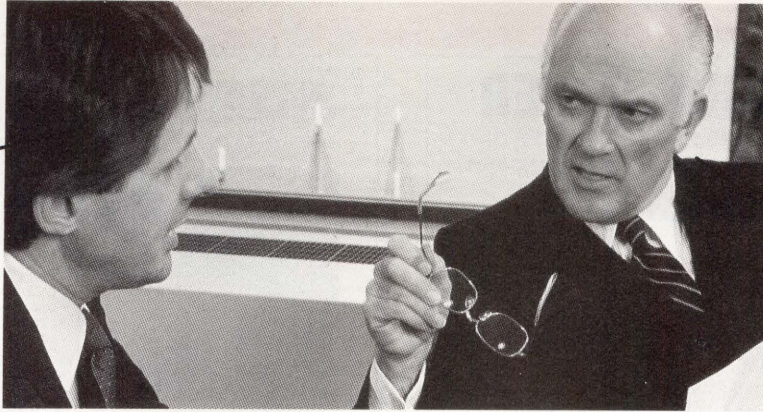
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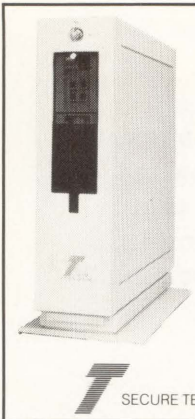
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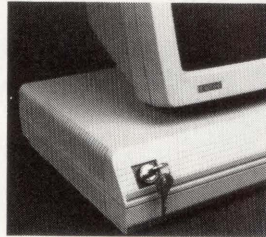
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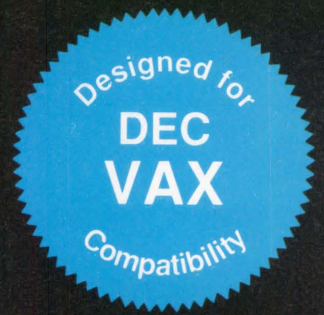
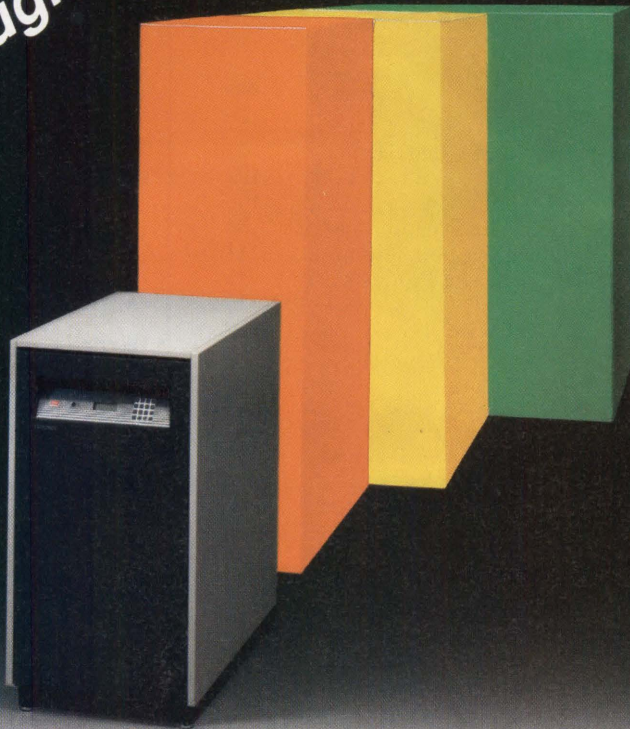
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COMDEX: The White Elephant Of Shows

BACK END

John C. Dvorak

COMDEX — The Show of Shows for the small computer user comes and goes every November. The site of the show is fickle Las Vegas, Nevada — the middle of the desert. At November 1987's show, there was a huge tropical storm that flooded the town and drenched the show-goers. Every year there's some screwball weather anomaly that hits Vegas and every year the local press tells everyone that it was a fluke. "Normally it's sunny all the time."

A few years ago, it was a dust storm. Then there was a wind storm. It snowed during the last Consumer Electronics Show. I remember one show when the humidity was so low that the resultant static was blowing up systems left and right. It's always something.

The show itself is also an anomaly. There's no reason to have a show like this at this time of year. It's too late for the holiday buying season. It's not a great time to make announcements, either.

The show started in November years back, because the industry was too young and too stupid to know when to have a show. Since then it has become a show to prove your manhood — kind of a rites of passage thing. Sure, a few deals are done and a few contacts made. But, for the most part, the show is nothing more than a showcase that companies use to prove that they aren't about to go broke. "See! We're here, aren't we?"

This year's show took place right after the stock market crash and all the players were abuzz about who may or may not be there. Almost every company, no matter how much it suffered from the crash, managed to go to the show and maintain a firm handshake

and a pasted-on smile. "What? Me worry? Hahahaha! It's just a setback," they all said.

One highlight at the show was an over-promoted session called "How will the Stock Market Crash Affect the Computer Industry?" Everyone concluded that there always will be money available for the ubiquitous "good idea." Furthermore, it was said that as long as you have confidence in the industry, everything will be ok. Right? And cows can fly.

The show offered some interesting insights into the future. I saw, for example, dozens upon dozens of cheap 286 motherboards. Here's what to expect: a 10-12 Mhz 286 motherboard with 1 MB of memory, built-in VGA, built-in parallel and serial ports, and a floppy and built-in hard disk controller. Cost: \$900. Not bad, eh? All you do is drop it in your AT box, add a monitor and keyboard, and you're in business. This is a lot of mips for not much money. I saw just such a board.

Meanwhile, I ran into Clive Sinclair at the show. Remember him from the old Timex Z-80 days? He's considered one of England's great inventors and has been knighted; I called him Sir Clive. Anyway, he designed a cute little laptop called the Z-88. With 3 MB of main memory, a Z-80 microprocessor, the OZ operating system and software called *Pipedream*, this machine is headed toward another dimension, perhaps the Twilight Zone. You see, Sir Clive dearly loves the Z-80 much like other pioneers still love some chip or other.

We're seeing much less of this kind of off-the-wall idea nowadays, and that's too bad. Things are a little boring if we can't find weird products to ridicule. Actually the Z-88 might be nice if it were \$99 or so, but it's priced at \$500. At least

it's designed to load and unload files easily to and from an IBM PC.

I was most impressed by the Siemens 777-MB 5¼-inch hard disk. This fast hard disk should be able to meet most small computer users' storage needs, don't you think? To back up a disk drive like this on standard 360-KB floppy disks would require 2,158 diskettes and take about 71 hours. Sounds like job security for someone.

I got a kick out of the Siemens marketing guy who explained to me that the flying heads of these little hard disks are like a Boeing 747 flying ¼ inch off the ground at 600 miles per hour!

The weirder products aside, there were two distinct trends seen at the show: toward larger high-resolution analog monitors and toward the 386-based computing for IBM PC users.

Most of the new stuff at the show was just upgrades. The most talked about upgrade came from WordPerfect and its newest *WordPerfect* word processor release, version 5.0. Its ability to load full-color graphics into a document and then wrap the text around it turns the word processor into a full blown desktop publishing system. Over the last few years, these guys have gone out and stolen the word processing market from everyone.

There was also much talk about the future of OS/2, the cloning of *PostScript*, networks, the PS/2 line and what it means, color printers, flat panel displays, portables, "where's Apple?" and the impact of the players' strike on the NFL. Soon your eyes glazed over as you heard people talking about this or that for the umpteenth time.

Next year I expect things to be much the same but probably smaller. In fact, if 1987's market crash was any indication, this may have been the last big show — ever.

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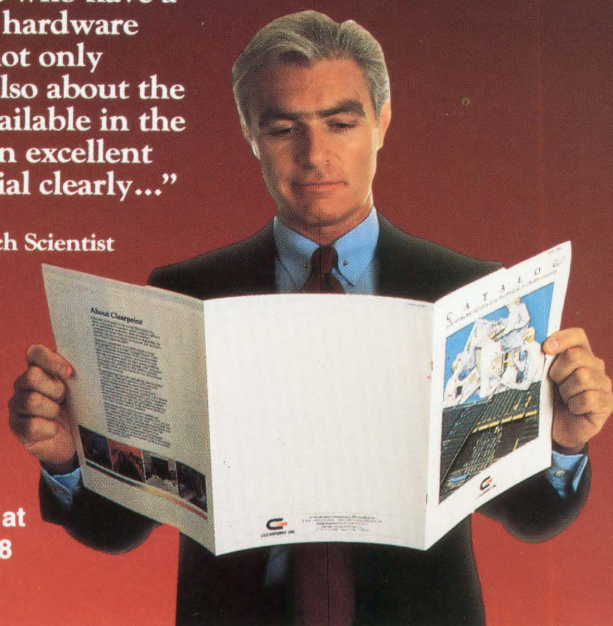
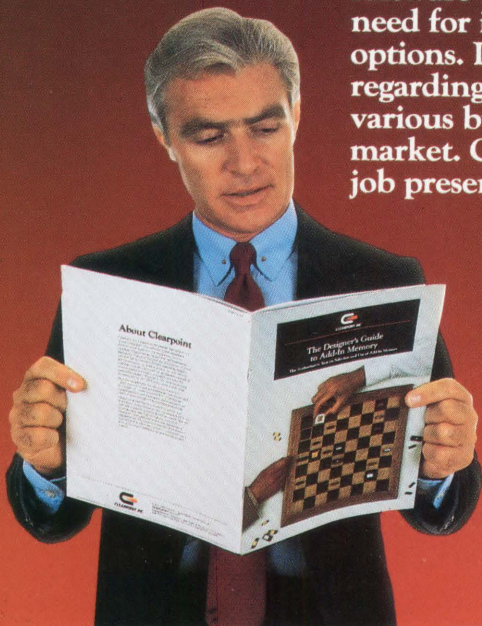
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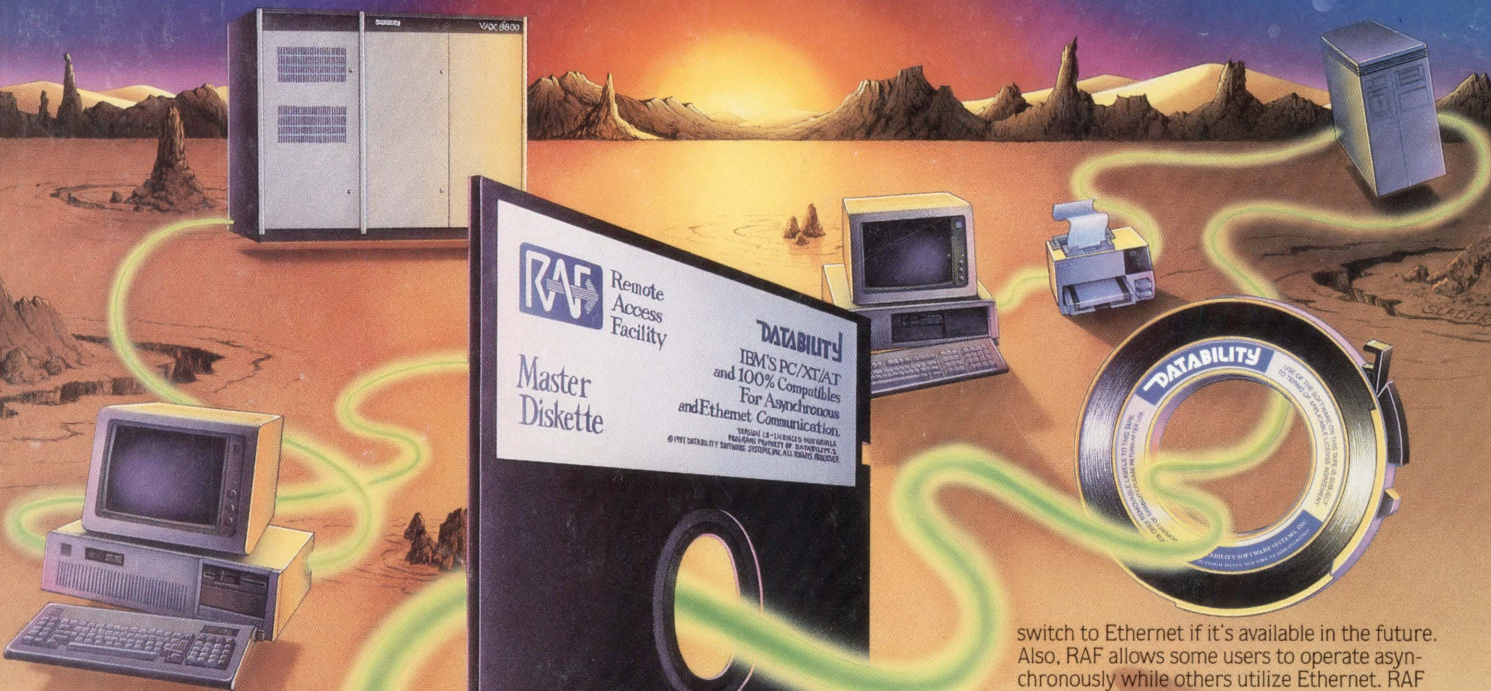
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