

HP Professional

THE INDEPENDENT MAGAZINE FOR NEW WAVE COMPUTING ▲ VOL. 6 NO. 2

▲ FEBRUARY 1992 ▲

NEW WAVE

Network Storage

- ▶ Optical Storage Breaks Out Of Traditional Molds
- ▶ RAID Rewrites The Book On Disk Array Usage
- ▶ Tales Of The Tape — New Capacities For Competing Formats
- ▶ Choosing Between NFS And AFS: Not A Simple Coin Toss



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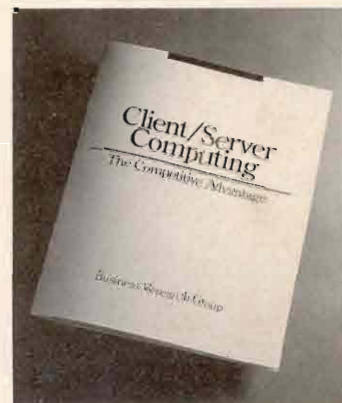
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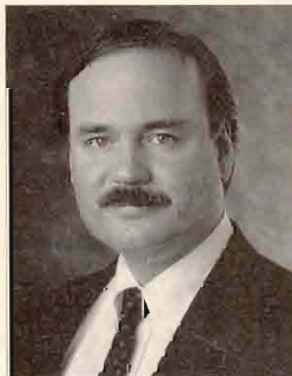


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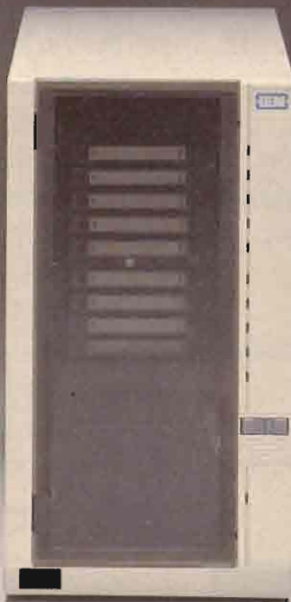
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CIRCLE 122 ON READER CARD

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FEBRUARY 1992

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*Cover Illustration
by Jeanne Berg*



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HP PROFESSIONAL ISSN 0986145X is published monthly by Professional Press, Inc., 101 Witmer Rd., Horsham, PA 19044. Subscriptions are complimentary for qualified U.S. and Canadian sites. Single copy price, including postage \$4. One year subscription rate \$30 U.S. and Canada; \$60 foreign. All orders must be prepaid. For reprints, contact Reprint Management Services, 505 E. Airport Rd., Lancaster, PA 17601; (717) 560-2001, Fax (717) 560-2023. Second Class postage paid at Horsham, PA 19044, and additional mailing offices. POSTMASTER: Send all correspondence and address changes to HP PROFESSIONAL, P.O. 616, 101 Witmer Rd., Horsham, PA 19044. COPYRIGHT © 1990 by Professional Press, Inc. All rights reserved. No part of this publication may be reproduced in any form without written permission from the publisher. All submitted manuscripts, photographs and/or artwork are sent to Professional Press, Inc. at the sole risk of the sender. Neither Professional Press, Inc. nor HP PROFESSIONAL magazine are responsible for any loss or damage. HP PROFESSIONAL is an independent journal not affiliated with Hewlett-Packard Company. HP and Hewlett-Packard are registered trademarks and HP PROFESSIONAL is a trademark of Hewlett-Packard Company.



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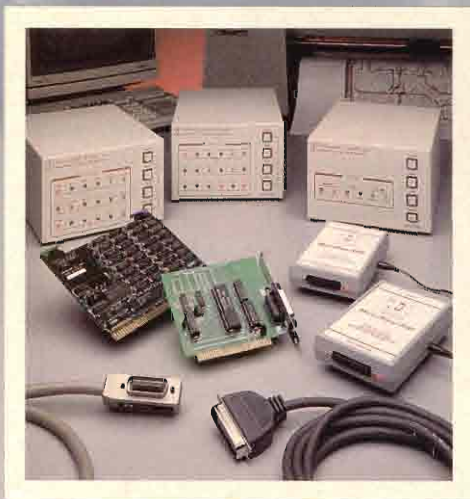
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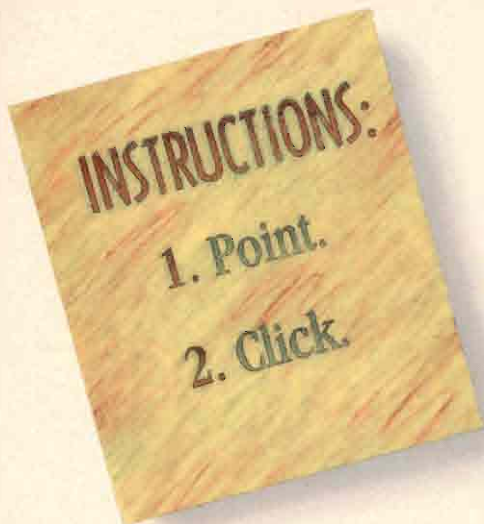
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You may have used other PC-to-host alternatives. And they may have worked just fine – as long as you had just DOS-based PCs. Take a closer look at Session, however, and you'll quickly discover that it's designed to work in today's graphical, point-and-click PC world.

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Session's point-and-click interface gives you easy, familiar access to host information.

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And because Session offers an easy-to-use, graphical front end to your host applications and data, it's your company's first, hassle-free step toward client/server computing.

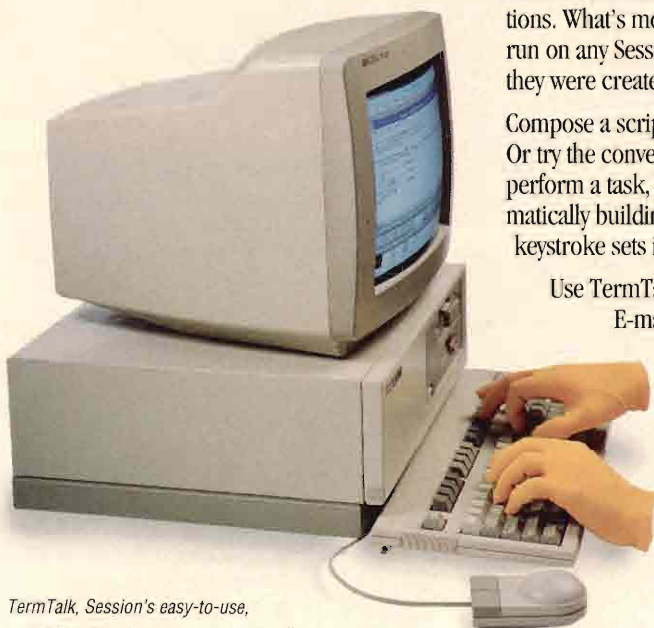
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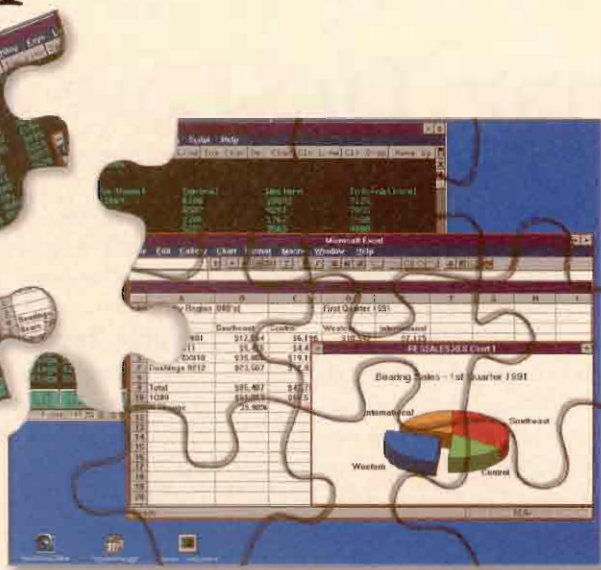
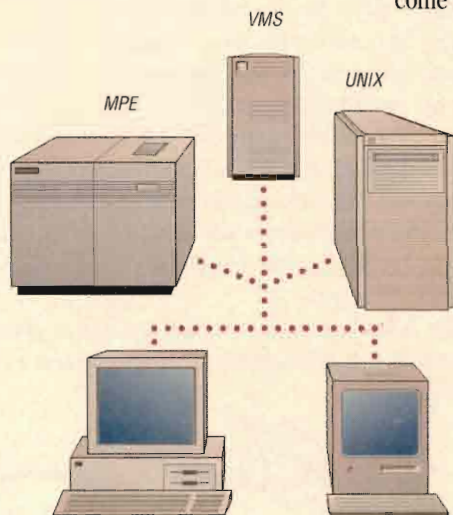
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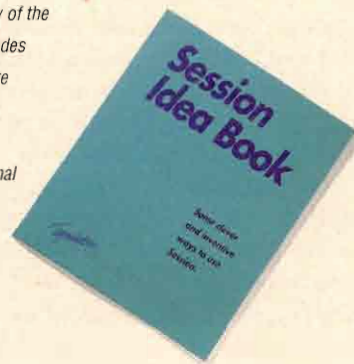
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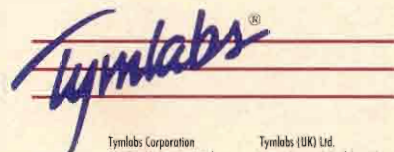
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CIRCLE 243 ON READER CARD

Redefining The Low End



By Grant Evans

Now that the naysayers who doubted HP's ability to maintain its workstation price/performance lead have been stifled by the 705/710 introduction, the second stage of HP's assault on Sun's market dominance has begun. And this time the odds are in HP's favor.

Allow me to steer those folks requiring additional evidence of the acclaim reaped by these systems to the January 13 *Product Viewpoint* published by Aberdeen Group, a Boston-based

computer and communications research firm. The report, entitled "Hewlett-Packard Shoots the Workstation Silver Bullet," concludes that as a result of the 705/710 introduction, workstation decision makers will regard the HP Apollo 700 Series as the "benchmark of excellence" in 1992.

If I didn't know for certain that the Aberdeen Group was an independent, impartial organization, I'd swear that this report was written by some rising star within HP's own marketing department. But it wasn't. It's based on a factual analysis of the workstation market — its players, products and customers.

The majority of these decision makers today buy a motley assortment of boxes — varying in not only in price, but in price/performance and sheer performance qualities. Increasingly, these buyers want low-priced models available for those users within their organizations who don't require a 77-mips workstation that costs more than their annual salary. They want a RISC-based UNIX workstation for under five grand.

In recent years, Sun has maintained its top ranking in the market by positioning itself as the only player to offer a RISC-based UNIX workstation for under \$5,000. Sun recognized the potential represented by this segment of the market, capitalized on it, and as a result has led the workstation market in overall revenues since 1987. Now it looks as if all that is going to change.

Sun's current low-end SPARCstation sells for \$4,995 — just \$5 more than HP's new 705. But while the price difference between the Sun and HP low-end models is negligible, the comparison comes to a screeching halt there. Delivering 34 SPECmarks, HP's new *low-end* model outperforms Sun's *high-end* model. And while the low-end Digital DECstation is priced at \$3,995, it runs at half the speed of the 705. IBM is expected to make low-end additions to its RS/6000 line a few days from this writing, but it is unlikely that the new model(s) will go

below \$6,000 or above 26 SPECmarks. Truly, the 705 alone has opened a huge performance gap among the market's low-end models.

Double Trouble

The success of any low-end workstation hinges on the growth path offered by the rest of its product line. This is where the other half of the new HP low-end enters the picture. While the 705 is the new overall price/performance champ in the market, the 710 is firmly established as the leader in both performance and price/performance in the highly competitive under-\$10,000 arena.

The 710 will appeal to the more technically-oriented users than its little brother. HP believes that the engineering/technical crowd will be lured by the 710's 50 SPECmarks/58 mips/12 mflops — despite the fact that users will pay 90 percent more than the 705 for a 40 percent performance increase.

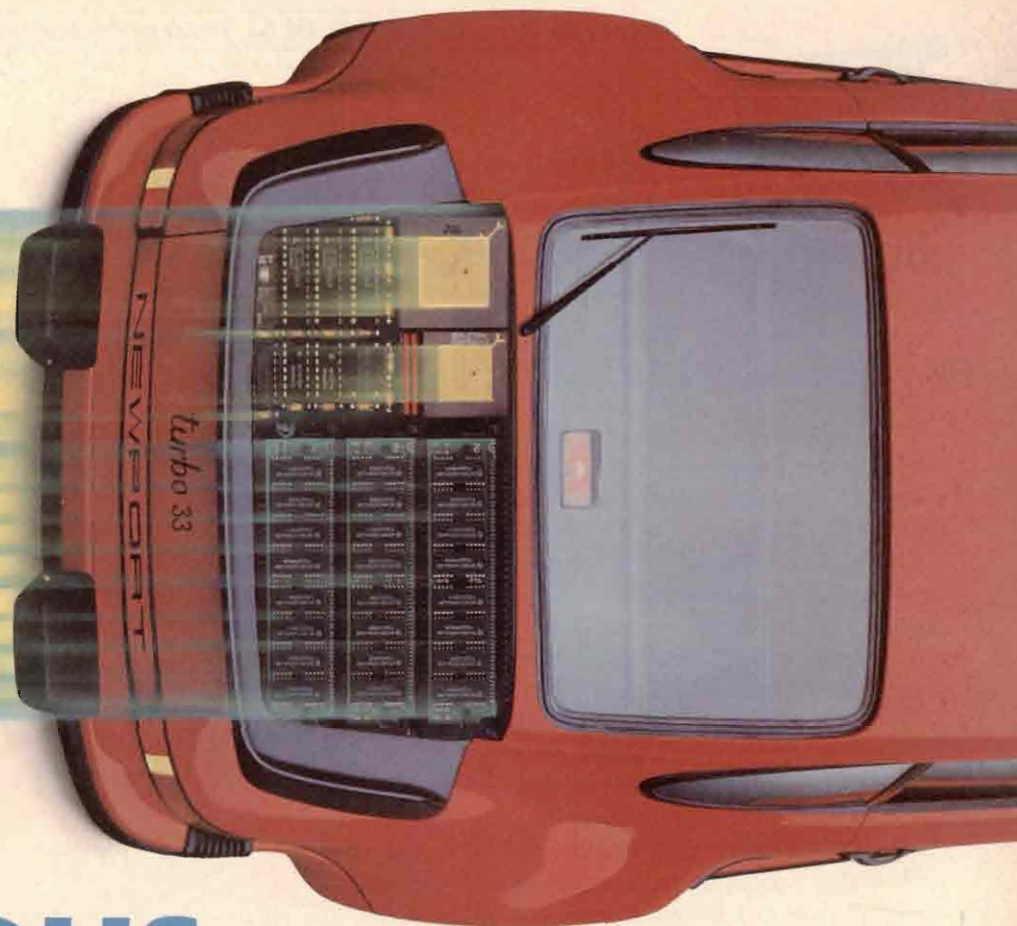
In the past year (which, coincidentally, neatly followed the first Series 700 introduction), we've seen a dramatic decrease in the amount of technological and price/performance leapfrogging taking place in the workstation market. HP has had a lot to do with this, and by raising the price/performance hurdle another few notches, it has all but guaranteed itself a secure spot at the top of the heap.

Beyond the price and price/performance factor, the people who invest in these systems want to standardize on a single, stable operating environment. Such an environment must meet three criteria: It must feature standards-compliant software; it must include desktop models of varying power for different users; and it must allow for flexible configurations.

Although Sun and DEC have supplied the under-\$5,000 workstations required by the market, the market's growth slowed down in the second half of '91. Much of this can be attributed to the inability of any one workstation vendor to satisfy all of the market's needs. By rounding out its product line with the 705 and 710, HP appears poised to meet the market's changing needs. Aberdeen goes so far as to say that HP alone is positioned to meet all of the enterprise-wide requirements of today's workstation users.

Although Aberdeen's silver bullet analogy is nice, I'm beginning to think that 30-megaton neutron bomb is a more suitable description.

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INDUSTRY WATCH

BILL SHARP

Good news is often tough on journalists. Schooled ad

nauseam in the imperatives of negative voice, we suffer grave discomfiture in the face of all things sweet and nice. So, naturally, when HP announced a second straight year of multiuser UNIX systems growth in excess of 50 percent, I nearly doubled over in pain — explaining good news can be a bear, folks.

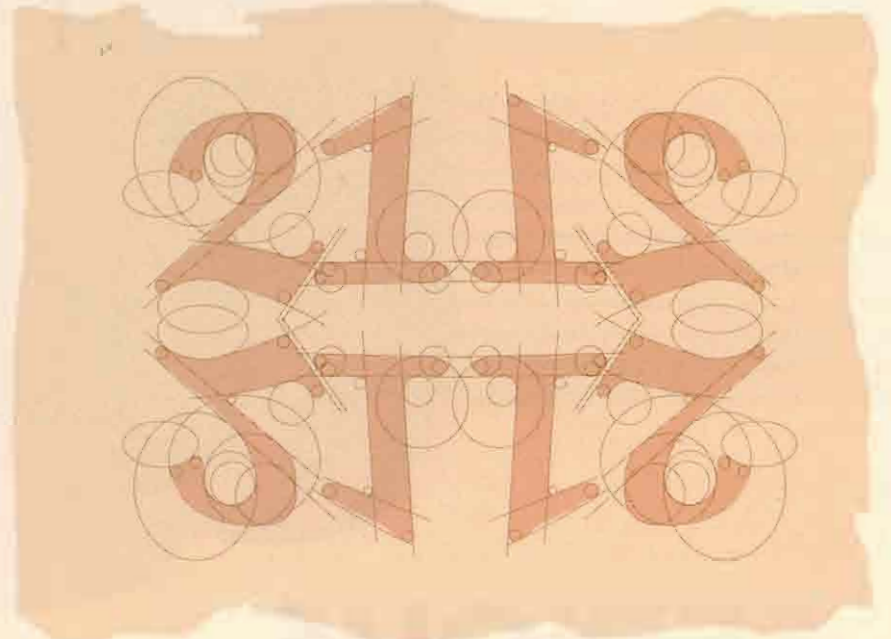
It's no use asking HP why it happened. All they're capable of telling us is good reasons for the good news, and no self-respecting, sneaky, funny-hat-wearing reporter worth the trade-in value of a 1947 Royal typewriter will ever accept good news reasons for good news. Just as all bad news has bad news causes, so too must all good news have sinister origins. This is the well-known, time-honored and unquestionable journalistic precept called "Universal Cynicism."

I have no choice but to explore the *real* reasons for HP's recent success. In fairness, of course, we will represent more than one point of view, so here are three explanations from 1) HP, 2) a respected industry consultant, and 3) a brilliant, imaginative journalist.

All According To Plan

Bernard Guidon's smile could not have been broader without causing him serious injury. As general manager of HP's General Systems Division, Guidon manages the HP-UX multiuser systems business. He was scheduled to appear before industry consultants within an hour to announce 51 percent growth in commercial HP-UX for fiscal year 1991, so he had good reason to smile.

Guidon sites HP's aggressive main-



frame downsizing program as a significant reason for success in commercial UNIX. The program couples the very significant cost savings of moving to HP's RISC systems from IBM or other large systems together with relationships with mainframe software providers, conversion tool vendors and systems integrators working to make the move easy.

Guidon also argues that HP's biggest rivals, DEC and IBM, are both out of touch with customers and are failing to respond to their needs effectively. "IBM moves only after it is clear where the market is going," he says. "The market used to move slowly enough to allow them to do that, but now it is moving too fast to wait."

That is why IBM is breaking off business units to create more responsive pieces of its total business. Meanwhile, says Guidon, DEC insists on believing that the market will move where it tells it to move, isolating itself.

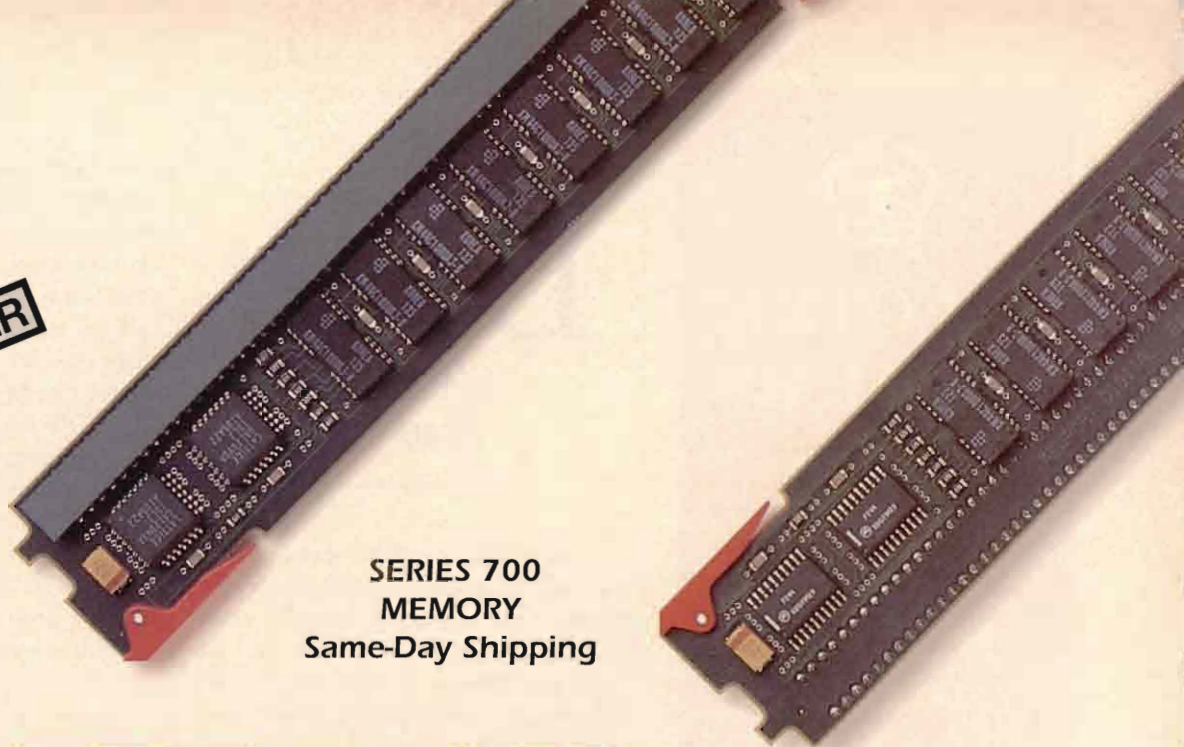
HP, he believes, is providing price and price/performance, open systems to serve

customer needs, and downsizing help to reduce costs in a poor economy.

They Started Small

Let's face it, if HP started out this year having only sold one computer, and managed to ship out just one-half of another UNIX system, that would be 50 percent growth. International Data Corp. (IDC; Framingham, MA), is willing to grant that there are quite a few HP multiuser UNIX systems out there, but maybe not a vast number, says IDC Analyst Carolyn Osgood. Her explanation of the high growth rate is simply that "HP is running on a small installed base, so growth is going to be higher.

"HP has done an excellent job of merchandizing open systems at the same time that DEC and IBM have dragged their feet in embracing real open products." This gives HP "an aura of openness" that has become a major advantage in allowing HP to penetrate new markets, even in a poor economy.



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CIRCLE 196 ON READER CARD

But clearly there
must be other
factors at
work here.

Osgood cites HP's good UNIX multiuser performance, coupled with a reputation for open systems and a small installed base as the primary reasons for high growth rates. In support of her argument, HP's growth rate in fiscal year 1990 was 67 percent, with 51 percent in fiscal year 1991. An exploding sales business with a small base would experience a large jump in percentage growth, followed by decreasing numbers in subsequent years. The only way to resolve this is to get installed base numbers on UNIX multiuser systems from HP, which they are loathe to provide.

The Da Vinci Factor

All the above is well and good, but clearly there *must* be other factors at work here — and I have found evidence. During recent travels in California, I saw dramatic increases in the number of mirrors at HP facilities. Bathrooms now have mirrors twice the size seen in earlier visits. Employees were walking the halls with mirrors of various sizes.

This curious influx of mirrors at HP

seems silly unless you know your history. Leonardo Da Vinci, Renaissance Italian painter, sculptor, architect and engineer, loved mirrors. His journals were written backwards so they could only be deciphered with a mirror — yes, a mirror. This reporter has uncovered strong evidence that in its efforts to maintain secrecy, HP has adopted that old standby of cryptography — backward writing. And it was this move to backwards writing that, in effect, resulted in the company reporting 51 percent growth in commercial UNIX.

Few people know that HP's actual growth in multiuser UNIX was in fact 21 percent for fiscal year 1991. This is still very good considering the economy, and better than the competition, but far from the phenomenal 51 percent reported. So, you may ask, how did the numbers get switched? Here's my theory: During the dry run presentation before the board of directors, a staff member held up the encoded card with the 21 percent growth printed on it in huge letters and then forgot to hold up his decoder mirror to reverse the figure, plus, he had the card upside down.

The innocent speaker gave the number he saw, which looked to him like 51 percent. Aghast staffers, unwilling to explain the gaff to top management, decided it was easier to go with 51 percent then to explain that growth was in fact 21 percent. And *that*, friends, is the *real* story behind HP's 51 percent growth in commercial HP-UX multiuser systems for fiscal year '91. ■

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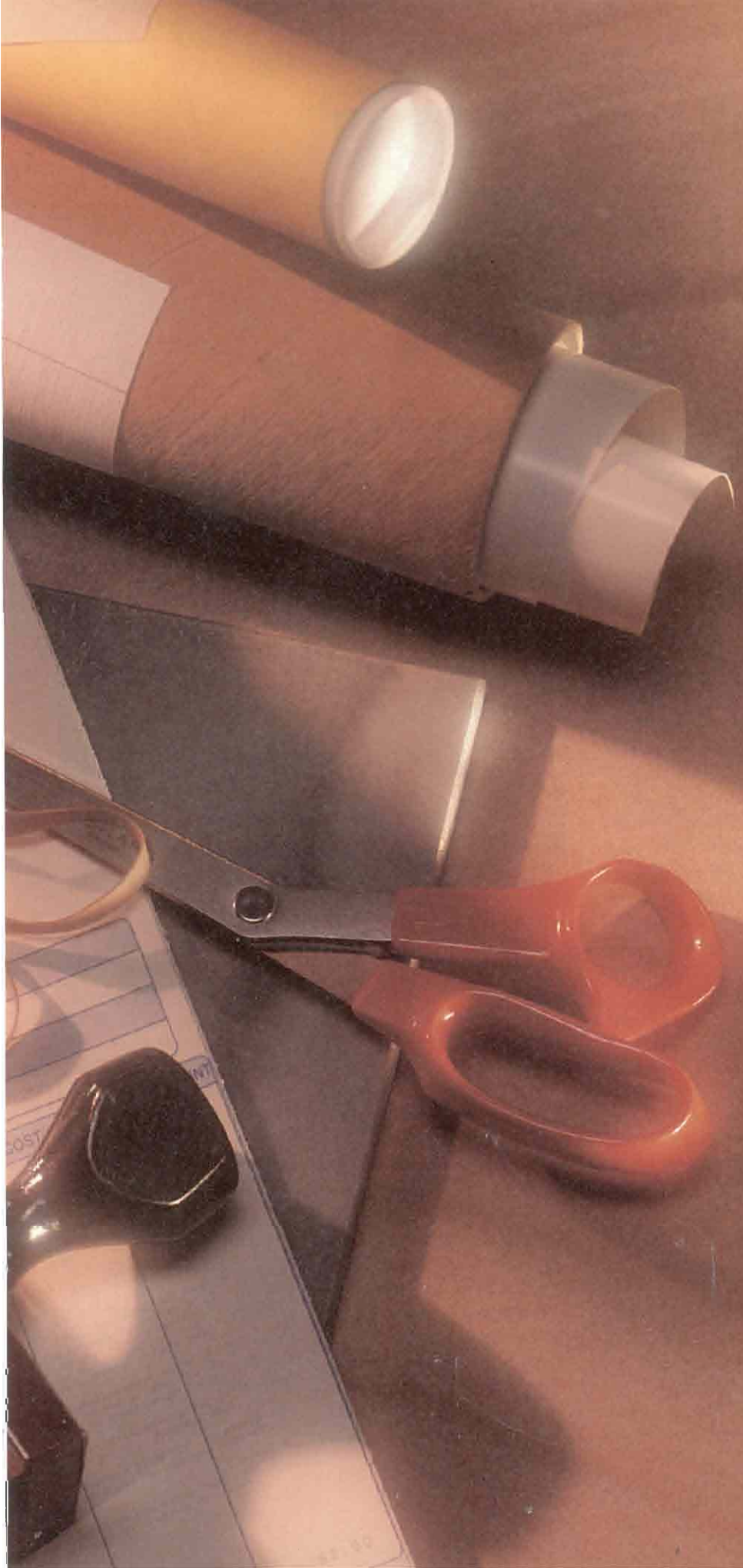
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CIRCLE 111 ON READER CARD

705, 710 Fill Workstation Gaps

HP's New Low-End Models Open Some Eyes

If you're in the market for a workstation or X terminal, and planning to buy anytime this year, your decision is simple: Buy HP Series 700 products. That's what Gary Eichhorn, general manager of HP's Workstation Business Unit, would have you believe, and there are quite a number of folks who agree with him.

Last month, just 10 months after redefining the top end of the workstation market with its Series 700 models 720, 730 and 750 workstations, HP did the same to the low end with models 705 and 710.

HP's new model 705 sells for a mere \$4,990, but outperforms the best workstations from Sun and DEC with 35 mips and 34 SPECmarks. And that is the *bottom* of HP's current lineup.

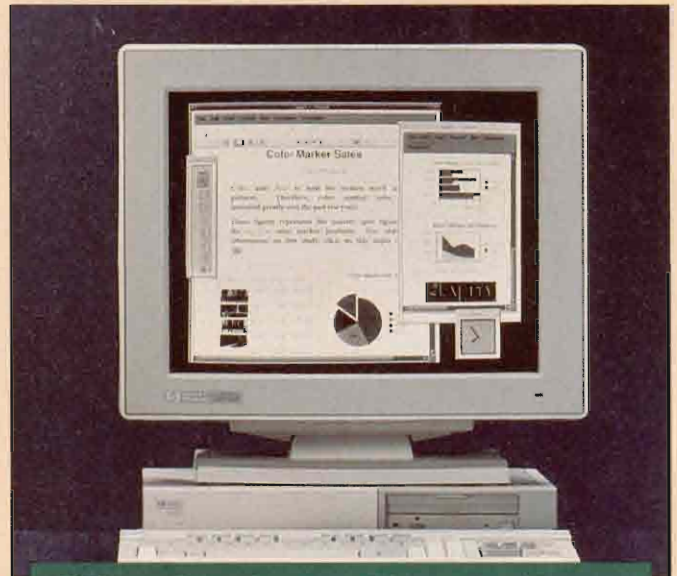
The new model 710, priced at \$9,490 and described in last month's issue, provides 57 mips and 57 SPECmarks. (Please note that the price of the Model 710 changed in the final announcement by HP: The price noted in the January issue was changed by HP

when the company decided to bring its Model 705 to market sooner than expected — just after your January issue went to press.)

So what is this 705 thing? It is a lower-performance version of the Model 710. That means the processor runs at a slower clock speed. While the 710 functions at 50 MHz, the 705 works at 35 MHz. This in turn allows HP to save on some of the other components because they can function at a slower speed. An example is the standard inline SIMMs used in the 705 rather than the custom memory of the 710.

Another big savings is going to greyscale rather than color, and implementing HP's graphics capabilities on the same single board as the rest of the system. Graphics capabilities in the product are derived from the CRX/GRX products used with the upper models of the line.

The pizza-box case is the same as that used with the Model 710 and for the 700 series X terminals. Except for the model number plate, all three look identical. The product comes standard with 8 MB of internal memory,



HP's new 705 workstation redefines price/performance.

which some folks argue is not enough, but it is expandable to 64 MB. The 16 MB version sells for \$6,340.

Model 705's base price is diskless, but there is space to add two internal disks for up to 840 MB of mass storage, and external mass storage can go as high as 9 GB. The backplane for this model is the same as the 710, with two serial ports, parallel, external SCSI-2, audio port and ethernet connectors.

What all this means is that for a moderate decrease in performance, HP was able to drop the price of the 705 quite a bit, down to where no other vendor in the low end of the market can get

near the price/performance of the product.

You would expect HP to be excited about the product, and they are: Pierre Bouchard, product line manager for volume (low-priced) workstation products says, "We expect it will be a very popular machine and we anticipate some very high sales activity." This is corporate lingo for what I heard in a less formal conversation: "We're going to sell tons of these!"

Market analysts out there seem to agree. In a market analysis report HP included in all its press kits, Aberdeen Group Inc. (Boston, MA),

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CIRCLE 240 ON READER CARD

writes, "Aberdeen believes that with the introduction of the HP 705, the majority of value-driven workstation buyers for new standalone applications will give HP their business over Sun, Digital, IBM and Silicon Graphics."

Nancy Battey, director of workstation research for International Data Corp. (Mountain View, CA), agrees that the 705 introduction is important as a price point, but believes that the 710 will be sold in greater volume.

"Seventy to eighty percent of customers require color

HP's Gary Eichhorn:
"We expect to be a full generation ahead...for some time to come."

systems, and the 710 is also more expandable," she says. "But the 705 will appeal to commercial and price sensitive accounts HP wants to penetrate."

She adds that the new products "won't kill Sun, but they will put them on the



defensive for a change." Meanwhile, Eichhorn, who just a few months ago was one of the rising stars at Digi-

tal Equipment Corp., has the helm of a fast ship that is tearing up the workstation waters around all comers. He seems to be behind the aggressive early appearance of the 705, and has more plans in store.

DEC, Sun and Silicon Graphics all have chip problems that are preventing them from competing effectively for the time being, and HP plans to make the most of it. "We expect to be a full generation ahead of them for some time to come," Eichhorn says. He expects to still be leading the pack at the end of this year, "not just in semiconductor power, but in graphics and X performance, independent of the processor."

Eichhorn expects to take some significant business not only from his competitors, but from the commercial world so dominated by PCs, as well. To make that happen, HP's new reseller channels will be up and running over the course of the year, and, says Eichhorn, "The 705 is the fuel for the new reseller channel. This is really the gas in the tank that allows these people to go full force. They will be taking this product and aggressively moving toward their goals in the program."

Over the past several years, HP's efforts to make it big in the workstation business have been criticized for being ineffective. One old hand there used to retort, "Ever try to turn a battleship?" Could be the HP workstation battleship has been transformed into some kind of a speedboat. Whatever it is, it's moving fast!—*Bill Sharp, Technical Editor*

HP OpenSTORE Cashes In

Fujitsu Adds POS Strength; Two Major Sales Announced

On the unofficial first birthday of its OpenSTORE architecture, HP announced a partnership with Fujitsu Systems of America (FSA) under which FSA will integrate the HP 9000 Series 800 in-store processor with its own Atrium9000 POS products.

Speaking at a briefing luncheon held in conjunction with last month's National Retail Federation (NRF) show in New York, representatives of both companies said that the alliance will result in a complete store-level solution for retailers requiring a UNIX-based platform combined with a point-of-sale (POS) system operating in an open systems environment.

To demonstrate the growing appeal that open systems solutions represent to retailers, HP announced sales to two leading retail chains. Home Depot, the nation's largest

home-improvement retail chain, and Strawbridge & Clothier, a \$1 billion East Coast department store chain, announced that they will migrate from proprietary systems to HP OpenSTORE. HP estimates the value of the two deals to be about \$7 million.

Thomas Rittenhouse, vice president and controller for the Philadelphia-based Strawbridge & Clothier, says he has had open-systems intentions for a long time. "It behooves us to move to an open systems architecture," Rittenhouse said.

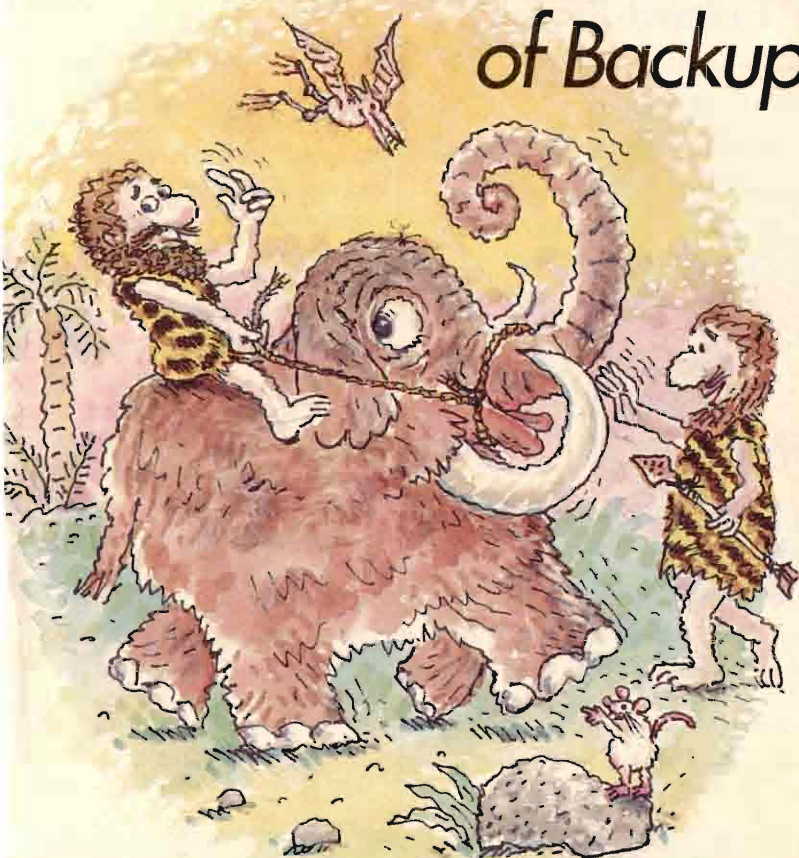
OpenSTORE is HP's comprehensive, integrated store-automation solution based on open systems. Targeted at large retail organizations, OpenSTORE consists of hardware, software, integrations, consulting, implementation services and customer support.

"Retailers are facing chal-

lenges to reduce operating costs, improve customer service and store performance. Technology can play a role there," said Jeffery Siegel, HP's store automation marketing manager.

According to Siegel, the past year has been busy with the introduction of HP's second-generation RISC-based store system and the broadening of OpenSTORE to include features such as network management and helpdesk automation. Momentum was gained through the addition of OpenSTORE partners on all layers of the architecture. Today, there are over 50 such partners, bolstering HP's ability to help retailers migrate to open systems from numerous proprietary platforms and address a broad range of application requirements. —*Grant Evans, Managing Editor*

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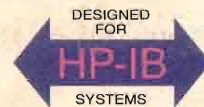


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CIRCLE 105 ON READER CARD

HP-Novell Pact Pushes NetWare Toward RISC

Network OS Will Run Directly On PA-RISC Chip By 1993

HP and Novell closed out 1991 with a strategic multiyear relationship which will result in a native version of NetWare to run directly on HP's PA-RISC platforms. In addition, HP will distribute Novell products, including NetWare, through its direct sales channels and will offer NetWare site licenses to some of its larger accounts.

Although 1991 was a year replete with partnerships and alliances for the Provo, Utah-based networking giant, Novell's collaboration with HP is viewed by many as being not only the most extensive, but the most significant. The coming version of NetWare for PA-RISC will mark the first time the popular operating system will be available for any RISC-based platform.

NetWare has been ported to numerous other platforms in the past, but always running on top of the operating system as opposed to running directly on the microprocessor. As a result, ported versions have lacked the speed associated with native NetWare — which runs directly on the Intel chip. When the PA-RISC version of NetWare is released in 1993, it will boast the performance advantages of the native NetWare with the power of RISC architecture. This will enable companies to integrate PA-RISC servers within their NetWare environments.

In addition, HP and Novell announced that some



HP President John Young (left) and Novell Chairman Ray Noorda at the announcement of their companies' partnership.

elements of HP NewWave desktop manager and network licensing (NetLS) will be incorporated into NetWare, providing increased functionality for Novell net-

working solutions. The incorporation of these agent tasks is expected to reduce the time administering a NetWare network by as much as 30 percent.

HP will also market and support NetWare, running on top of the HP-UX operating system, for the HP 9000. The move is designed to complement HP's current offering of NetWare for the HP 3000 running on top of MPE/iX. HP 9000 NetWare licenses are slated for availability in the first quarter of this year ranging in price from \$2,725 to \$24,900.

The two companies also are pursuing the integration of Novell's MHS-based messaging solution with HP's messaging solution using X.400 and X.500 protocols. — *Grant Evans, Managing Editor*

Cognos Turns To The Desktop

New Division To Market PowerPlay And Impromptu

After years of focusing its efforts on providing tools for the midrange market, Cognos Inc. (Ottawa) has diversified and created a new division to address the burgeoning desktop software market.

Cognos' new Desktop Software Division will market the company's PowerPlay desktop executive information system (EIS) that runs under HP NewWave and Microsoft Windows environments, and Impromptu, a Windows-based desktop SQL query tool. In addition, Cognos announced that PowerPlay will now support the Apple Macintosh to reflect

the growing popularity of that platform in commercial environments.

As part of the desktop division introduction, Cognos announced a partnership with Dun & Bradstreet Software (D&B Software), under which D&B will incorporate and resell PowerPlay with its future client-server applications.

According to Jeffrey Papows, Cognos president and COO, the formation of the desktop division is important from two perspectives. Papows noted that although the company's midrange emphasis will continue unabated, Cognos will direct a much larger effort on the desktop market to rapidly broaden

and diversify its user base. In addition, Papows noted, the announcement signals the wide-reaching acceptance of Cognos software as "the pre-eminent client-server based reporting standard."

HP and Cognos have a long-standing relationship. Cognos' PowerHouse is the most widely installed application development software on HP systems. According to Cognos, PowerPlay's support for HP's NewWave environment will bolster Cognos' position as a solutions provider in the HP market.

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CIRCLE 112 ON READER CARD

Rocky Mountain BASIC Lives

First Annual Conference Dubbed "RMB Strategy For The '90s"

HP has joined TransEra Inc. and TSA to co-sponsor the International User Association (IUA) for Rocky Mountain BASIC Users' first annual conference, "RMB Strategy for the '90s," to be held March 18-20 at the Long Beach, CA Hilton.

The conference will bring together a variety of RMB experts and users, and will feature keynote addresses by Andy Rodgers, HP BASIC business unit manager, and Al Arbon, TransEra's HTBasic product manager. In addition



to management roundtables, the conference will feature a vendor showcase by the sponsors and third parties.

HP cited its commitment

to the RMB environment as a reason for co-sponsoring the show. HP is placing new emphasis on HP BASIC as an operating environment. The

recent release of HP BASIC Plus, a GUI based on the Motif look and feel, has revitalized the RMB market. HP has stated that it will continue to release future enhancements to the RMB environment.

Rocky Mountain BASIC is a generic name for HP's Series 200/300 workstation BASIC and TransEra's HTBasic. According to HP, there are some 300,000 RMB users worldwide.

For more information, contact the IUA at (800) 488-7560.

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For Your Information

■ SATCOM selected the UNIFACE 4GL toolset to build its next generation of logistics, maintenance and financial applications for the HP 3000 and other platforms and operating systems, including HP-UX and MPE/iX. (804) 499-9803 (ext. 202).

■ HP and TI formed a relationship to make TI's integrated CASE (I-CASE) solution, Information Engineering Facility (IEF), available on UNIX-based HP 9000 commercial computers. (408) 447-5456.

■ The International Standards Organization (ISO) voted to standardize the Exabyte 8mm data format used in its EXB-8200 8mm Cartridge Tape Subsystem. (303) 447-7434.

■ PeopleSoft expanded its N. American operations by opening Canadian offices in Toronto, Ontario and Vancouver, British Columbia.

PeopleSoft develops PS/HRMS a client-server, human resources, benefits and payroll system. (510) 946-9460 or in Canada, (416) 777-6706.

■ Walker Richer & Quinn shipped version 3.7 of its HP terminal emulator, Reflection 1 for Windows. New features include 132-column mode, support for dynamic data exchange, color configuration and keyboard mapping. (206) 324-0350.

■ R-Byte and Fujitsu Ten intend to cooperate in the development, manufacture and distribution of the R-Byte 3.5-inch, 4mm DDS/DAT drive, RB100. (408) 452-8860.

■ A federal appeals court overturned a \$1.5 million judgement against Hewlett-Packard saying that Hypoint Technology, who won the award couldn't pursue the claim under federal antitrust law. In 1987, Hypoint Technology accused

HP of an illegal market monopoly in the service market for HP computers.

■ HP now offers a stand-alone 4 mm HP DAT backup solution for Apple Macintosh Computers. The solution is based on HP's 3.5-inch DAT drive which offers up to 2 GB on a 90-meter DDS Cassette. (408) 447-7371.

■ Intergraph Corp ported its CAD software, MicroStation, to HP's PA-RISC based 9000/700 Series workstations. (205) 730-2940.

■ HP and Madge Networks Inc. signed an OEM agreement whereby HP will resell the Madge Smart 16/4 EISA Ringnode as its Token Ring network interface card for HP Apollo 9000 Series 700 systems. (408) 441-1300.

■ HP now supports all three LAN technologies, Ethernet/802.3, FDDI and in a recent announcement, IBM's industry-standard Token Ring

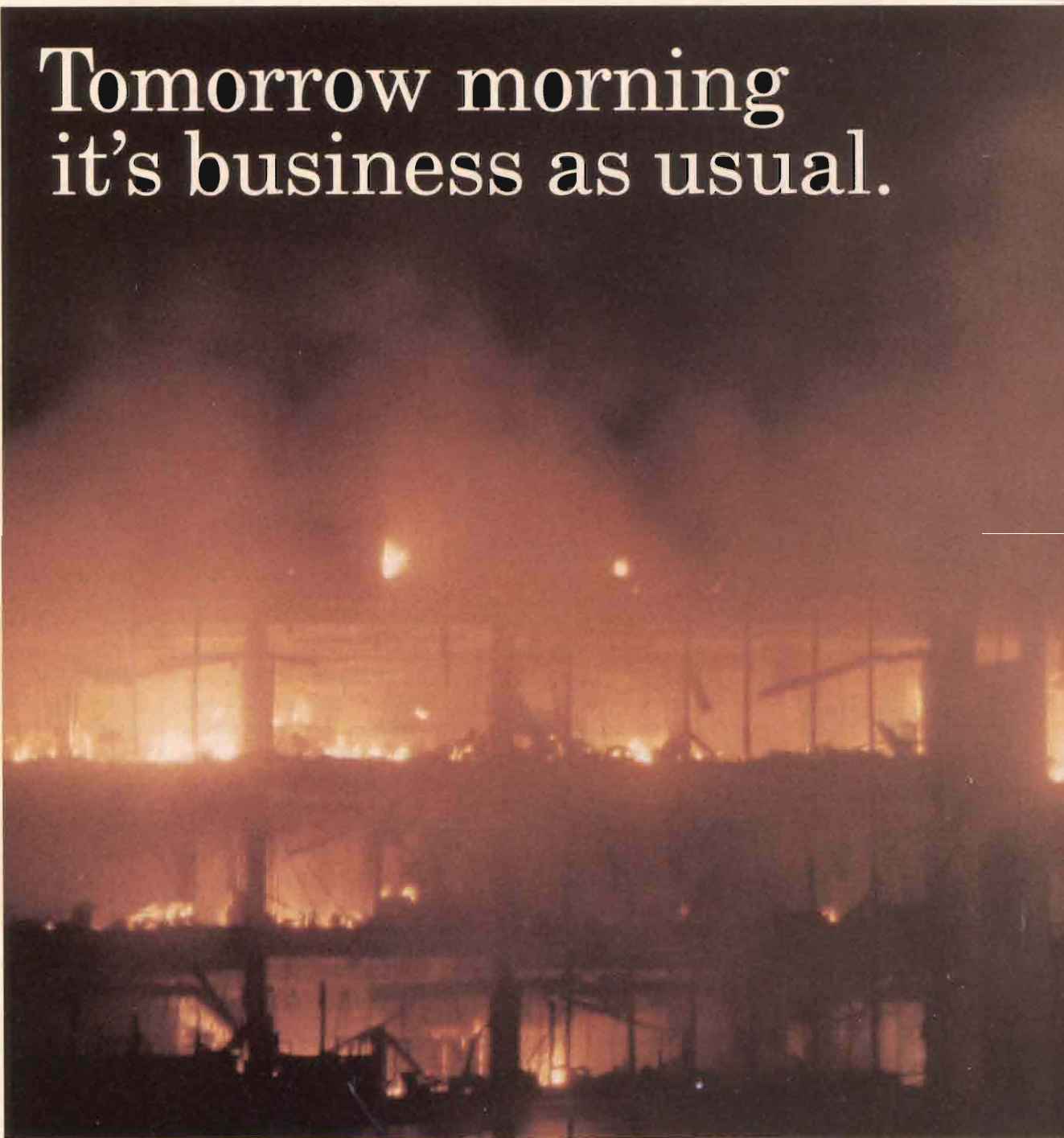
networking protocol, which allows all HP high-performance RISC-based systems to be fully integrated into installed Token Ring networks.

■ R Squared and Andataco joined forces to become Andataco Squared, a value added reseller specializing in UNIX workstation and peripheral products.

The new entity's focus will be add-on and add-in products for users and resellers of HP Apollo, Sun, Silicon Graphics, DEC and IBM RS/6000 workstations. (619) 453-9191.

■ Oracle Corp. now offers its ORACLE RDBMS application development tools, gateway products and applications for HP's new 9X7 (NOVA) line of RISC computers. With this release, Oracle products on HP MPE/iX will move to user-based pricing. (415) 506-3117.

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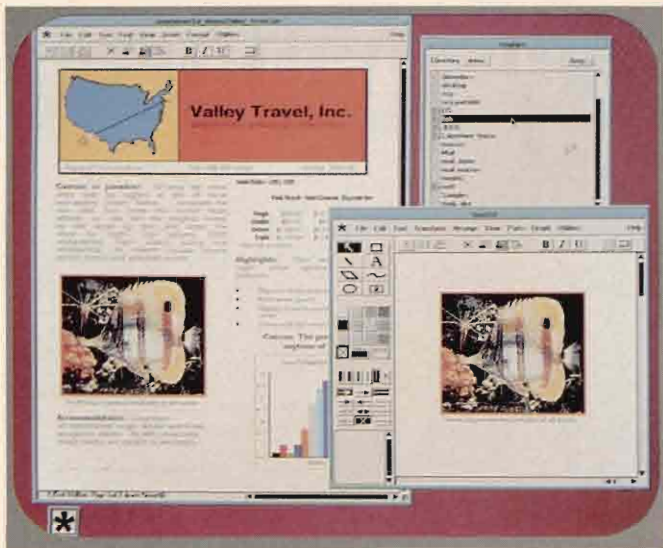
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Another * For The Record Books



Applix' Aster*x Puts Technology To Practical Use

Although client-server computing and X Windows have been in our computing vocabularies for some time, for many of us the best displays of these technologies are found along the aisles at trade shows. Finding practical, everyday applications is another matter. You often wind up thinking, "Great technology, but what do I do with it?"

Fortunately, the dearth of applications is being remedied. Applix Inc.'s Aster*x brings several office applications to UNIX workstations that you might have believed only existed for PCs and traditional midrange systems.

Aster*x Words is a full-function WYSIWYG word processor. Features include multiple fonts; style guides and templates (that can be customized); international spell checkers and thesauri; columns, table of contents and index generation; multiple level lists and merge.

With Words, you can take advantage of the X-clipboard cut and paste facilities. Audio and video support let you express yourself beyond the written word. Multiple undo and redo lets you change your mind about what you wrote. Text, spreadsheets and graphics come together into one dynamic document through live links. Modifications made in one facet of your document are automatically reflected in the compound document.

Aster*x Graphics features a color pixel editor, X Window screen capture and importing of HPGL, TIFF and other file formats. Basic drawing tools such as ellipses, lines and polylines are included. Images can be refined further with Graphics' transformation tools. And, objects can be stored in a personal library.

Aster*x Spreadsheets provides full spreadsheet functionality with the financial, statistical, string and mathematical functions. Spreadsheet cell styles can be customized with gridlines, various typefaces, styles, sizes and color. Graphs can be generated from worksheet data and edited. Realtime data can be fed into an Aster*x spreadsheet from the outside. Spreadsheets can do goal seeking and several spreadsheets can be linked together.

Aster*x Mail ties it all together, even if you're on another platform. It uses the standard UNIX sendmail transport. Features include

compound document attachment and audio support and documents sent can be transparently converted to a format preferred by the recipient. It also offers system-wide and personal distribution lists. Messages can be sorted and queried for fast access, and mail can be marked as certified, urgent and reply-requested.

Aster*x goes one step further with its Extension Language Facility (ELF) and Macro support. ELF and macros provide the functions, commands and editors required to tailor your environment to your liking.

Realizing the world doesn't follow one big, happy protocol (contrary to popular belief!), Aster*x provides Filter Packs allowing you to import and export data to and from various other formats. The Standard Filter Pack includes filters for ASCII, DCA, DIF/XDIF, EPSI, HPGL, Microsoft Window bitmap, SYLK, TIFF and others. Optional Filter Packs can be purchased to provide transparent conversion of data to and from packages such as WordPerfect, Framemaker and MacPaint.

Aster*x is supported on the HP 9000 and HP Apollo 9000 Series minicomputers and workstations. Prices start at \$695. — David B. Miller, Senior Technical Editor

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CIRCLE 302 ON READER CARD



- 46. Sends com...
- 47. Computer-automated test (acronym).
- 49. Gathering data.
- 56. Hyperbolic sin.
- 58. Breaks the 640K _____ barrier.
- 59. **The perfect language fit for technical users.**
- 61. IBM PS2 bus (abbrev.)
- 71. Automation technique for test & measurement.
- 77. Online keyword documentation.

- Across**
- 1. Rocky Mountain Basic compatible
 - 3. Fast Fourier Transform (acronym)
 - 5. HTBasic 386 Compiler.
 - 6. Complex numbers.
 - 7. HTBasic's price is _____

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can make developing your application much less puzzling.

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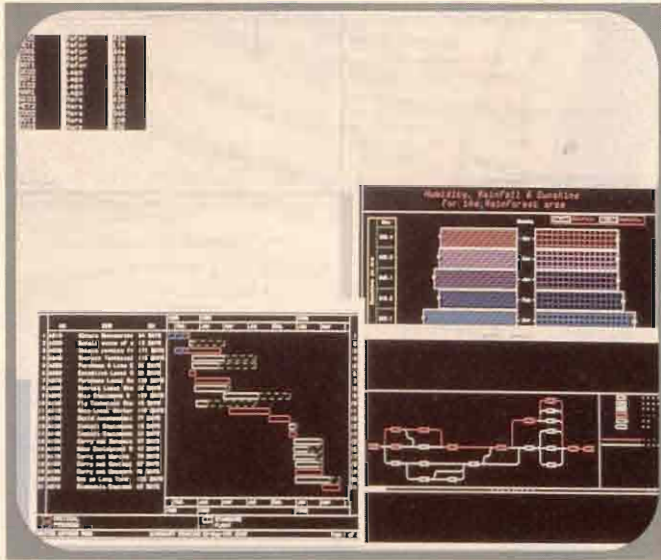
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CIRCLE 165 ON READER CARD

Appetizing Applications



Lucas Management
Systems' ARTEMIS
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Management
Cooks Up A Recipe
For Success

Computing projects, like multi-course meals, require the properly timed execution of several preparatory activities to achieve the desired outcome. ARTEMIS 7000, from Lucas Management Systems (Fairfax, VA) helps coordinate a processing feast for the pickiest computing connoisseur.

ARTEMIS 7000, a project management information system for your HP 9000 workstation, supports a buffet of applications including arrow and precedence networks, full critical path analysis, cost integration, and resource loading and leveling.

On the financial side of the table, you can specify a budget amount for each activity, track actual expenditures and cash flow, and compute cost variances and report earned value.

The ARTEMIS main menu displays all ARTEMIS

applications. Going a la carte, we focused on ARTEMIS Project, with its pull-down menus including, Setup, Add, Modify, Process, Report and Utility. The arrows keys let you navigate the menus and select options.

The choices are self explanatory. Setup lets you create new projects, Add permits adding activities and resources. Modify lets you do just that. Process lets you analyze activities, store plans, create summaries, as well as set target dates and project items. The Report options generate ARTEMIS report graphs, or allows you to create your own reports.

Like a good recipe, ARTEMIS Project provides helpful hints throughout its menu selections. Once all preliminary information is entered, ARTEMIS Project sets up the tables and calendar for your project.

To concoct a new project in ARTEMIS Project, add the following ingredients: activities, logic constraints, resources, then set up a project calendar to taste, and finally create a resource pool.

Once activities, logic constraints and resources have been defined, you can analyze the project and create a preliminary project schedule. You can then determine the early start, late start, early finish and late finish dates for the activities in your project.

The standard ARTEMIS Project report options are listed on a Report menu and include Activity, Resource,

Schedule, Level, Cost, Item, Graph and Utility. A Browse screen, containing Display, Connections, Menu and Status Windows, enables users to review details of a given project.

A key ingredient of ARTEMIS Project is its ability to perform "what if" analysis, to help you foresee the possible results of a project before any commitments are made.

You can recalculate the project schedule using the options on the Process menu. Following reprocessing the project, you can generate new project reports that show the results of the changes made. You can then compare the new results with the previous ones and determine the impact of variances before they occur.

ARTEMIS Project is priced at \$10,450 for a single user language license, and \$3,155 per user (50 user minimum) for the 50 user language license.

ARTEMIS Project runs on the HP 9000 Series 800/300/400/700; DEC VAX; IBM RS/6000 and Sun SPARC platforms. With its pull-down menus and extensive online help, ARTEMIS Project should sate the most demanding project palate. — *Charlie Simpson, Technical Editor*

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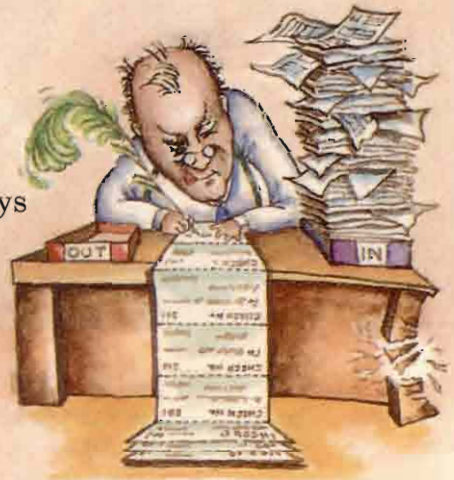
This is the 2^{long} time that passes
while you wait for the forms
that 2^{HIGH} printed.

This is your 2^{big} warehouse
that stores the forms that
2^{HIGH} printed.



This is the 2^{many} trips lugging around
the forms that 2^{HIGH} printed.

This is the 2^{busy} accountant who pays
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CIRCLE 265 ON READER CARD





Optimizing Optical Storage

**Advances Such As Rewritable Disks, Jukebox
Devices And Multifunction Drives Are Upping
The Appeal Of Optical Storage**

By Ron Levine

At last, optical storage devices appear to be gaining widespread acceptance among network users. Although optical technology has long held the promise of decreasing archival costs while improving network data storage and retrieval capabilities, it has, until recently, been limited primarily to specific applications.

For years, systems installed in medical, publishing, financial and document imaging environments have had optical storage units incorporated in their network configurations. These days, because of the availability of simplified interfacing methods coupled with a hunger for more storage capacity, users in more traditional computing sites are recognizing the advantages optical devices offer in everyday data management, archival storage and backup.

By now, we're all aware of the optical storage unit's ability to capture audio, video, text and other data in an integrated format. But optical media also provides advantages in traditional data

A

s the price of optical media falls, it will become less expensive per megabyte of storage than magnetic media.

processing — higher capacities than magnetic media, removable drives (as opposed to stationary Winchester-type drives), and random access historical data retrieval instead of sequential magnetic tape accessing.

The case for optical storage is bolstered by users' needs for all three of these benefits. With the addition of any one of them, traditional technologies may become more effective and more economical. For example, if the need exists for removability and increased capacity, but not for random access, tape cartridges are more economical than optical disks.

Today, network users within the government, Fortune 100, and other major corporations and institutions are looking closely at optical storage and retrieval subsystems, and many are integrating them onto their networks. As the price of optical media falls, it will become less expensive per megabyte of storage than magnetic media. As R&D costs are recouped by manufacturers, optical drive prices also will deflate. This will make optical devices more attractive to smaller users requiring the capacity, removability and random access advantages. The durability and longer life expectancy of optical disks, and the fact that the media can easily be taken offline and locked up for security, adds to its appeal.

Optical On The Network

WORM (WRITE ONCE READ MANY) and erasable (read/write) disks each offer network users the capacity, removability, random access and durability associated with all types of optical media. The main advantage of WORM is that you can't alter a file once it has been written. This makes it the ideal medium in applications where audit trails are required, such as in financial and accounting environments and medical recordkeeping. WORM is the media of choice wherever tamper-proof archival storage is needed.

The disadvantage of WORM is that the disks aren't reusable.

When filled to capacity, the media must be replaced — not an inexpensive proposition at an average price of \$250 per cartridge. Therefore, WORM media isn't practical in applications where data needs to be constantly changed or updated.

The erasable (rewritable) optical disk can be used as a high capacity replacement for the standard magnetic disk or as a replacement for backup magnetic tape. This type of optical medium can be written to and erased repeatedly. It allows for convenient access to large amounts of data, permits unrestricted file modifications and, as it's removable, data security can be provided. Today, the slower access times and the higher cost for the drive and media associated with optical storage versus conventional magnetic disks are its primary drawbacks.

With last year's introduction of multifunction optical disk drives, users now can combine WORM and erasable optical capabilities on one network device. If your site runs some applications requiring audit trails or the security of unalterable media, along with other applications needing the flexibility of read/write media, one multifunction drive now can handle both jobs. This reduces the cost of optical storage on the network as one server can be used with both types of media. This newest development in the optical disk market does have one disadvantage — although there are format standards for the rewritable media, none exist for WORM media. Thus, WORM media may not be compatible from one vendor to another.

Perhaps network managers searching for large-scale storage and retrieval solutions have found their best friend to be the optical jukebox (or library system) with its robotic autochanger mechanism. By providing online access to offline storage, optical jukeboxes provide unattended "near-line" access to a vast amounts (100 GB and more) of data within a few seconds.

HP refers to these jukebox devices as Direct Access Secondary Storage (DASS). They can economically replace the standard secondary storage peripherals in applications such as backing up online disks, logging transactions, distributing software, archiving historical data and exchanging data between systems.

DASS devices bridge the gap between primary storage (usually online, fast, fixed magnetic hard disks) and secondary storage (usually offline, slow, magnetic tape, or floppy disks on smaller systems). Access time and storage costs vary greatly between primary and secondary devices. Whereas hard disk access times are measured in milliseconds, access times for tape are measured in seconds (minutes if the tape is unmounted). The cost of storage is somewhere between \$5 to \$10 per MB for magnetic disk and under 20 cents per MB for tape. Rewritable optical disk fills in the void.

The average access time of a rewritable optical drive is .1 second for standalone drives and 10 seconds for library type systems. Rewritable optical media cost 30 to 40 cents per MB of stored data.

Major advantages of using DASS on a network include:

- Unattended Backup — Optical libraries provide an automated means to backup networks without operator intervention. This

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ISA 4070



ISA Model Number	4070	4090	4091	4092
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CIRCLE 190 ON READER CARD

Rewritable optical disks make archival storage convenient because files are written, updated and stored directly on the disk.

backup activity can be run overnight, between shifts, or in a continuous background mode.

■ **Archival Data Storage** — Optical disks don't require any periodic maintenance in order to assure future file readability. With a 10-year minimum life expectancy, the worry over data protection is eliminated. Rewritable optical disks make archival data storage convenient because files are written, updated and stored directly on the optical disk. They then can be retrieved at any time without an operator being present. Disaster recovery tasks also are simplified as it's easier to send this compact media off-site than it is to ship reams of tape.

■ **Document Storage** — DASS is ideal for managing the ever increasing document storage demands. Text combined with scanned images, text integrated with voice data, high resolution scanning and printing, and the addition of color capability to these devices increase storage criteria dramatically. Optical storage media are the best suited to handle these expanded storage requirements.

Optical Products For LAN

MULTIFUNCTION DRIVES: These accept both WORM and rewritable media, and provide application flexibility in high-capacity storage LAN environments. A single file server can be used for both write-once and read/write (erasable) tasks. One such optical disk subsystem is the RF-11JM multifunction desktop jukebox, introduced by Plasmon Data Systems a few months ago. Although the system is small enough to reside next to a PC, it holds up to 11 optical disks in any combination of WORM or erasable media. Each 940 MB write-once disk or 1 GB erasable disk stores 500,000 pages or more of computer-generated text. Thus, the RF-11JM allows LAN managers to maintain millions of pages of text or images in a "near online" condition, ready to access.

David Kalstrom, Plasmon's vice president of marketing, states, "The biggest obstacle for those wanting to incorporate

optical technology onto their system is integration." To address this problem, Plasmon unveiled an optical disk subsystem called the RF-7010X. This 5 1/4-inch multifunction optical disk drive doesn't require any additional file management software or device drivers. It contains an internal conversion unit that makes the drive ready for immediate use with most operating systems, including UNIX and MS-DOS. The conversion unit, along with a SCSI port interface and a host bus adapter allows for installation on HP, IBM, DEC, Sun and other computers.

HP provides a family of 5 1/4-inch multifunction optical disk library systems ranging from a single disk, 650 MB unit up to a 144-disk, 93.6 GB library. The model C1716M, single drive (650 MB), complements the optical libraries for single-user applications. It is sold as a separate drive mechanism for configuration flexibility.

HP models 10 and 20 are 16-disk (10.4 GB) and 32-disk (20.8 GB) optical libraries, respectively. They can be configured as rack-mountable units or can fit into a desk-side cabinet.

The larger models 60 and 100 optical library systems can sustain up to an 88-disk (57.2 GB) and 144-disk (93.6 GB) capacities, respectively. These two are floor-standing units. All models have asynchronous SCSI interfaces to simplify the system integration process. The robotics adheres to the SCSI II command set. The entire optical family conforms to ANSI and ISO Continuous Composite standards for rewritable optical media, and the proposed Continuous Composite write-once standard.

CD-ROMs: CD Net (Meridian Data Inc.) is a practical way to distribute CD ROM-based information over a LAN. This complete hardware and software subsystem integrates up to 14 CD ROM drives onto a standard LAN. CD Net connects to a LAN like any other node, insulating the user from the complexities of the network. It's compatible with Ethernet, ARC-NET and Token Ring networks, and supports Novell, 3Com, Ungermann-Bass and LAN Manager networking software.

CD Net consists of CD ROM drives and a network board with an Intel microprocessor integrated with its own power supply into a single tower cabinet. As the CD ROM application software can be installed directly on the network's main server, diskless workstations can be used to access CD Net. Users don't need Microsoft Extensions and network software on individual workstations. Each network user can selectively access any of the CD ROM drives on the LAN.

For those users with considerable investments in CD ROM hardware, Meridian Data offers a software-only package for placing CD ROM-based information on the network. Called CD Net Software, this product can transform a standard PC with one or more CD ROM drives into a CD network server. Compatible with Novell Netware and NetBIOS-based network applications, CD Net Software allows CD ROM network access by minicomputers and Macs through the use of PC Host Servers. This is the same software used in Meridian's turnkey CD ROM networking system.

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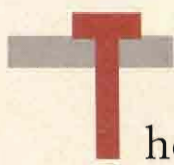
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CIRCLE 296 ON READER CARD



he 35mm optical tape has a storage capacity of one terabyte (1,000 GB) on an 880 meter, 12-inch reel.

A new technology, CD-Recordable (CD-R) holds the promise of providing LAN users with a cost-effective and standards-based alternative to WORM. Meridian Data, Philips, Sony, Sun Microsystems, Kodak and others have formed a consortium to establish standards for the new writable CD ROMs. The group wants to ensure that end-users can place a CD ROM disk in any CD-R drive and know that it will work regardless of who manufactured the drive or the media. The members of the consortium want to eliminate the interchangeability problems that plague current WORM technology, says Frederick Meyer, spokesperson for the consortium and president of Meridian Data.

Optical Tape Drives: Five production model optical tape drive subsystems, manufactured by Creo Products Inc., now have been installed in Canada and Australia. The Canadian Center for Remote Sensing in Ottawa was the first site to receive these reel-to-reel optical tape drives. The 35mm optical tape has a storage capacity of one terabyte (1,000 GB) on an 880 meter (approximately 2,800 feet), 12-inch reel. Its data storage capacity is equal to 5,000 conventional magnetic tapes, or 1,000 double-sided 5 1/4-inch optical disks. It can store the amount of data contained on approximately 1 billion sheets of standard 8 1/2 by 11-inch paper.

The Australian Center for Remote Sensing also is using the Creo optical tape drives to meet its requirement for storing and rapidly accessing satellite imagery from an archive dating back to the commencement of operations in 1979. The European Space Agency's facility in Frascati, Italy has become the third remote sensing agency to purchase an optical tape subsystem. It has ordered a Creo drive with SCSI and HD-96 interfaces.

The capacity of optical tape is unmatched and therefore it may very well become the standard methodology for recording and archiving raw satellite and geophysical data, as well as entire libraries. At present, Creo provides the drive subsystem itself, while integrators provide the means for incorporating these units into mainframes or other central storage facilities.

Media: HP has qualified 3M's 5 1/4-inch optical rewritable disk media for use on HP storage systems. The 3M media, in

both 512- and 1024-byte formats, meets all ANSI and ISO standards. It provides a double-sided capacity of 650 MB per cartridge. HP has been a major customer for 3M optical media, but now will market the certified optical disks under its private label for use on its optical drives and jukebox systems.

Late last year, 3M also announced the availability of 3 1/2-inch rewritable optical media. This single-sided media complies with the proposed ANSI Constant Composite Servo format and will be available in two formats: a 512K sector disk with a capacity of 128 MB; and a 1024K sector layout with a 133-MB capacity. The 3M media is compatible with 3 1/2-inch rewritable drives manufactured by Sony, IBM, Teac and M.O.S.T.

ICI Imagedata, which developed Digital Paper (the medium used in the Creo optical tape drive), is now embarking on a program to educate potential users on the media's minimum maintenance concept.

According to David Owen, product manager at ICI, because magnetic tape must come in contact with and "slide" over a fixed head, it requires the use of a low front-face friction. When the tape is tightly wound onto a reel this causes a constant "pull" to unwind (i.e., tension relaxation). This can cause cinching and blocking of the tape. The tape must be rewound periodically (every three to six years) to safeguard its readability.

The optical tape drive employs a non-contact read/write mechanism. This enables the use of a high friction coating on the front and back of the optical tape. As a result, rewinding isn't necessary as the tension on the wound tape holds steady, which in turn eliminates a major maintenance requirement when archiving data.

TODAY, MULTIFUNCTION OPTICAL drives and jukeboxes can easily be interfaced directly to the LAN file server. Once installed, the optical subsystem looks and acts like any other network device. The addition of optical technology on the network may provide the data storage and data accessibility solution you've been searching for.

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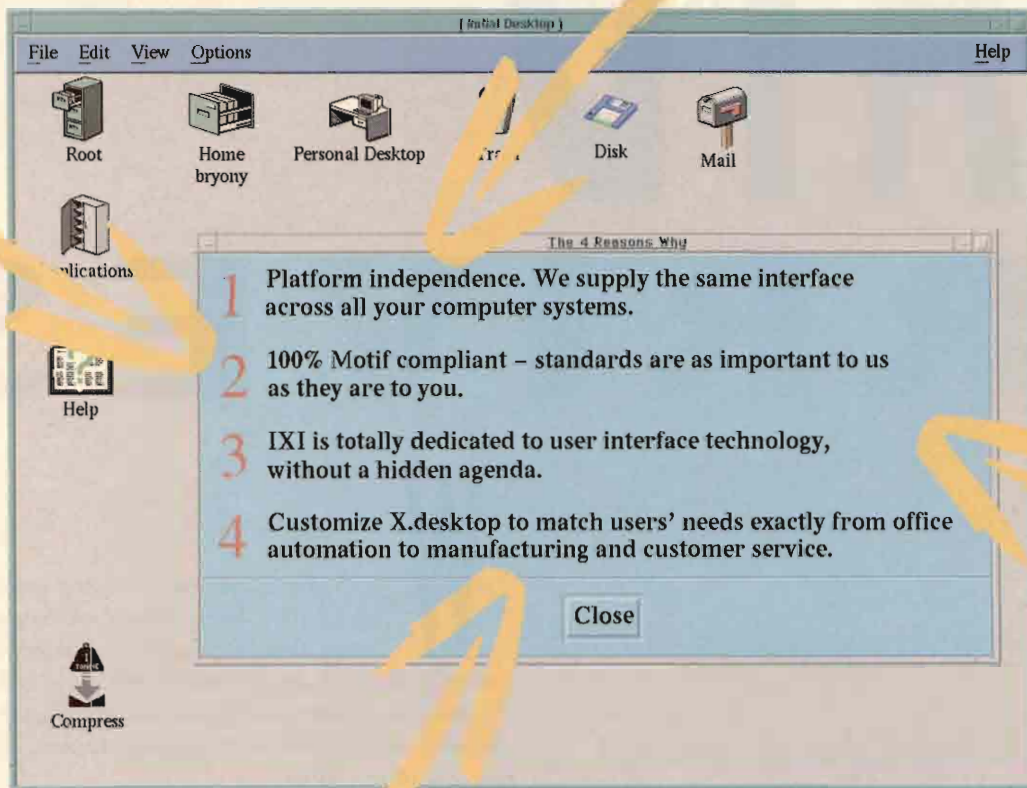
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CIRCLE 470 ON READER CARD

RAID ARRIVES!

....

This New Approach
To Using Disk Arrays
Stands To Improve
Performance And Reduce
Mass Storage Costs

....

BY BILL SHARP

We all lose data on our computer systems at one time or another. Many failure mechanisms exist, from water damage caused by flash floods or clumsy plant watering to overheating from accumulations of cat hair because Crackers insists on enjoying the warm air rising out of my color monitor. Among the more common failures in normal offices are disk drive crashes.

Before you rush off in a blind panic over the imminent demise of your 80-MB hard drive containing the only copies of your tax returns and Christmas card address lists for the past five years — relax. This is a theoretical discussion.

Depending on whom you ask, disk drive crashes account for 20 to 30 percent of all computer system failures. Twenty percent roughly equals the number of failures caused by operator error and fully doubles the number of failures caused by floods, fur and other environmental factors beyond the control of mortals and cat owners. Thus we stand here now, casting a suspicious eye on disk drives in our quest for improved reliability.

We will now pause 60 seconds for those who feel the need to begin backing up their disk drives because reading this article is making them nervous

Welcome back. Those of you who aren't already just a tad nervous perhaps should be. As computer systems pervade our planet, mass storage mechanisms multiply. Demand for data



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NS/VT

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X/O TO: CONNECTIVITY CITY

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DATE: 6-1-92

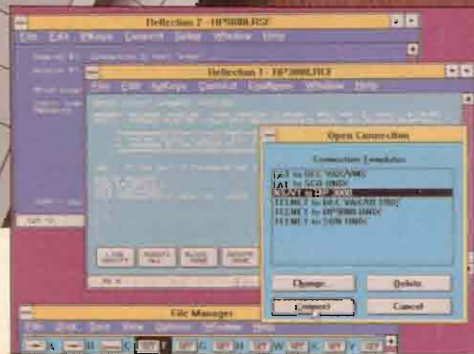
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storage capacity expands steadily to serve the systems needs of client-server, database, human interface and other data-hungry applications and subsystems.

Disk arrays, collections of disk drives that store large amounts of data for computer systems, are commonplace. And disk drive failures, although not an everyday happening, are most definitely not rare, either. The failure rate quoted for disk drives is the number of hours expressed as the mean time between failures (MTBF) is a number that relates to each drive.

As the number of disk drive mechanisms (also called spindles) in a system increases, so does the probability of a disk drive failure on that system. Probability dictates that a 100-disk drive array will experience a failure far sooner than would a single drive. For any large assembly of disk drives, say 100 or more, a disk drive failure every few weeks is a certainty and must be planned into normal maintenance operations.

Ed Pavlinik, disk array product manager for the HP Network Server Division (Boise, ID) is well acquainted with the problems of disk failure, as it is one of the primary reasons for his new products. "In the past, when disk failures occurred you lost data and waited for the support engineer to come on site to fix it," he says. "That could take as long as 48 hours, and he might have to reload the whole computer system if the failure was serious, so the repair could take up to another eight hours."

Users either could risk long downtime during a failure, with its attendant costs, or pay the very high up-front cost of full disk mirroring. At a time when increasing numbers of applications demand systems with as close to zero downtime as possible, users also face tough competition and a recessionary economy that forces them to cut costs, making mirroring a tough choice. Airline and car rental operations, brokerages, banks, insurance companies, catalog sales, government offices, manufacturing process lines and hospitals are just a few of the businesses where computer downtime or lost data can be catastrophic — reliable and cost-effective mass storage is crucial to them.

RAID!

THIS IS WHERE RAID arrives on the scene, and we're not talking insecticide here. RAID means redundant array of inexpensive disks, and has its origins in a 1987 technical paper from the University of California at Berkeley written by Patterson, Gibson and Katz. Five years later, an impressive assemblage of computer firms are using the concept to improve performance and reduce costs of mass storage.

Companies with RAID-based products currently available for sale include HP, Compaq, Data General, IBM and several smaller companies including Maximum Strategies, MDB and Storage Concepts. IBM's RAID products are produced by Maximum Strategies. DEC has made RAID-like noises, but in fact is selling conventional disk arrays so far.

Which brings us to a significant question: what's so special about RAID? The special part is that Patterson, Gibson and Katz sat around thinking their way through the functioning of disk drives and offered some method to sprinkle through the madness that computers sometimes represent. They devised specific schemes for redundant arrays of disk drives, numbered zero through five. All RAID levels make use of a disk array controller (a small processor chip) to manage the data moving in and out of the disk array. We will skip some RAID levels. HP considers levels 0, 1, 3 and 5 to be of interest.

AS THE NUMBER OF DISK DRIVE MECHANISMS INCREASES, SO DOES THE PROBABILITY OF FAILURE.

RAID Level 0: The array controller can make the array behave like one large disk or like several small, coordinated disks. This means that for applications where data transfer speed is important, portions of a large file can be stored simultaneously on multiple disks. Where I/O speed or completion of multiple independent tasks is crucial, the controller can treat each spindle as an independent drive, each taking a separate task. RAID Level 0 doesn't include data protection, so a disk failure can mean inaccessible data and possibly a system crash.

RAID Level 1: This solution is nothing new in the industry. It's called disk mirroring. A disk controller sends identical data to two disk drives and each stores that same body of data. An array of four spindles would include two identical sets of two drives with fully redundant data. If a drive fails, the controller automatically switches to the functioning drive for all activity. This is a very effective method for ensuring high availability. Its flaw is that mirroring doubles the cost for mass storage over non-protected systems. A Level 1 RAID mirrored system stores on four drives what an unprotected disk array stores on two drives. For the incurably insecure, mirroring can be extended to provide completely duplicated data sets on three drive systems, which triples the cost of a single-drive system.

RAID Level 3: Like most sound choices, Level 3 is a compromise. Where Level 1 offers good performance with minimal protection against data loss and Level 2 provides high levels of protection at high levels of cost, RAID Level 3 adds a disk drive to the system that is dedicated to ensuring recovery from a failure on one of the other disks. Each write to a disk on the array is accompanied by an encoded write to the data protection disk. Disk spindles are synchronized so that all disks in the array read or write on the same sector of their respective disks in parallel.

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Each read or write operation involves all disks in the array as each data disk receives part of the data and the data protection drive receives parity information. This structure means that the array looks like one large disk to the computer, making it possible to provide larger storage with arrays than can be provided with a single large disk drive.

In the event of a disk failure, the controller automatically reconstructs the missing information from the encoded data on the data protection disk. According to HP, the RAID can function in this manner with no loss of system performance until the faulty disk is replaced. After a new drive is installed, the controller rebuilds the lost data on the new drive using the parity information from the data protection disk.

What is most significant here is that RAID allows the computer system to continue functioning with no effective loss of performance in spite of the fact that a disk drive has failed. Normal computer functions need not be interrupted even to replace the failed drive. HP selected RAID Level 3 as the basis for its high availability (HA) disk arrays described below.

RAID Level 5: Level 5 is a variant on RAID Level 0. It offers flexible use of the drive spindles so the array can function as independent disks or as one large disk, depending on the application. However, unlike Level 0, this system uses data protection, and in contrast to Level 3, the encoded parity data is

spread across the various disks. This system offers potentially better performance for processing multiple operations simultaneously, where I/O efficiency is important. According to HP's Pavlinik, some vendors have implemented RAID Level 5 disk arrays, experiencing mixed results. He says data availability is just as in Level 3, but performance may be better or worse than Level 3, depending on the application. "Level 5 has the disadvantage of being more complex, and therefore more costly than Level 3," says Pavlinik.

User benefits of RAID disk arrays are several:

- No lost data — Computer companies won't tell you that you avoid lost data with RAID because the implied warranty in that statement makes their legal departments tremble uncontrollably. The correct weasel-word phrase is "high data availability," which sounds like we might be going out for dinner and a movie. What they mean is that your words and numbers are there when you want them, not trapped on some useless, smoldering disk drive that will never spin or read or write again.
- Increased mass storage per system — Because some RAID systems can make a large array of disks look like one disk to the computer system, RAID effectively increases the allowable mass storage limits for most systems.
- High storage capacity for footprint — Most RAID systems will cram more storage into a given amount of floor space than

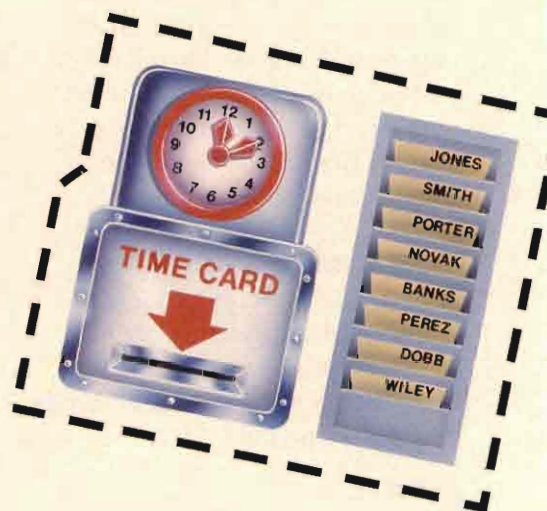
LOOK WHAT YOU CAN



TIME



TAPE



MAN HOURS

conventional mass storage systems due to the use of small disk drives sharing a common controller and power supply.

■ The hallmark of RAID disk arrays is flexibility. Some types of RAID don't offer data protection because it isn't necessary for all applications. Others require data protection and are optimized for high data transfer rates for intensive database use with large file transfers by making the array behave as one large disk. Yet other applications need the independent functioning of disk drives required to support I/O intensive applications, with data protection as well. Some RAID systems allow users to switch from one RAID level to another as their needs change, or tune the RAID to function at some compromise between high data transfer and high I/O speeds that best suits the application at hand.

HP Products

ONE OF THESE DAYS I may write to you about some technology for which HP doesn't have a product, but that article is a few months off. HP *does* have RAID products. Attendants at Interex last year were tipped off that these were on the way well in advance, and there also was that clever pamphlet with the not-too-evasive title, "Disk Ar-

rays" that HP began distributing in advance of the November product announcement. If you want that pamphlet of introductory information on RAID arrays, from which this article borrows shamelessly, ask for "Disk Arrays," with the Tinkertoys cover, part number 5091-1396E — good basic information.

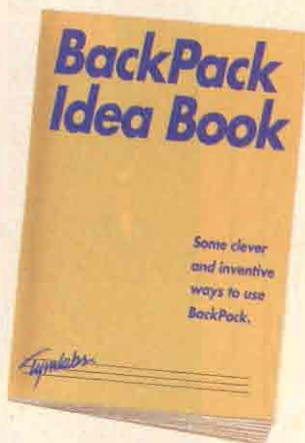
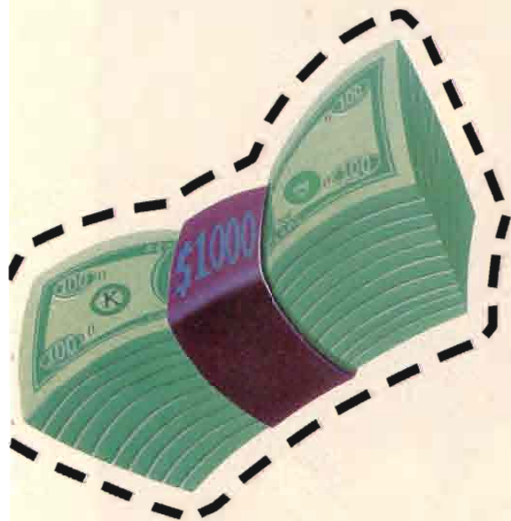
Now for the iron itself. HP's disk arrays are called arrays rather than RAID products because they can be used in RAID Level 0, 3 or in conventional disk array form, depending on the product and the application. All the new array products come in a 19-inch wide, 1.9-meter high cabinet with HP fiber-optic-link (HP-FL) interface. Fiber optics allow placement of the disk arrays up to 500 feet from the computer, and the data still moves back and forth in a flash (no pun intended).

HP's disk arrays are at present designed solely for use with HP PA-RISC multi user computer systems. Supported systems include HP 3000 Series 900, up to and including the 980/300, as well as the HP 9000 Series 800 systems. Support for other products, HP and non-HP, will likely follow at some point, but HP is focusing on its own systems now to provide a competitive advantage, says Pavlinik.

In ascending order, the disk arrays are:

HP C2252B — Includes two 1.36-GB SCSI-2 disk drive spindles for a total storage of 2.72 GB. This product doesn't provide data protection. Base price is \$28,675.

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HP C2254B — Set up just like the preceding product, this one includes four SCSI-2 drives for total storage of 5.44 GB, again with no data protection. Both of these products function as standard disk arrays, with the advantages of high capacity and fiber-optic links to the computer. Base price is \$45,290.

HP C2252HA — The HA stands for "high-availability." This product includes two data storage disks for total capacity of 2.72 GB, and adds a third spindle dedicated to data protection. Base price is \$36,980.

HP C2254HA — Top of the line is a five-disk system, four of them for data storage with a capacity of 5.44 GB, and the fifth dedicated to data protection. Base price is \$53,600.

Both of the high end systems function as RAID Level 3 disk arrays, providing data protection. Because the disk drives are easily removed even while the system is running, this feature also makes possible the exchange of system data by moving disk drives, as well as physical replacement of drives for system backup, or removal for system security.

Information stored on the two high-end arrays is "striped," or spread across two or four drives, depending on the array capacity. This is when multiple drives appear to the computer as one drive, working in unison. This makes it possible to expand mass storage capacity beyond what the computer thinks it can handle, as well as improving data-transfer rates.

Perhaps best of all, according to Pavlinik, the cost of mass storage is continuing its downward trend with the new products. "Over the past ten years, the cost per megabyte for mass storage has gone down by about 10 percent per year," he says.

Pavlinik says HP's current disk drive products for the high end cost about \$13 per MB of storage. The new two-disk product costs about \$13.6 per MB with HA data protection, and \$10.5 per MB without HA, he says. The top end of the line looks more cost effective because the controller is spread over more drives. The 5.44 GB product costs \$10 per MB with HA, and \$8.3 per MB without data protection.

Would you like to continue to see articles on this topic?

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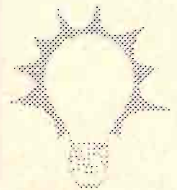
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T A L E S O F T H E

TAPE

BY MILES B. KEHOE

As Storage Capacities Increase, So Does
Competition Between The Established QIC Format
And The Newer 4mm Drives

What images come to mind when you think of magnetic tape as a mass storage media for your system? If you've been in the business a few years and have done most of your work on minicomputers like the HP 3000, you might think of nine-track reel-to-reel tape subsystems. If your experience has been in the workstation or PC realm, cartridge tape is most likely the technology that comes to mind. Regardless of your experience, you've no doubt been exposed to the surge of popularity garnered by the 4mm and 8mm tape cartridge technologies.

You may be surprised at the scope of the changes that magnetic tape technology currently is undergoing — the capacities and performance levels that we consider impressive today will soon seem inadequate. However, before we look at where the technology is heading, let's review the current options.



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CIRCLE 245 ON READER CARD

The mainstay in magnetic media remains the half-inch reel tape. Also known as nine-track, this technology is well established in minicomputer environments such as the HP 3000 as well as in mainframe shops. Although nine-track is among the most popular mass storage options for these systems, some other technologies are more commonly found in use with smaller, networked systems.

QIC, 4mm And 8mm Tape

THE MOST POPULAR TAPE format used with PCs and workstations is the quarter inch cartridge (QIC) tape. This technology, invented by 3M, uses the familiar 5-1/4 inch cartridge and has grown from 60 MB capacities five years ago to the 1 GB cartridge tapes available today. QICs

offer a high level of compatibility with existing and earlier QIC data formats, and use established technology. There are more than seven million users of QIC — far more than any of the other formats.

More recently, however, 8mm and 4mm tape cartridges have been adapted from consumer applications for data processing. These formats offer high capacities coupled with compact form factors, and have been touted in recent years as the backup and interchange format of the future.

The 8mm tape technology, a spin-off from the video camera market, is backed by Exabyte Corp. and Toshiba. The format's multigigabyte storage capacities have made it very popular in the workstation market.

The 4mm technology, based on the Digital Audio Tape (DAT) introduced by Sony for the home audio market, is the format backed by HP. Like 8mm technology, multigigabyte

[DIGITAL DATA STORAGE]

Digital Data Storage (DDS) is a recording format that supports the use of Digital Audio Tape (DAT) for computer applications. It was developed by HP and Sony, with contributions from computer systems manufacturers, end users and other tape drive manufacturers. The features inherent within DAT technology offer users improvements over other technologies in cost, reliability and performance, while the benefits of DAT with DDS technology resulted in an industry acceptance of DDS as a standard.

Industry analysts predict that shipments of DDS drives will reach 500,000 per year by 1994. The market research firm International Data Corp. (Framingham, MA) estimates that HP controlled 45 percent of the worldwide DAT market in 1991, with its nearest competitor garnering 25 percent.

The demand for unattended backup grows as hard disk capacities, operator costs and the volume and intrinsic value of stored end-user data increases. There are considerable benefits associated with an industry-standard medium that provides unattended operation on tape drives attached to almost every type of computer. The development of the DDS format came about because of the need for a standard format, combined with customer demand for storage devices offering high reliability, capacity and performance.

An objective in the development of the DDS format was to make backup a painless, unobtrusive procedure. DDS cassettes don't require preformatting which saves valuable operator time. To allow easy access to data stored on DDS tapes, DAT DDS drives have a fast-search facility. It provides access to data at up to 200 times the normal read/write speed, allowing data to be randomly accessed in an average of 20 seconds on a standard DDS tape.

Backup performance is measured by the rate of data transfer combined with the amount of operator intervention required. A DDS product allows 2 GB of user data to be backed up in approximately two hours on a standard 90-meter DDS cassette. Operator intervention is not required.

DDS DAT products now offer capacities of up to 8 GB on standard DDS cassettes. This is achieved by using an extension of the DDS format known as DDS-DC (DDS-data compression), which provides for hardware data compression. DDS-DC implements an advanced data compression algorithm known as data compression Lempel Ziv (DCLZ) to extend the capacity and performance of DAT technology, while maintaining the full functionality and features of the standard DDS format. HP was the first company to market a 3 1/2-inch DDS-DC product. Industry analysts predict that 4mm DAT technology will achieve up to 20 GB capacity on a standard DDS tape by 1995.

The DAT technology and the DDS format offer reliability and performance advantages. DAT offers low tape speed for easy, more reliable handling and the 90-degree wrap angle of the tape around the head reduces head and mechanism wear caused by tape repositioning. In addition, tape tensioning with DDS drives is achieved electronically rather than mechanically, reducing tape stress and repositioning time.

Since DDS products were introduced in 1988, the DDS format has become the de facto industry standard for data storage on 4mm DAT tape. Cooperation among tape drive manufacturers in developing the DDS format led to the formation of the DDS Manufacturers Group. The group meets four times per year to formally discuss enhancements to the standard, and also is responsible for ongoing compatibility testing for DDS drive and media manufacturers.

The DDS format has been published as an international standard (ISO 10777) and European standard (ECMA-150). Work to establish DDS as an ANSI (American National Standards Institute) standard is underway and expected to be published in the first half of 1992. DDS-DC has been published as ECMA-150 and the DCLZ algorithm will be published as ECMA-151. Work continues toward publishing DDS-DC and DCLZ as ANSI standards. — Robert Tillman is General Manager of HP Computer Peripherals Division in Bristol, England, where HP DAT drives are developed and manufactured for the worldwide market.

HP and Sony insist that the DAT technology offers benefits that position it as a better choice for the future.

capacities are available today in products marketed directly by HP. When used in conjunction with data compression controller devices, capacities of up to 8 GB of data are attainable on a single 4mm cartridge.

Where is mass storage headed? In the next five years, users will be faced with some real changes. At this point, it looks like the two primary camps in cartridge technology will be the 3M-backed QIC tape and the HP-backed 4mm tape. Advocates of both sides see 8mm tape losing ground as advances are made in the QIC and 4mm technologies.

3M and other distributors of conventional cartridge tape technology point out the compatibility of their format, and the stability of the technology. HP and Sony, working together to advance the 4mm format, insist that the DAT technology offers benefits that position it as a better choice for the future.

Michael Stevens, business operations manager for 3M's Data Storage Products division, and Richard Raimondi, marketing manager for HP's Mass Storage Group (Boise, ID), present two starkly contrasting views of the future of mass storage.

The QIC Story

THE QIC FORMAT PIONEERED by 3M is the resulting product of 20 years of tape evolution. Although the format was all but declared dead a few years ago when capacities apparently topped-out in the 150 MB range, 3M and its partners have expanded QIC capacities beyond the 1 GB range by investing in proven data compression technologies. Archive Corp. recently introduced a 2.1 GB QIC drive, and other manufacturers will bring similar products to the market early this year.

3M's Stevens foresees QIC capacities approaching 10 GB in

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Hewlett-Packard and Sony have joined forces to create the DDS format, which so far has been endorsed by 20 vendors.

the next two years, and reaching as high as 35 GB within four years. Stevens also predicts that tapes not unlike today's QIC will push the 100 GB barrier by the end of the decade.

One interesting aspect of the projected increases in QIC capacities is that these objectives do not require the introduction of new technologies. 3M claims to be able to offer such capacities by moving to the thin head technology already common in disk drives, and by improving media and recording head technologies.

Stevens notes that QIC uses highly stable Gamma Ferric Oxide as a recording medium, offering greater tolerance to environmental factors than the metal particle-based 4mm tapes. Stevens says that by moving to a Barium Ferrite Oxide technology, tape capacities quadruple almost immediately. And the use of Barium Ferrite is not a new technology.

The QIC camp is represented by an industry association, Quarter-Inch Cartridge Drive Standards Inc. (QIC Inc.). This group, with members like IBM, Tandberg Data, Eastman Kodak and even Hewlett-Packard, performs independent testing to ensure different tape and drive suppliers meet the organization's compatibility goals.

The 4mm View

RICH RAIMONDI, WHOSE DIVISION within HP sells a complete line of mass storage devices, is quick to point out that QIC is far from an obsolete technology, and that HP markets several QIC tape solutions. Still, he makes it clear that HP is excited by the future prospects of the 4mm devices.

Raimondi sees several areas in which 4mm tape technology offers advantages over conventional QIC tapes. He stresses the

high inherent reliability of the 4mm tape because of both the smaller form factor and the more intelligent error correcting device controllers (ECC).

Because the 4mm drive mechanism is smaller, Raimondi claims, it generates less heat than the larger QIC drives. In addition, the device controllers are more intelligent, and feature both data compression and error correction technology. These factors allow 4mm tape to offer capacities of up to 8 GB today.

With improved recording densities and compression techniques, considerably higher 4mm capacities can be reached in the near future. And, because 4mm tape speeds are much higher than traditional QICs, the seek times for individual files are better on 4mm tape as well. Many studies indicate that the most frequent use of backup tape is to restore an individual file, so this short access time stands to provide a competitive edge for 4mm technology.

While the QIC market has an independent organization to ensure compatibility, the 4mm market is less structured. Hewlett-Packard and Sony have joined forces to create the DDS format, which so far has been endorsed by 20 vendors. But ultimately the task of ensuring compatibility is left to individual vendors.

Let The Buyer Beware

DESPITE ITS APPEALING high-tech feature set, there are some things the smart data center manager will watch for when using 4mm tapes. First, because 4mm tapes are an outgrowth of the audio consumer market, there is the risk that lower quality audio-grade tapes might find their way into the data center. Be sure to always use the higher data processing quality tapes.

Second, because the smaller tapes are more sensitive to humidity, they require more care. In fact, some studies have shown that the error rate is much higher in the 4mm cartridge, and that the corresponding error correction code is executed far more frequently than in QIC drives. This can slow the effective throughput even where the tape speed is higher. According to Tandberg Data's Rich Peters, the need for extensive error correction requires that up to 40 percent of 4mm tape capacity be dedicated to error correction, thus limiting the prospects for capacity growth.

Finally, because the smaller form tapes look like DAT audio tapes, there is always the possibility that backup tapes might disappear from the data center for home use — although DAT home audio systems are not nearly as widely used as standard cassette tapes or CDs. As always, site security is critical.

HP is placing its bets on the 4mm devices. With high performance backup software, controllers that can write to multiple drives at the same time, and with plans for stackers and juke boxes, HP clearly wants to augment its 45 percent share of the growing 4mm market. Considering this, it's probably no

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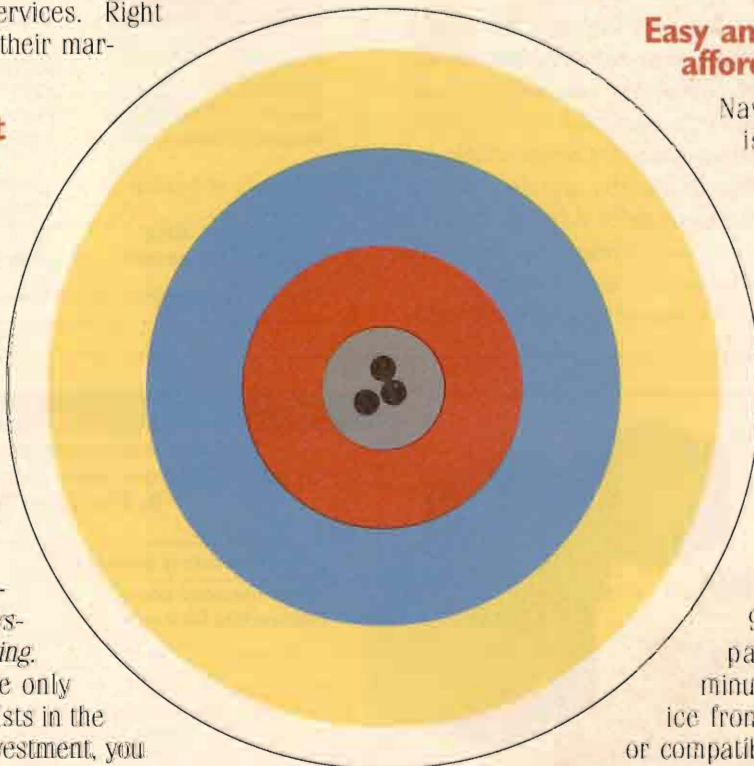
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coincidence that HP's Mass Storage Group is beginning to mimic the highly successful Peripherals Group — which has so prosperously led the market in laser printers.

Which To Buy

BOTH QIC AND 4MM advocates recognize that there are market needs for both types of devices. 3M continues to push capacities higher and higher with proven technology and an industry-wide format, while HP and Sony push the newer technology with 4mm devices which hold promise for the future.

Which is right for your data center? Ultimately, the answer depends on your site and your organization's particular storage requirements. QIC drives offer convenient centralized storage for a wide variety of systems and PCs connected via a network. QIC also offers a better operating range for temperature and humidity. While 4mm tape already has the capacity for full-system backup, its technology appears to be moving toward a distributed environment in which each workstation or PC has a DAT drive. And those small tapes are a cinch to store.

Regardless of your decision, rest assured that both technolo-

gies will continue to make advances in compatibility, functionality and capacity. With these constant improvements and growing user bases, both technologies are likely to be around for some time. — *Miles B. Kehoe, based in Mountain View, CA, is now a Sysop on CompuServe's HP Systems Forum (GO HPSYS). He can be reached there at 76711,405.*

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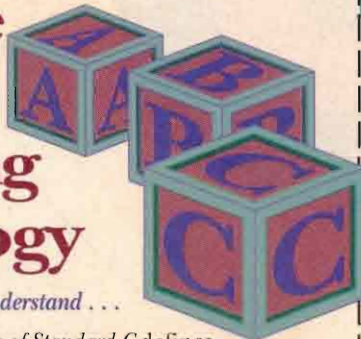
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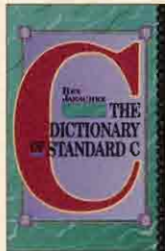
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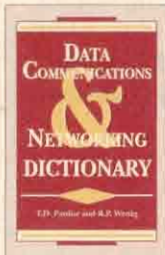


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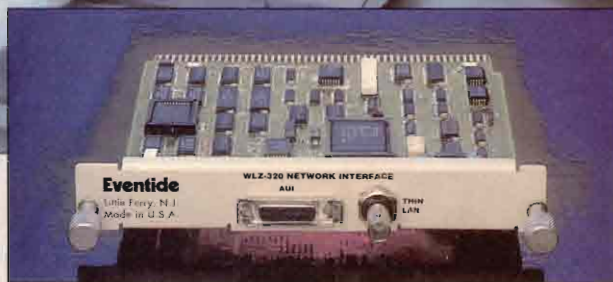
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NFS VS. AFS

A distributed file system (DFS), which allows users to access and update data at remote servers, is the heart of today's network. For several years now, the de facto DFS for UNIX systems has been Sun Microsystem's Network File System (NFS). With its public domain specification, more than one million user nodes in use and some 300 source code licensees, NFS has been an easy choice until now; the proverbial no-brainer. Now, the field has broadened to include the Andrew File System (AFS) from the Open Software Foundation (OSF).

Although very similar in many respects (AFS will even support NFS clients), the two DFS options have their differences, and the choice between them is more than one of taste. Performance, security and management concerns also are important factors.

Both systems are also part of overlapping environments that are positioned directly against each other in the market. It's going to be difficult to make a clear choice between AFS and NFS

By Gordon McLachlan

The Choice Between

These Similar

Distributed File

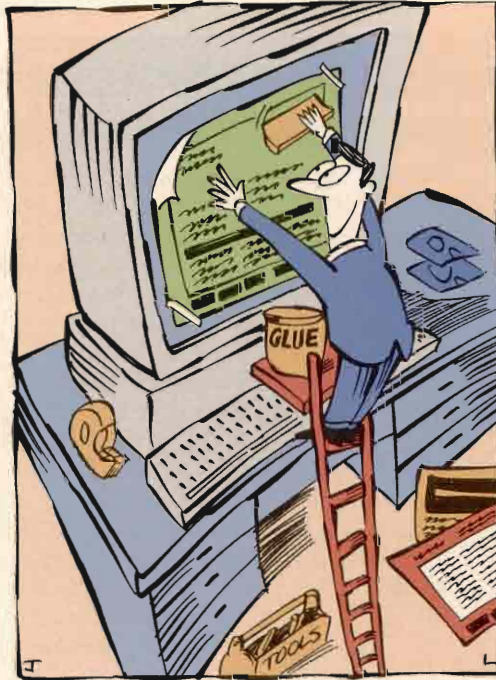
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based on their merits as file systems alone. The environments of which they are a part also enter into the decision.

While file transfer mechanisms have been hanging around since the first two computers were hooked together with a piece of wire, a DFS clearly is different from a simple file transfer

mechanism because it makes files on the server look and act like they physically reside on the client workstation.

Access transparency means that a user can treat a file or directory on a remote server just the same as a local one. The DFS eliminates the need to log on to a remote host, run file

[SECURITY FOR DISTRIBUTED FILE SYSTEMS - KERBEROS AND SECURE NFS]

Under standard UNIX security, network servers can be accessed either by users who remotely log in to the server with a valid username and password, or by a user logged in to a "trusted host" which can get at the server without a remote login. Both of these approaches cause potential problems that Sun and the OSF have tried to cover with Data Encryption Standard (DES)-based schemes for network-wide user authentication.

Although their goals are similar, the approaches taken by Sun's Secure NFS and the OSF's Kerberos authentication server are quite different.

In both systems, a user is prompted for a password that is used to encrypt transactions between the client workstation and the server. The major distinction is that Kerberos requires a physically secure, dedicated server to handle authentication. Secure NFS is spread around the network and doesn't require a dedicated server.

NFS And Secure RPC

Secure NFS does, however, require the use of Sun's Network Information Server (NIS) name service to access a network database of user data. Kerberos is designed to operate independently of the name service, and contains all the data it needs on the dedicated server. By staying independent of other network services, Kerberos can be used with a variety of network and server protocols. As a matter of fact, Kerberos was originally developed at MIT for use with NFS, and it is expected that Sun will support Kerberos as an alternative to Secure NFS.

Secure NFS is based on Secure RPC, which is also used with the Sun License service and NIS name server. Secure RPC uses shared-key encryption, in which a public key known to the network is added to a private key — known only by the client and server — to produce a third key that is used for encrypting transmissions.

NIS spreads the contents of the `/etc/passwd` file across the network. This eliminates the need to maintain copies of the password file on every workstation on the network.

NIS is a distributed database system that lets systems share password files, group files and host tables across the network.

When a user logs into a workstation using Secure RPC, the login program retrieves the user's record from the central NIS user database. This database is a network-wide equivalent of the `/etc/passwd` file normally kept on every UNIX workstation. The retrieved record contains the user's network name, a public encryption key, and a secret key encrypted with the user's password. The workstation login program then decrypts the secret key using the password provided by the user. Combining the decrypted secret key with the public key produces a third key that will be actually be used for the balance of the session.

Subsequently, when the remote procedure call mechanism (RPC) is invoked for NFS, encrypted user information is buried in the RPC header, continuously authenticating the user to the server.

Kerberos has to handle things differently because it is not tightly coupled to either the network naming service or to the underlying RPC mechanics.

When an AFS user logs in to the network, the client workstation sends off a message which includes the username to the Kerberos server. Kerberos checks its database to find the password associated with the given username. Kerberos then makes up a "ticket," using the password as a DES key, and sends it to the workstation.

When the client gets the ticket, it decrypts it using the password it got from the user. If the ticket decrypts properly, the workstation knows it got the proper password from the user. The password is never sent across the network, not even in encrypted form.

The ticket that the workstation gets back at login is called a "ticket-granting ticket." Whenever the client wants to access a server, it uses the ticket-granting ticket to communicate with a ticket-granting service for that server. The ticket-granting service notifies the server that it is going to be used by the client, and is given a session key to use for encrypting transactions between client and server. The client is also sent another ticket, containing the server session key, and the business proceeds.

Another difference between Secure NFS and Kerberos is how they terminate a client-server connection. Kerberos tickets expire at an arbitrary deadline; usually eight hours. If the deadline passes, Kerberos requires that the client be reauthenticated. By contrast, NFS sessions stay intact as long as the workstation stays up. Coupled with the fact that NFS servers do not keep track of their client sessions, it's possible to get accessed by a client even after you've taken away file permissions.

Decisions, Decisions

Both systems provide much better security than standard UNIX methods. Still, it's probably wise to consider no networked system 100 percent secure. Both systems can be broken, with NFS slightly more vulnerable than Kerberos to message forgeries, and Kerberos more vulnerable to "dictionary" attacks on encrypted tickets using guessed passwords.

For most users, a choice between Secure RPC/NFS and Kerberos methods will depend more on your other environmental software than on absolute levels of security. With Sun's method requiring NIS on both clients and servers, and Kerberos requiring a guru-level hack to install in application software, it all boils down to choosing whose bags you want to carry.

transfer programs on two machines, find the files and provide some obscure commands to move them. Under a DFS, all that stuff just happens automatically.

Both AFS and NFS are built on top of remote procedure call (RPC) systems, that hook directly into the operating system kernel to intercept accesses to network resources. The operating system primitives that normally are invoked by a process' I/O operation are replaced by calls to the DFS through the RPC mechanism. Simply put, network devices look like local devices to both the operating system and the user.

Neither entry has a clear advantage. This isn't surprising, considering both are built on the same "vnode" interface to UNIX developed by Sun. Administrative commands for the two systems differ, but to a client program or user, it all looks the same.

Login Security And Access Control

BOTH AFS AND NFS provide login security, or user authentication, requiring a user to provide a username and password to log in to a client workstation.

AFS uses a dedicated authentication server based on the Kerberos security server developed for MIT's Project Athena

in the mid-1980s. NFS uses either UNIX authentication or its more protective Secure NFS.

The sidebar to this article discusses DFS security issues in more detail, but this is an area where NFS takes a well-deserved beating. When used on top of standard UNIX security mechanisms, NFS actually can be a security risk if it isn't carefully administered. Even with Secure NFS, workstation super users can forge messages that let them get at directories they aren't supposed to be able to access.

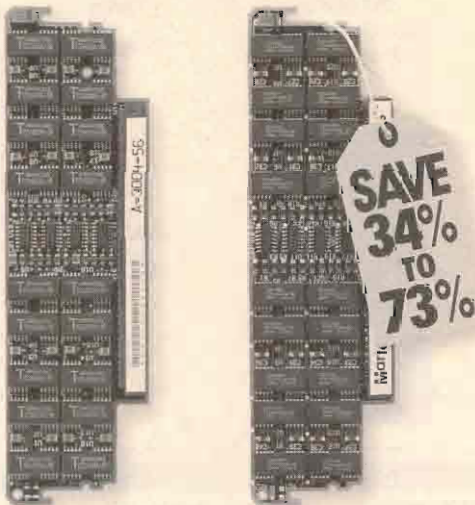
NFS security improvements, including its "Kerberization" are ongoing, but AFS looks tighter. On the other hand, one million users haven't had the opportunity to hack through AFS yet.

Name Services And Location Transparency

AN ABSOLUTE REQUIREMENT of any DFS is the ability to actually find files on the network. The use of symbolic names for workstations, users, printers, and files and directories helps a lot. By using symbolic names, users doesn't have to deal directly with arcane network addresses, or keep track of which server has the data this week.

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NFS can't lock files. If two programs want to have their way with the same file simultaneously, so be it.

work addresses, and shield users and programs from the underlying network. Location transparency is a nice byproduct of a naming service. By using the symbolic name of a resource or user, instead of a network address, the administrator can reconfigure the server without blowing things up. Both NFS and AFS provide name services.

Sun's Network Information Service (NIS or YP, because it was called Yellow Pages until Sun got into a copyright scuffle with a phone company), spreads the contents of the /etc/passwd file across the network. This eliminates the need to manually maintain copies of the password file on every workstation. NIS is a distributed database system that allows systems to share password files, group files and host tables.

The OSF DCE also uses a distributed directory service, but

it has been Kerberized and is designed to augment X.500. The OSF code is based on offerings from DEC and Siemens-Nixdorf.

Data Consistency

NFS SERVERS ARE connectionless and stateless. They are connectionless because they don't keep track of which clients have accessed them, and stateless, because they don't track which files are being used. The advantage of this approach is efficiency. Server resources aren't used by a client connection, so there's theoretically no limit to the number of clients that may be attached to a server. Also, clients that mount a file system but never use it don't squander network resources on useless housekeeping. It also provides for fast recovery from a server crash because NFS doesn't have to worry about re-establishing a bunch of connections when the server comes back.

The bad part is that NFS can't lock files. If two programs want to have their way with the same file simultaneously, so be it. This might not be so bad for read-only data, but obviously can result in a few complications for your typical transaction-processing system.

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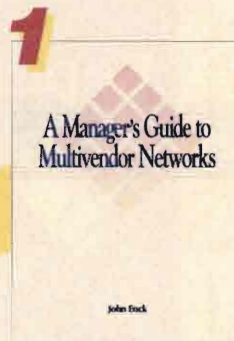
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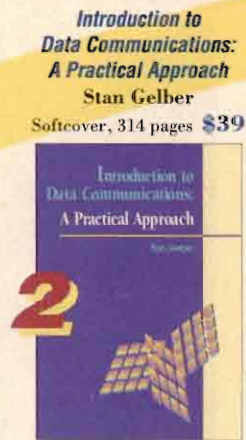
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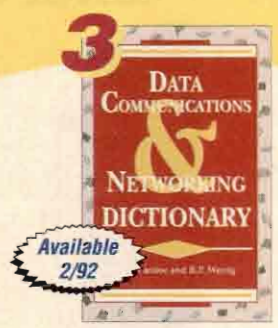
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is available as an add-on to NFS that provides a Network Status Monitor daemon to lock files. At this time, it isn't part of NFS itself, so non-SVR4 implementations still can't lock.

Under AFS, concurrent file access and file locking is handled via "tokens." When an application wants to update a file, it has to get a "write" token. If it wants to read the file, it gets a "read" token. By keeping track of these tokens, and when they were issued, the file server knows which workstations have valid copies of data, and can then know when data goes stale.

Time Synchronization

TIME SYNCHRONIZATION IS important when transactions are spread across different machines — especially when those machines' system clocks may be off, or in different time zones.

A time server provides a method for all systems on a network to get the "correct" time, so they can properly sequence transactions or perform other coordinated activities. Again, both NFS and AFS provide effective time services, although they employ different APIs.

Performance: On a LAN, both networks will offer good per-

formance, but AFS claims a leg up on wide area network (WAN) performance because of its client caching feature.

The AFS client cache manager can pull down blocks of data from the server, caching it locally for subsequent access. Using this method, larger amounts of data are transferred in each access, making more efficient use of network bandwidth. In effect, a performance penalty is paid up front — while it will take longer to get data on the first access, subsequent access times are faster. NFS doesn't cache data on this large scale, and has to hit the network for disk I/O more frequently.

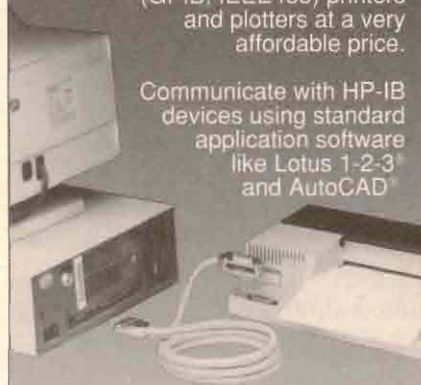
For AFS to work properly, you have to provide it with plenty of workstation memory and disk buffer space, and be willing to take the occasional coffee break for a file download. On NFS you'll suffer in smaller doses, but over a greater span of time. To many, direct file access over a slow WAN will sound like a better idea than it is.

Reliability and Availability: AFS' token-based file tracking mechanism also lets it easily replicate data files on the network, minimizing the effects of a downed server or network link. Replication also allows system backups, without taking away critical files, and lets administrators reconfigure servers on the fly and move data files from one server to another without fouling things up.

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An NFS client, once it has been given a file handle by the server, never needs to go back to the server to update the file link. As a matter of fact, with the server being connectionless and stateless, it has no reason to. If the server gets reconfigured while the client is working on it, all sorts of interesting things can occur.

AFS also operates differently from NFS in the way it handles disk housekeeping information. Rather than simply keeping disk allocation information in memory, and updating it to disk only occasionally, AFS keeps track of all disk transactions between updates. In the event of a server problem, it can recover its disk using the transaction log. This reduces the amount of time required for the disk check phase upon restart.

Scalability: Theoretically, NFS will scale better to large networks because of its connectionless and stateless nature, which doesn't impose any limit on the number of clients attached to a server, and which generates less housekeeping overhead.

On the other hand, AFS is designed for better performance across a WAN, which almost certainly enters into the equation for any network where scalability is an issue.

The Bottom Line — Which One?

CHOOSING NFS USED TO be so easy. Everybody had it, and it worked well enough. Is the AFS alternative good enough to force a switch? Good question.

Even though DEC, HP and IBM are all on the OSF bandwagon, it's hard to ignore the one million users and the huge investment that already has been made in NFS. The OSF tacitly admitted as much when they included full NFS client support in DCE.

AFS may be a great idea, but it may be a little late to dethrone NFS. Even its claimed advantages in performance and security may be blunted by the mere use of NFS clients on a network. None of those workstations will be able to make use of Kerberos security or client caching. The market vote on this one will take longer than a Presidential election.

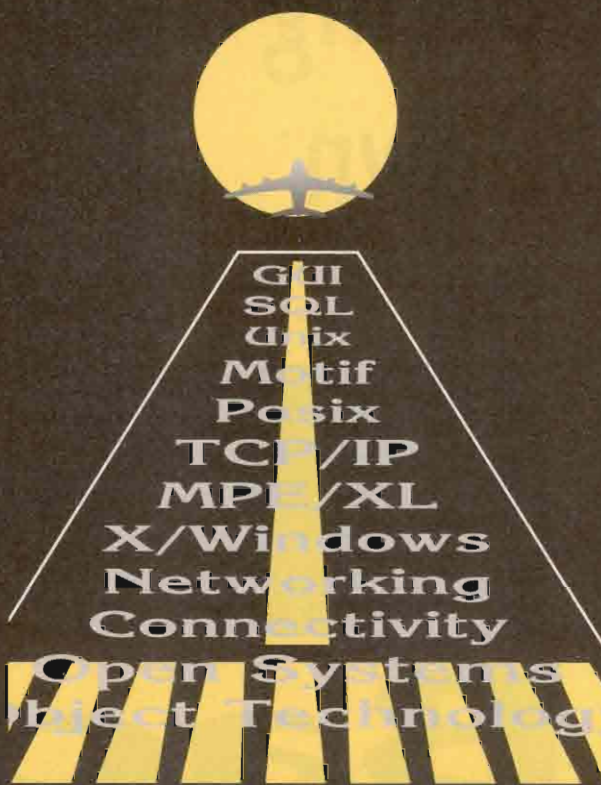
Sun and AT&T also are unlikely to be left on the sidelines while the OSF has its fun. AT&T already is working with DEC and the Advanced Computing Environment consortium, and is talking to the OSF.

If NFS is properly Kerberized, it still could be integrated into DCE. OSF members have shown no reluctance to start cannibalizing DCE and stuffing it into their own network architectures. AFS is just a module of DCE, and could be taken out without any irreparable damage being done.

The fat lady hasn't sung yet.

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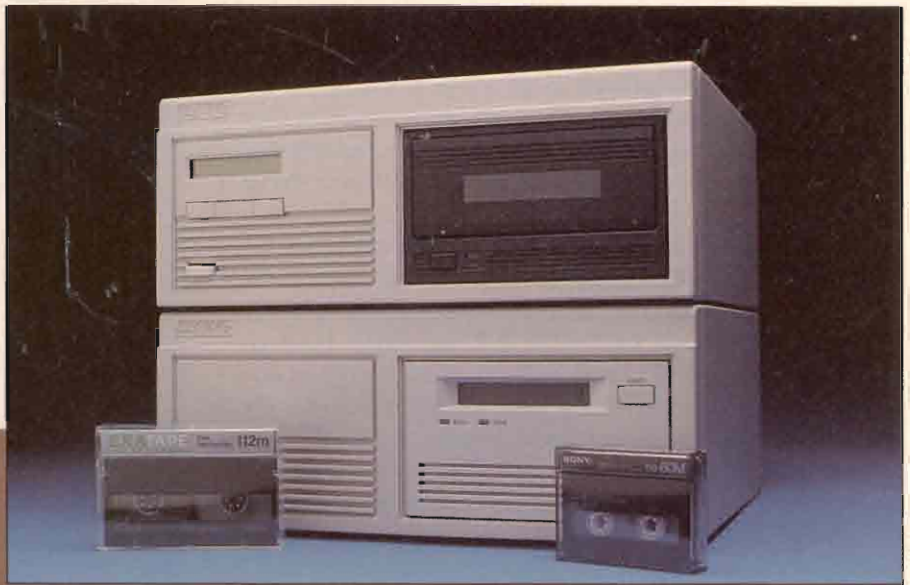
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Two Small Ways To Make A Big Impact
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Downsizing has affected nearly every facet of computing over the past few years. (One notable and particularly irksome exception is color monitors. I still can't comprehend why a good, legible color monitor requires a forklift and a hydraulic jack to get onto your desktop.)

The trend toward "smaller is better" is especially noticeable in the tape backup market. Once the exclusive realm of the ubiquitous nine-track drive, these days

the tape storage market is seeing an increasing number of managers being lured to the small sizes and large capacities offered by 4mm and 8mm cartridge tape drives.

Bering Industries (Campbell, CA) is one of the few vendors these days offering both formats with its Echo 4950XL 8mm drive and an Echo 2420 4mm DDS drive.

Bering's Echo 8mm series of drives offer a range of features. Model numbers



By David B. Miller

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The Echo 2420
is a 4mm DDS
drive, not a plain
DAT drive

492n and 492nXL use the long time standard 2.3 GB Exabyte 8mm drive. Model numbers 495n and 495nXL sport the high capacity 5.0 GB drive, also from Exabyte.

The Echo 2420 is a 4mm DDS drive, not a plain DAT drive, which is compatible with the HP Series 6400 DAT drive. DDS cartridges store up to 2 GB of data.

Installation

The 4950XL led two lives during its stay in our lab, neither of which was on an MPE XL system (which is what the XL in the model number stands for). Occasionally, we had the drive installed on an HP 9000 Model 360 workstation, and other times on an HP 9000 Model 834. We didn't need the features offered by the 4950XL for MPE purposes, but we put full faith in the notion that an Exabyte drive is an Exabyte drive no matter what it's called, and that it should work on our HP-UX systems anyway. It did.

Connecting to the 360 simply required daisy-chaining it to the HP-IB bus. We could do a little more on the 834. The 49x0 models come with a push-button disk backup feature that lets you make an image backup, totally controlled from the drive's front panel, of any disk on your HP-IB bus. This drive had two HP-IB connectors, one for the cpu-to-drive connection and the other for connecting the drive to the rest of the HP-IB bus. We couldn't do this on the 360 because we had SCSI disks.

Drive configuration is done with two front panel buttons and an LCD readout. We set up the HP-IB address, HP7980 emulation (also available are CS-80, HP7974, HP DDS and others) and fast file mark processing.

On our HP 9000/834, we were able to use the push-button disk backup fea-

ture. The drive searches the HP-IB bus for disks, and displays them one at a time on the LCD panel. Upon selecting a disk, the drive will perform an image backup, optionally verifying each operation.

A database of backed-up disks is saved to do restore operations from the front panel. Because the entire disk is restored, care must be taken to prevent the restore from being interrupted midstream.

Other utilities available from the front panel include the typical tape loading/unloading/positioning functions and various useful statistics about tape capacity and errors. Media certification can be initiated from the front panel. A disk utility lets you display disk statistics, format disks and verify them.

In an era when many of the buttons, bells and whistles are being removed from the hands of the user and are being integrated into the box, I found it reassuring to have some of that control returned to me through the front panel.

The Echo 2420 DDS drive had a sparse front panel in comparison to the 4950XL. Only an eject button, busy light and tape-in-the-drive light are visible. Cartridges load themselves after being pushed in part way. Tape operations are handled by your backup software or through the mt command.

Software setup is very similar for both drives. To emulate an HP7980, the Echo 8mm mknod command looked like this example:

```
mknod /dev/rmt/Echo c 9 0x070182
```

The Echo 4mm drive on the HP 9000 model 425t was setup with the command:

```
mknod /dev/rscsi/dat1nb c 54 0x0e0103
```

which provided a Berkeley-style close and no rewind. Other settings for the drives' minor numbers are available if you require a different configuration.

The only other task we needed to complete on the HP 9000/425 was to run

TABLE

Echo 2420 (4mm DDS) Platform: HP9000/425t, 16MB RAM, 68040, Rodime Disks, HP-UX 7.0				
File System	Size(KB)	Command	Time	KB/Sec. (Sec.)
/extra	58,996	tar cf /dev/rscsi/dat1nb /extra	529	112
/extra	58,996	fbackup -f /dev/rscsi/dat1nb -i /extra	531	111
Echo 4950XL (8mm Exabyte) Platform: HP9000/360, 8MB RAM, 68030, 7959S Disk, HP-UX 7.0				
File System	Size(KB)	Command	Time	KB/Sec. (Sec.)
/	134,293	tar cf /dev/rmt/Echo7980	1470	91
/	145,878	/etc/backup -archive	1526	96
Echo 4950XL (8mm Exabyte) Push Button Disk Image Backup Platform: HP9000/834, 32MB, PA-RISC 1.0, HP2203 disk, HP-UX 7.0				
File System	Size(KB)	Command	Time	KB/Sec. (Sec.)
Disk Image	430,151	From Front Panel	1920	224

Some typical backup operations using the Bering drives on different HP-UX platforms.

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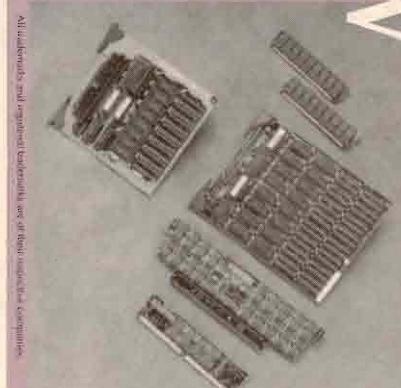
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SAM to include the SCSI tape driver and regenerate the kernel.

Just Plain Backup

We did nothing fancy to test the drives' operation. We used the standard tools such as tar, or the backup scripts supplied with HP-UX.

Although the maximum sustained transfer rate for 8mm and 4mm tape drives is 246 KB/sec. and 183 KB/sec., respectively, I've rarely seen drives stream at maximum speed without some external help — at least in my experiences with them on DEC VAX platforms. In that market, there is software that pro-

vides specialized data caching that eliminates the start/stop nature of most backups and keeps the tapes streaming.

Not having this sort of utility available and having what could be considered a very typical "trashy" disk, replete with files of various sizes and types, I was curious to see how fast backups would go with these drives.

Table 1 lists some of the backup operations we performed with the drives on various platforms, and the tapes' throughput based on the total time of the job, not just the portion in which data was actually being transferred to the drive.

Of course, the particulars of your site — how your data is organized on your disks, the distribution and the size of your files, and a host of other factors — will determine the level of performance you will realize in your shop.

The manuals for both units were concise. The Echo 2420 4mm DDS manual was written solely for HP 9000 Series 300 installations while instructions for HP-UX, MPE, MPE XL, PASCAL, BASIC and SRM based systems could be found in the Echo 4950XL manual.

If downsizing has become a crusader's call in your company, or if you'd just like to enjoy the convenience of unattended backup, check out the cartridge drives from Bering. There's one right for your particular backup needs. ■

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How Kelly unleashes HP performance.

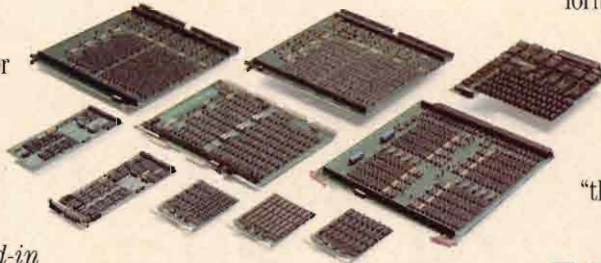
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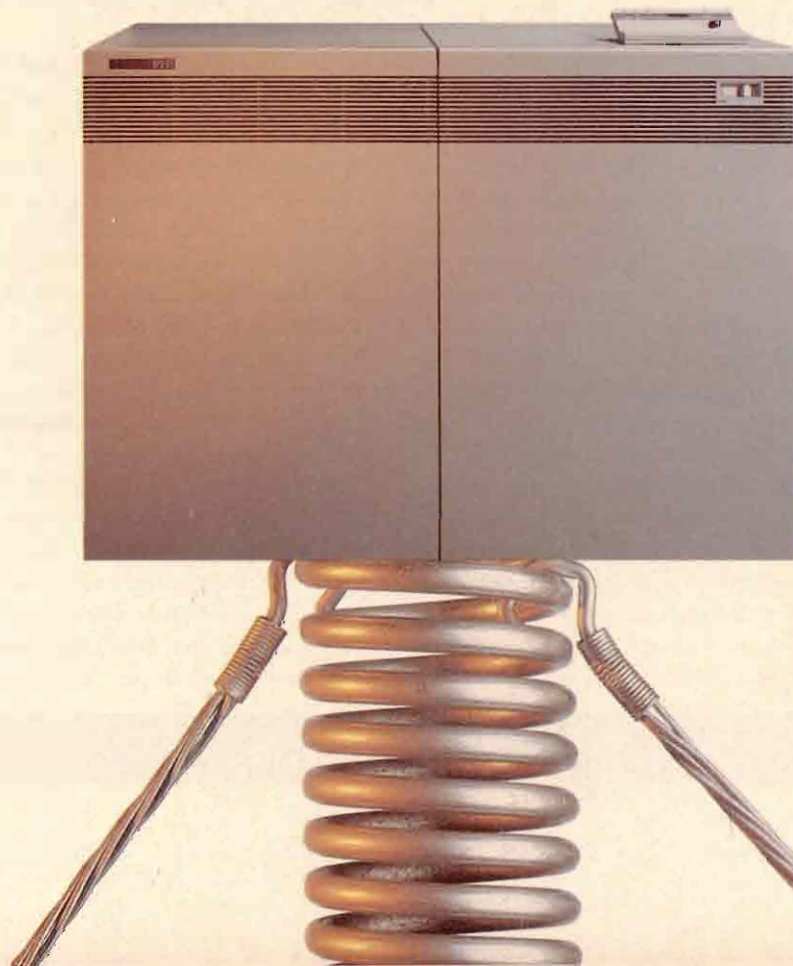
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The Spirit Of Automation



Singapore Computer Systems' LL'Spirit Brings HP 3000/ PowerHouse Users In Line With Newest Database Technologies

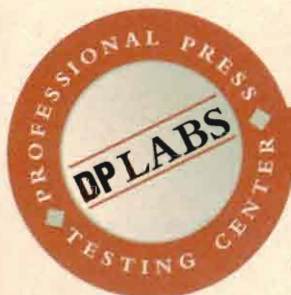
Client-server and relational database technologies have been getting good press during the past few years, generally overshadowing the role our minicomputers and 4GLs still play in addressing real business needs. Having recently survived the semi-successful (and expensive) porting of a minicomputer application to a UNIX-based file server, I have a fresh appreciation for the role of TurboImage, the HP 3000 and Cognos' PowerHouse 4GL software.

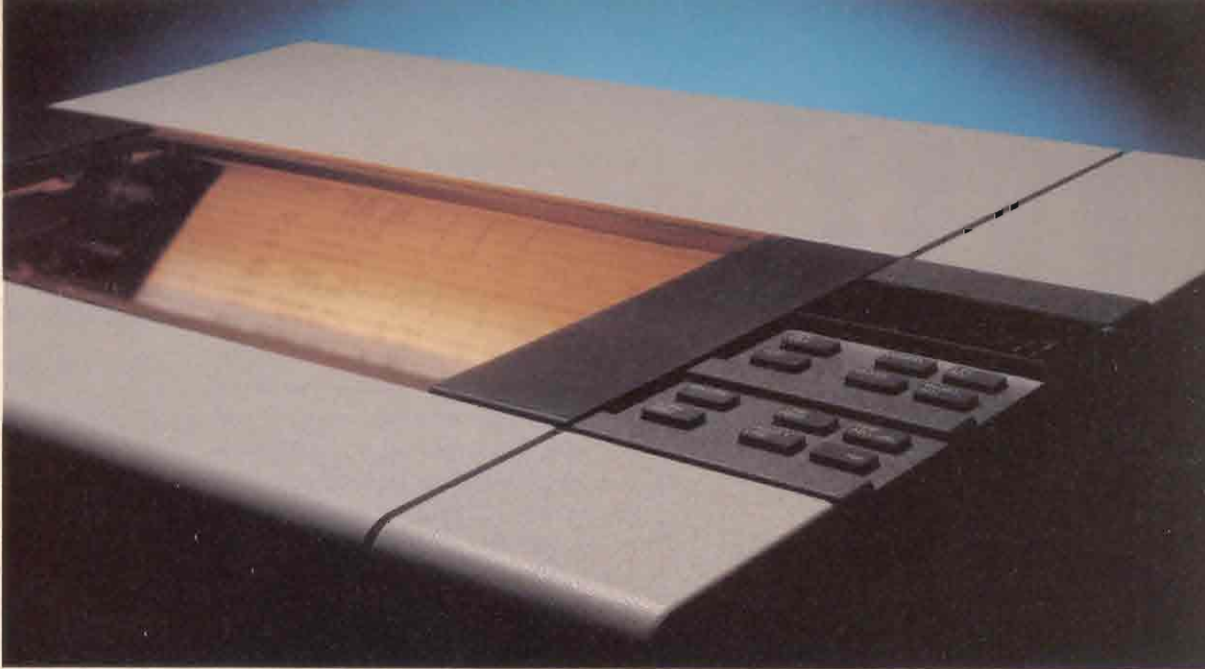
One area in which the newer technologies have a sizable advantage over their minicomputer ancestors is in "re-engineering" applications — making structural changes to a system without

requiring a file-by-file impact analysis and without requiring that changes to the system be made on a file-by-file basis. LL'Spirit from Singapore Computer Systems (Singapore) is a re-engineering tool that brings to users of Cognos' PowerHouse on the HP 3000 some benefits of the newer database technologies.

LL'Spirit assists in the development and re-engineering of Cognos' PowerHouse programs on the HP 3000 under MPE V and MPE XL. (Versions for PowerHouse on the IBM AS/400 and DEC VAX are planned.) LL'Spirit works by storing information about your application (programs, data dictionary and documentation) in an "encyclopedia"

By Joel Martin





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CIRCLE 101 ON READER CARD

FROM THE LAB

similar in principle to how your data dictionary stores information about your data. You can think of the encyclopedia as a repository, or as a higher level of abstraction than the data dictionary as seen in *Figure 1*.

The benefit of having this new hierarchical level is that information about the entire application can be stored and managed in a single place, providing a view across all of the application's component files. LL'Spirit makes it possible to generate data entry screens, QUIZ reports and accompanying documentation directly from its encyclopedia.

Existing data entry screens also can be selected for auditing by LL'Spirit and an "impact analysis" of potential changes can be run to facilitate modifications to databases, database elements and files, screens, reports and documentation. Some types of global system changes can be performed directly through LL'Spirit, eliminating the tedium and risk of error inherent in trying to identify and edit all affected files, screens, reports and documentation.

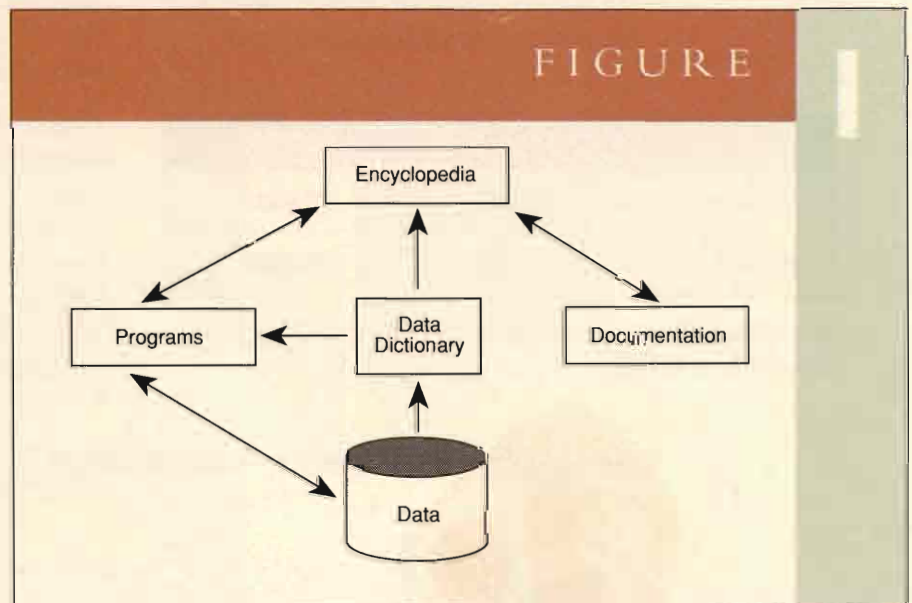
Using LL'Spirit is straightforward. Entering the SPIRIT user-defined command from the MPE prompt brings you to the

Information about the entire application can be stored and managed in a single place.

main menu of LL'Spirit as seen in *Figure 2* which, by the way, is written in PowerHouse. All of LL'Spirit's functions are accessed through the menu and subordinate menus as are the text editor of your choosing and the PowerHouse tools (QDD through QTP).

Online help is available on this and every screen by typing HELP in the ACTION field and entering a carriage return.

Handily, the LL'Spirit environment is configurable. It's easy to change the default text editor (item 42), the location of the PowerHouse programs, the location of the LL'Spirit encyclopedia and the location of the documentation files. Unfortunately, a single LL'Spirit encyclopedia only can support a single application.



LL'Spirit's "encyclopedia," or repository, is similar in function to your data dictionary.

Supporting multiple applications requires the creation of multiple encyclopedias, each in a unique group or account.

In practice, I feel that this will be only a minor annoyance, but it would be nice if LL'Spirit supported a system-wide level of abstraction as well. (If you have multiple Qschemas, and therefore require multiple encyclopedias, you may need to propagate some changes across each encyclopedia.)

After you have confirmed or modified the SETUP default values, you'll perform an initial load of the LL'Spirit encyclopedia through function 11, Load Data Definitions. The encyclopedia can be loaded from one of four possible sources: an existing Qschema; a PowerHouse dictionary source file; Dictionary/3000; or directly from a TurboImage root file. As LL'Spirit works exclusively with Cognos' PowerHouse, you'll likely use the Qschema to load the encyclopedia, as I did. If you choose to have the load execute in batch mode, you call up the Batch Job Attributes screen which provides you the opportunity to modify the job logon, to set a date and time for job execution, to keep or purge the jobstream \$STDLIST and to modify a few other attributes of batch jobs running under MPE. The same screen is called up each time you choose an LL'Spirit function that submits a batch job.

Once your data definitions are loaded into the encyclopedia they are maintained through LL'Spirit. Modifications are made to PowerHouse Qschema system options (the schema title, default date formats, etc.), user classes, data elements, data files and database notes. You then use the encyclopedia to generate a new Qschema and possibly a new entity relationship map and new element/file cross reference listing as well.

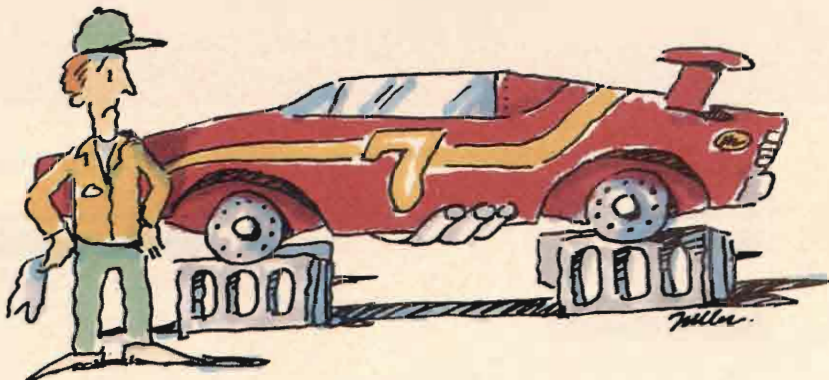
Spiritual Elements

There are two major component products of LL'Spirit: Developer and Re-Engineer. The Developer has two functions that include generating PowerHouse programs (actually just QUICK and

QUIZ, not QTP) and auditing QUICK programs (see Figure 2). LL'Spirit Re-Engineer has three functions: to document PowerHouse programs; analyze the impact of a potential change; and generate a printed manual of your complete application as defined in the encyclopedia.

Generating PowerHouse programs is as straightforward as using other functions of LL'Spirit. The generation subsystem permits you to define separate naming conventions for your QUICK and QUIZ programs and automatically compiles the programs for you if desired. The QUICK screens generated include both menu and

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data entry screen types. All of the programs I generated were executable as created by LL'Spirit and served their function as prototypes quite well. LL'Spirit also generates a TurboImage database or individual QUICK and QUIZ programs from the information in its encyclopedia.

The auditing facility of LL'Spirit is limited to auditing QUICK screens and has no functions for auditing QUIZ or QTP programs. The documentation credits the auditor with "extensive knowledge on how to code high quality and efficient QUICK programs" though beyond checking for PowerHouse compilation errors I wasn't able to determine what tests the audit performs. Initially, I had trouble selecting the QUICK programs to be audited, but only because LL'Spirit didn't support the same wild card usage as MPE supports. The auditing facility may have much to offer but without more support from the documentation, I found its value to be limited.

The impact analysis facility provides a good window on your application's components through View Program Map and Cross Reference Entity/Program.

The impact analysis facility of LL'Spirit also could benefit from better documentation. One example is given of performing an editor change to a set of files (with the option to recompile the affected programs) but the documentation makes no attempt to illustrate LL'Spirit's benefits across the range of re-engineering tasks: identifying all areas to be impacted by a

structural change; modifying the database and dictionary; modifying and recompiling the affected screens, reports and transaction programs; and updating the documentation.

The impact analysis facility provides a good window on your application's components through its View Program Map and Cross Reference Entity/Program functions. View Program Map displays header information of a program and optionally shows the program security, files used and child/parent relationships. The cross reference of entities to programs accepts as input an entity name or an entity name with wild card characters, and displays a list of all program source locations and the type of usage for the chosen entity or entities. The text editor then can be invoked to modify a source program displayed in the list.

One problem in managing any large body of application programs is generating the documentation and keeping it current. Possibly LL'Spirit's finest feature

FIGURE

2

MODE: ACTION:		L L ' S P I R I T		SPT0000.6.00	
Expiry : 11/20/91		MAIN MENU		09/04/91 17:13	
INITIALIZ		POWERHOUSE DEVELOPMENT			
01 Setup		Qsch : QSCHMAC			
DATA DICTIONARY		41 - use mpefile -			
11 Load Data Definitions		42 EDITOR			
12 Maintain Data Definitions		43 QDD 47 QUICK			
DEVELOPER		44 QUTIL 48 QUIZ			
21 Generate PowerHouse Programs		45 QSHOW 49 QTP			
22 Audit QUICK Programs		46 QDESIGN 50 SETQKGO			
RE-ENGINEER		USER DEFINED UTILITIES			
31 Document PowerHouse Programs		61			
32 Analyze Impact of Software Change		62			
33 Generate Documentation Manual		63			
		64			
		65			
		67			
		68			
<I> Enter HELP on any screen for assistance					
PROJECTS	QUIZP	f3	f4	f5	f6
					f7
					f8

All LL'Spirit functions are accessed through the main menu.

is a tool to create technical documentation. Documenting programs via LL'Spirit is a three step process. First, you add or modify comments in your program source code so that they can be recognized as text to be included in your LL'Spirit generated documentation. Second, you select the program source files to be documented (using wild cards, most likely) and instruct LL'Spirit to create the documentation files. Finally, you configure or affirm the layout for the printed manual and generate the paper copy.

The LL'Spirit reference manual is again too spartan in its description of these functions, but with relative ease you can produce a laser printed technical document complete with table of contents, section headings, cross references, two indexes and even a user configurable disclaimer for the first page!

The quality of your documentation will depend in large part on the quality of the comments in your source code but it's this direct linkage of the source code to the printed manual that will help ensure that your documentation remains current. You need not fear that your source code will become incoherent if you include many comments solely for the benefit of the printed manual. LL'Spirit has a provision for identifying in the source code supplemental files of

documentation to be included in the printed manual.

LL'Spirit is potentially a valuable tool for developing, supporting and documenting your HP 3000 applications written in Cognos' PowerHouse. The prototyping, cross-reference and documentation generation facilities are good,

but the reference manual and tutorial are much weaker than the product deserves and the product's focus is comparatively narrow. In offering some of the benefits of the newer database technologies, LL'Spirit may bring significant benefits to your PowerHouse application development and maintenance efforts. ■

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APOLLO

Fred Mallett

But I'm Not Dead Yet!

Recently, as I loaded HP-UX on one of our Series 400s, I heard the words "But I'm not dead yet!" Thinking another "Monty Python and the Holy Grail" fan was greeting me, I looked around to discover no one. As I resumed the load, the voice became rather insistent until I asked, "Who isn't dead?" It turns out my Series 400 (//trigger) was rather upset that I was giving up on it and switching over to HP-UX even though Domain/OS was still living a vibrant life. I pointed out that although Domain/OS was still alive, its prospects for a long life weren't particularly bright.

Now I know that analysis was a big mistake. Have you ever seen the size of the color monitor cable on a 400? And they sure can use it. As I'm waiting for the welts to heal, I figure I'll stand here (can't sit) and relate the lecture //trigger gave me.

Cause For Punishment

The reprimand started with //trigger reminding me of a recent meeting I had with HP. It seems that SR10.4 isn't even on the product price list yet (as of this writing, anyway), which is a bummer because this column originally was intended to be about my experiences with SR10.4.

I got another slap when //trigger pointed out that this means Domain/OS will be supported through the end of the millennium. "Huh?" I asked, then ducked quickly. It turns out that most products stay on the price list for three to five years, and HP commits to support products for five years after they come off the price list. So Domain/OS will be

supported through the end of the decade, which also happens to be the end of the millennium.

Now, as I think about this (not out loud as //trigger is still watching), it seems that anyone with a production network would let those nodes do what they are doing now. Why throw the entire network into a state of flux by jumping from Domain/OS to HP-UX? (Actually, I have some good reasons to do that.) It seems best to just leave those DNs and even series 400s running the best OS in the industry until they become obsolete. Obsolete because of the hardware, not the OS.

Think about running your applications on a DN 300 today (for those of you not around back then, think of .5 MB of main memory, 1 mip cpu and a 35-MB hard drive). Now, think about running your DN 5500 eight years from now and you'll see my point. Before Domain/OS goes away, the hardware will. In other words, don't say Domain/OS is dead until it is. Right now, and for a while to come, it's still the workhorse operating system of your network (pronounced "mature product"). There are even some new products planned to bump up the speed of those machines capable of running Domain/OS.

Personal Reprieve

Don't tell //trigger, but there are still some valid reasons to switch some Series 400s to HP-UX. If you're involved in software development, you must get new products out, and the Series 700s only run HP-UX. Putting some 400s on HP-UX will help. Also, preparing for OSF will be easier to do from HP-UX than from Domain/OS. But as far as OSF's arrival date is concerned, I've stopped holding my breath. The release of OSF/1 still is missing key functionality,

and I can't see HP spending the time and money to rewrite OSF code for them. Maybe OSF 1.1 will support a mission critical application, but I understand OSF/1 is more of a "see how it works" release. A solid release of applications that run on OSF won't be out until just around the time those DNs are about fully depreciated anyway.

Keeping Domain/OS Alive ...

Because Domain/OS still thrives, it seems only appropriate to cover a few technical tidbits relating to it.

Do you have trouble logging out? Do you get a message about having to blast processes every time you logout? Has this happened ever since you loaded PSKQ3? Two things about this: First, by closing all windows before you log out, you can



I often hear people say they wish there was a way to "capture" the transcript of a shell command session.

bypass it. But that's not a fix. Neither is what I am about to tell you, but it's worked on seven out of eight nodes I've tried it on. Look at soft links in /lib. It turns out that the install puts a soft link from /lib/x11lib to /lib/x11lib.r4. On one node, x11lib wasn't even there after the load. What I did to fix the problem was delete the softlink, and copy or hardlink x11lib to x11lib.r4. I used the command:

```
In /lib/x11lib.r4 /lib/x11lib
```

On each of the machines to which we applied this fix, the effect was immediate. The reason I say that it worked on seven of eight nodes is this: I called HP to relate this, and the engineers couldn't duplicate my success. Since then, I have successfully applied this method to another network of 15 nodes.

One interesting thing I discovered by chance occurs while using xdm mode login under X Windows. Normally, when the registry daemon (rgyd) is unavailable, and there is no local registry on this node, you can login as "user" without a password. This feature is used while loading the first node in a network from cartridge tape, as there is no registry to use. It's disabled after a registry is created in the network, or the local registry is enabled by the first login from the network registry. It's also disabled, (or not enabled) by xdm. I spent two hours trying to figure out why I couldn't login until I stumbled on the answer. For some

reason, I decided to get rid of the /etc/daemons/xdm file to revert to DM window management, and "user" login worked again.

... And Kicking

I often hear people say they wish there was a way to "capture" the transcript of a shell command session. For activities such as system backup and monitoring when tape volume swaps were made, this information is invaluable. Under the DM, you could use "PN," but under X Windows that is no longer an option. Another way is to pipe standard and error output (using the |& symbol in the Cshell) to the tee command. The problem here is that the symbol is different in each shell. The best solution I know of is to use the "script" command. Jeff Detterman of Rockwell International says he uses it on the DEC ULTRIX systems. I couldn't believe I hadn't heard of this command before if it existed under standard UNIX. Turns out it has been around forever, and exists on all UNIX platforms I have access to. The command is simple to use:

```
script [-a] [filename]
```

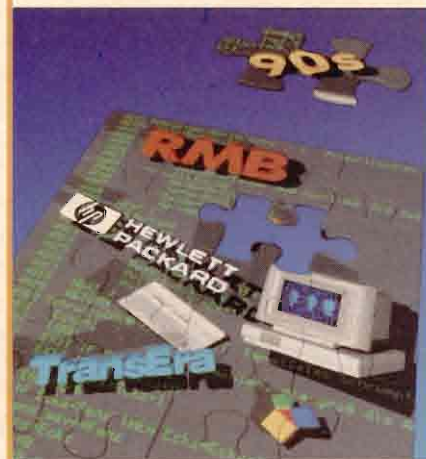
It makes a type script of everything written to the terminal (pad) until the shell exits. The -a option means append, and if you don't assign a filename, it writes to a file named "typescript." Remember, it forks a new shell to execute in, so an end-of-file is used to return to your original shell, and to stop logging. If you get messages about ttys, use /etc/mkdev to recreate your ptys as they are corrupt.

That's all I can think of for SR10.3. Besides, SR10.4 is just around the corner. I knew I could write something to make //trigger smile.— Fred Mallett is president of FAME Computer Education in Corpus Cristi, TX. He serves on the InterWorks board of directors.

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PC TIPS

Miles B. Kehoe

A Personal Touch

A WIN.COM file is created by the Windows SETUP program

from the files WIN.CNF, a .LGO executable file and a .RLE graphics file appropriate to your video card. All of these files are stored in the SYSTEM subdirectory under your primary Windows directory.

You can create a WIN.COM by combining these three files. For example, to create a WIN.COM file for your VGA system, you can use the command:

```
COPY/B WIN.CNF/b+VGA.LGO.LGO
/b+VGA.LGO.RLE /b MYWIN.COM/b
```

After executing this command and moving MYWIN.COM into the primary Windows directory, you can start Windows using the command MYWIN.

Customizing WIN.COM

You might have guessed that if you provide your own graphics file in place of VGA.LGO.RLE, Windows will display your graphics image rather than the Microsoft logo. However, there are a few details you should understand about both RLE files and the WIN.COM program.

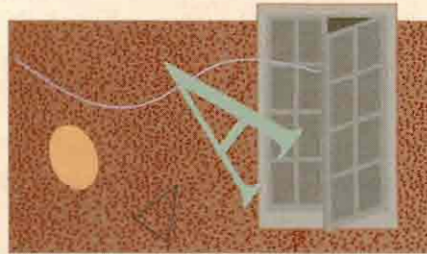
First, to be able to recover from any problems, you should make a working copy of the Windows SYSTEM directory. Change to your primary Windows directory and type:

```
XCOPY .\SYSTEM .\WORK /s/e
```

This will copy all files in the SYSTEM directory into a new directory named WORK. Complete all your experimentation on the files in this working directory. If you do, you always can recover your original WIN.COM file by using the earlier COPY statement.

In the PC world, one of many graphics file formats is Run-Length Encoded

(RLE) format. RLE files are standard BMP files in compressed format using a technique called, logically enough, run-length encoding. If you have a graphics image and a program to convert to RLE format, you have the ability to create your own Windows logo.



The only real restriction to using any RLE file is that the maximum file size of the RLE you use must be less than about 55 KB after compression. Depending on the image you're using, this can limit the uncompressed file size to anywhere from 800 KB down to 200 KB. All you can do is experiment until the compressed RLE file is small enough.

Unfortunately, none of the standard Windows utilities creates RLE format files. For example, PAINTBRUSH supports only BMP, MSP and PCX formats. Nonetheless, there many of public domain utilities that can convert several graphics formats into RLE format.

The Program Manager

When Windows starts, it follows a process analogous to the system startup process. After WIN.COM displays the logo, the Windows code checks the SHELL in SYSTEM.INI. The default shell, PROGMAN.EXE, loads the familiar Program Manager.

PROGMAN next checks WIN.INI as to how to initialize Program Manager. You can specify programs to be loaded or run automatically, and several other customization features. The standard Pro-

gram Manager interface groups, and the applications and icons within the groups, are maintained in Group files you define when you first create a Program Group.

Occasionally, one or more of the group files may be damaged or deleted. When this happens, Windows reports an error message every time you start it or NewWave. To fix the problem, you must restore the missing or damaged group file, or remove any reference to that group in the PROGMAN.INI file. You'll find this file in the primary Windows directory, and you can edit it with any text editor such as NOTEPAD. The actual format of the group files is binary and is not documented, so you don't really have the option of creating your own group files manually.

Out Of Memory

One of the most frustrating errors in Windows is the message reporting that you have exceeded your systems memory capacity. What makes this message especially frustrating is the fact that it often happens when you're sure you have free memory in your system.

In Windows, there are two programs that manage system resources. These applications, USER.EXE and GDI.EXE, keep track of screen contents and manage the number of open windows and other resources. In Windows 3.0, these programs each allocate only 64 KB of memory; when these two 64 KB segments are full, Windows reports it's out of memory. Luckily, Windows 3.1 is reported to solve this limitation. — Miles B. Kehoe, based in Mountain View, CA, is now a Sysop on CompuServe's HP Systems Forum (GO HPSYS). He can be reached there at 76711,405.

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NETWORKING

Tim Cahoon

Deciphering Addresses

Network addressing can be a confusing topic. While

some addressing schemes are used only for a particular protocol, others relate to a specific media. Some even may require the use, whether directly or indirectly, of other addressing schemes. One thing is certain: There is no single standard.

Here are three popular network addressing schemes and how they are used.

The first type of addressing is used by physical media. If your workstation is connected to a Ethernet LAN, it must have some type of interface card. This card has a unique built-in numeric address (each manufacturer has a range of numbers). This address identifies your workstation on a particular physical network or *wire*.

Ethernet addresses are built-in hexadecimal numbers assigned to an interface card by the manufacturer and used by your software. Token-Ring addresses, however, are assigned when hosts are added to a ring. An Ethernet address might look like this:

```
02:07:01:07:05:0E
```

There are many other examples of how hosts connect to physical media, and each media has a unique way of addressing hosts. The purpose of the software is to move data between two points over a common "wire," which could take the form of radio waves, fiber optic cable or copper wire.

Single Protocol Addressing

The second type of addressing is for single protocol networks such as X.25. An X.25 address, or more properly called an X.121 address, is used to identify hosts

connected to a X.25 packet network. Every address must be unique.

It's important to understand that X.25 addresses only function within an X.25 network. If the two hosts you need to connect both use X.25, the job is simple. If not, then you need some type of protocol, such as IP, that provides end-to-end communications.

An X.121 address can be up to 14 digits long. The first four digits are called

**ONE THING IS CERTAIN —
THERE IS NO SINGLE
NETWORK ADDRESSING
STANDARD.**

the DNIC, Data Network Identification Code. Of these four digits, the first three identify the country and the last digit identifies which Packet Switched Network (PSN) within that country.

The last 10 digits of the address are assigned by the PSN. Some may use all of 10 digits and others may use less. BT Tymnet, for example, uses six digits to identify the host with an optional two digits for subaddressing if needed. Therefore, a BT Tymnet address can range from 10 digits (4 DNIC + 6 Host) to 12 digits (4 DNIC + 6 Host + 2 Subaddress). The only time an X.121 address is assigned to a host would be if you had a totally private network. As a PSN customer, your vendor will assign an X.121 address to each host for you.

Novell's IPX protocol also fits into this category. Traditionally, IPX hosts used IPX addresses to talk to other IPX hosts. Keeping the workstation addresses unique across several IPX networks is a concern if those networks are linked.

Novell uses a hexadecimal address scheme to identify hosts and networks. The complete address is made up of four hexadecimal numbers which range in value from 0001 to FFFF. The complete address is in the form of:

```
NNNN.hhhh.hhhh.hhhh
```

NNNN is a hexadecimal number representing a specific network and hhhh.hhhh.hhhh represents a host within that network. Neither the network portion, the host portion or the whole address can have the value of all Fs. This value is used to represent a special address for broadcast packets. Many times the host portion of the address will be set to the same value as the interface card if practical.

These types of protocols use the physical layers to communicate across the wire. At this level, the applications can communicate with each other. At the physical level, only the interface cards talk to each other.

End-To-End Protocols

The third type of addresses are used by what I refer to as end-to-end protocols. One such protocol is the Internet Protocol (IP). IP, of TCP/IP fame, finds a path from point A to point B using whatever means possible.

For example, the data being transmitted may start on an Ethernet, leave it via a bridge or router, jump to a Token-Ring network, pass onto an X.25 network, followed by a satellite network, and then finally back to an Ethernet network and the designated host. In this journey, the IP packet was encapsulated into many different types of packets, through numerous protocols, with many

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different addresses. Yet the IP address remained the same. (Remember that IP just gets the data there; TCP makes sure it arrives correctly.)

While IP has been designed from the ground up for that purpose, vendors such as Novell have been extending their protocols to allow similar capabilities.

Inside IP Addresses

Because TCP/IP is so popular let's take a closer look at how the addresses work. IP addresses are made up of four eight-bit octets. An eight-bit number can have a decimal value from 000 to 255. So an IP address can be represented by the following range:

000.000.000.000 to 255.255.255.255

IP addresses have been divided up into three main categories: Class A, Class B and Class C. To identify which class a network address belongs to, you must look at the value of the first octet. If the value is 1 to 127, then the address is a Class A. Class A addresses use the first octet to identify the network and the last three octets to number the hosts on that network. An example might be:

126.1.254.55

Breaking it down, we see that it is for a host on network 126 with an address of 1.254.55. This numbering scheme only allows for 127 Class A networks but each network can have up to 16,777,215 hosts.

A Class B address has the value of the first octet range from 128 to 191. A Class B network uses the first two octets to identify the network and the remaining two octets for the host. An example would be:

191.55.234.167

This address is for network 191.55 and host 234.167. The Class B addresses allow for 16,383 networks with up to 65,535 hosts per network.

Class C addresses are those whose first octet has the range from 192 to 223. The range from 224 to 255 is reserved for re-

search purposes. A Class C address uses the first three octets to identify the network and the last octet to identify the host. An example would be:

192.56.187.219

Here the 192.56.187 represents the network and the 219 is the address of the host. The Class C range of addresses allows for up to 2,097,151 networks, with up to 255 hosts per network.

To learn more about IP addressing, you should refer to the NS3000 manuals if you are an MPE user. You also should purchase, "Internetworking with TCP/IP. Principles, Protocols, and Architecture," by Douglas Comer. An updated edition recently has been released. The book is highly recommended as both an instructional aide and resource guide to TCP/IP.

I recently received a copy of "A Manager's Guide to Multivendor Networks," by John Enck. The book covers many topics at a level appropriate for management. The author discusses a variety of systems including those offered by DEC, HP and IBM, and provides enough information to understand the products without going into too much technical detail. You may want to buy a copy or two for key people in your organization.—*Tim Cahoon provides wide area network and HP technical support for the manufacturing operations of a Fortune 500 company.*

Would you like to continue to see articles on this topic?
Circle on reader card
yes 338 no 337

Editor's note: Here's some additional information on the two books mentioned in Tim's column:

Internetworking With TCP/IP. Principles, Protocols, And Architecture, by Douglas Comer. Hardcover, 547 pages, \$54, ISBN 0-13-468505-9 (1991, Prentice-Hall).

A Manager's Guide to Multivendor Networks, by John Enck. Softcover, 250 pages, \$35, ISBN 1-878956-03-5 (1991, Professional Press Books, [215] 957-4265).

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Make plans to attend NECRUG's 13th annual conference now.

CIRCLE 177 ON READER CARD

HDS Unveils RISC-Based X Terminals

Human Design Systems announced the ViewStation FX Series color, RISC-based X Window terminals.

The ViewStation FX Series features an Intel i960 RISC cpu and two ASIC processors for communications and graphics. The ViewStation can run local X clients, offloading the host cpu and allowing more X terminals to be connected to a given computer. Open Look and Motif window managers can be run locally to reduce network traffic and improve interactive performance. In addition to local window managers, user-written X clients can be run locally to further distribute processing.

The ViewStation FX Series includes built-in diagnostics that can be displayed on-screen or remotely, and also features an SNMP agent for network management. One parallel and two serial ports are included for local printing and communication with non-networked hosts. Ethernet connections include thinwire, thickwire and twisted pair, with automatic sensing and selection.

The ViewStation FX is available in RAM and FLASH-PROM versions. Standard memory configuration for all models is 2 MB, with memory capacity of up to 72 MB available using standard SIMMs.

Contact Human Design Systems, 421 Feheley Drive, King of Prussia, PA 19406; (215) 277-8300.

Circle 400 on reader card

Bradmark Announces DBGENERAL/SQL

Bradmark Technologies introduced DBGENERAL/SQL, the database management tool designed for use by the ALLBASE/SQL user.

DBGENERAL/SQL features include database integrity analysis, performance enhanced data access, database structural analysis, security and access controller, and capacity management.

DBGENERAL/SQL benefits HP 3000

systems using IMAGE, TurboIMAGE, TurboIMAGE/XL and ALLBASE/SQL.

Contact Bradmark Technologies Inc., 4265 San Felipe, Ste. 800, Houston, TX 77027; (713) 621-2808.

Circle 399 on reader card

ADAMS 6.0 Enhances Mechanical Simulation

Mechanical Dynamics Inc. announced Version 6.0 of ADAMS, the software product line used to develop 3-D computer models of mechanical systems that contain moving parts, and to analyze and simulate the operating performance of such systems.

A real-time kinematics capability allows designers and engineers to develop "software prototypes" of mechanical system product concepts and to interactively move the system around in three dimensions to examine different design approaches. Five new general purpose force elements have been added to ADAMS six existing force entities. The new forces allow users to model complicated environmental force effects including friction, aerodynamic lift and drag, solar and fluid pressures and hydrodynamic forces, and provide capabilities for modeling the behavior

of mechanical systems that include flexible parts.

ADAMS Version 6.0 now incorporates network licensing and the X Window system into its user interface. Network licensing provides ADAMS users with the ability to float their graphical pre- and post-processing environment on a workstation network. The X Window system allows graphical applications to be executed on one workstation while its user interface is displayed across the network on another workstation.

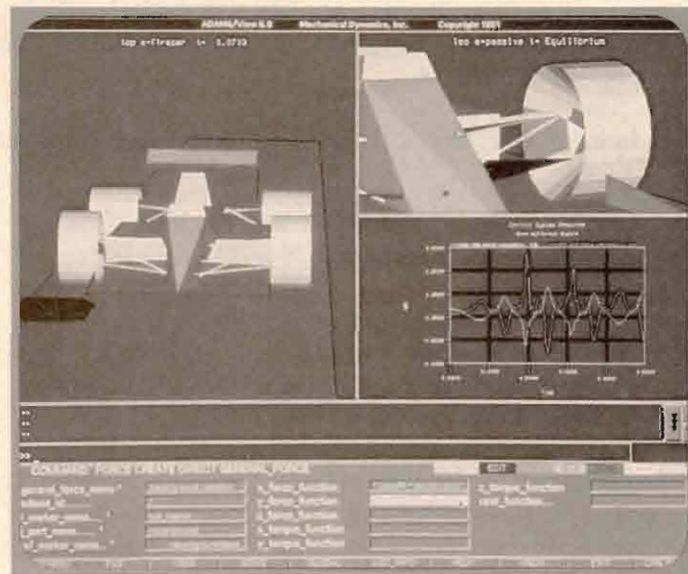
The ADAMS product line is supported on engineering computers including UNIX workstations from HP, DEC, IBM, NEC, Silicon Graphics and Sun.

Contact Mechanical Dynamics Inc., 2301 Commonwealth Blvd., Ann Arbor, MI 48105; (313) 994-3800.

Circle 395 on reader card

700 Series Gains Memory From Clearpoint

Clearpoint Research Corp. announced add-in memory upgrades for the HP Apollo Series 700 Model 720, 730 and 750 PA-RISC workstations.



ADAMS 6.0 offers mechanical system simulation, improved integration with CAD and FEA and advanced animation capabilities.

The HPME-725 uses 4-megabit technology on the 32- and 16-MB options, and 1-megabit technology on the 8-MB option. Designed with 128-bit interleaved memory, the HP Apollo Series 700 requires two boards for system operation, each providing 64 bits. To accommodate this design, Clearpoint memory is offered in three upgrade options. The 8-MB option consists of four 2-MB boards, the 16-MB option consists of two 8-MB boards, and the 32-MB option consists of two 16-MB boards.

List pricing for the HPME-725 is \$8,400 for the 32 MB upgrade, \$4,200 for the 16 MB option, and \$2,100 for the 8 MB set. Contact Clearpoint Research Corp., 35 Parkwood Dr., Hopkinton, MA 01748; (508) 435-2000.

Circle 398 on reader card

HP Delivers CASCADE For PA-RISC Workstations

HP announced that Mantix' program management system CASCADE is available on HP Apollo 9000 Series 700 PA-RISC workstations.

CASCADE allows users in engineering, manufacturing, defense and telecommunications companies to generate management reports showing resource and schedule information extracted from an Oracle relational-database management system.

Elan Unveils UNIX-Based Desktop Publishing Package

Elan Computer Group released Avalon Publisher Version 2.0, a word processing and desktop publishing package for UNIX.

Avalon Publisher Version 2.0 runs under Open Look or Motif and is available on UNIX platforms including HP 9000/300, 400, 700 and 800 Series, Sun-3, Sun-4 and SPARCompatsibles.

Features include color support for both text and graphics, a mailmerge utility, enhanced graphics, and filters for word processors including WordPerfect, IslandWrite, Microsoft Word, FrameMaker

and Interleaf. Other new features include annotation frames, user definable paragraph libraries, autosave and autonumbering. Contact Elan Computer Group Inc., 888 Villa St., 3rd Floor, Mt. View, CA 94041; (415) 964-2200.

Circle 397 on reader card

Unipress Ships VSI*FAX For UNIX Platforms

Unipress Software Inc. announced VSI*FAX UNIX Facsimile System. VSI*FAX is a send/receive external fax modem system that automatically transmits text or PostScript files created by standard document processors such as Uniplex or FrameMaker. VSI*FAX also allows you to display faxes under X Windows, route faxes or print them.

The VSI*FAX package comes with the SX-200 fax modem and the VSI*FAX system software. Features include multiuser scheduling, multiple fax modem support, fax number directory, spooling capabilities, auto retry and electronic mail notification of success/failure.

Additional VSI*FAX modules include FXView, an X Window/Motif fax viewing interface, and FXScript, a PostScript emulator.

VSI*FAX is available on UNIX hardware platforms including HP, Sun, IBM and DEC. VSI*FAX pricing starts at \$1,600.

Contact Unipress Software Inc., 2025 Lincoln Highway, Edison, NJ 08817; (908) 287-2100.

Circle 394 on reader card

Bering Backup Systems Support HP Computers

Bering Industries introduced the ECHO 4420/4425 XL and 2420 2.0 GB 4mm DAT/DDS tape backup systems.

The ECHO 4420/4425 XL supports HP 3000, 9000 and 1000 computer systems using the HP-IB interface, including the newer 800 and 900 Series computers. The ECHO 2420 is a similar system designed for the HP 3000, 9000 and 1000 workstations with SCSI interface. The HP-IB version emulates the

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3003V-(M/Y)

HP7974, HP7980 and HP1300H tape protocols allowing utilization of the various backup/restore features under HP-UX, RTE, MPE V and MPE XL operating systems. Both ECHO models use extended 90 meter

DAT cassettes with storage capacity exceeding 2.0 GB of uncompressed data.

ECHO DAT drives backup and restore data at an average rate of 11 MB per minute and are capable of handling "bursts" of up to

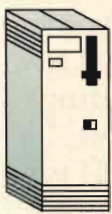
1 MB per second. Using HP's Fastsearch capability, files can be retrieved in an average of 30 seconds. The ECHO 4420 XL has an external real-time clock and auto-timed backup program that create a mirror image of any CS/80 or SS/80 hard disk without computer access.

The SCSI version ECHO 2420 lists for \$3,290. The HP-IB version ECHO 4420/4425 XL lists for \$4,490.

Contact Bering Industries, 246 East Hacienda Ave., Campbell, CA 95008; (408) 379-6900.

Circle 390 on reader card

ANNOUNCING NFS FOR THE HP 3000!



DEC VAX

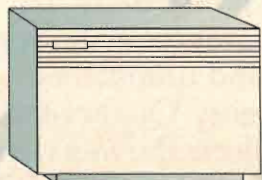
NFS (Network File System), the Unix de facto standard for distributed file access, is now available for HP 3000 systems.

NFS/XL is a high-performance implementation of NFS for MPE XL. NFS is the most popular industry standard networking service that provides transparent access to remote file systems. NFS is supported on a wide variety of machines ranging

from workstations and personal computers to mini-computers and mainframes.



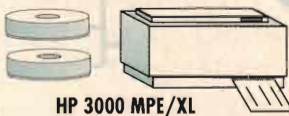
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Zubair Interfaces Expands HP 9000 Memory

Zubair Interfaces Inc. announced the Z-RAM/332, Z-RAM/340 and Z-RAM/400+ memory expansion boards for HP 9000 workstations.

The Z-RAM/332 is a 4 MB expansion board for the HP 9000 Series 332 workstation. The Z-RAM/340 expansion boards provide 4 MB memory upgrades for the HP 9000 Model 340 workstation. The Z-RAM/400+ is available in 4-, 8-, 16- and 32-MB ECC modules and is compatible with the HP 9000 Series 345, 375, 380, 400, 425 and 433. The Series 345 and the HP Apollo 400DL can be upgraded to a maximum of 64 MB. The Series 375, 400, 425 and 433 models can be upgraded to 128 MB using the 32 MB modules. Each module consists of a pair of boards.

Contact Zubair Interfaces Inc., 5243-B Paramount Blvd., Lakewood, CA 90712; (213) 408-6715.

Circle 391 on reader card

Infotek Upgrades Apollo Memory With New DM Series

Infotek Systems added a new line of memory boards compatible with Apollo workstation models DN3500, DN3550, DN4000, DN4500 and DN5500.

Designated the DM Series, the new memory boards are designed to fit into established Apollo workstations. The DM Series boards are Parity-Error Checking and are based around high-density, 1- and 4-megabit SOJ DRAM chips. The DM Series boards are available in 4-, 8- and 16-MB densities.

The DM500+4 4 MB board is \$865. The 8 MB DM500+8 lists for \$1,325, and the 16 MB DM5500+16 is \$2,795.

CIRCLE 268 ON READER CARD



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Circle 392 on reader card

**Oak Grove Systems Develops
OGS-480 FormsWriter**

Oak Grove Systems announced the OGS-480 FormsWriter printer, which allows you to load paper, forms, labels, envelopes or transparencies from the top, rear or bottom of the printer. It features Remote Spool and optional HP-IB compatibility to any HP 3000/9000 host, offers a C-sized carriage with a 24-pin printhead, four internal fonts and six co-resident emulations.

The OGS-480 FormsWriter is \$1,595.

Contact Oak Grove Systems Inc., 1550 El Camino Real, Ste. 270, Menlo Park, CA 94025; (415) 325-1500.

Circle 389 on reader card

**Comprehensive Systems
Releases GUS/3000 6.0**

Comprehensive Systems announced Version 6.0 of GUS/3000, the end-user report writer for MPE V and MPE XL operating systems.

Version 6.0 includes Native Mode execution under MPE XL, simple label formatting, enhanced MIS programming functionality, and extended data dictionary maintenance. Version 6.0 also includes support for Bradmark Technologies SUPERDEX, providing relational database ability to IMAGE and TurboIMAGE.

GUS/3000 gives end-users the ability to create customized reports and labels from data contained in TurboIMAGE data bases, KSAM and MPE files. End-users produce reports by making one character selections off menu or by pressing a function key. All output may be previewed on the terminal, printed, or saved on a disk. GUS/3000 also automates file transfer to the user's PC.

Contact Comprehensive Systems Inc., Penthouse Suite, 720 King Georges Rd., Fords, NJ 08863; (908) 225-9670.

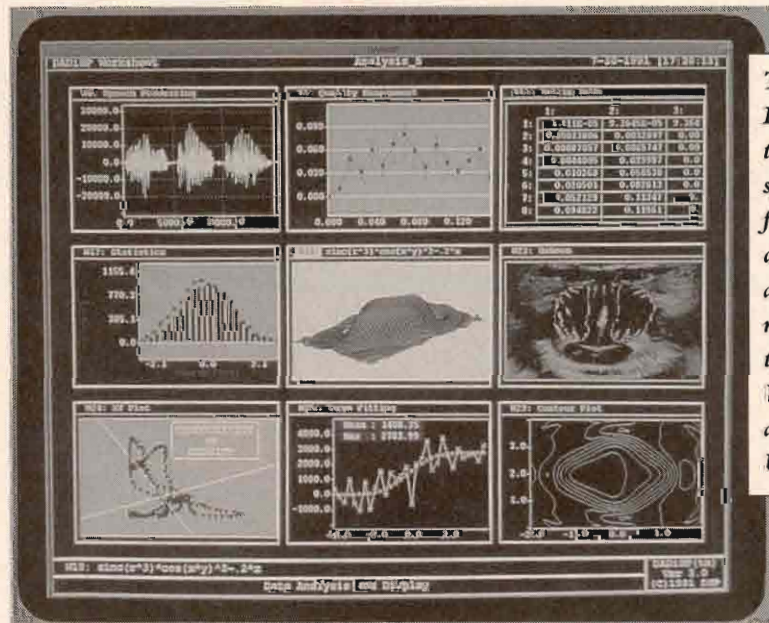
Circle 388 on reader card

**DADiSP Spreadsheet Available
On HP Series 700**

DSP Development Corp. produced DADiSP, the technical spreadsheet for scientific data analysis, available on the RISC-based HP Series 700 workstation. DADiSP has been ported specifically to X11 Windows and HP-UX 8.0.

The DADiSP Worksheet is a visually-oriented graphic tool designed for data analysis in applications like laboratory research, electronic test and measurement, physiological monitoring and digital signal processing. DADiSP combines menu-driven analysis tools and windowed graphics to handle tasks like mathematical problem solving, "what-if" gaming, and graphic analysis of samples information.

DADiSP can directly exchange data with instruments using the IEEE-488 (HPiB, GPIB) protocol. DADiSP can also perform



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data acquisition with analog-to-digital (A-to-D) boards. DADISP software runs on the entire HP 9000 Series.

Prices range from \$895 to \$6,995. Contact DSP Development Corp., One Kendall Square, Cambridge, MA 02139; (617) 577-1133.

Circle 387 on reader card

Epic LazerFAX 2000 Adds Memory To FAX printer

Digital Data Systems introduced the Epic LazerFAX 2000. Similar to the Epic LazerFAX 1000, but with 512 KB of RAM, the Epic LazerFAX 2000 can store 30 to 120 pages of incoming fax documents.

Epic LazerFAX 2000's 512 KB of RAM (expandable to 2 MB) enables you to store incoming faxes when printers are busy or off line. Epic LazerFAX 2000 also scales oversized faxes to fit 11 inch paper and allows you to share a voice phone line. Faxes are printed on any HP compatible printer in 150dpi (high speed) or 3000dpi (high quality) mode. A standard thermal fax machine plugged into the Epic LazerFAX 2000 can be used to send faxes on the same line. A PC or network printer cable can be attached for transparent sharing of the same printer.

The Epic LazerFAX 2000 lists for \$549. Contact Digital Data Services Inc., 775 Franklin Rd., Ste. 100, Marietta, GA 30067; (404) 425-5700.

Circle 379 on reader card

Kingston Ships Memory For HP Apollo 9000 Systems

Kingston Technology added to its line of HP Apollo 9000 compatible upgrades a series of 16 MB modules for Models 720 and 730, as well as 16 MB and 32 MB modules for Model 750.

The new 700 series products add to Kingston's existing HP Apollo memory line that support Models 375, 380, 400dl, 400s, 400t, 425e, 425t and 433s. Kingston's line of data storage subsystems support HP Apollo systems and provide flexible enclosures for hard disks, tape backups and optical drives.

Kingston memory is fully compatible and carries a lifetime warranty. The 16 MB memory upgrade kit is \$5,490. The 32 MB upgrade kit is \$10,995.

Contact Kingston Technology Corp., 17600 Newhope, Fountain Valley, CA 92708; (714) 435-2600.

Circle 384 on reader card

Applix Launches Release 2.0 Of Aster*x Software

Applix Inc. released Aster*x 2.0 office integration software for the X Window System.

Aster*x includes word processing, graphics, a set of macro tools, plus optional spreadsheets, mail and filter packs.

Release 2.0 includes GUI enhancements like the ExpressLine, keyboard mnemonics, a pop-up special characters keyboard and a preferences editor. Aster*x 2.0 also adds extended graphics functions. In Aster*x 2.0 Spreadsheets, users can manipulate data with 46 new built-in financial, general, math, string and special functions. In addition, users can print formulas, drag and drop column widths, search for numbers and text, and highlight data by outlining a single cell or group of cells.

Aster*x is shipping on HP 9000 Series 300 and 400 platforms. Aster*x price starts at \$695. Additional optional filter packets are available for \$295 each.

Contact Applix Inc., 112 Turnpike Rd., Westboro, MA 01581; (508) 870-0300.

Circle 383 on reader card

Iomega Introduces Erasable Optical Storage System

Iomega Corp. extends the LaserSafe 650 MB magneto-optical storage system for UNIX, OS/2 and Netware 286 environments.

The LaserSafe erasable optical mass storage system is a second-generation 5 1/4-inch optical disk system that includes an external SCSI ID select, an external termination switch, an external switchable power supply (110/220), and dual SCSI connectors that allow the use of multiple Iomega drives on the same adapter.

The LaserSafe system uses removable 5 1/4-inch magneto-optical ISO standard cartridges, each providing either 596 or 652 MB of storage depending on the sector size chosen (298 or 326 MB per side).

The LaserSafe storage system is \$4,999. The cartridges are \$299.

Contact Iomega Corp., 1821 West 4000 South, Roy, Utah 84067; (801) 778-3345.

Circle 385 on reader card

CCG Announces IO-Tape Stacker

Contemporary Cybernetics Group (CCG) introduced the CY-CHS10i, a data storage system that features a CY-8200 or CY-8500

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8mm tape drive, 10 tapes in a desktop cabinet and provides random or "intelligent" robotic access to the cartridges. Capacity ranges from 25 to 250 GB, depending on configuration.

With a CY-8200 8mm tape drive, the CY-CHS10i can store 25 GB on 10 tapes. With the CY-8500 installed, it can store 50 GB on 10 tapes. Optional data compression increases storage capacity per tape by up to five times, giving the user the potential for storing up to 250 GB.

The CY-CHS10i features an internal, self-switching power supply, ball bearing cooling-fan, and a removable cartridge holder. Contact Contemporary Cybernetics Group Inc., Rock Landing Corporate Center, 11846 Rock Landing Dr., Newport News, VA 23606; (804) 873-0900.

Circle 378 on reader card

**DIC Digital Introduces
New 2 GB Cartridge**

DIC Digital announced its new 4mm, 2 GB 90 meter tape cartridge. With data compression, the new 2 GB cartridge is capable of storing up to 8 GB of data.

In addition to the new 2 GB tape cartridge, DIC Digital has redesigned its cartridge, offering a new Data Grade cassette to meet computer industry applications. Contact DIC Digital Supply Corp., 222 Bridge Plaza South, Fort Lee, NJ 07024; (201) 224-9344.

Circle 393 on reader card

**Lawson Associates Offers
Open Database Solution**

Lawson Associates Inc. expanded its open solution environment by introducing Lawson Accounting, Human Resources and Distribution software applications. These products now have SQL capabilities to run on Oracle and Informix databases as well as Lawson's own relational database. Multiple database accessibility allows companies to seamlessly move between databases. This allows companies involved in mergers and acquisitions to use acquired hardware and software.

Packages in the Lawson Accounting, Human Resource and Distribution product lines support the HP 9000 Series 800 (HP-UX Release 7.0) hardware platform. Also supported is the DECSystem Series (ULTRIX Release 4.0) and IBM's RS/6000 (AIX Version 3.0).

Contact Lawson Associates Inc., 1300

Godward St., Minneapolis, MN 55413; (612) 379-2633.

Circle 382 on reader card

**Memory Kits Available
For HP Apollo 9000, DN 5500**

Helios Systems announced add-on memory kits for four models of HP Apollo 9000 series workstations and a 16 MB memory board for the HP Apollo DN 5500 workstation.

For models 720, 730 and 750, Helios has 16 MB and 32 MB memory kits, each consists of two boards that expand memory capacity to 64 MB in the 720 and 730, and 192 MB in the 750. Prices are \$3,295 for the 16 MB kit and \$6,610 for the 32 MB kit.

For model 425e workstations, Helios announced 4 MB, 8 MB and 16 MB memory kits, each consists of two boards that when mixed can expand memory capacity to 48 MB. List prices are \$710 for 4 MB, \$1,450 for 8 MB and \$2,400 for 16 MB.

For the HP Apollo DN 5500 workstation, Helios has a 16 MB memory board, four of which brings the workstation up to its maximum capacity of 64 MB. List price is \$2,850 each.

Contact Helios Systems, 1996 Lundy Ave., San Jose, CA 95131; (408) 432-0292.

Circle 377 on reader card

**PV-Wave Point & Click
Directed To HP MOTIF**

Precision Visuals announced an HP MOTIF version of its PV-WAVE Point & Click product that runs on the HP Apollo 9000 Series 700 workstation.

The major features of PV-WAVE Point & Click include: data import/previewer, which eliminates the need for expensive data format converters; synchronized tables and graphics, which allow direct manipulation of the data; extensive menus that allow the product to grow as users' needs change; a macro tool, which automates complex or repetitive tasks; and low-hassle installation because of a new license manager.

PV-WAVE Point & Click MOTIF for the HP platform cost \$4,500 for a single floating license.

Contact Precision Visuals Inc., 62301 Lookout Rd., Boulder, CO 80301; (303) 530-9000.

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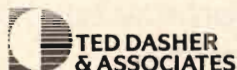
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