▲ UNSHIELDED TWISTED-PAIR AHEAD IN NETWORK RACE PAGE 20

PRICE WATERHOUSE'S ALEN DARR ANALYZES THE LAN PAGE 55

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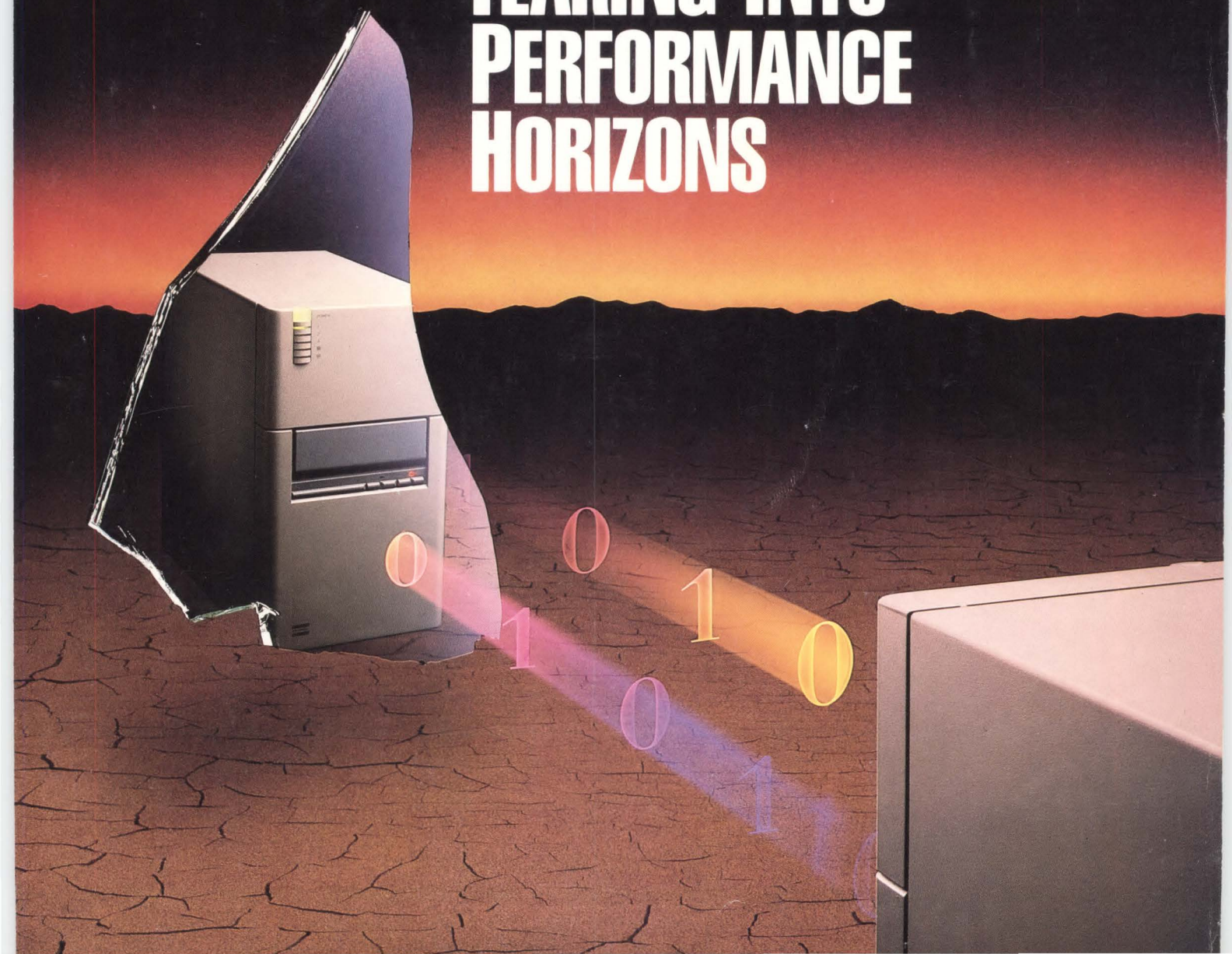
JUNE 15, 1988, VOL.8, NO.6 $3.00

REPORT 6 STORAGE SUBSYSTEMS PAGE 32

TEARING INTO PERFORMANCE HORIZONS



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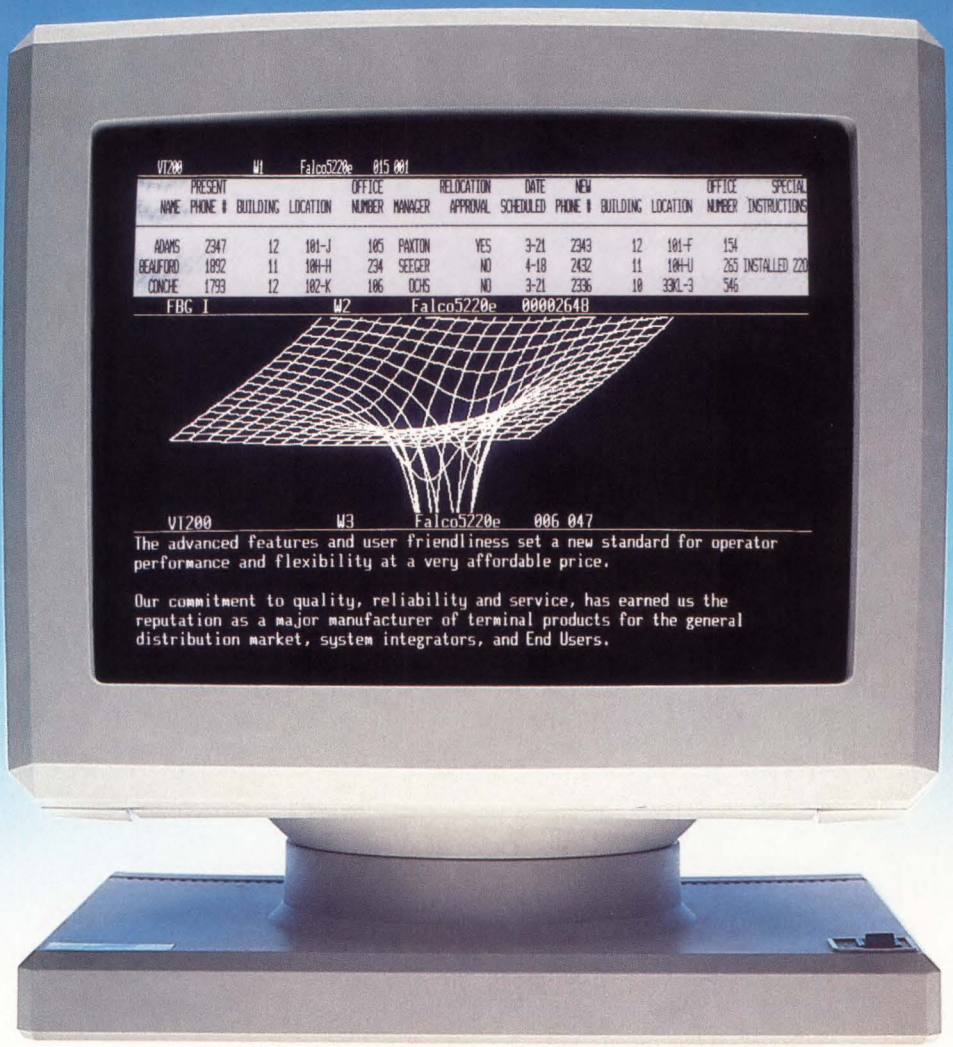

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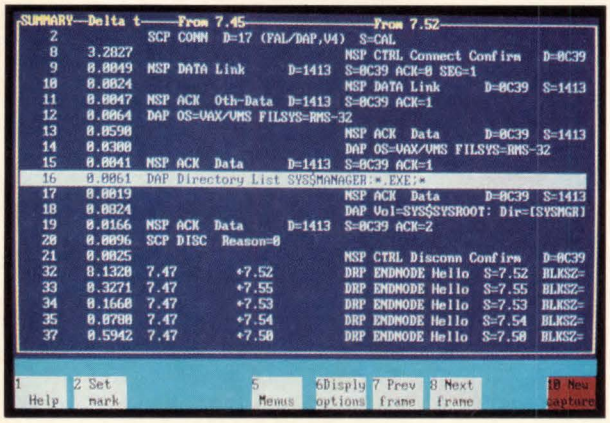

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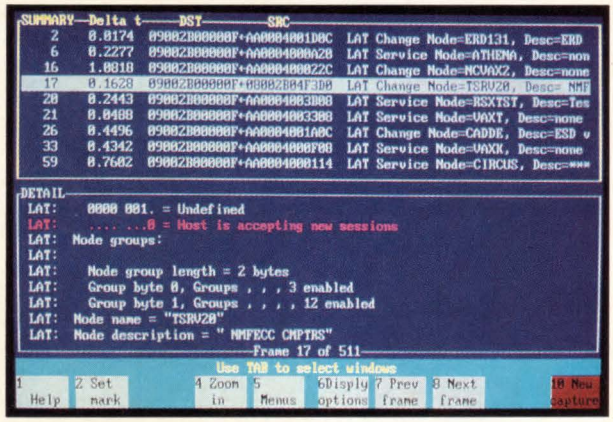
The Sniffer's DECnet protocol interpreter handles key protocols, including SCP, NSP, and DRP, as shown in this SUMMARY analysis of Ethernet frames. You can CAPTURE information based on lower level protocol content, node addresses, pattern matching, and/or frame error conditions, then instantly DISPLAY information in the format you prefer for analysis and understanding.



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FROM THE BLUE LINE

At a recent HC/WG Labs technical development session, Richard Steincross, our Senior Respondent—Hardware, voiced his opinion on the matter of nonstandard standards. In a uncharacteristic fit of vexation, Richard was more than upset at the lack of consistency in the matter of implementation of standards.

Richard's target for his technical diatribe was the Small Computer Systems Interface (SCSI)—and interconnect schemes in general—he still has bad dreams over getting RS-232C serial printers to work.

Although SCSI is an international standard that defines a specific 8-bit bidirectional peripheral interface, how it's implemented seems to be an exercise in Chinese menu making. Makers of things SCSI (or should we say scuzzy) tend to use the chip sets from either Emulex or NCR, thus proclaiming instant hardware compatibility. Where they differ is how the protocol firmware is meshed into the final design. You do see advertisements claiming conformance to the standard and the Common-Command Set (CCS) subset of the very rich command protocol defined by the SCSI standard.

The problem is you can implement CCS in many ways and make the calls nonstandard in how they react; marketing people call this the competitive edge. The Approved Standards Committee X3T9.2 responsible for the standard did make provisions for vendor-unique codes and functions—a demand forced on them by the member companies.

Of course if vendor unique is allowed, vendor unique it is; thus giving rise to Richard's concern. You see, not all SCSI is indeed SCSI—or compatible SCSI. A host adapter that may work with a Brand A disk drive most likely won't work with Brand Z or a so-called SCSI-compatible scanner. We know because we are in the process of testing various devices at HC/WG Labs.

Now an interesting situation occurred with SCSI. Apple Computer, formally the paragon of Yuppie know-it-all-ness, decided to add a SCSI port to the Macintosh Plus. Good idea, only the first attempt wasn't close to SCSI and the Top-Sider-shod developers even redefined the connector, a real no-no to SCSI mavens. Consequently, users who thought they could attach any old SCSI device to the system found it wouldn't work without lots of work, violating the whole purpose of SCSI. Of course this was just another example of how a standard could be violated.

Faith and begorra! In rethinking its product plans, Apple rethought its thoughts on SCSI, at the same time tossing away Top Siders in favor of Hush Puppies, along with its arrogant ways. And, you guessed it, Apple did indeed make SCSI, SCSI. In fact, Apple may be one of the few systems companies that can indeed claim total compliance to the SCSI standard. If you have a SCSI Winchester disk drive, plug it in and it will work. The same goes for scanners, and although we haven't tested it, Talaris' laser printers that have SCSI ports will probably work.

Even though denizens of DEC-dom don't wear Top Siders, or have alligators on their shirts, it seems a certain air of arrogance befits them when eschewing standards. DEC doesn't violate standards, it just ignores them. Case in point: The company behind the big gray boxes recently introduced a write-once optical subsystem called the RV20. Heady stuff for those of you who dream of zillions of gigabytes at your fingertips. But did the mighty colossus choose SCSI as the system interconnect bus—nah, too easy. Did it choose the Intelligent Peripheral Interface (IPI) standard designed specifically for large systems? Nah, it doesn't fit the company's image. Rather, true to DEC-i-ness, the company chose the Intelligent Systems Interface (ISI) pioneered by Control Data Corp. and ignored by the industry as a whole. To CDC's defense, ISI did foster IPI. What DEC found compelling about ISI, insiders tell us, is that no one else uses it and the expense factor in creating an ISI-compatible controller, which will most likely be too great.

DEC may really have something here. By using proprietary or technically sticky interfaces and controllers, there is no standard conformance problem. That should really make you happy, Richard.

Editor In Chief

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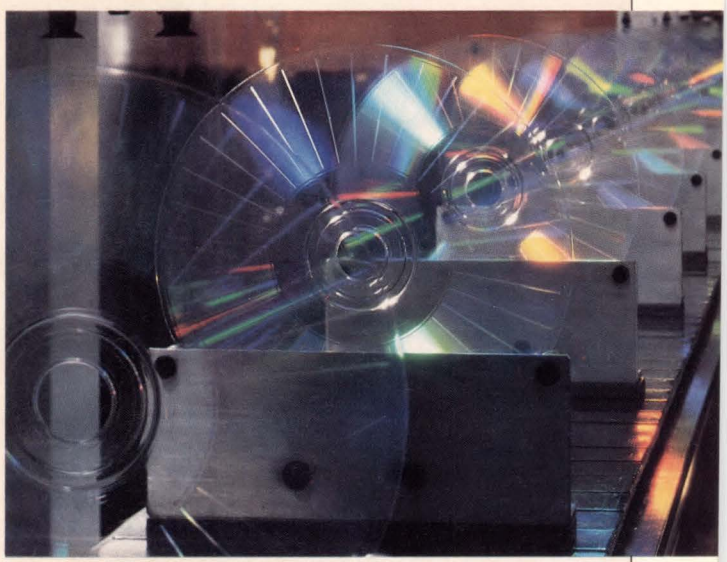

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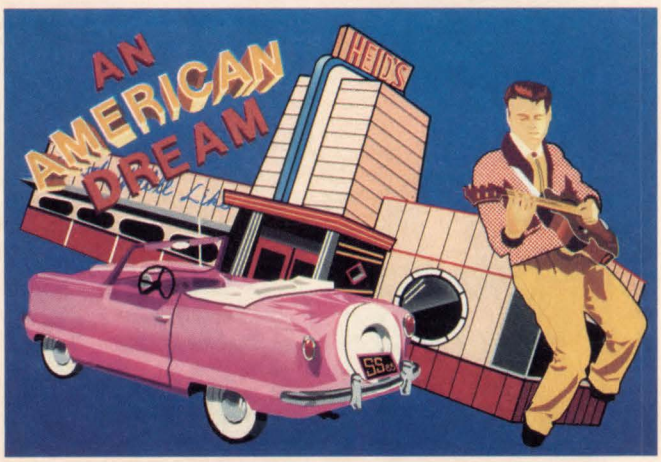

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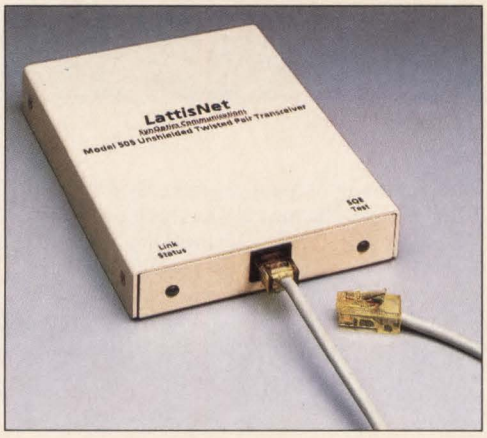
HOW REVIEW

PRODUCT FOCUS



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STORAGE

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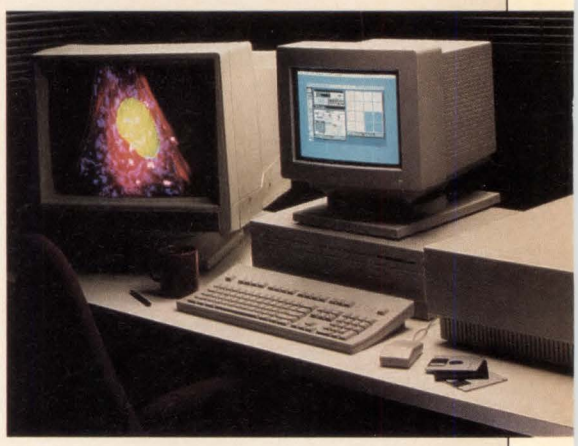

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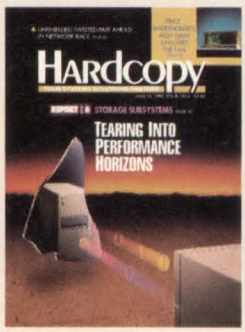
DEPARTMENTS



This month's cover illustrates the mirroring of data, which allows you the comfort of knowing your data is always secure and available when you need to retrieve it. Art direction by Steve Wolowitz and photography by Rick Wahlstrom for Ebey, Utley and Company.

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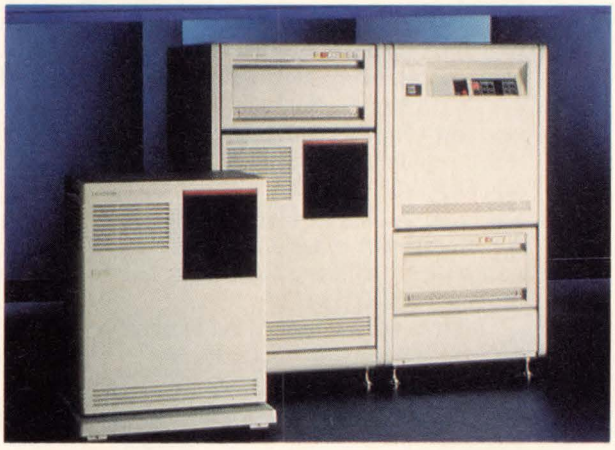

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LETTERS

NOT HAPPY. . . .

I have read with some interest your editorial reply to David Meile's letter, "Toner Problem is Messy," in the April 15, 1988 issue of *Hardcopy* on page 12. You suggested that he "read more carefully before you point out errors." I suggest that you take your own advice.

I quote the fourth paragraph from Brown's article, "Consumables Eat Up Majority of Laser Printer Maintenance Expense," in the February 1988 issue of *Hardcopy* on page 28:

"With some printer manufacturers, additional products are required when replacing a toner kit. For example, Digital Equipment Corp.'s LN03 $83 toner cartridge also requires that a customer purchase a $189 maintenance kit . . . making the cost of DEC's toner kit a hefty $272."

I agree with you that no *explicit* reference was made as to the frequency of use of these products. However, Brown implies that I need to purchase both products (i.e., DEC's toner kit) every time I replace the toner in the LN03 . . . whenever that might be.

Clearly, Brown's implication is incorrect. I do not need to purchase the maintenance kit every time I change my LN03 cartridge. I save $189 from her quoted $272 because I only need to purchase the toner cartridge if I am not planning on applying the maintenance kit!

It seems very clear to me that Meile was quite right in his original letter. While it is true that the data presented was accurate, the context in which it was presented indicated a maintenance cost significantly higher than occurs in practice.

Paul R. Ganci, Ph.D.
Honeywell Inc.
Colorado Springs, CO

Your response to my letter (published in the April 1988 issue) puzzled me. Indeed, I saw no reason to print the letter in the first place. One does not need to be an industry analyst in order to spot an error in fact.

Your reply was factually untrue. You state: "The article explains that for proper maintenance of LN03 printers, DEC requires the purchase of both kits." I quote from the article itself:

"With some printer manufacturers, additional products are required when replacing a toner kit. For example, Digital Equipment Corp.'s LN03 $83 toner cartridge also requires that a customer purchase a $189 maintenance kit—making the cost of DEC's toner kit a hefty $272."

The key word here is *requires.* To replace toner on an LN03 laser printer does not require a maintenance kit at all. On the other hand, every 10,000 pages or so, the user is required to install the maintenance kit. The maintenance kit does not require the user to replace toner, or vice versa.

If the author had stated this as I have just done, I would concede your point. But Renee Brown glossed over that particular fact, thereby leading anyone reading the article to believe that a user is required to purchase $272 worth of materials every time the toner needs to be replaced.

The *DECdirect* catalog also supplied a description of the LN03 toner cartridge kit and the user maintenance kit. Nowhere does it say that they must be purchased together. Average pages per kit are given for each. Since you mention pricing for the kits in your response, I assume that you also had the opportunity to read the description.

David Meile
Health Computer Sciences
University of Minnesota
Minneapolis, MN

Enough said.—Ed.

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If your system is big, busy, and expensive, minimizing downtime is probably a major consideration. So you want the fastest backup you can possibly get.

On the other hand, smaller systems and networks may be able to get by nicely with a backup solution that's somewhat slower, but much less expensive.

The point is that no single backup answer is right for everybody.

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INDUSTRY CONSENSUS PUTS UNSHIELDED TWISTED-PAIR AHEAD IN NETWORK RACE

Surpassing both standard (RG-8) and thin-wire (RG-58) cabling schemes, telephone twisted-pair wire may soon prove to be the pervasive network connection

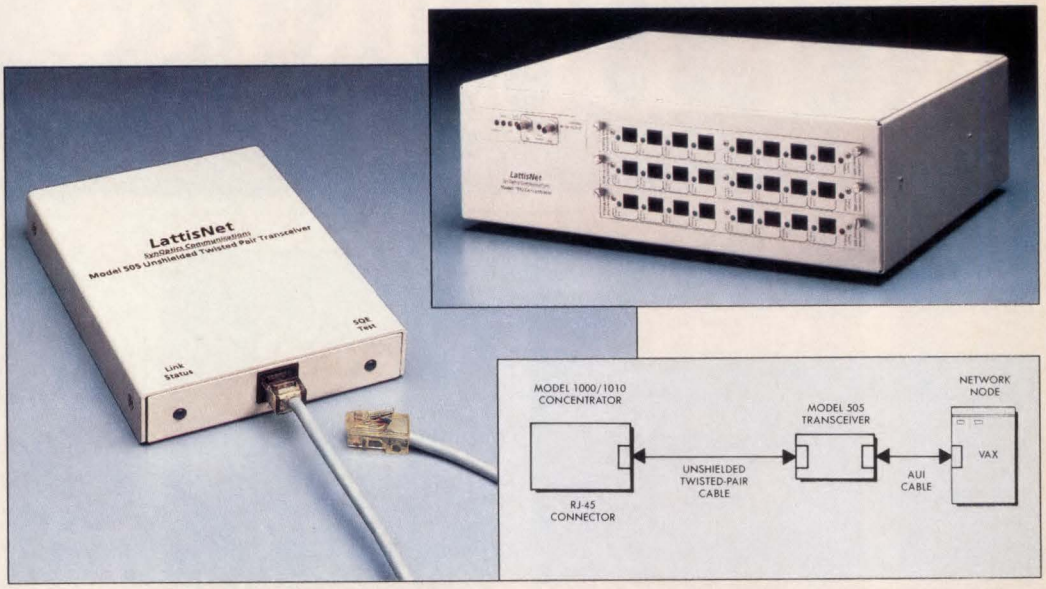
by **Brad Harrison,** *Midwest Editor*

Once believed to be overly susceptible to noise and incapable of transmission speeds of 10 Mbits per second—the maximum throughput of Ethernet—telephone twisted-pair wires may soon prove to be the pervasive network connection, surpassing both standard (RG-8) and thin-wire (RG-58) cabling schemes; that is, if the consensus reached by the IEEE 802.3 10Base-T committee on network connections yields a truly workable standard.

Until recently, the IEEE working group was considering two schemes. One being a star topology with send and receive signals carried separately—a scheme similar to a starLAN 1-Mbit network favored by the majority of participants, including AT&T (Morristown, NJ), Hewlett-Packard (Palo Alto, CA), SynOptics Communications Inc., Micom-Interlan, Ungermann-Bass (Sunnyvale, CA), Wang Laboratories (Lowell, MA), and Western Digital (Irvine, CA).

The second scheme, backed by Digital Equipment Corp. (Maynard, MA) and 3Com (Santa Clara, CA), was similar, but viewed the network topology as a combination of twisted-pair with coax backbone. Thus, signals are sent and received on the same lines. DEC and 3Com both argued that this bus-based approach allows multi-drops for support of multiple workstations across a coax connection.

The star concept, sponsored in part by SynOptics, uses differential transceivers for fully balanced transmission lines, thus managing signal attenuation or reflection—a factor committee members weren't sure the DEC/3Com scheme could ensure.



***SynOptics Communications Inc.'s centralized concentrator and transceivers use** twisted-pair to support each node on the network. Multiple concentrators are connected via fiber optics.*

Even though the consensus seems to favor the majority approach, the votes may not all be in. Clearly, there is a predominance of coaxial cable in existing Ethernet networks, making the star topology hard to implement.

"You must distinguish between product issues and standards issues—they're far from the same," insists DEC's Director of Local Area Networking, Gail Daniels.

DEC can, and does, claim an extensive base of Ethernet products, including unshielded twisted-pair. "We've never ignored the issue. We offer what is needed. We felt our standard proposal best reflected what the user base required,"says Daniels.

Preserve the Wire

Because of the hundreds of thousands of coaxial nodes (both RG-8 and RG-58) already installed, DEC and 3Com both believe there is a strong desire to preserve that base. The 24-gauge twisted-pair would serve mostly to link the wiring closet to the wall plug—something IEEE members called "a logical first step."

Possibly tempting committee members and making twisted-pair compelling is the ample supply of telephone wiring bundles already installed in virtually any facility—eliminating the need to run new and expensive coax cable to support a network. Moreover, phone companies are taking a proactive interest by providing additional "not-used" pairs in the telephone wiring bundles. Interestingly, Pacific Telephone officials say it isn't so much foresight on their part to support networks as it is an attempt to avoid having to pull extra wire later for expansion of the telephone system.

Making use of skinny wire even more compelling is IBM. It has standardized shielded twisted-pair for its token ring network and is developing 16-Mbit twisted-pair solutions that may represent the next generation of the 802.3 standard. There's even talk of combination token ring/Ethernet networks in the future.

Another factor in favor of the twisted-pair wiring scheme is that it avoids the problem of mixed media. "But not initially," claims international communications consultant James Swanner (Tokyo), "There is a lot of coax in place and already people are dropping twisted-pair lines off it—just like DEC and 3Com proposed."

continued on sector 18

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continued from sector 16

Swanner isn't necessarily rubber-stamping the DEC/3Com idea. He also thinks twisted-pair will win out in new installations: "if for no other reason than cost," he says.

Big Bucks

Fortune 500 companies are standardizing on twisted-pair. "That's what the telecom staff is familiar with," argues Charles Feltman, marketing manager at Communication Machinery Corp.

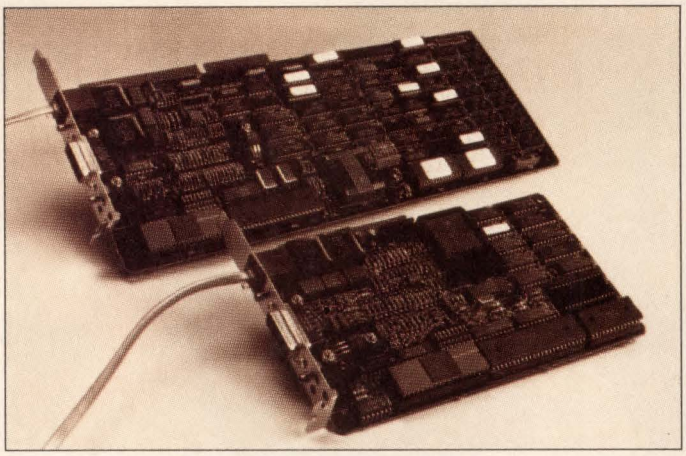
Feltman's company manufactures TCP/IP hardware and software for thin-wire and doesn't see the impending standard for twisted-pair as being a threat. "We've been wanting it and it will eliminate much of the technical confusion," he says.

It's All in the Chips

Even with a consensus of opinion stabilizing standardization efforts, don't plan on ordering the official green book yet. There is still a great deal of wrangling and politics to be worked through. Currently, SynOptics is the only company that can claim adherence to the proposed standard—and that may change as the document evolves.

One of the important elements needed to support the standard is the availability of low-cost silicon. The internal operation of the chip is dependent on the standards specifications. "It's a real chicken and egg situation," notes one committee member.

SynOptics is well aware of the need for readily available transceivers and has signed up Micom-Interlan and Kinetics Inc. as allies. Micom-Interlan is already delivering its NP600-UTP and NI5210-UTP protocol processors to attach IBM PC/XT/ATs to twisted-pair nets. Cirrus Logic Inc. (Milpitas, CA), a manufacturer of specialized, application-specific IC, and National Semiconductor (Santa Clara, CA) are reportedly eyeing the emerging market as well, thus making available chip sets in larger quantities than you might expect.



Linking PCs to telephone wire, *Micom-Interlan NP600-UTP and NI5210-UTP boards* (left) *use the same transceiver chip found in SynOptics Communications Inc.'s LattisNet products. Unshielded twisted-pair is normally used in point-to-point star configurations* (below), *with the wiring closet or concentrator at the center. This is in contrast to the multi-drop, or "daisy-chain," configurations used with coax.*

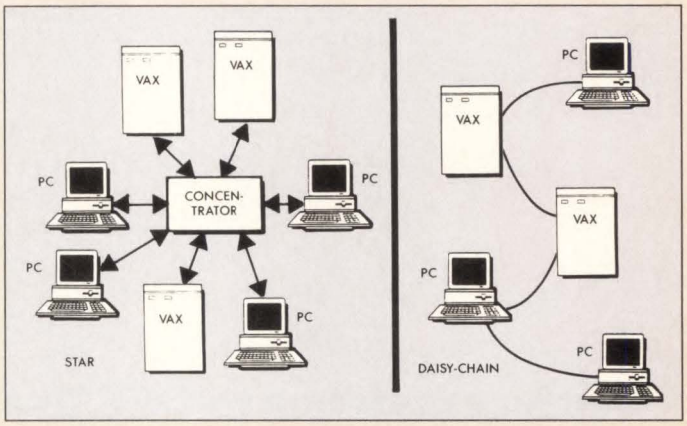
Companies like Kinetics are making plans to take advantage of unshielded twisted-pair as well. According to the company, it expects to be able to attach Macintosh SEs to twisted-pair LANs later this year. Kinetics, like Micom-Interlan, expects inexpensive chip sets to be available, thus reducing design and integration time and costs.

DEC Fights Back

Even though DEC may not have won on the IEEE ballot, it still believes its approach to be valid. The company continues to recommend IEEE 10Base2 thin-wire, except in situations where rewiring is difficult or impossible. DEC's Daniels notes that the company's posture is to support the customer, "and the demand we've seen is for multi-drop twisted-pair," she says. DEC's unshielded twisted-pair products, announced in September, consist of a thin-wire-to-twisted-pair adapter, a wiring closet, and support for a variety of cables.

Paying the Piper

Price is one of the compelling reasons to use twisted-pair (see Table). But don't be fooled by the relatively low cost per foot for fiber optic cable—the high cost of fiber optic transceivers and test equipment, as well as a growing need for qualified installers, keeps the cost of fiber optics high. Fiber optic cable is primarily being used for network backbones or closet-to-closet connections. It's also being used to support individual nodes that have high data-rate requirements, such as graphics workstations.



Interestingly, fiber optic cable is serving as a backbone for twisted-pair installations. Fibercom Inc. (Roanoke, VA), for one, claims that it's installing networks with fiber as the backbone and twisted-pair as the connection to the desktop, and SynOptics uses fiber to connect its twisted-pair concentrators. According to many indications, a combination of twisted-pair and fiber is shaping up as the Ethernet media solution to meet or beat.

Additional information about the products or services described in this article can be obtained by contacting the company directly or circling the appropriate reader service number.

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Santa Barbara, CA 93117
805-968-4CMC
Circle No. 123

Kinetics Inc.
2500 Camino Diablo, Ste. 110
Walnut Creek, CA 94596
415-947-0998
Circle No. 124

Micom-Interlan
155 Swanson Rd.
Boxborough, MA 01719
800-LAN-TALK or 617-263-9929
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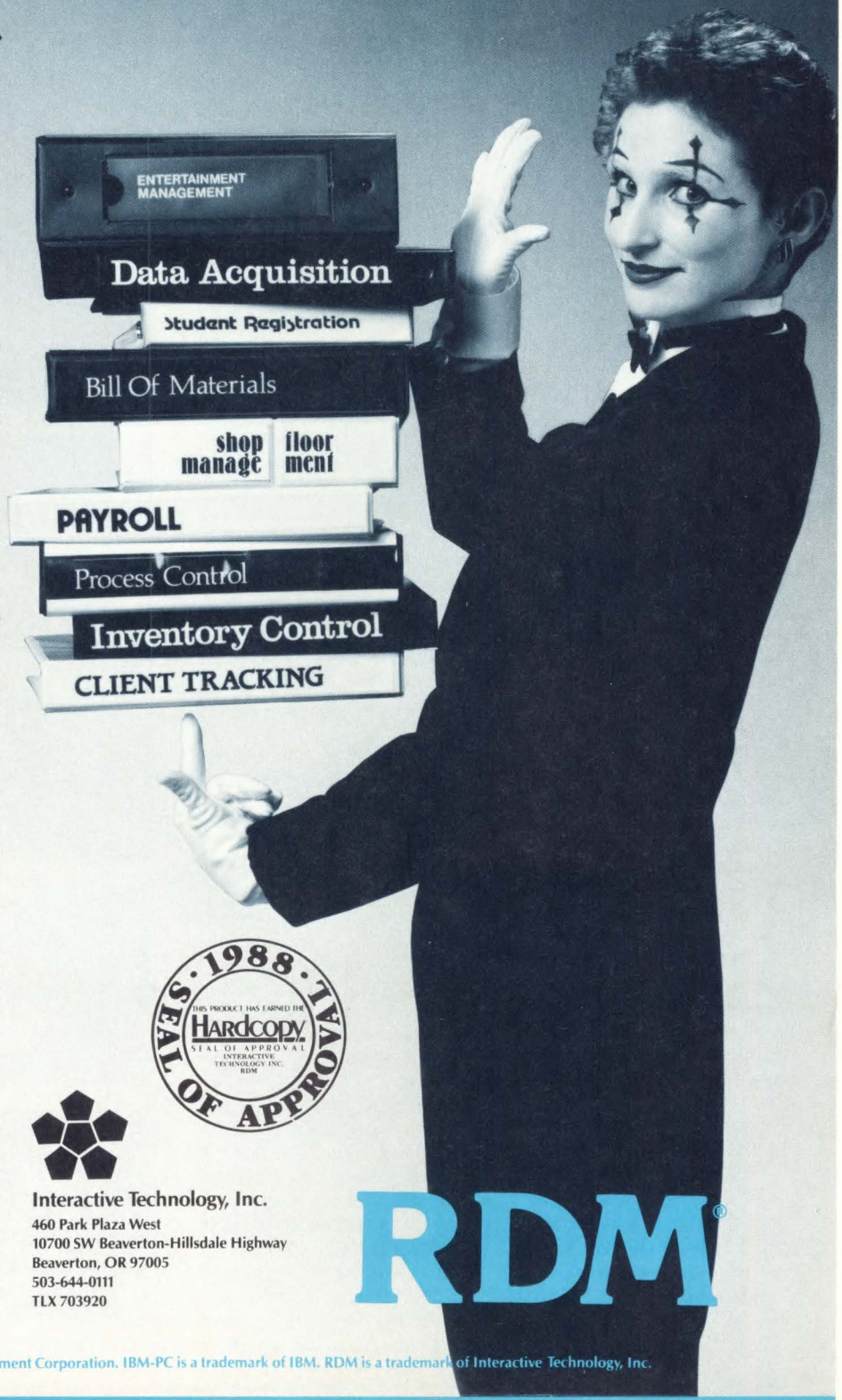

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FILM RECORDERS ADD PROFESSIONAL, LOW-COST GRAPHICS TO YOUR BUSINESS PRESENTATIONS

by Lynn Haber, *East Coast Editor*

More than one year ago, Apple Computer Inc. promoted a concept called desktop presentations whereby businesses, utilizing their PC's and graphics-oriented software, could conceive, design, and produce the materials required for boardroom meetings and presentations. Since then, vendors continue to roll out hardware and software products designed to turn that concept into reality. Today, one of the hottest desktop presentation products to hit the market is film recorders.

Although available for more than a decade, film recorders—devices that produce slides from computer-generated text and graphics—have dropped to a price/performance level that begs for the attention of corporate users.

Why? Because, according to Jim Willey, director of presentation products at Polaroid Corp., 10 million managers in the United States alone made an average of six to 10 presentations last year—totaling 600 million 35mm slides and 400 million overhead transparencies costing $6 million.

Marketed by companies such as Bell & Howell Co., General Parametrics Corp., Genigraphics Corp., Lasergraphics Inc., Matrix Instruments Inc., Mirus Corp., and Polaroid, film recorders and systems range in price from $4,000 to more than $30,000.

"Today, for $4,000–$7,000, you can obtain a usable, quality slide at a reasonable price," says Peter Testan, director of the color hardcopy market requirement service at CAP International Inc., a Marshfield, MA, research firm.

The next level of film recorder is priced in the $12,000-to-$13,000 range and is used as a shared resource, notes Testan. For more professional or commercial applications, film recorders are priced at $30,000 and up.

CAP anticipates that the market for film recorders will grow at a rate of 20% between 1988 and 1992, accounting for $148 million in revenue by 1992—representing 30,000 units shipped. In 1987, 12,000 units were shipped that accounted for revenue of $111 million.

In addition to saving money by producing slides in-house—using outside services for slide reproduction can cost from $15 to $100 per slide versus doing it yourself for $1 or less per slide—other user benefits include greater creative and process control, data security, and time savings.

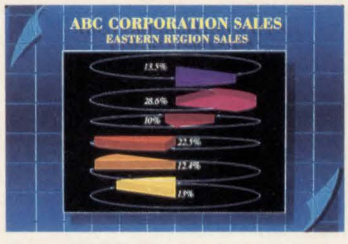
Who's Doing It?

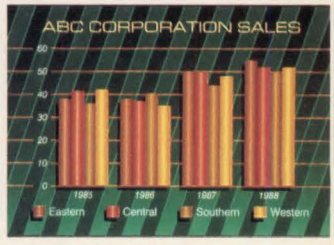
While more organizations are using 35mm slides in-house for business purposes, not all do.

"The way most business operate today is that they'll do the layout and creation of the slide on their PCs with the help of presentation software, and then, via modem, send the information to an outside service where the slide is completed," explains Testan.

"For the most part, the person using a film recorder today is a visual graphics professional whose full-time job is creating presentations," says consultant Alan Paller, president of AUI Data Graphics, a division of Computer Associates

continued on sector 22





Ranging in price from $4,000–$30,000, *the film recorder, which produces slides such as these from computer-generated text and graphics, is one of the hottest desktop presentation products to hit the market.*

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Polaroid's Turbo Palette computer film recorder* (left) *is *an IBM PS2-compatible device that utilizes a Bell & Howell Quintar 1080 color graphics controller to prepare graphics information and automatic exposure on the palette recorder. The Turbo Palette is priced at $3,495. General Parametrics' Photometric Slidemaker* (right), *a 4000-line desktop film recorder, features screen preview, selection of 2000- or 4000-line resolution, and is supported by more than 40 graphics packages. The Photometric Slidemaker is priced at $4,495.*

continued from sector 20
(McLean, VA).

Full-time users include commercial graphic design companies, audio/visual departments within government, training departments within large business organizations, and that rare person who does management presentations as a profession. "At this professional/commercial level," Paller adds, "slide production has moved almost completely in-house."

"While a specialized department, such as the graphic arts department or a computer support group, is, today, the primary user of film recording equipment, the trend is to decentralize slide making," Testan says.

"The trend is to delegate slide making to the individual departments," Testan adds. "And, to make that happen, vendors are striving to make their equipment easy to use."

A Product Glimpse

General Parametrics, for example, offers PictureIt, an easy-to-use business graphics software that helps the user create professional slides by virtually filling in the blanks. PictureIt helps users create customized graphics by offering a selection of pre-designed word charts, bar charts, pie charts, org charts, etc. The software also allows the user to change colors, type styles, backgrounds, size, and placement, and to create overlays, display multiple charts, etc. Finally, users can preview the image on their monitors before shooting the film.

"The preview capability is the biggest selling tool for our product," says Herbert Baskin, president and chief operating office at General Parametrics.

The recently introduced Photometric Slidemaker from General Parametrics is a 4000-line, desktop, IBM PC-compatible film recorder costing $4,495 that runs more than 40 popular graphics software packages including Lotus' Freelance Plus, Harvard Graphics, HP Graphics Gallery, and the Master Graphics Series from Ashton-Tate. General Parametrics is expected to introduce an Apple Macintosh-compatible product later this year.

A new player in the market is Mirus, which recently introduced the Mirus FilmPrinter, an Apple Macintosh-compatible device priced at $5,895. The foundation of the Mirus product is its Direct Digital Imaging technology, similar to that found in high-end film recorders that reportedly results in higher-quality slides. Today, most low- to mid-range film recorders or those priced less than $10,000 are video-based or opto-mechanical font wheel devices.

Important features for users to look for in a film recorder include resolution or how sharp the slide looks, how many minutes it takes to make a slide, PC compatibility, software compatibility, ease of use, and price.

Additional features include device capability to reproduce text and graphics, and options for hardcopy of the slides for handouts.

Additional information about the products or services described in this article can be obtained by contacting the company directly or circling the appropriate reader service number.

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Quintar Division
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Matrix Instruments Inc.
One Ramland Rd.
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716-381-8320
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Mirus Corp.
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Los Altos, CA 94022
415-949-5544
Circle No. 109

Polaroid Corp.
575 Technology Square
Cambridge, MA 02139
617-446-5566
Circle No. 110

Making the Film Recorder Work for You

"By bringing slide production in-house, the company has saved thousands of dollars and has gained control of content and timing for its presentation requirements," reports Stephen Perry, manager of computer services at Cotton Inc., a nonprofit organization representing cotton farmers.

"For one annual meeting alone, we spent $14,000 dollars on slides in two weeks when using an outside service. Now, doing the work in-house, we don't even spend $5,000 a year," he says.

"The company uses a Bell & Howell Co. CDI4 film recorder and 35mm Express software from Business & Professional Software Inc. to produce an average of 3000 slides a year," Perry says.

Cotton Inc. uses slides in its presentations to clients, at conferences, and seminars.

Perry's number one priority for the film recorder is quality and how sharp the image looks. "After that, it's all in the software," he says. "We like a package that's easy to use, offers flexibility, and is powerful."

The Bell & Howell film recorder operates with an IBM PC/AT computer. Perry reports that a Hewlett-Packard Co. LaserJet Series II printer is used for hardcopy output of slides.

"Today, 90% of our slides are produced in-house," Perry says.

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COMPETITIVE PRESSURE AND DECENTRALIZATION BROADEN CIM HORIZONS

by Edith Myers, *Senior Editor*

Facing stiff foreign competition and fighting what industry analysts term a complacent malaise over production efficiencies, U.S. manufacturers are beginning to fight back.

Besides undertaking massive reorganization to streamline operations and decentralize management, manufacturers are using Computer Integrated Manufacturing (CIM) as part of their field artillery.

What makes CIM a potent weapon in the manufacturing battle? Mainly, it provides up-to-the-minute information on shop operations in contrast to weekly or monthly reports—"A factor," says Dataquest Inc. (Cupertino, CA) Analyst Bob George, "that improves the overall management response."

A strong advocate of this trend is Stina Hans, president of MCBA Inc. She believes that a CIM-directed strategy starts with a strong fundamental business information system. "That's the foundation for an integrated system," notes Hans.

Hans' advocacy shouldn't be a surprise since MCBA offers a Material Requirements Planning (MRP) II system. And, like any good salesperson, she is quick to argue the benefits of her product.

MRP and CIM are more than just buzz words, offering you a better way of controlling manufacturing. So much so that suppliers of manufacturing software are zeroing in on the Digital Equipment Corp. market with a vigor that is justified both by reason and by results. For example, Cincom Systems is enjoying new VAX business. "In fiscal 1987, 80% of our new sites are VAX-based. And," says Tom Womeldorf, Cincom's director of applications products, "78% are companies with IBM mainframes in their corporate headquarters. This is a trend, believes Womeldorf, brought on by a shift toward decentralization of manufacturing operation and DEC's support of networking.

Similarly, David Sohm, vice president, marketing, for Ask Computer Systems Inc., reports equally impressive numbers. He claims that Ask's MANMAN manufacturing package is used in 600 DEC installations with an additional 500 DEC sites employing MAXCIM—a package acquired by Ask last August along with its developer, NCA Corp. "The DEC business is customer driven," says Sohm. And large manufacturing companies want more individual—targeted—software packages at the plant level. "That really supports the return of decentralization," he adds. Moreover, Sohm believes that the VAX is just a good, "hot" machine for manufacturing operations.

Even Arthur Anderson & Co. is getting on the VAX bandwagon. Its MAC-PAC integrated package has been marketed to IBM mainframe users for the past three years. Early this year, however, the company announced MAC-PAC/D for the VAX user, an important strategic support shift, claim industry analysts.

The Arthur Anderson software is designed for government contractors and meets expected Federal standards. "We sell mainly to primes—prime government contractors,"says Carleton F. Kilmer, partner in charge of aerospace and defense markets in the company's Boston office. He says that this is a good, but demanding, market.

But Arthur Anderson is noting a discernable trend among the primes to decentralize, "This has created a need for smaller, standalone manufacturing control systems for their divisions," says Kilmer. He further confides that Arthur Anderson is eyeing a potential $50- to $150-million in sales to the emerging second-tier (non-prime) organizations. He believes that supporting these organizations opens up an even broader base of smaller-shop business.

Generic Support

What Arthur Anderson, Ask, and Cincom offer is generically called MRP II software for manufacturing resource planning. This software helps you with such critical activities as coordinating inventory with sales projections, and production scheduling, as well as tying it all together with accounting systems.

Interestingly, the "II" is misleading. There never was an MRP I. Regardless of the marketing hype attachments in the name, MRP is a powerful tool for manufacturing resource planning. And it is a prime component of emerging CIM systems. MRP is a mature technology, proven in thousands of manufacturing environments, with predictable cost benefits and a fairly rapid return on investment.

Get It Together

Clearly, CIM and its components, such as MRP II, are modular solutions. For ex-

continued on sector 26

Additional information about the products or services described in this article can be obtained by contacting the company directly or circling the appropriate reader service number.

Company	Product	System	Price
Arthur Anderson & Co. 67 W. Washington Chicago, IL 60602 312-507-2375 **Circle No. 169**	MAC-PAC/D	All VAX/VMS	$80,000–$300,000
Ask Computer Systems Inc. 2440 W. El Camino Real Mountain View, CA 94040 415-969-4442 **Circle No. 170**	MANMAN	All VAX/VMS	$55,000–$260,000
Cincom Systems 2300 Montana Ave. Cincinnati, OH 45211 513-662-2300 **Circle No. 171**	Control:	All VAX/VMS	$100,000–$400,000
MCBA Inc. 425 W. Broadway Glendale, CA 91204-1269 818-242-9600 **Circle No. 172**	Manufacturing System	All VAX/VMS including MicroVAX	$3,000–$80,000

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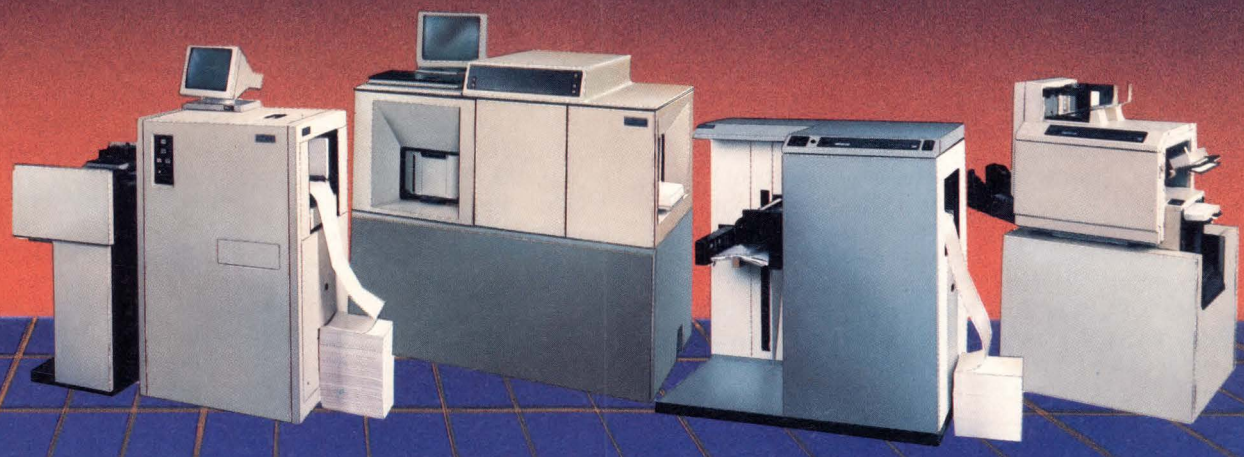

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CIRCLE 383 ON READER CARD

continued from sector 24

ample, MRP II is composed of the business information control, while true CIM—not yet here—will combine MRP with CAD/CAM, numeric control, and even quality control data. "That's true CIM," says Hans, "but it's not here yet."

Following this modular approach to MRP II, MCBA has released the final manufacturing system component for VAX computers. The new package, Capacity Requirements Planning, is the 18th in MCBA's modular MRP II software system. Written in VAX COBOL, it's a shop floor management tool for comparing a work center's projected load to available capacity. The software provides you with advanced information about potential bottlenecks, thus permitting you to make adjustments before production is impacted.

Great Expectations

Although MRP II does offer great benefits, the sale isn't easy. "Indeed, a great deal of pre-sale education and post-sale support is demanded," reports Gary Morley, vice president of General Electronic Data Systems (Grand Rapids, MI), an MCBA reseller. "Even though we have installed some 25 MRP II software systems, the sale hasn't gotten any easier," says Morley. He attributes most of the problems to "overblown expectations. The reality has to match the user's expectations. And right now, that's a big problem." He also warns that too much too soon can be a disaster and recommends a gradual implementation of MRP.

Because MRP is not only a complex mix of software—and frequently demands new hardware—implementation can be tough, takes a long time, and is often encumbered with a number of stumbling blocks; that is, unless a great deal of thought goes into the planning process. For example, Davidson Plyform (Grand Rapids, MI), a manufacturer of plywood products for office furniture, has installed MCBA's software, and Don Campbell, the company's senior vice president, is happy about it. "We purchased the MCBA software in 1984 and started implementation on a PDP-11/23. We converted to a MicroVAX II in April 1987, and the conversion took about two hours," he says. The entire system is up and running now and Campbell expects fine tuning to be complete by the end of this year.

Campbell stresses, however, the importance of knowing where you're going from the outset. "We had an excellent manual system with all controls in place," he says. "It's important to have all your ducks in a row with your manual system before you go to a mechanized version."

A Dual Role

Another MCBA reseller, Mark Wise, president of Alpha II (Columbus, OH), targets smaller manufacturers and enjoys annual sales of more than $25 million. He says that it helps to play the dual role of vendor and consultant. "That way, at the front end of a sales cycle, I can ask a potential customer to tell me about his business and then I see what I can offer him from my bag of tricks," he says.

Wise's bag of tricks includes tools geared to getting customers closer to a true CIM environment. He now offers an engineering package called Design Graphics, developed by Engineering Systems Corp., that he can interface with MCBA's MRP II packages. He hasn't done this for a customer yet, but says "there's a lot of interest."

An interesting illustration of advanced implementation is J.S. MacLean Co. (Columbus, OH). Although a customer of Wise, the company has gone beyond the MRP II software offered by Wise's firm. Therefore, in concert with Wise, the MacLean Co. developed an electronic bidding system that the company claims is "state of the art." "We developed the specifications, and Wise wrote the software in DEC DIBOL," says MacLean Controller, Richard Gomez.

The MacLean Co. makes retail store fixtures and often bids on providing what Gomez calls, "the whole inside, the guts of the store," when a big retail store is remodeling or refurbishing. A bid for a job can include an almost infinite number of details such as dimensions of a piece of glass and whether or not it needs beveled edges. "It took a year-and-a-half to develop the system," says Gomez, "but it cut manpower invested in each bid by 50%." Moreover, he insists that the system is tailorable to meet the needs of any industry—a sales venture the company is actively pursuing.

The Bar Code Link

MRP systems aren't limited to sales or business applications. Coshocton Stainless (Coshocton, OH), a $200-million-a-year operation, hasn't interfaced CAD or other engineering systems to its MRP II systems, but has tied in a shop floor production reporting system. This system uses bar coding, an important CIM component on the factory floor, tied into a DEC VAXcluster 8250 and MCBA's MRP II software.

Second Try

Interestingly, many companies have developed some form of MRP and are familiar with the concept. "Consequently, we don't have to sell the idea of MRP," says Cincom's Womeldorf.

The Cincom Control: manufacturing system (an MRP II product) accommodates, in one system, management of discrete, repetitive, and project-oriented manufacturing. Additionally, Cincom claims that the product is functionally identical to the IBM equivalent, thus avoiding retraining on the part of users.

Further, Womeldorf says that Cincom's Control: meets all Federal requirements for companies wanting to participate in government procurement, which makes it a powerful tool. In fact, Cubic Corp. (San Diego) has taken advantage of Cincom's ability to build Federal conformance into the package. Cubic's Engineering Manager, Don Wilson, points out that most MRP systems have deficiencies in conforming to government requirements. "Cincom, however, worked with us to bring the system in line with what the government required," he says. That requirement is a generic configuration that segregates operations such as contract and special cost reporting.

CIM Directed

Similarly, Arthur Anderson had geared its MAC-PAC offering to the government's requirements. The VAX version is slated for final testing by July 1, with deliveries to begin in August. Kilmer stresses, "The VAX version will have all the functionality we have been offering IBM users for three years; it will not be a reduced set."

Further, MAC-PAC includes features that support integration with robotics, bar code readers, automated storage and retrieval, and CAD/CAM, making it a firmly CIM-directed product.

Equally CIM directed is a high-end MRP II system being jointly developed by DEC and ASA International Ltd.'s Manufacturing Systems Group (Foster City, CA). This package ties in real-time bar code reading on the shop floor. Both companies expect it to be used for such things as parts validation and time and attendance records of employees.

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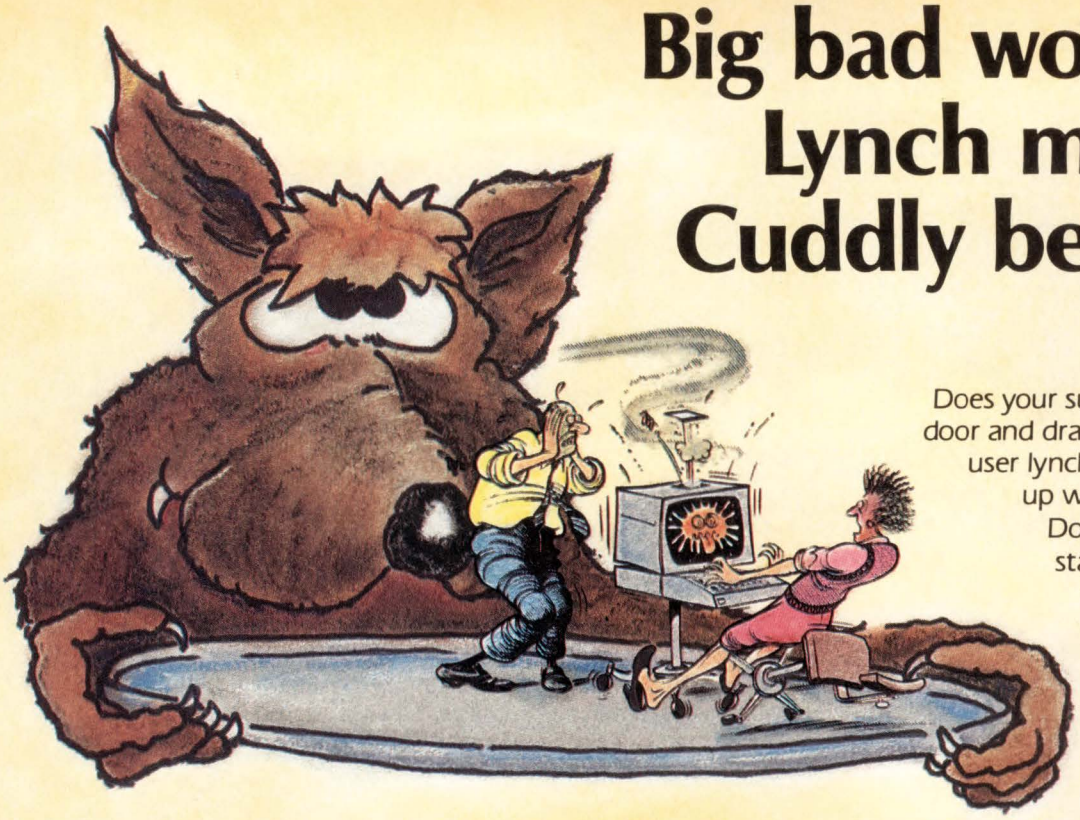

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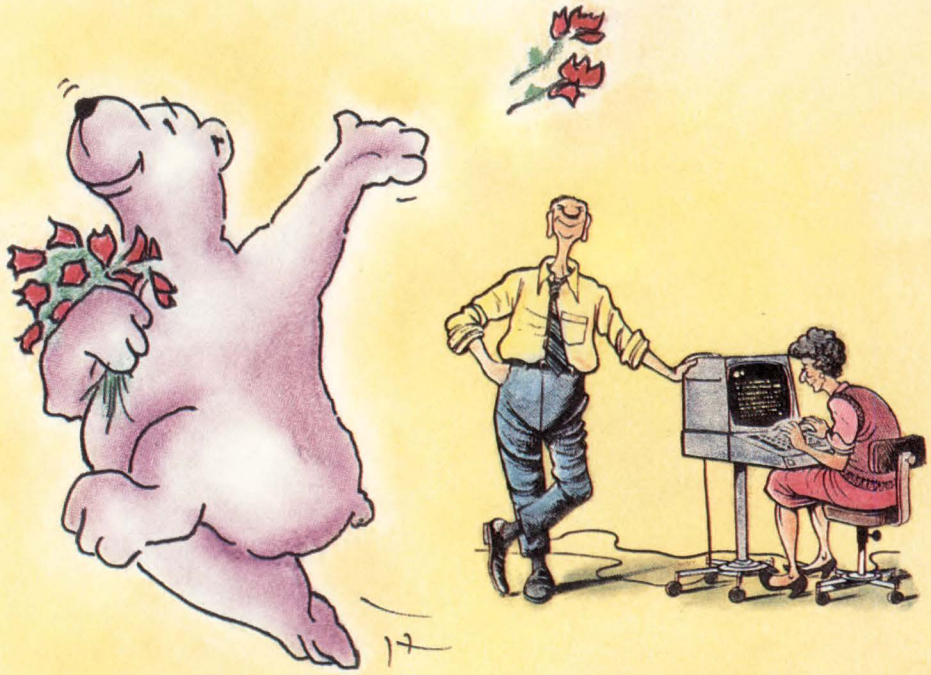

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CIRCLE 451 ON READER CARD

THE MASS. REPORT

Calling on the neighbors

Our long-awaited New England spring has finally sprung and we took the opportunity to pay some calls on our neighbors along Route 128 ("America's Technology Highway," according to the signs). On this trip we went south to the Needham area, where The Interface Group, producer of the Comdex, Interface, and World Computer Conference shows (among others), is nestled among several computer start-ups and parts distributors. After narrowly beating the construction time required for building the Great Pyramid of Cheops, TIG's headquarters building finally appears completed, although it still bears no sign that is readable from the highway. TIG grew so rapidly that the Needham Fire Department refused to allow the company's building(s) to be occupied until TIG added a multistory garage.

TIG now includes an airline (Five Star), a travel booking service (GWV), and—the latest as of this writing—a major Las Vegas hotel! Yup, Shelly Adelson, TIG's owner, mover, and shaker, has purchased The Sands. We sent our Ninja correspondent, Sam Murray, to sneak around. Seems Shelly has plans to add 1000 rooms to The Sands and, get this, tack on a convention center bigger than Las Vegas' own! It could happen. The Las Vegas Convention Center's West Wing was a TIG project. What's next? Stay tuned.

Down the road we found Stellar Computer, John Poduska's latest baby. Dr. Poduska founded Prime Computer and Apollo Computer. His latest claim to fame is the Stellar Graphics Supercomputer Model GS1000, a highly parallel machine that marries analytical muscle with strong graphics abilities. The GS1000 is sort of an "ooomph and ooohh" combination that Stellar markets as a "new class of computer." We concur. Stellar's niche is neither mainframes nor graphics workstations, but a wide range of technical computing applications normally implemented on either or both. The company's strategy is to offer users a buffet instead of requiring them to choose from columns A or B.

The GS1000's specs are impressive. It is a 64-bit machine capable of 20–25 Millions of Instructions Per Second (MIPS) and peak rates of 40 double-precision Millions of Floating Point Operations Per Second (MFLOPS). But what really impressed us was the GS1000's balanced architecture, which brings more power to the application than many other systems with the same or better raw numbers. The GS1000 uses a Synchronous-Pipeline Multiprocessor (SPMP) to support its Chinese-buffet claim.

The SPMP consists of three proprietary application-specific integrated circuits, one each for executive-level, multi-stream processing; vector floating-point calculation; and graphics rendering. The SPMP modules work in parallel and communicate with each other, memory, and I/O via a high-speed (1.28 Gbytes per second) system bus that Stellar calls its DataPath (DP) facility. The combination of tightly coupled SPMP and high-bandwidth DP avoids most of the bottlenecks associated with multiprocessor systems, particularly processor-to-processor and processor-to-memory transfers. Main memory is 16–128 Mbytes of DRAM, including a 16/32-plane virtual pixel map (a flexible windowing approach borrowed from workstation architectures that apportions main memory into sets of dynamically reconfigurable frame buffers), and 1 Mbyte of cache SRAM, an unusually high proportion of cache to main memory. Three VME buses are used: two for internal I/O and one for external use. Another user-accessible bus is provided by a built-in, Intel SPC/386 used for diagnostics and console control. Essentially an IBM-compatible, the 386 subsystem offers access to PC-DOS and AT boards—a nice touch.

The GS1000's software architecture is similarly impressive. Stellar's "Stellix" OS is based on UNIX V. 3 with Berkeley extensions. Most important of the Stellar-provided enhancements is a process-construct translator for the Multi-Stream Processor that addresses a major concern of parallel architectures: breaking up the instruction stream into "threads" for concurrent (parallel) execution. Early attempts at parallelism often expended so much of a computer's resources to that task that no benefit was attained unless the application remained fixed. Stellar claims its compilers not only "spin" threads efficiently on the fly, but spin them finer. That is, Stellar's software generates four separate streams of finely granulated object code not only from loops, but from source sequences it recognizes as most efficiently handled by one or another of the SPMP's pipelined processors. Where desired, the programmer can fine-tune this process further, or initialize the system as a loosely coupled machine.

Stellar's "StellarVision" graphics environment extends its balanced approach to proprietary architecture and open access by building on standard tools where possible. These include PHIGS+ for 3D rendering and MIT's X Windows V. 11. The programmer who demonstrated the GS1000 to us had no problems when downloading preprocessed graphics and raw datasets from Sun and Digital Equipment Corp. systems; tiling, overlapping, and zooming windows; and rotating, shading, and sequencing images. Stellar claims a rendering capability of 150,000, 100-pixel, Gouraud-shaded, Z-buffered triangles per second. The results of this power as viewed on a 19-in., 32-bit-per-pixel screen are very impressive. It's also guaranteed to ruin your day if you work regularly with an EGA.

Stellar's agreements with software suppliers now cover more than 30 application programs. Included are popular packages for electronic engineering design (UC Berkeley's Spice), chemistry (Polygen's Quanta), math (Linpak routines from Argonne National Labs), and packages for mechanical, geophysical, fluid dynamics, image processing, and animation applications. By late April, Stellar had almost a dozen systems with orders for another 75. The company expects to be in full production by late spring. Prices for GS1000 configurations start at $100,000.

Part of a continuing series of Bomb Squad Field Updates

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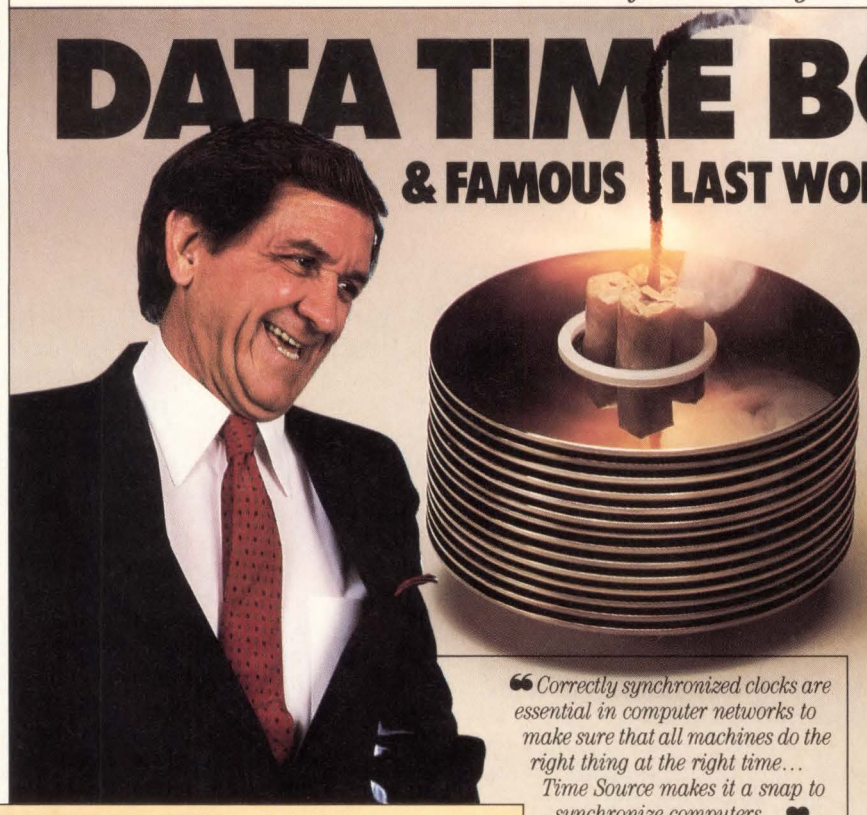

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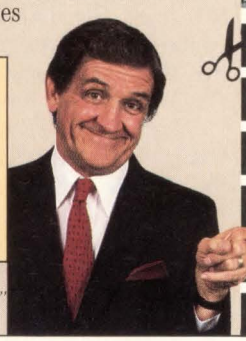

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CIRCLE 402 ON READER CARD

Object-orientation and images: Keeping up with improving output devices

If it has done nothing else for us, image processing has been a catalyst (perhaps the most significant one) for low-cost desktop publishing. Creating raster images that have smooth edges and meet the needs of quality phototypesetting is no mean feat. And, as output devices improve in resolution (with 300 dots per inch [dpi] being a benchmark for the minimum acceptable resolution), image processors have to keep pace.

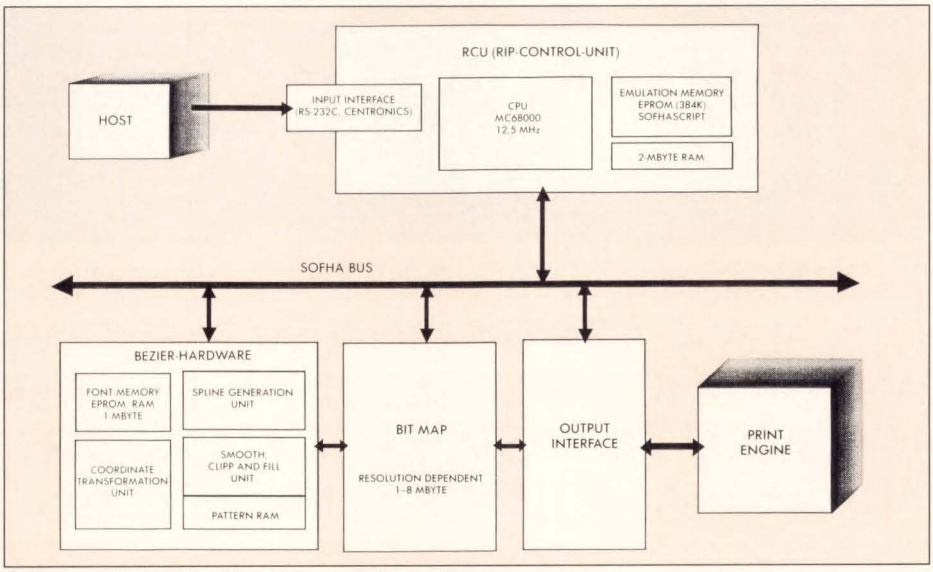
The Right Crayons

Every object we see is a collection of smaller objects. Typically, we think of an image as a collection of dots—pixels. But, as resolutions increase, manipulating all those dots becomes progressively more cumbersome. The solution to this problem is to eliminate our fixation with pixels; we must treat the image as a collection of well-understood and predefined objects that are dense pixel constructions.

Object-oriented hardware and software allow the construction and manipulation of a sophisticated image rather than a collection of individual pixels. Not only are the objects more easily managed by the software, but the amount of data required is reduced tremendously when compared to a bit-mapped image. Data reduction means faster response time, even with high-resolution, raster images. The objects themselves are stored in a uniform format, such as a bit map, but the displayed image consists of the object as modified by pointers and parameters.

For a German firm, SOFHA GmbH, the right objects are splines. More specifically, Bezier splines. The company's object-oriented SOFHA-RIP (Raster Image Processor) converts digital data into 11th-order Bezier splines. Any image this hardware creates is a collection of these splines. A straight line, for instance, is quite simply a first-order spline. To create a more complex image, such as a character in a specific typeface, an assortment of splines form the inside and outside outlines.

SOFHA claims that choosing splines frees the systems from dependence on the coordinate system. To describe, transform, rotate, or scale an object, the system only has to recalculate the control points.



Figure—Converting digital images into splines, *the Bezier hardware eliminates the need for coordinate system parameters and relies on end points. The bit map is the resolution-dependent portion of the circuit, and the Raster Image Processor (RIP) system creates an image that the output device can handle, whether it produces 300 or 3500 dpi.*

The SOFHA system architecture (see Figure) could be used in almost any laser printer and supports 2000-character-per-second output of 600-dpi characters—adequate for 25-page-per-minute output. The RIP hardware produces an appropriate image—one of the correct resolution to match that of the actual print engine—in the 1–8 Mbytes of bit map.

The RIP firmware provides printer emulation, object handlers, and an interpreter compatible with Adobe Systems Inc.'s PostScript, although the hardware will also work with any other Page Description Language (PDL).

Role of the PDL

Having an on-board PostScript interpreter may be the key to long-term success for any image-processing vendor. Interestingly, what is happening is that among the image processing systems, the PDL, and the PDL tools, vendors are creating multiple (nested) layers of object orientation. Consider that now a character is interpreted by the PostScript PDL as one item in a set of objects (a specific character in a specific font), which the laser printer interprets as a set of objects (such as the Bezier splines, along with parameters to define their presentation).

As image-output devices improve, such RIP architecture will continue to serve well. New implementations of PDL, such as Adobe's new Display PostScript, look promising because they more tightly couple the PDL and the output device.

For additional information about the products discussed in this article, please contact the company directly or circle the appropriate reader service number.

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by the HC/WG Laboratory Staff

Application requirements are placing greater demands on the storage element of computer systems, and the most current storage subsystems reflect the need for fast, high-capacity storage. But, speed and capacity are only part of the story. Indeed, what we at HC/WG Labs have found is that storage subsystems, traditionally designed to tightly couple to a host system, increasingly are moving farther away from the host.

The impetus for such change is the network. Within the Digital Equipment Corp. environment, making use of the network is paramount. In fact, we're seeing networks expanding into multi-vendor, multi-CPU areas (see "Report: 2 Multi-Vendor System Extensions Take a Big Byte Out of the VAX," *Hardcopy,* page 32, February 1988). But distancing the storage system from a single host and allowing multiple users or systems to share isn't DEC's province alone.

The previously mentioned article described how Macintosh computers are being aggressively incorporated into DEC systems. Some packages allow the VAX to see the Macintosh transparently as simply another process, while others let the Macintosh user select the connection to the VAX using the Mac's icon list—just as with any Mac application. Other vendors are using similar means to incorporate IBM PCs into their networks.

This transparency applies to mass storage as well as interconnections of processors (Figure 1). Many mass storage subsystems are being targeted at PC and Macintosh users. As these small systems are incorporated into networks, their increased memory capacities become available to the network, too. Thus, local storage subsystems, although connected directly to one particular machine, are no longer local when that machine is connected to a network—any system on the network can get to the information.

This form of connection and access has blurred the distinction between mass storage subsystems, traditionally located near and accessible to a single host, and the file servers used by Apollo, Sun, and local area network builders. Traditionally, files stored on a host's subsystem could only be transferred to the storage system of another system through RS-232 or other connections. File servers, however, provided transparent access to files by any system on the network. With transparent interconnection, this distinction is fading.

In this report, we're going to give an overview on how the various technologies, from tape to optical disk, are being combined with intelligent interfaces to create the latest storage subsystem designs. We'll also look at how software control of these systems is being managed by operating system vendors.

A Quick Look

The changes and advances in storage technology are occurring at breakneck pace as new developments let one technology leapfrog the other in speed and capacity. A brief look at the various technologies in use today might be useful.

Magnetic media has been the standard for decades—for both tape and disk storage. The time-honored method of increasing capacity is to add disk drives. Plessey Peripheral Systems continues that tradition with its Ples-

Coordinated by Ed Teja, responded to by Terry Davis, Bill Brent, and Richard Steincross, Senior Respondent—Hardware.

Courtesy Plasmon Ltd.

Microscopic crosshatches that make the platinum surface of Plasmon's WORM disks resemble the surface of a moth's eye actually provide *an ideal surface for optical recording. The crosshatching improves light absorption; when the drive writes data on the disk, the laser gasses away the crosshatches, leaving a highly reflective area of smooth platinum. The high contrast between the crosshatched and smooth areas furnishes an easily readable encoding with lower noise levels. The ME (for Moth eye) series 5.25-in. disks range in capacity from 200 to 800 Mbytes.*

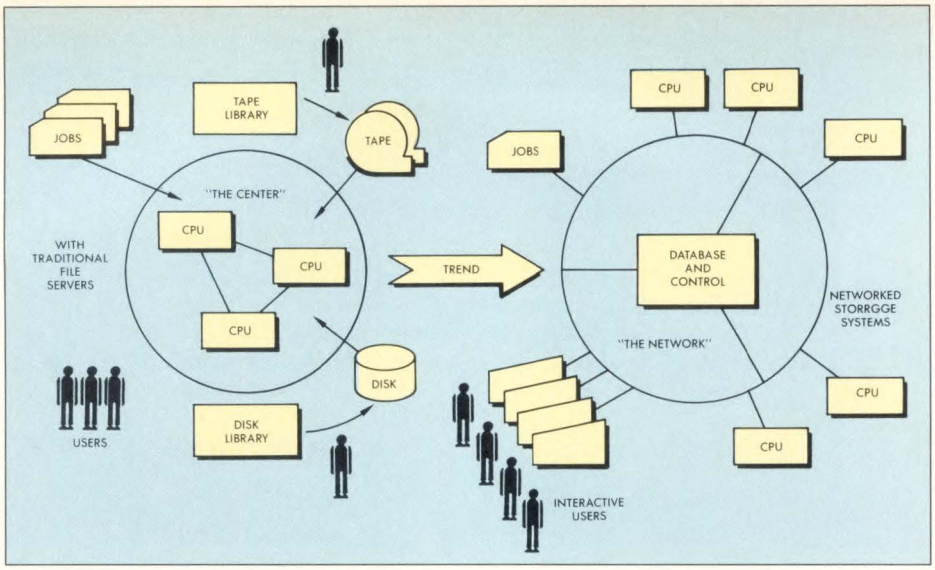
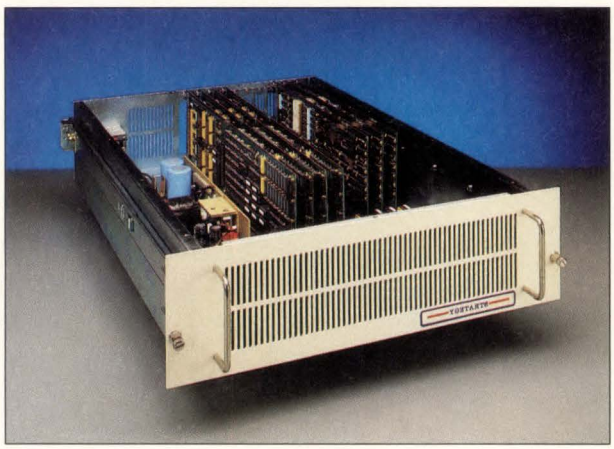


Figure 1—Transparent connections mean *that a host can deal with the mass storage on a PC as if it was local storage. Thus, mass storage devices and file servers become indistinguishable.*



File-access controllers allow *multiple hosts to access multiple drives. The Strategy 1, for example, from Maximum Strategy, combines a variety of drives to provide peak performance burst load data transfers of 32 Mbytes per second and 32-Gbyte storage capacity and then makes all information accessible to any host system by filename.*

sey Modular Subsystems. Plessy's 12-Gbyte subsystem consists of 20, 5.25-in. drives.

Other subsystems tend to furnish some specialized benefit, such as caching, over sheer capacity. MDB Systems Inc. offers subsystems that address operation in severe or hostile environments. For example, MDB's Data Shuttle 2000 provides as much as 760 Mbytes of storage in two shock-isolated disk canisters. The rack-mounted unit costs from $5,115 to $15,950, depending on configuration.

But now, we also see that the physical size of data storage systems continues to grow smaller, the electronics smarter, and the media capacity greater. Technological advances in recording surfaces, tape substrates, and drive mechanics continue to increase the bit density of tape media. Capacities in excess of 1 Gbyte on a .25-in. data cartridge are predicted for the near future (see "Striving for 1 Gbyte of Storage in a .25-in. Data Cartridge," *StorAGE,* page 6, March 1988). So, even though magnetic tape has been with us for a while, it's far from reaching its limits.

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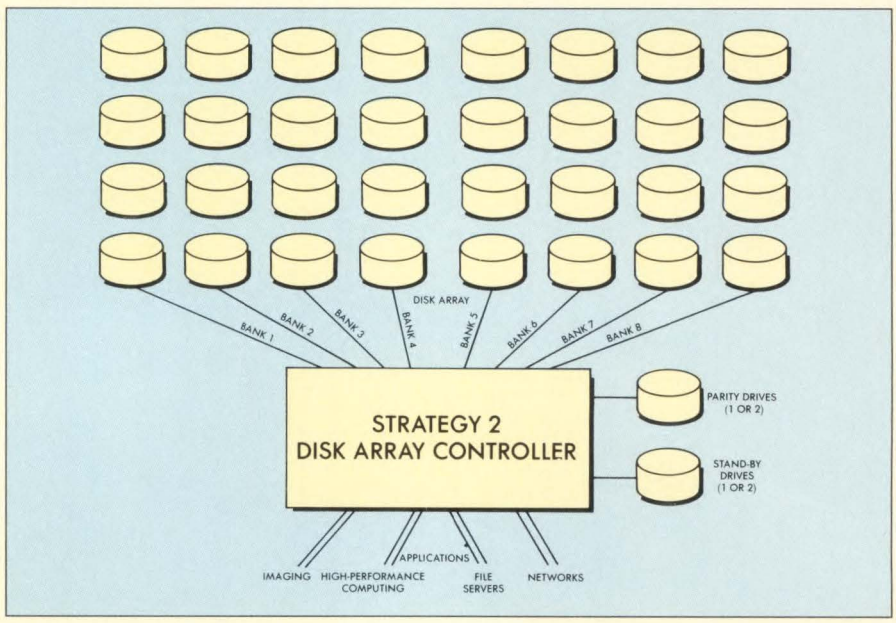
DEVELOPING A HIGH-END SUBSYSTEM

The way a subsystem is configured to accommodate the various storage options tells you a lot about the system considerations. Some configurations aim for more performance, using high-speed drives (such as Fujitsu America's parallel-transfer drives) and optimized device interfaces. Other subsystems are designed more for reliability and fault tolerance than performance. Some subsystems are designed for both.

Maximum Strategy Inc. has just introduced its Strategy 2 Disk Array Controller. The name Disk Array tells a lot about the controller. Enhanced Small Device Interfaces or storage module drives are configured in banks (see Figure), with each array containing as many as four disk drives. The result is as much as 32 Gbytes of disk storage. And speed? The controller accommodates sustained data-transfer rates of 20 Mbytes per second, with burst rates at 40 Mbytes per second.

The price is a bit steep for many applications, however. Controller configurations start at $22,000, which is fine as long as you're developing a sophisticated system that requires a high-performance, high-capacity file server or image storage.



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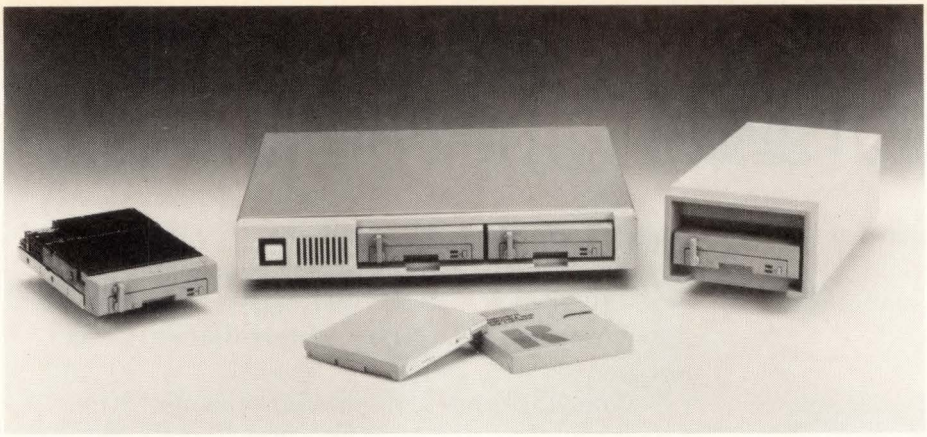
CIRCLE 443 ON READER CARD



Combining half-height Winchesters with 20-Mbyte removable Winchesters for backup, *Ricoh Corp.'s Mass Storage Systems let you configure the computer's storage system internally or externally. The system supports either ST-506 or SCSI disk drives to accommodate the system's price and performance requirements.*

One way that backup subsystems can *pace subsystem capacity increases is with helical-scan technology. For instance, Megatape Corp. offers cassettes with 500- and 750-Mbyte capacities.*

continued from sector 34

Another magnetic tape technology that is driving capacity standards is helical scan. Using standard videotape cartridges and off-the-shelf drive components, helical-scan tapes achieve capacities and bit densities unheard of a decade ago. For instance, Transitional Technology Inc.'s CTS-8 Cartridge Tape Subsystem records 2.3 Gbytes on a standard 8mm videocassette. This capacity, in fact, represent the norm. Exabyte Corp.'s EXB-820 also features 2.3 Gbytes on a 360-ft. cartridge using a Small Computer System Interface (SCSI) interface.

In the magnetic disk arena, as with other media, there have been dramatic capacity increases as units have become more compact. Recent Winchester drives record data at densities in excess of 40 million bits per square inch, whereas high-capacity floppies reach densities of up to 1.2 million bits per square inch. While quite a contrast exists between these two numbers, both

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EXPERT SYSTEMS: THE KEY TO TOTAL DRIVE AVAILABILITY?

BY DAVE VARNER, Service Marketing Manager, Digital Equipment Corp.

As applications become increasingly data intensive, data reliability becomes more important than ever before. Today, in environments where applications are mission-critical, downtime can cost a million dollars a minute. Downtime can mean that a major financial institution is unable to return money it borrowed for the day and must pay interest on the float overnight. Downtime can mean that highly paid scientific technicians fail to collect all of the data from a costly, real-time technical experiment. Even in less critical situations, downtime can mean that hundreds of office workers must remain idle while repairs are made.

In the past, the storage or information management industry has responded to the issue and implications of downtime by focusing almost exclusively on the hardware elements of drive mechanisms and their design. This focus has, in fact, produced highly reliable drives. Improved head mechanisms, improved servo-motor designs, better head retraction systems, advanced metallic coating processes, self-calibration systems, and hundreds of other advances have made today's highly reliable disk drives possible. As a result, today's user can generally expect a hard disk drive to achieve a Mean Time Between Failure (MTBF) of 40,000 hours or more. Not bad, but is it good enough?

If it isn't good enough, what else can be done to improve disk reliability even further? The answer, in part, is that we know an MTBF of 40,000 hours isn't good enough. Even if the industry were able to double the reliability (as it eventually will) and obtain a very high MTBF of 80,000 hours, major computing system users could statistically expect about one drive failure per month. As good as that may sound against the statistics of just 5–10 years ago, most major corporate users aren't satisfied. Considering the costs associated with even a short period of downtime or a small loss of data, who can blame them.

In addition, many technical manufacturing and drive design experts doubt that quantum gains in drive reliability can be readily obtained in the near future—not, at least, within traditional price-performance guidelines that indicate that users are reluctant to pay significant cost premiums for fractional reliability advances. After all, if money were no object, users concerned with data integrity and storage reliability would opt for volume shadowing—that is, an on-line duplicate of all data storage—and thereby

continued on sector 38

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All of this comes with a one year warranty and nation-wide on-site service (overnight replacement available). Best of all, it's thousands less than the competition.

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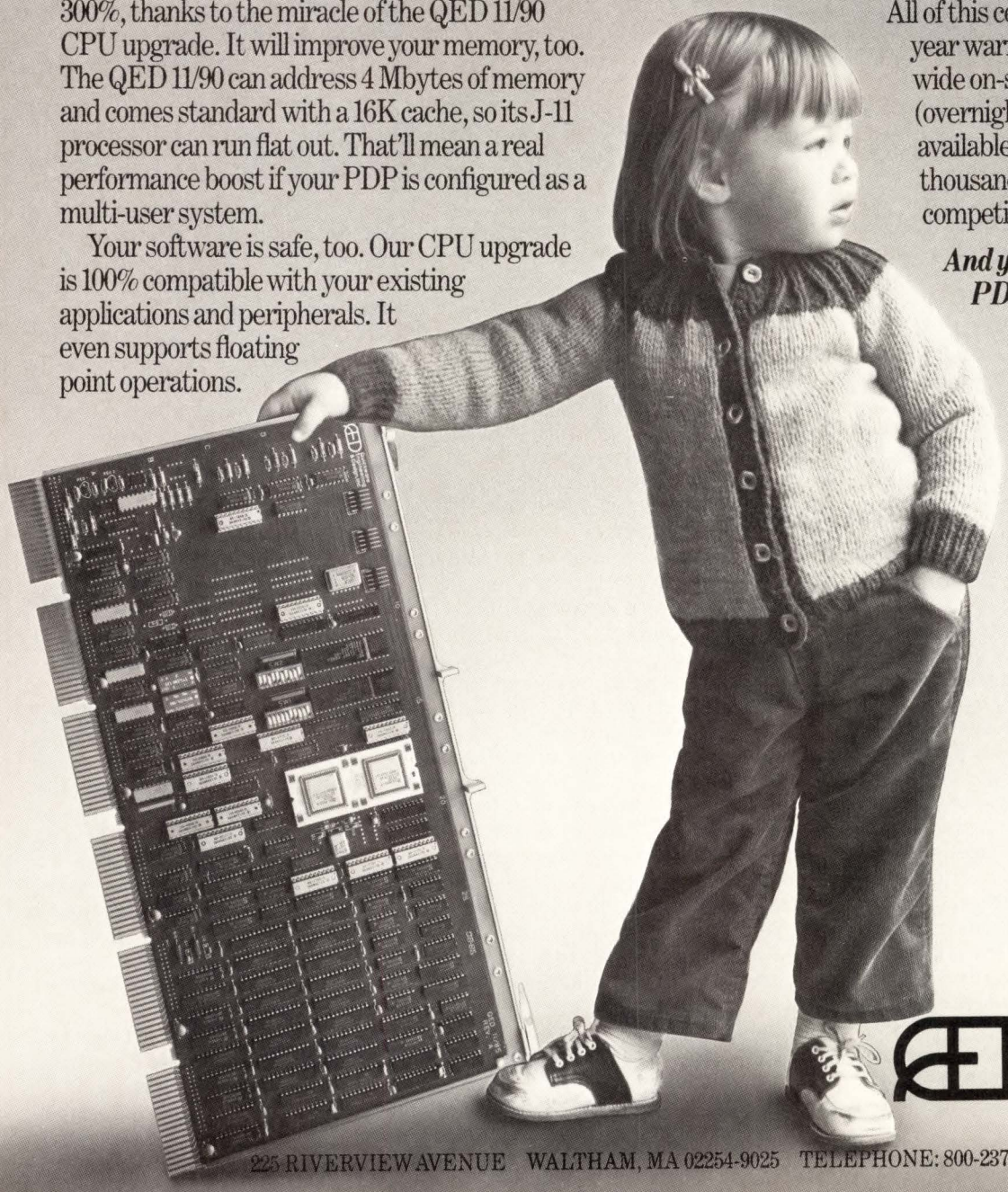

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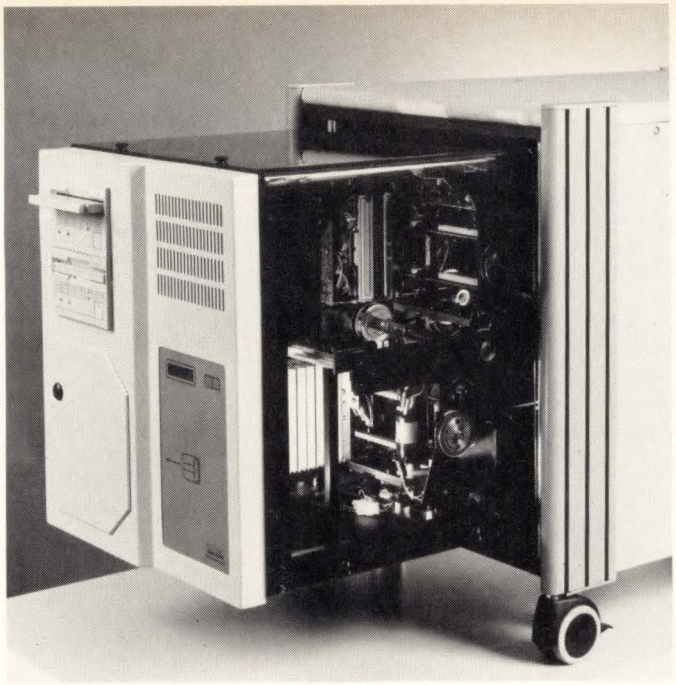
CIRCLE 429 ON READER CARD



Subsystems that can play large numbers of optical disks, *much in the same way that a jukebox plays records, afford extremely high storage capacities. The Cygnet Systems Inc. 5000 Series relies on as many as 32, 5.25-in. optical disks and can change optical disk cartridges in four seconds.*

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present challenges to the industry to reduce the number of flaws in the media and institute handling procedures for those that do occur. This challenge will continue as capacity demands increase.

Bernoulli technology is finding its place midway between floppy and Winchester technologies. Essentially a flexible disk mounted in a rigid cartridge, Bernoulli disks use the venturi effect of an air stream created by the rotating disk to maintain a cushion of air between the head and the media. These drives achieve densities near the middle of the floppy-to-Winchester range.

Removable Winchester disk cartridges have also come into their own, combining the speed of the Winchester drive with the portability and expandability of the floppy disk.

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gain access speed advances in the bargain.

Obviously, both users and drive manufacturers want to keep the cost per megabyte for disk drive products as low as possible while attaining 100% reliability. Impossible?

It is impossible, at least in the near term, if the reliability focus remains limited to the drive itself and its moving parts. It has always been a natural law of science that moving parts wear out. Friction will ultimately damage even the most reliable products. But you can attain much short-term success if you begin to look at reliability from a different angle—and thus find ways to make downtime a thing of the past.

First of all, some redefinition of terms and subtle new understandings are required. For example, there is true reliability and there is perceived reliability. If you never experience a failure in a device, there is a high degree of perceived reliability in the device and it may not necessarily mean that true reliability has been improved at all. What has been experienced is an increase in availability.

Next, we should be careful to clearly identify the real issues surrounding drive reliability. Is the average user, for example, really interested in whether or not a disk drive offers a 40,000- or an 80,000-hour MTBF? While MTBF is important, it seems clear that the user is much more interested in ensuring that data is always accessible.

So, if you turn the focus to availability and aim toward eliminating downtime caused by drive failure rather than continuing to aim for eradication of the forces of friction, you may be able to overcome problems previously believed to be insurmountable or just too costly to fix.

This focus on availability reflects the general thought process that evolved at Digital Equipment Corp.—the possibility of a software solution to the issue of downtime. For, if downtime can be reduced—or even eliminated—availability can be increased more rapidly than raw hardware reliability breakthroughs.

The "focus-on-availability" approach begins with the awareness that many years of experience with computer systems—and disk drives in particular—have made drive designers, manufacturing experts, and service representatives quite familiar with symptoms of disk drives that signal impending problems or failure. During this time, the software industry has evolved several novel approaches for gathering, programming, and making practical use of *expert systems*—computerized programs built on or around the knowledge of one or more human experts. These programs can take advantage of the human expert's specialized knowledge, acquired from many years of training and experience.

Specifically of interest here are the human expert's predictive capabilities. An experienced physician, for instance, can rather accurately tell you whether or not your mild cold will turn into a severe case of pneumonia. An experienced drive technician, closely watching the behavior of a drive over some period of time, can fairly accurately predict whether or not a user should take the precaution of moving the drive off-line. This predictive capability forms the basis for the expert-system-based approach to forecasting whether or not a particular disk drive is developing problems.

Till now, the process has been evolutionary. It began with an expert system designed to monitor the health of a computer's major components, such as CPU, memory, and network, as well as drives and subsystems, but, in its latest iteration, DEC's VAXsimPlus, one expert system, has evolved to include the ability to take action when it recognizes impending drive failure.

Here's how it works. Acting as storage-system monitor, located either on-site or anywhere in the world, the expert-system-based approach continuously tracks system activity and alerts users to potential problems before a system interruption or data loss occurs. Usually, VAXsimPlus can automatically invoke precautionary procedures such as automatic copying of data from a suspect disk. One central monitoring location can monitor a single DEC system, a VAXcluster, or an entire DECnet network.

On one hand, the expert-system-based approach involves nothing more complicated than having VAXsimPlus monitor system and periph-

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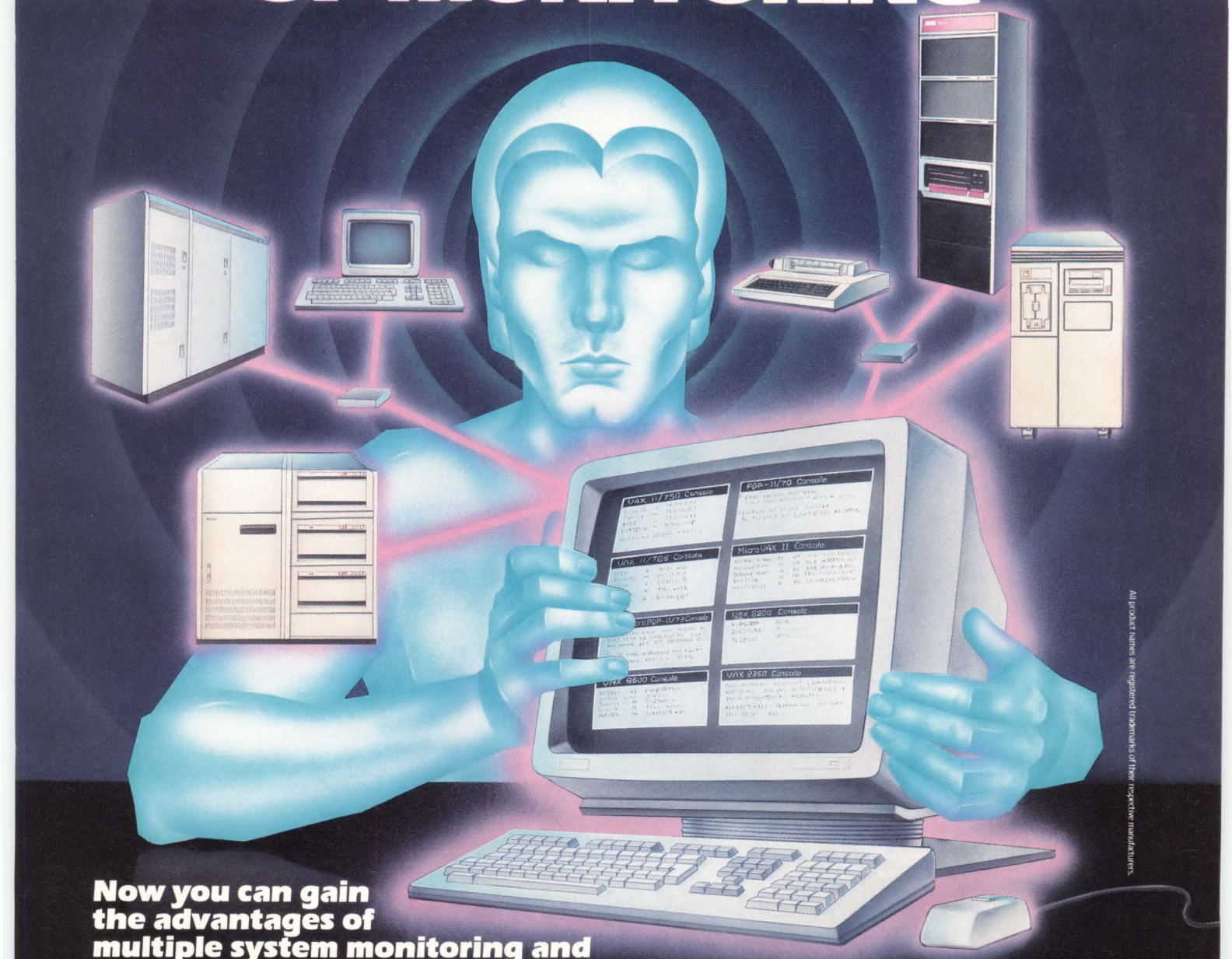
THE NEW MASTERMIND OF MONITORING



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eral activity. But VAXsimPlus also gauges the relative importance of certain system-wide events. For example, if your car squeaked a bit all the time, a small noise wouldn't concern you. On the other hand, if your car had a history of riding noiselessly, you would pay much more attention to the first occurrence of squeaking and look for other indications of possible trouble. This, in a simplified way, is exactly how VAXsimPlus operates.

In terms of storage, if the VAXsimPlus expert system recognizes other warning signs or determines that the collective occurrence of certain events spells near-term trouble—based on hundreds of man-years of experience built into the product—dynamic disk reconfiguration occurs automatically. Before the suspected drive causes any downtime and before any data is lost, the system steps in.

This means that, even if the drive isn't able to deliver that 80,000-hour MTBF in the near term, users need not be concerned. They may not even be aware of true drive reliability, in absolute terms. What users will notice is the dramatic decline of costly system shutdowns due to drive failures. Financial losses and data losses that happened when drives failed before trouble was detected may be relegated to technological folk stories that will be recounted when speaking about the "good old days."

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Additional information about the products or services described in this article can be obtained by contacting the company directly or circling the appropriate reader service number.

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Optical Storage

One other major storage technology is the various optical devices available. Features of these devices include high-storage capacities, media reliability, and compactness. CD-ROM; Write Once, Read Many (WORM) disks; and optical tape are three of the most well-known optical technologies.

CD-ROM is at the edge of the storage subsystem category, since CD-ROM can't be written to. The media is prerecorded for distribution like its CD predecessors in the music industry, but the large storage capacity of CD-ROM makes it an ideal medium for distributing large volumes of data (one 5.25-in. disk can hold up to 600 Mbytes) that can be rapidly scanned to locate information. Because of this capability, CD-ROM is included in some multimedia storage subsystems, and we include it here.

WORM drives use media and read/write technologies similar to CD-ROM (although WORM disks are available in 12-in. diameter as well as 5.25in.). Once data is written, it's permanently recorded on the disk. This makes WORM disks ideally suited for archiving and data logging. Each side of a 12-in. optical disk can hold up to 1 Gbyte of data.

Like the WORM disk, optical tape is a write-once, read-many medium that cannot be erased, but has massive storage capacity. The Optical Tape Storage System from CREO can record 1000 Gbytes of data on a single reel of 35mm tape.

The credit-card-sized laser card is now receiving much interest, but projected applications fall into the same categories as other optical media. The laser card can be prerecorded to distribute information (like the CD-ROM), or can be used to write information for archiving and later retrieval (like the WORM disk and optical tape). But the prerecorded cards are more likely to be used for books-on-a-card applications, while the write-once cards will be used for personal medical and financial records.

None of the optical systems presently provides erasability, although such devices are under development and are promised for the near future. But nonerasability can also be viewed as permanent storage, and in many applications that is an advantage rather than a drawback.

Who Uses What?

No single-storage medium answers the needs of every system or every application; each medium has its stronger and weaker points relative to the others. But, by capitalizing on the strengths, companies can create powerful storage systems. What some see as a weakness, or drawback, to a particular technology can become a strength in the right application.

Utilizing the unique strengths of each media technology is, in fact, the key to combining them into powerful and versatile systems. One sees the advantages of each more clearly by looking at the ways in which some of the available systems combine and apply the various storage technologies.

For archiving and retrieval applications, the permanence of WORM storage eliminates the possibility of overwriting critical data. DEC's first offering in this technology, the RV20 laser drive with its optical media, provides VAX users with a compact subsystem for archiving massive amounts of data. Each disk cartridge will store 2 Gbytes, with media life exceeding 30 years. The system performs like a conventional DSA tape drive and responds to standard VMS tape commands. To the operating system, it appears to be a random access tape drive.

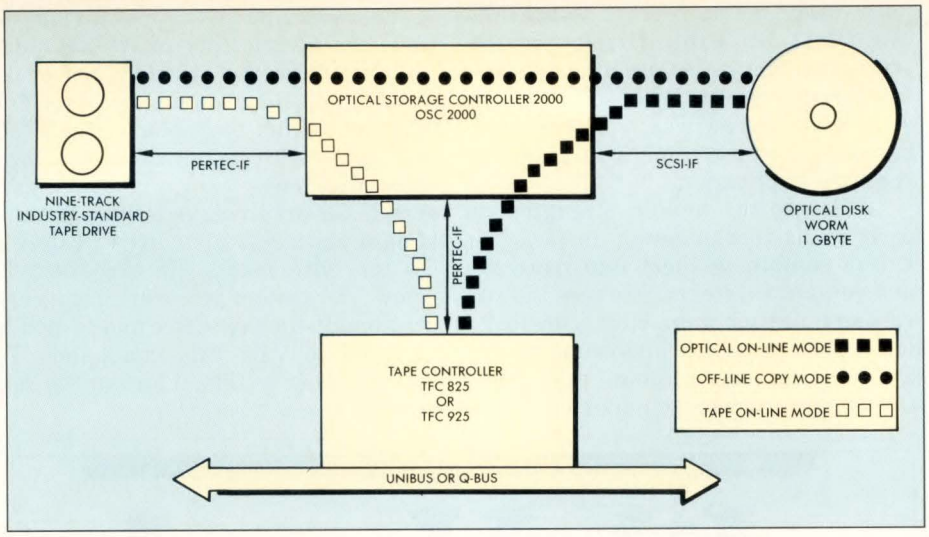

Figure 2—Tape controllers act *as the system interface for both a WORM disk and a magnetic tape drive. The specialized optical controller then provides a link to the disk via a SCSI interface.*

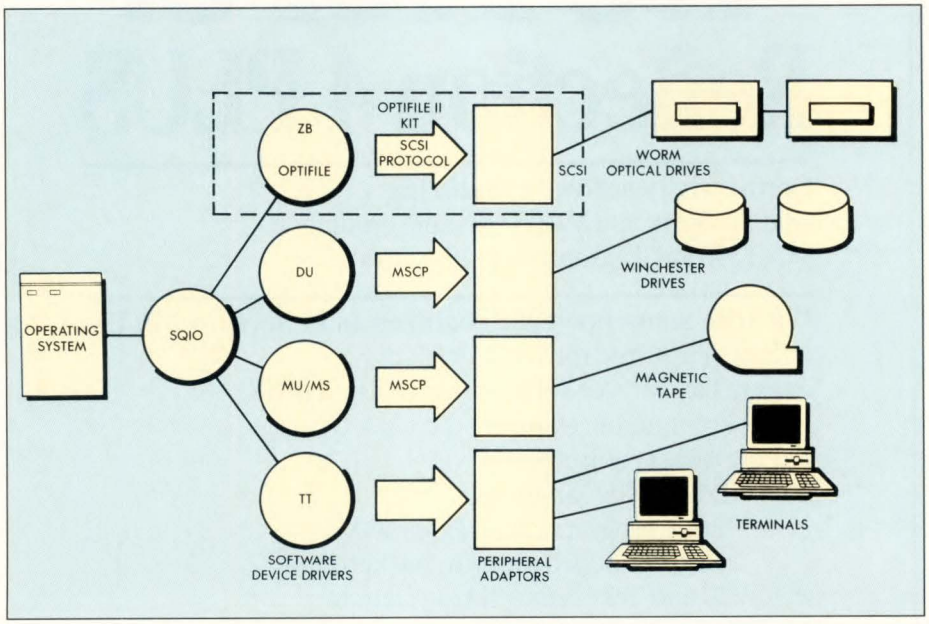

Figure 3—Emulating standard magnetic media, *the Optifile II resides outside of the operating system as a separate device driver. The same driver handles both 12-in. and 5.25-in. media and drives from different vendors.*

Non-Erasable Media

Since no standards currently are set up regarding the utilization of optical storage, controversy exists about the best method of implementation. Should the disk be used to emulate a magnetic disk or a magnetic tape? Most storage system developers are finding that WORM drives are best suited to tape emulation, since disk controllers aren't easily adapted to the peculiarities of media that cannot be erased and rewritten. Vendors such as Aviv Corp. provide a subsystem that permits magnetic tape and WORM drives to share one controller (Figure 2).

Disk controllers are designed on the assumption that an older version of a file that has been rewritten now represents reusable free space. Since an old file can't be overwritten when an updated version is written to an optical disk, another level of control software must be added to intercept controller commands and convert them to operations appropriate to optical disks. Such operations must place a pointer in the file header that says the data in the file is old and directs users to the new version. This adds software overhead and creates longer access times, reducing throughput significantly.

One solution comes from KOM Inc. The company's Optifile provides drivers that route all writes to the next available sector on an optical disk and log the location of the latest version of each block. Thus, the WORM can emulate magnetic media (Figure 3), running VMS and RSX-11M-Plus.

Play It Again, Subsystem

The other solution to WORM disk usage involves the use of unique controllers that combine the rapid head positioning and data retrieval capabilities of the optical disk with the sequential nature of the tape drive. These

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Ironically, perhaps, this improvement in hardware reliability is coming at the hands of a unique service capability. However, expert-based service solutions should not seem far afield to those professionals who are closest to information management systems.

In fact, many believe that today's information management systems are computer systems in their own right and tomorrow's total computing solutions may be driven by data and information management solutions. It is certainly clear that we've moved well beyond the era of data storage systems as mere peripherals, when a drive failure can have such a critical impact on today's business organizations. Investments in information must be protected.

Computer system users demand data availability; that is, a system that continues to perform despite the presence of a fault. If failures can be predicted, the impact must be minimized or completely avoided.

Continuing to push the limits of hardware reliability will remain an important factor. Of equal significance will be the collective integration of all technologies to create whole systems that users not only perceive to be more reliable, but that, in fact, are more reliable. Reliability affects a manufacturer's cost and service margins, too. Highly reliable systems are paramount to any computer company's success.

The industry must move from reactive service to predictive service and, hence, proactive service. Raw reliability must continue to increase, but 100% data availability must be the goal. Expert-based service technology will be critical to reaching this goal.

controllers write versions of files sequentially, as do tape controllers. But these devices, though they simulate such activities as tape rewinding, do so much more rapidly since the disk merely needs to move its head.

One example of this approach is the QLC-1000 optical controller offered by Qualogy. This device emulates the operation of a Tape Mass Storage Control Protocol device and connects SCSI optical disk drives from various makers to DEC computers. Like DEC's RV20, this controller accepts all standard tape drive commands from the DEC host. Both controllers allow daisy-chaining of multiple drives to provide access to up to 4 Gbytes of data storage at any given time.

Other systems utilize one or two optical drives while adding capacity to store and retrieve up to 20 optical disks under control of a local microprocessor. These optical disk storage and retrieval units, often referred to as "jukeboxes" due to their mechanical similarities to the old, familiar music devices, provide even greater storage and retrieval capacities without operator intervention.

Cygnet Systems Inc. and OSI both provide such systems in the OEM marketplace. OSI's unit provides access to 32 or 40 Gbytes of data under program control. Cygnet offers a 5.25-in. jukebox with up to 31 Gbytes of storage that can swap disks in eight seconds or less. The Cygnet Series 1800 jukebox uses the larger, 12-in. disks and can be configured with up to five drives accessing up to 141 optical disks.

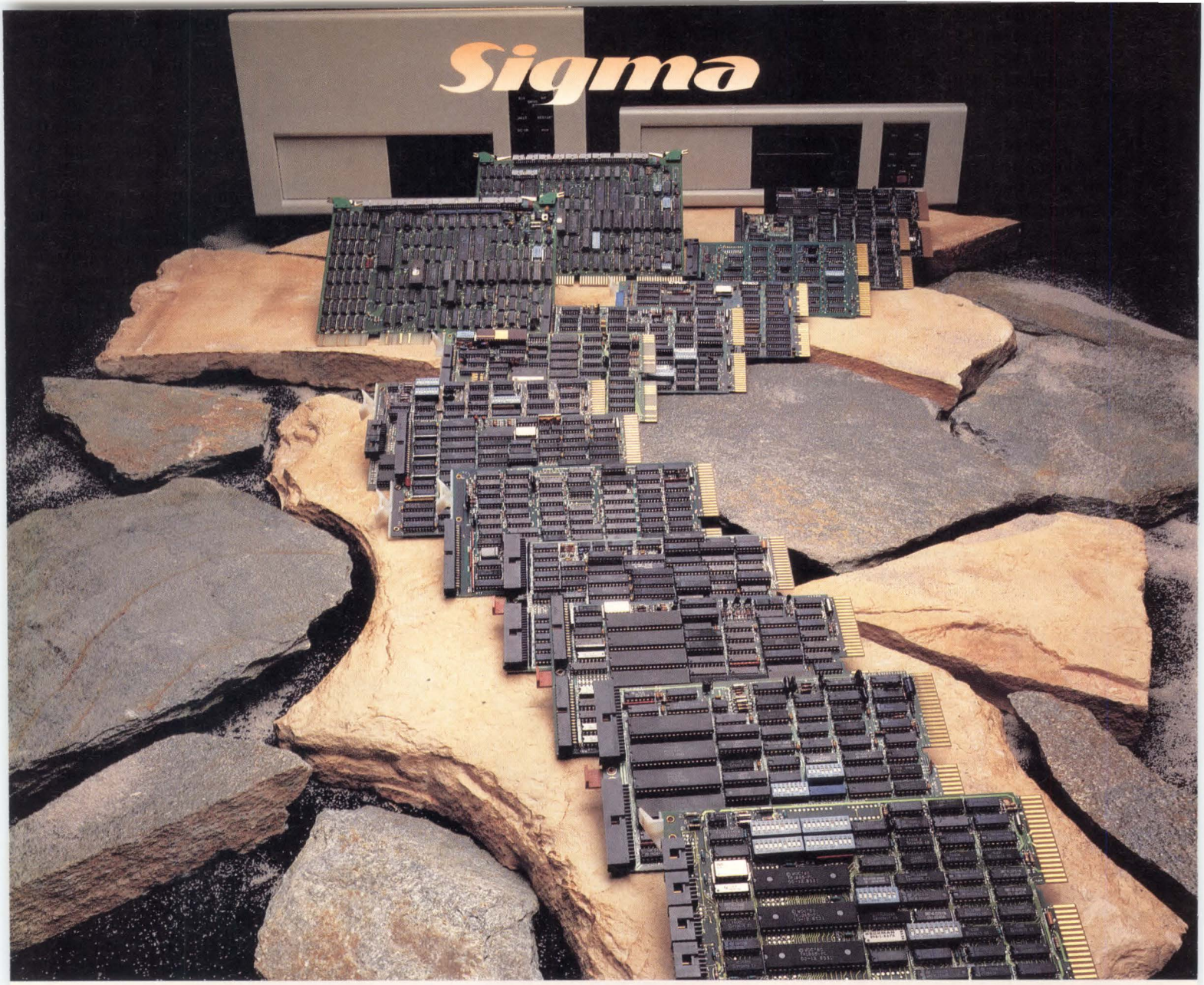
Specialized Solutions

CD-ROM units are finding their niche as well. Although these units are read-only, their compactness and large capacity provide an ideal means of distributing large amounts of data, text, and images. Hewlett-Packard has initiated a LaserROM information service that provides technical and support information on compact disks. By using drives that interface to IBM PC/ATs or HP's Vectra PCs, the technical information can be accessed regardless of main computer system availability. HP estimates that each LaserROM disk can store the equivalent of a 25-ft.-high stack of manuals.

The half-height form factor drive used in the LaserROM system is finding a home in other storage systems where the compact drive size allows CD-ROMs to be combined with tape drives, floppy drives, and Winchesters of similar size, in combinations that can be tailored for individual system needs. The Fujitsu America subsystems for storage-intensive PC applications neatly package Winchester drives with backup tape cartridge drives. Other combinations becoming available include CD-ZOL units for information access (like HP's LaserROM service). And backup and audit-trail functions are increasingly occurring on write-once disks and helical-scan tape cartridges.

Selecting the Package

Storage subsystems are finding their way into all kinds of systems and networks, large and small, local and remote. These systems package virtually all available storage technologies, making them available to systems ranging from Macintosh to VAX. From the traditional close-to-the-host machines to systems with intelligent interfaces that can be positioned anywhere in a network to serve multiple masters, no perfect unit exists for all circumstances and needs. But, with the broad array of technologies, capacities, and speeds available, there are combinations better able to meet the specialized needs of increasingly complex applications.



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REPORT 4: MICRO-TO-VAX OPERATING SYSTEMS, PART III

RT-11, RSTS, AND RSX: PUTTING THE PDP-11 THROUGH ITS PACES

ALTHOUGH OFTEN OVERSHADOWED BY THE VAX, THE VENERABLE PDP-11 REMAINS A MAJOR WORKHORSE COMPUTER. THE HC/WG LAB STAFF EXPLORES WHICH PDP-11 OPERATING SYSTEMS OFFER SPEED, WHICH OFFER MULTIUSER OPERATION, AND HOW TO TELL THE DIFFERENCE.

by the HC/WG Laboratory Staff

Getting the most out of any computer often means picking the right software—starting with the operating system. Each of the PDP-11 operating systems has a heritage that suits it to differing operating environments.

RT-11

With RT-11, Digital Equipment Corp. provided a small, fast, single-user environment. Real-time and commercial markets found RT-11's combination of low cost and high performance to be a powerful reason to use it; its simplicity lets the programmer get the "closest to the iron" of any PDP-11 system.

With its emphasis on speed, RT-11 is sometimes compared to a racing car in that most of its design trade-off decisions were heavily weighted toward speed. Features that would slow processing were left out.

However, RT-11 is sometimes likened to a loaded gun—extremely easy to shoot yourself in the foot with—a surprise to anyone used to more restrictive environments requiring special privileges and programming incantations before the user encounters serious danger. The single-user nature and the speed of RT-11 usually make this potential danger acceptable.

RT-11 does have some optional, more restrictive environments for those able to exist with the resultant reduced speed and capability.

The File System

Each disk volume begins with a directory area followed by the contiguous file space. Each file has a unique directory entry consisting of the filename, starting block number, blocks allocated to the file, the file creation date, and some file status bits.

RT-11's contiguous files make access fast and consistent. Once a file is open, the only overhead operation needed to reach a block in the file involves adding the block number to the starting block number to get a physical disk-block number. More complicated file systems that scatter parts of files throughout the disk require computation to determine which piece of the file contains the desired block.

The problem with a contiguous file structure is that you can't extend the file length easily. When a file is created, the user (or programmer) specifies the initial file-block allocation. Once the space for a file is allocated, the only way to increase the space allocation requires users to define a new, larger file area, copy the existing file into it, and add the new data at the end.

As files are created and deleted, a large number of small, unused areas tend to build on the disk. Open areas can only be reused if they are big enough for a new file. When the open area consists of small fragments too small to hold a file, the fragmented space is wasted. This is called disk fragmentation and the only known cure is to "squeeze" the disk.

Squeezing a disk relocates the files to combine the open space into contiguous locations. Then the directory is updated to reflect the changes.

Another limitation of the RT-11 file system is that disk block numbers are kept in a single 16-bit word. This limits the disk volume to about 33 Mbytes.

Creating Logical Disks

The RT-11 version of subdirectories is provided by logical disks. These disks are artificial constructs allowing you to treat a disk file as a separate disk drive. A logical disk has directories and contains files, but its maximum file space is determined when it's created. If the logical disk gets full, a new, larger space must be allocated before it can be extended. Because logical disks break up the disk space, using logical disks tends to increase the fragmentation problem.

Coordinated by Carl Warren, Editor-in-Chief; responded to by Steve Bostwick, Senior Scientist; Steve Davis, VMS Columnist; Milton Campbell, RT-11 Columnist; Mark Hartman, RSTS Columnist; Bob Gezelter, RSX Columnist; and John Schimpf, UNIX Respondent.

Interrupts and I/O

The default environment for RT-11 allows user programs to connect directly to the hardware interrupts and talk directly to device control registers in the I/O page. This is one reason RT-11 is often the system of choice for interfacing to custom equipment—the I/O environment generally eliminates the need to write programs for specialized equipment, which is important in a laboratory environment where the researcher and the programmer are often the same person.

While programs running under RT-11 can easily manipulate external devices directly, the operating system also supports standardized device access through device handlers and system calls. But, to maintain its simplicity and speed, the I/O system has a single device handler that only processes I/O requests one at a time. This allows device handlers to be fairly simple at the cost of slightly reducing the parallel activity possible in the system.

While developing device handlers for any system can never be called easy, RT-11 device handlers are the least difficult to build of any of the DEC operating systems. For this reason, RT-11 is usually the first PDP-11 system to support new devices from DEC. The ease of handler development also means that you can build your own device handlers and RT-11 will boot easily.

Program Environment

RT-11 comes with three monitors: the Single Job monitor (SJ), the Foreground/Background monitor (FB), and the Extended-Memory monitor (XM). The SJ does not use the memory map available on most PDP-11s; it runs only one program at a time. The size of the SJ monitor requires 2 Kwords of memory, with the remainder available for device handlers and the user job.

The FB monitor is also an unmapped system. The FB monitor supports a foreground job (such as real-time data collection), a background job (such data analysis), and up to six "system" jobs (such as Sysgen), which are similar to the foreground job. The FB monitor is about twice as big as SJ. The unmapped SJ and FB systems are still available for two reasons: first, a PDP-11 runs faster without the memory map enabled and, second, many systems are still in use that are based on processors such as the LSI-11 board and the T-11 chip, which do not support memory mapping.

The XM monitor of RT-11 accepts a decreased execution speed for the increased flexibility the memory map offers. This support for memory mapping allows larger programs to be built and provides additional protection.

All RT-11 monitors are interrupt driven; FB and XM explicitly support multiprogramming. RT-11 uses a simple, deterministic scheduling algorithm involving the highest-priority job that can run and the halting of time-slicing round-robin scheduling. Such an algorithm is critical in real-time environments where the system has a limited time for capturing data or taking action. The foreground job receives first priority, followed by the system jobs in a fixed sequence, with the background job(s) having the lowest priority.

RT-11 provides two basic program execution environments:

- a "raw machine" privileged environment (the only one available with SJ and FB) gives the program access to all parts of the system, and
- a virtual environment has some restrictions but allows programs to use more memory.

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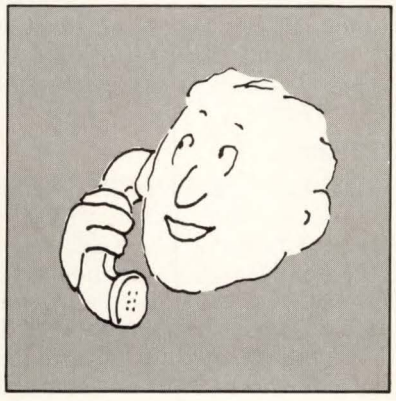
How to free Salespeople



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An additional third environment is provided by the VBGEXE utility under the XM monitor. VBGEXE masks many of the peculiarities of the XM monitor and allows programs to run in a large memory space but restricts their access to interrupt vectors and the I/O page.

RT-11 swaps protection and access checking for execution speed. Errant programs can corrupt the system or each other, even though the XM virtual environment and the VBGEXE environment are more restrictive. Despite this apparent opportunity for system anarchy, RT-11 has well-defined system calls and access methods that make well-behaved programs fairly easy to build.

Utilities

KED is the preferred RT-11 editor. A full-screen editor for the VT100 (and more recent) terminals, KED was one of the earliest DEC-supplied screen editors and uses a keypad arrangement that is basically the same as EDT. The RT-11 package also includes a much older editor, Edit. Edit is a character-stream editor more suitable for use on hardcopy terminals.

RT-11 has two kinds of command files. The first, indirect command files, are processed by the keyboard monitor. Indirect command files are fast and simple to use but cannot do complex command processing. The IND utility, however, can process more complex command files, call indirect control files, and provide command processing similar to that of other DEC operating systems.

The program development utilities included with RT-11 are:

- the Macro assembler,
- a program linker, and
- a librarian.

DEC also offers such layered products as FORTRAN-IV and FORTRAN-77. Third-party vendors provide Pascal, Modula-II, C, and COBOL.

RT-11 includes two debugging tools, SD (also called DBG-11) and ODT. SD provides a screen-oriented debugging environment and some symbolic debugging capability. ODT is not a symbolic debugger and is fairly tedious to use. Both debuggers are easy to use with assembly language programs, but can be used for higher-level languages.

The file utilities provided with RT-11 provide for moving files, deleting and creating, backing up volumes, patching files, getting directories, dumping files in various formats, as well as comparing both text and binary files. Additional utilities provide error logging, transparent spooling (to printers), and print queuing.

The networking capability of RT-11 is limited. DECnet/RT-11 is compatible with DECnet Phase II and supports serial lines (but not Ethernet), and DEC officials have said that a DECnet Phase-IV-compatible product for RT-11 is under development.

RT-11 includes device handlers for Mœiernet interface boards, but additional software must be written to interpret the network protocols. RT-11 is distributed with the VTCOM/TRANSF programs, which provide a file-transfer method over serial lines similar to Kermit, the public domain program.

Multiuser Add-Ons

In addition to RT-11, the family includes CTS-300, which provides support for multiple DIBOL users. Third-party packages, such as TSX-Plus and SHAREplus replace RT-11 as the basic operating system, while retaining file-system compatibility with RT-11. Although very different in the details of their operation, both TSX-Plus and SHAREplus provide a multiuser environment that appears to the user to be similar to RT-11. Most RT-11 commands work as expected, and perhaps more importantly, most system calls from programs are compatible with RT-11, allowing RT-11 programs to run without change.

RSTS

Until VMS came along, DEC's flagship commercial operating system was RSTS/E (Resource Sharing Time Sharing/Extended). Even today, RSTS is a powerful, secure, and efficient operating system that is the right choice in many environments.

Many key features of VMS grew out of the flexibility of RSTS, especially the ability to emulate other operating systems. In fact, RSTS emulates the RT-11 operating system so well that the RT-11 development group within DEC used a RSTS system for some of its development work.

As its name implies, RSTS is based on the idea of *resource sharing*—dynamically assigning system resources to attain the maximum throughput possible. This function differs from a real-time operating system, which provides optimal response for the highest priority task.

Comfortable Software

RSTS, while powerful and dependable, is an older, more mature operat-

ing system than VMS. Unlike VMS, where sweeping changes with each release are the rule rather than the exception, RSTS users who follow DEC's well-written and comprehensive documentation when developing systems for RSTS can count on years of compatibility with future releases of the operating system.

Of all the PDP-11 operating systems, RSTS is the most compatible with VMS from the user's point of view. The RSTS DCL command line interface is actually closer to the DEC DCL standard than is VMS. Thus, minor differences between commands issued to RSTS or to VMS exist. In fact, many RSTS/VMS sites have taken to changing the system prompt to help users determine which operating system is serving them.

RSTS is also much easier for a system manager to set up than is VMS. RSTS system manager commands are integrated into DCL. The system manager, or authorized users, can use simple DCL commands to inquire about or change account.

RSTS developers have a choice of languages. BASIC-Plus is bundled with RSTS and is the standard against which all other BASIC is measured. Although BASIC-Plus is not a truly compiled BASIC (there is no task-build or link edit step), the language is fast enough for most programming purposes and, within limits, is upward compatible with BASIC-Plus-2 (BP2). BP2 is a compiled BASIC, and can be linked with separately compiled subroutines written either in BP2 or in Macro-11, the standard PDP-11 assembly language. And several versions of FORTRAN and COBOL, as well as Pascal, C, RPG, and even APL (the *only* PDP-11 APL as far as we know) are available.

The real power of RSTS is at the user level. The DCL command language operates either interactively or in batch mode, and DCL commands can be written into files for use as command procedures.

RSTS can also share read-only sections of very large programs. For example, BP2 programs can be linked to the BP2 resident library—a memory-resident collection of commonly used BP2 routines. While this library occupies 16 Kbytes of memory, you typically save 10–14 Kbytes by using this library, resulting in much better use of the PDP-11 memory.

File Services

Record Management Services (RMS) file services are the backbone of RSTS' file capabilities, including indexed, relative, and sequential files that are virtually identical in form and function to the RMS files found on VMS. The RMS utility programs on RSTS, while versatile, do not integrate into the DCL environment—mainly because RMS on RSTS predates DCL by nearly five years!

The SORT/MERGE package of RSTS is also virtually identical to its counterpart on VMS, permitting sorting by any number of input fields from multiple input files, changing the collating of sequences and actual modification of data during sorts based on user-defined conditions. For example, SORT/MERGE can be instructed to change a six-character field containing "Ca", "Cal", "Cal.", "Calif", or "Calif." to the standard "CA" in the same or a different field.

RSTS and VMS share the same Backup utility—or so it seems to the system manager. RSTS writes VMS-compatible Backup tapes, and can read VMS Backup sets. The entire range of operation is available to RSTS Backup, including incremental or complete backups, selection of files to back up from a given volume, and output to tape or disk. The only operation not supported by RSTS Backup is a volume image backup, which is inadvisable anyway due to the way RSTS organizes its files. Backup also permits RSTS to take advantage of lower-cost streaming tape drives.

For an operating system that started out as an eight-user educational system, RSTS has adapted well to the world of networking. RSTS supports DECnet Phase IV over conventional DECnet interfaces such as DMR-11s, and also supports DECnet over Ethernet. Although RSTS doesn't yet support Ethernet terminal servers, when pressed on the issue, the RSTS development team simply grins broadly and says nothing. We anticipate this capability soon.

RSTS supports up to 63 simultaneous users (including terminal users, batch jobs, and nonterminal "detached" tasks), up to 4 Mbytes of main memory, and more than 30 Gbytes of disk memory, and will run on any PDP-11 processor from the 11/23 to the top of the PDP-11 line. Although much attention is given to the vast amount of codes available for PCs, many programs are still available for RSTS, in both the commercial and the public domain. A considerably larger number of programmers with PDP-11 knowledge also are available.

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For business applications, the PDP-11 is still an inexpensive machine, operators are easier to find, the RSTS software license costs much less, and the environment is more stable than VMS.

RSX

RSX-11 is a family of operating systems that range from single-user systems to large-scale systems supporting 60+ users.

Presently, the RSX-11 family consists of:

- RSX-11M-Plus for 22-bit systems,
- RSX-11M for 18- and 22-bit systems,
- RSX-11S for non-disk-based systems,
- Micro/RSX for packaged Micro-11 systems, and
- P/OS for the Professional 350 and 380.

Family Resemblance

While differences exist among members of the RSX-11 family, they share many similarities and similar, if not identical, features. The differences among family members tend to relate to the particular hardware configuration and intended job.

For example, while RSX-11M can run on any processor in the PDP-11 series, RSX-11M-Plus requires at least 256 Kbytes of memory on a system with 22-bit memory addressing. Thus, RSX-11M-Plus is restricted to more recent versions of the PDP-11.

But RSX-11M-Plus has several features designed to improve system operation in large installations. These features include support for accounting, batch processing, and on-line device reconfiguration, as well as support for Instruction/Data space and Supervisor mode.

Another case in point: although RSX-11S is the only memory-resident member of the RSX-11 family, it's supported on all Q-bus and Unibus PDP-11 CPUs. You can use full memory configurations (up to 4 Mbytes) and most peripheral devices will be supported. However, no support is given for features requiring Files-11 disk support.

The difference, then, is that RSX-11S provides an efficient and powerful platform for situations—such as a process-control environment—where an operating system requiring disks would not be appropriate.

All Multiuser, But Different

Most members of the RSX-11 family provide multiuser protection that isolates one user from another (see "PDP Perspective . . . RSX," *Hardcopy,* page 80, December 1987). This facility ensures that you cannot damage someone else's activities through your errors and it prevents non-privileged users from crashing the system.

RSX-11M-Plus enhances multiuser activity by making multiuser tasks available. Multiuser tasks permit several copies of the same task, for example PIP, to share the same read-only portions. Since such areas are a significant portion of many programs, the savings that result from multiuser tasks greatly increase system capacity

Brickwall Protection—a facility that ensures that a particular task cannot corrupt another task being executed under the same (or different) account—is common to all members of the RSX-11 family. As with all mem-

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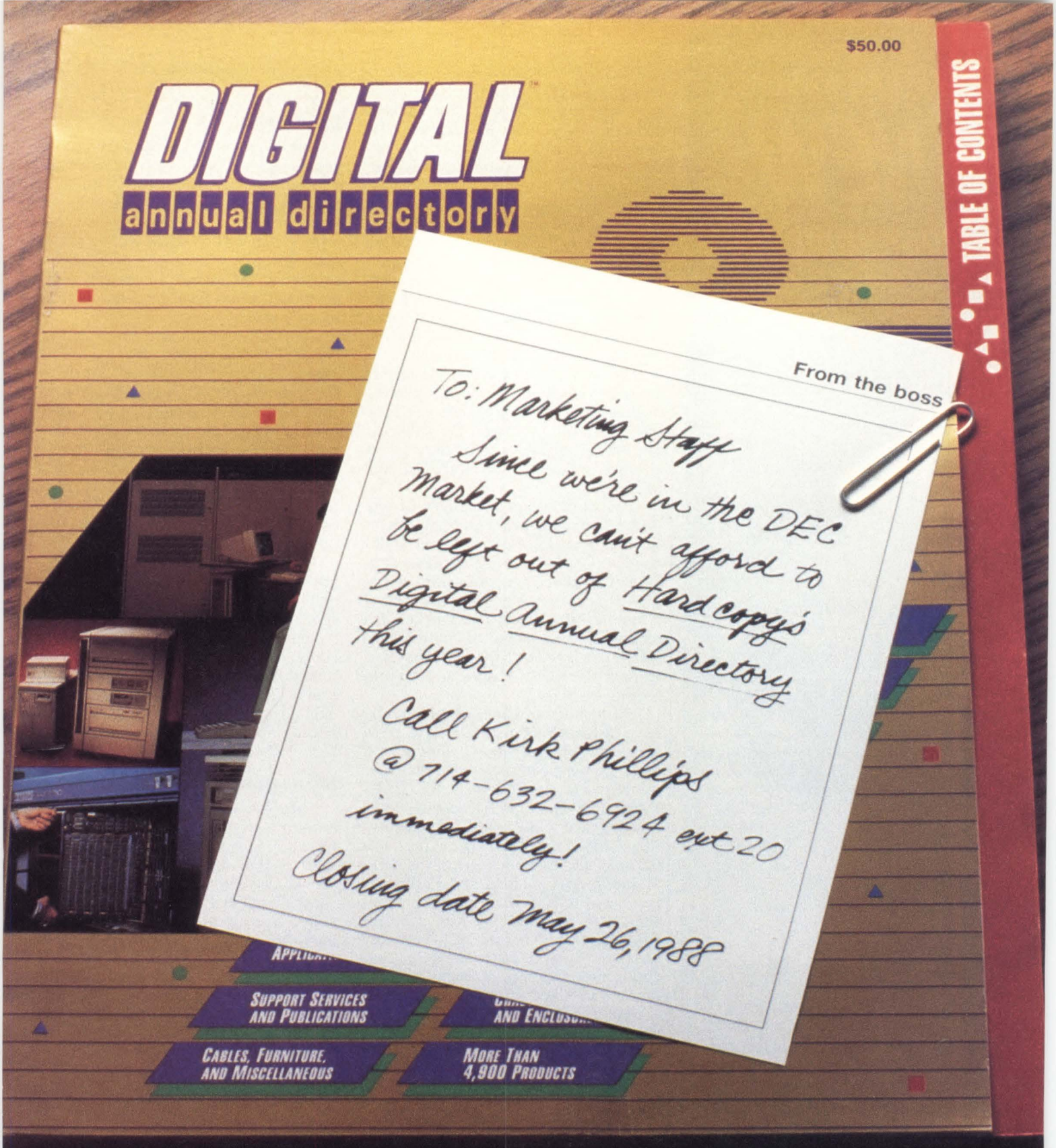

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bers of the RSX-11 family, your tasks can only interact with the system through a defined set of interface routines (the Executive Directives). Furthermore, your tasks are not mapped to the Executive, hence it's impossible for a task to damage another task or the operating system, in contrast to systems such as MS/DOS, where system corruption is an ever-present danger.

The interface routines make it possible to run exactly the same task (binary executable image) on a small system running under RSX-11M and on the largest RSX-11M-Plus system.

The members of the RSX-11 family are fairly efficient. Of course, the more facilities an operating system provides, the higher the overhead. For this reason, RSX-11M-Plus and its derivatives are less efficient than RSX-11S and RSX-11M.

The disk-based members of the RSX-11 family are all extremely versatile platforms for many end-user applications. Typical uses range from student time-sharing in university environments to real-time process control in industrial settings such as chemical plants. A wide range of applications software is available for these systems, from accounting packages to word processing systems.

All members of the RSX-11 family have DECnet implementations to allow for networking of these systems with other systems conforming to the Digital Network Architecture. RSX-11M-Plus, RSX-11M, and RSX-11S have Routing and End Node implementations of DECnet. The DECnet products for preconfigured members of the RSX-11 family (Micro/RSX and P/OS) are restricted to End Node services. In either case, DECnet permits systems running members of the RSX-11 family of operating systems to participate as active members of networks containing more than 65,000 computer systems.

Members of the RSX-11 family come equipped with a sophisticated suite of program development tools for applications development. The standard development tools for the RSX-11 family include text editors; Macro-11, a powerful macro assembler; LBR, a utility to maintain libraries of object modules; and TKB, a linker capable of building complex images involving disk and memory-resident overlays, shared libraries, and other structures.

A variety of higher-level languages are available for members of the RSX-11 family. DEC's offerings include FORTRAN-77, Pascal, DIBOL, and COBOL-81. Third-party software firms also offer languages such as PL/1 and C.

Schedules

All members of the RSX-11 family use a priority-driven scheduling scheme whereby each task in the system is given access to CPU time based on its priority. The higher a task's priority, the more CPU time will be available. You can control the priorities—subject to safeguards to prevent nonprivileged users from causing damage to the system.

All RSX systems are event-driven systems (based upon timer and I/O events). Many of the events that drive the system are not directly accessible to your tasks, but it is possible for a task to be notified of some events. Many systems have some version of an event-flag mechanism, and the RSX family also provides the Asynchronous System Trap (AST)—a mechanism for the user-level interrupt to be delivered to a task in a safe manner.

Unlike hardware interrupts, ASTs are queued to tasks in a first in-first out manner. Thus, there is no danger of synchronization failures caused by an interrupt interrupting other interrupts. In fact, the AST mechanism is probably one of the most powerful, user-accessible mechanisms in RSX. ASTs permit you to write applications managing real-time processes in a highly efficient manner.

Managing System Devices

The Queue Input/Output (QIO) request directive provides the foundation for all I/O requests processed by the system. QIO defines a division of responsibility between user tasks and device management wherein users are not able to use information related to the particular arrangement of I/O devices on the system. For example, users have no access to information about disk geometry—such as the number of cylinders, tracks, or sectors. Also, drivers provide high-level functions directly to user tasks without additional mechanisms to control interaction. The QIO mechanism in RSX-11 and VMS is a flexible mechanism for the creation of special-purpose services.

Device drivers provide most of the support processing required to process an I/O request. A driver exists for each type of device; in some cases, the same device may have more than one potential driver, depending on the functions required of that device. Drivers convert the conceptual models of I/O provided by the QIO-level interface to the actual physical operations required to imple-

ment the I/O requests.

RSX-11 also features Ancillary Control Processes (ACPs) that support more processing than can be performed by a device driver. When an I/O request, such as a file lookup, requires extensive processing, the operating system's Executive queues the request to the appropriate ACP (in this example, F11ACP, the Files-11 ACP) for processing. The ACP performs the processing, perhaps requiring the associated driver to process tens or hundreds of individual I/O operations, and returns the information requested.

ACPs provide an extremely powerful mechanism for the implementation of complicated facilities on RSX-11 systems. Many system facilities, such as disk files (managed by F11ACP), ANSI magnetic tapes (MTAACP), DECnet connections (NETACP), remote DECnet management operations (managed by NMLACP), and DECnet remote terminals (managed by RMHACP and RMTACP) are provided by ACPs.

All RSX systems use the Files-11, Level 1 disk structure. Files-11 specifies how disk space is allocated and managed. Each file in an RSX system is entered in a directory that is, in turn, entered in a Master File Directory. Under RSX-11M, directories are named using the owner's User Identification Code (UIC).

With RSX-11M-Plus, Micro/RSX, and P/OS, directories are named using either UICs or text strings. Files-11 has no limit on the number of noncontiguous disks areas that can be allocated to a particular file. Disk volumes up to 2**24 blocks are supported by Files-11, Level 1.

RSX-11M provides full support for Files-11, Level 1. File access is provided by both File Control Services and RMS. RMS-11 supports the creation and maintenance of indexed files as well as the conventional sequential, direct, and relative files.

VAX Runs Like a PDP

When VAX/VMS was first released, most of the user mode utilities (editors, compilers, etc.) actually were executing in PDP-11 compatibility mode under the RSX-11 Applications Migration Executive (AME). As more programs ran in VAX native mode, the use of the AME within VMS was discontinued. Many users no longer needed the ability to emulate RSX systems on their VAX systems, so the AME was unbundled from the normal VAX/VMS product and rereleased as VAX-11 RSX.

VAX-11 RSX provides an excellent emulation of an RSX-11M/RSX-11M-Plus environment on any of the many processors in the VAX series, from VAXstation 2000s to the large 8800s. Older VAX systems like the VAX 11/780, have hardware provisions for emulation of the PDP-11 instruction set. Newer VAX processors, which do not have these hardware emulators, must emulate the PDP-11 instruction set in software (greatly reducing performance of the emulated programs).

However, if you need to run nonprivileged programs intended for execution on a PDP-11 system, VAX-11 RSX provides an excellent vehicle. Most of the facilities supported by RSX-11 in user mode are supported by VAX-11 RSX; in fact, VAX-11 RSX often performs Sysgens and Netgens for various members of the RSX-11 family.

Soft-Sell Ending

The point that HC/WG Labs would like to leave you with is that you have choices. Selecting the optimum operating system requires that you understand your needs thoroughly. But the choices are good ones.

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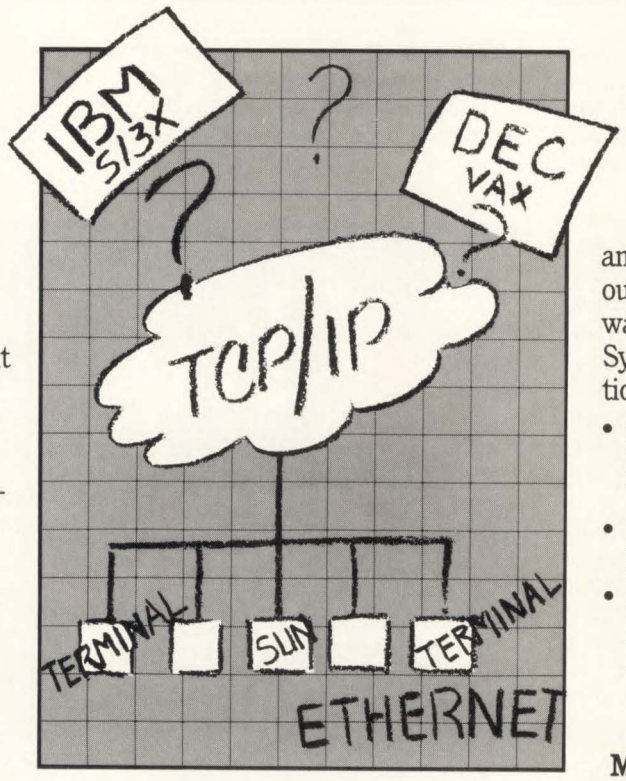

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Linking the LAN for the Best Connection

As part of our ongoing series of making actual connections of systems via networks, we've asked Price Waterhouse's Alen Darr to perform the TCP/IP connection for us via the Excelan Ethernet system

by Alen Darr, *Price Waterhouse*

After completing the integration of the Apple network with our MicroVAX II Local-Area Network (LAN) (see "HC/WG Labs Evaluates Alisa Systems' AlisaTalk, Part 1," *Hardcopy,* page 38, February 1988, and "HC/WG Labs Evaluates Alisa Systems' AlisaTalk, Part II: Making the Final Connection," *Hardcopy,* page 54, April 1988), I was asked to install and integrate a PC-based LAN into the MicroVAX network. After some initial resistance on my part, I agreed to the project, but only on the basis that it would have to be more than just another PC-based LAN. What I received from *Hardcopy* exceeded my expectations—a complete Excelan PC networking system consisting of two PC LAN boards (which support both thin-wire and thick-wire Ethernet connections) and a complete Transmission Control Protocol/Internet Protocol (TCP/IP) implementation for both the MicroVAX II and the PC.

The Excelan networking boards are capable of: 1) creating a PC-to-PC network using one PC as a network file server, and 2) allowing a PC to become part of an Ethernet network (see Figure). If you are using PCs as development workstations, this product may be your connection to the network.

There's a lot to integrating a network. Before we get into the details of implementing the Excelan products, you may need to understand more of the basics of networking (see sidebar, "Why Network at All?).

Although step-by-step details for implementing the physical network connection are beyond the scope of this article, I would like to comment on the quality and quantity (measured in linear feet) of the documentation included with Excelan's product. The manuals are well prepared, easy to follow, and allow you to easily integrate the software and hardware. Briefly, the following steps are required to integrate an IBM PC/AT into an existing MicroVAX II/Macintosh network.

The first step is to install the EXOS 205T Intelligent Ethernet Controller into a 16-bit slot of the PC/AT.

Next, install the LAN WorkPlace network access software for PC-DOS on the PC/AT. Although this process is usually uneventful, it can involve the shuffling of about 15 disks in and out of the PC/AT.

You then make the physical connection of the PC/AT to the existing Ethernet network. This is a simple process of tapping onto the existing thin-wire with a T-connector and connecting to the Ethernet controller.

As mentioned previously, both thick-wire and thin-wire connections are supported on Excelan's Ethernet controller—most manu-

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Product: LAN Workplace HostAccess
Price: $150

- Supports both thin-wire and thick-wire Ethernet connections
- Complete TCP/IP implementation for the MicroVAX II and PC
- Create a PC-to-PC network using one PC as a network file server
- Allows PC user to become part of Ethernet network

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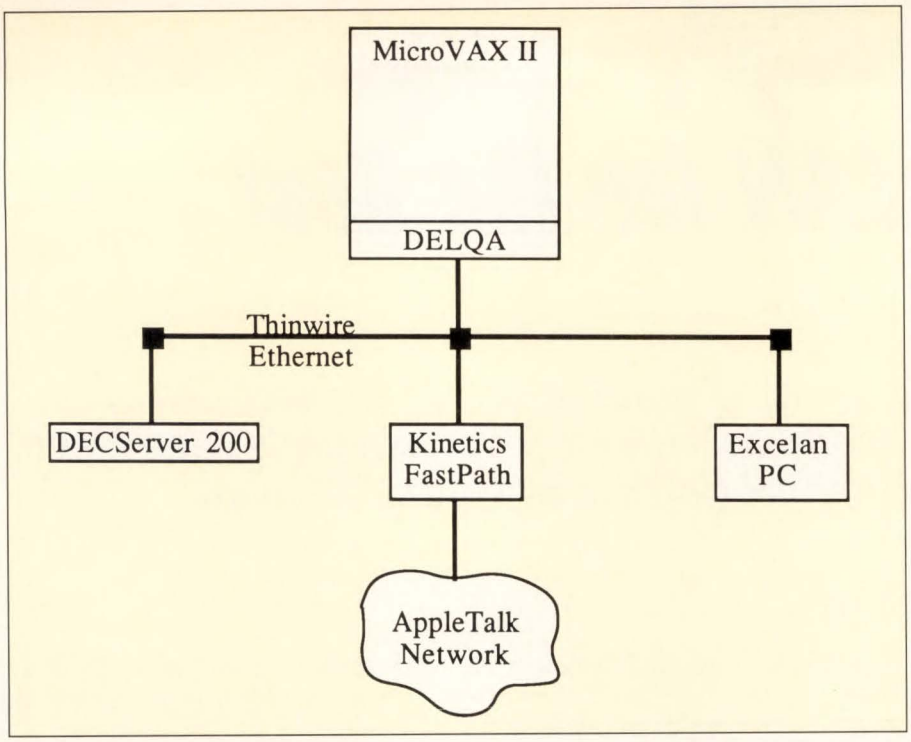

Figure—This MicroVAX II-based network configuration at Price Waterhouse was used *as the test network for the Excelan EX5500 LANalyzer.*

print spooling really does speed up processing.

The LANalyzer is a network tool that enables the network manager to monitor network traffic and, if required, simulate such traffic at or near the network's saturation point as an aid in planning for network expansion. Packets can be generated and injected into the network to simulate various traffic patterns. These packets can contain errors in the Cyclic Redundancy Code (CRC), preamble, and backoff. Stored packets can be searched for specific bit or byte patterns. Various protocols can be analyzed including DECnet, Transmission Control Protocol/Internet Protocol (TCP/IP), Xerox Network System (XNS), and AppleTalk. StarLAN networks can also be analyzed with the addition of one PC board.

Installing the LANalyzer

If a kit version of the LANalyzer is purchased, the installation of the hardware and software proceeds in much the same manner as the installation of other PC add-in boards. The software setup is very straightforward as the installation routine prompts the user for information. For purposes of our tests, we were fortunate to receive an EX5500 system, which arrived as promised—preconfigured and ready to go. All that was required was connection of the EXOS 325 board to a transceiver.

LANalyzer Features

The LANalyzer provides your net-

continued on sector 62

Using the LANalyzer

With all of its capabilities, the LANalyzer is imposing to the first-time user. Excelan anticipated this and eliminated potential problems by designing an easy-to-use interface and providing predefined network tests. Each LANalyzer session consists of a series of tests. Each test is a program of user-defined criteria that determine which packets are to be collected or generated over the network. As a test is being run, test data is displayed on the screen. Captured packets are held in the Excelan EXOS Network Controller's memory and can be displayed at the conclusion of the test or stored to disk for later analysis.

You interface with the LANalyzer via eight menu-driven screens:

- the Cable screen provides access to the Time Domain Reflectometry (TDR) test (frequency continuity test of the Ethernet medium),
- the Setup screens allow the specification of test criteria,
- the Run screens display the results of running tests,
- the Name screen provides user-definable names for Ethernet and Internet addresses and Transmission Control Protocol (TCP) ports,
- the Trace screens display data concerning collected packets,
- the Statistics screens display information relative to the packets collected or transmitted during a test,
- the Config screens determine the interaction of the LANalyzer with its host PC, and
- the User-Template screens define data-entry and packet-display formats.

TCP/IP Software

The kernel of the LANalyzer software is the TCP/IP software that is included as part of the network management software. The TCP/IP software from Excelan consists of three components: TCP, Internet Protocol (IP), and Network Executive (NX). TCP and IP can implement existing DoD standard protocols on the system. NX runs on the controller board and implements the International Standards Organization (ISO) Data Link layer.

Upon power-up, the TCP/IP driver downloads the NX program to the controller board. The general interface provided to the user is the ISO Transport layer. All lower-level layers are hidden from the user. After the NX program is downloaded, the network can be addressed on the VAX through queue input/output calls from high-level languages.

On PCs and UNIX, Excelan al-

continued on sector 58

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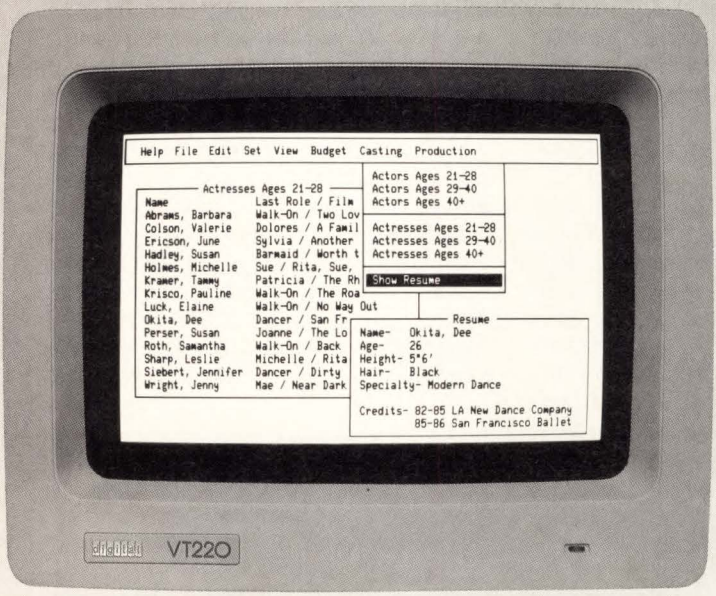

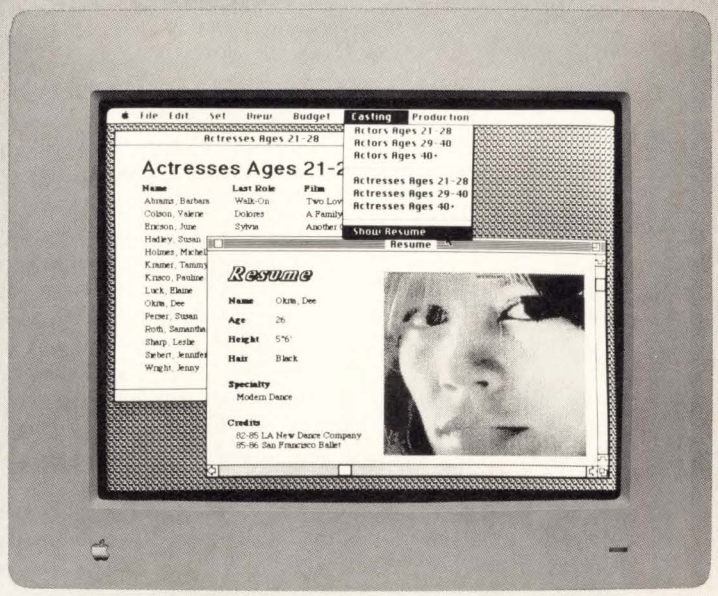

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continued from sector 56

lows direct program access to the TCP/IP functionalities from high-level languages via the "socket" library. Sockets are TCP/IP library calls and will be covered in detail in a future issue.

Excelan provides many of the higher-level routines needed to fully utilize the TCP/IP network. These routines provide user functionality at the Session, Application, and Presentation ISO layers. With these routines, the user has complete use of the network.

Sample Session

The LANalyzer provides a default test (DEFAULT.TST) that is used, in conjunction with the manual, as an introduction to the LANalyzer. DEFAULT.TST is a very good introduction to the use and capabilities of the LANalyzer, and is used as a template for the development of further tests.

To construct a new test, you must first load the LANalyzer with an existing test; you then modify the Setup, Name, Config, and Template screens to create the new test. You invoke the Test screen to perform the new test's operation on the network. Other screens can be used to further customize the test. Once you are satisfied with the operation of the new test, it can be saved to disk under a new name.

Up to eight channels are available during a LANalyzer session; each LANalyzer channel is used to create a separate view of the system's operation. Some of the parameters that can be set for a channel include channel name, whether the channel is enabled (active) or not, range of packet sizes, patterns the packets are to match (up to sixteen different patterns may be combined by logical operators), activation triggers, and whether the data is to be captured to the EXOS' buffer or disk.

The packet patterns that may be specified are called filters. Some typical filters of interest are based on matching specific fields within the packet. For example, the first three bytes in the Ethernet address contain the vendor's hardware address. By setting the filter to capture only those packets that have the first three address bytes of AA-00-04, AB-00-0x, or 08-00-14 (hex values), all DECnet and Excelan packets would be caught. All others would be ignored. A filter could also be configured to capture all DECnet remote load requests by examining the Ethernet type field and accepting only those packets with the value 6001 hex. The LANalyzer Application Library and the appropriate vendor documentation provide the specific field information that can now be used to maintain and analyze networks.

DEFAULT.TST is automatically loaded if no command line options are passed to the LANalyzer program. The DEFAULT test demonstrates most features of the LANalyzer including:

- display of the Setup screen to show the current configuration, including which channels are being used and statistics for those channels (Figure 1);
- display of the Run screen, which includes bar graphs of the packets captured in each of the active channels and summary counters for all errors (Figure 2);
- display of the Run Global screen showing information concerning all traffic on the network, including peak network utilization, average utilization, snapshot utilization, kilobytes of data, and peak and average traffic (Figure 3);
- examination of the trace buffer after the Run session has been completed or aborted, including the packet number, length, source and destination addresses, and channels captured (Figure 4);
- display of packet information, including Ethernet address of source and destination, protocol, time stamp, length, and errors; and
- display of packet data in both hex and ASCII.

Running the DEFAULT test re-

continued on sector 60

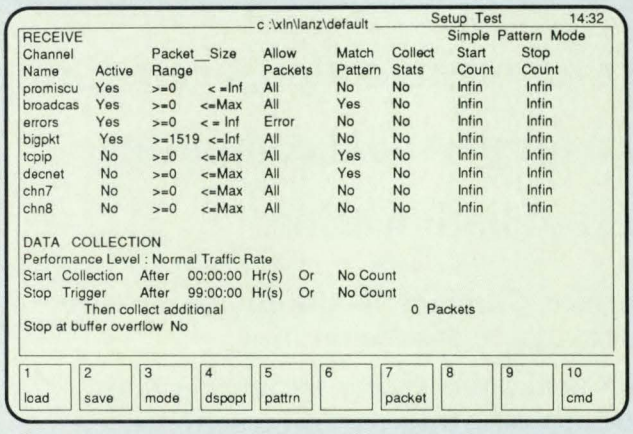

Figure 1—The Setup Test screen includes *fields relevant to the major components of the test: receive channels, start and stop triggers, transmit channels, and names of files in which to save test results.*

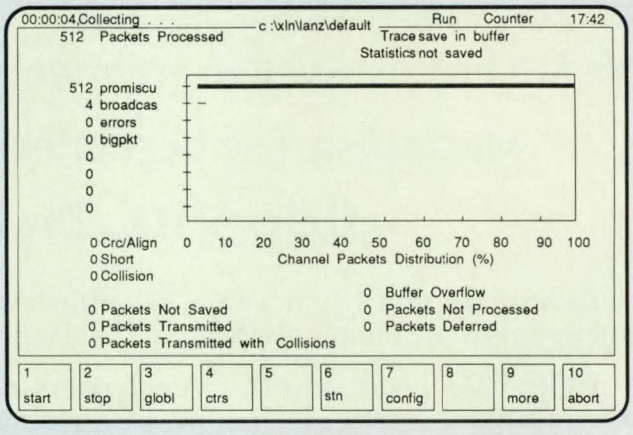

Figure 2—The Run Counter screen is displayed *as soon as a test is initiated, and includes data on general test results relating to all traffic observed on the network, all enabled receive channels, and packet transmissions.*

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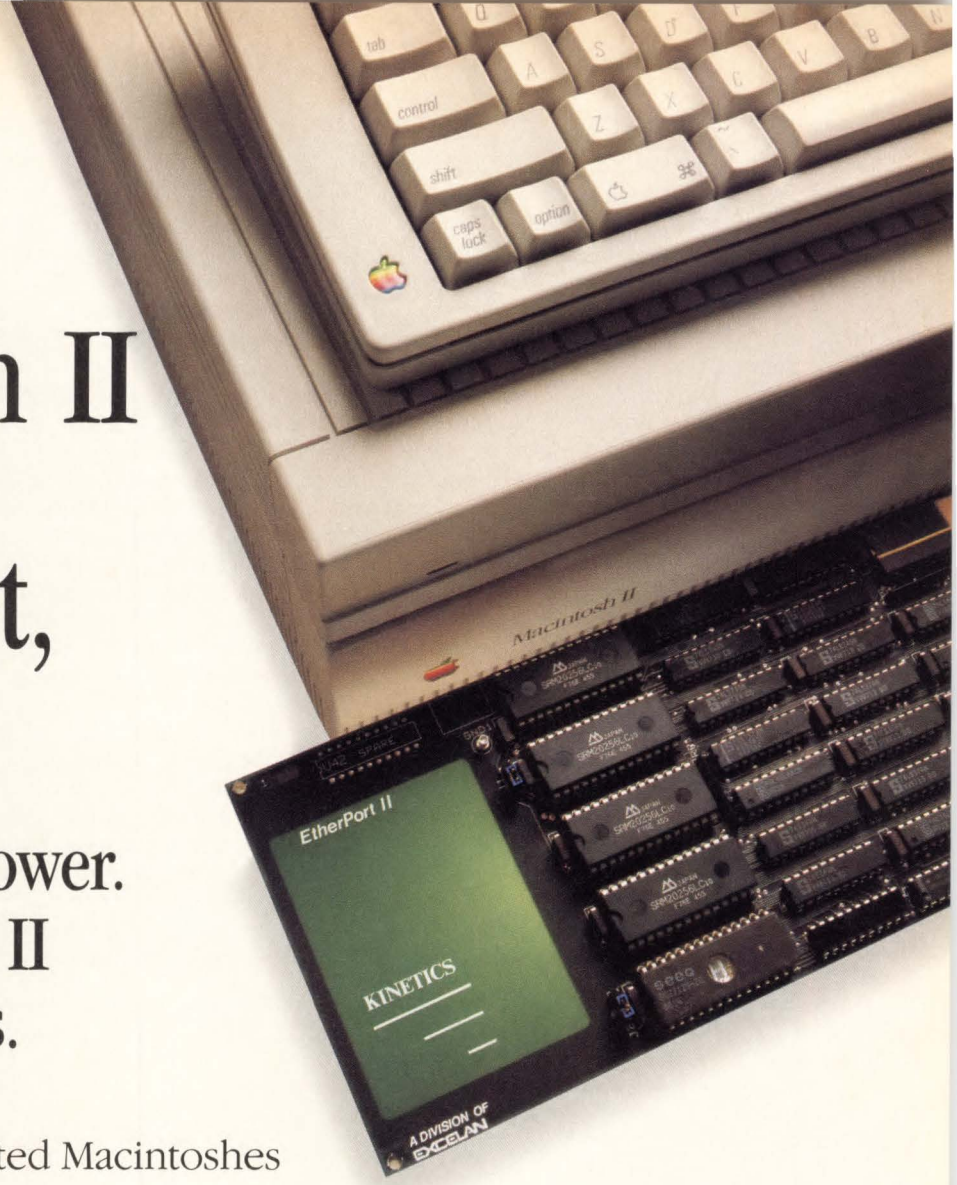

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continued from sector 58

veals the true power of the LANalyzer. The various screens are brought up via the function keys, and each screen provides a unique view into the operation of the network. The combination of the information on all of the screens encompasses much more information than was previously available to the network manager.

After the DEFAULT test has been run, you can examine the packets that have been captured in the buffer. This is perhaps the most fascinating feature of the LANalyzer. Bringing up the Trace Buffer screen reveals information concerning each packet captured by the DEFAULT test: test-relative packet number, length, absolute time stamp, destination address, source address, type of Ethernet packet, the channels that captured the packet, the type of error (if any) in the packet, and whether the packet was also generated by the LANalyzer.

If a packet looks interesting, simply highlight it and press the F6 function key. The packet of interest is now displayed on the screen. The DEFAULT test sets up a generic decode screen that contains extensive information, including the packet data. The data display can be modified according to your needs by making changes on the Display Options screen from within the Trace screen. The Trace screen even has the ability to display packets that contain a specific string of data.

Another interesting exercise is to modify the DEFAULT test to look into DECnet. First the LANalyzer must be hooked into a DECnet network. The LANalyzer program is then loaded and the Setup screen is brought up (refer to Figure 1). The arrow keys are used to bring the cursor into the ACTIVE column. Using the "+" and "-" keys, deactivate all channels except the DECnet channel. Set up the test to run for a couple of minutes. The Run screen is then brought up and the new test is run. Assuming average traffic on the DECnet network, packets of information are now captured within the trace buffer.

The next step is to save the information contained in the trace buffer to a disk file for later analysis. The Trace screen must first be brought up. Function key F4 activates the "savbf" routine that will save the captured packets to a data file. You are then prompted for the information necessary to save the file. For convenience, name the file DECTEST.

The packet trace data is saved to disk; the LANalyzer program is exited. The Excelan Protocol Decode utility, LANZDSP, will be used to completely decode the DECnet packets in the trace file. To start LANZDSP, enter the following command line:

LANZDSP /B1 /E20 DECTEST

This command line will start the LANalyzer decode program using the trace history file DECTEST. The other two options instruct the decode program to begin processing with the first packet (/B1) in the trace file and end processing with the 20th packet (/E20). As the decode program processes the packets, the results are displayed on the screen. Appendix C of the LANalyzer manual contains a complete reference for the LANZDSP utility.

The first three lines of the decode display generated by the LANZDSP utility will contain the Packet Header Information—including the protocol, Ethernet type, source and destination addresses, length, and timing information. After the Packet Header Information has been displayed, various DECnet-specific data is displayed followed by the actual packet data. Close examination of the DECnet packets can be rather revealing as shall be seen next month.

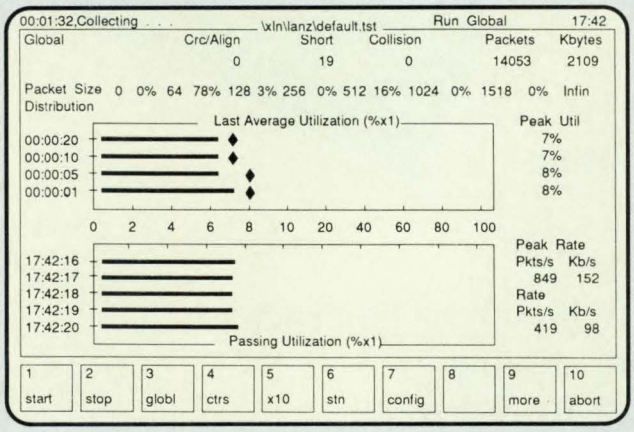

Figure 3—The Run Global screen displays *information on all packets observed on the network while the test is in progress.*

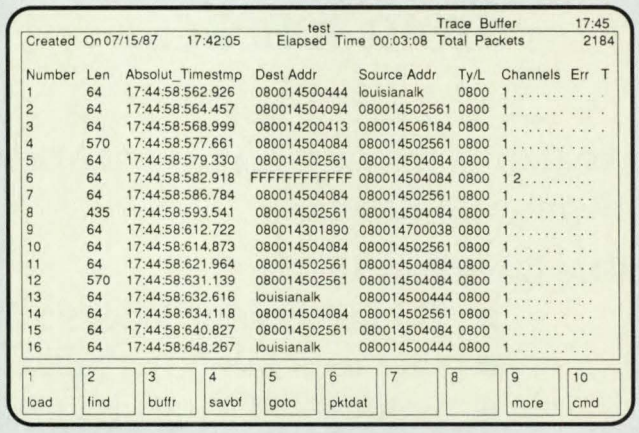

Figure 4—The Trace screen, *specifically a Trace Buffer screen, as indicated by the words "Trace Buffer" in the upper right corner, is a scrollable window showing data on the trace buffer or file and gives a brief description of each packet.*

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Like all members of MDB's DR11-W family, its VME module is 100% DR11-W compatible, and also has a switch selectable DRV11-WA mode. This means VAX or MicroVAX users who are migrating to VME systems will have a much easier task of software driver conversion from DEC systems to VME.

Now that you've entered the VME world, it's good to know the leader in connectivity is already on-board.

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CIRCLE 423 ON READER CARD

continued from sector 56

work manager with the ability to completely maintain an Ethernet or 802.3 LAN. The LANalyzer performs network measurement, traffic analysis, troubleshooting, and debugging operations on a PC-based system. Data can be captured to disk, time stamped, and remotely accessed.

The user interface is via menu-driven screens that prompt you for the input.

Specific abilities of the LANalyzer include:

- monitoring network traffic by examining all or specific packets,
- capturing and storing packets or packet segments on disk,
- analyzing network activity in real time,
- analyzing captured packets and decoding various protocols,
- performing low-level Time Domain Reflectometry (TDR) tests on the network media,
- generating network activity for performance measurement, and
- inserting network errors as an aid to troubleshooting.

The LANalyzer performs these operations according to user-defined criteria. Packet collection criteria can be selected on the bit or byte level. Specific headers or types of packets can be selected. Up to eight different channels of network information can be collected simultaneously. Either default or user-defined filters can be used to aid in specifying packets to be analyzed. Collection can be triggered by time, event, or keyboard input. Data can be captured to disk for later analysis or remote collection. Complete statistics and error reporting are built into the system.

Next Month

Next month, we will continue using the LANalyzer to explore the inner workings of various LAN protocols, including TCP/IP and DECnet. We will design our own tests to gain an understanding of the TCP and IP protocols and then use this information to diagnose and troubleshoot network problems. The LANalyzer will also be used to investigate specific DECnet data. In addition, we will explore the TCP/IP "socket" interface to higher-level protocols.

Alen Darr is a management consulting services manager in the Sacramento office of Price Waterhouse.

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EXPANDED SYSTEM	1.52 GIGABYTES	17 MEGABYTES	64
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PDP PERSPECTIVE . . . RSX *by Robert Gezelter*

Network file access—it's easier than you think!

Often, we need to read or update information stored on another system in our DECnet network. While it is possible to implement special-purpose network servers (see "PDP Perspective . . . RSX," *Hardcopy,* page 62, March 1988) to provide such services, it is often possible to use existing system facilities to accomplish most routine tasks.

The information contained herein is applicable regardless of the RSX family member you are using—RSX-11M, RSX-11M-Plus, Micro-RSX, RSX-11S, or P/OS. Because of the close family relationship between the RSX-11 family and VAX/VMS, much of the material in this article applies in concept, if not in detail, if you are using VAX/VMS.

Two tasks are involved in every network operation: a User task and a Server task. The Server for network file accesses is the File Access Listener. At command level, users typically use the Network File Transfer (NFT) utility as the User component of the network file operation. NFT can be requested in several different ways, depending on the command language in use. Monitor Console Routine (MCR) users invoke NFT using the command NFT. Digital Command Language (DCL) users invoke NFT when they issue a COPY, TYPE, DELETE, or DIRECTORY command that involves files located on different systems in the network.

Users' programs may also directly access remotely located files by using RMS-transparent remote file accesses as well as the FCS-11-based Network File Access Routines to directly access files located on the same (or other) network node from application programs.

The organization of a file does not affect its ability to be accessed from other locations in the network. Any type of RMS file can be accessed remotely, whether it is a sequential, random, or indexed (keyed) file.

Generally, accessing a remotely located file is almost as simple as accessing a file on your local system. In many cases, the definition of a logical name

Listing 1

```
$ mcr ncp set alias marcy dest marcia -
$-username gezelter password ocean -
$-scope term ti:
$ directory marcy::[hardcopy]input.fil

Directory MARCY::FR001:[HARDCOPY]
20-APR-88 11:01:55

INPUT.FIL;1               1./1.              08-FEB-88 05:29:54

Total of 1./1. Blocks in 1. Files

$ type marcy::[hardcopy]input.fil
1000
123
101
88
67
$ fortran/list nettst
$ link @nettstbld
$ run nettst
Sum of all input values is 1379
$
```

Listing 2

```
Professional Tool Kit FORTRAN-77 V5.0-0          10:47:47     20-Apr-88          Page 1
NETTST.FTN;7              /F77/OP/TR:ALL/WR

0001          PROGRAM NETTST
        C
        C     NETTST-Program to Demonstrate the use of Remotely located files
        C
        C     Author:  Robert Gezelter          20-April-1988
        C
        C     This program serves as a demonstration of the use of a file located
        C     on another node in a DECnet network. Note that using remotely located
        C     file is as simple as using a local file.
        C
0002          INTEGER*4 TOTAL,VALUE
0003          DATA TOTAL /0/

0004          OPEN(UNIT=1,STATUS='OLD',READONLY,
             1  NAME='MARCY::[HARDCOPY]INPUT.FIL')

0005      11  READ(1,*,END=999) VALUE
0006          TOTAL = TOTAL + VALUE
0007          GO TO 11

0008      999 WRITE(6, 10) TOTAL
0009      10  FORMAT(1X, 'Sum of all input values is', 16.0)
0010          CLOSE(UNIT=1)
0011          CALL EXIT
0012          END

Professional Tool Kit FORTRAN-77 V5.0-0          10:47:47     20-Apr-88          Page 2
NETTST.FTN;7              /F77/OP/TR:ALL/WR

PROGRAM SECTIONS

Number   Name       Size              Attributes

  1     $CODE1  000222    73          RW,I,CON,LCL
  2     $PDATA  000134    46          RW,D,CON,LCL
  4     $VARS   000010     4          RW,D,CON,LCL


VARIABLES

Name  Type  Address   Name  Type  Address   Name  Type  Address   Name  Type  Address   Name  Type  Address

TOTAL  I*4   4-000000   VALUE  I*4   4-000004

LABELS

Label  Address          Label  Address          Label  Address          Label  Address          Label  Address

10     2-000000         11     1-000042         999    1-000130

FUNCTIONS AND SUBROUTINES REFERENCED

 CLOS$   EXIT    OPEN$


Total Space Allocated = 000366    123

No FPP Instructions Generated
```

or network alias permits you to access a file without repeatedly specifying access control information for the remote node. The only difference between a local file access and a remote file access is the need to specify the remote node name, username, and password in addition to the normal device name, directory, and filename. Remotely located files can be accessed from DCL or MCR (Listing 1) as well as from within user-written applications programs. Indeed, almost any type of file access that can be performed on a local file can be performed on a remote file.

Writing a program to access a remotely located file is quite simple (Listing 2). NETTST makes use of RMS' transparent remote file access capabilities to read a sequential input file located on a different system.

In most cases, files accessed over the network can't be accessed at the same speed as files accessed locally. The access time required for data being accessed on remote systems depends on the throughput and latency of the links connecting the two systems. For example, consider two networks: One network uses 9600-bit-per-second, RS-232C circuits to connect your local system to other systems in the network; the other network is composed of machines connected to a local Ethernet.

On the first network, you have slow access times caused by the relatively low bandwidth of the communications link. To be precise, the transmission delay of a 10-block file, containing a total of 5120 bytes of data, will be in excess of five seconds. With the second network, you have a relatively fast response for the transmission of the same file since Ethernet is capable of transferring the same data in less than a second.

This comparison is not completely fair, however. The overhead of setting up a logical link to the other system, validating the access, and initiating the file access add overhead. Usually, with relatively small file transfers, the substitution of Ethernet for the serial RS-232C connection doesn't appreciably improve the transfer rate. Interestingly enough, the effective transfer rate of the relatively slow DECnet link is comparable to the speed of a normal floppy disk. With optimum conditions, DECnet remote file access over Ethernet links offer performance comparable to local hard disk accesses.

System and data security are other considerations when using files over a network. The systems connected to the network must be managed in a manner that ensures that unauthorized users do not gain access to sensitive data.

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CIRCLE 395 ON READER CARD

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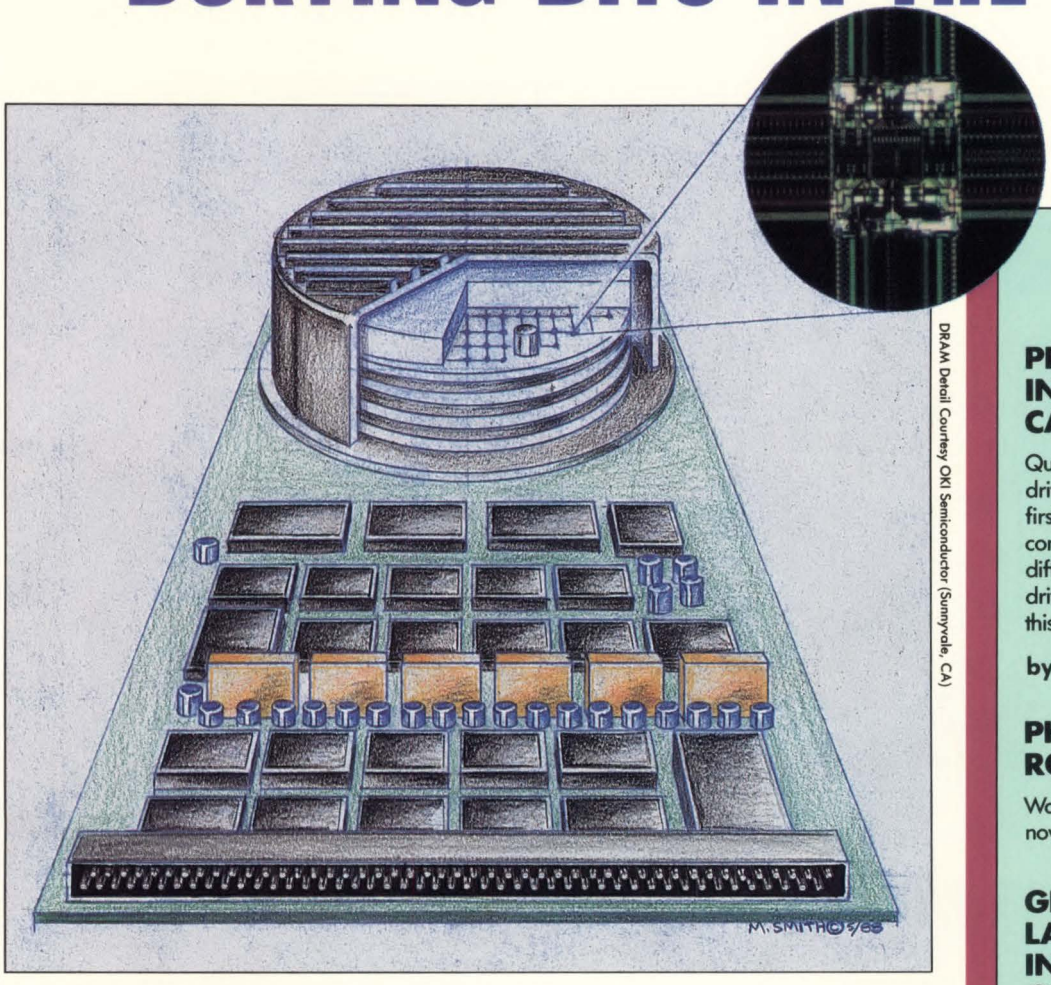
FROM THE PUBLISHERS OF
HARDCOPY MAGAZINE AND HC/WG LABS

JUNE 15, 1988, VOL.1, NO.4

BURYING BITS IN THE SAND



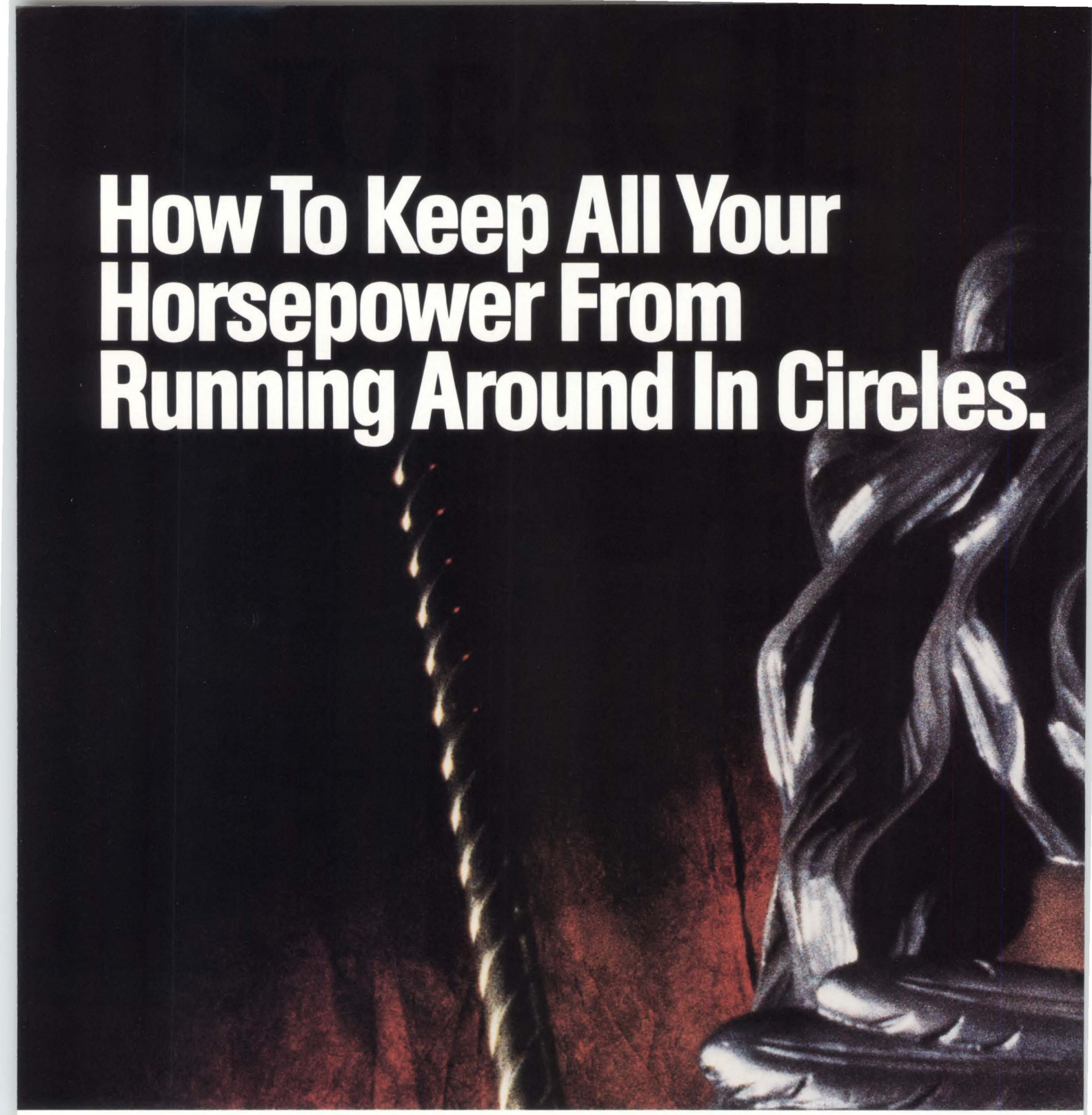
MARTY SMITH

DRAM Detail Courtesy OKI Semiconductor (Sunnyvale, CA)

Imagine 5.5 Gbytes of instant access storage in a desktop box. Believe it or not, such devices do exist and more are on the way. What is shown here is Laser Dynamics Inc.'s (Scotts Valley, CA) semiconductor storage module that stores 550 Mbytes of data for a cost of about $10/Mbyte. The module, which is to be ready in about 18 months, uses 6-in. silicon wafers with interconnected, 1-Mbit Dynamic Random Access Memory (DRAM) cells (shown in detail circle) to produce 55 Mbytes per wafer. Ten wafers are stacked together to produce the module. Of course, electronics are needed and, like board-mounted Winchesters, the semiconductor module does require a controller, formatter, and error-correction code (ECC) electronics and firmware. Each of the modules is designed to be linked with other modules to allow you to form large storage arrays. With access speeds well below 100 nsec (the time it takes an electron to travel though 6 in. of nichrome wire), the modules may become integral parts of graphics and image workstations or an integrated cache for optical storage.

CONTENTS

How To Keep All Your Horsepower From Running Around In Circles.



To really understand your performance problem, just turn traditional thinking around.

You see, your CPU is really more like a peripheral—it's usually your storage subsystem that sets the pace.

When you look at the problem that way, it's a horse of a different color. The solution, of course, isn't a CPU upgrade. It's better management of the data.

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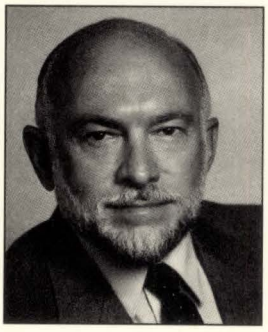
SYSTEM INDUSTRIES

CIRCLE 407 ON READER CARD

PHIL DEVIN'S ROTATIONS



WAITING FOR SCSI—HERE IT IS, NOW WHAT?

After eating up literally millions of dollars of industry, travel expenses, and salary budgets, an ANSI subcommittee hatched the Small Computer Systems Interface (SCSI) in 1986. Only now are we able to reap the fruits of this labor. Apple Computer has been delivering SCSI on Macintosh products for two years, but only a close circle of friends has benefited from storage revenues.

Why hasn't SCSI become the powerhouse connection for all small computers? The fault lies not in the stars, but in the standard itself.

What'd We Do Wrong?

Despite some honorable (but hardly philanthropic) efforts to establish a "Common Command Set" to reduce the number of options and, hence, the scope of varying implementations, most disk drive vendors are forced to support as many as 30 flavors of SCSI!

The result of this "pick one from column A" mentality has been a series of delays in:

- availability of SCSI disk drives,
- widespread SCSI support in operating systems,
- IBM's decision to openly support SCSI devices on PS/2, and
- most of all, revenues for loyal vendors.

Where Are the Drives?

This is not to say that the SCSI industry has led a fallow existence in recent years. Indeed, the industry has been less profitable than proponents ever imagined. Drive suppliers have long trumpeted the strength of their SCSI orders, but a quick look at unit shipments of SCSI versus those of Enhanced Small Device Interface (ESDI) makes ESDI look like the interface of choice. Don't forget that backlog as well as shipments must be combined to get a true feel for the market. Disk drive manufacturers have simply been unable to provide satisfactory SCSI solutions in production volumes; ESDI is the winner by default.

SCSI chip suppliers are to blame for much of this problem, often showing a lack of support to disk drive engineers previously unheard of in the semiconductor industry. Efforts to provide product differentiation have produced such varied SCSI implementations from each chip house that the resulting products are often incompatible. In its haste to get products to market, one disk drive company ended up with three incompatible SCSI products!

Software Hooks

It's hard to tell if an operating system has been designed to support a particular I/O scheme if it isn't detailed in the documentation. Further investigation looks into MS-DOS BIOS routines shows some peculiar hints to SCSI's future. The IBM PC/XT disk I/O routines are all based on the physical addressing of SCSI. If you recall, the original IBM disk controllers were designed by Xebec, and the similarity to Xebec's SASI chip design was obvious.

Rumors of IBM's possible dedication to SCSI were bashed when someone discovered that the AT controller design was based on Western Digital's controller chip set's command file structure.

Most computer manufacturers have little interest in supporting third-party SCSI devices and, therefore, make no mention of their intentions in software documentation. Encouragingly, Phoenix Technologies admitted recently that SCSI support exists in its BIOS routines for the Micro Channel.

It now appears that, in order to make SCSI a software-supported standard, an industry-accepted UNIX package that relies on SCSI for disk I/O must have general acceptance.

I Am Curious Big Blue

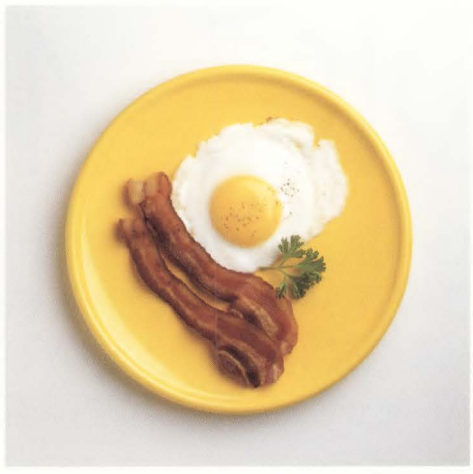
Dataquest has predicted the impending IBM announcement of SCSI support on the PS/2 for almost a year. Recent in-depth analyst briefings at Boca Raton define a planned, high-performance internal and external SCSI bus for multiple peripheral types. The announcement is expected in June 1988.

Limited I/O expansion slots in PS/2 models make the SCSI architecture a "must" for these machines. Synchronous SCSI support is probable from IBM. But volume shipments of new, synchronous, SCSI protocol parts haven't been sufficient to meet IBM's demands, until recently. This is another significant example of a company waiting for SCSI. Watch for IBM's SCSI implementation to be similar to the OEM versions of the 9332 and 9335 disk drives.

The effect of having both Apple and IBM supplying SCSI I/O ports will hopefully reduce the independent SCSI specifications to fewer than 30. Vendors might profit by stopping the support of so many variations of SCSI and settling on the most popular, forcing the standard. The underlying fact is that no company will turn down an order.

The unfortunate delay in the commercialization of SCSI may be a lesson to us all. I hate to make a comparison with governmental lawmakers, but it might be appropriate on the next standard to get the politics out of the way before the document is written and submitted to committee.

SOME THINGS JUST NATURALLY GO TOGETHER.



Like needle and thread. Salt and pepper. Emulex and MicroVAX. All are considered well-known pairs.

So it should come as no surprise that Emulex has introduced a family of high-performance controllers for DEC's new MicroVAX 3500/3600 computers.

Two new Emulex products are MSCP disk controllers which support a well-known pair of drives. The QD34 can support four SMD-E drives of any capacity with transfer rates of 3 megabytes per second. The QD24 easily handles four compact ESDI drives with data transfer rates to 15 megabits per second.

Another new product, the QT14 tape controller, features the industry's only switch-selectable capability for a pair of well-known emulations – TMSCP and TSV05.

These new products reflect the new MicroVAX form factor and, of course, are totally DEC-compatible. So if you're considering one of the new MicroVAX models, include an Emulex controller to make another well-known pair. After all, some things just naturally go together.

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PROVIDING TRUE DATA INTERCHANGE CAPABILITY: QIC-40

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BY R. GORDON ROOT, DEI

Once you had to choose between dump-and-restore data backup or data interchange, and these choices represented polarities more than choices. Consider: Quarter-inch cartridge (QIC) tape drives excel in the role of inexpensive, high-capacity dump-and-restore media, but varying implementations of the various format and capacity options available using two QIC form factors have made media transportability in the QIC arena more a promise than a reality.

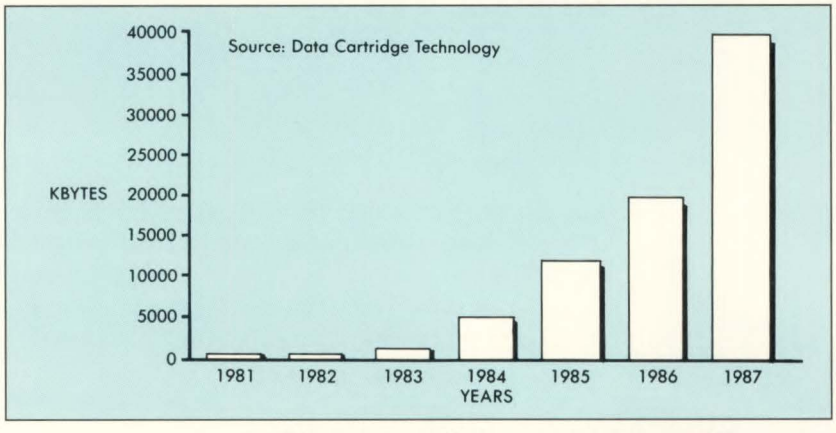


Figure 1—Disk capacity in small computers is growing *at a rapid rate. Any backup media that will serve this market must have the same potential for growth.*

With half-inch reel-to-reel tape drives, on the other hand, you're sure you have the ability to move media between differing systems—strict recording standards for nine-track tape promote near-universal media transportability. However, reel-to-reel tape drives have proven too large, too costly, and too short on capacity to satisfy PC users with high-capacity Winchester disk drives. Regardless of what backup medium you choose, it must track the amazing growth in disk capacities shown in Figure 1.

Combining Backup and Restore

The shortcomings of having to decide between dump-and-restore and universal transportability are clear. And to better understand the need for media that spans the two polarities, consider the current state of the data storage hierarchy, as shown in Figure 2. Data storage devices can be classified into one of two distinct storage functions:

continued on sector 8

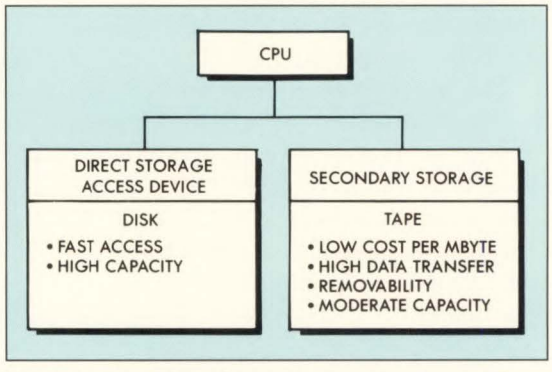
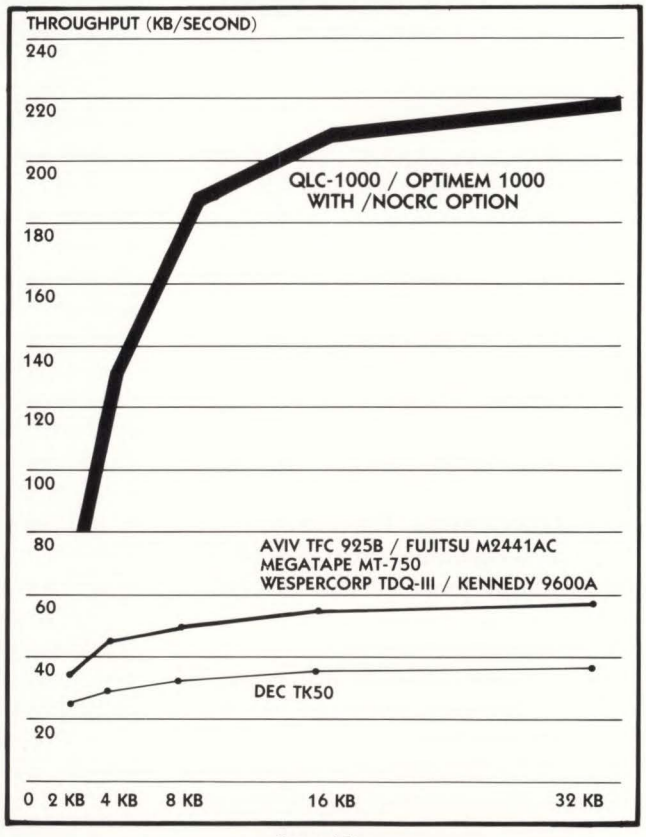


Figure 2—The data storage hierarchy divides *all of the storage peripheral needs into two major categories: direct-access or secondary storage devices.*

When You Think Optical for Archiving—

THINK FAST!



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—DIGITAL REVIEW—
November 23, 1987

TESTS WERE PERFORMED at Digital Review Labs on a MicroVax II using VMS 4.5 backup utility with cyclic redundancy checking (CRC) disabled (/NOCRC). Digital Review Labs tested with 50,000 block contiguous files transferred from a CDC WREN3 Winchester disk sing a Dialog DQ696 controller.

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QUALOGY

continued from sector 8

- direct-access storage devices (DASD) or
- secondary storage devices (tape).

DASD devices provide on-line access—a job that requires fast data access (transaction) times and high-capacity storage. Ever since the '60s, this has been the domain of the disk drive.

Secondary storage applications include data backup (safety), archival storage (filing), and data interchange (for data and program distribution). This has been the traditional role for a variety of tape drives. Tape drives, as a group, tend to feature a low cost per Mbyte, high data transfer rates, removability, and flexible storage capacities. Secondary storage is divided into four subcategories:

1. Dump-and-restore media—ranging from floppy disk and digital tape cassettes to QIC and HI/TC drives. These provide backup and data exchange capability (media transportability between the same drives and systems).

2. Fast-access removable media—applications such as digital imaging require large storage capacities, and this arena is usually forfeited to optical media.

3. Data acquisition and archival media—half-inch tape reels, optical WORM devices, and helical-scan video tapes are the contenders for this market.

4. System data-interchange media—a number of technologies now compete for secondary storage that provides global data interchange. If this data-interchange capability could be combined with dump-and-restore, you would have a peripheral to accommodate the most significant portions of your secondary storage needs.

It is this combination of secondary storage qualities that PC and super-microcomputer systems require to an increasing degree. The ideal secondary storage system furnishes the capacity to back up the high-capacity, rigid (nonremovable) disk drives of the '80s and to accommodate the needs of large-volume software distribution. The success of more and more system applications depends on being able to distribute enormous quantities of software or data: UNIX operating system updates or Computer Aided Engineering (CAE) design data files.

In the minicartridge 3.5-in. form factor, there is now a standard that will give dump-and-restore QIC drives the format for data interchange—the QIC-40 tape format. This format supports 40 Mbytes on 20 tracks of a 200-ft., .25-in. minicartridge tape using an

continued on sector 10

FINDING ROOM FOR GROWTH

The same tape technologies that currently propel 5.25-in. tape drives toward 5 Gbytes offer minicartridge drives the opportunity to reach to 1-Gbyte capacity. Capacity improvements will come in three areas:

- linear (bit) density,
- track density, and
- tape area.

A drive's linear density is a function of the magnetic particles used in the tape and the encoding method used by the drive. We already have a broad array of magnetic particles used. Chromium dioxide, widely used today, is capable of 25,000 flux changes per inch and has been produced with coercivities as high as 800 oersteds. Cobalt-doped gamma ferric oxide has been certified at 900 oersteds, can reach 1000 oersteds, and typically has a 550-oersted rating. This is the most commonly used type of particle found in tapes for audio and video cassettes as well as for data recording. In the floppy disk arena, barium ferrite is making news, showing coercivities as high as 1000 oersted and recording densities of 50,000 flux transitions per inch. So, many appropriate magnetic particles are available.

There are more efficient coding schemes than the group-coded recording method that has been used. Run-length limited codes (both 1,7 and 2,7) will make better use of the available flux change capabilities to store data in the same space.

Track density can also be increased. In the same form factor that QIC-40 records 20 tracks, QIC-100 records 24 tracks, and several manufacturers have announced that they can easily reach 40 tracks. With the application of servo systems and autotracking techniques, the reliability of data recorded in such narrow tracks is ensured.

Increasing tape area—making it longer—provides the speediest path to higher capacity. And longer tape shouldn't require any changes to the drive design. For instance, the QIC-40 recording format permits 40 Mbytes on a standard 200-ft. cartridge for a typical cost of $.75 per

continued on sector 11

Saved.

Laserdrive 5¼" Removable 810 Mb WORM Cartridges: How they'll change the way you store data.

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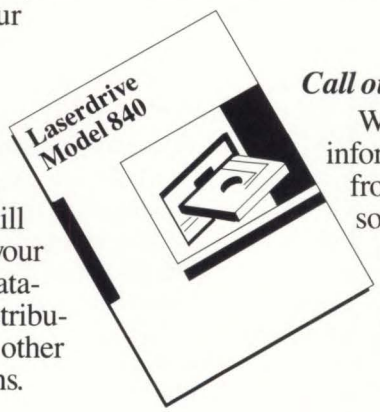
The Laserdrive Model 840 Optical Disc WORM Cartridge System.



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"THE SIMILARITY OF THE DATA STORAGE FORMAT TO THAT OF A FLOPPY DISK MAKES THE TAPE CARTRIDGE DRIVE EASY TO IMPLEMENT."

continued from sector 8

MFM recording scheme.

The QIC-40 format, illustrated in Figure 3, includes three distinct areas:

- reference burst,
- beginning gap, and
- recording area.

The forward and reverse reference bursts are recorded at 5K flux reversals per inch and provide a relative offset for the center line of the tracks. The forward burst provides the reference for even-numbered tracks; the reverse burst provides reference for odd-numbered tracks.

The beginning gap is a section of erased tape. For even tracks, the beginning gap starts at the load-point marker and runs from 0.5-in. to no more than 2-in. long. Then you find the beginning of the even-numbered tracks. For odd-numbered tracks, the gap is at least 1.5 in. and less than 2 in. between the early warning marker and the recording area for odd-numbered tracks.

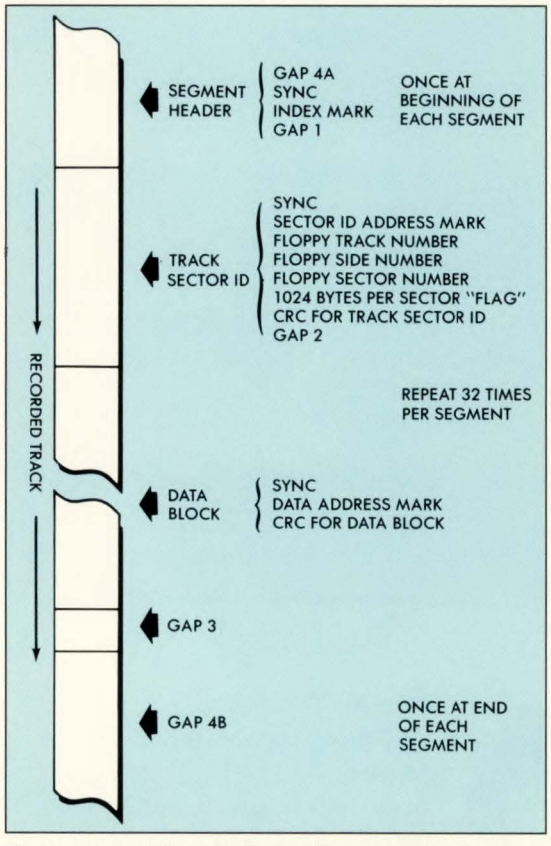


Figure 3—The QIC-40 format defines *several parameters important to data interchange, such as the record and block length, that let a user customize the format to match particular system requirements without compromising data interchange. The format process also writes ID records that act as landmarks that the drive can use to locate all other records.*

The recording area of each tape track consists of 68 segments, separated by 1 in. of erased tape. Each segment contains 29 data sectors and three error check and correction (ECC) sectors. Each tape contains 2176 sectors.

Within each track are 17 flexible disk tracks (FTK). It takes four segments (128 sectors) to make up each FTK. Tape tracks 00 through 09 correspond to flexible disk side (FSD) 0. Tracks 10 through 19 correspond to FSD 1.

The similarity of the data storage format to that of a floppy disk makes the tape cartridge drive easy to implement. Existing system drivers can view the tape cartridges as volumes, so that backup routines and copy commands need no modification.

Data to Go

In addition to its interchangeability and high capacity, the compact size of the 3.5-in. tape drive and its data cartridge make it an attractive choice for desktop systems. Although a single data cartridge can hold as much information as 50 floppy diskettes and still fits easily into a shirt pocket, we like to call it the "Personal Data Cartridge." Personal Data Cartridges are easy to transport and the packaging protects the data from physical stress—another important aspect of a backup medium.

Furthermore, the QIC-40 drives prove easy to implement in a system—you can choose interfaces that emulate floppy disks (QIC- 107) and work with floppy disk controllers, or, for higher performance, those that use the SCSI interface (QIC-108). This means that you can make the price/performance analysis, select the appropriate drive, and still maintain data interchange. Performance and recording format are not so interdependent that performance increases are achieved at the expense of compatibility.

Other Backup Choices

Of course, minicartridge tape isn't the only backup option available to system designers, but it seems the only one likely to bridge the gulf between data interchangeability and dump-and-restore.

Of the other contenders, optical disk and helical-scan tape drives (especially rotating digital audio tape) have received the most attention as viable removable-media data storage options. So it's important to apply the criteria of secondary storage devices to

them. Helical-scan media costs around $12 for a 2-Gbyte cartridge—roughly a penny per Mbyte. Optical disks average $65 per 400-Mbyte WORM (write-once, read many) disk—approximately $.16 per Mbyte. So both do offer reasonable storage costs. Neither technology, however, has any interchange standard as yet, and it will be some time before any standards emerge for either. Data interchangeability standards will be among the last concerns of the manufacturers who are taking these products to market.

Future Developments

In order to keep pace with the rapidly growing capacities of rigid-disk drives, the 3.5-in. form factor cartridge must also increase beyond its current 40-Mbyte limit. Although rapid growth in capacity might seem out of the question, it is very much a real possibility. In fact, after closely examining the currently available technology (see sidebar, "Finding Room for Growth"), attaining 1-Gbyte storage using the 3.5-in. form factor seems very reasonable.

The challenge is to maintain the reliability of data interchange while increasing capacity. The QIC standards committee is now considering a double-density version of the QIC-40 format (QIC-80) that will allow you to store 80 Mbytes on a standard 200-ft. cartridge (120 Mbytes on high-capacity cartridges) and still be able to read cartridges recorded in the QIC-40 format.

A new dump-and-restore-only format, the QIC-110, will sacrifice data interchange for higher capacity—storing as much as 160 Mbytes on a 300-ft. cartridge—so you can optimize use of the cartridge, and perhaps the tape drive, choosing the format that gives you data interchange or the one that affords the highest capacity. SA

R. Gordon Root, vice president, strategic planning for DEI (San Diego, CA), is responsible for marketing and strategic planning for current and future product lines. He has an M.B.A. degree from the University of Southern California.

continued from sector 8

Mbyte; on a 300-ft. tape, the same format stores 60 Mbytes for a typical data storage cost of $.58 per Mbyte. This capability is available now by reducing the base film thickness of the tape from 10 microns to 7 microns (the same thickness used in rotating digital audio tape). Then, if you reduce the coating thickness from 3 microns to 0.9 microns (already used on floppy diskettes), it makes room for as much as 400 ft. of tape in a standard 3.5-in. form factor cartridge—storing up to 80 Mbytes using the QIC-40 format.

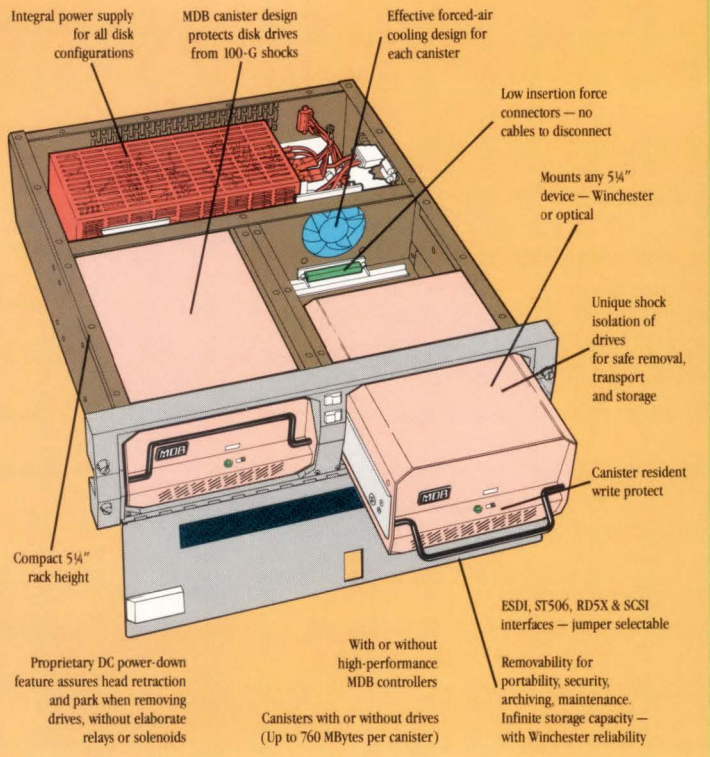
With so many options readily available for increasing data storage capacity in the 3.5-in. form factor, the question is not how, but when?

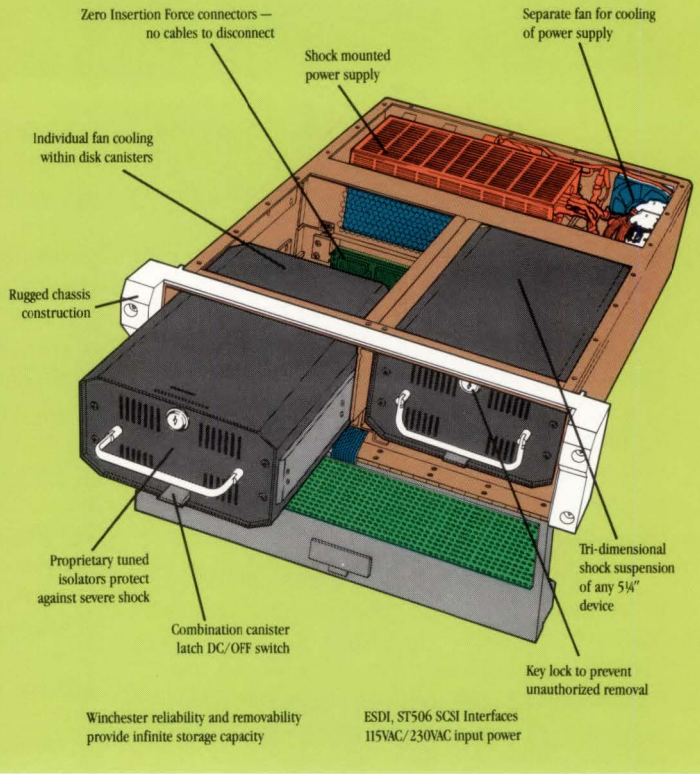
Table—Capacity Potential Using Alternative, Proven Technologies

	Current	Possible	Multiplier
5.25-in.			
Linear Density	10K bpi (GCR)	80K bpi (2,7)	8
Track Density	18 tracks	40 tracks	2.2
Tape Length (area)	600 ft.	1200 ft.	2
Total Multiplier			35.2
150 Mbytes (current capacity) x 35.2 (multiplier) = 5280 Mbytes (total potential capacity)			
3.5-in.			
Linear Density	10K bpi (GCR)	80K bpi (2,7)	8
Track Density	20 tracks	40 tracks	2
Tape Length (area)	200 ft.	300 ft.	1.5
Total Multiplier			25
40 Mbytes (current capacity) x 25 (multiplier) = 1000 Mbytes (total potential capacity)			

(Capacity = bpi x tpi x tape area)

Currently available technology should easily allow *5.25-in. QIC tape drives to store more than 5 Gbytes and 3.5-in. drives to reach 1 Gbyte.*





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The DATA SHUTTLE 2000 is the latest in MDB's family of removable-disk subsystems. Drawing upon real experience in airborne and shipboard ruggedized, militarized installations, MDB is able to offer proprietary shock protection in this affordable and functional package.

You'll get the new freedom of removability: large-capacity data portability, the ultimate in data security, easy software updating, file duplication backup, and maximum system up-time during disk replacement. It has a failure-proof power-down scheme that is automatically implemented when removing the canister.

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That's why MDB will warranty the disk drives for shock-related failures for one-year — even if the manufacturer doesn't! Available with or without controllers or drives so you can integrate your own disks.

The removable-drive subsystem for harsh environments not requiring the added cost of MIL-Spec.

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Rock solid dependability ideal for heavy industrial environments.

Designed for use in non-military environments, but where shock and vibration protection is a prime requirement, the DATA SHUTTLE 3000 offers many of the operational features of the Model 4000 for rock-solid rugged dependability.

For example, it utilizes the same shock and vibration protection canister with its built-in-fan as the MIL-Spec Model 4000, making it ideal for use in the heavy industrial machine factory environment where shock and/or vibration may pose problems. Zero Insertion Force connectors provide long life to an already reliable product.

The rugged chassis of the 3000 also includes a shock isolated commercial power supply, with commercial interface connectors and slides.

Put it all together and it's a cost-effective alternative to the full MIL-Spec DATA SHUTTLE 4000.

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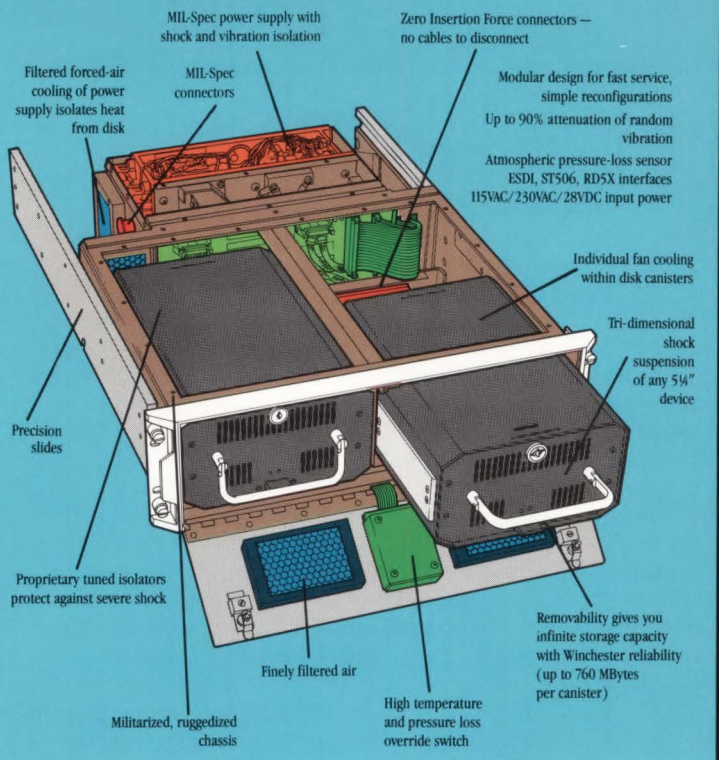

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It's put together with thoughtful engineering and proprietary concepts. Power is automatically disconnected from the drives when the canister is being removed. Zero Insertion Force connectors provide long life to an already reliable product. Individually cooled canisters protect drives against shock and vibration within the DATA SHUTTLE and during transport.

You can configure the DATA SHUTTLE 4000 to have one or two removable drives, or one removable and one shock protected fixed drive, such as a floppy diskette drive or cartridge tape drive. Available with or without controllers or drives.

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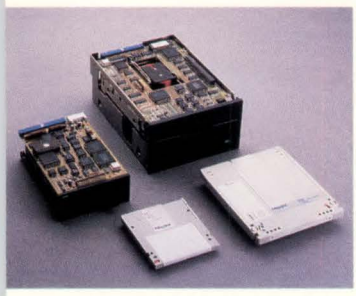
CIRCLE 384 ON READER CARD

GEORGE LANGWORTHY'S INSIGHTS TO OPTICAL STORAGE

TECHNOLOGY, PRODUCTS, AND THE VAST GULF BETWEEN



Available in both 5.25-in. and 3.5-in. models, *Maxtor chose tropical names for its erasable optical drives. The 1-Gbyte Tahiti and the 160-Mbyte Fiji both use Thermo-Magneto-Optic (TMO) technology.*

The long-awaited transformation of a new optical storage technology into real product may be at hand. But, as it evolves through its last formative months (or years), remember that the tentative product still will produce a great deal of hoopla, hyperbole, and outright misinformation.

The difficult thing about such evolution is that many hopeful candidates aren't up to the task of ever becoming products—often simply because too much is ascribed to the technology too soon. But the premature attention paid to a false start can turn to enthusiasm for a more realistic product. Once in a while, such timing even gives a technology a second chance.

Technological Karma

Three years ago, some would-be vendors, notably Sharp and Verbatim, introduced Thermo-Magneto-Optic (TMO) storage technology. Developed in part by Dr. Geoffrey Bate, TMO is interesting due to the combination of optical and magnetic technologies. A laser light heats the media, making the magnetic dipoles mobile and subject to reorientation in a strong magnetic bias field. The drives use media of either plastic or glass substrate developed by Philips and DuPont Optical Co. and Daicel. TMO sounded marvelous. The only thing missing was working product. And three years, the vendors discovered, was too long a time to maintain an OEM's interest.

Recent history has Tandy, known to many as Radio Shack, similarly tempting the fates with the announcement of a nonexistent writable (and presumably alterable) Compact Disk—Read-Only Memory (CD-ROM) player. Like TMO three years ago, this product is based on an, as yet, untested technology. The idea is that the drive creates a reflective bubble on the underside of the CD surface. The idea sounds promising, but Tandy officials readily admit that a real product lurks at least 18 months into the future. This "just kidding" announcement had repercussions. Exposed to the air of reality, the bubble didn't reflect—it burst. Tandy stock has suffered and interest in optical technologies forced through another artificial and premature peak.

Fortunately for the optical storage business, a contender emerged from the wings to take advantage of this renewed interest. Ironically, that timely contender is TMO technology. This time the vendor is Maxtor Corp (San Jose, CA). Already well known for high-performance and high-capacity 5.25-in. Winchester disk drives, Maxtor got its corporate feet wet in the optical arena with a dyed polymer, write-once drive (RT-800S) that Maxtor sells in concert with a subsidiary—Storage Dimensions—that provides the device-driver software.

Now, Maxtor has announced two erasable drives based on TMO technology, but is it real? According to the Vice President of Marketing, Skip Kilsdonk, Maxtor will have the new drives in full production by October.

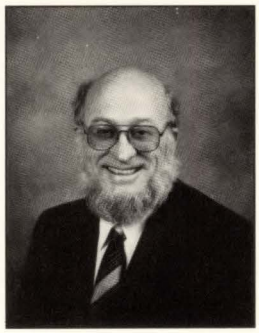
The new drives have two form factors: Tahiti I is a 5.25-in., 1-Gbyte drive with 30-msec average-access time; Fiji I is a 3.5-in., 160-Mbyte, 100-msec drive. Both use a Small Computer Systems Interface, thus easing integration tasks. Presumably, Storage Dimensions will provide the necessary software drivers.

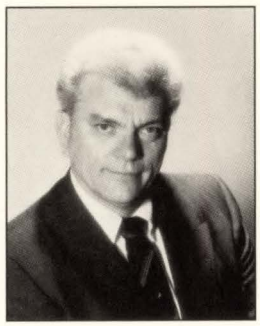
To achieve a capacity of 1 Gbyte, Maxtor uses a Zone-Bit Recording (ZBR) method similar to that used by Control Data in its Wren IV Winchester drive. ZBR apportions the media surface into recording zones to maintain a constant recording density as it moves from inner to outer tracks. As the read/write transducer moves to the outer edge, it adds an extra sector at each zone break. To ensure data interchange, Maxtor will also conform to the proposed X3B.11 cartridge standard that permits 300 Mbytes of data to be recorded per side. The 3.5-in. Fiji offers similar capability but at lower densities. This drive, to be created for Maxtor by Seiko-Epson, may prove to be an ideal disk for laptops and other portables.

The Tahiti drive, designed by Gordon Knight (the technology wizard behind the Optimum disk drive), is expected to cost approximately $2,500. The significant item to note regarding the Tahiti drive is its 30-msec average access time; until now optical drives have been much slower. The inherent weight of the read/write mechanism (diode, mirrors, and lenses) and the diode's strength have always limited the speed of the actuator. Maxtor is using a 30mW diode (as compared to conventional 20mW) and has mounted the diode and focusing units on a stationary platform. Only the mirror is mounted on the actuator.

At this time, Maxtor readily admits that the drives are still in the testing stage—the 3.5-in. Fiji, in particular, still needs some mechanical work. So, although you can expect to see some product shipped in the third quarter of '88, you might want to approach this technology carefully to avoid the three new-product demons: life cycle, reliability, and integration problems.

I. DAL ALLAN AND KEN HALLAM'S I/O UPDATE





AN EYE ON OPTICAL STANDARDS

The Compact Disc (CD) is a recent electronic marvel that's very popular with today's consumer. In fact, most of the people in the computer industry that I've spoken with own a CD player. I have one at home myself. They are small, easy to use, and not terribly expensive, yet the sound quality is excellent.

It didn't take long for someone familiar with computers to notice that the CD has a lot of information stored on it in digital form, which just might have a use in the computer field. Audio sound reproduction has traditionally used analog recording methods, which is one way to compact information, but isn't well matched to the computer industry. The player is a digital device already, so it shouldn't be too difficult to modify for computer applications.

When CDs were first employed as media in the music industry, several of the consumer electronics companies came to an agreement for recording standards. This made it easy to design machines that could play any disk conforming to the standard, and we didn't have competing recording formats. The leaders in this effort were N.V. Philips (a Dutch company) and Sony of Japan, although several other Japanese companies soon joined their efforts to create a de facto standard.

Partnerships between Dutch and Japanese merchants go back hundreds of years. Long before Commodore Matthew C. Perry sailed into Uraga Harbor on July 8, 1853, the Dutch had set up exclusive trading links with Japan. Perry, with four U.S. Navy vessels, ended the isolation of Japan enforced by the shogunate and ended the exclusive access enjoyed by the Dutch. However, the Dutch continued to have considerable influence in Japan because of their long association there.

Most readers might be surprised to find out a statue of a Westerner stands in front of the Osaka headquarters of Matsushita Electrical Industrial Co. The statue is a likeness of Anton Philips, the former President of N.V. Philips. It was placed there to honor the company that helped Matsushita emerge from the ruins of World War II.

The CD agreement was hammered out between Philips and Sony before any products had shipped and before any company had an installed base and a market to protect. This is in sharp contrast to what happened in the Videocassette Recorder (VCR) market. As you will remember, Philips had its own VCR format, V-2000, which it tried unsuccessfully to get the Japanese to adopt. The market success of the VHS format is well known, but less well known is the story behind it.

Japan Victor Corp. (JVC), a subsidiary of Matsushita, originally developed the VHS format. Rather than push a new product and proclaim it the "best" format for the consumer, the management at JVC opted for a quiet strategy. JVC contacted many other firms in Japan and asked for support of the VHS format and gave assistance to those firms interested in designing similar machines. This was a most unusual procedure in the hotly competitive consumer electronics market. It wasn't an instant success either, but JVC management stuck with it, and the results began to show. A technically superior product, the Betamax soon began to suffer in sales against the family of VHS products that are available from a wide variety of manufacturers. Philips, in spite of its long association with Matsushita, declined to embrace the VHS format and insisted on doing it "its own way." Philips, never strong in U.S. consumer electronics, had no chance with the V-2000 format in the U.S. market.

The experience with the VCR market led both Philips and Sony to realize that they could not establish a new consumer media standard on the basis of their name alone, nor simply through a product's technical superiority. Philips also learned that all partners in a joint effort must contribute to the result.

The V-2000 recorder/player was paraded before several Japanese companies as a finished product; all they had to do was sign the license agreement. This approach met with little enthusiasm in Japan, and Philips went home empty-handed. After this lesson was absorbed, a new approach was taken for the CD. Philips brought a series of drawings and concepts to Japan, then asked for suggestions. Sony saw the merit in the product and agreed to work with Philips to set the final specifications.

They jointly worked out a format for recording music and the meaning of various codes and subcarriers. These are all detailed in the "Red Book," a modest-sized volume available only from Philips. To get a copy, you must sign a license agreement and pay a fee to Philips.

Subsequently, another volume was put together to describe the methods by which computer information should be recorded on a CD, which is then referred to as CD Read Only

Memory (CD-ROM). This volume is known as the "Yellow Book," and, as before, may be obtained from Philips after signing a license agreement and paying a fee.

A third volume, the "Green Book," details the format for CD-Interactive (CD-I). CD-I is a mix of audio, computer, and video data on the same disk. The goal is for it to become a new form of entertainment media and a training aid for companies. The usual restrictions apply to the availability of this book.

If the Yellow Book describes the format for CD-ROM, we have a standard, and, therefore, a way for everyone to read a CD-ROM, right? Wrong. Computer people have faced this problem ever since the days of punched cards and paper tape. Removable media often moves from one system to another, and then the fun begins. Ever try to read a floppy disk on an IBM PC (or compatible) that was written by a Macintosh? How about vice versa? I've tried it on my Macintosh and I get the Mr. Yuk symbol on the screen. Nothing's wrong with the media or the format—it's just not the logical format the system was looking for and, therefore, the system is unable to read it.

What is the logical format? Logical format usually refers to the sector numbering, the location of the volume label, the directory format and location, and the defect management scheme. All of this depends on the operating system that will use it, not on the modulation code used in recording, the frequency of recording, and other items that are part of the physical format. The CD-ROM format, as specified in the Green Book, is of the physical type and does not resemble any other computer media format so you can't just treat it as a floppy or Winchester.

So it seems we need a logical format. The folks who want to use CD-ROM are, for the most part, book and catalog publishers. This explains the interest of the National Information Standards Organization (NISO), in the CD-ROM format. NISO is organized under ANSI as technical committee Z39, which has been assigned the task of codifying standards for libraries and the publishing industry. As with most ANSI technical committees, Z39 didn't attempt to create a new standard, but started with a working document from an outside source—in this case, a small informal club known as the High Sierra Group.

When creating this document, the High Sierra Group attempted to incorporate, into one standard, the ability to interchange prerecorded optical media between the two main types of micro processors in use today: Motorola and Intel. The degree of success they achieved remains to be seen. Some have argued that the majority of applications for CD-ROM are custom, turnkey, niche markets that do not require multisystem interchange. A truly universal application is yet to be found. Most of the publishing applications that make sense are catalogs. How many books do you want to read on a boob tube?

In any event, the work on the CD-ROM standard has been questioned since it requires the Yellow Book be used as a base reference. ANSI rules normally require that a proposed standard and any reference standard be in the public domain. This is because the standards are voluntary and should protect against anyone being singled out for favoritism or discrimination by a standard.

Rumor has it that Philips is about to make the Yellow Book public and ease the license restrictions, so this particular problem may go away.

The only other removable media standard in general use today is for the nine-track tape, ANSI Standard X3.27-1978. This is a logical format standard, and companies wishing to exchange large blocks of information use it often. In fact, if you have a database you would like recorded onto a CD-ROM, the first step usually is to get it recorded onto nine-track tape. Semiconductor firms that want to exchange design or mask information use standard nine-track tapes. So it follows that a new information interchange standard, with the potential to replace nine-track tape in some applications, is a serious undertaking with the potential to affect a large part of our industry.

While CD-ROM activity is approaching the standardization problem from the perspective of the publishing industry, the work being done by ASC X3B11 on 5.25- and 3.5-in. media is from the perspective of the computer industry. A small group within X3B11 is also working on a logical standard for optical media. This standard document attempts to describe file labels and structures and is loosely based on the nine-track tape standard. It's in its fourth draft and is known as document number X3B11-1986-152. This document is intended for use on optical media, regardless of diameter or recording method.

While the librarians are debating the merits of CD-ROM, the computer jocks at X3B11 are working on the media that *may* someday rival Winchester storage for speed and be a large improvement in cost. The X3B11 technical committee has already drafted one WORM standard for 5.25-in. disks (and has two more coming) and is working toward a media standard for 3.5-in. optical media.

My next column will be an update on X3B11 activity.

This month's column was written by optical recording specialist Ken Hallam. Write to Ken at 29112 Country Hills Rd., San Juan Capistrano, CA 92675.

Reader Interest Level

High	**Circle No. 253**
Medium	**Circle No. 255**
Low	**Circle No. 257**

VAX/VMS TOOLBOX *by Steve Davis and Matthew Owen*

As a text-processing language, TPU can be used to write programs for wholesale text and file manipulation

In the past several issues we've had a chance to explore some of the complexities and features of DCL. We aren't through with DCL, but several of our readers have requested more information on the Text Processing Utility, TPU.

TPU is a programmable text processing utility that is included with your VMS system. Using TPU, programmers can create text editors suited to specific, individual needs. TPU provides a migration path for veteran programmers by emulating their favorite editors and offering the prospect of customization including enhancements such as multiple windows and spawned subprocesses that may be incorporated.

But TPU is more than a means to creating an editor. As a text processing language, TPU can be used to write programs for wholesale text and file manipulation. This month's Toolbox describes one such program.

When we write the VAX/VMS Toolbox for *Hardcopy* each month, we have to know its length. WORDS.TPU tells us just that by counting the words in an ASCII text file.

WORDS.TPU consists of three "user-defined" procedures—procedures made up of "built-in" TPU procedures (referred to here as built-ins) and lexicals. User-defined procedures begin with the PROCEDURE statement and end with the ENDPROCEDURE statement.

The first user-defined procedure, TPU$INIT_PROCEDURE, is required. When TPU begins execution, this procedure is invoked, and the procedure passes control to the user-defined procedure, EXE. When control is returned from EXE, the built-in QUIT exits the procedure without writing an output file.

The EXE procedure is the next part of WORDS.TPU. The ON_ERROR/-ENDON_ERROR construct contains statements that will be executed in the event of an error. Our ON_ERROR construct returns control to the calling procedure, TPU$INIT_PROCEDURE.

After ENDON_ERROR, a built-in GET_INFO is used to return information about the editing session. When invoked with COMMAND_LINE as the first parameter and file_name as the second parameter, the filename on the command line is returned to the variable search_file. For example, if the command "$ WORDS TOOLBOX.TXT" were entered, search_file would become "TOOLBOX.TXT".

The next line uses the built-in FILE_PARSE to return the expanded

continued on sector 85

```
PROCEDURE TPU$INIT_PROCEDURE

   EXE;
   QUIT

ENDPROCEDURE;

PROCEDURE EXE

   ON_ERROR
      RETURN;
   ENDON_ERROR

   search_file := GET_INFO ( COMMAND_LINE , 'file_name' );
   search_print := FILE_PARSE( search_file );
   main_buffer := CREATE_BUFFER( 'main' );
   SET( NO_WRITE, main_buffer, ON );
   MESSAGE( FAO( "Working on !AS", search_print ) );
   message_buffer := CREATE_BUFFER( 'message' );

   LOOP
      input_file := FILE_SEARCH( search_file );
      EXITIF input_file = '';
      ERASE( main_buffer );
      POSITION( BEGINNING_OF( main_buffer ) );
      words_file := READ_FILE( input_file );
      POSITION( BEGINNING_OF( main_buffer ) );
      COUNT_FILE;
   ENDLOOP;

ENDPROCEDURE;

PROCEDURE COUNT_FILE

   ON_ERROR
      DELETE( message_buffer );
      MESSAGE ( FAO( "!AS has !UL word!%S.', WORDS_FILE, WORD_COUNT ) );
      message_buffer := CREATE_BUFFER( 'message' );
      RETURN;
   ENDON_ERROR

      word_count := 0;
      temp_range := 0;
      word_pattern := SPAN( "ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-$.'_/" );

   LOOP
      temp_range := SEARCH( word_pattern, FORWARD );
      word_count := word_count + 1;
      POSITION( END_OF( temp_range ) );
      MOVE_HORIZONTAL( 1 );
   ENDLOOP;

ENDPROCEDURE;

SAVE( "SYS$COMMON:[SYSLIB]WORDS.TPU$SECTION ");
QUIT
```

HOW TO SERIES

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CIRCLE 431 ON READER CARD

continued from sector 83

file specification for the file referenced by search_file. The resulting variable, search_print, is created for display to the user. CREATE_BUFFER is used to initialize an editing buffer designated "main" and referred to by the variable main_buffer. Buffers are the areas where text may be manipulated.

Then, the built-in SET, used with the keyword NO^WRITE and the parameter main_buffer, indicates that the editing buffer "main" is not to be written out (to a disk file) even if the contents are modified. The built-in MESSAGE normally inserts characters into a buffer referred to by the variable MESSAGE_BUFFER. When no buffer variable of that name exists, TPU displays the message on the terminal. Next, CREATE_BUFFER is invoked to establish the variable MESSAGE_BUFFER. This ensures that any additional messages will be inserted into the buffer named "message". This is done to prevent TPU-generated messages from cluttering up the user interface.

Now a LOOP is entered to process all files that match the file specification. On the next line, the built-in FILE_SEARCH is used to locate the next file matching the specification search_file. After returning all matching files, input_file will become null, causing EXITIF to jump out of the LOOP. ERASE clears the buffer of any previous file. Since ERASE doesn't reset the character position within the buffer, the built-in POSITION is used to move the pointer to the top of main_buffer. The BEGINNING_OF built-in returns the starting character position for the specified buffer.

Next, the built-in read_file is used to store the input_file in the current buffer (main). POSITION is again used to move the pointer to the beginning of the buffer and the procedure COUNT_FILE is called.

Next is the user-defined procedure, COUNT_FILE. COUNT_FILE is called by EXE and begins with its own ON_ERROR/ENDON_ERROR construct. In this case, any error is assumed to indicate that the count of words should be reported.

The first statement to be executed under an error condition is the built-in DELETE. When the buffer name message_buffer is passed to DELETE, that buffer is removed. This is done so that the display from the subsequent use of MESSAGE will be directed to the terminal rather than to the message_buffer. The display is constructed using the Formatted ASCII Output (FAO) lexical. Those who have followed VAX/VMS Toolbox will remember using this system service in the form of the DCL lexical function F$FAO.

FAO formats the variables words_file and word_count using the formatting directives !AS, !UL, and !%S. The directive !AS is replaced with the string associated with words_file. Next, the word "has" is concatenated to the string. !UL converts the integer word_count to a suitable numeric string. Next, "word" is added to the string. !%S adds the letter "s," making "word" into "words" if the last number referenced (in this case, word_count) has a value other than one.

The next line uses CREATE_BUFFER to recreate the message buffer referred to by message_buffer. Again, this is done to avoid having TPU-generated messages appear on the user's terminal.

The next lines of the COUNT_FILE procedure initialize the variables word_count and temp_range to zero. The subsequent line uses the built-in SPAN to create a pattern that will match the longest string of characters containing the characters specified. This pattern is referred to by the variable word_pattern. Any search using word_pattern will continue to match until a character not contained within the pattern is encountered. For example, if the pattern were "DOG", then the following strings would match: "DOG", "GOD", "DGO", "GDO", "OGD", "ODG", "DDD", "GGD", along with the rest of the permutations of the letters "D", "O", and "G".

In this case, the pattern is A to Z, 0 to 9, and several special characters. Since TPU doesn't differentiate between upper and lower case, the pattern will match lower case characters also. All characters not in this pattern are considered word delimiters. Of course, additional special characters could be added to prevent them from being considered word delimiters.

The LOOP/END_LOOP block beginning on the next line causes the statements contained within to be executed repeatedly until an EXITIF condition is met or an execution error (such as end of buffer) is encountered. The first statement in the LOOP uses the built-in SEARCH to locate the next "word" in the buffer. The location of this "word" is referenced by the variable temp_range.

The next line bumps the variable word_count by one. Subsequently, the built-in POSITION is invoked to reset the next search to begin at the end of the current word, which is referred to by END_OF(temp_range). Since this statement places the character position at the last character of the word found, MOVE_HORIZONTAL(1) must be used to move to the first character beyond the match. If this was not done, SEARCH would continue to match that single character. For example, if the word matched were "monkey", the POSITION invocation would leave us pointing at the "y". The repeated execution of SEARCH would continue to match "y" as the word indefinitely.

This LOOP continues until an attempt is made to move or search beyond the end of the buffer. At that point, the error procedure is invoked and control is returned to procedure EXE.

Statements following these procedures will be executed when WORDS.TPU is read as a command file (rather than a section file). The built-in SAVE is used to create a TPU section file containing the binary form of the above procedures that later will be invoked as a section file.

To compile WORDS.TPU into this section file, enter the following command at the DCL ($) prompt:

```
"EDIT/TPU/NOSECTION/
COMMAND=WORDS.TPU".
```

TPU will read in WORDS.TPU and compile the procedures. When the SAVE statement is encountered, these compiled procedures will be written to the specified output file.

By entering the following line into SYS$MANAGER:SYLOGIN.COM:

```
"WORDS:==EDIT/TPU/
NODISPLAY/
SECTION=SYS$LIBRARY:WORD
S.TPU$SECTION"
```

you can type "WORDS," a space, and the filespec at the DCL ($) prompt to get a count of the words in that file. For example:

```
"WORDS TOOLBOX.TXT"
```

When this command is entered, TPU will read-in the section file, look for the procedure TPU$INIT_PROCEDURE, and begin execution.

We hope you'll enjoy tinkering with WORDS.TPU. Thanks to those of you who've written with suggestions for improvement of the VAX/VMS Toolbox. We're pleased with the volume of response. Please continue to provide us with feedback; it's important to the ongoing usefulness of this column. ■

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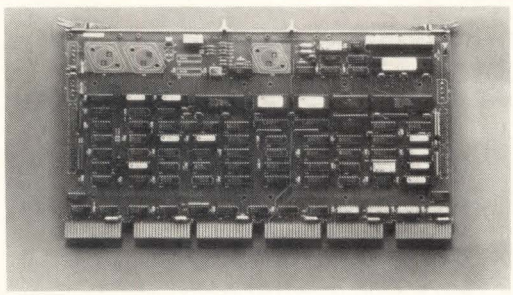

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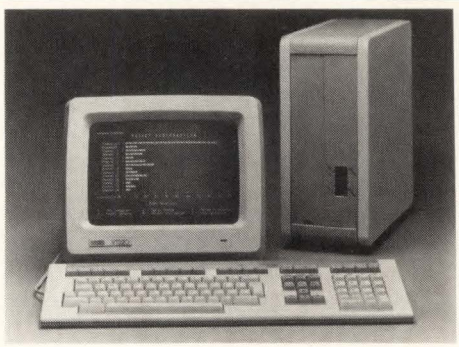

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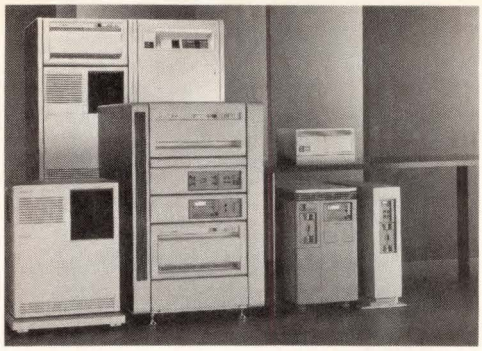

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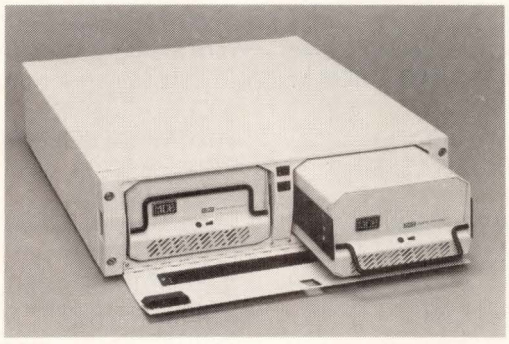

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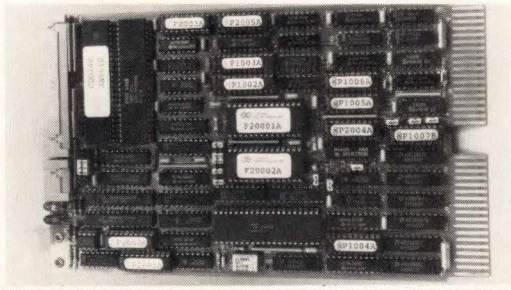

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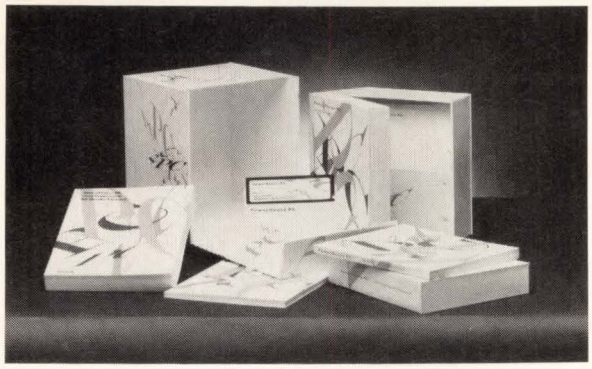

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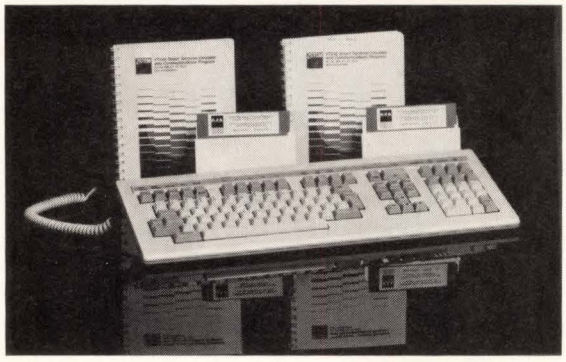

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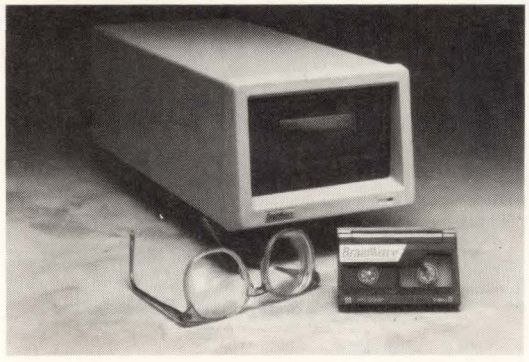

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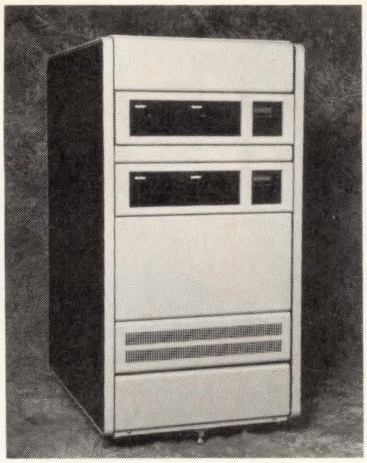

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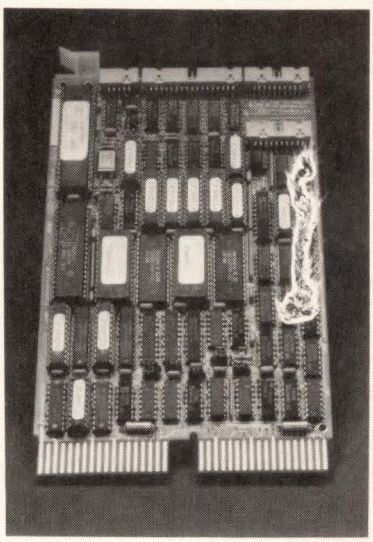

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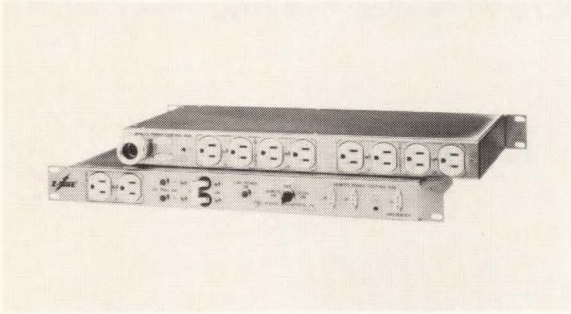

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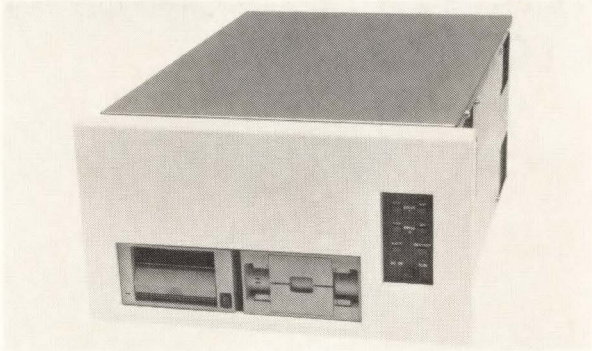

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Sigma Information Systems' SA-H160 10.5" rackmount systems enclosure provides mounting for four 5-1/4" dirves, incorporates a 14-slot backplane with 0.6" center slots, includes a 700 watt power supply with 90 amps of +5VDC, and a rear panel with flexible configurations for "A", "B", and "C" I/O panels.

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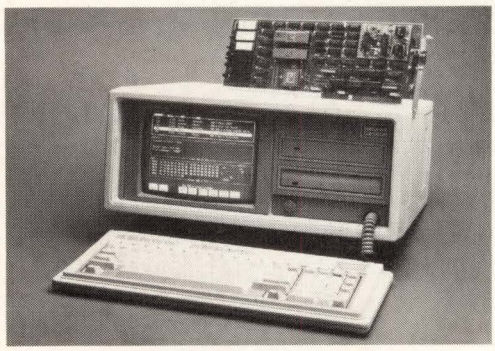
CIRCLE 488 ON READER CARD



THE SNIFFER is a family of portable test instruments used to tune LANs for peak performance and to troubleshoot LAN problems. By recognizing, interpreting and translating all seven levels of protocol information into normal English, The Sniffer reveals many previously undetectable problems. The DECnet protocol suite includes interpretation for MOP, DRP, SCP, NSP, DAP, NICE, SMB and even LAT.

NETWORK GENERAL
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The ANC-30F Fiber Optic Ethernet Transceiver (FODMAU) supports the industry standard (SMA) multimode fiber types including: 50/125, 62.5/125, 85/125 and 100/140 fiber. The ANC-30F AUI/Ethernet interface is used to connect directly to an AUI interface of an Ethernet host, a Fiber Optic Active Star Concentrator or a Local Repeater. Two ANC-30F's will provide a 1Km Fiber Optic interlink for Ethernet Local Repeaters. The ANC-30F provides a 10Mbps CSMA/CD 2Km fiber optic link between two Ethernet devices for a direct connection configuration. The ANC-30F AUI Interface is compliant with the Ethernet V2/IEEE 802.3 standard. It allows widely dispersed Ethernet computer hosts from different manufacturers to easily connect onto the Ethernet backbone network. The ANC-30F lists at $550 and is available for immediate delivery.

American Network Connections - 408-737-1511

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HARDCOPY PUTS IBM'S SAA IN PERSPECTIVE

IN OUR APRIL ISSUE, COMMUNICATIONS EDITOR ROBERT PAP INTRODUCED IBM'S SYSTEMS APPLICATION ARCHITECTURE, WHICH IS PURPORTED TO BE THE ANSWER TO INTRA- AND INTER-SYSTEMS AND APPLICATIONS COMMUNICATION; BUT IS IT? WE ASKED OUR MOST SENIOR DEC EXPERT, ROBERT GEZELTER, TO GIVE US HIS ANALYSIS AND COMPARE SAA WITH THE DEC APPROACH

BY ROBERT GEZELTER, RSX Columnist

IBM's Systems Application Architecture (SAA), is a master plan for a common set of applications-level interfaces (see "IBM's SAA: Commonality at the System and Application Level," *Hardcopy,* page 22, April 1988) implemented across the major members of IBM's system product lines. The goal of SAA is to ensure portability of applications from one member of the IBM product line to another with no changes. Thus, applications operating in a mainframe environment have some commonality with those of a personal computer.

With this in mind, you have to ask: "Does Digital Equipment Corp. need to follow in IBM's footsteps and support SAA?"

The answer lies in the approaches taken by both companies.

Since the mid-1960s, IBM has developed several incompatible product lines. Initially, the conflict was between IBM's mainframes and its small business computers (the System/3, System/36, etc.). Because these incompatible systems are typically sold into different, nonoverlapping markets by separate divisions of IBM, there is little conflict, and apparently little concern over incompatibilities.

The introduction of the IBM PC, in 1981, however, added yet another incompatible system to IBM's growing morass of differing products. Moreover, the PC, unlike the business systems, created a major incompatibility conflict rather than acting as a much-needed bridge.

Networking a Common Link

Although IBM has indeed laid the groundwork for a serious standard in the form of the Systems Network Architecture (SNA) for mainframe-to-mainframe communications, lesser machines are relegated to restricted supporting roles. This problem is eliminated by LU 6.2 Peer-to-Peer protocol support in more recent versions of SNA).

Even with the broadening of the overall communication environment, command languages are, for the most part, specific to each system. Consequently, even within IBM mainframes, several completely incompatible command languages exist.

Offering even more frustration is the inconsistency in IBM's approach to communication products that support a wide range of terminals. This has given rise to several forms of protocol conversion and added to the complexity of the system.

Of course, SAA purports to cut through this jungle of tangled protocols and command languages.

No Moss Growing

What was DEC doing while IBM was building these incompatible sys-

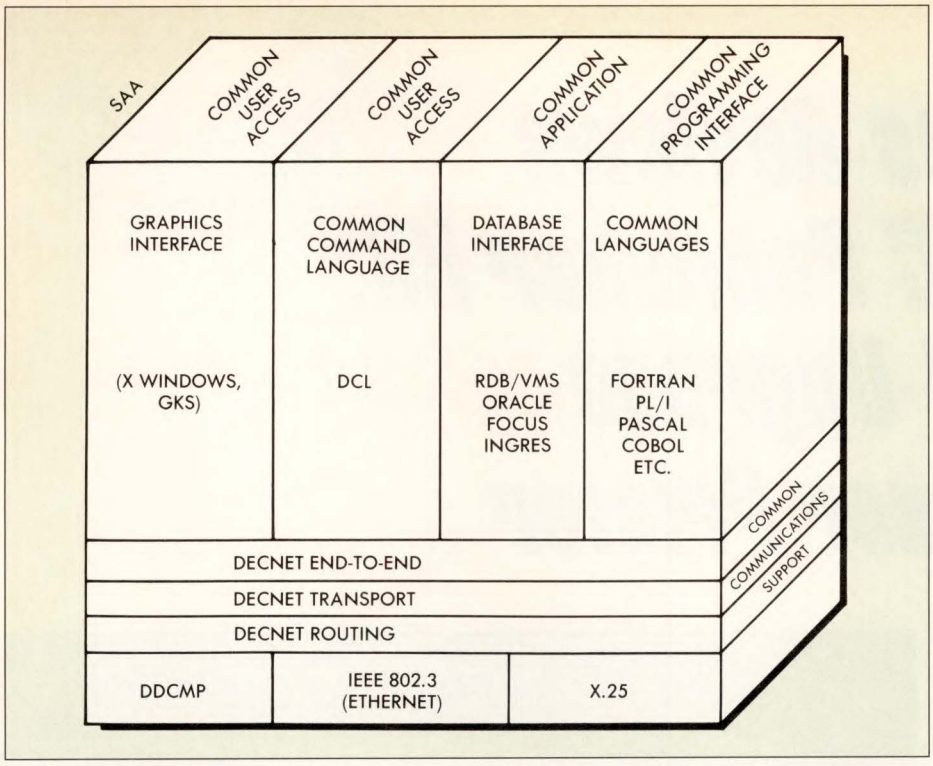


Figure 1—There is *indeed some commonality between IBM's SAA and DEC system architecture. Notice DEC has already developed and implemented full communication and application support. IBM is still at the description phase and has yet to produce working releasable software.*

tems? It hasn't been letting any moss grow on its systems. Rather, DEC has preceded IBM by 13 years in developing a common approach to linking systems and applications (Figure 1).

Developed in 1975, the Digital Network Architecture (DNA) defines how different systems interact to provide intersystem facilities, including task-to-task communications, remote data accesses, and remote terminal connections (Figure 2). Unlike IBM's SNA, DNA is based on a presumption of equality, thus all communications within a network specified by DNA are on a peer-to-peer basis.

To ensure commonality of use, all DECnet products adhere to the rules laid down by DNA. As a result, all implementations of DECnet provide for communications between processes executing on different systems with different architectures.

Similarly, DEC has common specifications for the development of languages on DEC systems. Thus, VAX FORTRAN and PDP-11 FORTRAN are compatible and interchangeable. Moreover, the Digital Command Language (DCL) is a common command language for all DEC systems. In addition, all DEC-implemented languages on the VAX conform to the VAX-11 Procedure Calling Standard. Adherence to this standard permits modules written in different languages to communicate without difficulty. These standard approaches equate with the common programming interface and common user access found in SAA.

Because DEC does have a communication orientation, ensuring a uniform access to data across local- and wide-area networks is paramount.

Network database functions range from the Datatrieve package to more sophisticated Structured Query Languages and relational products such as RDB (Digital Equipment Corp., Nashua, NH), Ingres (Relational Technology, Alameda, CA), Oracle (Oracle Corp., Belmont, CA), and Focus (Information Builders Inc., New York, NY).

Rounding out the commonality of structure approach is the support of X Windows. This user-viewed front end is the common access block of SAA. DEC also supports the Graphical Kernel Standard (GKS), which provides the necessary underpinnings for linking graphics-based applications to the system and user-viewed devices.

No Need for SAA

It appears that DEC doesn't need SAA to achieve application portability between the different members of its product line. This compatibility already exists.

But DEC-to-DEC commonality is no longer the issue. There is clearly a need to have system-to-system intra- and inter-communication at all levels. And DEC is acutely aware of this need. Whether IBM's or DEC's approach will be wholly embraced by the industry is unclear. DEC has created the beginnings of a firm foundation for mixed-vendor connectivity as evidenced by the Apple-to-DEC connection, and, unlike IBM, has demonstrable solutions. Maybe being number two has some advantages.

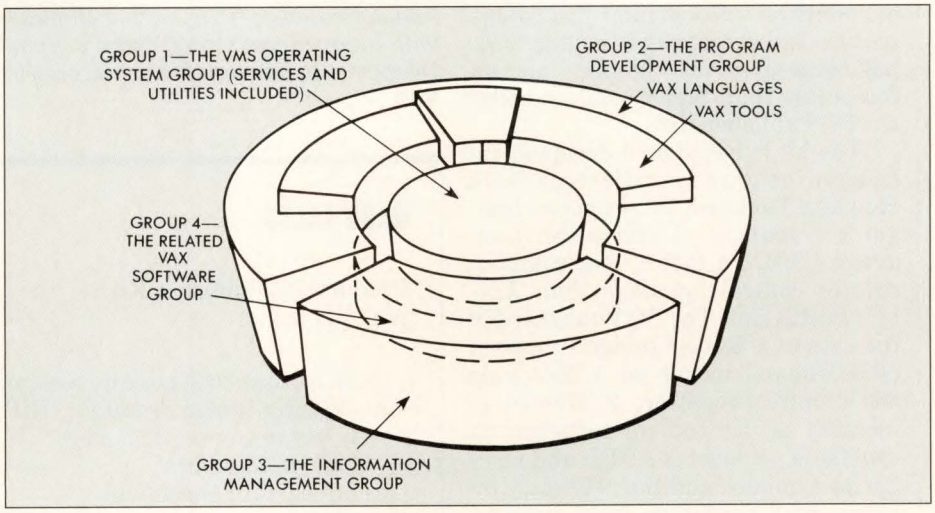


Figure 2—VAX/VMS provides *a much richer set of products and functionality than described by IBM's Systems Application Architecture (SAA) on systems ranging from personal workstations (MicroVAX 2000s) to corporate data centers.*

HC/WG Labs Reviews Imagen's PC Publisher Kit: A Powerful Upgrade for Your Laser Printer

by the HC/WG Laboratory Staff

Surveys indicate that the marketplace has absorbed more than 3 million laser printer engines in the past couple of years, and the trend is expected to continue. But the newest printers offer more capability than did their earlier cousins.

Specifically, the latest laser printer engines (see "Inside and Out Newest Laser Printers Sport More for Less," *Hardcopy,* page 19, January 1988) offer fast printing speeds, large memory buffers for graphics, and a multitude of fonts. The goal, of course, is to provide desktop output for emerging desktop publishing programs and business graphics.

However, laser printer technology doesn't come cheap. And you probably aren't that anxious to spend additional dollars on a new printer just to support the latest software. Imagen Corp. has recognized this dilemma and offers a less-than-$2,000 solution called the PC Publisher Kit.

The kit is based on a development Imagen originally undertook with Hewlett-Packard to promote Imagen's Document Description Language (DDL), a faster, less complex, printer control language than Adobe's PostScript. The PC Publisher Kit consists of a Raster Image Processor (RIP) board based on a Motorola 68000 microprocessor, 2 Mbytes of memory device control software, 22 typefaces, support for DDL and PostScript symbols, and the necessary interconnect cables to your printer. Imagen makes two versions for either the CX (LaserJet I and Plus) or the SX

PC Publisher for the Hewlett-Packard LaserJet Plus comes *with a 68000-based, Raster Image Processor (RIP) with 2 Mbytes of memory, a new back panel for the printer with interconnect socket, and a 22-font library of typefaces. You aren't limited to Imagen-supplied typefaces, however, but can add on Adobe and BitStream faces as well.*

HARD FACTS:

Product: PC Publisher Kit
Price: $1,895

- Motorola 68000 microprocessor-based Raster Image Processor (RIP)
- 2-Mbyte on-board memory
- 22 font typefaces
- Support for Document Description Language (DDL) and Adobe PostScript
- Emulations: Diablo 630, Epson MX and FX series, IBM graphics printer, Hewlett-Packard Series LaserJet and Canon-engine-based machines, NEC 35500/5510/7710, Qume Sprint series, and standard line printer output.

Imagen Corp.
2650 San Tomas Expwy.
Santa Clara, CA 95052-8101
408-986-9400
Circle No. 103

(LaserJet II) engine. The former is the one we used at the labs.

Supercharging the LaserJet

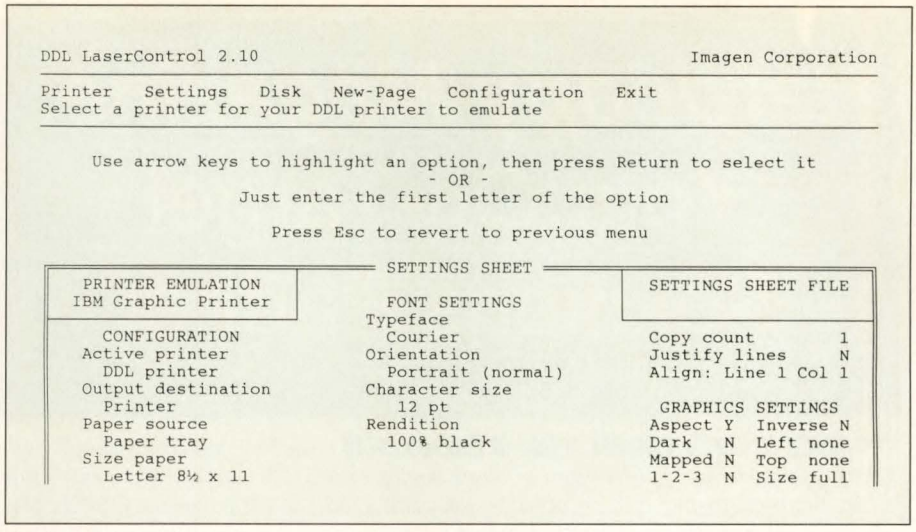
Adding PC Publisher is surprisingly simple, but we don't recommend you undertake it unless you possess some technical skills. It is necessary that you remove the top of your laser printer. Imagen's directions are explicit and need to be followed to the T. Basically, on the LaserJet Plus, you are going to disconnect all the internal controls and reroute the engine interface cable to a new connector that is mounted on a new, Imagen-supplied back panel for the printer.

Next, you mount the RIP inside your PC. We recommend an AT, and preferably a 386-based AT, especially if you're planning on doing desktop publishing.

The next step is to load the driving software. Imagen is now shipping V. 2 of the software that adds PostScript capability. Again, this is a simple step and involves following the installation procedures defined by Imagen. Basically, it is automatic and doesn't require any special intervention on your part. Imagen does supply a variety of fonts and output tools that are discussed later. The bottom line is getting the basic system up and running in a matter of about an hour's work.

Be aware that there are advantages and disadvantages to upgrading your LaserJet. First, you will lose PCL compatibility. PCL is the printer control language defined by HP. It makes generous use of escape sequences to control the printer's Canon print engine. Consequently, various tools we had created to draw lines, graphs, etc., wouldn't work with the PC Publisher. Imagen justifies this by noting that the idea is to get publisher pages out—not just words. At first we weren't convinced this was a justifiable argument. Of course, we were using V. 1 of the software and did encounter shortcomings. Upgrading to V. 2, however, convinced us that it was worth it to have the added capability of PostScript and scalable fonts.

Besides PCL, you also lose the front panel indicators on your laser printer; the entire electronics package is disconnected. We found this to be disconcerting—and still do. The PC Publisher software does provide a rich set of messages to indicate such things as paper out, improper paper size, or engine trouble. It's a matter of reorienting yourself from blinking lights and numbers (the HP display) to on-screen messages.



The LaserControl program, *developed by Insight Development Corp. in concert with Imagen Corp., allows you to configure the engine to support a variety of printer attributes (this artwork was the result of a screen dump created by configuring the printer for IBM graphics emulation), paper sizes up to B5, and destination. You can establish a variety of setups to be invoked when a special print job is needed.*

Software Fuels the Engine

The fuel for PC Publisher is the software developed by Imagen in concert with Insight Development Corp.

Insight's Laser Control program provides a shell that intercepts output from your PC and redirects it to the RIP controlling the printer. The advantage of this is that you don't have to try to make impossible patches to existing software from LPT1: or COM1:. However, it does use memory and will interfere with other drivers. At first we thought the problem was that the drivers for the RIP were load-list position sensitive. Indeed they aren't; and they only take up a small portion of the transient load area used by the initial boot of DOS. The LCSHELL that redirects output does demand larger amounts of memory and interferes with such programs as facsimile drivers. This problem is alleviated with a 386 machine that properly addresses large amounts of memory.

Although the goal is to provide a powerful engine to support desktop and graphics output, the Imagen/Insight software provides utilities to print directly from the command line. For example, DDLPRINT and a filename will print a file to the DDL printer, and PSPRINT performs the same task for a PostScript printer. You get to decide exactly what the printer is in your AUTOEXEC.BAT file:

```
Path =
C:\Util\Bat;C:\DOS.331;C:\pk
dPath = C:\WS;C:\Comm;c:\pk;
FastOpen C:=100
CED
MSMOUSE /1
SET FAXPGM=C:\FAX\FAX
C:\FAX\
RSched -DC:\FAXQUEUE\ -I(714)-
632-7540
PROMPT = $P$G
graphics
cd c:\pk
pkload -p -w c:\pk
cd c:\
Ver
```

This example shows a search path that finds the Imagen software in subdirectory PK, and loads it as a PostScript printer driver:
PKLOAD -p -w C:\PK—the -p denotes PostScript; a -d would indicate DDL.

Although we are fond of DDL and believe it to be a far more capable language than PostScript as far as speed and functionality are concerned, the industry has settled on the latter. Thus, we found that it's best to set the printer up as a PostScript device.

The advantages are that you get the full functionality of PostScript including rotations. Additionally, all the Adobe and BitStream fonts now work in the environment. Thus, with Ventura, and presumably Aldus PageMaker for the PC, you can have a richer set of fonts available. Additionally, you can create PostScript-compatible files that most service bureaus use for typeset-quality output. The

Hardcopy Magazine: Your On-Target Solutions Partner

The ability to handle complex output is demonstrated *with PC Publisher's ability to print reversed type (white type on black background). The engine recognizes that white denotes no dots and creates the necessary outline—a powerful feature for use with desktop publishing applications.*

output you get on your printer is essentially one-to-one with the final typeset—only the dot density varies from about 400 dpi on the laser printer to 1250–2000 dpi on the Linotype.

Speed Upgrade

One of the characteristics of the PC Publisher Kit that makes it a compelling upgrade is that it enhances the output speed of the LaserJet. An 8.5- x 11-in. Ventura page with a simple line graphic takes about 3.5–5 minutes to output. More complex pages can take as long as 12 minutes. The Publisher uses a 2-Mbyte memory to store the image (300-dpi resolution), and then outputs the data stream to the printer. All the necessary formatting and bit/byte characteristics are set up in memory, thus enabling the print engine to operate at its maximum speed.

Canon specs the CX series of engines at 8 pages per minute (ppm) but it does have an operating efficiency of about 12 ppm. With PC Publisher in place, all data streams (ASCII or graphics) are treated the same, so an ASCII A is treated the same as a complex graphic block. This means that there is some setup time and printing isn't instantaneous. What you do get is greater clarity.

Another factor we liked was the ability to have reverse type. PC Publisher recognizes that white type against a black background is the absence of toner in certain print zones—something you can't do with PCL or V. 1.0 of the PC Publisher print package.

Moreover, shading gradations that you would expect with color are possible with variances of the gray output. Thus, reasonably good art pieces can be output either as art pick-ups in Ventura or as standalone artwork.

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So You Want a Graphics Workstation Too!?

Everybody's an artist these days! Image processing workstations are a logical extension of the trend toward dedicated—but networkable—powerful—but affordable—graphics workstations. Perceptics Corp.'s NuVision workstation is designed to fit this "in-between" market niche—more processing power than the IBM PC board set can provide but at a considerable cost savings compared to the usual minicomputer-based system.

Although Clyde Spencer, graphics and imaging analyst at Dataquest Inc. (Cupertino, CA), views the market for high-end workstations as "stagnating," he does see a burgeoning market for innovative approaches such as that offered by Perceptics—due primarily to the Macintosh-based NuBus host and the ease of use resulting from the icon-based user interface.

The NuVision Imaging Workstation (as shown—NuVision chassis plus Macintosh plus monitor) lists *for approximately $26,000. Perceptics' NuVision may be purchased sans Mac if you already own a Mac II.*

Workstation Architecture

Perceptics' NuVision workstation affords you the power of real-time image processing and the friendliness of the Apple Macintosh II. The key feature of the imaging processor lies in the use of Perceptics' Smart Memories. Each memory module contains a dedicated TI TMS320C25 Digital Signal Processor (DSP) on board with the frame buffer. Thus, every time you expand the memory, you increase your processing power.

The DSP has direct, uncontested access to 2 Mbytes of image memory and, by running the DSPs concurrently (in parallel), a full-color RGB—or even a four-plane CMYK (printer's lingo for cyan/magenta/yellow/black)—image can be processed in the same time as a monochrome image.

The architecture of the NuVision workstation incorporates decoupled timing—the acquisition (digitization), display, and processing sections are completely independent, timing-wise. This permits faster-than-frame-rate processing in the Smart Memory while digitizing an RS-170 video signal or displaying a non-interlaced 66-Hz color image on the monitor. Timing decoupling is accomplished by having separate frame buffers for each acquisition and display on the Visual Interface (VI) module. The VI module is supplied with more than 5 Mbytes of integral frame buffer.

Video Interface

NuVision's video interface provides high-resolution image acquisition and display. Standard video input digitizes three channels of RS-170/330 512 x 480 monochrome image with options available for grabbing RGB full-color, stereo pair, or RS-343 1024 x 1024 images.

Standard video output displays are 768 x 512 pixels, with 1280 x 1024 resolution optional. The non-interlaced, 66-Hz display provides flicker-free viewing on high-resolution color monitors. Full-color (24 bits), pseudo-color, or monochrome images can be supported. A bit-mapped color overlay provides cursors and graphics.

Enhances the Mac

The NuVision image processor is designed to work in tandem with a Macintosh II, thus, taking advantage of the Macintosh NuBus expansion slots that allow you to incorporate other Apple or third-party hardware into your workstation. Moreover, the Macintosh host permits you to use a wide range of software—ranging from word processing to spreadsheets and graphics.

Software

NuVision includes general-purpose image processing software, including a Macintosh operating system device driver, a basic imaging application program, and an image processing subroutine library. The software is structured to build your extensions starting from any layer. Full C-language source code is provided to assist you in adapting to your specific requirements.

Since NuVision records images in the Tagged Image File Format (TIFF), any graphics files you create can be edited using Mac-compatible software such as LetraSet's (Peoria, IL) Image Studio, Silicon Beach's (San Diego, CA) Digital Darkroom, or Aldus' (Seattle, WA) Pagemaker.

HARD FACTS:

NuVision Imaging Workstation

Price: $26,000-$50,000, depending on configuration

- User-friendly, Macintosh II-based graphics workstation
- Software compatible with all Macintosh user programs—from word processing to graphics
- Open system utilizes standard NuBus slots for plug-in expansion cards

Perceptics Corp.
P.O. Box 22991
Knoxville, TN 37933-0991
615-966-9200
Circle No. 143

Have Your VAX and PCs, Too!

You think your new VAX is meeting all your company's computing requirements, but Accounting wants PC-compatible Lotus 1-2-3, the typing pool Microsoft Word, and Sales needs Ashton-Tate's dBase. Sound familiar?

Well, you're not alone. The use of both PC-compatible applications and sophisticated VAX computing is a steadily growing phenomenon. As reported in the *Intelligence Report* compiled by Computer Intelligence, "in February 1988, it was estimated that 1.5 million PCs were installed at 27,500 VAX sites." Market research also indicates that one-third of all VAX sites have from one to nine PCs, while only 17% have no PCs at all.

You can satisfy your company's needs by using a DECnet-based PC-DOS application server—Virtual Microsystems' multicell V-Server, for example. Because the V-Server sits as a network node, up to eight concurrent VAX terminal or VAXstation users on the DECnet network can access an available V-Server cell to initiate an MS-DOS session.

The 286-based V-Server serves as a VAX network partner designed to run MS-DOS-compatible applications. Thus, as a networked VAX user, you can take advantage of both VMS and MS-DOS applications.

More Than a PC

The V-Server is indeed a standalone personal computer system but with additional processing functions and consisting of three to eight independent, board-level client processors; a 286-based host processor; an Ethernet network card; a serial communications port; a 1.2-Mbyte floppy disk drive; a 12-slot PC/AT backplane; and an independent power supply—all contained in a PC/AT-style system enclosure.

The V-Server's multiple cell configuration provides *redundant capabilities; if problems arise with one of the cells, the remaining cells continue to function.*

Each client processor, dubbed cells, uses an Intel 80286 microprocessor operating at 12 MHz. Because Virtual Microsystems is using fast (less than 120 nsec) RAM, (minimum 1 Mbyte, expandable to 4 Mbytes), the system operates zero (0) wait states. The cell-independent processor structure of V-Server minimizes performance degradation regardless of the number of users simultaneously accessing the system. Moreover, the multiple cell configuration provides redundant capabilities—if problems should arise with one of the cells, the remaining cells continue to function independently.

The cell processors only have client responsibility; the main 286 processor runs the DECnet software and directs all of the network processing and system I/O. The Ethernet card provides either thin-wire or thick-wire connection to your DECnet network.

The serial port is used to attach any terminal for configuring the V-Server. The 1.2-Mbyte floppy drive is used for loading of DOS applications and data to and from standard PC-compatible media.

Max the VAX

The V-Server also makes full use of your VAX resources, such as storage and other peripherals. MS-DOS-compatible files are stored on the VAX storage system. Thus, you can ensure commonality of files by using the same application company-wide.

Access to VAX-stored data is completely transparent and is comparable to hard disk drives. Moreover, rather than using VMS commands, you use native DOS commands. Further, the stored data can be shared among other users and transferred to both VAX and other PC applications. Working in tandem with the VAX, data files are protected and backup is ensured—factors not found in a standalone PC environment.

No Disruption

The V-Server's host processor implements the DECnet software and directs all of the network processing and system I/O using standard DECnet protocols and VAX/VMS-resident DECnet I/O routines. The V-Server is compatible with DECnet and is easily installed without disrupting the network. Additionally, DECnet users are able to access resources on remote VAXes, as well as V-Server capabilities. The use of VMS-resident I/O routines results in faster response times and less overhead on VAX systems and networks.

The system software consists of VAX host and V-Server-resident modules, each using the same technology as the Bridge product line from Virtual. Therefore, V-Servers and Bridge systems can co-reside on the same VAX network, and can be accessed interchangeably.

HARD FACTS:

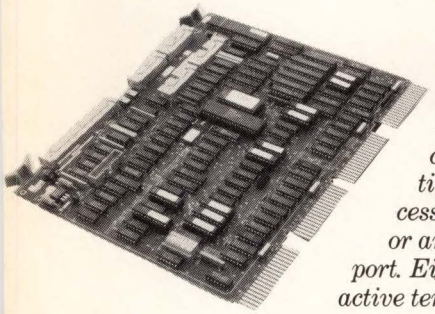
The V-Server

Price: $11,500 (baseline three-user system)

- Provides MS-DOS application services to VAX/VMS users
- Up to eight independent, board-level PCs

Virtual Microsystems Inc.
1825 S. Grant St., Ste. 700
San Mateo, CA 94402
415-573-9596
Circle No. 137

PRODUCT NEWS



The DU256 on-board formatter is *menu-driver to provide the operator with all controller and drive test options; this formatter is accessible via the system console or an optional diagnostic access port. Either method provides interactive terminal access.*

Add High-Performance Drives to Unibus Systems

A new disk controller, the DU256 from DILOG, interfaces up to four SMD/ESMD high-performance disk drives to Unibus-based VAX and PDP-11 systems. The DU256 features a data transfer rate up to 3 Mbytes per second, overlapped seek, enhanced media defect management, and simplified disk formatting procedures—all in a quad-height module.

The mapping capabilities of the DU256 permit a physical disk to be mapped into one or more logical units when it is formatted; when more than one drive is connected, each physical drive can be mapped into differing logical unit sizes, allowing the system manager to match drive cluster size with average file size. A command queue buffer stores up to 21 commands from all connected drives and queues them for proper order of execution. An elevator seek-ordering algorithm determines the execution order, reducing drive seek latency.

The DU256 is compatible with DEC's DU driver within the RT-11, RSX-11M+, RSTS/E, VMS, UNIX, and DSM operating systems. An on-board bootstrap provides support for RP02, RL01/02, RM02/05/80, RK06/07, TS11, TSV05, and DU driver devices.

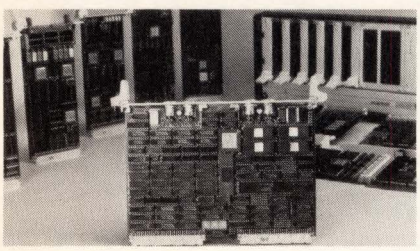
DILOG
1555 S. Sinclair St.
P.O. Box 6270
Anaheim, CA 92806
714-937-5700

Multipurpose VME Transputer

To access the high-speed processing capabilities of the transputer in VME systems, Parsytec's BBK-V2 modules include a local T800 or T414 processor equipped with 2 Mbytes of dual-ported, on-board memory that also may be accessed by other VME processors or DMA devices.

For control applications, the transputer has 1 Mbyte of on-board EPROM to enable the design of VME systems without mass storage. IBM PCs, OS-9, and UNIX systems can be utilized for software development—with compilers in C, Pascal, or FORTRAN 77.

Parsytec
c/o C&C Marketing
P.O. Box 280
Batavia, IL 60510
312-879-7003



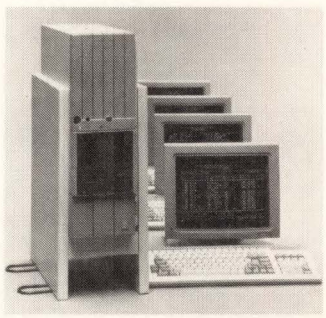
The BBK-V2 may be used *as a VME main processor, supplementary processor, or local pre-processing bus bridge.*

ITT Information Systems Now Alcatel XTRA Business Systems

Small-to-medium-sized businesses may want to consider the versatile product line of microprocessor-based business computers now offered by XTRA Business Systems. For the entrepreneur contemplating a multiuser, entry-level system, you need to know you're making the right decision. Can you easily add users? Can you grow into future applications . . . peripherals . . . data storage . . . operating systems?

The XTRA/286 XL Multi-User System is based on the 80286 8-MHz, 16-bit microprocessor, and supports the XENIX System V operating system. A unique 80186 microprocessor-based terminal control subsystem provides eight intelligent terminal ports; as your workgroup grows, you can expand your system to 16, 24, or even 32 ports by adding up to three more subsystems. For maximizing data storage, you have a total of five bays for integrating storage devices—the standard system configuration includes one 1.2-Mbyte floppy and a 60-Mbyte tape backup unit.

XTRA Business Systems
2350 Qume Dr.
San Jose, CA 95131
800-321-7661



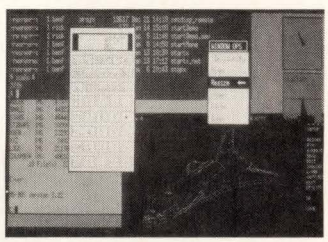
As the multiple terminal subsystem of the XTRA/286 XL allows you to expand *the system according to your needs, you don't have to buy more system than you need—start small and expand later.*

Windowing Software for UNIX/DOS Users

Based on MIT's X Windows V. 11, Locus Computing Corp.'s Xsight combines enhanced graphics performance with the ability to use DOS workstations and UNIX-based computers in standalone or networked environments.

Xsight is offered in two forms: Xsight and PC-Xsight. The Xsight version is targeted for Intel 80386-based machines running UNIX System V Release 3. With Xsight, the user can divide the screen into multiple windows, each emulating an individual graphics terminal running a different client program.

PC-Xsight makes it possible for IBM PCs and compatibles running MS-DOS to emulate graphics workstations when networked to UNIX systems using Xsight or any other X Windows software).



Graphics screen image using Xsight windowing software depicts *simultaneous UNIX and DOS directories, a CAD/CAM image from UNIX host-resident software, a real-time clock display, mouse-actuated calculator and window-operations menu displays.*

Locus Computing Corp.
3330 Ocean Park Blvd.
Santa Monica, CA 90405
213-452-2435

PRODUCT NEWS

Second-Generation CD-ROMs Are Only Half-Height

The Hitachi CDR-3500 has *a rated mean-time-between-failure rate of 10,000 hours, a 40-pin parallel interface (TTL level), and a 40-pin header-type connector.*

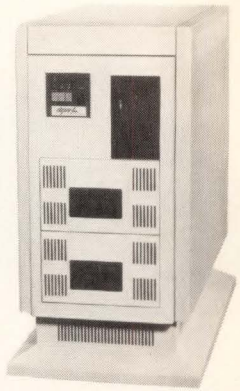
Hitachi's Model CDR-3500 552-Mbyte CD-ROM is truly a second-generation CD-ROM—a half-height unit that allows two drives to be installed into the space of a single, full-height drive, effectively doubling the system's storage capacity.

With your choice of either horizontal or vertical installation, the unit is much easier to handle, while the disk cartridge simplifies loading. Up to four drives can be daisy-chained, again doubling system storage capacity—for a total system storage capacity of 2.2 Gbytes.

The CDR-3500 CD-ROM storage drive incorporates a two-channel audio playback circuit with a headphone jack on the front panel and audio terminal output on the rear of the unit. The audio circuit expands the applications capabilities of your system to include computer-aided instruction and any future applications requiring audio capability.

Hitachi Sales Corp. of America
401 W. Artesia Blvd.
Compton, CA 90220
213-774-5151 **Circle No. 252**

Another Way to Grow



Dyna Five's SE102P system enclosure is shown *configured with two 8-in. Winchester drives and a TK50 cartridge tape.*

When was the last time you went shopping for DEC-compatible system enclosures? If it has been more than a year, your knowledge of what's available in the marketplace is probably obsolete. Expansion boxes and enclosures are available that perform various functions, including:

- integrate entire systems with additional backplane slots, power supplies, and space for mounting common disk drives;
- provide additional expansion backplane slots, power, and peripheral mounting space; and
- provide low-cost packaging for expansion backplanes without internal peripheral mounting space.

Dyna Five Corp. will exhibit its line of DEC-compatible enclosures for the MicroVAX II and MicroPDP-11 at DEXPO Spring in Cincinnati, OH.

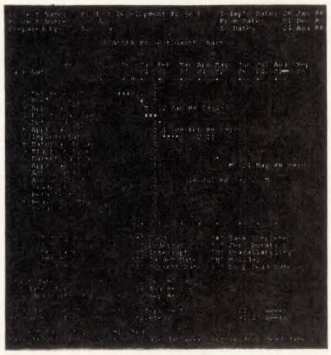
Dyna Five Corp.
A Gradco Systems Inc. Co.
7 Morgan
Irvine, CA 92718
714-770-2790 **Circle No. 258**

Tighten Project Management—Automate Your Project Engineers

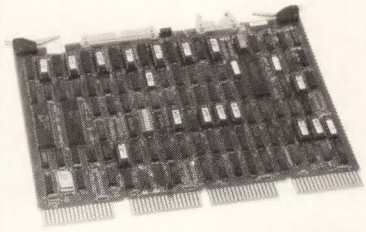
The Planner project management software program from Productivity Solutions Inc. (PSI) is an interactive, multiuser system for VMS environments. Planner V. 5.0 offers managers a cost-effective tool for scheduling and managing project activities, milestones, and resources. It also enables you to view overall project progress with the time-honored Gantt chart.

Your project management team can benefit from shared project data, improved team productivity, and enhanced information gathering with computer-generated project development reports. By automating Project Engineering with the Planner, managers can visually review the status of the projects under their control; and the program collects, allocates, summarizes, and records accumulated data—freeing up valuable personnel.

Productivity Solutions Inc.
128 Technology Dr.
P.O. Box 9164
Waltham, MA 02254-9164
617-899-8900 **Circle No. 254**



Use your VAX/VMS system to implement *PSI's Planner—a sophisticated project management software system.*



Each FEP, *capable of emulating up to 128 ports, is software compatible with any system supporting DHV11 multiplexers. It's also software compatible with DEC operating systems and supports asynchronous DECnet.*

Streamline Your MicroVAX Operations

A new, 128-port, dual-mode, Front-End Processor (FEP) for the Q-bus from Able Computer Communications is aimed directly at the MicroVAX market. Able's FEP expands the application processing capabilities of Q-bus systems by completely managing network access, freeing backplane slots, and decreasing bus overhead.

The FEP consists of a quadwide interface module and may be used to link Q-bus processors via single twisted-pair cable. Data integrity is ensured by error detection and correction techniques that use a subset of the High-Level Data Link Control (HDLC) protocol.

When used in single-processor applications, the FEP may be used with any of Able's Mux Master terminal, printer, or PC servers in either distributed or centralized user environments, supporting asynchronous devices at speeds to 38.4 Kbaud per second. When interfaced to any of Able's INX network exchanges, the dual-mode FEP links Q-bus systems with other DEC, DG, IBM, or HP processors.

Able Computer Communications
2567A S.E. Main St.
Irvine, CA 92714
714-553-1188 **Circle No. 256**

Data Communications And Interconnects

Enhanced LAT

Polygon's LAT allows a PC to communicate with a DEC host over Ethernet, using DEC's LAT protocol; supports EtherLink, EtherLink Plus, EtherLink II, and EtherLink/MC; enhanced version does load balancing, connecting to the least busy host offering the requested service; Available Services directory can be programmed to list favorite services first or list only services from certain group codes, and can also be manually established, providing security and eliminating the PC's overhead to process network service announcements; $69.

Polygon Inc., 1024 Executive Pkwy., St. Louis, MO 63141, 314-576-7709.

Circle No. 260

Systems Security, Power Conditioners/Supplies

Surface-Mount Block

Two Channel Mod Block; surface-mount block provides two jacks of any polarization, or one jack and a 3270 balun, in a single-block configuration; large barrel insulation displacement contacts provide a quick and reliable termination for 22–24 gauge inside wire cable, solid or stranded conductor.

The Two Channel Mod Block mounts flat on any surface by way of screws or double-sided adhesive tape (included) and is designed with integral strain relief; two-jack style $10; jack and balun version $35.

Mod-Tap System, 285 Ayer Rd., P.O. Box 706, Harvard, MA 01451-0706, 617-456-3500. **Circle No. 262**

Anti-Crash Surge Protector

Model DSDLP; surge protector for PCs and hard disk drives features unique brownout-blackout sensors for detecting undervoltages and power-line losses to prevent the drive's data head from contacting the disk surface; protects four AC outlets and two telephone receptacles; three-stage Surge Sentry circuitry offers fast response time to voltage transients and high-performance RFI/EMI noise filtering.

Model DSDLP provides power dissipation of 181.5 joules with power dissipation of 1.815 megawatts over 100 microseconds and is warranted to withstand a 6000V strike; $139.95.

Dynatech Computer Power Inc., 5800 Butler Ln., Scotts Valley, CA 95066, 408-438-5760. **Circle No. 264**

Systems Software

Disk Management Tool for VAX

PAKmanager; system software product assists VAX managers in managing their disk space; allows a VAX manager to instantly generate detailed reports that identify "space stealers" such as unnecessary duplicate files, aged files, excessive multi-version files, overallocated blocks, and expired files; reveals actual space taken up by unnecessary files; includes a powerful command-file building feature that makes it easy to recover wasted space quickly; reports can be generated for all files on the disk; generates binary output of all reports for further processing as desired.

PAKmanager features an easy-to-use screen menu interface, an optional DCL command line interface for experienced users, and a complete on-line help facility.

Demac Software, 18300 Von Karman, Ste. 700, Irvine, CA 92715-9966, 800-267-3862 or 800-634-6552 ext. 64, in CA.

Circle No. 266

OS/2 Programmer's Toolkit

Programmer's Toolkit; provides documentation and software that allows software developers to create applications exploiting the power of OS/2 systems and the underlying hardware; contains three reference manuals on OS/2 and a host of software utilities; $350; available now.

Microsoft Corp., 16011 N.E. 36th Way, P.O. Box 97017, Redmond, WA 98073-9717, 206-882-8080.

Circle No. 268

Applications Software

Payroll System

Release 2.0 Libra Payroll System; payroll system features several payroll start-up options; main menus now have arrows showing program flow and boxes showing categories clearly; Data Base Installation procedures have been simplified with "road map" messages letting the user know where he is and where he is going; features 1–99 companies and 20–999 expense codes; Tax File Maintenance, Company Constants Maintenance and Employee File Maintenance have been simplified.

Release 2.0 Libra Payroll System now has a report formatter with many reporting options containing menus and windows to guide the user; includes 99 Transaction files; many enhancements have been added to proofing, posting, and tax calculation; payroll can run with or without security; available for IBM PCs and compatibles and for multiuser processing when run on VAX or Novel Networks computers.

Libra Corp., 1954 E. 7000 S., Salt Lake City, UT 84121-3094, 800-453-3827 or 801-943-2084 in UT. **Circle No. 270**

Bar Code Software

VAX software prints bar code on DEC dot-matrix and laser printers; one-up, tractor-fed labels are printed via interactive keyboard entry or batch file input; features automatic numbering, multiple copies of the same label,

automatic centering of fields, and control of text density and character size; encoded data can be printed below the bar code and multiple description lines can be printed above the bar code.

Batch files are easily read using a free-format data input structure; extensive data editing is provided; error log is created for trouble-shooting invalid data; separate menu-driven module allows definition of multiple printer set-up parameters; non-DEC printers can be supported; $295+.

P.C. Inc., P.O. Box 7336, Wilmington, DE 19803, 302-478-3490. **Circle No. 272**

Workstations

Engineering Scientific Workstation

WARPspeed II; a line of DEC MicroVAX-based workstations for engineering and scientific applications; integrates concurrent processors (CPs) and graphics engines (GEs) with standard MicroVAX systems; MicroVAX processor provides the CP and GE units with I/O, standard library functions, and system call support but is otherwise free to perform other processing tasks on a concurrent basis; Q-bus-resident concurrent processors run at 3.5–4 MIPS and multiple processors may be added to multiply total system performance.

Up to four GEs are available on standalone WARPspeed configurations, more on network cluster configurations; GEs may share a CP or have a dedicated CP; features 1280 x 1025 resolution, 1-Mbyte display list, eight-pixel planes, 256 colors/16.7M palette, VT100 emulation, and pick/zoom/pan/clip functions; basic system includes MicroVAX CPU, 5M RAM, RD53, TK50, CP, GE with keyboard-monitor and mouse, VMS, and choice of compiler; $50,000–$140,000; available 30 days ARO.

Fedmark Inc., 3720 Farra-

5¼" MOBILITY, SECURE STORAGE AND WINCHESTER RELIABILITY...

With up to 760 MB per shuttle, each DEX Power Shuttle System comes complete with one or two 5¼ inch Winchester Disk Drive in 2 removable canisters and a disk controller.

Along with a one year warranty including shock related failure, the DEX Power Shuttle Family is designed to get you in and out of a wide range of environments from shock isolated commercial use to the harshest industrial requirements.

DEX POWER SHUTTLE-172

1 OR 2 86 MB DISK DRIVES

DEX POWER SHUTTLE-346

1 OR 2 173 MB DISK DRIVES

DEX POWER SHUTTLE-760

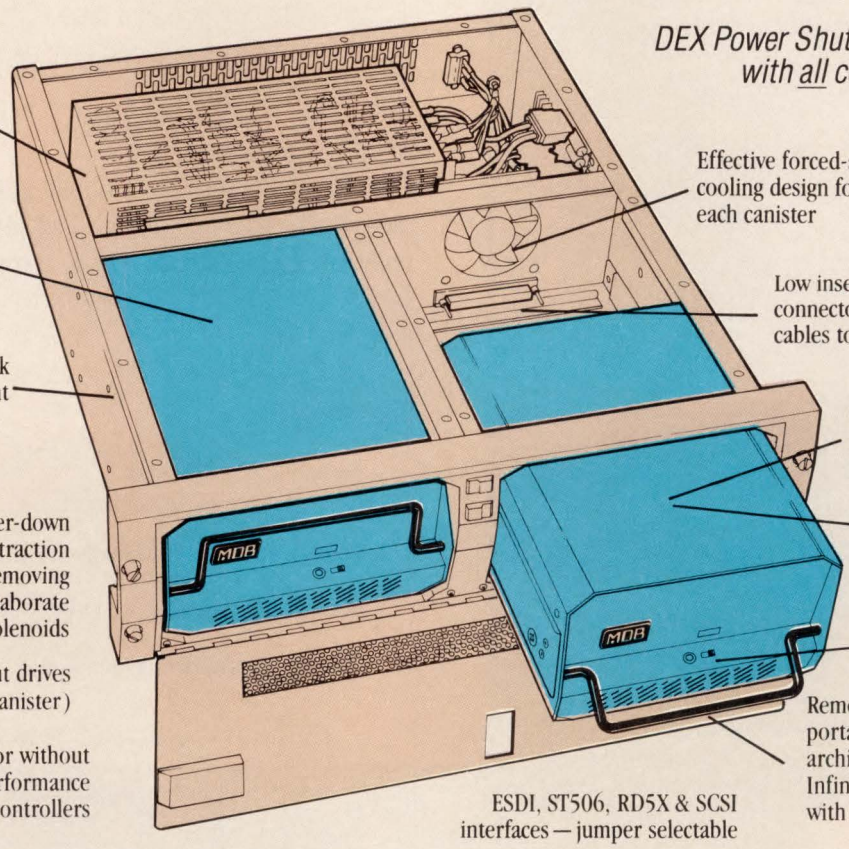
1 OR 2 380 MB DISK DRIVES

DEX 1061 SOUTH MELROSE AVE PLACENTIA, CA 92670

714 • 632 • 1841

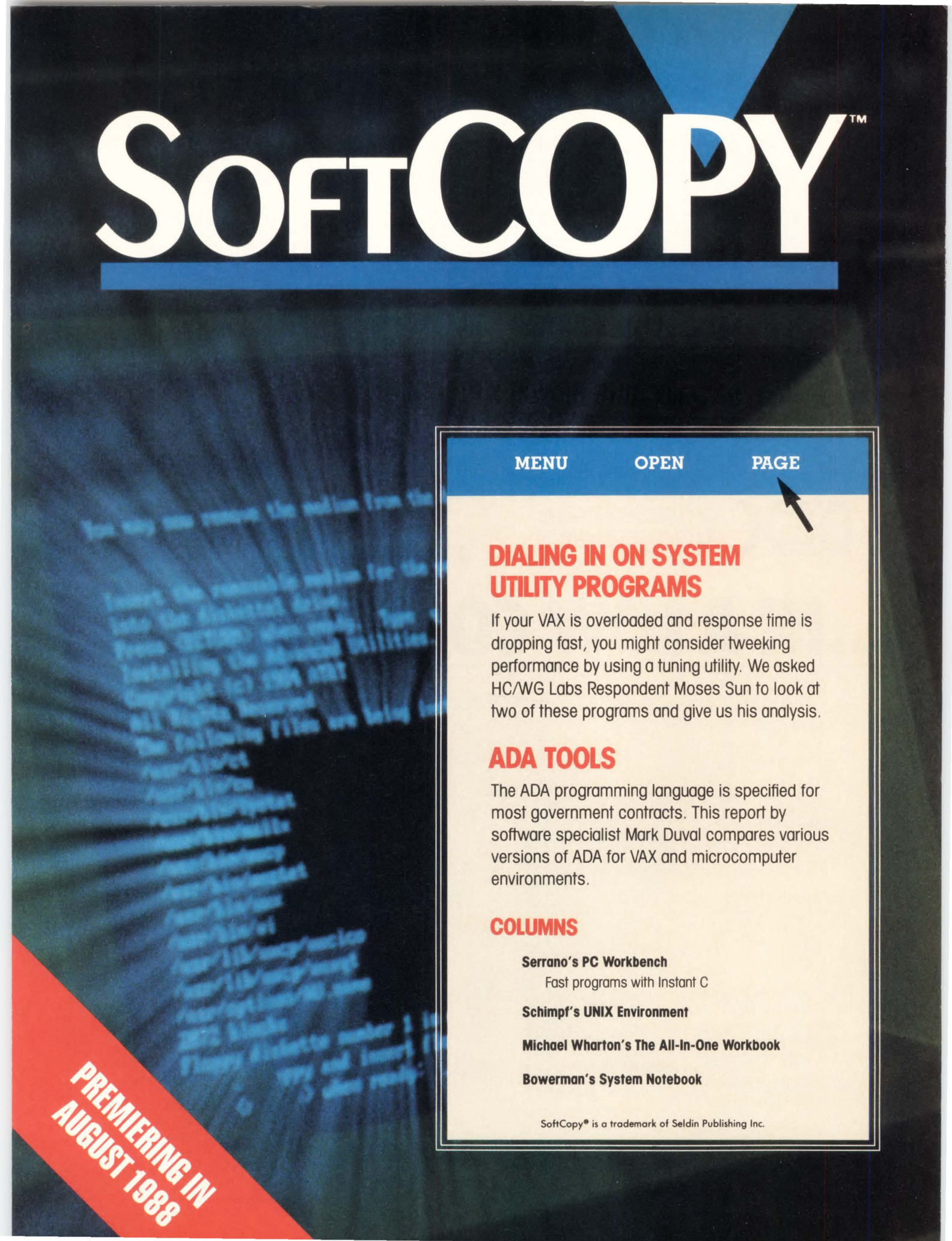
...IN A LOW COST PACKAGE

DEX Power Shuttle Family for use with all computer systems



CIRCLE 405 ON READER CARD

SoftCOPY™



MENU OPEN PAGE

DIALING IN ON SYSTEM UTILITY PROGRAMS

If your VAX is overloaded and response time is dropping fast, you might consider tweeking performance by using a tuning utility. We asked HC/WG Labs Respondent Moses Sun to look at two of these programs and give us his analysis.

ADA TOOLS

The ADA programming language is specified for most government contracts. This report by software specialist Mark Duval compares various versions of ADA for VAX and microcomputer environments.

COLUMNS

Serrano's PC Workbench
Fast programs with Instant C

Schimpf's UNIX Environment

Michael Wharton's The All-In-One Workbook

Bowerman's System Notebook

PREMIERING IN AUGUST 1988

gut Ave., Kensington, MD 20895, 301-946-1474.

Circle No. 274

IBM/DEC Connectivity

Basic Rate Connectivity

DCT 8500, DCT 8510; basic rate separators connect to any Basic Rate ISDN line that supports the CCITT S/T four-wire interface standard; use the Intel iATC 29C53 Digital Loop Controller to handle simultaneous transmission and reception of the Basic Rate 2B+D signal; DCT 8500 splits the ISDN Basic Rate 2B+D line into three separate physical ports, each compatible with standard serial interfaces such as those provided on the IBM PC and PS/2 and the DEC MicroVAX; sends and receives the D channel bit stream asynchronously through an RS-422 DB37 connector; special cable can convert the D channel access to a standard RS-232 DB25 connector; D channel access speeds can be set from 9.6 to 38.4 Kbits per second.

DCT 8510 performs all the functions of the 8500 and also features direct VME bus support; both units plug into standard VME bus card slots; when used in conjunction with systems such as the IBM PC and PS/2 or the DEC MicroVAX II, they can be used for applications such as ISDN operator consoles, ISDN workstation development, leased line elimination, CPE and CO switch certification, and ISDN switch emulation; DCT 8500 $995; DCT 8510 $1,195; available now.

ISDN Technologies Corp., 4151 Middlefield Rd., Ste. 101, Palo Alto, CA 94303, 415-857-0511. **Circle No. 278**

IBM-to-VAX Connection

Alcatel 8930; provides a high-speed, versatile solution for connecting IBM 43xx-, 30xx-, and 9370-class mainframes to DEC VAXes; uses Intel's Fastpath platform and FlexLink software; attaches directly to an IBM S/370-class block-multiplexer channel and provides a direct megabit-per-second pathway into the mainframe; data throughput rates of 100–150 Kbytes per second are achievable; users are able to share high-speed access to data files, initiate tasks on each other's systems, and share expensive devices all without the throughput constraints of communication-based links such as gateways; only one terminal is needed to access both systems.

FlexLink software provides full-screen DEC VTxxx emulation from an IBM 3270 terminal; 128 simultaneous virtual connections per physical link are supported; Mailbridge feature connects IBM/VM and VAX/VMS electronic messaging networks; existing electronic mail systems can be used as before; Alcatel 8930 can be customized to accommodate multiple, simultaneous connections; Fastpath control unit is housed in a freestanding 19-inch unit; operates in a commercial computer environment; requires no modification to the IBM System/370 operating systems; $80,000–$150,000; available now.

Alcatel Business Systems Group, White Hart House, Park St., Colnbrook, Slough SL3 0HU, England, 0753-685622. **Circle No. 280**

MAC/DEC Connectivity

FastNet for Macintosh II

FastNet II; intelligent communications controller provides Macintosh II users with the same features as the FastNet SCSI product; users can now communication over Ethernet at the higher speeds required for distributed multiprocessing, multitasking applications; operates at up to 10 MHz.

FastNet II includes 512 Kbytes of DRAM, 64 Kbytes of ROM, and software for downloading and diagnostics; physical LAN interface to Ethernet is provided through either a standard DB15 connector or an internal Ethernet-specified Cheapernet transceiver; $899.

Dove Computer Corp., 1200 N. 23rd St., Wilmington, NC 28405, 800-622-7627 or 919-763-7918 in NC.

Circle No. 282

Mac-VAX Database Solution

Omnis SQL Connectivity Pack; provides true application-level connectivity, giving Macintosh users transparent access to most popular minicomputer database management systems through a customized relational database application; includes Omnis CL/1 Server for the host system and Omnis CL/1 Station for the Mac desktop; Omnis CL/1 Server is a minicomputer implementation of CL/1, a SQL-based query language that provides uniform access to data in minicomputer databases and fields, regardless of the particular data management database or network used; Omnis CL/1 Station is a database for the Mac, enhanced to support Omnis CL/1 Server and available in single- and multi-user versions.

Omnis SQL Connectivity Pack supports the leading VAX data-management systems; the network linking the Mac to the VAX can be a direct or dial-up asynchronous link, an AppleTalk network, and an Ethernet using DECnet protocols; $3,500–$23,750+; available mid-1988.

Blyth Software Inc., 1065 E. Hillsdale Blvd., Ste. 300, Foster City, CA 94404, 415-571-0222. **Circle No. 284**

DECnet for Macintosh

CommUnity Mac; offers file-server capabilities through compatibility with VAX/VMS Services from DEC; is compatible with Macintosh Plus, SE, and II; includes remote file access to transfer files to or from the Mac to other DECnet or CommUnity systems; features VAXmail for sending and receiving mail between Macs and VMS systems.

CommUnity Mac is compatible with VMS, Ultrix, and RSX-11M; features a 68000-based intelligent Ethernet controller from Dove, Virtual Terminal including VT100/220/240 emulation, and task-to-task communications for Mac-to-DEC and Mac-to-Mac programming; Network Management displays network status, error, and traffic counters.

Technology Concepts Inc., 40 Tall Pine Dr., Sudbury, MA 01776, 617-443-7311.

Circle No. 286

Chassis, Backplanes, And Enclosures

Communications Cabinet

22-inch-wide communications cabinet; 40, 60, or 72 inches high; specifically designed to house DEC's Ethernet enclosures, DECserver 100/200, and DELNIs; available in DEC style and a version known as Valueline; options include vertical mounting power distributions, fan cooling, sliding mounting tray, and a general-purpose I/O connector panel; available now.

Lion Cabinets Ltd., Unit 12, Buslingthorpe Green Industrial Estate, Meanwood Rd., Leeds LS7 2HG, England, 0532-624040.

Circle No. 288

Rack-Mount Tray

RM-800F; allows the mounting of 2- x 8-in. Winchester devices in a 19-inch rack cabinet; designed specifically to accommodate Fujitsu devices and power supplies together with Fujitsu-style front panel; accommodates Fujitsu mount-compatible devices; available now.

Lion Cabinets Ltd., Unit 12, Buslingthorpe Green Industrial Estate, Meanwood Rd., Leeds LS7 2HG, England, 0532-624040.

Circle No. 290

Rack-Mounting Kit

19-inch rack-mount kit specifically designed to be compatible with the DEC

PRODUCT NEWS

BA23A-AR rack-mount kit; has all the items necessary to mount a DEC BA23 chassis, including slide rails; available now.

Lion Cabinets Ltd., Unit 12, Buslingthorpe Green Industrial Estate, Meanwood Rd., Leeds LS7 2HG, England, 0532-624040.

Circle No. 292

J-Style End Panels

Wide End Panels; allow side-to-side ventilation of mounted computer equipment; designed to suit DEC BA23A chassis and be specifically compatible with the DEC J-style end panel used in MicroVAX II (Q5) configurations; available now.

Lion Cabinets Ltd., Unit 12, Buslingthorpe Green Industrial Estate, Meanwood Rd., Leeds LS7 2HG, England, 0532-624040.

Circle No. 294

Sliding Plinth For 5.25-in. Devices

RM/DT-525S; allows the mounting of a 5.25-in. device on a sliding plinth; specifically allows the fixing of a 5.25-in. device on this T-slot base, into DEC-style runners; available now.

Lion Cabinets Ltd., Unit 12, Buslingthorpe Green Industrial Estate, Meanwood Rd., Leeds LS7 2HG, England, 0532-624040.

Circle No. 296

UXT-Tape Cabinet

UXT-Tape cabinet; 60-in.-high cabinet incorporates an additional strengthening kit designed to support a .5-in. magnetic tape transport, in a vertical orientation, and utilizes the vertical mounting kit supplied with the tape; available now.

Lion Cabinets Ltd., Unit 7-12, Buslingthorpe Green, Meanwood Rd., Leeds, England, LS7 2HG, 044-0532-624040.

Circle No. 298

IN THE QUEUE

The following products have been received by *Hardcopy* for review or HOW evaluation.

Access Technology Inc.
South Natick, MA
Product: 20/20
Status: At review

Adobe Systems Inc.
Mountain View, CA
Products: Adobe Type Library for IBM (1—Palatino, 9—ITC Garamond, 15—Trump Mediaeval); Adobe Type Library for Macintosh (Newsletters, Publishing Pack 1); Adobe Illustrator for Macintosh
Status: In HC/WG Lab

Aldus Corp.
Seattle, WA
Product: Pagemaker for Mac
Status: In HC/WG Lab

CIE Systems
Irvine, CA
Product: CI-2500 Dot-Matrix Printer
Status: At review

Complete Logic Systems
N. Vancouver, B.C., Canada
Product: Trilogy
Status: At review

Data Technology Corp.
Santa Clara, CA
Product: Crystall Print VIII
Status: At review

Golden Bow Systems
San Diego, CA
Product: Vopt Disk Orgainzer
Status: At review

Jyacc Inc.
New York, NY
Product: Jam V. 3.1 Development Environment
Status: At review

Lightgate
Oakland, CA
Products: Felix; Post-mouse
Status: At review

Meridian Software Systems Inc.
Laguna Hills, CA
Product: AdaVantage Compiler
Status: At review

Microsoft Corp.
Redmond, WA
Products: Microsoft Works for IBM PC; Microsoft Pageview
Status: At review

Modgraph Inc.
Burlington, MA
Product: GX-2000 Graphics Terminal
Status: At review

Monolithic Systems Inc.
Englewood, CO
Products: 386 Motherboard; Memory board; Multiport board
Status: In HC/WG Lab

Precision Standard Time
Fremont, CA
Product: Integrated Time Source
Status: At review

Procyon Computer Systems
Torrance, CA
Product: Star Draw for VAX
Status: In HC/WG Lab

Q.N.E. International
Langhorne, PA
Product: Quic-Pro 5
Status: At review

Rational Systems Inc.
Natick, MA
Product: Instant C/16m for IBM PC
Status: At review

The Santa Cruz Operation
Santa Cruz, CA
Product: SCO Xenix OS
Status: At review

Set Labs Inc.
Portland, OR
Product: PC Metric
Status: At review

Soricon Corp.
Boulder, CO
Product: Datasweep 1 PC Scanner
Status: At review

Techpower Inc.
Santa Ana, CA
Products: Everex System; System 1800
Status: In HC/WG Lab

Traveling Software
Bothell, WA
Products: LapLink Plus; Desklink Communication Software
Status: At review

VM Personal Computing
Danbury, CT
Products: Beyond.BAT; Relay Gold
Status: At review

White Crane Systems
Norcross, GA
Product: The Brooklyn Bridge Communications Program
Status: At review

MRI COMPUTERS

Presents:

A FOUR STAR PERFORMANCE!

USI/HSR **PEP-11** **PEP-70** **CACHE-70**

NOW APPEARING AT SELECTIVE SITES NEAR YOU

Including users such as: AT&T, Bell Labs, E.I. Dupont, Ford Aerospace, General Dynamics, NASA and many, many others...

PERFORMANCE ENHANCEMENT PRODUCTS FOR DEC VAX AND PDP11 SYSTEMS

USI/HSR

(UNIBUS Segment Isolator / High Speed Repeater)

The USI/HSR was specifically designed to allow maximum UNIBUS utilization and freedom in system configurations. The unit is totally transparent to system operation and requires no hardware or software changes.

As a UNIBUS Segment Isolator, the Unit electronically breaks the bus into smaller segments, thus enhancing the reliability of UNIBUS transfers. The unit will virtually eliminate TRAP 4, UNIBUS TIME-OUTS and VECTOR 0 Interrupts. And as a High Speed Repeater, this 25 nanosecond device allows your UNIBUS to run as fast as your CPU and memory can push it. Installation is "Plug and Play". Unplug an M920 or M9202 and plug in a USI/HSR.

Now you can...

- Add a second UDA50 to your existing UNIBUS.
- Add up to 60 units of DC load.
- Eliminate the need for additional UNIBUS Adapters (DW7XX-XX).
- Plan a migration to new CPU technology with the UNIBUS devices you now own.

PEP-11

(The PDP-11 Performance Enhancement Package)

This performance package consists of an amazing new 5ns UFUM (ULTRA FAST UNIBUS MEMORY) and a USI/HSR (UNIBUS SEGMENT ISOLATOR/HIGH SPEED REPEATER). Your PDP-11/24, 11/34 and 11/44 systems now have growth potential beyond all expectations.

If you are using older DEC UNIBUS Systems such as PDP 11/40, 11/45, 11/50, 11/55, or 11/60 you can easily double or perhaps triple your system throughput.

The memory comes in either 1/4 or 1 mb static ram arrays on a single board. It directly replaces the memory now in the system.

The upgrade is simply "plug and play", while the associated costs are only a fraction of replacing your current system with a new one. There is no need to retrain your people, renovate your computer room or rebuild your files.

PEP-70

(The PDP 11/70 Performance Enhancement Package)

This package consists of a new static ram, 2 or 4 mb memory board with a 15 nanosecond access time and a complete read or write cycle time between 100 and 200 nanoseconds.

The PEP-70 increases CPU and Bus throughput, thus allowing a previously CPU bound system to have the same User Response as a lightly loaded system. The additional UNIBUS bandwidth allows you to increase I/O capacity, I/O transfer rates, and User loads. System performance has increased by factors of 25%-45% at various RSTS user sites.

The PEP-70, when installed, is fully compatible with present hardware and operating system software. Installation is a simple process with minimum system down time.

The new memory board directly replaces the DEC MK11-B, C or MJ11 style memory. It is physically plugged into slot 19 in the 11/70 CPU backplane. This elminates the need for the entire MK11 memory cabinet, thus reducing CPU footprint by 50%.

CACHE-70

(PDP 11/70 Hyper-Cache)

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BY KIMBERLY SCHULZE, Associate Editor

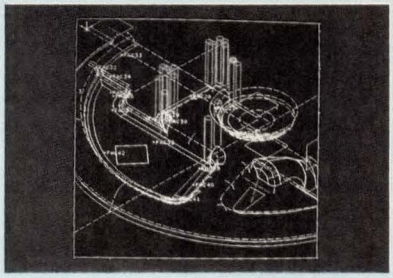
IN THE SPOTLIGHT

Be sure to bring your briefCASE to **CASE '88**, the Second International Workshop on Computer-Aided Software Engineering, which will be held July 12-15 at the Hyatt Regency Cambridge, in Cambridge, MA. It is sponsored, in part, by Index Technology Corp. and the Computer Society of the IEEE. The CASE '87 workshop drew 225 participants.

At the workshop, key researchers, developers, and leading-edge users of CASE technology will examine goals for CASE advancement in the next five years. In addition, the workshop will review and coordinate the many independent efforts to develop standards for CASE tools.

Working groups at the conference will consider future CASE requirements in five areas: management, methods for information systems development, enabling technologies, reverse engineering, and standards.

Additional sponsors of the workshop are Imperial College (London), Purdue University, Northeastern University, Washington University, and the Greater Boston Chapter of the ACM. Elliot J. Chikofsky, Index Technology's director of research and technology, is serving as General Chair, and Ronald J. Norman, assistant professor of information and decision systems at San Diego State University, is serving as Chair of the Program Committee.



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JULY

6–8—Integrated Information Services: Departmental Systems and Enterprise Networks; Minneapolis/St. Paul; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590; also July 20–22 in Washington, DC.

6–8—Using a Data Base in a Distributed Processing Environment; Washington, DC; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590; also July 18–20 in Boston.

11–13—Data Communications and Information Systems Security; Washington, DC; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

11–13—Design of Multi-Vendor Computer Systems; Minneapolis/St. Paul; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590; also July 25–27 in Washington, DC.

11–13—Evaluating and Implementing Local Area Networks; Detroit; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

11–13—Micro-to-Mainframe Links, PC Networks and Connectivity; San Francisco; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590; also July 18–20 in Washington, DC.

11–13—SNA—IBM's Systems Network Architecture; San Francisco; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

12,13—OS/2: Inside and Out; Denver; contact Digital Consulting Inc., 6 Windsor St., Andover, MA 01810, 617-470-3880.

12–14—Desktop Publishing and Beyond: Electronic Publishing as a Corporate Strategy; Washington, DC; contact Technology Transfer Institute, 741 Tenth St., Santa Monica, CA 90402, 213-394-8305.

12–15—Data Communications: Components, Systems and Networks; San Francisco; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

12–15—CASE '88; Cambridge, MA; contact Pamela Meyer, Index Technology Corp., One Main St., Cambridge, MA 02142, 617-494-8200.

13–15—Relational Data Base Management Systems: A Comparative Analysis; Minneapolis/St. Paul; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

14,15—Connectivity for Personal Computers; Detroit; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590; also July 28–29 in Pittsburgh.

18–20—Laser Optical Systems: Image Technology and Its Implementation; Orlando, FL; contact Technology Transfer Institute, 741 Tenth St., Santa Monica, CA 90402, 213-394-8305.

18–20—Voice/Data Integration and ISDN; New York; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

19,20—Software Engineering and CASE Technology; Seattle; contact Digital Consulting Inc., 6 Windsor St., Andover, MA 01810, 617-470-3880.

19–22—Benchmarking MVS Systems; Washington, DC; contact Technology Transfer Institute, 741 Tenth St., Santa Monica, CA 90402, 213-394-8305.

20–22—Data Communications Network Design and Optimization; Denver; contact the Institute for Advanced Technology, Registrar (ETCIAT), 1450 Energy Park Dr., St. Paul, MN 55108-5299, 800-638-6590.

25,26—How to Manage Software Engineering Projects; Dallas; contact Digital Consulting Inc., 6 Windsor St., Andover, MA 01810, 617-470-3880.

25–28—Queueing Systems and Computer Applications; Orlando, FL; contact Technology Transfer Institute, 741 Tenth St., Santa Monica, CA 90402, 213-394-8305.

27–29—Introduction to Data Communications; Los Angeles; contact Technology Transfer Institute, 741 Tenth St., Santa Monica, CA 90402, 213-394-8305.

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TAPING UP THE PROBLEMS

Here are some things you might be interested in. Remember the Kennedy Co. (Monrovia, CA)? You may have one of its tape drives and you might have been worried that the company fell off the face of the earth. Not so. The company, purchased by Shugart Corp. (Irvine, CA), is doing well with the Model 9610, a nine-track, .5-in., SCSI, streaming tape drive. If you are using a .25-in. tape drive, however, and are anxious to ensure its proper operation, you might want to call Steve King at KCS Computer Services Inc. (Huntington Beach, CA). Mr. King has informed *Hardcopy* that KCS has developed a proprietary head-alignment tool and procedure designed specifically for the small tape drives.

WHAT IS DEC UP TO NOW?

Expect to see a number of exciting things come from the people in Marlboro before too many more months go by. Our insiders tell us that DEC is working hard at developing an AT-bus extension for the MicroVAX 2000 and similar boxes. Additionally, the company is scouting various vendors for OEM products that fit on the VME bus, including 68030 microprocessor boards that run, believe it or not, real UNIX.

MAGIC IN THE STORAGE DEVICES

The next 18–24 months promise to be interesting indeed—especially if you're interested in the latest storage devices being worked on or those that are just finding their way into the marketplace. The list includes start-up Insite Peripherals (Santa Clara, CA) that is developing a 2.8-in., 100-Mbyte drive that uses an optical sensor mounted on a floppy-like transducer. The idea is to write thin, read wide, and possibly, use 3M Corp.'s Stretched-Surface Recording (SSR) media material. Additionally, Sony Corp. (Tokyo) is claiming to have equally impressive optical drives to match those offered by Maxtor (see "George Langworthy's Insights to Optical Storage," *StorAGE,* page 14, this issue). Like Maxtor, Sony is using magneto-optic technology and says that it is ready to ship.

SCIENTIFIC MICRO SYSTEMS: TIGHTENING THE BELT

Those of you who follow the ebb and flow of the financial stability of high-tech companies have probably been fascinated by the troubles of Scientific Micro Systems Inc. (Mountain View, CA). The company was doing well with DEC-compatible add-ons and made a name for itself as a stable supplier of SCSI protocol chips. But, with the acquisition of SuperMacs—the Macintosh add-on people—uncontrolled growth and losses as great as $10 million in Europe resulted. The upshot has been the stepping down of CEO Charles Matthews (now with DAT start-up, GigaTape, in San Diego) and the undertaking of a massive reorganization of the business and operating profile of the company. According to company insiders, a $40 million deficit exists with $20 million in credit and $20 million owed to vendors. What is expected is an 18-month pay-down scheme to be worked out and a selling off of SuperMacs—expected to take place this month.

BIG BLUE SWIMS IN THE SILVERLAKE

Come the 21st of this month, IBM will be opening its doors to the press and to customers to view the much-rumored Silverlake system. The new system, dubbed System 40, is based on the system 3x architecture and will stress system-to-system connectivity. But the big question has been: Will it use the Cipher/IBM 3480-look-alike, .5-in. tape drive? The answer is: No. IBM has decided to offer the system with one of two drive configurations: either a Cipher Data I 880, or a Telex Model 9270, both with the Intelligent Peripheral Interface (IPI). And yes, expect to see capability to support a wide range of communication devices.

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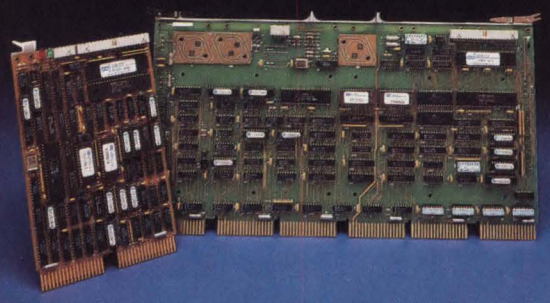

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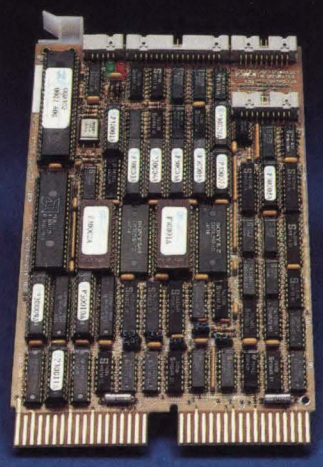

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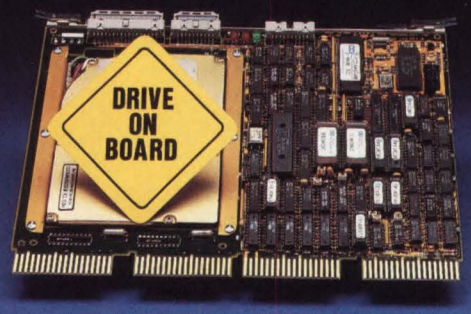

CQD100

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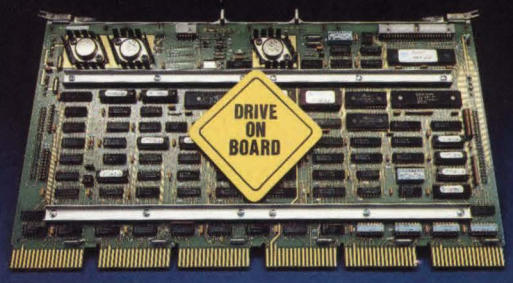

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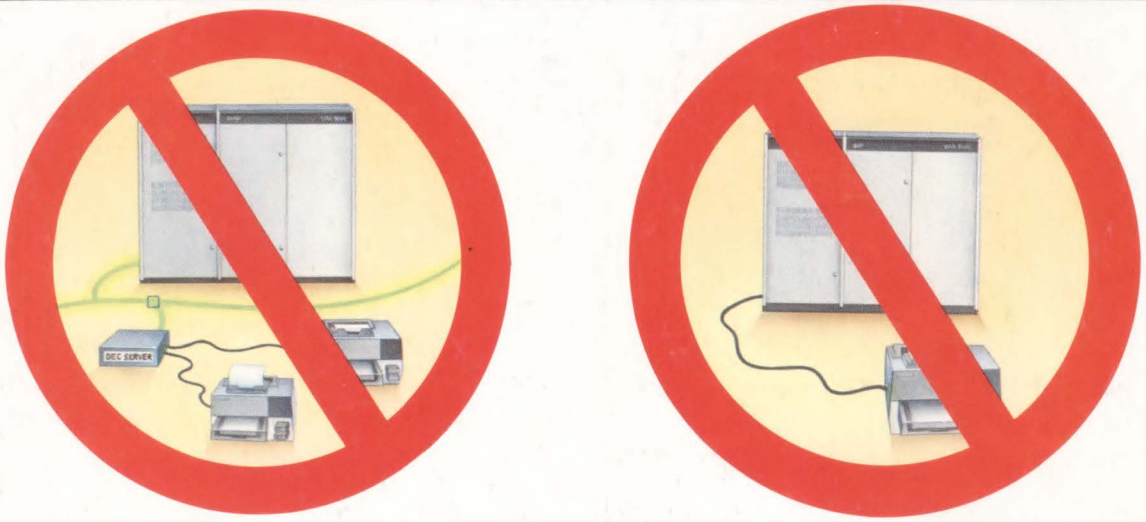

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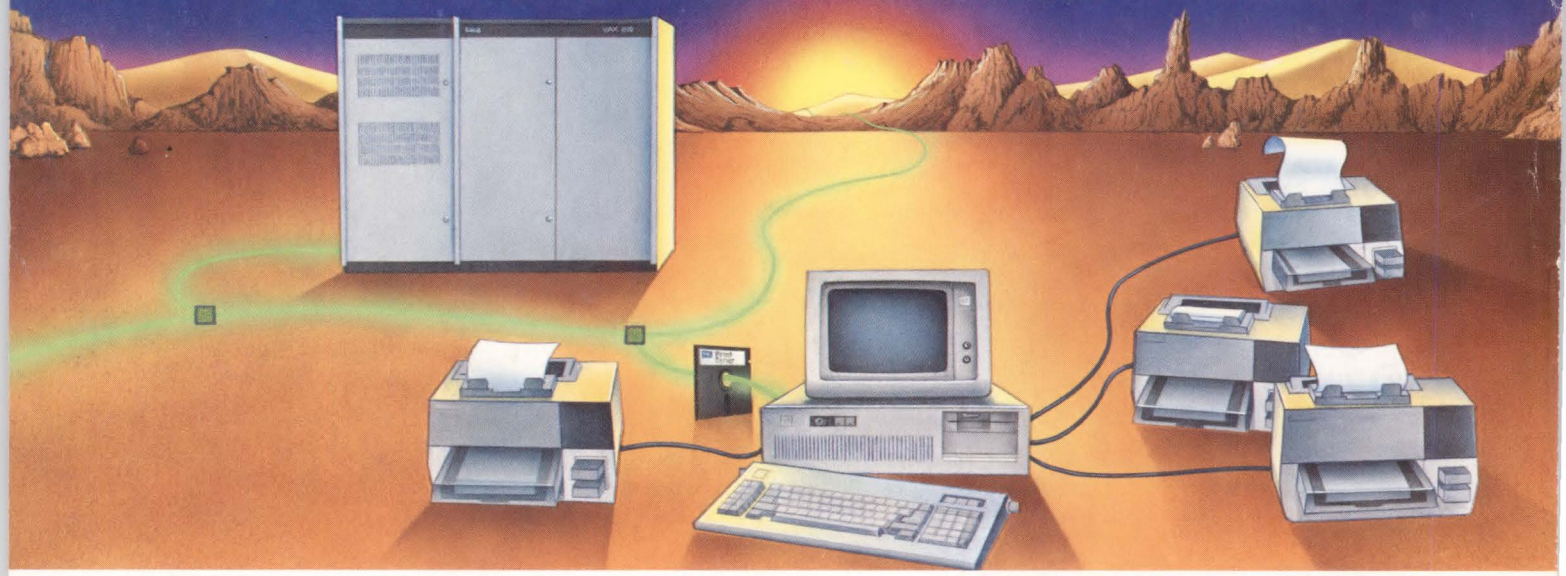

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