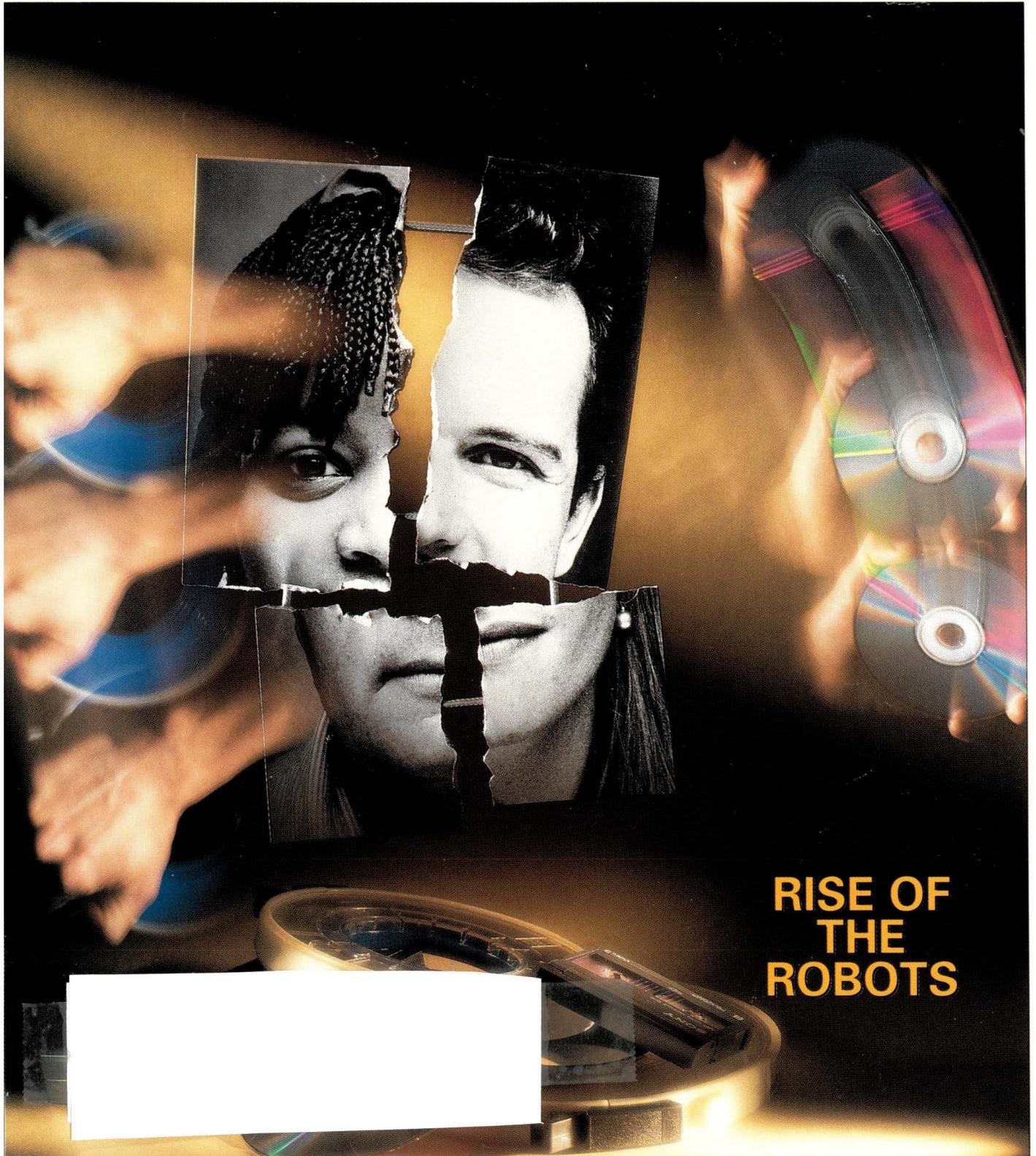


SUNEXPERT

Serving the UNIX Client/Server Network

JANUARY 1994 Vol. 5 No. 1 \$5.50



**RISE OF
THE
ROBOTS**

CDE: Birth of a Desktop

Reviews: Virtuoso, Olympus, SPARCclassic X

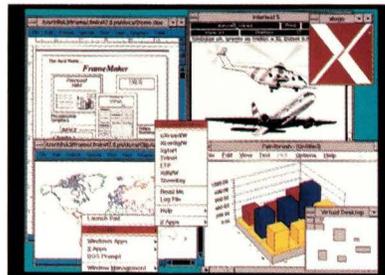


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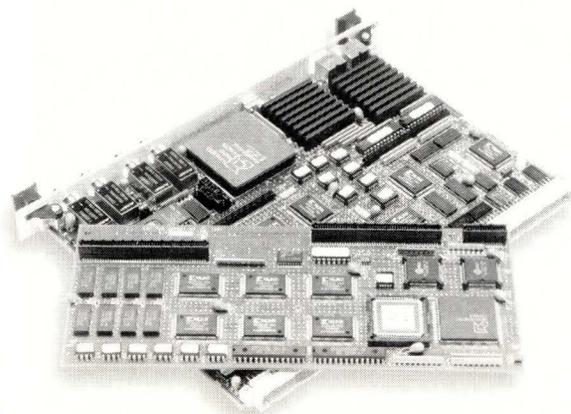
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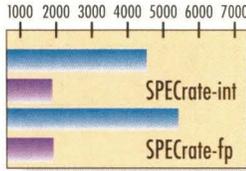
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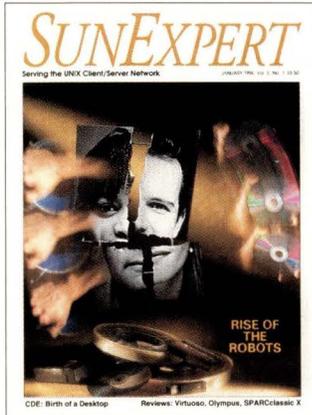
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SUNEXPERT

serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

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Editorial

The Chicken and Egghead Enigma

If you want to know what *really* happened at the October 1993 Common Open Software Environment/Common Desktop Environment Conference in San Jose, CA, take a look at Ian



Darwin's "Birth of a Desktop." Of course, a highlight of the conference was the Common Desktop Environment running identically on Sun Microsystems Inc. SPARC and X86, The Santa Cruz Operation Inc., Novell Inc./USL, Hewlett-Packard Co. and IBM UNIX systems. So your GUI might get a new look and feel with this year's Solaris varieties, but there was more to this conference than meets the eye, so to speak.

Sure, the first conference gave developers a CD containing executables, linkable libraries and header files for a new user interface standard, but some of us would stress that sessions devoted to a common API specification for a unified UNIX were just as, or more, important. Generally referred to as the "1170 API" because of the enormous number of calls it included, this COSE project brings together elements of POSIX, SVID, XPG4, X11, BSD, etc. Along with the CDE specification, this API—slimmed down now to under 1,000 calls—will be turned over to X/Open for Fast Track approval. And fast is not soon enough! Why? The chicken and Egghead enigma.

This flurry of unification activity—all the UNIX hardware platforms with one executable—could lead to a volume, stable target for software developers and, eventually, to coupon-stuffed mail-order catalogs and Egghead Software shelves brimming with low-cost productivity software for UNIX, I hope. UNIX developers now are caught in a chicken-and-egg enigma. Software is hard to find and pricey because there's no volume, and there's no volume because software is pricey and hard to find. I don't know about you, but I've grown a little cynical about UNIX pricing models that make me pay two or three times what a Macintosh or a PC user pays for the same functionality—if not the same application. These models seem to be throwbacks to the Good Ole Big Iron days and don't reflect the current rightsizing craze. Where's the craze for right pricing? Maybe there's more to this dilemma than meets my eye. Let *SunExpert* hear your opinions on this issue.

Doug Pryor

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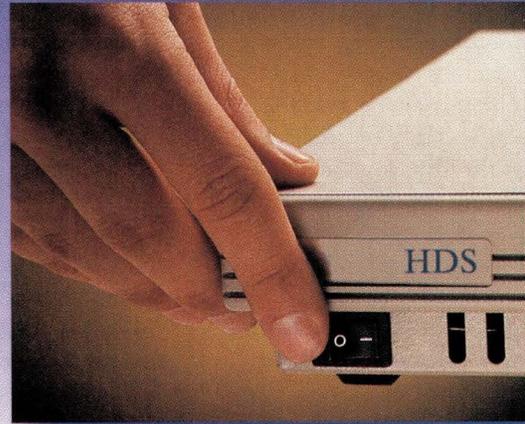
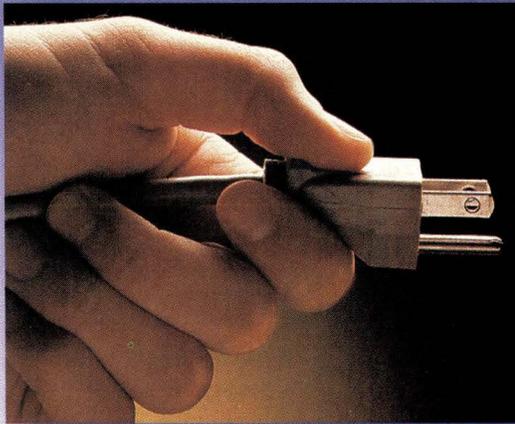
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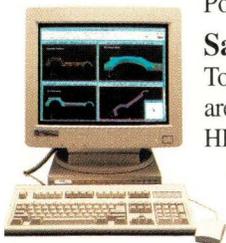
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NEWS

Object-Relational Database Bows

A new company, Montage Software Inc., has been formed to sell what it says is an object-relational database management system. The product would, says the firm, combine the features of relational and object-oriented databases.

Montage as a product is said to include the traditional strengths of RDBMSs, including SQL. However, it is supposed to extend the relational model to include "encapsulated" functions. These functions are not binary large objects (BLOBs)—and indeed, the company makes a point of saying that BLOBs are never used in Montage; they are instead actual objects that can contain both data and the code necessary to perform operations on that data.

Thus, the product allows a user to add new data types essentially at will yet not lose the ability to use familiar, SQL-based query methods.

The Montage database can be accessed with a number of tools. These include the Montage Viewer, which is a data visualization tool. The company says that Viewer allows users to navigate through data, zooming and panning with a mouse.

In addition to the Viewer and standard SQL tools, the product can be extended and customized still further with what the company calls DataBlades. These are modules that can be purchased to customize the product for specific applications.

There are currently three DataBlades available. The first is Text DataBlade, which manages text and document libraries and supplies text-searching

features. The second is the Image DataBlade, which supplies image conversion, storage, manipulation and so on. The last is the Spatial DataBlade, which provides lines, points, polygons and their spatial relationships.

But as remarkable as these technical claims is the company's parentage. Its founders and investors are a group of industry blue bloods, including many of the original executives of the former Ingres Corp.—such as RDBMS gurus Dr. Michael Stonebraker of the University of California at Berkeley and Dr. Paula Hawthorn, formerly of Hewlett-Packard Co. and Britton-Lee.

Meanwhile, the company's chairman is Gary Morgenthaler, who along with Stonebraker founded Ingres in 1980 under the name of Relational Technology Inc. In addition, Morgenthaler is a general partner in Morgenthaler Ventures, the noted venture capital firm, which also invested in the project. The company's other investors include Roger Sippl, who founded Informix Software Inc.

But, impressive as these credits are, what chance has a new database company in a market that is already crowded with databases? At least some people in the database industry are rather bullish on Montage. Christopher Keene, for example, is the president of San Mateo, CA-

based Persistence Software Inc., whose products do nothing but link RDBMS systems with the world of object-oriented C++ programmers. The Persistence product provides a code generator that converts object models in C++ libraries that can then access RDBMSs.

As an object-oriented developer himself, Keene questions whether Montage is really all that object-oriented. But he still likes the product. "I think what they're doing makes a lot of sense," he says. "There is an interesting trend in the database market. You're seeing more and more specialized databases, and in a way, Montage is a specialized database."

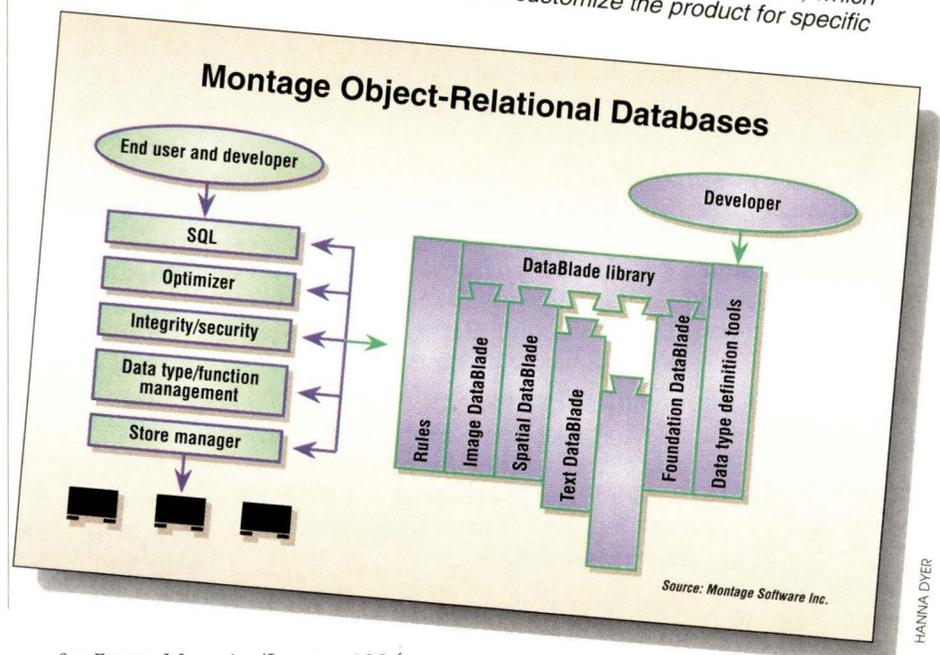
He says the product might be better described as a multimedia database than a object-oriented-relational cross. "I don't think it will be doing anything of particular use to the object developer...but it will be helpful to the multimedia developer."—*mjt*

Rational Pairs with Tower for Eiffel

Eiffel is a object-oriented language that has been growing in popularity since the wide-scale popularization of object-oriented programming. In just the past few years, it has gone from being a great unknown to a cult favorite—with newsletters (such as

Eiffel World, Goleta, CA,

The Montage database is said to have the characteristics of both relational and object-oriented databases. In addition, it is extensible via DataBlades, which can be purchased separately and used to customize the product for specific applications.

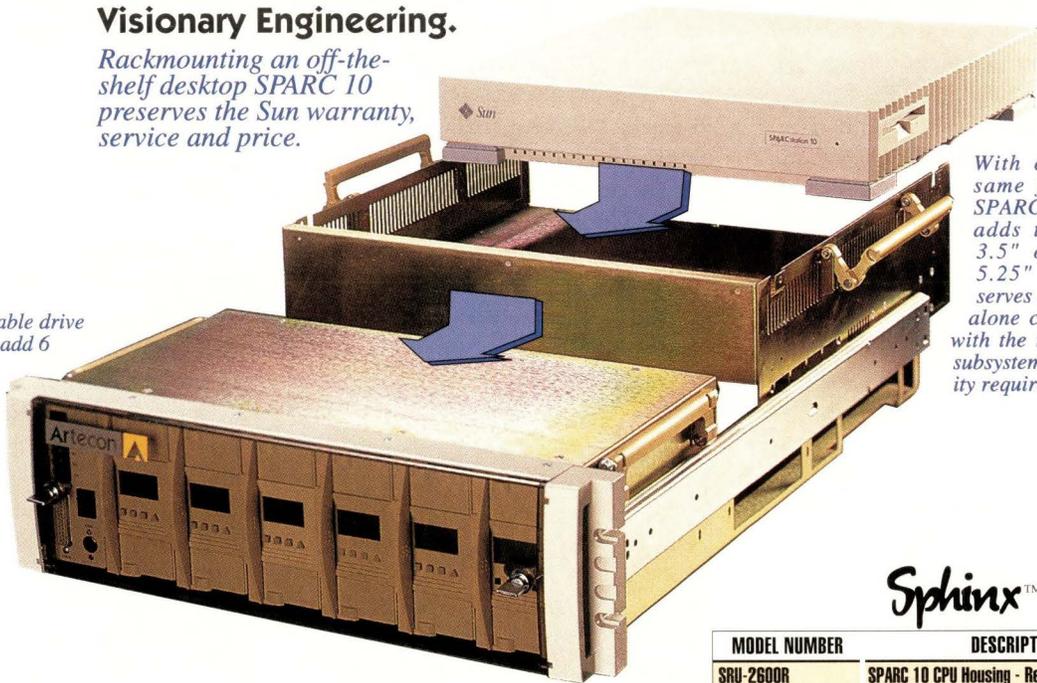


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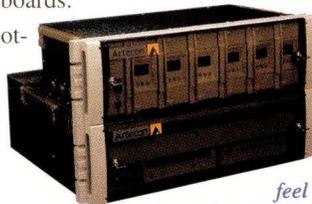
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which says it has a circulation of 35,000) and Internet news groups (such as `comp.lang.eiffel`). Bertrand Meyer, one of the language's principal designers, has successfully founded Interactive Software Inc., Goleta, CA, which markets Eiffel implementations and offers consulting.

In addition, Eiffel is starting to show signs of serious economic activity. For example, in September 1993, Santa Clara, CA-based C++ tool vendor Rational and Tower Technology Corp. announced an agreement under which Tower would convert Rational's C++ Booch Components to Eiffel. The two will then both have rights to sell the Eiffel components.

Both companies get something out of the deal. Rational gets an avenue into the Eiffel market. Tower gets access to the libraries.

Eiffel is thus a member of a rather select group. It, along with C++ and the odd SmallTalk implementation, is one of the few object-oriented languages from which people are actually making a living.

Suns Track Hazardous Cargos

Suppose your business was the transfer of hazardous cargoes so sensitive that you couldn't even talk about them.

That's day-to-day business for Marc Boyle, systems manager for the Billerica, MA-based Boyle Transportation Inc. "I really can't go into details," he says. "Suffice to say that it is high-security shipments for government and commercial clients."

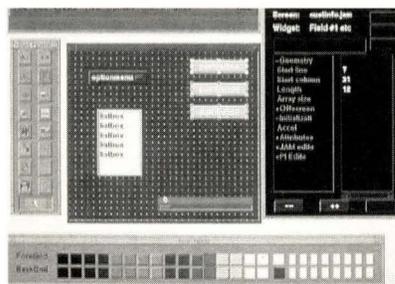
It is, he says, "certainly a niche market." It wasn't, in fact, what the company originally thought it would be doing. "We started the company about 21 years ago," says Boyle. "We had a lot of general freight customers...and then, we began to specialize in hazardous cargo."

But, like all niche markets, this one has its unique requirements. In particular, keeping track of the location of trucks carrying such cargo is fairly vital. "The term is Transit Visibility of Cargo," Boyle explains. "The customers want to know exactly where their cargos are at all times."

How does Boyle Transportation manage that feat? Via a system based on Sun workstations, the Sybase relational database from Sybase Inc., and a user interface built with JAM for Motif, the GUI tool developed by JYACC Inc. of New York.

"We brought in Sun SPARCstations and servers," explains Boyle. "We've got about 30 users here." The company then maintains real-time links with its trucks. "We keep satellite communications with the truckers."

At the central office, the Sybase RDBMS keeps tabs on the trucks' locations. Then, this information is displayed on intelligent maps, built with JAM, that run on the SPARCstations. "It's real time," says Boyle. "The maps are refreshed every 10 seconds."



JAM, the interface builder from New York-based JYACC, is the product Boyle Transportation uses to develop its intelligent maps.

He went with Sun Microsystems Inc., he says, because of the inexpensive compute power they represented. Sybase, meanwhile, gave him a robust RDBMS. He picked JAM for two reasons. First, "I was looking for extreme flexibility—we're not planning on going with any other database than Sybase, but if we were, we could switch the application without difficulty. We didn't go with Sybase's own 4GL so that we wouldn't be locked into Sybase."

Second, he was running his JAM on more than just Suns. "We've got 15 [SPARC-based] systems, plus PCs." The PCs had to support the same interface as did the Suns. In fact, they are what most users look at while Sybase runs in the background on the Suns.

What would Boyle tell anyone setting out to put together a similar sys-

tem. "I'd tell them to really focus on a core set of requirements," he says. In other words, look at what you really need to do, then look for tools that can fulfill those needs without locking you into any one approach.

In particular, he warns against the conventional wisdom that "one-stop shopping" is best. "People say they want to have all their tools from their database vendor," he says. "But you lose something that way. You lose flexibility. You can't go with someone else's database."—*mjt*

X Consortium Separates from MIT

The X Window System now has its own organization, separate from the Massachusetts Institute of Technology, which gave it birth. In November, the X Consortium Inc. became a separate and independent not-for-profit organization. It now has its own president—Dr. Luther C. Abel, formerly of Data General Corp. and Digital Equipment Corp.—and a new address. Instead of being housed on campus, the consortium has an office at One Memorial Drive in Cambridge, MA.

This is a significant transition for X. It had been associated with the university since its beginnings there in 1984. However, in recent times there was some feeling in the industry that the consortium could no longer remain comfortably in an academic setting. At the official announcement of the group's independence, its spokespeople stressed that now X belonged to the computer industry.

The X Window System appeared in 1984 as a group of researchers set out to produce a graphical interface that was platform independent. It was given the name "X" because it was said to have evolved from a similar project, "W," at Stanford University.

BESI Bows, But Does Sun Need It?

Meanwhile, over in the world of PCs, a new coalition of companies has announced BESI—the Bus Extension Serial Interface. BESI allows multiple peripherals, and particularly terminals, to be connected directly to a PC's bus, as though it were a board-level device.

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Terabyte Tape Solutions

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Circle No. 8 on Inquiry Card

With BESI, for example, text could be displayed on a terminal 100 times faster than if it went through a RS-232-C port.

And, says the coalition—which includes Applied Digital Data Systems Inc., Hauppauge, NY; Specialix Inc., Campbell, CA; and SunRiver Corp., Austin, TX—BESI could be available for SBus soon.

But, does anyone want it there?

For PCs, the need for BESI is obvious. “BESI was intended to solve a particular problem,” says Vincent P. Luciano, director of project and marketing planning in the business displays division of NCR Corp.’s ADDS division. “How to get a number of users at a distance from the host ...and yet give them the same display, keyboard and mouse as on a PC.”

Traditionally, that meant either connecting to dumb terminals via an RS-232-C port or installing a network and running X terminals. Each approach has drawbacks in speed, cost and performance. “So, people said, ‘Hey, wouldn’t it be great if we could only extend the bus of the computer so that it would reach other desktops,’” explains Luciano.

ADDS, Specialix and SunRiver ultimately agreed to jointly develop such a technology. BESI was the result. It requires a dedicated communications

chip on the motherboard of the host device. Then, each display or other piece of paraphernalia links to the host via two pairs of twisted-pair cable. One twisted-pair line carries data to the terminal; the other carries it back again. Thus, there is a two-way, high-speed link between desktops.

“Right now,” says Luciano, “BESI is available on EISA and ISA, and will be shortly on the MCA.” And the three companies will make the technology available to other firms. “We might sell the motherboard chips to someone, for example.”

That someone could put them on a Sun Microsystems Inc. workstation. “BESI is fully capable of going to SBus,” says Luciano. “The strategy right now is to launch the technology on EISA, ISA and MCA, and then move on to other environments.”

But does anyone need an extended SBus? That’s not so clear. “I think the last thing the peripheral market should do is go off and build a new interface,” says Dennis Daudelin, president of peripherals and Sun aftermarket vendor Aurora Technologies Inc., Waltham, MA. Aurora got its start providing multiport serial boards to Sun systems.

In particular, Daudelin cites a series of technical concerns. He is particularly unsure of whether intricate hand-

shaking built into standard serial line technology will show up in BESI. He is also uncomfortable with the notion that ISA technology will easily adapt to SBus. “I think, once they start to deal with different buses, they run into different problems. ISA and EISA are relatively slow buses...when you get into SBus, that all changes.”

Still, he applauds BESI, if only as an experiment. “It is good to see people continue to build things, since it allows the market to figure out what it really wants,” he says. “But, at first blush, this looks a little odd.”—mjt

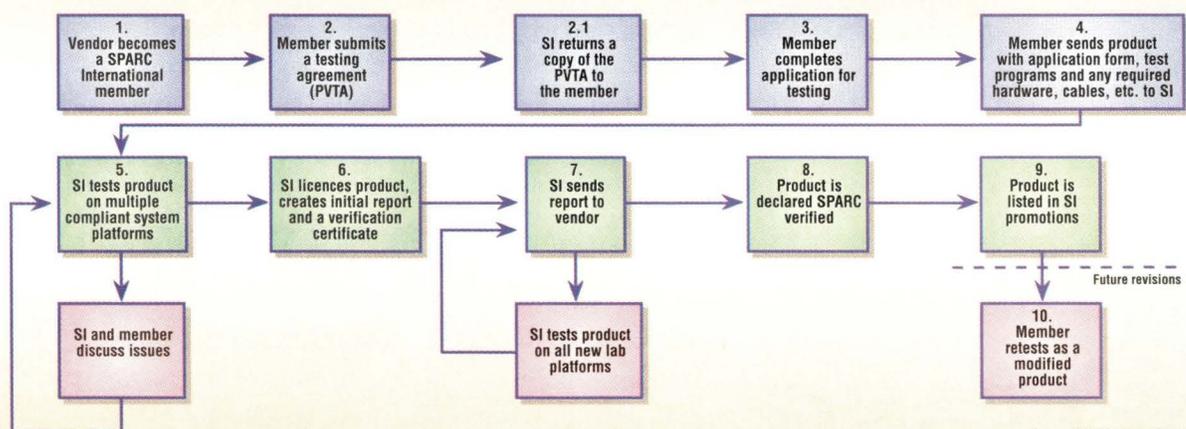
SPARC International Promotes Verification

SPARC International, the Menlo Park, CA-based not-for-profit that manages the standards process for the SPARC community, has begun a new push to get peripheral vendors to perform verification testing on their products. Since the organization’s founding, vendors could get the SPARC International brand for their products via a relatively simple testing procedure. However, many have chosen not to do so.

“It would be wrong to say that vendors have willfully avoided the verification process,” explains Roger E. Sack, program manager for SPARC International. “But, some of the com-

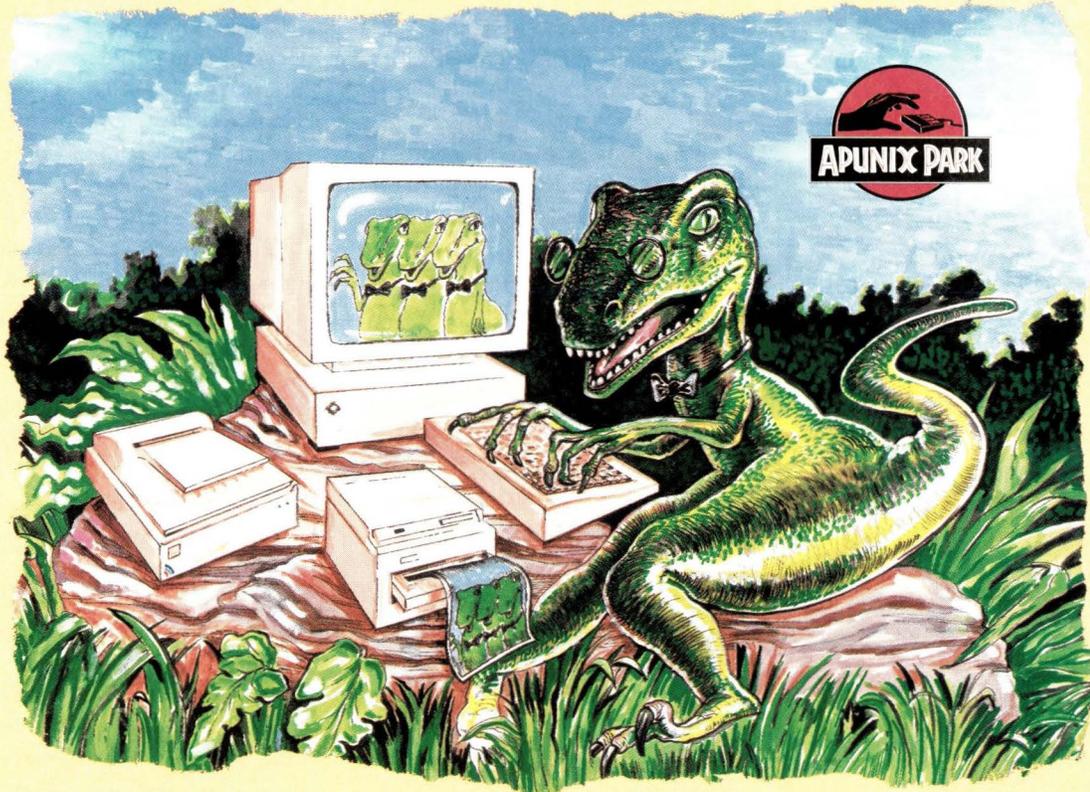
The SPARC International peripheral verification testing process is a relatively painless process of only 10 steps. Despite this simplicity, some vendors have regarded verification as a luxury.

SPARC International Peripheral Verification Testing Process



Source: SPARC International

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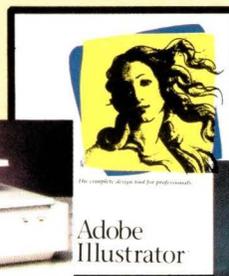
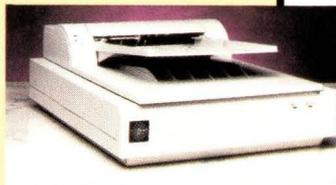
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Circle No. 2 on Inquiry Card



panies, frankly, are just under real financial constraints. They may see this [verification testing] as a luxury.”

He argues, though, gaining the SPARC International brand can be an easy and inexpensive way to allow someone else to perform some additional testing on your products. “Quite honestly,” he says, “there is a technical benefit to what we do, if only in that it allows you to avoid a support problem in the field.”

While Sack is quick to point that this is not “extensive QA stuff,” it can still be a quick and effective way to find out where your product doesn’t work. “You learn that your Sun-compatible doesn’t quite work with someone else’s Sun Microsystems Inc. clone...or with an interim rev of the operating system.” Moreover, it can be an easy way to check one’s product on platforms that you yourself don’t own. “It is nice to know your package runs on six or seven machines that you don’t have on site.”

The process of verification testing for peripherals through SPARC International is relatively simple. “There are three things you have to do,” says Sack. “Sign a membership agreement”—you don’t have to join the organization, but if you do, it is only \$500 a year—“sign a testing contract, fill out an application and send the product to us.”

SPARC International says it will have the testing done in 30 days or less. If the product passes, the vendors gain several advantages, says Sack: “They get a certificate; they get the right to use the [SPARC International] logo; they get on lists we publish...and we do a press release. It’s not in the contract, but we do it.”

All in all, he argues, it’s a bargain. “Without being specific,” he says, “I think that if you sat and did a cost analysis, just in terms of what it saves a vendor in terms of headaches, it would be quite impressive.”

NT on PowerPC: It’s Official

A sneak preview of PowerPC-based PCs was given by IBM’s Power Personal Systems division during a telephone press conference for journalists in which IBM discussed the

planned availability of the PowerPC Reference Platform (PReP) and plans to demonstrate the first PowerPC-based PCs at the November 1993 Comdex.

The company gave out little information on the hardware except to say IBM’s systems would be available in the second half of 1994 and a Software Developer’s Kit and technical specifications for the reference platform would be available in the first quarter of 1994.

IBM also said five 32-bit operating systems would be available for the machines within three to six months of their announcement. The operating systems are AIX, Workplace OS, Taligent (not initially as a native operating system but as technology layered on top of other OSs), Solaris and

IBM is also working on getting SCO UNIX, System V Release 4, and Novell Inc.’s NetWare on the platform.

Windows NT. The NT port, said Dick Guarino, the division’s general manager, systems development and marketing, was being done jointly by IBM and Motorola Inc. with some support from Microsoft Corp., the operating system’s developer. Guarino said the company is also working on getting SCO UNIX, System V Release 4, and Novell Inc.’s NetWare on the platform. OS/2 will be available only as a “personality” on the microkernel-based Workplace OS.

Guarino also discussed IBM’s speech technology, code-named Tang Lite. He said the technology would be portable across all operating systems. Asked about the nascent technology and the rush to develop viable speech recognition, Guarino said, “IBM is very much leading in this race.”—*Anne Knowles*

Notes Everywhere

Popular Lotus Notes groupware is stepping into new territory. Cambridge, MA-based Lotus Development Corp. recently announced two Notes versions, a NetWare Loadable Module (NLM) version and a native UNIX version for Sun Microsystems Inc. Solaris. The company also committed to porting Notes to additional UNIX platforms including The Santa Cruz Operation Inc. Open Desktop, Hewlett-Packard Co. HP-UX and IBM AIX, most likely in that order.

The Notes Server for NetWare is loaded on a NetWare file server as an NLM to connect Macintosh, OS/2 and UNIX clients and servers. It began shipping last month.

The native UNIX version of Notes Release 3 for Solaris is \$495 and requires at least a Sun IPC workstation running Solaris 1.1 with a Motif 1.1 interface for X11R4 or X11R5. Users can also run Notes for Solaris under OpenWindows 3.0, although a Motif look and feel is still supported in this mode. A separate option for an SMTP gateway with MIME support is also available for interoperability between Notes mail and UNIX mail users. The native UNIX versions will operate seamlessly with existing Notes clients for Windows, OS/2 and Macintosh, as well as X terminals, says Lotus. The Solaris version and forthcoming UNIX versions will accommodate both UNIX clients and servers, although Lotus expects that initial UNIX implementations will be as servers. “That’s probably the most common implementation, but clearly not the only one,” comments Greg Lazar, director of Business Alliances at Lotus.

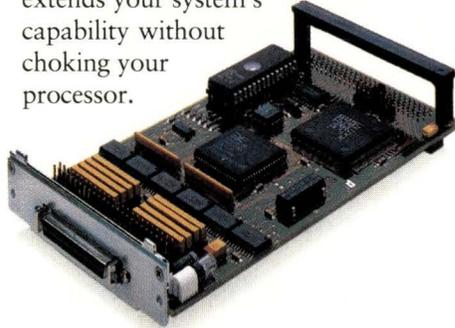
The additional UNIX versions, including AIX, are expected sometime this year, according to Lazar. He says the decision to port Notes has been driven by customers looking to deploy the software enterprisewide. Lazar also remarks that although Lotus’ leading 1-2-3 PC spreadsheet package has not been a “blockbuster” in the UNIX market, it has done fairly well and has contributed to Lotus’ overall success as a multiplatform software supplier, compared with competitors like Microsoft Corp. Lotus reports that since Notes’ introduction in



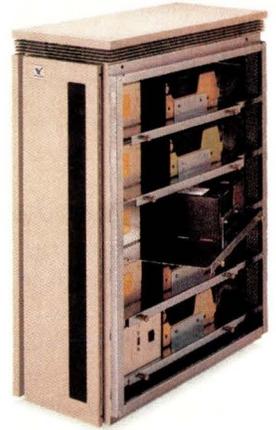
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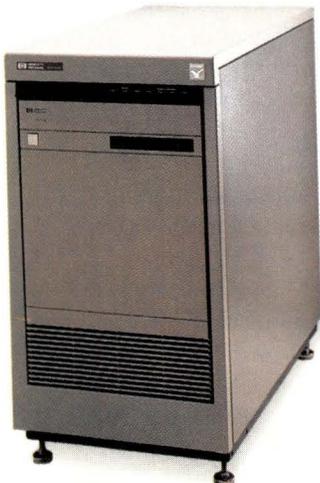
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1989, more than 2,000 organizations and nearly half a million users have installed the groupware. —Jane Majkiewicz

HIARC Does Jukes

Hierarchical storage management (HSM) vendor HIARC Inc., Irvine, CA, has announced that its SPARCUS 2.0 product now supports automated tape libraries. It currently works with 4mm and 8mm devices, and digital linear tape was planned for year-end 1993.

HP's Souped-Up Servers

Hewlett-Packard Co. introduced additional models to its Corporate Business Server systems designed for high-end OLTP and database applications. The new models nearly triple the performance of preceding models, says HP. The Model T500, for example, offers 1,500 transactions per second running Oracle 7, compared with a previous high of 710 transactions per second.

New Corporate Business Server models that are part of the HP 3000 and

HP 9000 series support up to eight and 12 processors, respectively. The SMP systems use an enhanced board incorporating HP's new 90-MHz microprocessors. Existing users can upgrade via a board swap. Other features include support for Storage Technology Corp.'s 3480-compatible tape backup units, as well as support for HP's 3000 VA PowerTrust uninterruptible power supply.

The Model T500 offers 1,500 transactions per second running Oracle 7.

The HP 9000 Model T500 is available now configured with one to eight processors. Nine- through 12-way SMP systems are available sometime this quarter. Prices range from \$165,000 for one processor to

\$660,000 for 12 processors. HP 3000 models are scheduled for first-half 1994 availability with prices from \$219,300 for a one-processor entry-level system to \$679,300 for an eight-way system. —Jane Majkiewicz

This Just In...

- At its first-ever users group conference, *The Math Works Inc.*, Natick, MA, announced a relationship with Waterloo Maple Software, Waterloo, Ontario. Under the terms of the agreement, Maple V, a symbolic processing package, will be made available from within Mathworks' MATLAB.

MATLAB is described as an environment for numerically intensive applications. It has particular strengths, for example, in matrix calculations. The company says that MATLAB has more than 140,000 users, and its first conference was attended by at least 400 of them.

- Merisel Inc.*, El Segundo, CA, has been named a master reseller by Sun Microsystems Inc. In Sun's scheme of things, a master reseller can market its products to VARS and OEMs.

- A new venture capital fund has been formed to invest solely in software companies. The *Hummer Winblad Venture Partners II*, a fund of Hummer Winblad Venture Partners venture capital firm of Emeryville, CA, has been capitalized at \$60 million. Like its predecessor, Hummer Winblad Venture Partners, the fund will invest only in software companies. Officials of the firm say they will consider companies in all stages of development, from start-ups to late-term companies.

This fund may be of particular interest to the Sun Microsystems Inc. community. One of the partners in the fund, along with company founders John Hummer and Ann Winblad, is Mark Gorenberg, who had formerly been a senior software manager in Advanced Product Development at Sun.

- According to *Highland Software Inc.*, attendees of the first Highland User Group have urged the inclusion of FLEXlm network license manager in the forthcoming COSE standard.



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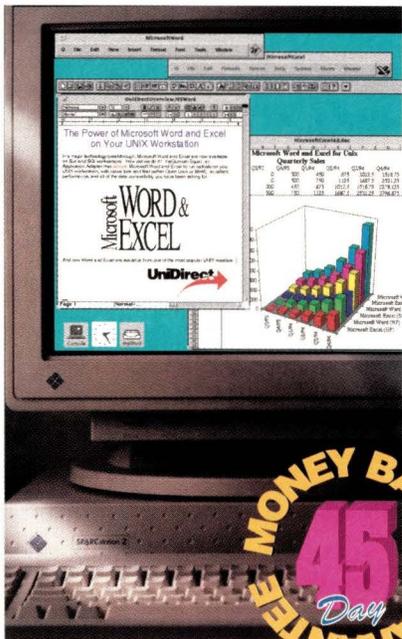
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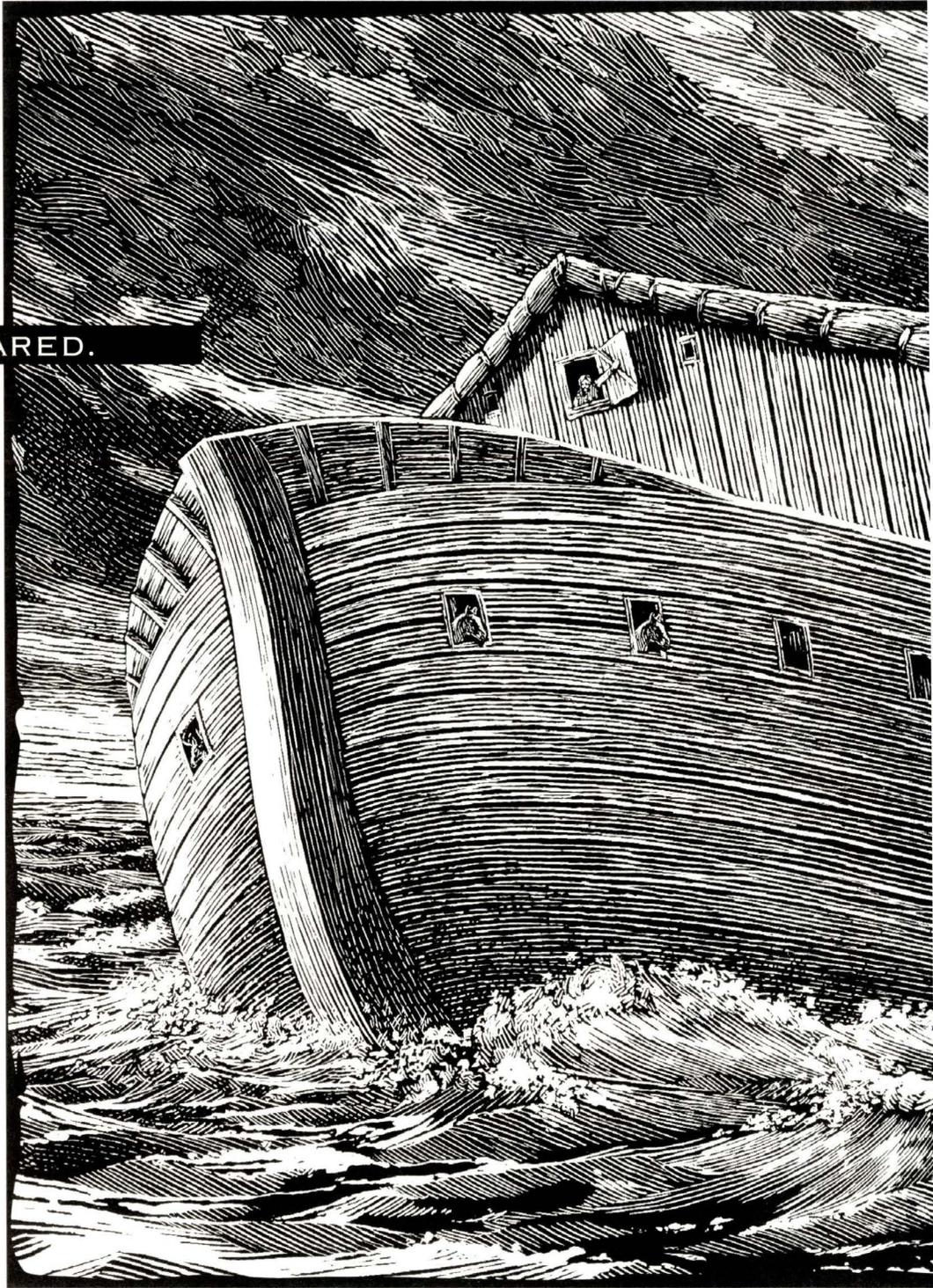
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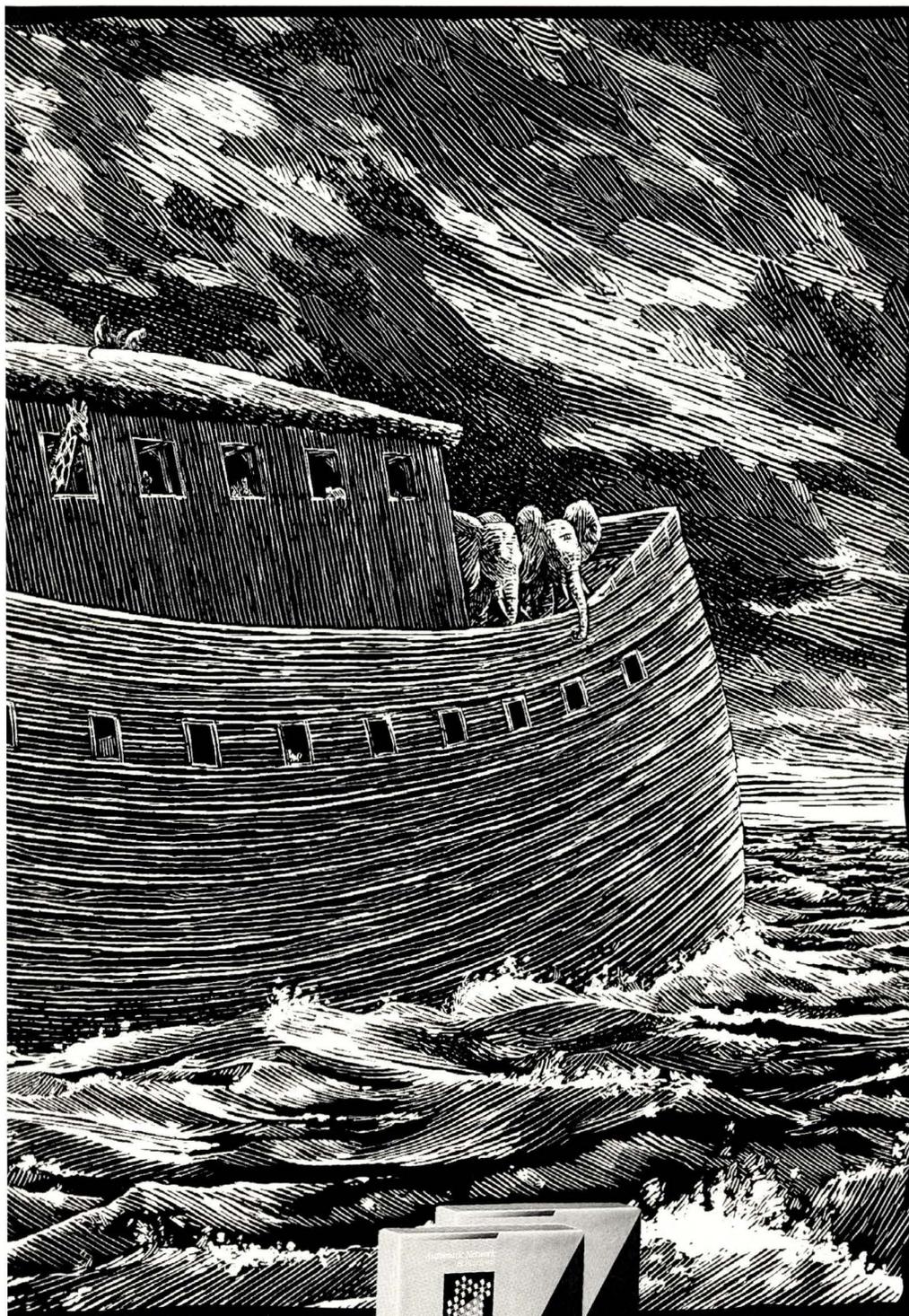
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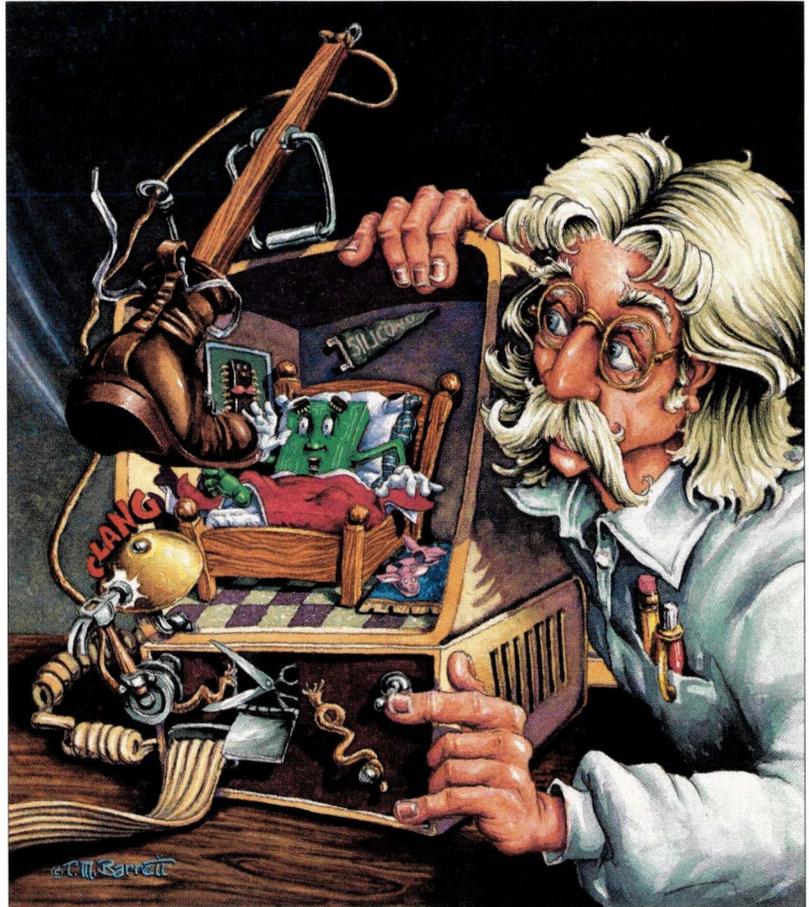


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TOM BARRETT

by MICHAEL O'BRIEN

"We suggest that the client's PROM software provide a way to do a complete bootstrap without 'user' interaction."

—RFC 951, Bootstrap Protocol (BOOTP)

"Doc didn't know when he first became aware that something was going on that concerned him."

—John Steinbeck, *Cannery Row*

"In the beginning was the Word."

—The Gospel According to St. John

Mr. Protocol Puts the Boot in

Q: OK, you're so smart, answer a simple question. What happens when I turn on my workstation?

A: You would have to ask something like that. All right then, two things happen. The first thing is that I answer the question. The second thing is that next month, we find another skill to hide behind the Big Q that's welded to the top of this column. By the way, if you happen to see the art director back there, I wish you'd ask her what kind of glue she uses on that thing. I've got something I've been trying to mount under the dashboard of my car for years, and I've never found anything as good as whatever it

is that holds that Q in place.

Mr. Protocol wishes it known that the following discussion pertains only to computers that came into existence after disk drives became common. Loading wondrous things into switch registers and toggling loaders into memory belong to the deservedly forgotten past.

When your average PC or Mac is turned on, it has a built-in ROM that reads (usually) the first sector of the disk into memory and transfers control to whatever code lies there, be it a program to load the rest of the system, or be it a virus. The first machine to do something radically different was the Xerox Alto, at least, so far as Mr. Protocol is aware. Alto processors had disk drives all right.

A man with a beard and short hair is shown in profile, playing a saxophone. He is wearing a dark shirt and a brown leather belt. The background is black, and the lighting highlights his face and the instrument. The saxophone is a golden color with some blue accents.

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They were Diablo-mechanism removable-cartridge drives, just like the good old RK-05 disk drives that legions of DEC PDP-11 users were used to.

These were not notable for their reliability. One of the follow-on machines, known as the Dolphin, had a built-in Winchester disk drive, which would have been a great improvement had it not been for the fact that the disk drive spindle and the drive motor were not collinear, but instead were connected by a drive belt. This rubber belt had a tendency to slip off the drive wheel on the disk spindle.

Therefore, the special capability of the Dolphin would tend to exercise itself

randomly, without warning.

This special capability was the machine's ability to boot itself over the Ethernet. The Alto and the Dorado were the first machines to do so because they were invented contemporaneously with the Ethernet. The protocol used was, of course, invented specifically for these machines, but it worked well. The Dolphin, when first powered on, went through an extensive self-diagnostic, and then (after waiting some time for the disk drive to get up to speed) attempted to perform a normal boot from disk. If it failed to get a response from the disk, it would send a broadcast on the Ethernet

asking for a boot server to send it a magic cookie followed by an operating system to run. The magic cookie, of course, cleverly consisted of a program to load the operating system.

Therefore, the hapless owner of one of these machines was forced to look closely at the screen after a boot to ensure that the system that was running was, in fact, a disk-based system. The machine would happily run in a network configuration as well, and one had to read the details of the header lines on the screen to determine that in fact there was no disk available. Then, of course, one simply turned off the machine, popped off both sides and the lid, put the damn belt back on, and turned the power back on. The top and sides went back on only after a successful disk boot, because after all, it might be that something else was wrong.

In order to load a new version of the operating system onto disk, it sufficed to run the network executive, which could be booted intentionally, and copy the new OS onto the disk. In fact one could format the disk from the "net exec" as well.

In some ways, life hasn't changed all that much in today's world, but it has become a bit more standardized. In 1985, Request for Comments 951 was written, describing a Bootstrap Protocol, called BOOTP. The protocol standardizes an interaction very similar to the one used by the Alto and the Dolphin, except that while the Xerox processors used their native 48-bit Ethernet addresses, which were wired onto the interface cards, BOOTP uses Internet addresses, which machines must discover as part of the boot process. This complicates matters.

The driving notion behind the BOOTP protocol is that it should be simple enough to be contained in some sort of built-in ROM, and that it should be simple enough to run unattended. In fact RFC 951 specifically says, "This is the type of boot that would occur during an unattended power-up." In case it isn't painfully clear, the accent is on simplicity. The entire protocol consists of a single request and a single response.

Mr. Protocol is fond of pretending

Figure 1. BOOTREQUEST and BOOTREPLY Packet Fields.

Field	# of bytes	Description
op	1	packet op code/message type 1 = BOOTREQUEST, 2 = BOOTREPLY
htype	1	hardware address type "1" for 10-Mb Ethernet
hlen	1	hardware address length "6" for 10-Mb Ethernet
hops	1	client sets to zero, optionally used by gateways in cross-gateway booting
xid	4	transaction ID, a random number, used to match this BOOTREQUEST with the responses it generates
secs	2	filled in by client; seconds elapsed since client started trying to boot
-	2	unused
ciaddr	4	client IP address; filled in by client in BOOTREQUEST if known
yiaddr	4	"your" (client) IP address; filled in by server if client doesn't know its own address (ciaddr was 0)
siaddr	4	server IP address; returned in BOOTREPLY
giaddr	4	gateway IP address, used in optional cross-gateway booting
chaddr	16	client hardware address, filled in by client
sname	64	optional server host name, null terminated string
file	128	boot file name, null terminated string; "generic" name or null in BOOTREQUEST, fully qualified directory-path name in BOOTREPLY
vend	64	optional vendor-specific area

HANINA DYER

that the Protocol of the Moment is the Salvator Mundi, the Alpha and the Omega, the answer to all problems and the restorer of lost hair. Well, I'm here to tell you that not only has BOOTP never restored a single follicle that I'm aware of, it has also never booted a single machine, at least, not on its own. BOOTP is an information discovery tool, not a full bootstrap channel. It is designed to inform a client of its own Internet address, if necessary, and also of the name and location of a bootstrap file on the

Not only has BOOTP never restored a single hair follicle that I'm aware of, it has also never booted a single machine.

network that will meet its needs. It is then up to the client to use a service such as TFTP, the Trivial File Transfer Protocol, to obtain that boot file. TFTP is mentioned in RFC 951 because TFTP was originally designed, like BOOTP, to be simple enough to be placed in ROM.

Looking at particular cases, Mr. Protocol is struck by the similarities to a SNOBOL IV statement: BOOTP packets consist of a number of fields, all parts of which are optional. Oh well, all right, almost all.

Figure 1 shows the fields in both a BOOTREQUEST and a BOOTREPLY packet. These are UDP packets, so the simple ROM implementations do not have to support TCP.

The protocol supports a number of different scenarios. If the client (the system trying to boot) knows the IP address of the server, naturally, the UDP packet can be addressed to that server, but if not, the client can simply issue the BOOTREQUEST as a broadcast packet. When the server responds, it can provide the address of the server that has the desired boot file in the address in the `yiaddr` field, thus informing the client of the IP address the client should use. This is an important advantage of BOOTP

over the old RARP (Reverse Address Resolution Protocol) method, because RARP is tied specifically to Ethernet, whereas BOOTP depends only upon IP and UDP and can thus work over, for example, an 802.5 token-ring network.

The `ciaddr` exists separately from the `yiaddr` because it is not assumed that a server implementation will easily be able to extract the client's IP address, if provided, from the surrounding UDP packet. Also, although this sounds nasty, it is possi-

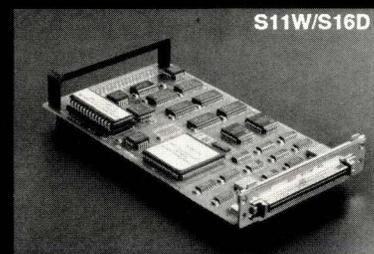
ble that the address in the UDP packet sent by the client is not actually the IP address that the client expects to hear in a response packet, although Mr. Protocol can't quite believe anyone would ever actually design a system this way. Admittedly, a system while booting is just about as intelligent as a box of rocks (mainly because that's just about what it is). However, even such a system should at least agree with itself about what its own IP address is. Nevertheless, this protocol will work even if it doesn't.

The `sname` field can be used if the client wishes to restrict its request to a particular server. This field also comes in handy if the desired server isn't on the local cable, since broadcast packets are not passed through gateways. A local server can decide, based on a name lookup, that the desired server is on another net, and forward the packet (obviously no longer as a broadcast packet).

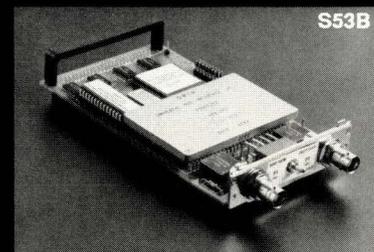
The `file` field is bidirectional. The client can put a generic type of file in there, such as `unix` (or, if it has no taste whatsoever, `sysv`). The BOOTREPLY packet would then replace this generic request with an explicit path to the correct boot file. This, in conjunction with the `siaddr` field, also filled in by the server, is all

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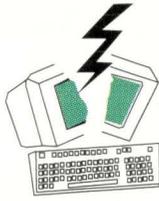
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the information the client needs to run TFTP. The RFC suggests that the `vend` field could be used to do an exchange of authentication keys to provide somewhat more security than TFTP typically provides. In fact, a large number of things have now been defined for this field, since 1985 was a long time ago, at least in our industry.

So, what is this wondrous good protocol for? Mr. Protocol is glad you asked.

Certainly it's designed to be idiot-proof, since as mentioned earlier, most systems are pretty idiotic at boot time. The protocol was originally designed with things like diskless workstations in mind, but its use has expanded with time. To be as up-to-the-minute as possible, at least one vendor's ATM switch initializes itself using BOOTP. It cheats, though, and uses a special-purpose Ethernet interface to do it. BOOTP over ATM isn't around yet, as far as Mr. Protocol is aware.

RFC 951 doesn't even have the usual "Security Considerations" paragraph common to almost all other RFCs (even though they almost all say "Security issues are not discussed in this memo"). Some of the follow-on RFCs do, though, and what they have to say is interesting. Because booting systems are idiots, they'll believe anything and anybody, unless some sort of key-exchange authentication is wired into the ROM. Mr. Protocol isn't willing to claim that no workstations exist with such ROM security features, but he's never heard of any that do. Consequently, it would be possible to completely take over a workstation that boots using BOOTP, which sounds like a singularly worthless thing to do, but isn't. For one thing, the workstation might have a disk worth raiding, though one would then proceed to wonder why it didn't boot from that disk. However, it would also be possible to write a fairly short network-bootable program that behaved just like a normal system to all outside appearances, right up to the point where the login prompt appeared, at which point it would proceed to collect names and passwords and email them off to a secret account in Koh Samui, then fake a

crash and proceed with a normal boot. This is even better than running a fake login program, since it doesn't leave any traces behind, not to mention the fact that the *pad thai* in Koh Samui is pretty good, by all accounts, and accounts is just what you can collect there, since your fake server will eventually hit every workstation on the cable as they reboot.

BOOTP in its more modern incarnations can even be used to provide information about routers, domain names, and so forth, through the `vend` field, so a fake BOOTP server can compromise all sorts of things about even a legitimately booted system, simply by lying to it on the way up. Also, BOOTP can be used to do dynamic allocation of resources, again through options in the "vend" field, so a malicious BOOTP client can simply grab every resource in sight and hang onto it, leaving everyone on the network very very puzzled, since who in the world would ever suspect BOOTP? Most people don't even know it exists.

Now you do.

So the next time you install a new release of the operating system, you might want to pay attention to who can get at the boot information. Mr. Protocol does. He has assigned it a priority right after making sure of who has the Big Stuf Ding-Dongs. ➡

Mike O'Brien has been noodling around the UNIX world for far too long a time. He knows he started out with UNIX Research Version 5 (not System V, he hastens to point out), but forgets the year. He thinks it was around 1975 or so.

He founded and ran the first nationwide UNIX Users Group Software Distribution Center. He worked at Rand during the glory days of the Rand editor and the MH mail system, helped build CSNET (first at Rand and later at BBN Labs Inc.) and is now at an aerospace research corporation.

Mr. Protocol refuses to divulge his qualifications and may, in fact, have none whatsoever. His email address is amp@expert.com.

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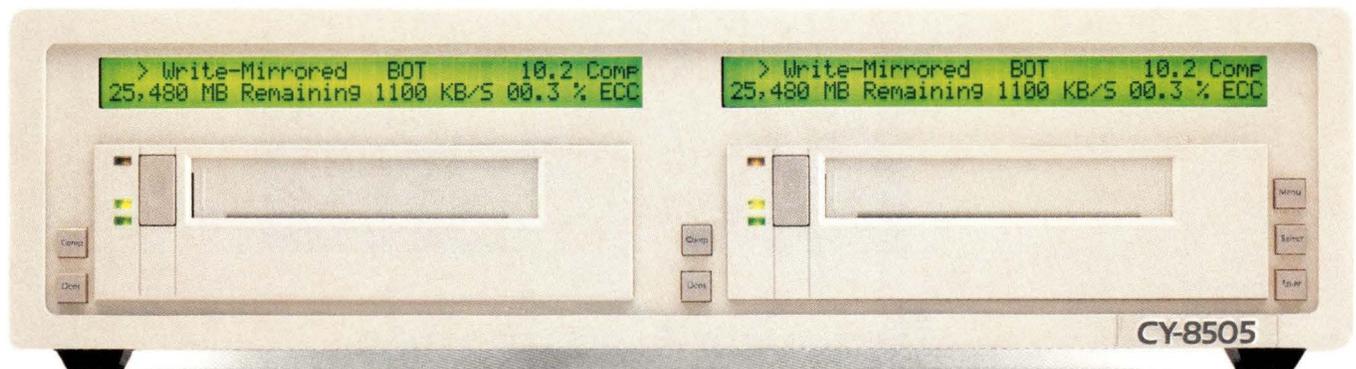
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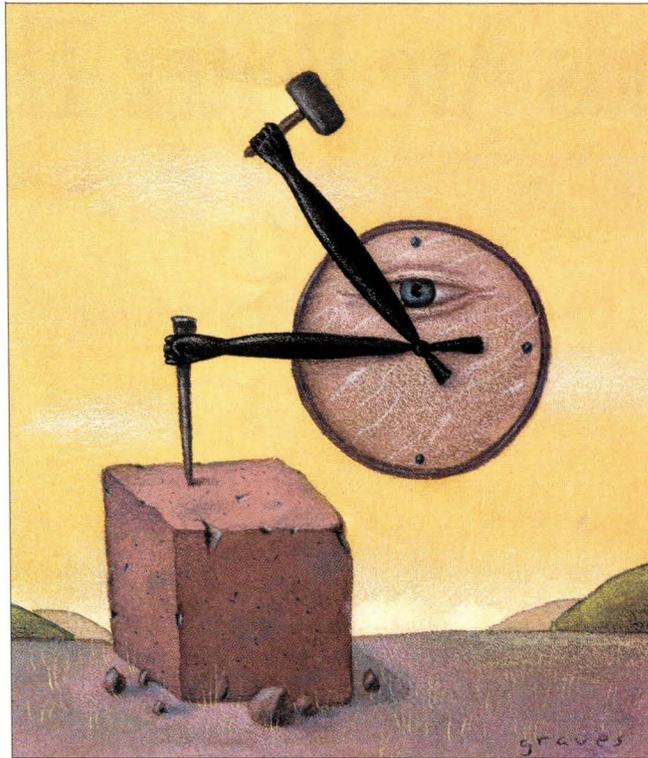
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KEITH GRAVES

Running Commands from the Clock

by PETER COLLINSON,
Hillside Systems

Before UNIX came along, we tended to turn machines off when we went home at night. I did my Ph.D using a PDP-8. It had core memory. You would turn it on again in the morning to find the memory contents were unchanged. This was one of the delights of nonvolatile memory hardware. Then along came the PDP-11 and UNIX.

I remember persuading my management that we shouldn't turn it off at night. The reason was that the early systems were great until they were stopped. At that point, you could lose file systems as you interrupted a super-block update or got in the way of a radical directory reorganization. In the days before `fsck`, file system repair was an arcane art. We lost days of work sometimes, as I struggled to put the file system back together without losing too many files. A carefully constructed shutdown program that killed all the active processes before doing a couple of `sync()` system calls helped with this. But leaving the system on was a good solution. As long as it didn't crash, you were OK.

A side effect of leaving the power on was that suddenly we could run programs from the clock. In the early hours of the

morning, a script could be started to perform some task or other. This was great. All those drudgery housework jobs could be done by scripts that, once written, just kept working.

cron

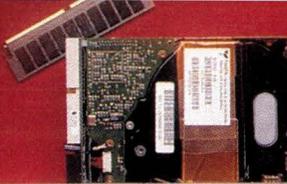
The oldest system for running things from the clock is `cron`. Cronos was the Greek God of Time; the Romans called him Saturn. Cronos spent his time devouring his sons because he thought that they would steal his powers. Luckily, `cron` doesn't go round killing its offspring. It just runs things from the clock.

Originally, `cron` was a plaything for the superuser only. In recent systems, it has been opened up for everyone to use. The idea is that a program, `cron`, sits in the background emitting jobs at intervals. The jobs are derived from a group of files that are set up by any user. On current Sun systems, these files are stored in a directory called `cron/crontabs` in the spool directory and named by the user login name.

Since `cron` runs jobs on behalf of a user, these files are a potential security risk. To prevent tampering, the files are owned by root and set read-only. A setuid program,

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`crontab`, is provided to list and change the files. It will only allow you to access your own file. Of course, the superuser can access anyone's file. The command

```
% crontab -l
```

will list the current contents of your file.

```
% crontab -r
```

will remove your file. To create the file, you can just type `crontab` and enter the data directly into the command. However, it's more usual to use

```
% crontab -e
```

This throws you into the editor of your choice, taken from the `EDITOR` environment variable. When you exit from the editor, the file that you have just created is placed in your personal `crontab` file.

A benefit of using the `-e` option is that the `crontab` program will check the syntax of the file and will not change the original if a syntax error is found. This helps to prevent finger trouble causing strange things to happen on the machine.

The file format has changed little since early UNIX systems. The file contains a number of lines. Each one gives a time specification and a command to be executed at that time. A line contains six space-separated fields: minutes past the hour, hour of the day, day of the month, month of the year, day of the week, and finally, the command to be run.

The first five fields are all numbers or number ranges. The day of the week field codes Sunday as 0 and Saturday as 6. This is on SunOS and Solaris; other systems use the coding 1 to 7, where 1 is a Monday. You insert a star to show the value "any," if a field is "don't care."

OK, then. To run a command at 1 a.m. every day, you create a line:

```
0 1 * * * command
```

Be a little careful here. If you don't put in an explicit minutes field, `crontab` will run your command every minute during the selected hour, and that may not be quite what you had in mind. Also, on a system with many users, it's not a good idea to select an obvious time, like dead on the hour. Everyone will do that, and the machine will die from overload when all those commands start executing. It's better to pick some other time that is not on a 5-minute boundary.

If you want to run a command in the early hours of Sunday morning, then you can add a day number:

```
47 1 * * 0 command
```

Each of the fields can be a comma-separated list.

```
47 1 * * 6,0 weekend
47 1 * * 1,2,3,4,5 daily
```

will run the `weekend` command on Saturday and Sunday, and the `daily` command Monday through Friday. You can also give a range by using a hyphen, so the daily line can be written

```
47 1 * * 1-5 daily
```

It's easy to create lines that run commands on the first day of the month:

```
41 2 * 1 * monthly
41 2 1 1 * annual
```

runs `monthly` at 2:41 a.m. on the first day of each month, and `annual` at 2:41 a.m. on January 1.

Dealing with the end of the month is harder because `crontab` will only action the command when the time matches exactly; it has no idea of dealing with "missed" commands. Actually, this also means that the job will not be done if the machine is down when the alarm is supposed to fire.

The code that understands the time specifications that you can give to the `at` command is fairly flexible.

The best strategy for dealing with the end of the month is to call the command on the 28th, the 29th, the 30th and the 31st. The command then needs to work out whether it has been called on the real last day of the current month and exit if that is not the case. This is not a terrifically hard piece of shell using the `date` command to get the current values.

Commands

What should the command be? First, it's not being run from a terminal and so `crontab` needs to find a way to set up the standard input, output and error channels. By default, the standard input is set to point at `/dev/null`. This makes sense; any command that expects input from the user will read from standard input and get an instant end-of-file indication.

The `crontab` daemon arranges that any output the command may make on the standard output and error channels is sent to you in the mail. This can be fine, if the output is an error message or only happens when something unusual happens. It can be truly annoying if it's idle chatter.

The command is passed into `/bin/sh` for execution so it can contain redirection of the standard I/O channels:

```
7 1 * * * 2>&1 daily >log
```

will divert both the output channels to the log file. The log

file should be an absolute pathname; otherwise, you will end up writing the file on your home directory. For the super-user, that's the root of the file system, and this might be embarrassing. I guess that I generally embed the diversion commands in the script that `cron` executes; that keeps all the decisions about file placement in one file.

In fact, I usually make `cron` call a script to perform some task rather than adding raw commands in the command file. This gives me much finer control of the actions that are to be made. It also makes `crontab` files easier to read, because they consist of a set of (hopefully) meaningful names that are actioned at certain times. On a site with a number of systems, it allows me to maintain a single `crontab` file and tailor the commands that are run to the machine that is doing the work.

The problem with using a log file is that you never remember to look at it and so errors can be ignored. I get round this by making the scripts that I call from `cron` write a visible error message when they fail catastrophically. For my nightly dump scripts, I add the line

```
echo 'Dump problem' > /dev/console
```

and in the morning I see a message in my console window. This is usually because I have forgotten to load the tape. You could send yourself mail or take some other action to raise the alarm when things are broken.

What about the rest of the environment? What search path will be set up? If I write a script to be executed by `cron`, what can I assume? The answer is assume nothing. The search path is rudimentary and probably wrong for you. In general, it's better to write scripts that set up their own environment before they do the task at hand. Then you can test them with some certainty that they will also run the same way from `cron`.

If the script is written in `csh`, then the shell will read your `.cshrc` file at startup time. This is not encouraged because you often put lines in your `.cshrc` file that are inappropriate for running scripts in the background (although you shouldn't). For safety, background scripts should always be called with the `-f` flag suppressing the use of the `.cshrc` file. Anyway, I never recommend that people write `csh` scripts. The Bourne or Korn shells are much better programming languages.

Be careful about security with scripts called by `cron`. Ensure that no one else can write to them and get their evil commands to be run by you, indirectly. This is especially important if you are root. My personal policy is to make these scripts `-r-x-----`.

If you try to use

```
% crontab -e
```

and see the message

```
crontab: you are not authorized to use cron.
```

then you need to wander along to your systems administra-

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tor and ask them to set things up for you. Access to the `cron` system is controlled by a couple of files in `cron`'s spool directory. The systems administrator can set things up to permit certain users to use the system or can deny access to specified people. They need to create a zero-length `cron.deny` file to allow access by anybody.

at

The other system that is used to run commands from the clock is `at`; no Greeks need apply. This is designed to run one-off shell scripts at a certain time. Originally, `at` was a separate subsystem that had a queue-reading program that was called frequently by `cron`. These days, `at` and `cron` are integrated into one system.

The `at` command queues a job, a small shell script, that is executed at some time in the future.

```
% at 12:30
at> make
at> doit
at> Ctrl-D
job 24583 at Thu Oct 28 12:30:00 1993
%
```

You supply the time that the job is to be run on the command line. Since you have not given the command the name of a script to be run, it prompts with `at>` to show that you are entering commands. Each line is passed into the job file. You end the input by typing Control-D. The program

then prints a line with a reference ID and confirms the time that the job is due to be started.

The code that understands the time specifications that you can give to the `at` command is fairly flexible. It tries to adapt to human foibles rather than forcing the human to fit into the program author's view of the world. For example, 1 p.m. can be specified as: 1300, 13:00, 1:00p, 1p.

The time can be followed by a date giving a specific day that the command is to be run. You can say things like

```
% at 1pm tomorrow cmd
```

This takes data from the file `cmd` and runs it at 1 p.m. the next day. The data is assumed to be a number of shell commands. You cannot put the name of an executable file here. These command options can be used to requeue `cmd` to be run daily. Simply add the line to the end of the script.

If you specify a date, the time value can be "now," so a requeue command could read

```
at now tomorrow cmd
```

running the script contents at the same time the next day.

Running at Jobs

Time passes. At the appropriate time, the `cron` daemon will run your `at` job and send you any output in the mail. The stored job is fairly complicated because `at` attempts to preserve your current environment. It writes the values of all

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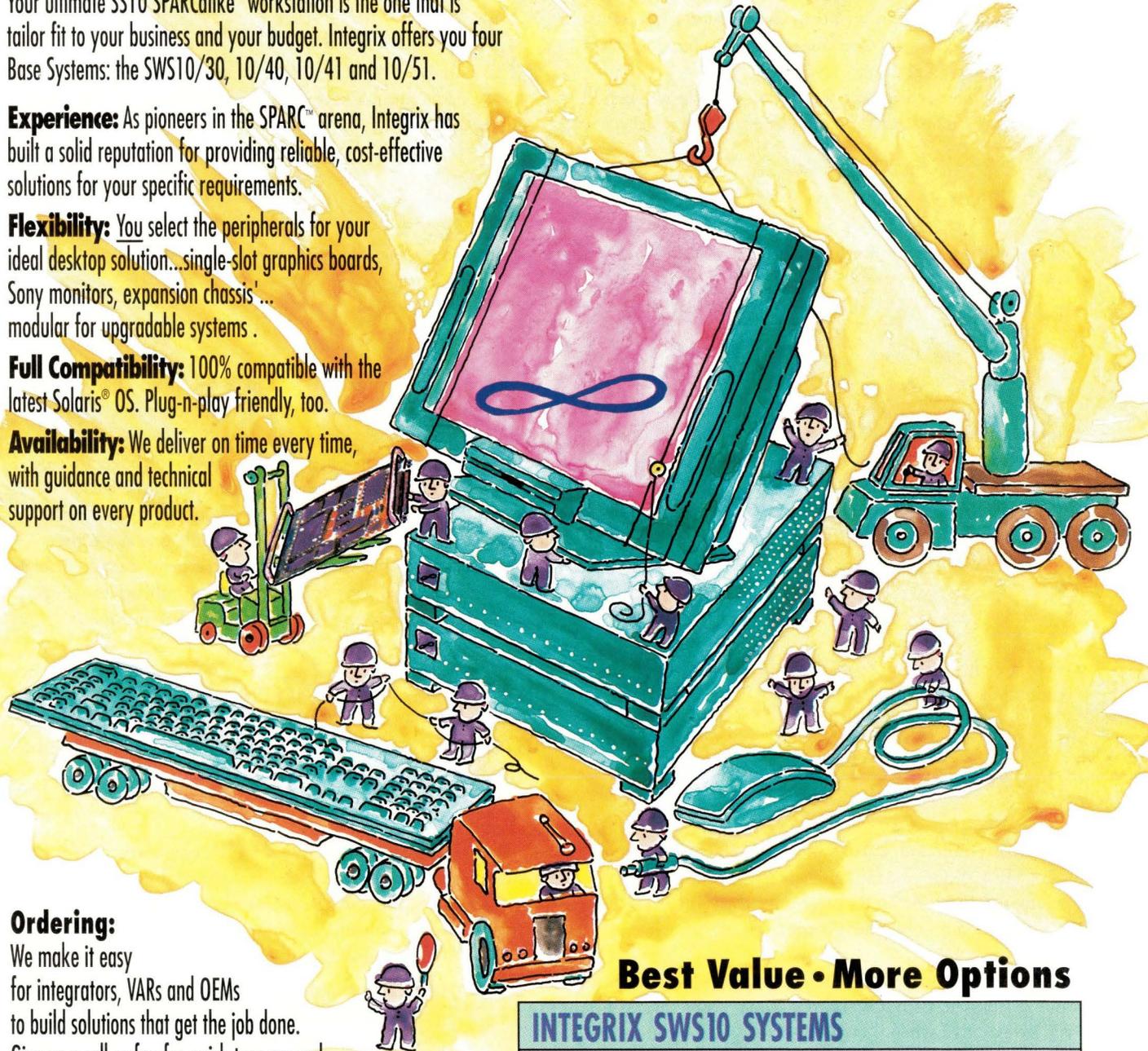
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your current environment variables to the start of the job file and adds a `cd` command to change to the directory from where you invoked the command. The directory had better still be there. It also uses the shell from the `SHELL` environment variable to run your commands. You can override this and force the usage of `/bin/sh` or `/bin/csh`—see the manual page.

Like `cron`, `at` will send you mail if it finds any output on the standard output or error channels. To suppress this, you need to encourage your scripts to write log files. You will find that `at` scripts are often more than one line long, and this can complicate things.

When you are writing the script, you can add redirection commands after each command, for `csh`:

```
cmd2  >& log
cmd2  >>& log
```

This is a little unsatisfactory. You can use the ability to group commands:

```
( cmd1 ; \
  cmd2 ) >& log
```

Users of `csh` must remember to add a semicolon after each command but the last. A backslash at the end of a line in `csh` is eaten by the shell, so you must have a semicolon to terminate the command.

This is a little simpler in Bourne and Korn shells; the backslash here means “include the newline”:

```
( cmd1 \
  cmd2 ) > log 2>&1
```

Alternatively, you can use the Bourne and Korn shell's `exec` command.

```
exec > log 2>& 1
cmd1
cmd2
```

The `exec` command replaces the current shell by its argument file without generating a new shell. If it's given no arguments, it can be used to rearrange the standard I/O channels for any subsequent commands. That's what is happening here.

If the program processing the `at` queue finds a job whose time has passed, then it will run it. This means that your job will be executed when the system is rebooted if your system has crashed. You have gone home leaving a job in the queue. As a result, a command that requeues itself will not get lost because of a system crash or some intentional downtime.

Of course, this could be inconvenient if there are several CPU-intensive jobs in the queue that need to be started. As the machine comes alive, there is no CPU to spare because it's devoted to running these jobs from `at`. This isn't as bad as it seems because modern `at` systems have controls that constrain the number of jobs that can be run simultaneously.

Both SunOS and Solaris have control files called `queuedefs` in the `cron` spool directory that allow the systems administrator to tailor the number of jobs that are run at once. By default, `at` can run only four jobs at the same time.

There are two ways of looking at the queue of `at` jobs. The command `atq` prints the whole queue so you can see whether other users have queued jobs. This command was derived from 4.2BSD. The System V alternative is to say

```
$ at -l
```

This only lists your jobs. You can't easily see other people's.

The `atrm` command is given a job number and deletes the command file:

```
$ atrm 24583
24583: removed
```

Alternatively, you can use the System V variant:

```
$ at -r 24583
$
```

The `batch` command is related to the `at` command, but it runs the job now. This is not a “real” batch queue with job time limits, queue control, job priorities and the like. The intention is to permit users on a machine to cooperate to run CPU-intensive jobs one after another in the background. It places the job in a separate queue from the one used by `at` and is constrained to run only one at a time.

Again, if you find that you cannot queue `at` or `batch` jobs, then you need to consult your systems administrator to set up the relevant control files allowing or denying access.

Further Reading

UNIX Power Tools has a nice little section on `cron`, `at` and `batch`. The book is by Jerry Peek, Tim O'Reilly & Mike Loukides and others. It's published by O'Reilly & Associates (ISBN 0-553-35402-7). ➔

Peter Collinson runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests; doing whatever, whenever, where ever... He writes, teaches, consults and programs using SunOS running on a SPARCstation 2. Email: pc@expert.com.

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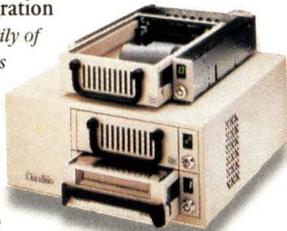
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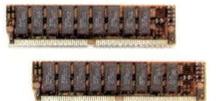
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ROBIN JAREAUX

Sources for Sun Information (Take 2)

by RICHARD MORIN, Technical Editor

It is not always easy to get needed information about Sun (and related) products. There is no shortage of raw data: A slew of catalogs, magazines, conferences, trade shows and electronic channels vie for our attention. This column lists a sampling of them, in fact, lest you miss out on any.

The larger problem, sifting the data for useful information, is a bit harder. One person's gold is another's dross, so the final selection must be done by each individual. Much of the selection can be performed by choosing the appropriate data channels, however, and the descriptions below may help in that process. (Note: This column is an updated version of the I/O_{pener} for May 1991.)

Catalogs

The Open Systems Products Directory is published by UniForum. Although physically smaller than in previous years, it is still the premier broad-spec-

trum catalog for UNIX products. The 1993 catalog is available now. The 1994 catalog, listing more than 7,500 products and services, will be available in March. UniForum is also preparing on-line and CD-ROM versions of the 1994 catalog.

The Catalyst Catalogs, published by Sun, list third-party hardware, software and services for Suns. Several versions are available, including the 1,776-page comprehensive catalog and several smaller, topical catalogs ("Interactive UNIX," "Open Look," "Solaris SPARC" and "Solaris X86").

The Catalyst program also issues CD-ROM collections of SPARC-related software. These "Catalyst CDWare" disks contain trial versions of third-party software, allowing users to try things out at leisure before making a purchase. Some packages employ a software lock to disable selected features. This allows customers to purchase enabling codes over the telephone.

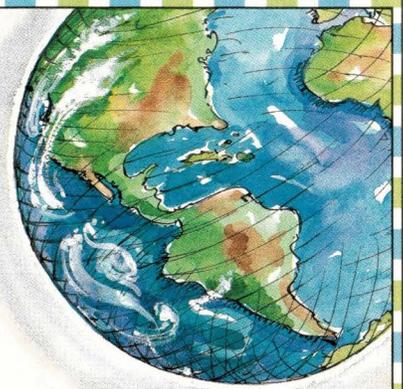
Magazines

There are several magazines that cover UNIX in general and Sun in particular. Some of these, like *SunExpert*, are complimentary to qualified readers. Others are available only via paid subscriptions. Some are sent only to members of specific organizations.

It would be inappropriate for me to review specific magazines, some of which are competitors of *SunExpert*. Suffice it to say that all of the major trade magazines blend industry news, technical articles, product features, etc. The tone of each magazine is unique, however, and you should examine several to find out which ones best meet your needs.

Open Systems Today, *UNIX Review* and *UNIXWorld* are the most prominent trade magazines serving the general UNIX community. *SunExpert*, *Sun Observer* and *SunWorld* fill the same niche for the Sun community. *Sun Observer* and *UNIXWorld* require paid subscriptions; the others are com-

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plimentary (controlled circulation). At press time, *SunWorld* and *UNIXWorld* are in the process of changing their names to *Advanced Systems* and *Open Computing*, respectively.

UniForum members receive *UniForum Monthly*, a monthly magazine containing organization and industry news, technical articles, etc. Members may also subscribe to the *UniNews* newsletter, which covers topical issues of concern to the UNIX industry.

Usenix members receive a bimonthly publication named *;login:* and a quarterly journal named *Computing Systems*. Aside from its unusual name (taken from the original UNIX login prompt), *;login:* is notable for UNIX and Usenix news, book reviews, reports on standardization activities, etc. *Computing Systems* contains scholarly articles on operating system research, interesting computer applications and other topics related to UNIX.

I have avoided discussing Sun and UNIX books, for fear of getting lost in that substantial topic. The Usenix version of the 4.3 BSD manual set warrants an exception, however.

Aside from providing a convenient reference to BSD UNIX, it contains a fascinating and useful collection of original papers and documentation. Vendors frequently absorb these papers into system documentation. Unfortunately, precision sometimes gets lost in the process. The originals have a clarity and tone that makes them well worth having.

The Usenix manual set is convenient, economical and amazingly useful. Unfortunately, the BSD 4.4 set is not yet ready, and the stocks of 4.3 manuals are diminishing rapidly. (The System Administrator's manual is already out of print.) Consequently, you may wish to order desired volumes now.

Sun User Group (SUG) members receive a quarterly newsletter named *README*. *README* contains SUG announcements, articles by Sun users and news about upcoming and/or recent SUG events. Correcting a long-standing reliance on marketing

announcements, SUG is now steering *README* toward a more technical focus.

Sun's monthly *Software Technical Bulletin*, though not technically a magazine, is a gold mine of technical advice, bug fixes, etc. The *STB* is not available by subscription, unfortunately, being an integral part of the stan-

UNIX events are marked by a strong technical emphasis; no marketing talks are tolerated.

dard Sun software support contract. Contact your Sun sales office for more information.

UNIX Conferences, Etc.

A variety of conferences, symposia, trade shows and workshops fill the UNIX calendar. Varying widely in technical level and focus, these gatherings provide something for everybody. In point of fact, they provide far too much for anybody to digest.

Consequently, some selectivity is needed. Pick events that meet your needs and have convenient times and places. Many of the same vendors show up at different trade shows; any major show will attract all the key players. If you can't attend a technical conference, consider ordering the proceedings; most organizations sell these at reasonable prices.

Usenix holds a scattering of conferences and workshops each year. Usenix events are marked by a strong technical emphasis; no marketing talks are tolerated. The smaller conferences and workshops cover specific topics (graphics, systems administration, Mach, UNIX security, etc.), bringing researchers and serious practitioners together for a few days of intense discussions.

The C++ event, originally held as a workshop, has now grown into an annual conference. The summer and winter conferences (typically held in

January and June) tend to focus on the UNIX kernel, but other aspects of UNIX are also discussed. The summer conference is often accompanied by a small trade show.

UniForum holds a massive conference and trade show each winter. The conference sessions are also substantial but are not exclusively technical. Instead, they concentrate largely on the commercial side of UNIX, from standards issues through market projections to (occasional) product promotions.

A number of other UNIX trade shows are held around the country (and the world). UNIX Expo, held each fall in New York, is an even larger, commercial version of the UniForum event. Unlike UniForum, it is intentionally aimed at end users and resellers. Notably, it features an innovation known as The Software Shop, which makes shrink-wrapped UNIX software available for purchase at the show.

Other UNIX (and Sun) events fill the calendar. Some of these are local or regional events; others are topical. Finally, UNIX events are held in Canada, Europe, Australia, Japan, etc. There is little excuse for missing out, but a little research may be needed. Scan the magazines noted above for announcements of trade shows and conferences.

Sun Conferences, Etc.

The Sun calendar, though less crowded, has its share of events. Northern California, in particular, is well served by Sun-related conferences. Each December, SUG holds its annual conference and trade show at the San Jose Convention Center. Each July, Sun Expo comes to the same site.

Both events draw substantial numbers of vendors and users. The SUG conference is longer than the Expo, and, with refereed papers and published proceedings, can claim more of a technical focus. Either one is guaranteed to delight a trade show aficionado, however, and each offers a selection of tutorials.

Finally, SUG assists local user groups in holding occasional regional confer-



ences. These are short (one to two days), intimate and allow Sun users to "network" with others in the same locale. Local user group meetings are, of course, an excellent way to meet other Sun users, exchange gossip, and get up-to-date information about Suns.

Instant Gratification

Many UNIX sites are active participants in the global electronic bulletin board known as Usenet. Still more have access to electronic mail via the Internet or UUCP. These provide excellent channels for immediate feedback on UNIX and Sun questions.

For information and discussions regarding SUN and Usenix, subscribe to `comp.org.sug` and `comp.org.usenix`, respectively. There are several other interesting organizational lists; look for names starting with `comp.org` in your `.newsrc` file.

The moderated Sun-Spots news group (`comp.sys.sun`) has been replaced by a mixture of moderated and unmoderated subgroups: `admin`, `announce`, `apps`, `hardware`, `misc` and `wanted`. `comp.sys.sun` has been replaced. The moderated source code news group (`comp.sources.sun`) has disappeared entirely, perhaps because of the UNIX industry's success in making source code portable. Check out `comp.sources.reviewed` and `comp.sources.wanted` as alternatives.

For the best FTP-able collection of Sun-related files, try `/pub/sun-info` on `sunsite.unc.edu`. The `OMG-IDL-CFE` directory contains Sunsoft's implementation of the OMG interface development language. `sample-drivers` holds sample device drivers for Solaris 2.0. `sun-dist` has distributed patches and fixes for both SunOS and Solaris. `sun-managers` and `sunspots` archive these (defunct) news groups.

The `sunflash` subdirectory is an archive of the Sun-Flash mailing list. I strongly recommend this mailing list to anyone who wants to keep up on events and product announcements in the Sun community. Subscription

requests should be sent to `sunflash-request@sunvice.east.sun.com`.

The `sunergy` subdirectory contains information about Sunergy's bimonthly newsletter and televised satellite downlink programs. Send mail to `sunergy@sun.com` or phone the Sunergy office at (415) 336-5847 for more information. →

Richard Morin operates Prime Time Freeware (`ptf@cfcl.com`), which publishes mixed-media (book/CD-ROM) freeware collections. He also consults and writes on UNIX-related topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at `rdm@cfcl.com`.

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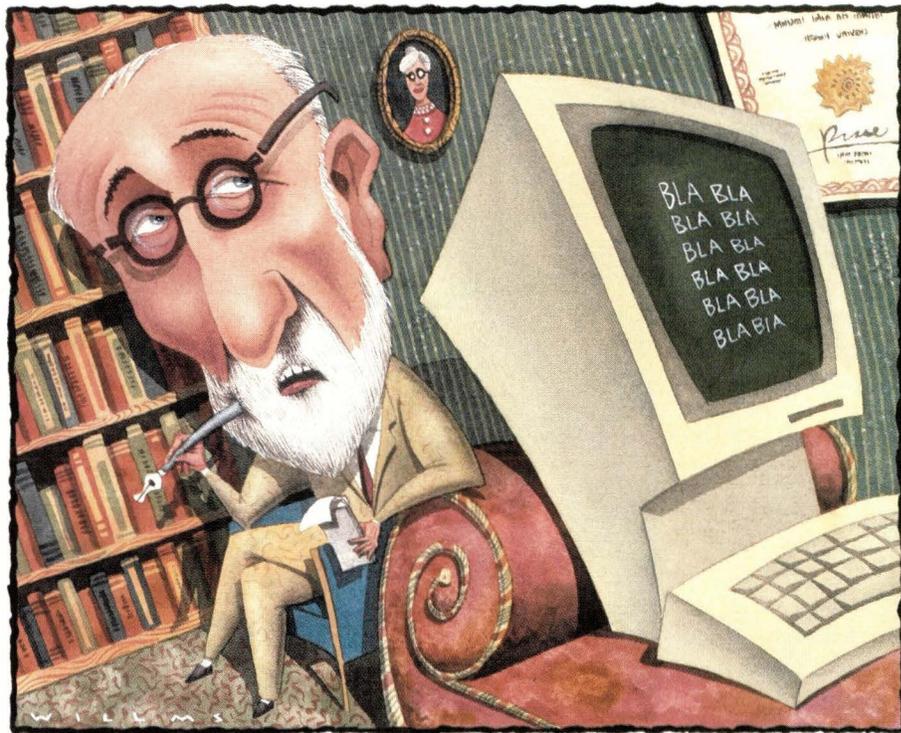
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Help! My Computer Is Insane

by S. LEE HENRY

The computer reclines on the computer room couch. Its disks are getting heavier and heavier. The sounds of its fans are becoming muffled, the room lights dim, and only the voice of the sysadmin comes through its deep and lethargic trance.

“You are going back, back to before the power failure, back to your first encounter with 4.1.3. You’ve just completed an `fsck`, and all your file systems are intact. You feel stable and safe. Now look at `/export/home`. What do you see?”

Computer psychotherapy? Is this a 2001 thing? Is Hal saying once again, “I know I’ve made some poor decisions lately, but I’m all right now?” Well, maybe not. But computer insanity is a concept that engineers of reliability are considering as a fairly serious issue. Why? Because the more we design systems to overcome their most likely failures, the more we have to admit that computer actions are not always predictable. Ironically, it is also the case that in designing systems to be reliable, we often introduce new opportunities for computers to act irrationally. Almost any form of redundancy, for example, introduces the possibility

that the redundant components or data stores will disagree or become out of sync—a rare and frustrating type of schizophrenia to be sure.

What Is Reliability?

Although most of us have a concept of what reliability is, there is a common misconception worth addressing. That is, reliability is often considered to be synonymous with availability, while the two are decidedly not the same thing. Reliability incorporates accuracy and fault-tolerance; availability, on the other hand, merely means that the system is usable.

Basically, all schemes for reliability entail doubling—doubling disks, doubling CPUs, doubling power supplies, doubling data, and sometimes, all of the above. This doubling can wind up costing a lot, not only for the doubled components but for tying them together and building in failovers that effect the transitions to working units when failing units are detected. There is also a cost associated with managing doubled-up systems, whether the doubling and

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the failover are automated or handled manually. They are simply more complex to build, to understand and to manage.

Network Reliability Design Principles

The best approach for anyone looking to enhance reliability at their site is to avoid setting up any system or network component with so important a role in their operation that its failing takes down everything.

When you design systems so that each component or host provides a single function, each service is separable, easier to manage and straightforward to duplicate. In addition, their problems are simpler and, thus, easier to diagnose. If your NIS server and your database server are separate systems, you will have the flexibility of rebooting one without affecting the service of the other.

The most effective thing to do to enhance system reliability is to reduce the chance of human error.

In systems built upon this principle, at any particular time, some service may be unavailable. This is a familiar and manageable state for almost every system administrator who has come to understand a simple and basic truth of the trade—at any given time, something is broken. There are always tasks in their queues, always some problems waiting to be addressed and always some mysteries waiting to be solved. But, for the most part, these systems are up and running and problems get addressed when time and priorities permit.

As an added bonus, each individual component in highly modular systems is, for the most part, considerably more reliable. This is no surprise. Systems with fewer breakable parts break less often.

The Weakest Link

Probably the single most effective thing you can do to enhance the reliability of your systems is to reduce the chance of human error. Although we don't like to think about it, human error is the single biggest cause of system problems. One of my biggest errors was *newfs*-ing the wrong partition and blowing away */usr* on a system while about a dozen people were logged on. It's easy to do. Wouldn't it be nice if it weren't? When we design systems for reliability, we have to anticipate human mistakes and safeguard against them.

Reducing the chance of human error can take many forms, but common sense dictates a number of general guidelines:

- Disastrous things should be hard to do,
- Nonconsequential things should be easy to do,
- Similar functions should look similar,

- Disparate functions should look dissimilar,
- Requesting confirmation before making a significant and irreversible change is a good idea,
- Requesting confirmation for trivial changes is a bad idea—this will lull users into confirming without thinking.

Approaches to Host and Application Reliability

Designing systems that are composed of single-function, robust parts, and making disasters hard to invoke inadvertently will provide a good basis for keeping your system manageable. To the extent that you can avoid establishing critical dependencies, this approach provides the best overall immunity to disaster.

For those hosts and applications that are unavoidably critical, there is a growing set of techniques aimed at improving reliability. In particular, the following techniques currently exist in one form or as off-the-shelf products:

- On-line backup
- Disk mirroring
- Warm backup
- Redundant processing

Each of these techniques employ automation and redundant components to increase the reliability of the system and to reduce the need for human control (and the chance of error).

When selecting an approach to reliability, you should be careful to evaluate what failures you are guarding against as well as what vulnerabilities continue to exist. Many reliability products guard against disk failures. Some guard against controller or CPU failures. We'll take a quick look at some reliability technology below and follow up with a closer examination of some actual products and what they buy you in a later issue.

On-Line Backups

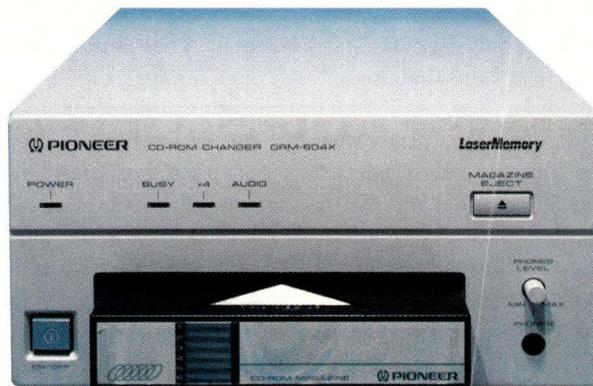
A lot of thinking about data reliability comes from the engineers of database technology. Reliability in the database world involves the duplication of data so that the current state of a database can be reconstructed after a failure corrupts the original copy. An on-line backup, consisting of a database dump and a corresponding transaction log, represents the first line of defense, allowing the database system to recover from a disk failure. This improves the reliability of the product and is standard practice in all major database products, such as Sybase and Oracle.

The speed, reliability and cost of disk technology makes on-line backup an increasingly attractive alternative to tape backup. On-line backups increase the availability of a system because it is easier to reload a database from disk after a failure has occurred. That is, users will still have to wait while the system is reloaded, but with on-line backups the reload time is considerably shorter than with tapes.

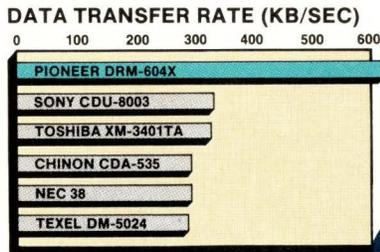
On-line backups guard against disk failures. However, it is important that the original and backup copies be kept on separate disks. This last statement may seem obvious, but you can't imagine how many sites store both copies on the same disk and then weep out loud when the inevitable failure shows them their mistake. (Those silly humans!)

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Disk Mirroring

Disk mirroring, in which two disks maintain identical data, is another approach to solving disk failure problems. With disks becoming more reliable and less expensive, products that provide disk mirroring are becoming popular. Sun's Online Disk Suite is one product that provides this option along with other options to enhance disk reliability.

Disk mirroring is an easy-to-use and understandable technology. One of its prime advantages is that it provides data redundancy without affecting the complexity of applications that need not "know" that mirroring is taking place.

Disk mirroring guards against disk failures and is often used in addition to, or as a replacement for, on-line backups. The disadvantage of disk mirroring, as compared with on-line or tape backups, is that it will quickly delete both copies of your /usr file system if you (the human) issue a `newfs` command.

Two Heads are Better Than One

Redundancy engineers have moved beyond the fairly simple approaches of disk mirroring to systems that use duplicate CPUs as well as duplicate disks. Some very advanced systems, especially those that need to operate without human intervention (e.g., those that are used in space vehicles) incorporate a high degree of both CPU and data redundancy.

By adding a CPU, the availability of the overall system can be improved, allowing applications to continue processing after a disk or CPU failure. For example, a secondary server known as a "warm backup" can be configured to accept the on-line backups produced by the primary server and to take

over operations following a failure of the primary server. The High*Availability product offered by Open*Vision provides the mechanisms needed to implement a warm backup strategy for any number of SunOS or Solaris applications.

This type of reliability is by no means limited to the database world. Increasingly, the network services provided by the major operating systems are incorporating this approach. The exchange of information between NIS+ masters and replicas, for example, employs a transaction log, the batching of updates and a periodic synchronization that enables, if required, a complete download of the NIS+ data from master to replica.

You're Not Alone in This World

Although CPU redundancy can significantly improve the availability of a system, it comes with its own fundamental problems. Getting back to the psychological disorders of computers, multi-CPU reliability techniques must be paranoid. They must constantly be on guard for a teammate who goes insane.

More importantly, once insanity has been detected (which is not always that easy), the reliability tools must be able to effect the transfer of control to a properly functioning unit (disk, controller, CPU, database copy, etc.). That is, an orderly process must be developed to reestablish control of the system.

There is also a "window-of-loss" that must be considered when dealing with multiple CPUs. For example, suppose your database application was happily communicating with the primary server and it crashed halfway through your processing. When the failure is detected, you can switch over

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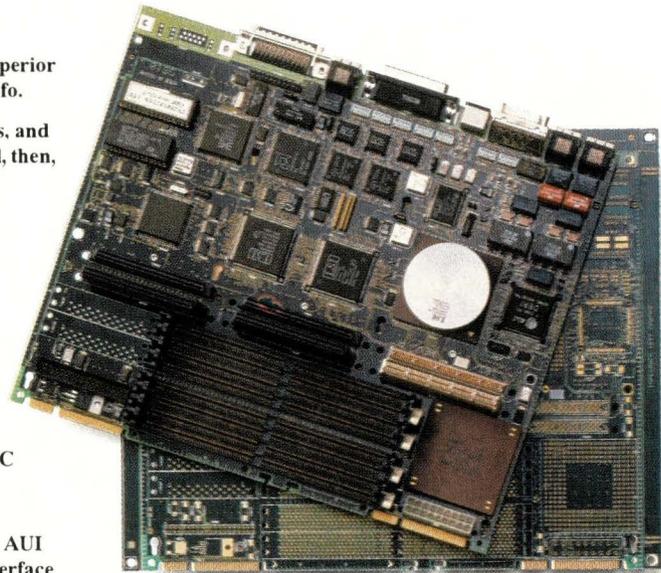
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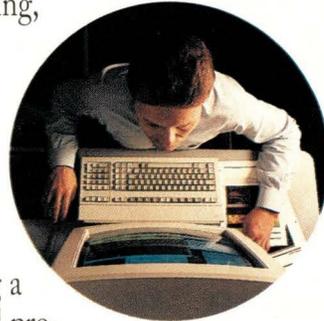


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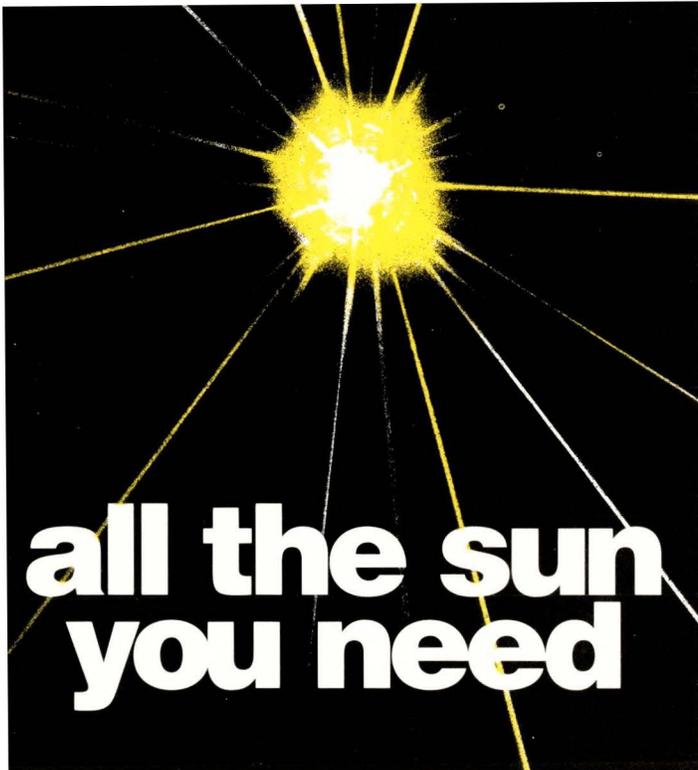
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to the secondary server, but how do you know if the first part of your processing was complete or not? If the secondary server is synchronized with the primary server every hour, chances are that your previous work was lost. However, if the secondary server is synchronized every microsecond, chances are that your work was properly replicated to the secondary server.

Some servers close the window of loss by having multiple CPUs perform completely redundant processing. If a single computer fails, the other computers will continue processing without missing a beat. In this case, an arbitrator is used to determine the "correct" result, given the outputs from all of the redundant systems. Naturally, if the arbitrator imagines a failure (i.e., hallucinates) or makes a decision to trust the wrong component, severe damage might result anyway.

This approach solves a great deal of problems but is also difficult to build and is more expensive than any of the other solutions we have discussed.

The UNIX Way

The modular design of UNIX and the connectionless nature of many of its tools provide a robust foundation upon which to build tools for reliability. When NFS, for example, can't establish a connection, it keeps trying. This type of robustness plays into the hands of reliability engineers.

The open, modular design and years of development groundwork have made UNIX fertile territory for sophisticated and modular reliability tools. Some reliability technology is already resulting in portable modules. One exciting example is replication technology, which modularizes the duplication of data across systems. Sybase's replication server and similar technology quietly incorporated into Lotus Notes provide this kind of replication component. Undoubtedly, Sun's conferencing software is handling this same issue in providing duplicate views of the in-progress conference to all participants.

Back to the Couch

Whether you're seeing double or contemplating a lobotomy to recover the sanity of a crazed server from a frightening psychosis, reliability is likely to become an increasingly viable consideration in the day-to-day operation of your systems.

Acknowledgments

I'd like to thank Dr. Frank Pittelli and Dan Roche of Rapid Systems Solutions Inc. for providing some of the background material needed to write this article, as well as introducing me to the "insane" side of my computer systems. For additional information on the reliability techniques and/or the products presented here, you can reach Dr. Pittelli at frank.pittelli@rssi.com or (410) 381-6610. ➡

S. Lee Henry is on the Board of Directors of the Sun User Group and manages computer and networking services for the Physics and Astronomy Department at Johns Hopkins University. Send mail to slee@expert.com.

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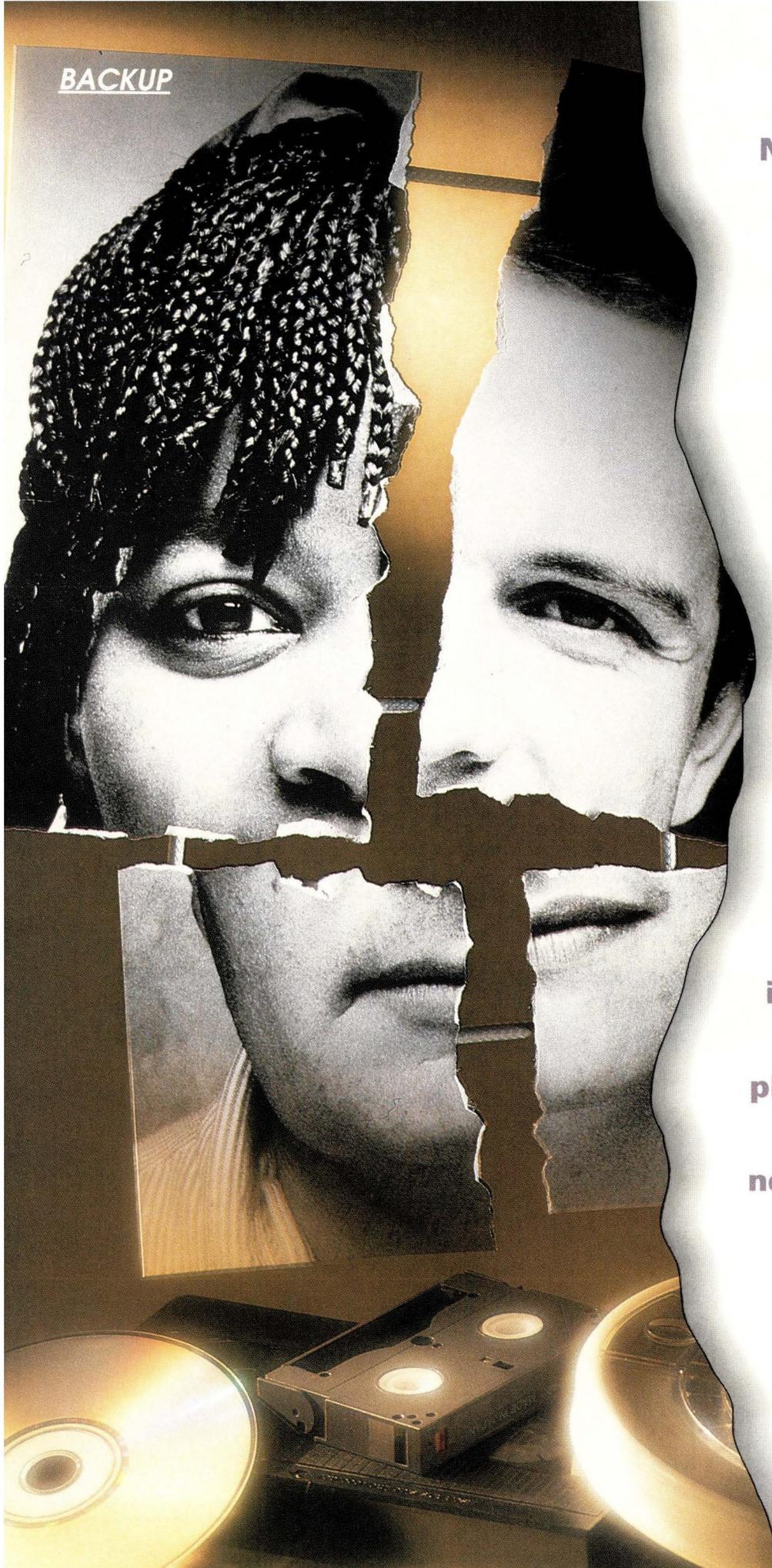


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BACKUP



**Not that long ago,
the UNIX com-
munity regarded
backup as a rela-
tively simple
matter best
left to human
drudges. Today,
in an age of
increasingly com-
plex and heteroge-
neous networks, it
is still drudgery,
but no one con-
siders it simple.**

Rise *of the* Robots

Ten years ago, there weren't any questions about backup. For UNIX systems, it was a matter of disks. "The midrange assumes that all storage is attached," says Kevin Daly, president of Odetics Corp. subsidiary ATL Products Inc. "Traditionally, everything has been on disk." Or, at most, backup was a matter of a single quarter-inch drive running off a SCSI port.

Above UNIX, on the mainframes and even the minicomputers that were very much a part of commercial computing in the late '70s and early '80s, tape was the order of the day. Backup meant tape libraries and large staffs of human "computer operators" who did nothing but mount and unmount tapes.

DOUG MINDELL

by **MICHAEL JAY TUCKER**, Executive Editor



Now, though, all that certainty is gone. Mainframes wilt where they stand. UNIX, and networks, are the MIS choice. UNIX systems, and Suns in particular, have so much data to store, they now need to back up via tape libraries, just the way mainframes used to.

But there's the rub. This is the '90s. Nobody can afford the human staff that tape libraries require. How, then, can Suns get the tape they need, without the overhead they can't afford?

The Economics of Tape

First, the economics. Tape, in its various formats—quarter-inch cartridge, 8mm, 4mm and so on—has always had a place in the open systems market. For decades, it was the chief medium for software distribution—until companies like Sun Microsystems Computer Corp. began promoting CDs for the same purpose.

But, recently, there's been a renewed appreciation of tape as a backup medium. The reason is simple: There's so much more to back up. "The amount of data in networks," says

Odetics' Daly, "is growing at something around 50% a year."

That's particularly true in networks where UNIX systems in general, and Suns in particular, are moving into what used to be mainframe territory. "It used to be a pretty select selling process," says Paul Wordeman, of Software Clearing House Inc. (SCH), which markets a series of tape library management software products. "It used to be that there were only a few people in UNIX with a tape library big enough to justify a tape management system. That's not true anymore."

Not only is there more data to safeguard, it is more important than it was before. "Before, most data in UNIX-oriented settings wasn't all that critical," says Carol Tuchin, director of sales and marketing at Box Hill Systems Corp., which sells into the backup market. The loss of a workstation's files might mean disaster for an individual, who might lose a month's work or even an entire career. But, for the company as a whole, it wasn't a life-threatening crisis.

But, she continues, "now it is." If an organization has downsized and has put its accounts receivable on a SPARC-

Judgment Day: A Look into the Future of Quarter-Inch Cartridge

by MAUREEN MCKEON
Research Editor

Tape-storage technology has come a long way from its humble origins and is on its way to unexpected levels of advancement, including storage capacities in the gigabyte range and the invention of autoloader robotics. The helical scan methods of 4mm and 8mm tape storage are alive and well and have found their place in the market. Helical tape's arch rival, however, quarter-inch cartridge, has been rumored to be gasping its last breath.

Quarter-inch technology is being challenged by CD-ROM, 4mm and 8mm tape for its two most common applications. Software distribution that was originally done with quarter-inch is rapidly moving to CD-ROM techniques. Backup on quarter-inch formats has been rivaled by 4mm and 8mm tape storage methods. Quarter-inch cartridge, however, targets the 1- to 3-GB range. Richard A. Peters, vice president of marketing for Tandberg Data Inc., went so far as to say, "If you're looking for storage below 1 GB, quarter-inch is the

only solution." Also in the under 3-GB range, Exabyte Corp. will be coming out with a 2-GB quarter-inch offering this spring that will be well-suited for the lower-level PC network market or for use with single workstations, according to Gary Brooks, Exabyte's program manager for quarter-inch programs. Helical scan, 4mm and 8mm tape, on the other hand, target storage needs in the multigigabyte range.

A factor that will help the quarter-inch market is that storage density on quarter-inch has only just begun to be tapped. Quarter-inch vendors plan to expand offerings to meet the multigigabyte range one day and project hitting the 4-GB mark (for minicartridge) in the next year or two. However, both 4mm and 8mm have already doubled the 4-GB compressed capacity that quarter-inch just recently achieved.

Quarter-inch in its original form, 5 $\frac{1}{4}$ -inch data cartridge, has a fairly large installed base and has been used for quite some time in the midrange market. The higher end quarter-inch products, 3 $\frac{1}{2}$ -inch minicartridges, are fairly new to the market. That new-

ness has lent an advantage to helical, due to the fact that users tend to feel safer with technologies that have been available longer. Dennis Casey, a market analyst with Peripheral Strategies Inc., believes it's easier to get people in the workstation market, in contrast to those in the PC market, interested in quarter-inch. "More people in the workstation market are familiar with quarter-inch, which makes it an easier sell," according to Casey.

A sign of the minicartridge's bright future is in figures compiled by Peripheral Strategies: In 1993 2.4 million minicartridge units shipped, up from 1.5 million in 1992. Growth was slower for 8mm tape. In 1992, 174,000 8mm tape units shipped, whereas in 1993, 185,000 units shipped.

The minicartridge market has seen a boom this year and probably will continue to grow next year as well. Casey says, "The reason for that may be a higher ratio of tape drives to single systems. For a small work group, the 500-MB minicartridge is an excellent price/performance product and is the only solution for under \$300."

based server, and if that server goes down, the company may go with it. "Fifteen years ago," says Gregory Kenly, director of network storage solutions at Storage Technology Corp., "you didn't have mission-critical information on your network. Now, I don't know how many companies would keep on going if you pulled the plug on their network."

So, tape backup would seem to be the answer. It's a tested technology, well-understood by both the UNIX and the MIS communities, and it's cheap.

Or is it?

The Trouble with Tape

"There is good news, and bad news," says Doug Herrington, backup-and-restore product manager of R Squared. The good news, he says, is that the media price for tape is going down. "The bad news is that tape has a lot of administrative costs."

It is easy to say that one does or will do tape backup. But, it can be a lot harder to actually manage it. Human factors tend to get in the way. "People don't want to deal with

remembering to put the tape in and out," notes Sylvia Berrens, vice president of Sun VAR and aftermarket Apunix Computer Services. "People forget to do it."

Of course, the MIS world dealt with these issues by hiring a staff to do nothing but swap tapes—but that was expensive. "Some years ago, I uncovered a company that had six full-time people just changing tapes," says Michael Peterson, president of storage-oriented market research firm Peripheral Strategies Inc., Santa Barbara, CA. "That's horrible."

For UNIX people, it is also out of the question. There is no way that Sun-oriented facilities, even MIS facilities, which downsized expressly to get away from the support costs associated with mainframes, can hire staff just to swap tapes. "People are simply reluctant to staff up with tape monkeys," explains Odetics' Daly.

Or, to put it even more bluntly, "If you have to hire people to get tape," says StorageTek's Kenly, "then you can't afford it."

Again, there would seem to be an easy answer at hand. Robots, that is, automated tape libraries, seem to offer all the advantages of tape with none of its drawbacks. Since 1980,

The Reliability Factor

The whole point of tape backup is to safeguard information. Backups are the main way we ensure that our data remains accurate and intact. Data reliability is a factor you can't afford to argue with. By design, quarter-inch tape drives are more immune to mechanical defects, hazards of heat, humidity and debris, which lead to loss of data. With other forms of tape media, special handling and storing are required to ensure data protection.

Another point affecting data reliability is the engineering of the drive. "Helical scan tape drives are more complicated by design and have more moving parts and motors, creating higher chances of mechanical problems. Couple that with heat buildup caused by those moving parts and motors, and the stability of its tape is at risk," Tandberg's Peters explains. To make matters worse, there is danger of tape being drawn into a rotating mechanism and winding around a drum in 4mm and 8mm storage forms. The engineering and design of quarter-inch drives is much simpler, since much of the mechanics reside in the cartridge. Additionally, quarter-inch provides a tape path that is always protected in an enclosed package.

Next to data reliability, the most important factor in a purchase deci-

sion for a backup method is cost. Several factors contribute to the cost of QIC. Because much of the technology behind quarter-inch cartridge lies in the cartridge and not in the drive, the tapes are more expensive than 4mm and 8 mm cartridges. On the other hand, says Peters, the metal particle (MP) tape used in helical storage, is "susceptible to more damage than quarter inch." For example, MP tape is extremely sensitive to heat and humidity and must be handled carefully and stored in controlled environments. Another hindrance with MP tape, as used in helical scan, is the accumulation of excessive debris and sometimes even clogged recording heads. The special care required by the tape results in a higher cost of handling. Thus, although the initial media cost of quarter inch may be higher, the cost of maintaining these drives is less. The relative simplicity of the quarter-inch drives allows for fewer mechanical parts and less maintenance.

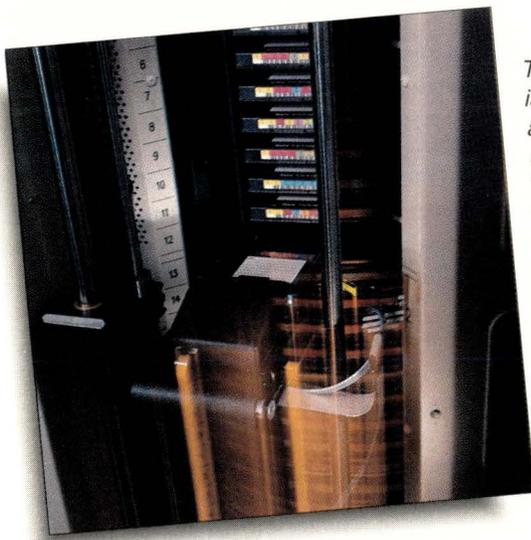
All things considered, quarter-inch costs less than competing helical options. Peters claims, "At 2.5-GB capacities, QIC is normally 20% less expensive than DAT [4mm]."

Interchangeability makes for another simple aspect of quarter-inch. Industry standards are set in media, size and data recording formats, to name a few. Quarter-inch media

products come in only one grade. All quarter-inch tape was designed to withstand the torture of rapid starts and stops.

Despite reports of its imminent demise, quarter-inch cartridge technology will continue to live and probably even grow. "As high-performance drives hit the market, quarter-inch will be used in near-line storage, to access large databases, etc.," according to Exabyte's Brooks. Peripheral Strategies' Casey agrees and points to QIC's future role in hierarchical storage management as a factor in its favor. "Hierarchical storage management is a trend, although we have yet to see a substantial amount of implementation."

Compared to helical scan, high-capacity quarter-inch has come to market a bit late and must battle with a more established 4mm and 8mm tape market. It's doing well in the catch-up game. Quarter-inch has vast potential mainly due to its untapped tape area capacity (about seven times longer than 4mm). Next-generation products will utilize that capacity. Compared with helical scan products, quarter inch has the upper hand in areas such as data reliability, cost and interchangeability. These factors are the main reasons why quarter inch, despite rumor, will be alive and well throughout the '90s.



The rise of the robots is represented by this automated tape handler from Odetics. Tape robots can provide UNIX-oriented networks with the advances of tape libraries, without their human costs.

dozens of such machines have come onto the market. They range from relatively small desktop devices, such as Advanced Digital Information Corp.'s (ADIC) DAT Autochanger (which offers up to 96 GB in a device that has a smaller footprint than an old-fashioned Sun 3/50), to powerful mid-size systems, such as the CLARion tape array

from Data General Corp., to giants, such as the storage silos of StorageTek. This company was originally a mainframe backup vendor but is now moving into the open systems market. Its largest product, Powderhorn, can hold some 6,000 cartridges, and as many as 16 Powderhorns can then be connected.

Indeed, the number and types of robots can be overwhelming. Introductions have come fast and furious over the past few months. One, which may have significant impact on the market, is from none other than Exabyte Corp. The well-known tape technology company announced four tape libraries last October—including a 4mm library and three half-height 8mm systems.

A month later, Digital Equipment Corp. had announced a mini-library as well, the DLT2500, which offers a five-cartridge, SCSI half-inch tape

subsystem that can back up 100 GB in less than 11 hours. DEC has been attempting to promote its DLT tape technology—originally a proprietary storage technique—as a backup method for Suns and PC-LANs.

Which is not to say that DEC and its DLT are alone in the half inch. A variety of companies both large and small are

Does HSM Have a Future?

HSM, or hierarchical storage management, is one of those terms that is too popular for its own good. The concept is fairly simple—an HSM product is software that automatically migrates older, less used files from fast but relatively expensive storage media (like hard disk), to other, slower and less expensive media. A file might, for example, slip from disk, to optical, to tape...and come back again...without the user ever noticing a change.

But, simple as the concept is, the term has been made complex by its very success. More and more companies are entering the field, sometimes offering tools only remotely related to HSM. "It's become a buzzword," laments Robert Brandenburg of Introl Corp., which does have an HSM tool among its products.

But what's really happening with HSM? Once you get past the vapor screen of new product announcements that aren't, you can discern certain trends. "Distribution and heterogeneous systems," says Jim Taggart, product manager at

Alphatronix Inc. "That's what's driving this market and will in the future." Where once an HSM might have resided on a single server, now it has to be distributed over a great many, very different systems.

"The direction is toward the distributed solution," agrees Jay Bretzman, product manager at Lachman Technology Inc. "And most of the new products adhere to the true client/server model—anyone who doesn't will have to niche out to survive."

Yet, while it is distributed, HSM is being forced by the market to be managed from a single location. "LANs are being viewed as much more subject to centralized management," explains Dan Cronin, vice president of marketing at Epoch Systems Inc., which was among the first vendors to bring HSM technology to UNIX networks. He notes that as networks and open systems move into what had been MIS applications, they are being required to take on the facilities for centralized control required by those applications. "From

a corporate perspective, there is a much, much greater need for centralized policy and control."

The trend toward centralization is one that shows up wherever there is a corporate network taking the place of a corporate mainframe. "The premise I have is that the regimentation of the MIS department is starting to show up in the distributed computing environment," says Jack Nilsson, product manager for Lago Systems Inc., which makes the Datawheel storage device. "Not in any Big Brother sense, but in the good business practices that MIS represented."

There is also some interest in applying HSM technology to smaller installations—an HSM for work groups that don't need a full-sized system. "We're working on a 'lite' version of our file-migration product, File Trek," notes Dana Kammersgard, of Artecon. "It will be able to handle 60% to 70% of the needs of most customers."

Other companies that offer low-end HSM include Epoch, QStar

eager to play in the same size format. In November, for example, Computer Upgrade Corp. announced two half-inch tape libraries that use standard VHS tape cartridges. The two new products were the CU-TB482, which can store up to 48 VHS tapes for a total of 864 GB, and the CU-TB602, which can store 600 cartridges for a total of 10.8 terabytes.

And the reason that many vendors are offering robots is that they offer savings on personnel. "The message I would urge you to convey," says Peripheral Strategies' Peterson, "is automation. This isn't just another mass-storage device." Indeed, the storage issue becomes almost secondary to labor savings.

"People can cost-justify an automated system in six months."

"Our numbers show that it costs about \$2.50 to do a manual mount of a tape," explains Odetics' Daly. "That compares to \$1.50 for an automated one...and, remember, some of these large libraries will do 50,000 to 100,000 mounts a year."

"I hate to keep coming back to money," adds R Squared's Herrington, "but robots help the bottom line. Why not go with one? They never talk back, and they don't care about the company health plan."

On the other hand, he adds, "robots, in their native form, can be a bit hostile."

R.U.R.

That's not to say that your average tape-handling system is plotting a rebellion with the laser printer and the fax modem. It's just that robots of any sort, including tape handlers, can be difficult to program, difficult to interface to the rest of the network, and hard to manage once they are in place. "Software is the key," says analyst Peterson.

And there's more than one type of software involved—software for the robot, which is hard enough, and software for the tapes. "Generally, the problem is not automating the backup itself," says David Bynon, director of storage product marketing and development at Artecon. "But rather in automating the management of the tapes."

In particular, he notes, there is tracking. Tapes have to be tracked, their location remembered, and their histories kept on line. It is particularly true for some companies doing business with the government. "They'll need to track tapes for up to seven years...because that's the federal requirement. For a large data center, that could be up to 10,000 tapes."

But there's more: "You need to do more than just track them. Tapes need maintenance. They need to be brought in, rewound and retensioned periodically. You need a software package that is going to help you manage that process...that

Technologies Inc. and Advanced Archival Products Inc. "We sell a lot of it [low-end HSM]," says Christopher Kokias, director of marketing at Advanced Archival. "Not everyone wants a full-blown package."

But, among those who do need full-size packages, there is an increased need for data security. As HSMs begin to become responsible for mission-critical, corporate data, that means they have to blend with backup and disaster recovery services. "In any given company, there are a few precious resources, and one of them is data," notes Kevin Horigan, vice president of North American sales at storage management product vendor QStar. "Disaster recovery, fault tolerance, backup, those are going to be done at the network level, because the networks are now handling the crown jewel of the enterprise—the data."

Moreover, HSMs are starting to become associated with the backup of not just system files but application files. For example, several of the HSM vendors, among them Epoch, are actively working to provide HSM and backup servers to popular rela-

tional databases. Several standards groups are now in operation to provide industrywide standards for the backup and management of applications.

In fact, Introl's Brandenburg thinks that, eventually, vendors will decide on common file management solutions. "Some companies will focus on the manipulation of files, and hopefully we'll be one of them," he says, "while the application developers can focus on their applications." Currently, he says, many vendors—and particularly database vendors—have to invent their own file systems.

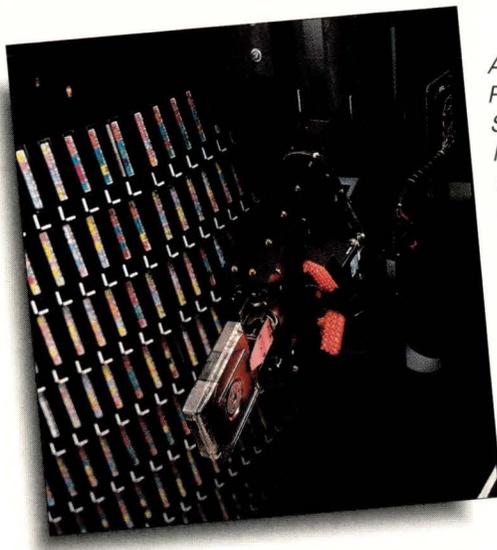
But that brings up a question. If these sorts of HSM functions are moving down into standards, then it is a short drop from there into the operating system. Could HSM actually become merely a part of the OS? Could it become, in short, merely one more offering that every workstation vendor will provide?

"I think that, within the next year, we'll start seeing some basic [HSM] capability from the hardware vendors," answers Artecon's Kammersgard. He warns that some HSM vendors, at least those that provide only limited functionality, will

face hard times. "For people who are making money on HSM, like us, that means we'll have to do one of two things," he says. "We'll either have to keep ahead of the curve, with improved technologies, or else we'll have to get into another line of business."

Most HSM vendors, though, think there isn't much problem in keeping ahead of that technology curve. System vendors are, after all, not focused on HSM, whereas they are. "From what we've seen, there will always be room for good HSM vendors," says Randall Thornburn, vice president of marketing and sales for Advanced Software Concepts Inc.

In fact, rumor says that there have already been some expensive and embarrassing failures among hardware vendors attempting to integrate HSM into the system software offerings. "I don't see where it [putting HSM on the operating system] has been done, yet," says David West, marketing manager of Peripheral Devices Corp., which markets Delta Micro Systems products BudTool and MigTool. "But I can think of a few companies that have tried, and been most unsuccessful."



A giant robot, the Powderhorn from Storage Technology can hold up to 6,000 cartridges. StorageTek is best known for its main-frame products, but it is moving rapidly to consolidate its position in the Sun market as well.

will tell you when a tape needs to be rewound, when it is old and can be used," says Peterson.

And, until recently, there weren't a lot of companies out there selling product that could do even some of that. However, says analyst Peterson, that is starting to change. He cites such companies as Delta Microsystems Inc. with its BudTool, Legato Systems Inc., Software Moguls Inc. and so on. "Really," he concludes, "the software has to be in place first."

The other major software issue—that of device drivers for robots—is also being addressed, sometimes in some rather surprising ways. Box Hill, for instance, tries to eliminate the need for them entirely. The company markets a device called the Tape Box, says Sales Director Turchin. "You put it in any robot, and it takes care of things."

Typically, a robot attaches to a workstation via a SCSI connector. The workstation then has to support a device driver for the robot. The Tape Box eliminates much of that. It has its own Ethernet connection and its own firmware. In this way, the robot can exist as an independent entity on the network. "It's a black box," says Turchin. "You have to set it up to understand your network, but after that, it just works by itself. You could slip it into a closet, and every night it would kick in by itself."

Invisible Engines

What, then, is the future for tape backup? For one thing, its

market is going to be bigger. "We think the market is only now just emerging," says Box Hill's Turchin. "It used to be that just the big engineering companies had UNIX. Now, we get financial institutions, clothing stores, airlines, supermarkets—even convenience store chains."

That, in turn, means that it will have to become increasingly automated. The difference between tape subsystems and tape-handling robots may vanish entirely. "People need to go with removable media," says Odetics' Daly. "But they need to do it without staffing up."

In the process, backup as a concept will change. It will come to mean more things than it currently does. "More capacity, higher spends, increased numbers of cartridges...all those are true," says Dan Stromska, vice president of sales and marketing at ADIC. "But, more, I see backup expanding into the realms of hierarchical storage management." HSM is, of course, technology that automatically migrates older, less used files from expensive storage media to less so—say, from disk, to optical media and finally to tape (see "Does HSM Have A Future?").

StorageTek's Kenly thinks that backup will start to blend as

Don't Count Out Optical

Not too long ago, everyone thought that tape was doomed. "When I started in this business, I was told I would be out of a job in two years," says Bernie Wu, vice president of product development for Conner Storage Systems Group. "That was in 1986," and Mr. Wu is still very much in the tape business.

Tape was supposed to be swept away by optical media. It didn't happen. "What happened," says Wu, "was that over the last three years there have been major technical breakthroughs in helical scan recording...first in 8mm, and now in 4mm."

As a result, says Stan Corker, director of removable media research at market research firm International Data Corp., Framingham, MA, was that "tape has caught up, if not overtaken optical." He notes, in fact, that optical systems have yet to achieve the volume sales the industry expected would be the norm by now. "In fact, it hasn't had the volume to drive its prices down—and it hasn't had the volume to reinvest its profits in R&D—where, on the tape side, there's been enormous volume."

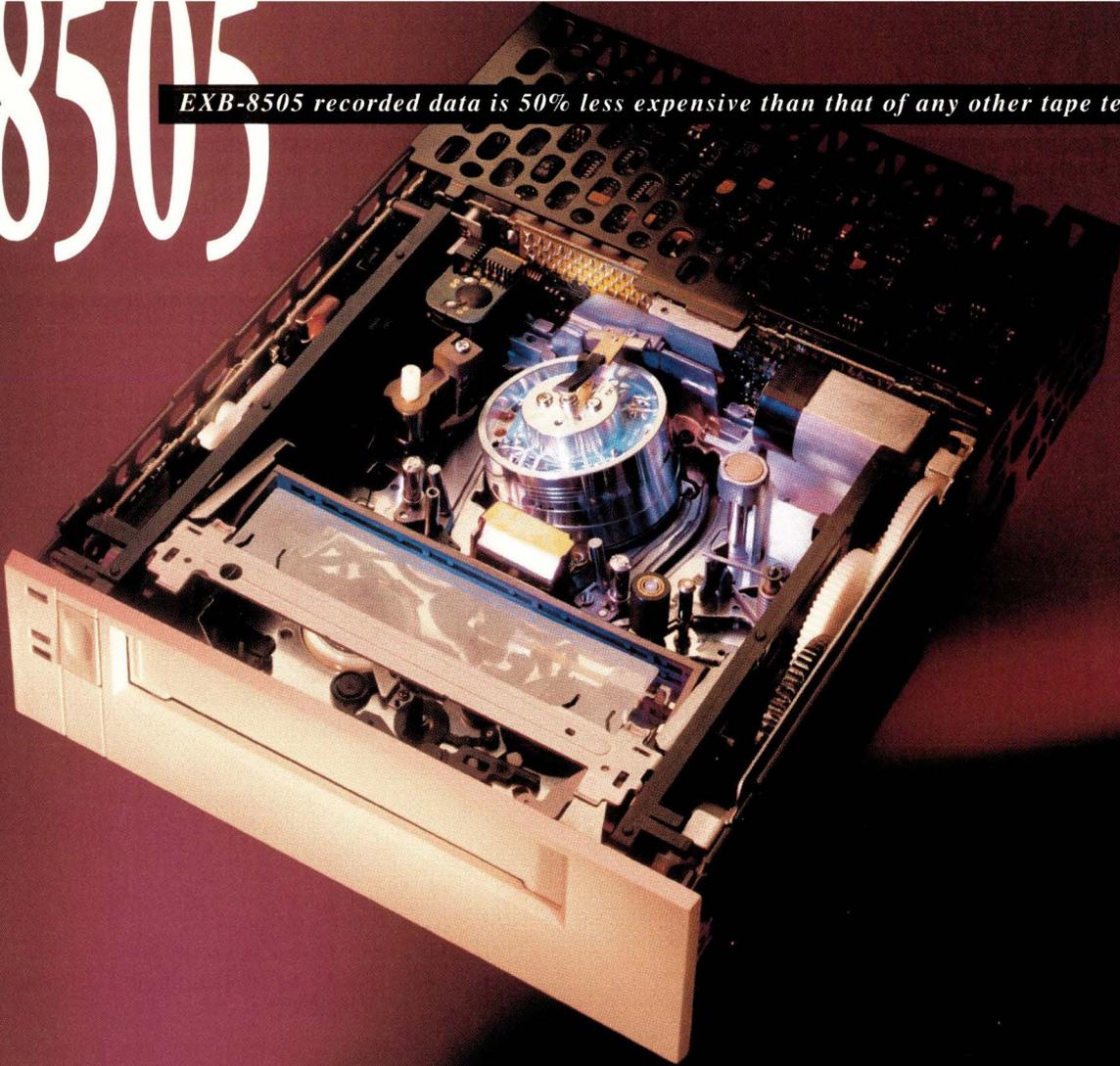
Still, optical has its defenders. For one thing, optical—in the form of CD-ROM—has managed to largely supplant tape as a software distribution medium. "A lot of people have gone to optical," notes Steven McAllister, vice president of marketing for Andataco, "not for backup, but for software and data distribution."

In addition, CD-ROM comes in only one flavor, which some users find distinctly reassuring. "People are tired of having to deal with different formats: 8mm, DAT, QIC, whatever," says Craig Caudill, president of Falcon Systems Inc., a Sun and workstation aftermarketer. "With CD-ROM, it's always compatible."

Beyond CD-ROM, with write-once-read-many and magneto-optical, Caudill sees a major role in archiving—mostly because he sees optical media as the only place with both the storage capacity and the high speed necessary for the sheer amounts of data that corporations now store and access on a daily basis. "Corporation information has become like toxic waste," he jokes. "There's just not enough room for it, anywhere."

8505

EXB-8505 recorded data is 50% less expensive than that of any other tape technology.



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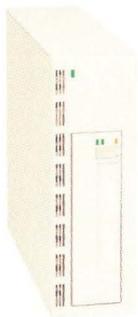
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well with various types of fault tolerance. "I think you will see disaster recovery become a superior form of backup," he says. "When people start losing information in these networked environments, that gets very interesting."

In fact, disaster recovery is already showing up in tape robots. StorageTek's own products are supposed to have it shortly. At the other end of the spectrum, Andataco is already marketing an Encore system that backs up a file at two locations. One copy is kept locally, while another is sent out via network or modem to storage off-site.

But what may be most important for tape-handling robots will be their increasing invisibility. "If robots are going to make it," says Odetics' Daly, "then they're going to have to sneak in." He says that, increasingly, backup must become removed from the users, invisible to them, unimportant to them, but present all the same.

"Right now," he says, "you have to put windows in the jukeboxes so people can watch the arm moving around. Sooner or later, the fact that it's a robot must become unimportant." →

Companies Mentioned in this Article

Advanced Archival Products Inc.

6595 S. Dayton St., Suite 1200
Greenwood Village, CO 80111
Circle 200

Advanced Digital Information Corp.

14737 NE 87th St.
P.O. Box 2996
Redmond, WA 98073-2996
Circle 201

Advanced Software Concepts Inc.

2430 Vineyard Ave., Ste. 205
Escondido, CA 92029
Circle 202

Alphatronix Inc.

P.O. Box 13978
Research Triangle Park, NC 27709
Circle 203

Andataco

10140 Mesa Rim Road
San Diego, CA 92121
Circle 204

Apunix Computer Services

5575 Ruffin Road, Suite 110
San Diego, CA 92123
Circle 205

Artecon

P.O. Box 9000, Dept. 5500
Carlsbad, CA 92009
Circle 206

Box Hill Systems Corp.

161 Avenue of the Americas
New York, NY 10013
Circle 207

Computer Upgrade Corp.

1921 Sampson Ave.
Corona, CA 91719
Circle 208

Conner Storage Systems Group

Conner Peripherals Inc.
36 Skyline Drive
Lake Mary, FL 32746
Circle 209

Data General Corp.

4400 Computer Drive
Westboro, MA 01580
Circle 210

Delta Microsystems Inc.

111 Lindbergh Ave.
Livermore, CA 94550
Circle 211

Digital Equipment Corp.

OEM Storage Business
146 Main St.
Maynard, MA 01754-2571
Circle 212

Epoch Systems Inc.

8 Technology Drive
Westboro, MA 01581
Circle 213

Exabyte Corp.

1685 38th St.
Boulder, CO 80301
Circle 214

Falcon Systems Inc.

1417 W. North Market Blvd.
Sacramento, CA 95834
Circle 215

Introl Corp.

2817 Anthony Lane South
Minneapolis, MN 55418
Circle 216

Lachman Technology Inc.

1901 N. Naper Blvd.
Naperville, IL 60563-8895
Circle 217

Lago Systems Inc.

151 Albright Way
Los Gatos, CA 95030
Circle 218

Legato Systems Inc.

260 Sheridan Ave.
Palo Alto, CA 94306
Circle 219

Odetics Corp.

1515 S. Manchester Ave.
Anaheim, CA 92802
Circle 220

Peripheral Devices Corp.

Continental Plaza
1002 W. Ninth Ave.
King of Prussia, PA 19406
Circle 221

QStar Technologies Inc.

Jefferson Plaza
600 E. Jefferson St., Fifth Floor
Rockville, MD 20852
Circle 222

R Squared

11211 E. Arapahoe Road
Englewood, CO 80112
Circle 223

Software Clearing House

110 Three Centennial Plaza
895 Central Ave.
Cincinnati, Ohio 45202
Circle 224

Software Moguis Inc.

12301 Whitewater Drive, Ste. 160
Minnetonka, MN 55343
Circle 225

Storage Technology Corp.

2270 South 88th St.
Louisville, CO 80028-0001
Circle 226

Tandberg Data Inc.

2649 Townsgate Road, Suite 600
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A Sampling of Quarter-Inch Tape Drives

This buyer's guide lists quarter-inch tape drive manufacturers. VARs, distributors and resellers can be reached by contacting the companies below.

Company/Manufacturer Model	Capacity*	Interfaces	Form factor (inches)	Sustained transfer rate (KB/s)	Seek rate	Cache size	Backward compatibility †	Error correction coding	Recording format	Data library automation	Software provided	Other software support	Native support for vendor OS	Price (\$)
Colorado Memory Systems Inc., 800 S. Taft Ave., Loveland, CO 80537. Circle 230														
PT-25	2.4 GB/ 1.2 GB	SCSI	5¼	300	—	—	r/w, r	Reed-Solomon	QIC-1000	no	CMS Backup	kernel	no	1,295
PTE-25 (external)	2.4 GB/ 1.2 GB	SCSI	5¼	300	—	—	r/w, r	Reed-Solomon	QIC-1000	no	CMS Backup	kernel	no	1,495
PT-50	4 GB/2 GB	SCSI	5¼	300	—	—	r/w, r	Reed-Solomon	QIC-2GB	no	CMS Backup	kernel	no	1,695
PTE-50 (external)	4 GB/2 GB	SCSI	5¼	300	—	—	r/w, r	Reed-Solomon	QIC-2GB	no	CMS Backup	kernel	no	1,895
Conner Peripherals Inc., Tape Products Group, 1650 Sunflower Ave., Costa Mesa, CA 92626. Circle 231														
2150	250 MB/ 150 MB	SCSI	5¼	112	90 ips	—	r/w, r	Reed-Solomon	QIC-24, 150, 120 (optional)	no	Conner Backup (optional)	Aim, Syntron, Cheyenne, Tallgrass, 5th Generation, Mountain, Dantz	no	—
2525	525 MB/ 320 MB	SCSI	5¼	200	120 ips	—	r/w, r	Reed-Solomon	QIC-525	no	Conner Backup (optional)	Aim, Syntron, Cheyenne, etc.	no	—
Anaconda 2750	1.64 GB/—	SCSI, SCSI-2	5¼	600	—	—	r/w, r	Reed-Solomon	QIC-1350	no	Conner Backup (optional)	—	no	—
Contemporary Cybernetics Group, Rock Landing Corporate Center, 11846 Rock Landing, Newport News, VA 23606. Circle 232														
CY-3600	—/250 MB	SCSI	5¼	112	—	64 KB	r	Reed-Solomon	QIC-24, 120, 150	no	—	—	—	—
CY-3800	—/525 MB	SCSI, SCSI-2	5¼	240	—	256 KB	r	Reed-Solomon	QIC-24, 120, 150, 320, 525, 1000	no	—	—	—	—
CY-4000	—/1.2 GB	SCSI, SCSI-2	5¼	240	—	256 KB	r	Reed-Solomon	QIC-24, 120, 150, 525, 1000	no	—	—	—	—
CY-4200	—/2.5 GB	SCSI, SCSI-2	5¼	300	—	256 KB	r	Reed-Solomon	QIC-24, 120, 150, 525, 1000	no	—	—	—	—

* compressed/uncompressed † r=read, w=write

compiled by MAUREEN MCKEON

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QUARTER-INCH TAPE DRIVES

Company/Manufacturer Model	Capacity*	Interfaces	Form factor (inches)	Sustained transfer rate (KB/s)	Seek rate	Cache size	Backward compatibility †	Error correction coding	Recording format	Data library automation	Software provided	Other software support	Native support for vendor OS	Price (\$)
Exabyte Corp., 1685 38th St., Boulder, CO 80302. Circle 233														
EXB-2501	1.5 GB/ 750 MB	SCSI-2	3½	567	—	256 KB	—	Reed-Solomon	QIC-121	no	Enterprise, Filesecure	Cheyenne, Novastor	Solaris 1.0, Solaris 2.0	—
Optima Technology Corp., 17526 Von Karman, Irvine, CA 92714. Circle 234														
Diskover 525T	—/525 MB	SCSI	5¼	234	—	256 KB	r/w	ECC	QIC-24, 120, 150, 320, 525	no	—	—	Solaris 1.0, Solaris 2.0	—
Sankyo Seiki America Inc., Storage Products Division, 2649 Campus Drive, Irvine, CA 92715. Circle 235														
CP-150SE	250 MB/ 150 MB	SCSI, SCSI 2	5¼	112	—	64 KB	r/w, r	—	QIC-120, 150	no	—	—	—	403
ST-150	250 MB/ 150 MB	SCSI, SCSI 2	5¼	112	—	64 KB	r/w, r	—	QIC-150	no	—	—	—	454+
CP-525SE	525 MB/ 320 MB	SCSI, SCSI 2	5¼	240	—	256 KB	r/w, r	Reed-Solomon	QIC-120, 150, 525	no	—	—	—	540
ST-525	—/525 MB	SCSI, SCSI 2	5¼	240	—	256 KB	r/w, r	Reed-Solomon	QIC-120, 150, 525	no	—	—	—	601+
CP-1000SE	—/1 GB	SCSI, SCSI 2	5¼	300	—	256 KB	r/w, r	Reed-Solomon	QIC-120, 150, 525, 1000	no	—	—	—	792
ST-1000	—/1 GB	SCSI, SCSI 2	5¼	300	—	256 KB	r/w, r	Reed-Solomon	QIC-120, 150, 525	no	—	—	—	837+
ST580M	1.2 GB/ 580 MB	SCSI-2	3½	252	—	512 KB	—	Reed-Solomon	QIC-555M	no	—	Novastor	—	—
QICPort 2000	1.2 GB/ 580 MB	SCSI-2	3½	200	—	512 KB	—	Reed-Solomon	QIC-555M	no	—	Novastor, Cheyenne, Sytos	—	—
QICPort 2000C	—/1.2 GB	SCSI-2	3½	200	—	512 KB	—	Reed-Solomon	QIC-555M	no	—	Novastor, Cheyenne, Sytos	—	—
ST-1200M	1.2 GB/—	SCSI-2	3½	252	—	512 KB	—	Reed-Solomon	QIC-555M	no	—	Novastor	—	—
DATAPORT 4400	4 GB/2 GB	SCSI-2	3½	183	—	1 MB	—	Reed-Solomon	DDS-1	no	—	Novastor	—	—
ST 4400D	4 GB/2 GB	SCSI-2	3½	183	—	1 MB	—	Reed-Solomon	DDS-1	no	—	Novastor	—	—
DATAPORT 4800	8 GB/4 GB	SCSI-2	3½	200	—	1 MB	—	Reed-Solomon	DDS-2	no	—	Novastor	—	—
ST 4800D	8 GB/4 GB	SCSI-2	3½	366	—	1 MB	—	Reed-Solomon	DDS-2	no	—	Novastor	—	—
Tandberg Data Inc., 2649 Townsgate Road, Westlake Village, CA 91361. Circle 236														
Panther 250	500 MB/ 250 MB	SCSI, SCSI-2	5¼	540	120 ips	64 KB	r/w	Reed-Solomon	QIC-120, 150	no	kernel	Legato	Solaris	885
Panther 525	1050 MB/ 525 MB	SCSI, SCSI-2	5¼	1200	120 ips	256 KB	r/w	Reed-Solomon	QIC-525	no	kernel	Legato	Solaris	1,035
Panther 1200	2.4 GB/ 1.2 GB	SCSI, SCSI-2	5¼	1200	120 ips	256 KB	r/w	Reed-Solomon	QIC-1000	no	kernel	Legato	Solaris	1,195
Panther 2500	5.0 GB/ 2.5 GB	SCSI, SCSI-2	5¼	1800	120 ips	256 KB	r/w	Reed-Solomon	QIC-2 GB	no	kernel	Legato	Solaris	1,345
TEAC America Inc., 7733 Telegraph Road, Montebello, CA 90640. Circle 237														
MT-01F	1.1 GB/ 580 MB	SCSI, SCSI-2	3½	252	—	512	r	Reed-Solomon	QIC-3030 MC	yes	Syτος Plus	Corel	—	899
WangTek Inc., 41 Moreland Road, Simi Valley, CA 93065. Circle 238														
51000MT	—/1.2 GB	SCSI, SCSI-2	5¼	285	—	—	r, r/w	Reed-Solomon, CRC	QIC-1000C	no	—	—	—	895

* compressed/uncompressed † r=read, w=write

4 a.m. - Gary, our response time has slowed from 1 second to 40 seconds. Help!! -- Anita, Order Processing

p.m. - I had to put Union on hold three times, while I waited to get online. What's going on? -- Phyllis, Customer Service

p.m. - I'm putting 42 people on overtime to get these orders out tonight! It's gonna be your neck, Gary! -- Anita, Order Processing

3 p.m. - Gary, I want an explanation! NOW!
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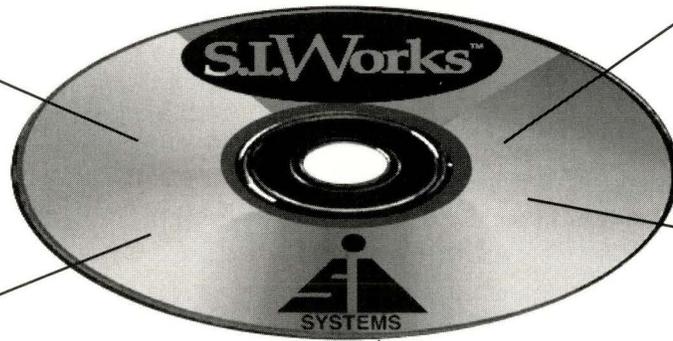
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I've championed software portability for more than a decade. You *did* read my review of Solaris 2 in the October 1993 issue of *SunExpert*, right? So you *know* how happy I was to see Solaris 2 running identically on systems with SPARC and Intel Corp. processors. Just imagine how I felt at the Common Open Software Environment/Common Desktop Environment Conference in San Jose, CA, at the end of October 1993 when COSE's entire CDE was shown running identically (almost bug for bug—it was, after all, a development snapshot) on Sun Microsystems Inc. SPARC and X86, The Santa Cruz Operation Inc., Novell Inc./USL, Hewlett-Packard Co. and IBM Corp. UNIX systems.

by IAN F. DARWIN



Birth of a Desktop

There may be a new desktop in your future: The first COSE Conference shows developers executables, linkable libraries and header files for a new user interface standard.

Same colors. Same icons. Same backgrounds. Same front panel. Same calculator. Same calendar. Same menus. Same help system. Wa-HOO-Dah! This stuff isn't just portable, it's *ported*. And I have in my hot little hands a CD with executables and linkable libraries and header files for five of those platforms (sans Solaris X86). It's real, OK? No more talk about CDE being vaporware, cuz it isn't. And I've got a /vmmunix mail bomb right here for any doubting Thomases who say in public that CDE isn't real.

Well, so the calendar and mail programs weren't there. Honesty compels me to admit it. The calendar program wasn't quite ready when the five companies did the "code freeze" for the conference. A recognizable descendant of SunSoft's Mailtool, now in its third or fourth user interface, will be shipped in the Sun section of the Snapshot CD and part of the finished version of CDE. This mailer uses Apple Computer Inc.'s Bento format for encapsulation (though it can read Mime mail and OpenWindows Mailtool formats). Bento is also used in the Text Widget and the dterm terminal emulator. So, in all cases, you can drag an attachment and drop it into a text pane: in mail you're composing, in text you're editing, and (generally) in text windows in any application.

Pulling for Solaris 2?

CDE is a Good Thing. It may, in fact, be the Best Thing to happen to commercial UNIX since NFS

and X. It includes several of the key SunSoft DeskSet tools (or close replacements), plus a standardized full-screen login that uses the XDM control protocol and an easy-to-use (for most people) front panel drawn from HP's VUE. OpenWindows users can think of the front panel as a fancy root menu or workspace menu that is always pinned up, that has icons for the dozen or so most common operations and subpanels (slide-up menus) for many more, and that you can configure either by editing configuration files or by dragging and dropping an action onto the subpanel. The front panel also lets you select from one of many workspaces (like the virtual screens in `olwvm` and `vtwmm`, workspaces are just collections of windows).

The File Manager behaves like a cross between IXI's file manager and the OpenWindows File Manager, except it's Motif-based. There is also an Application Manager, which is a file manager view of a special directory that contains icons to start up all the standard applications. This is like the Program Manager of MS-Windows, except that it is implemented using the same program as File Manager views, so there is nothing new to learn and no inconsistencies between the two. A good idea! As well, icons of any sort—files/directories or program/actions—can be dragged from any file manager view onto the root window, letting you customize the screen as much as you like.

CDE is based on the Motif GUI—for compatibility with most of the X industry—but has been extended to allow better cooperation with your existing Open Look applications. Of course, your existing Open Look, Motif and some other X applications will run together under CDE.

And this functionality will be available, identically, on IBM, HP, SCO, Univel UNIXware, probably Digital Equipment Corp. OSF/1... and the next release of Solaris.

Most of the media and the user community have been urging Sun to "pull" users onto Solaris 2 by making it better, rather than trying to "push" them by selling machines that were incompatible with the older SunOS 4.X. CDE, which won't be released for SunOS 4.X, but will probably be released for the summer release of Solaris 2, is just such a pull.

Other Vendors

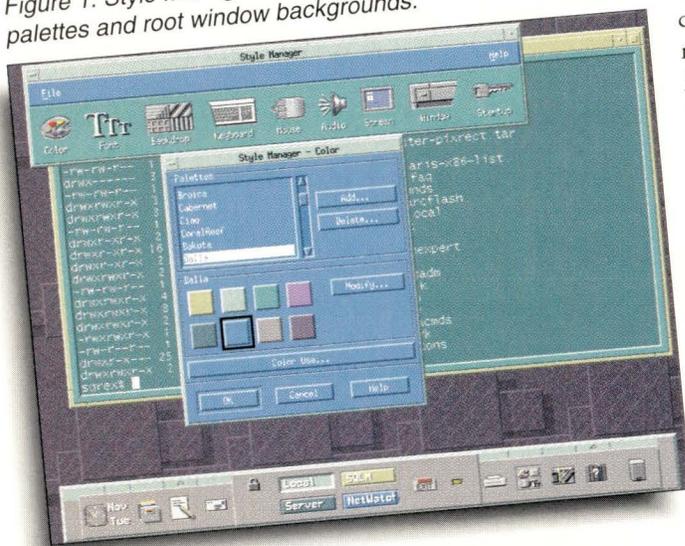
DEC was conspicuously absent from the demo room floor. I cornered a senior DEC manager toward the end of the conference. He assures me that DEC is fully committed to the COSE process, which includes the CDE dashboard. Unfortunately, DEC's very top management dragged their feet on committing to CDE, and then legal entanglements (of the type you'd expect when blending the copyright notices, er, copyright source code, of five major computing companies) prevented DEC from getting the source code in time to show up at the demo room. If there is a second CDE conference next year, expect to see DEC showing core CDE exactly the same as the other vendors.

Silicon Graphics Inc. comes to mind as a vendor that has not committed to CDE. SGI recently announced its own second major desktop design, called Magic. So SGI may try to go it alone. I think I see another Open Look scenario—other interfaces may be better, but it's too small a market for that sort of competition. Ditto for other vendors who don't go with CDE. My guess is that there'll be a showdown in another year or so, and the anti-CDE forces will leave town on the last stage-coach before high noon.

Coopetition

How did this cooperation among competitors come to be? All major UNIX players already knew that cooperation among Open System vendors really does make for a bigger market. How? They've all been members of the

Figure 1. Style Manager includes a variety of standard color palettes and root window backgrounds.



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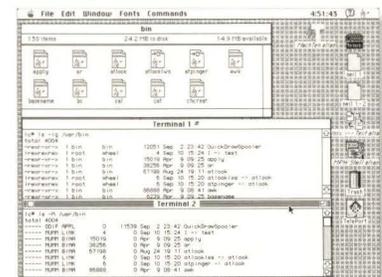
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X Consortium from its inception. Each has contributed large chunks of code to it (Sun gave the initial frame buffer code, and much later the entire XView tool kit, and wrote the sample PEX implementation under contract), and they have seen X grow as an industry standard that helped bring in the present era of network-transparent GUI-based computing (something the non-X folk still can't do).

How do they ensure that everybody's version has the same features and bugs? By having only a single copy of the source. Hopefully they have off-site backups :-). It's shared by NFS across the Internet; vendors extend the master source and do official builds from that same source (I don't know the IP address, and I wouldn't tell you if I did). The process seems to work; the snapshot does seem to have the very same version on all platforms.

Conference Sessions

The conference went on for three full days, so I can't report on everything I heard (heck, I can't even *remember* half of what I heard). It was sure interesting seeing all those big-name hardware vendors on the same platform.

All those big-name vendors *have* put together a common desktop. Sure it's largely built from existing technology, but there are some new goodies too. For example, the `dtcalendar` program is familiar to SunSoft OpenWindows `cm` users, but has a few new features and (finally!) a published API so you can write your own calendar manager program or put calendar smarts into some other application. I imagine an accounting system that uses the calendar interface to remind you in 30 days to check if that "Net 30" invoice actually got paid, but I'm sure you readers can think of something more imaginative than that.

There's a lot of other support, too, like running remote applications transparently (including fallback to another machine if a given server is down) just by clicking on its icon, a full-blown help system with hyperlinks and many other services.

As befits a professionally run conference, the slides were all done in a uniform way and the printed proceedings (with last-minute changes, and without the keynote speeches) were given out when you registered. Bravo!

The sessions themselves began each morning of the three-day show with a non-technical panel or keynote or two, and the rest of the day was spent on technical sessions (with an ISV panel after lunch the last day). There weren't any unimportant sessions, but the ones I found most important were on internationalization, session and workspace management, drag-and-drop, messaging (i.e., ToolTalk), the new Help services, AT&T's (well, Novell's) Windowing Korn Shell (a `ksh`-based scripting language for X) and the Builder. Many of these are familiar to experienced Sun developers,

but the drag-and-drop API is totally new (layered atop the Motif drag-and-drop API). The Builder is available to all CDE companies (I hope they all decide to bundle it) and is based on SunSoft's devGuide but with numerous changes and additions and, of course, Motif support. Your existing GIL (.G) files can be read in, converted to BIL files automatically, and a Motif UI built automatically.

A future version (after first customer shipment) will, I hope, support the Windowing KSH, which would bring the power of a tool like Visual Basic to all users of the CDE desktop. If they can only add Display PostScript to that, they'll have something with a lot of the functionality of the NeWS window system too.

Motif itself has been extended to provide Open Look functionality, for example, the Toolkit by adding widgets and the Window Manager by mouse functionality (Button 3 for Menu, for example). The terminal emulator `dterm` even has (like `xterm`) the Sun function key support. The Properties Sheet model as a way of controlling application behavior survives, though the Properties program is replaced by the Style Manager, which does the same thing but in a more graphical way (see Figure 1). Style Manager also includes a variety of standard color palettes (pairs of foreground/background colors) and root window backgrounds. Each "workspace" can have its own background. The word "style" is used advisedly. CDE looks like it has some style, like it was designed. The colors work well together, and the backgrounds are "designer" styled, low-key, comfortable to look at. They are not the usual collection of backgrounds collected by us computer techies. Most of the Style Manager stuff derives from HP Vue, which won the Industrial Designers Society of America Gold award for excellence in design. Having seen it (via CDE), I can see why.

One of the surprises for me was the announcement of the X-based printing services. It's an X server that renders into a bit map that gets sent to your printer. Sound familiar? Sound like NeWSprint warmed over? Remember

Does CDE Really Mean Anything?

I believe that it does:

- CDE provides a desktop that is as easy for end users to use and to reconfigure as the MacOS, MS-Windows, Windows NT and OS/2 desktops.
- At the same time, CDE provides more functionality than NT or OS/2, since it rides atop a full-featured operating system that has all the power of these OSs and isn't divided into arbitrary and mutually exclusive subsystems the way NT is. Also, the OS it sits on is time-tested and is multi-user from boot.
- And yet CDE does share a common overall look-and-feel with all other CUA (IBM's Common User Architecture) derivatives including MS-Windows, NT, OS/2 and Motif.

The release schedule I outlined in this article gives OS/2 a chance to gain some ground in the never-ending "battle for the desktop." The UNIX vendors, with CDE, have sent a formidable entry onto that battlefield. And it's an entry that looks good where it counts—on your screen!

NeWS? The Better Window System that time and sunshine forgot. Most of the things that NeWS pioneered—including irregular window shapes and PostScript—have now been incorporated into X (except for device-independent graphics, and full server program-mability, but I digress—again). It only remained for most of the products layered atop NeWS to get incorporated into X, and here is one of them now. If you want near-WYSIWYG output from X, you should be able to get it with this. Some applications will still want to generate PostScript directly, however, because of the overhead of sending full-page bit maps. It's a good start, and they do provide standardized dialogs for printer selection and other dealings with the printer subsystem.

Some will say that the Common API Specification for UNIX session was among the most important. This is another COSE project (CDE is just one technology of COSE) aimed at providing the grand unified UNIX specification. It builds on POSIX, SVID, XPG4, X11, 4.3BSD-Reno, and various and sundry other APIs. The nickname "1170 API" originally referred to the number of calls listed in the API (with a bit of editing, they've gotten it down below 1,000). It is planned that this new API, along with the CDE specification, will be turned over to X/Open to become standards quickly via the Fast Track process, which is reserved by X/Open for cases in which "broad industry consensus" exists. CDE and the COSE API are certainly supported by all the key players, so both are likely to "Fast Track" their way into the standards menagerie, er, repertoire. With any luck, this API will be called XPG5, to keep things simple and uniform.

The ISV Panel featured Lotus Development Corp. and several other large software builders commenting on how CDE makes UNIX an even more attractive porting platform (with Wabi as a fallback for MS-Windows applications that wouldn't sell enough to justify a port to UNIX). Certainly CDE and the COSE API do simplify (they aim to trivialize) the process of porting applications from one vendor's UNIX to another. This, too, is a Good Thing.

Using CDE

It worked OK on the demo room floor. So it should work at home, right? Well, as a reward to me for promoting cross-vendor portability, my desktop got switched from a SPARCstation to a 486 running UnixWare Personal Edition. No problem, it's UNIX, right? Well, apart from some missing utilities probably caused by a missing "package," that is in fact right. I was able to install the software, and once I got a working (800-by-600) monitor, the visual effect was pretty good.

On a Sun 1,152-by-900 monitor, it should be great—it was at the show. And indeed it is great on a Sun monitor. I got it up and running on my IPX, and found it almost identical to the UNIXware system, except of course for the "real screen" resolution.

Starting it automatically, a la XDM, is just a matter of installing a script in one of the System V startup script directories. On USL systems like UNIXware, you copy the file explicitly. Sun and a few of the other vendors give you a script to enable/disable automatic startup. Front Panel configuration is pretty simple. If you have a control with subpanels, you can just drag an icon onto the subpanel, and it gets installed automatically. This thing *is* as easy to use and configure as MS-Windows. Maybe more so.

Since the `dtlogin` program uses the standard XDM protocol, I wanted to try `dtlogin` against an X terminal. However, the only X terminal I was able to get my hands on that I could use with XDM was monochrome (an NCD), and the release notes clearly state that the current "snapshot" of CDE is only set up for high-resolution color displays. Well, fools and reviewers rush in. I told the NCD to point its XDM host at the USL system, and

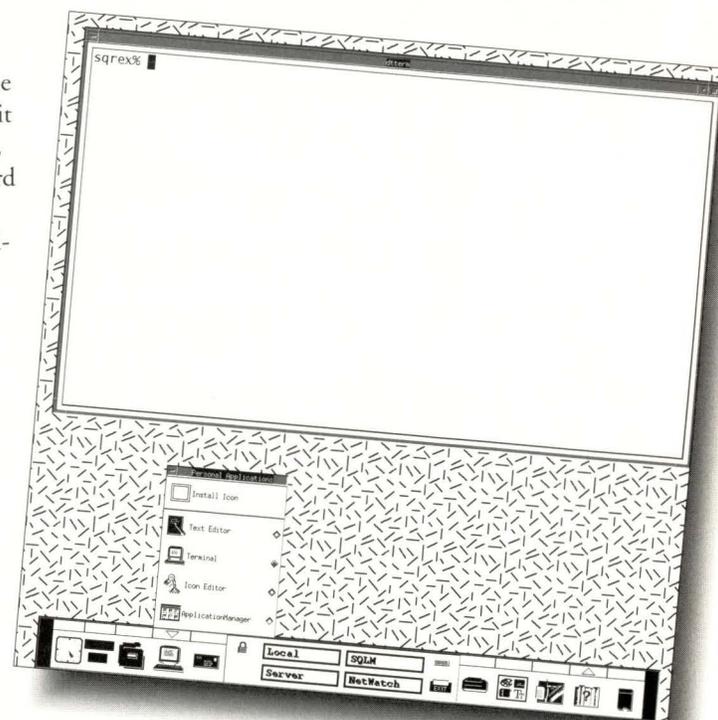


Figure 2. CDE runs on a wide range of X displays.

restarted it. Amazingly enough, it worked, and worked better than it did on a low-resolution 16-color VGA (remember, the October 1993 snapshot is just a snapshot; 16-color VGA may work someday). Figure 2 shows it running on the monochrome NCD.

The window manager is derived from `mwm` via HP VUE. As such, if you don't want to create dozens of new icons for all the stuff in your root menu, you can still use most of your `.mwmrc` file with a few minor changes. Right now I have CDE running, but I also have all the menu-based capability that I've built up over the years of using SunView and X11. Once again, CDE gives you the best of both worlds.

So, this snapshot works, and most of it works well enough for daily use. By the time of the next snapshot (which I should get around the time you get to read this issue), all the tools should be working. By the time you get your hands on CDE from one of the vendors, it should be a working, finished product.

So When Can I Get It?

Each participating company is free to set its own schedule, though the founding five have committed to ship-

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ping this year. The schedule for Solaris 2 seems to favor June at the earliest. Still smarting from customer reaction to the Solaris 2.X conversion, SunSoft is likely to make the 2.4 Solaris (June) release include an unbundled CD-ROM of CDE, and even the 2.5 Solaris release (October/November) is likely to include CDE, only as "bundled but optional" software. Sun definitely wants users to convert when they feel ready, not when SunSoft forces the issue. This means you'll be able to get non-CDE versions of the OpenWindows/Solaris environment for at least a year after this article appears in print.

A senior SCO official intimated that SCO would be at least as cautious, and I'd expect HP, IBM and the rest to follow suit. So look for shipments to begin around this year's middle or third quarter.

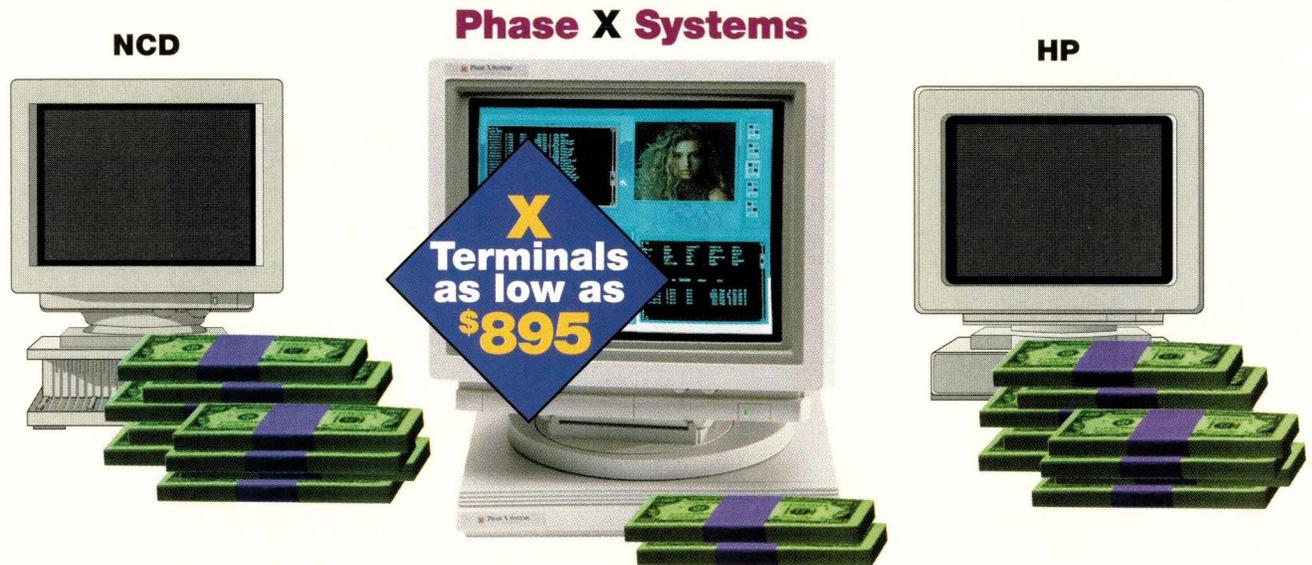
But what about developers that want to get on-stream sooner? "Be there, or be square." But what if you missed the CDE conference? There doesn't seem to be any formal method for getting early access to the technology, but I imagine that each vendor is free to provide this through its own developer-relations channels. Meanwhile, you can order the *CDE Conference Proceedings*, October 26-28, 1993, ISBN 0-13-301474-6 (order number 30147-3), from:

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Ian Darwin has been using SunOS since about 1985, and has used lots of other UNIX versions before and since. He would like to write his own operating system but is much too busy using existing ones in order to pay the bills. You can sometimes reach him via email at ian@sq.com.

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Virtuoso, Olympus and SPARCclassic X

This month, we present reviews of a sophisticated yet easy-to-use design package, the latest in printer technology and Sun's X terminal.

Virtuoso

by LIAM QUIN

When you think of UNIX applications, graphic design, artistry or drawing might not be the first things that come to mind. But a recent release from Altsys Corp. could change all that. Altsys' Virtuoso is a sophisticated, professional-quality drawing package that balances a wide range of features with an almost disconcerting ease of use. I don't think I've enjoyed using anything on UNIX this much since I first met the UNIX typesetting software more than a decade ago!

Installation was a snap. I put the CD-ROM into the drive, double-clicked on the icon, and up popped a little window with check boxes for several parts of the package, together with the size of each part, and a running

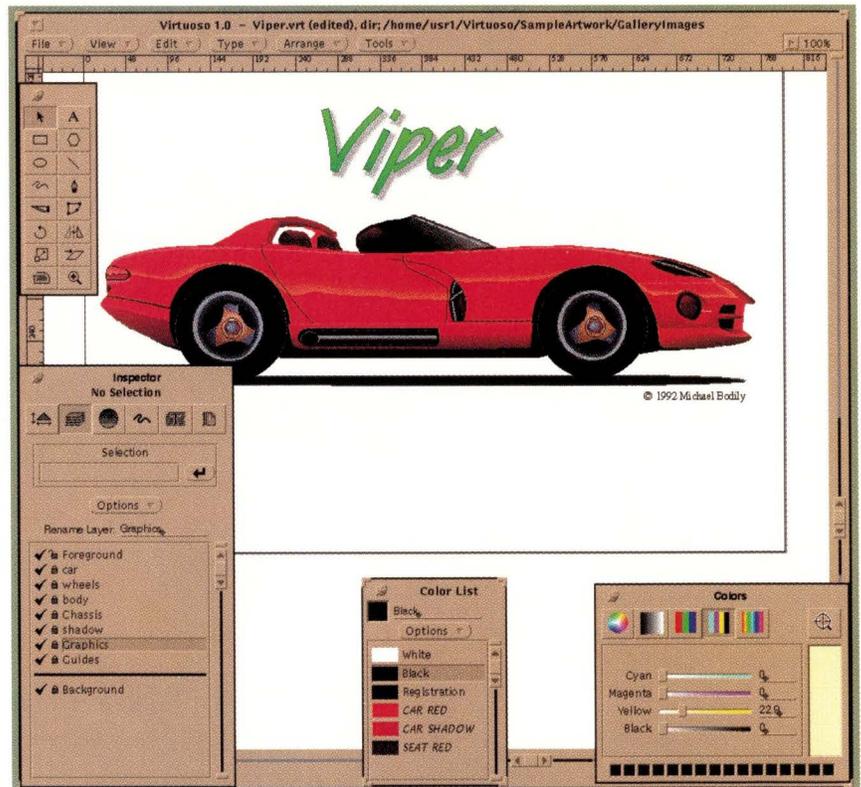
The creators of Virtuoso took great pains to integrate the product with the Sun environment.

total that changed as I selected what I wanted to install. There are about half a dozen things: a tutorial, the sample artwork, the extra Type 1 fonts and

the program itself (separately for Solaris 1.X and 2.X).

Once I'd chosen what I wanted (everything, of course!) and set aside some 30 MB of storage, I entered a directory name and away it went, showing an Open Look UI gauge to mark progress.

There's an icon to double-click on



(you do use File Manager, don't you?) to set up File Manager icons; I ran this without a problem, but a colleague found there were permissions problems. When I called Altsys about this, I received a patch within a day or two and everything was fine.

If installation was easy, running Virtuoso was even easier. Just double-click on a Virtuoso file—for example, one of the clip art files.

After a moment, the Virtuoso logo appears in an annoying little window of its own that stays on top of all the other windows. On my Sun 4/110 at home, it takes maybe a minute or two to load, but on the SPARCclassics and the SPARCstation 10 in the office the logo goes away in a matter of seconds. It's replaced by a small base frame with the logo in it and some menu buttons. This floating menu bar lets you get at global properties, open files, quit and see the by-now-essential animated "About..." box.

A few seconds later, the document appears in a window of its own. Anyone who has used another drawing package won't be surprised when a floating tool palette also appears.

All the standard features are there, such as rectangles with optional rounded corners, a polygon tool, splines and lines, rotators and scalers, an autotracer, and of course powerful text facilities.

The tools are powerful, and you can combine them in interesting ways.

Since space is short, and you're probably already anxious to stop reading this review and start using Virtuoso, I'm going to describe only a few of the things that make the package special, and skip right over the standard Adobe Illustrator-style features we all know are there.

The Sun Environment

Altsys has obviously read the Open Look UI specification fairly carefully. The designers have taken the idea of properties and produced an Inspector dialog box. You can look at and change the properties of anything with this, even multiple objects—if the selections are of different types, the inapplicable controls are grayed out, just as you'd expect. This mechanism works

elsewhere too, including in the Type panel, by the way.

The Inspector is divided by a group of clear icons into categories, including one for setting or changing the exact position and dimensions of any object; you can even change the type of a curve from tangent to corner to curve. You can change the units of measurement at any time, too, and watch all the numbers get converted in the twinkling of an eye. The Inspector lets you get at one of the most powerful features of Virtuoso, the Layer panel. You can define any number of layers in your drawing, simply by clicking on New (minor nit—why is there no default item in the layer menu?). You can move objects from one layer to another, hide or lock a whole layer by clicking on its checkmark or padlock icon, move a layer up and down by dragging it through the scrolling list to where you

Virtuoso

Company

Altsys Corp.
269 W. Renner Pkwy.
Richardson, TX 75080

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(214) 680-2060, ext. 294

Fax

(214) 680-0537

Email

virtuoso_info@altsys.com

Best Feature

Ease of use: The consistent and clear way the features integrate with each other, with the OpenWindows desktop, and with the Open Look GUI make this product fabulous to use.

Worst Feature

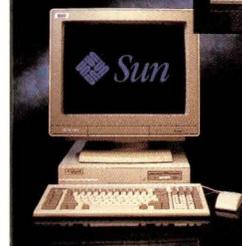
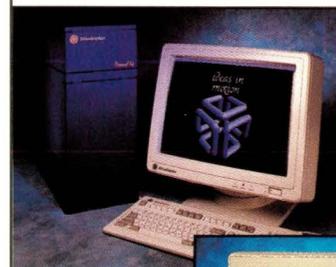
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want it, and even delete a whole layer. This is layer management as it ought to be. Layers beneath the thick horizontal bar are "background," and don't print. By default. As you can probably see by now, you can configure Virtuoso to your heart's content. Thankfully, you can use straightforward, well-designed dialog boxes to do it, too.

It's interesting that Virtuoso's text handling is pretty smooth, with hung punctuation, semi-justification (technically, "Cogent left"), automatic copyfitting and zillions of other little features all packed into a few neat panels in the Inspector.

If you start playing with the color panel, you're in for a surprise. I don't remember seeing anything so easy. Simply *drag* the color you want onto the object, and drop it there to set the color. And you can click on a little magnifying-glass to copy a color from anywhere on the whole screen into the color panel.

This use of drag and drop is ubiquitous in Virtuoso, including importing text and graphics from the File Manager, setting the color of objects, moving objects around, moving tab stops on the text ruler, dragging blue guidelines from the page rulers. (You can even see the text as you drag it, not simply an inconvenient bounding box. And yes, you can turn that off, too.) If you've used OpenWindows for a while, you won't be surprised by any of this.

Documentation and Performance

The manual, including the color separation guide, is a model of clarity and simplicity. I've not had to use it often, but when I have, it has always been helpful. Sometimes I could wish for a few more technical details, but then, I write programs too.

Oh, and Virtuoso supports ToolTalk, so double-clicking on a Virtuoso file in File Manager doesn't start a redundant copy of the application if there's already one running. Believe me, you wouldn't want it to.

Which leads me to the downside. Virtuoso uses The NeWS Toolkit. On my 4/110, it's barely usable. I use it because it's so much more productive than the other tools I have that I don't

mind waiting. On the SPARCclassic, it's more than acceptable, although I did notice a slight improvement when I went from 16 to 24 MB of memory. On the SPARCstation 10, there's no problem at all, of course. I've had a few crashes, but mostly on my 4/110, because of PostScript time-outs. On the more modern machines it's fine, and if I lose time it's usually because I spend so long deciding between choices of effects, or switching between different or slightly modified fonts.

Virtuoso is enough to make me want a SPARCstation 10 all to myself anyway.

Text handling is better in Solaris 2, because you can convert text to paths, but watch out. Virtuoso won't run under OpenWindows 3.3 (part of Solaris 2.3), because Sun dropped support for NeWS, opting instead for Adobe Systems Inc.'s X-based Display PostScript, which is more widely used although less interesting technically. Sun is also moving from Open Look to Motif; it will take Altsys some time to convert, but we predict they'll do it despite being upset with Sun, if only because they can then support the IBM RISC System/6000 and other workstations that support Motif and Display PostScript (see "Birth of a Desktop," in the Features section).

I wish I could go into more detail about the features, but there are so many it'd take half the issue. Frankly, I don't understand why anyone using Sun workstations and having even the slightest need for drawing tools or the mildest hint of creativity hasn't already bought Virtuoso. I'm waiting for the Sun version of Fontographer...maybe after the COSE/CDE Virtuoso. Please?

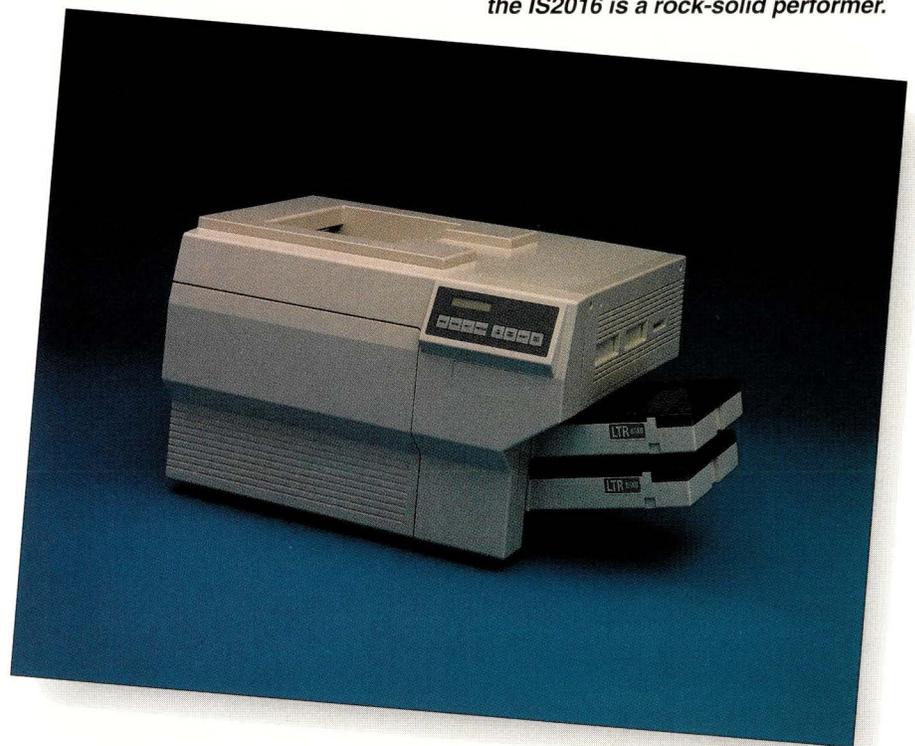
Liam Quin has a degree in computer science from the University of Warwick, in England, and says his main interests are digital typography and information retrieval. He currently works as contract development manager for SoftQuad Inc., the industry-leading SGML vendor in Toronto.

The Olympus Image Systems Series 2000 IS2016 Electron Image Printer

by BARRY SHEIN, Technical Editor

One comment on the perpetually just-around-the-corner paperless office: The paperless office has about as much chance as the paperless bath-

Whether printing simplex or duplex, the IS2016 is a rock-solid performer.



room. That said, we continue to review the ever-improving printer technology that comes to our attention. This month we take a look at the Olympus Image Systems Inc.'s Series 2000 IS2016 electron image printer.

The 2016 is a NeWSprint device that uses a high-speed video interface supplied on an Olympus SBus card. Device drivers and printer handling software arrive on a 3½-inch floppy. By the way, the SBus card includes a Centronics parallel port (they also throw in a Centronics cable) for whatever you like, perhaps your old printer.

Installation was easy. The steps in the ring-bound documentation were clear and easy to follow. The docs for the printer installation assume that you have NeWSprint 2.0 or later already installed either locally or in an NFS-mountable file system. If that is the case, you simply pull the drivers off the disk with `extract_unbundled` and follow the script. The disk drive must be local. Also, if your NeWSprint server is NFS-mounted, you have to make a local copy of the driver if you want it loaded at boot time. One caveat worth noting if you plan to use a SPARCstation 1: You must have boot PROM Version 1.3 or higher.

There was nothing memorable to say about the software installation (which is good news).

This printer has one very salient feature: It can print duplex (on both sides), as well as simplex (one side). This is very handy and economical for many common applications because it lets you use half the paper. It also lets you print documents in what looks like a more final or professional form, since most print media is printed on both sides. One-sided printing says "computer printout" all over it. Perhaps the only downside of double-sided printing is losing the ability to make a quick printout for a meeting, staple it together, and then use the blank side to take notes (I often do this). I suppose duplex printing is not very useful for overhead foils either. Well, you can still print simplex if you like, so this new printer simply increases your options. Use your common sense out there.

The device is a little larger than a typical laser printer, but it's certainly table-top in size, not huge. The extra size seems to be adequately explained by its duplex printing capability. Duplex printing is accomplished via paper path rather than dual print mechanisms. You can see this when it is printing; the paper comes about half-way out and then is sucked back in to do the other side. Once printed, the paper itself drops into a depression in the top of the printer (rather than a tray of some sort). This is OK for a small group but holds out little promise for sites that need to collate jobs automatically (the optional 10-bin sorter/mail box would solve this problem). It can hold 500 sheets of output, so don't confuse that with a light-use feature. Olympus claims a monthly duty cycle of 100,000 pages.

Other options available for the IS2016 include additional paper cassettes (legal, 7¼ by 10½ inches, A4), a base cabinet stand with storage below the printer for supplies and a large capacity (1,000 sheets) feeder—that's more than an hour of full-bore printing.

Series 2000 IS2016 Electron Imaging Printer

Company

Olympus Image Systems Inc.
15271 Barranca Pkwy.
Irvine, CA 92718-2201

Phone

(714) 752-5935

Best Feature

Ease of use and maintenance.

Worst Feature

The lack of a manual feed.

Price

\$5,295 includes SBus card, interface cable, RTU for NeWSprint, NeWSprint handler software and two-year on-site warranty.

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1-800-443-6699

Carrying the Load

We have done a fair amount of printing on this printer (jobs as large as 2,000 sheets) in a number of configurations over several months and thus far have never seen a paper jam, which is worth noting considering that the duplex mechanism is inevitably more complicated than a simplex mechanism. This performance is better than the reliability ratings claimed by Olympus. It says the jam rate is one in 5,000 simplex and one in 2,500 duplex. Also, the printer seems fast (it is rated by the manufacturer as 20 pages per minute simplex and 12 ppm duplex), although as documents become graphically more complicated, any bottleneck seems to be in the NeWSprint software rather than the printer. Plain text pages just flow out of the printer, while a PostScript file stops every two sheets (four sides) for a moment (using a SPARCstation 2). And the two standard paper trays—each 250 sheets—keep the printer well fed. Unfortunately, there is no capability to feed sheets manually, which might be a drawback for some. The printer has a 53db noise rating and is quiet enough to use in your office.

The electron printing engine's 300-dpi print quality was very good, as good as any 300-dpi laser printer we have used. Yet it is not a laser printer. The IS2016 uses a technology Olympus calls electron imaging. It's a five-step process that requires fewer components than laser printing. The printer has a print cartridge, a dielectric-coated print drum, a developing unit, a transfer corona and a cleaning unit. A controller rasterizes bits for the 2,456-electrode matrix in the print cartridge. These electrodes shoot electron streams at the print drum; the result is a latent image. This image on the drum is rolled by the developer, which picks up toner that is electrostatically transferred to the paper. Fuse it and voilà, a page.

Summary

Overall, the IS2016 is a rock-solid printer. The duplex print capability is a handy feature I'm sure some will cherish (save a tree!). The printer inte-

grates and works well with Sun's NeWSprint software and performed without a hitch.

SPARCclassic X Terminal

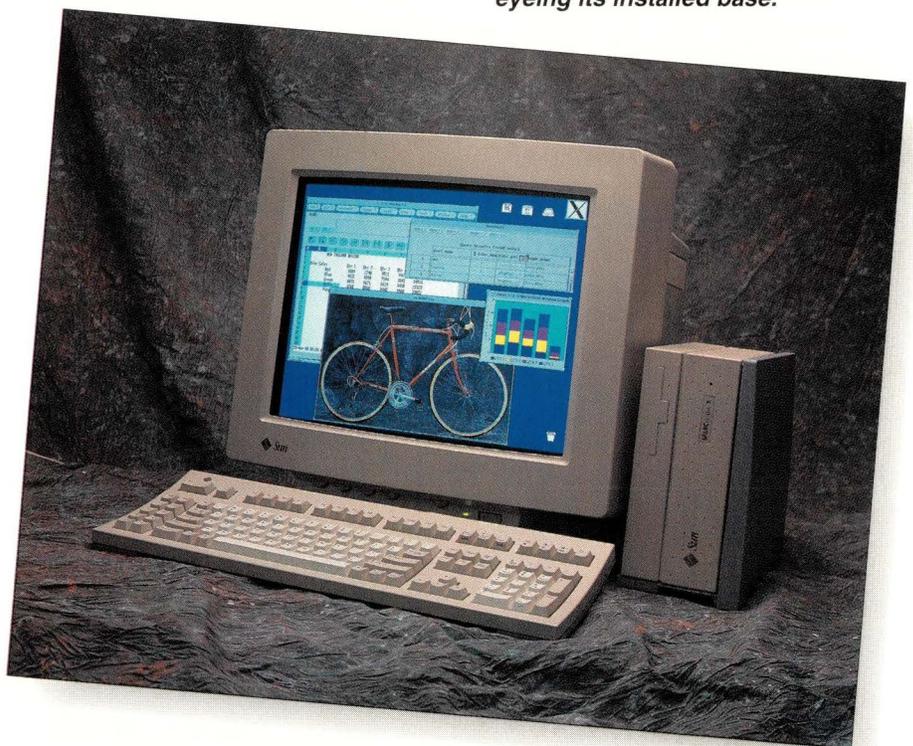
After years of preaching the evils of X terminals, Sun Microsystems Inc. has decided to build one. Sun's major complaint with X terminals was that people might feel X terminals are a good economic compromise between workstations and dumb terminals, but they'll realize soon afterwards they needed a full-blown workstation all along. To give Sun credit where due, this X terminal design addresses that issue squarely: It's upgradeable to a full-blown workstation with minimal effort. In fact, this Sun X terminal is a SPARCclassic workstation, just stripped down a bit and delivered with a specialized kernel whose only function is that of an X terminal.

The model we received for review had a 16-inch color monitor and 8-MB memory and is otherwise a diskless SPARCclassic workstation. The various plugs (SCSI, serial, etc.) in the back are all intact and covered over with easily removeable soft rubber jackets. The processing unit is designed to sit on its side, upright,

next to the monitor, which has its own stand. The keyboard is Sun's newer Type 5, whose layout is reasonably pleasing to me. I disliked some of the earlier SPARCsystem keyboards.

Installation of the software was straightforward. The software distribution comes on a CD-ROM. There is more than one distribution on the disk: Solaris 2.X (which we don't use here) and Solaris 1.1 (better known as SunOS 4.1.3). Although the main path in the instructions is for Solaris 2.X, we got it all up and running under Solaris 1.1 without undue problems. The software installs itself, by default, under the directory `/usr/SUNWXT`. A kernel and configuration file also needs to be put under `/tftpboot` for booting. This is all sensible to me. It's basically a diskless workstation with a specialized kernel and follows the pattern we've seen previously with Sun diskless workstations. The configuration file is an ASCII text file, which can be modified with any editor, although Sun encourages you to modify it with the set-up menus instead. This configuration file holds various information,

The SPARCclassic X is Sun's answer to any X terminal vendor eyeing its installed base.



like whether or not you will use XDM, network configuration details (subnet mask and so forth), paths for the terminal to find applications in and hardware details.

Overall, the terminal works fine. Performance feels good. I decided not to report benchmarks on this product since it doesn't really seem interesting; it's a fast SPARC processor and a reasonable, standard, Sun graphics implementation. There's little new or interesting here with regard to performance issues.

Now for the gripes! My biggest gripe with this product is that if you don't run NIS or NIS+ you don't get any sort of host name service. That's right, you will have to enter IP addresses in dotted numeric format, so get out the Post-It and start scribbling! Since almost all X terminal manufacturers provide at least IEN116, if not full-blown DNS (more common), name server client access, this seems like a rather large oversight. There are sites out here that have good reason not to run NIS in its various forms (a lack of faith in its security is one reason; we're a big, public Internet site and would rather not be used for target practice). Even being able to hard-code the hosts you access into the config files by hand would be better than this!

My next gripe is much smaller but seems fair game to mention: There's no access to the audio features of the workstation, even though they supply a microphone—at least I couldn't find any. And there is a notice to this effect in the manual for the system. That's a little disappointing since sound has become part of what makes you a member of a Sun workstation environment these days.

It would seem to me that either of these gripes could be easily fixed in a future release of software, though I don't know if Sun has any plans to do this. The audio might require a modified audio tool also unless they are very clever, since the root of the problem is that there's no device directory on an X terminal, hence no `/dev/audio` file. But I'm sure some simple scheme could be devised. Other X terminal manufacturers have

SPARCclassic X Terminal

Company
Sun Microsystems Inc.
2550 Garcia Ave.
Mountain View, CA 94043-1100

Phone
(415) 960-1300 or your local Sun sales office.

Best Feature
An X terminal upgradeable to a standard SPARC workstation later.

Worst Feature
If you don't run NIS or NIS+, you'll be typing in numeric IP addresses.

Price
\$4,445

Circle 143

supplied audio features. There must be something resembling a de facto software standard out there that could be employed, such as an X11 extension or similar.

The good news is that you can upgrade this system to a full-blown workstation by the addition of a disk (I suppose you could run it diskless. Do people still do that?) and a Sun operating system software license, and software if you don't have it. This would also add back those missing features, although it does usurp the original purpose of buying an X terminal.

Overall I think this is a good, solid product that a lot of people will buy. The main attraction, beyond being a competent X terminal implementation (other than that name server problem), is the ability to upgrade it to a full-blown workstation later. This means that sites can purchase modern software access in steps and adjust as needs dictate. That's a reasonable plan, and this is the only product I know of designed to fit that plan. →



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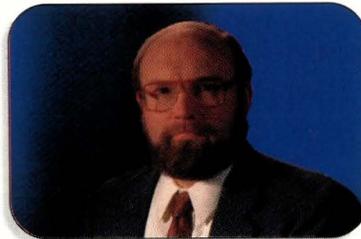
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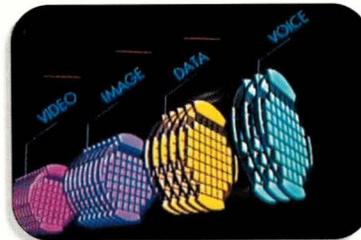
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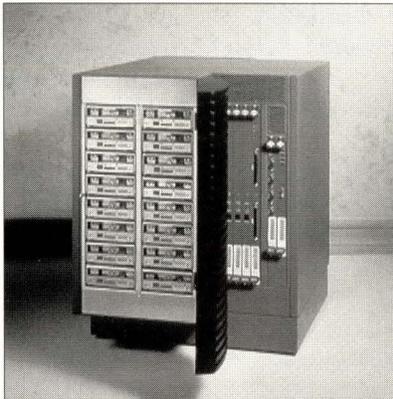
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NEW PRODUCTS

The product descriptions are compiled from data supplied by the vendors. To contact them for more detailed information, circle the appropriate reader service number on the card located elsewhere in the magazine.

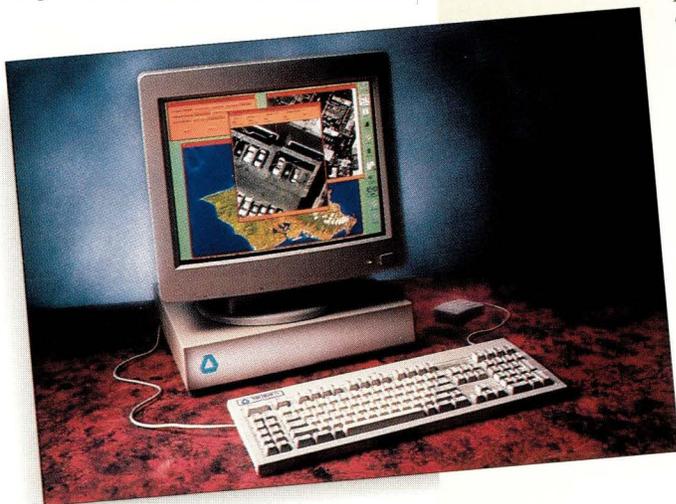
HiPPI Storage Server

A mass-storage RAID system that attaches to a workstation via the HiPPI interface has been announced by



Maximum Strategy. Called the Gen 4L, the product contains up to 16 3½-inch IPI disks for a total of 59 GB. In addition, the product comes with a high-performance parallel interface (HiPPI) that gives the Gen 4L a sustained data transfer rate of up to 55 MB/s.

HiPPI is a high-performance interface originally developed for supercomputers. It is, however, becom-



ing increasingly common in the high-performance workstation and server market. The Gen 4L can connect either directly to a host, or to a HiPPI switch that can then be attached to a number of client systems and peripherals. Pricing begins at \$98,000.

Maximum Strategy Inc.
801 Buckeye Court
Milpitas, CA 95035-7408
Circle 101

SunSoft Book on MP

A new book, *Multiprocessor System Architectures*, by Ben Catanzaro, has been published by SunSoft Press. Described as a technical survey of multiprocessor and multithreaded systems using SPARC and Solaris, the book provides an in-depth study of the technical and design considerations associated with multiprocessor systems. In particular, the book introduces the reader to the technology of packet-switched buses and multithreaded applications environments.

Catanzaro is a SunSoft employee known for his work in processor architectures at both Sun and Intel Corp. His book, which has the ISBN number 013-089137-1, is 550 pages long.

Mobius SPARCalikes

Three new SuperSPARC-based Sun-compatible systems have been introduced by Mobius. The three SPARCalikes are the IPS/10 Models 51, 52 and 54. All three use the 50-MHz SuperSPARC processor, have 1 MB of cache per processor, 32 MB of memory and four SBus expansion slots. The Model 51 is a uniprocessor version. It uses the Sun GX graphics technology and offers 136 MIPS. The 51's price begins at \$11,995.

The 52, meanwhile, has two 50-MHz SuperSPARCs and uses the Sun TurboGX+ graphics technology. It offers 272 MIPS at a price of \$19,995. The Model 54, finally, is a four-processor device offering 540 MIPS. It is priced at \$26,995.

Mobius Computer Corp.
5627 Stoneridge Drive, Bldg. 312
Pleasanton, CA 94588-8503
Circle 100

It is available at technical bookstores, or through SunExpress at (800) USE-SUNX, or from Prentice Hall, at a price of \$42.

PTR Prentice Hall
113 Sylvan Ave., Rte 9W
Englewood Cliffs, NJ 07632
Circle 102

Artecon Launches Lynx

A family of 3½-inch disk and tape subsystems has been introduced by Artecon. Called Lynx, the products are



“stackable” enclosure modules. The modules can contain disk or tape systems and then be stacked “Lego-style,”

the company says. They then connect to one another via SCSI and power connectors in their tops or bottoms, as the case may be. The company says that this configuration eliminates much of the clutter and complexity of more traditional means of system expansion.

Each module has its own 40-watt power supply (20 watts for tape devices), a cooling fan and a filter. And each has a front-panel LCD and keypad for the display and setting of various subsystem parameters. A typical Lynx module would be 2½ by 6¼ by 10½ inches and weigh between five and six pounds.

Up to seven units can be stacked vertically or horizontally. Pricing depends on precisely what a Lynx contains—tape, disk drive, etc.—and ranges from \$395 for an empty Lynx enclosure to \$4,995 for a 2-GB removable subsystem.

Artecon

P.O. Box 9000, Dept. 5500
Carlsbad, CA 92009-9000
Circle 103

Wyse Shows Family of X Terminals

Leading character terminal vendor Wyse Technology has introduced a new line of X terminals. The WX series of machines are based on the MIPS R3000 and achieve up to 100,000 X stones. They feature a 1,280-by-1,024 resolution and come with 64 MB of display memory. Moreover, the terminals come with a PCMCIA port for additional memory devices.

There are five models in the series. Three of these are color terminals, with 15-, 17- and 19-inch screens. Two, meanwhile, are monochromatic at 17 and 19 inches. All five offer NFS font support. Pricing ranges from \$3,995 for a 19-color system, to \$2,095 for a 17-inch monochrome.

Wyse Technology Inc.

3471 N. First St.
San Jose, CA 95134
Circle 104

SCSI Switch from Applied

A product that allows both local and remote switching of SCSI computers and peripherals has been announced

by Applied Concepts. The SCSI Switch ACI-2012 attaches to a workstation or server via the system's own SCSI port and then provides access to up to 14 SCSI devices. The user can switch between those 14 devices from a front panel on the device, or remotely, via a network connection. Users can



be on the local system, or they can be elsewhere on the network.

The product supports Fast SCSI (i.e., 10-MB/s) computers and peripherals in asynchronous and synchronous mode. There are several models at different price/performance points. The Model ACI-2012A comes with 50-pin Centronics connectors at a cost of \$1,375. The Model ACI-2012B, meanwhile, has 50-pin flat ribbon connectors and lists for \$1,325. And, finally, the Model ACI-2012C comes with 50-pin high-density connectors at a price of \$1,425.

Applied Concepts Inc.

9130 SW Pioneer Court
Wilsonville, OR 97070
Circle 105

PowerPC Tools on Sun

For ISVs and others who want to use Sun workstations and compatibles to produce software for PowerPC chips, Motorola has ported PowerPC software tools to the Sun platform. In particular, Motorola has announced the availability of the PowerPC 601 and 602 cross-development packages for Sun. The packages contain highly optimizing C and FORTRAN compilers, simulators and a source-level debugger.

The complete package, including the C and FORTRAN compilers, costs \$5,000. The C and FORTRAN compilers by themselves are \$1,500 each. The complete tool kit also includes an

Architectural Simulator, which allows developers to work with a virtual PowerPC environment prior to the availability of silicon. The Simulator can also be purchased separately for \$3,500.

Motorola Inc.

Microprocessor and Memory
Technologies Group
6501 William Cannon Drive West
Austin, TX 78735-8598
Circle 106

Pocket Power Protector

A power protector for notebook and laptop computers has been announced by Electronic Specialists. The Note Book Pocket Protector is said to be designed to provide interference filter and spike/surge protection for very small systems. It will fit into a pocket, purse or briefcase for travel.

The product comes with a dual-mode RFI interference filter coupled with 58,500 surge amp suppression. It comes with a standard AC plug and socket and is available for standard U.S. 125-volt or dual 125/250-volt foreign power. The U.S. 125-volt version is \$64.95, while the dual voltage model is \$79.95.

Electronic Specialists Inc.

171 S. Main St.
Natick, MA 01760
Circle 107

Program Visualization

Software that makes it easier for developers to envision C programs in 2D or 3D has been released by Cadre Technologies. Called Ensemble Viewer, the product allows a programmer to browse through a piece of software while looking at such things as program flow, data structure and physical file structure. It can display a program's procedural, data and file elements.

Moreover, Ensemble Viewer allows the resulting diagram of a program to be viewed from different angles, exactly as a CAD/CAM module might be, so that users can see details of its behavior that might otherwise remain invisible. The product also uses color extensively for the same reasons.

The product is currently available on the Sun SPARCstation. Other UNIX

workstations are planned for early this year. Pricing starts at \$2,395.

Cadre Technologies Inc.
222 Richmond St.
Providence, RI 02903
Circle 108

Solbourne Announces Boards

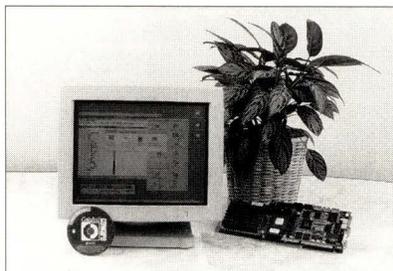
Server builder Solbourne has announced a set of new board-level products for its enclosures. Solbourne—which early on adopted the strategy (developed first in places like the VME community) of selling a basic, empty enclosure and then devoting R&D efforts to the boards to fill it—now offers its customers the Series 6 (50-MHz) line of products. These boards provide multiple SuperSPARC CPUs that can be incorporated into new Solbourne machines, or added to older ones as upgrades.

In terms of performance, a Solbourne 900 server with an 8-CPU Series 6 (50-MHz) board yielded a SPECrate_int92 of 11,211 and a SPEC_ratefp92 of 15,050. Pricing on the boards begins at \$24,900. As an upgrade from the company's existing 33-MHz products, however, the cost is much lower, at \$8,990.

Solbourne Computer Inc.
1900 Pike Road
Longmont, CO 80501
Circle 109

Opus Goes Incognito

Opus Systems has introduced Incognito, a SPARC-based ISA board and associated software that give PCs



access to Sun applications. The company calls the product a UNIX Application Engine, saying that it is for the PC user who normally does not want or need the full functionality of a workstation but must have access to one or

more applications only available in the Sun environment.

Opus has sold 32-bit accelerator boards for PCs for many years, and one such board, the InBoardEngine/MS1, is the hardware component of the product. This is a MicroSPARC-based device that offers 59.1 MIPS and comes with standard UNIX inter-

faces, such as Ethernet and SCSI.

However, it is the software that is the real meat and potatoes of the product. Incognito comes with Incognito/Share, which allows PC users to access both PC and UNIX applications through their PC's monitor and keyboard. There is also Incognito/FS, which allows UNIX and PC operating

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Rave Computer Association, Inc.

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(313) 939-8230
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systems to share files; Incognito/Launch, a MS-Windows utility that lets Windows and OS/2 users access UNIX applications by clicking on an icon; and Incognito/QuickStart, an installation program for the Solaris operating system.

While Opus wouldn't turn away end users, the company says it will be selling chiefly to OEMs. OEM pricing begins at \$995.

Opus Systems
300 Coronado Drive
Santa Clara, CA 95054
Circle 110

Digital Image Recorder

Datacube released its MD1/8GB digital image recorder as a high-performance system for the recording, storage and playback of digitized



imagery. It provides 8 GB of image storage in a nine-disk RAID format. Burst data rate is 40 MB/s for recording or playback with a sustained 12-MB/s bandwidth.

The MD1/8GB will store variable image sizes at variable bit precisions (4- to 16-bit). This unit is a three-part system comprising a channel controller, storage chassis with RAID disk array and ImageFlow Constrained-Latency, High Bandwidth (CL/HB) software that manages the integral 16-MB image silo. The MD1/8GB is priced at \$65,000.

Datacube Inc.
300 Rosewood Drive
Danvers, MA 01923-4505
Circle 111

Expert System from Cincom

An expert system generator that can assist programmers and other professionals has been released by Cincom. The product, XpertRule Version 2.1,

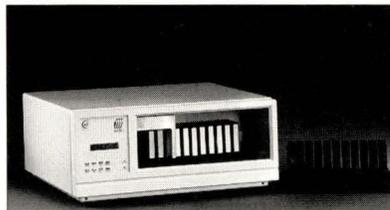
is described as a knowledge specification and application generation system that allows users to quickly develop, prototype and refine applications requiring complex decision processes. With it, developers can capture the expertise of specially skilled individuals. The program can then represent this information graphically as pattern rules, decision and exception trees and truth tables.

Expert systems, and expert system generators, largely fell from favor along with the rest of artificial intelligence during the 1980s. However, Cincom says that XpertRule is different. The company says that the product is easy to use and efficient, something that many of the '80s-era "knowledge engines" were not. In addition, the product is not expected to stand by itself. It produces C code that can then be incorporated in other "smart" applications that will run on Sun workstations. XpertRule runs on a PC but generates code for workstations. Pricing begins at \$990.

Cincom Systems Inc.
2300 Montana Ave.
Cincinnati, OH 45211
Circle 112

Dual-Drive 8mm Autoloader

A dual-drive, 8mm autoloading tape library has been introduced by Advanced Digital Information. The VLS-8, which is based on Exabyte's



half-height EXB-8505 8mm tape drive, has up to two drives and an 11-cartridge magazine. With data compression, the product offers unattended capacity of 100 GB. It supports data transfer of up to 2 MB/s.

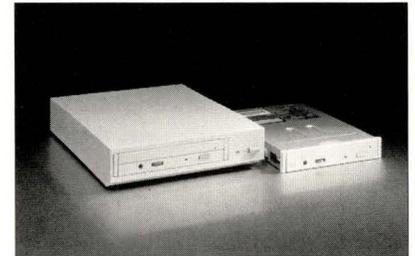
The company says that the VLS-8 comes with a number of library control and diagnostic functions that are accessible from a front control panel. Pricing begins at \$14,500 for a single-

drive model, and \$20,900 for a dual-drive model.

Advanced Digital Information Corp.
14737 NE 87 St., P.O. Box 2996
Redmond, WA 98073-2996
Circle 113

Double-Speed CD-ROM

Toshiba America Information Systems has expanded its CD-ROM offering with a double-speed CD-ROM drive. The XM-4101 Series comes in two models that feature 320-msec average access and a 300-KB/s



data transfer rate. They offer features critical to multimedia applications. They are MPC-2-compliant and support Kodak multisession Photo CD. Fully integrated audio and a 64-KB buffer are standard. MTBF is rated at 45,000 hours.

Two models are available. The XM-4101B internal drive lists at \$320, and the TXM-4101L external lists at \$410.

Toshiba America Information Systems Inc.
9740 Irvine Blvd.
Irvine, CA 92718
Circle 114

New Classes from Bell

For those in search of training for their staff, Bell Atlantic has added five new Sun-oriented courses to its curriculum. Bell Atlantic, best known as a communications vendor, also offers a series of courses and classes through its Business Systems Services and Computer Technology Services groups. The classes include System Administration Essentials, SunOS 4.X to Solaris System Administration, Solaris System Administration I, Solaris System Administration II and SPARC Uniprocessor Desk/Datacenter Systems Maintenance.

Most of these classes last for five days. Prices range from \$1,375 to \$1,875 per student. Bell Atlantic has training centers in Minneapolis, Milwaukee and Philadelphia.

Bell Atlantic CTS

Hi-Tech Training Center
W143 N9350 Henry Stark Drive
Menomonee Falls, WI 53051
Circle 115

UNIX-to-NetWare Printing

Meridian Technology introduced TCP HostPrint, a NetWare Loadable Module for bidirectional printing. TCP HostPrint allows users to print from NetWare to UNIX and UNIX to NetWare. Output of text files sent to PostScript, HP PCL and DEC LNO3 are also handled. It uses existing NetWare print queues so utilities won't change for NetWare-to-UNIX users. Likewise, UNIX-to-NetWare users can work with their familiar UNIX commands.

One copy is priced at \$595 and gives NetWare and UNIX users access to available printers on both NetWare and TCP/IP networks. Documenta-

tion, on-line help and 90-day free support are included.

Meridian Technology Corp.

11 McBride Corporate Center Drive
Suite 250
Chesterfield, MO 63005-1406
Circle 116

Total Tec's Total RAID

A new RAID system, compatible with a variety of host platforms and applications, has been introduced by Total Tec Systems. The RAID system is host/operating system-independent and requires no software drivers for operation. It integrates with standard SCSI peripherals and can be configured for use on any system including Digital Equipment Corp. (including DEC's Alpha AXP), Sun, IBM Corp. RISC System/6000, Novell Inc., Hewlett-Packard Co., Silicon Graphics Inc. and PCs.

The system supports RAID levels 0, 3 and 5, allowing users to customize RAID to meet their specific application needs. An expandable architecture allows up to seven parallel SCSI disk channels per rank and up to four ranks

for SCSI disk drives, totaling 28 SCSI disks per RAID controller. Three host systems are supported by offering three SCSI host channel cards.

Enhanced features include 32 MB of on-board cache and hot-swap capability. Total Tec offers the system in a variety of configurations. A typical 8-GB solution including 3½-inch drives is priced at \$27,995.

Total Tec Systems Inc.

2 Gourmet Lane
Edison, NJ 08837-2910
Circle 117

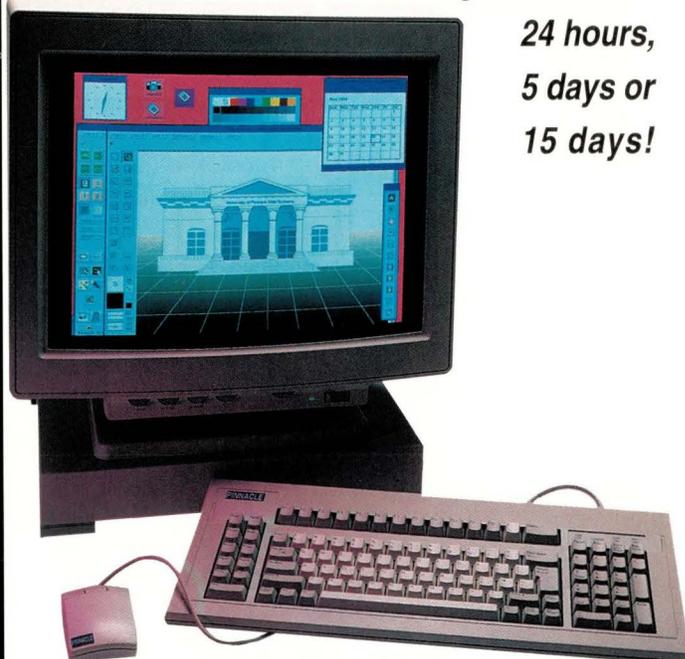
Simplified Router Configuration

Cisco Configuration Builder from Cisco Systems is a software application that creates synchronized router configurations and simplifies initial configurations. Configuration Builder includes tools for viewing, checking and changing interrelated configuration parameters. Simultaneous, multiple router configurations can be executed from the same screen when commands must be synchronized with other routers. Other features include unique address

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Pinnacle Data Systems, Inc.



verification and a help index.

Later this year, Configuration Builder functionality will be added to the CiscoWork series of router management applications running on SunNet Manager, HP OpenView and NetView 6000. Configuration Builder is priced at \$495.

Cisco Systems Inc.
P.O. Box 3075
1525 O'Brien Drive
Menlo Park, CA 94026
Circle 118

Document Scanners

Two new scanners have been added to Pentax Technologies' product list. The DS6 is a sheet-fed scanner that provides a 7-ppm throughput speed. It provides 300-dpi quality and 256 levels of gray-scale scanning. The DS10 is a flatbed scanner that provides 11-ppm throughput. It provides 300 dpi and

256 levels of gray scale but can be upgraded to provide 16.7 million-color capability. The DS6 will retail at \$789, and the DS10 will sell for \$2,195.

Pentax Technologies Corp.
100 Technology Drive
Broomfield, CO 80021
Circle 119

Fujitsu 36-Track Tape Alternative to IBM

Formerly an offering available only from IBM, 36-track tape drives are now sold by Fujitsu Computer Products. The Diana 2 is being targeted at minicomputer, network and standalone desktop systems. A seven-cartridge autoloader and a 10-cartridge autoloader are the two configurations available. Doubling the number of tracks from 18 to 36 doubled storage space available. The Diana 2 quadruples the storage capacity of IBM-com-

patible 3480/3490 drives from 600 MB to 2.4 GB per cartridge. The 10-cartridge model allows up to 24 GB of data storage.

Pricing ranges from \$20,000 to \$25,000, depending on options.

Fujitsu Computer Products of America Inc.
2904 Orchard Pkwy.
San Jose, CA 95134
Circle 120

Three-Minute Break

The Wall, a multimedia action puzzle game for workstation users, is now available through Qualix Group. The mission is to break out of jail within three minutes by clicking on, thus destroying, horizontally or vertically adjacent blocks of the same color. Zoo Corp., based in Japan, developed the game in an effort to expand the limited supply of entertainment software

Upgrades, Enhancements, Additions...

- A new release of XoftWare/32 for MS-Windows and OS/2 has been announced by AGE Logic. Version 3.0 of the product comes in two flavors. XoftWare/32 for Windows allows users to concurrently access and display MS-Windows, DOS and network-based UNIX applications on the same PC. XoftWare/32 for OS/2 allows users to access and display network-based UNIX applications along with OS/2, Windows and DOS applications. **AGE Logic Inc.**, 9985 Pacific Heights Blvd., San Diego, CA 92121. **Circle 121**

- RAD Technologies has released Version 2.0 of ScreenPlay, its multimedia package for UNIX systems. The new version provides Timeline with tools for editing videos and audio. **RAD Technologies Inc.**, 2639 Terminal Blvd., Mountain View, CA 94043. **Circle 122**

- The Empress database, from Empress Software, is now available in Version 6.4. The new release features its own Dynamic SQL. **Empress Software Inc.**, 6401 Golden Triangle Drive, Greenbelt, MD 20770. **Circle 123**

- Structured Software Solutions has announced Version 3 of its FacetTerm software. FacetTerm is software that allows character terminals to support multiple windows. Version 3 of the product will include such things as a screen saver, a Window Watch (which detects and monitors off-screen events), and screen lock security feature. **Structured Software Solutions Inc.**, 4031 W. Plano Parkway, Suite 205, Plano, TX 75093. **Circle 124**

- TI has reduced prices on its microWriter and microMarc Printers. The microWriter Basic model is now

\$599, down from \$729. The microMarc is now \$339, down from \$369. **Texas Instruments Inc.**, P.O. Box 6102, MS 3242, Temple, TX 76503. **Circle 125**

- DataViews, the graphical development tool from V.I., is now available in Version 9.5. The product is now easier to use and features tools that allow DataViews applications to integrate with Motif. **V.I. Corp.**, 47 Pleasant St., Northampton, MA 01060. **Circle 126**

- Virtual Technologies has announced Version 2.0 of its Sentinel debugging environment. The new version will be integrated with Hewlett-Packard Co.'s SoftBench development environment. **Virtual Technologies Inc.**, 46020 Manekin Plaza, Suite 160, Dulles, VA 20166. **Circle 127**

- Legato Systems has upgraded its Networker backup product. Version 4.0 of the product will include data management capabilities, including support for such things as multiple jukeboxes and large file systems. **Legato Systems Inc.**, 260 Sheridan Ave., Palo Alto, CA 94306. **Circle 128**

- Version 3.0 of Woodside Technologies' Fortress software is now available. The new version of the UNIX security product includes several new security checks, RSA MD4 and MD5 file inoculation, and support for Motif and Open Look. **Woodside Technologies Inc.**, 474 Potrero Ave., Sunnyvale, CA 94086. **Circle 129**

- Run-time fees have never been popular with developers. Neuron Data, however, will be a little more popular with them soon. The company has announced that it has dropped all run-time fees for its entire product line, including its Nexpert Object and Elements product lines. **Neuron Data Inc.**, 156 University Ave., Palo Alto, CA 94301. **Circle 130**

packages for SPARC. The Wall is priced at \$39.95.

Qualix Group Inc.

1900 S. Norfolk St., Suite 224
San Mateo, CA 94403
Circle 131

Motif Migration

Integrated Computer Solutions has introduced a line of Open Look-to-Motif migration products, allowing Open Look DevGuide and XView developers to migrate their existing applications to a Motif API. GILconvert is the new tool that complements Builder Xcessory (BX) 3.0 and allows for Motif application integration. Developers can now take existing GIL files created by DevGuide and read them into BX. BX translates the GIL files into a Motif interface and allows the developer to modify the interface if required. BX then generates Motif API-compliant C, C++ or UIL code.

GILconvert for Solaris 1 and Solaris 2 will be included with the purchase of BX 3.0 as part of a 90-day introductory offer that started in the fourth

quarter of 1993. After the promotion, it will be sold as a standalone product for \$2,500 per developer license.

Integrated Computer Solutions Inc.

201 Broadway
Cambridge, MA 02139
Circle 132

Distributed Hierarchical Storage Management

Artecon's FileTrek is a client/server network-based distributed Hierarchical Storage Management (HSM) system for Sun SPARC and Hewlett-Packard Co. 9000 platforms.

FileTrek's HSM features include user-transparent file migration, automatic restoration, archiving and system backup.

FileTrek automatically and transparently moves targeted files to less-expensive storage, based on user-defined criteria. Administrators can restore migrated files from an optical jukebox or 8mm stacker without manually moving files from disk to backup media and back to disk when the files are needed.

Among the industry standards FileTrek supports are IEEE Mass Storage Reference Model and ISO 13346 NSR (nonsequential recording format).

FileTrek supports SPARC servers running Solaris 1.X and 2.2, HP 9000 Model 700 workstations and Model 800 servers running HP-UX 8.07 and 9.0X. FileTrek also supports Artecon's optical jukeboxes and 8mm stackers.

Pricing starts at \$7,100 and includes a server license for up to 16 cartridges, and client licenses for unlimited workstations (same platform) in the network.

Artecon

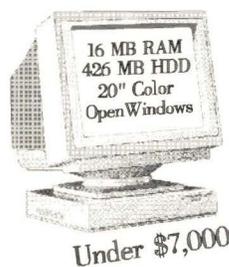
2460 Impala Drive
Carlsbad, CA 92008
Circle 133

Motorola Shows Rack-Mount Computers

A line of systems and servers has been introduced by the Motorola Computer Group. The Series 900 machines, which are based on the Motorola 88110 processor, are sold as

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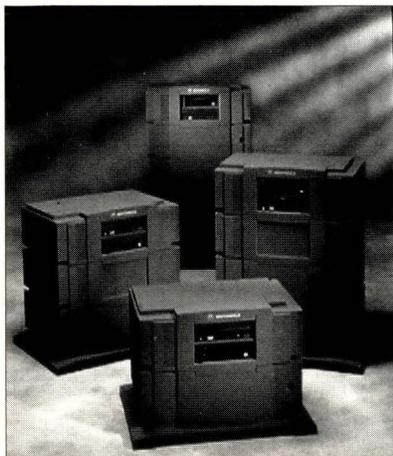
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modules that can be stacked and matched to achieve whatever configuration the user desires. The company says that a Series 900 might be configured for such diverse tasks as a multi-user computer or a server in a distributed environment.

The Series 900 includes three types of modules, each housed in its own enclosure and containing its own power and cooling systems. The first of the three is a CPU module, with one or two processors. The second is a VME expansion module that can support up to four 6U VME boards. The last is a SCSI device expansion module with four bays that each support a SCSI-2 device.

A base configuration would have a CPU module and a SCSI module. However, up to five modules can be stacked. Modules link via simple connectors on the tops and bottoms of the modules. Pricing on a CPU module ranges from \$4,200 to \$55,000, while the VME module is \$1,600, and a SCSI module is \$1,100.

Motorola Computer Group

Motorola Inc.
2900 S. Diablo Way
Tempe, AZ 85282
Circle 134

Multinetwork Print System

QMS has added another feature to its 1725 print system. The 1725 SLS (Software Loadable System) stores operating code on a standard internal hard disk rather than in firmware, making the printer easier to update and manage, since upgrades are made

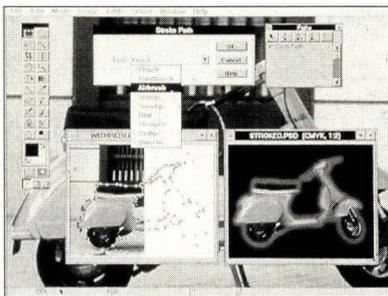
by downloading software from a floppy disk over the network rather than by changing ROMs.

The 1725 SLS, a 17-ppm, 600-by-600-dpi multinetwork laser printer, will sell for \$5,999.

QMS Inc.
P.O. Box 81250
Mobile, AL 36689-1250
Circle 135

Adobe for SGIs and Suns

Adobe PhotoShop 2.5, originally a Macintosh software package, has made its way onto faster Silicon Graphics Inc. and Sun workstation platforms.



PhotoShop is described as a package that performs color correction, painting, presentation preparation, professional prepress and darkroom tasks. The 2.5 version running on Sun and SGI workstations offers the same features as the Macintosh and Windows version, including creation of fully binary-compatible files that can be shared via floppy or network. Additionally, all versions share an architecture that accommodates third-party accelerator boards and plug-in modules for computation-intensive functions such as filters, paint and edit tools, color mode conversions and image-resizing rotation.

Photoshop can be used to manipulate scanned or computer-generated continuous tone, bit-map, gray-scale or color images. Users may edit and reposition an image or portion of an image, and import and export image files with other graphics programs. The program provides a variety of special effects filters and 16 million-color paint capability.

Photoshop on SGI workstations is targeted for the digital film, video, animation, industrial design and geo-

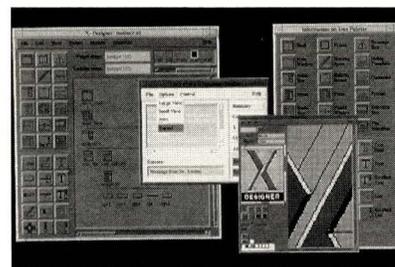
graphic information systems markets. Photoshop on Sun is geared toward the prepress and publishing markets.

PhotoShop 2.5 will be network licensed with a floating or right-to-use license scheme allowing anyone on a network to use the product. A single right-to-use license will sell for \$1,895.

Adobe Systems Inc.
P.O. Box 7900
Mountain View, CA 94039-7900
Circle 136

Open Look-to-Motif Conversion Choices

Imperial Software Technology has enhanced its X-Designer GUI builder to enable users to convert their Open Look interface design to Motif. This



Open Look converter is an add-on program that reads the .g files used by DevGuide as its savefile format and converts them to the equivalent .xd files used by X-Designer. Final adjustments can be made using X-Designer before generating the interface code in C, C++ or UIL.

The product is available to existing X-Designer users on Sun under their maintenance agreements and will ship to new X-Designer customers as part of the standard product. X-Designer is distributed in the United States by V.I. Corp.

V.I. Corp.
47 Pleasant St.
Northampton, MA 01060
Circle 137

Correction

The price for a TurboSPARC 1 upgrade ("Pinnacle Powers Up on Weitek," *SunExpert*, November 1993, Page 8) is \$3,195.

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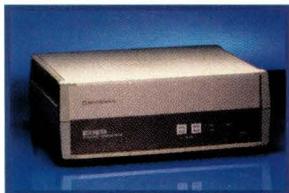
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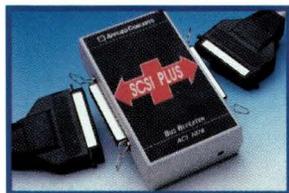
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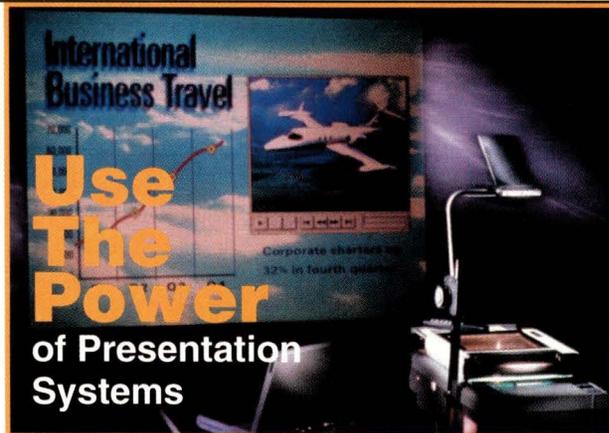
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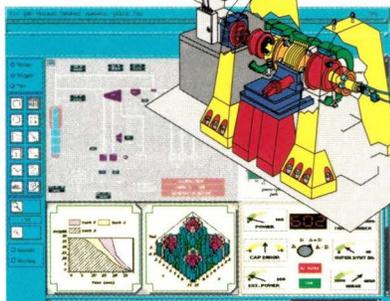


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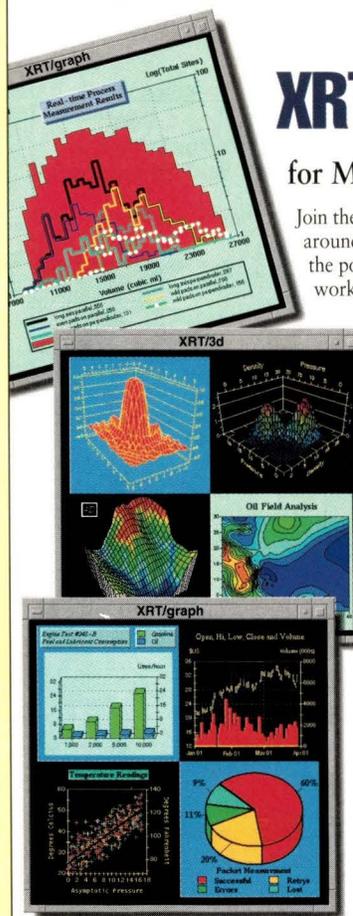
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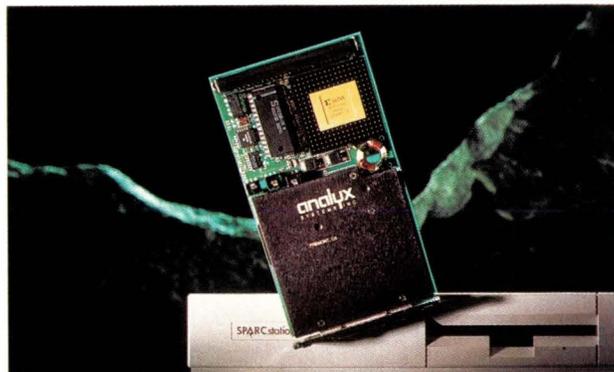


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- ✓ RESPONSE TIME DEPENDS ON NETWORK LOAD
- ✓ INCREASES NETWORK TRAFFIC
- ✓ REQUIRES EXTRA MEMORY FOR LOCAL CLIENTS
- ✓ UPGRADE PATH IS UNKNOWN



SPARCstations

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- ✓ RUNS ALL SUN APPLICATIONS
- ✓ HIGH PERFORMANCE
- ✓ LOCAL PROCESSING
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CONS

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- ✓ HIGH PERFORMANCE
- ✓ LOWER COST PER SEAT
- ✓ RESPONSE TIME INDEPENDENT OF NETWORK LOAD
- ✓ NO NETWORK TRAFFIC
- ✓ EASY SYSTEM ADMINISTRATION

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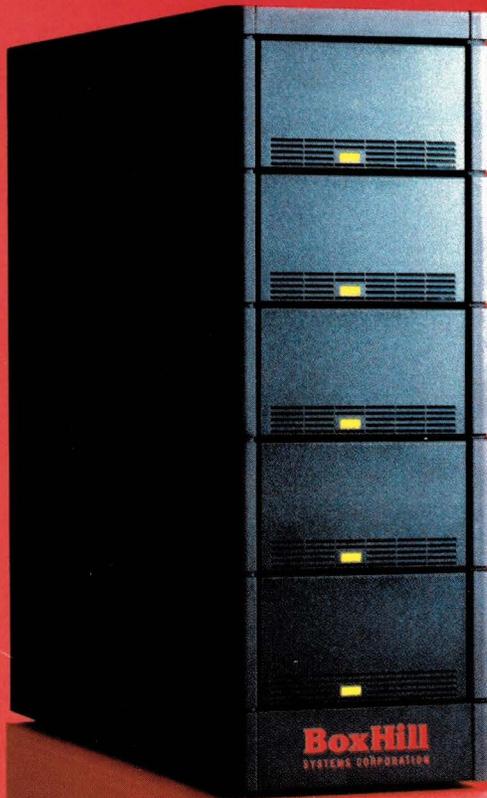
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