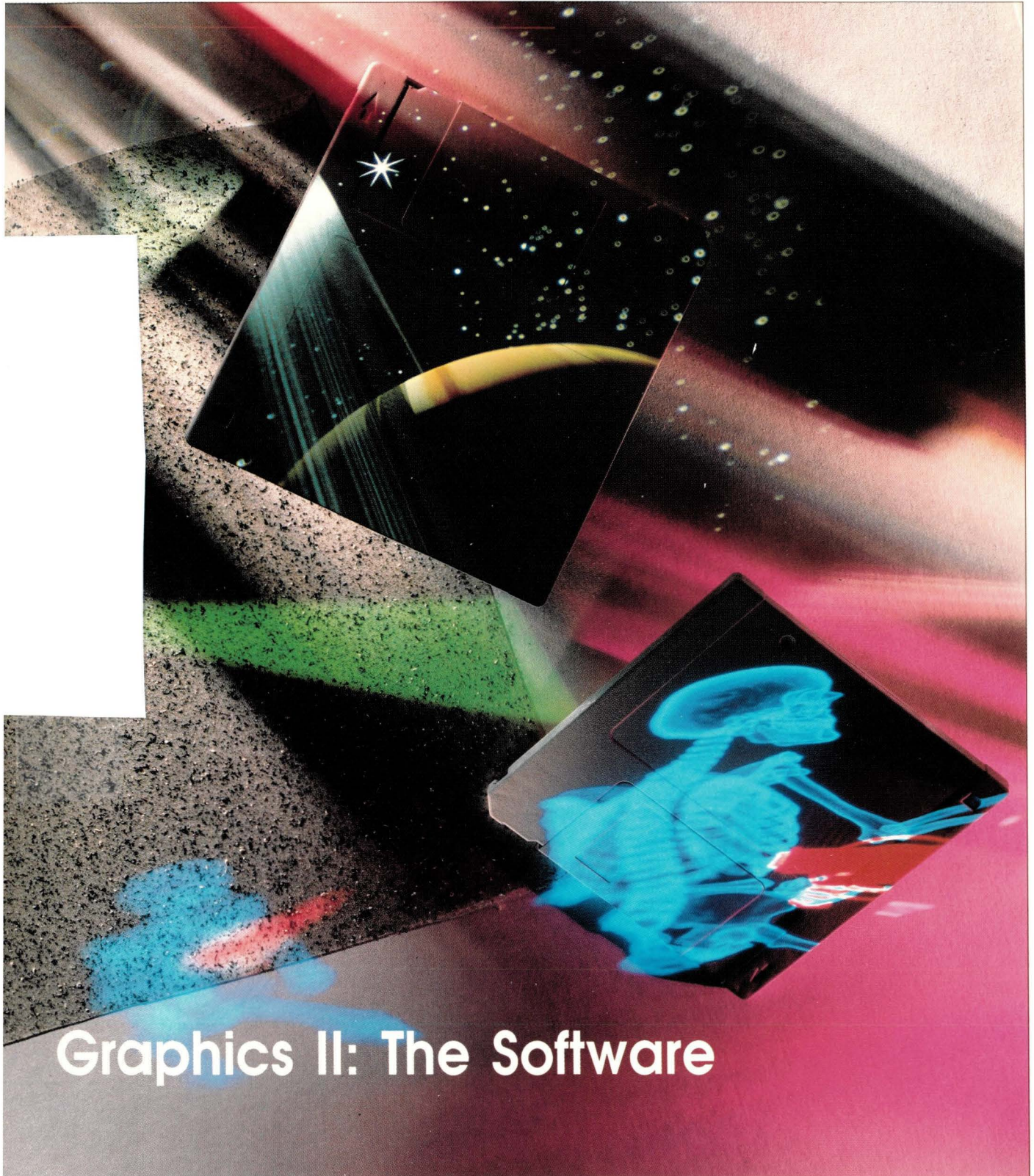


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News: Galaxy, Solaris

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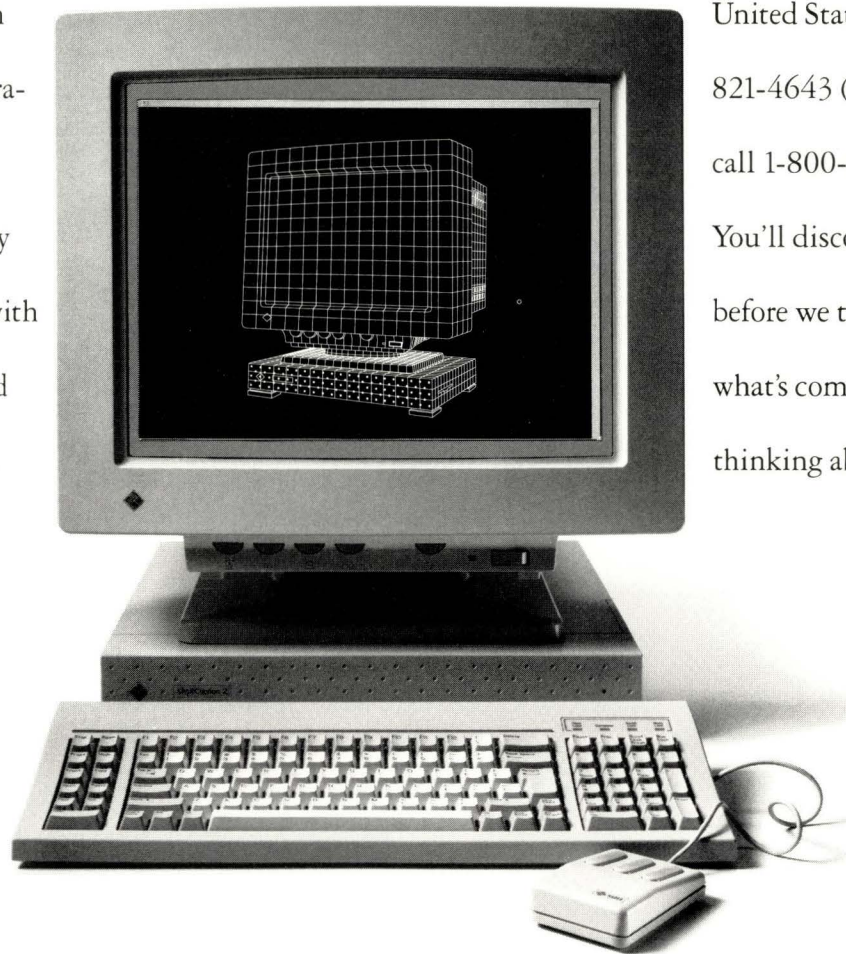
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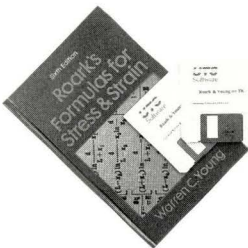
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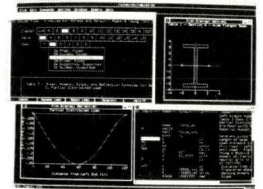
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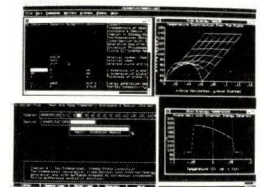
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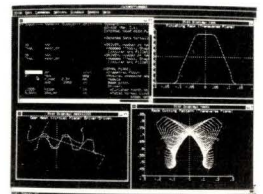
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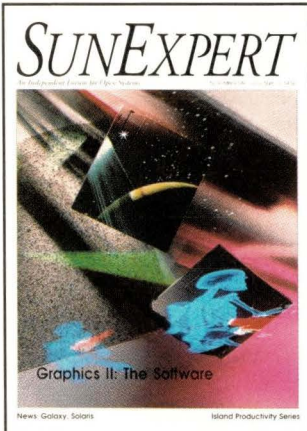
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Circle No. 34 on Inquiry Card

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Barry Shein



Cover Photograph
by Logan Seale

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Dinah McNutt

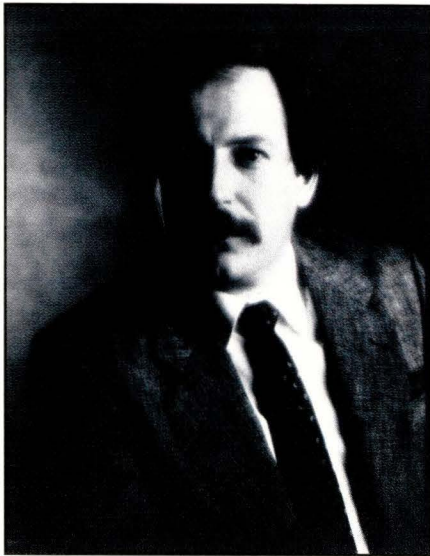
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SUNEXPERT

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

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Editorial

MIRVing the Arrowhead

Well, it seems the arrowhead is now a MIRV (McNealy's Intel Reclamation Vehicle). The mass-market Intel 80X86 family has joined SPARC, UNIX and Open Look on the arrowhead. How many standards can you fit on the head of an arrow? Or, better yet, how many companies can you name that were once Sun Microsystems Inc.? If you have any theories about how recent Sun flare ups and expansion might impact you, pass them along to me at dpryor@expert.com. Perhaps, we can come up with a unified theory that we can test at the Sun User Group Conference and Exhibition in San Jose, December 8 through 11. McNealy will be giving the Wednesday morning keynote address at the San Jose Convention Center. It's not too late to make plans to attend. Contact peter@sug.org.

Meanwhile, take a look at this month's "Features" section. We have put much of our effort behind one topic: graphics. Michael Jay Tucker's wide-ranging special report shows how Sun's emphasis on standards and competent performance has found a sympathetic audience even in application areas long thought to be bastions of specialized software and hardware.

Doug Pryor

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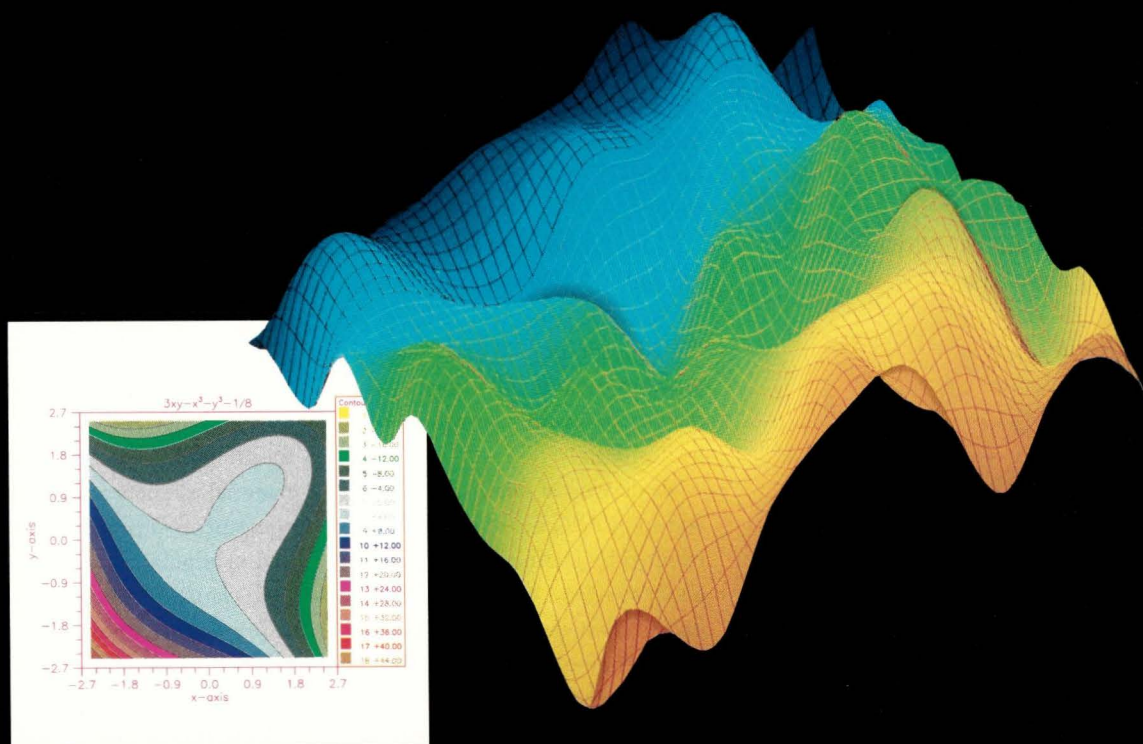
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Mike Kimble, system administrator,
Center for Electrochemical
Engineering

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Stefan Boeriu, user consultant,
Center for Computational Science
and Engineering

Just for the Fun of It

Dear Editor:

Just want you to know most of the hackers I know greatly enjoy Mr. Protocol. In fact, he is 90% of the reason I read *SunExpert*. The other stuff is enjoyable, but Mr. Protocol is fun.

Oh yeah, that Michael O'Brien guy is OK, too.

Kevin Layer
Franz Inc.
uunet!Franz.COM!layer

POSIX Position

Dear Editor:

Peter Salus' standards column "Real Time, At Last" (*SunExpert*, July, Page 50), may have inadvertently left the readers with the impression that our VxWorks real-time operating system lies beyond the reach of emerging POSIX real-time standards.

To set the record straight, we actively participate in POSIX committee work and will produce and sell POSIX-compliant versions of VxWorks when this standard is finalized by the IEEE. Furthermore, our company has recently become the first real-time software firm to join the x/Open ISV council with the express purpose of achieving international recognition and x/Open branding for real-time POSIX.

As pioneers in the area of UNIX-compatible real-time software, we welcome the emergence of POSIX standards and look forward to maintaining our lead in delivering the most advanced open systems, real-time solutions.

Mitch Bishop
Director of Marketing
Wind River Systems Inc.
Alameda, CA 94501

Hidden Meaning

Dear Editor:

I would like to correct the reference made to our company in the excellent article "Operating Systems: Where To From Here," by Mary Jo Foley (*SunExpert*, June, Page 50).

Hidden in the text was "KFW (a PC add-in board vendor)." In fact, KFW Corp. designs PC add-in SPARC, coprocessor and parallel processor boards. All of our designs are manufactured and sold by licensees.

We developed the first ever PC add-in SPARC board in 1989 (distributed by Definicon) and are about to release our latest SPARC product, which provides a RISC workstation on a single-slot PC add-in card.

The point is minor, but important to us.

L. G. Pane, President
KFW Corp.
Thousand Oaks, CA

Mirror Images

Dear Editor:

I wouldn't want the person who is drawing out network connections on the cover (or page 51) of the August issue of *SunExpert* to work on one of our networks.

Look carefully; he is writing backwards. Are his networks backwards as well? :-)

Michael L. Brown
uunet!cs.wisc.edu!ftms!
brown%astroatc.UUCP

You Could Look It Up

Dear Editor:

Entertainment is one thing; accuracy is another (*SunExpert*, July, Page 29). The Oxford English Dictionary was definitely not "done using troff." In fact it was not "done" on a UNIX system.

I would not like anyone to imagine we litter the texts of our dictionaries with typesetting codes. On the contrary, we litter our texts with generic tags that are somewhat less ugly and rather more meaningful. This means that our material is independent of the equipment/software used to store and manipulate it.

To clarify for Mr. Protocol: We have a big investment in Sun/UNIX and we do make extensive use of `ditroff` internally. We can achieve printed text of more than acceptable quality for the day-to-day needs of our lexicographers given the work done on front and back ends for `ditroff` and the creation of fonts, etc. The following changes are achieved programmatically: `text -> troff -> PostScript`. But that is in-house. We leave typesetting to experts.

The OED project was done at the University Press on an IBM 4341 donated by IBM United Kingdom Ltd. The book was typeset by Filmtyp Services Ltd., Scarborough, United Kingdom, and manufactured in the United States by Rand McNally & Co., Taunton, MA.

James Howes
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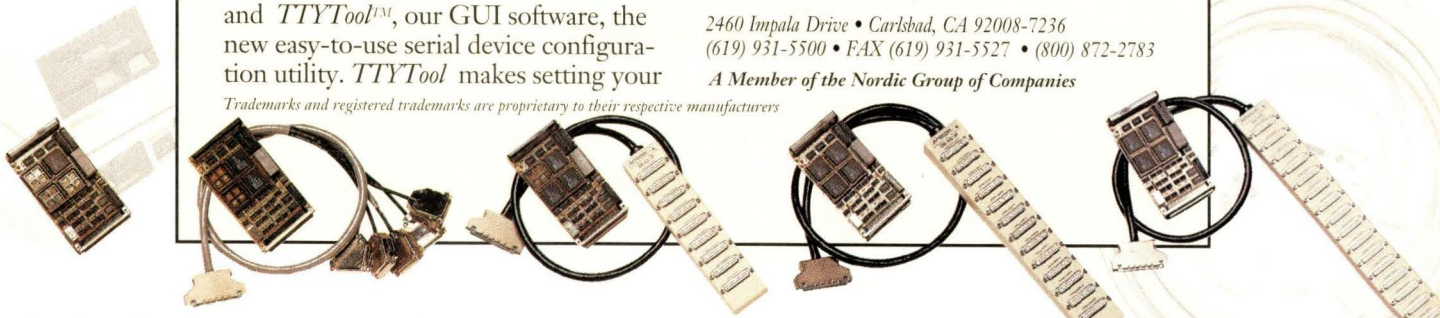
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Of Epoch's Proportions

Dear Editor:

I am writing in regard to the article "There's More Than One Way to Network a Sun," (*SunExpert*, August, Page 50). The article was very well written and discussed some important topics. As you know, the Epoch System was mentioned in the portion of the article that refers to LSI Logic.

Unfortunately, I believe the Epoch

System was unfairly represented, although much of what was written was technically accurate. I would like to clarify a couple of points.

The Epoch is not a jukebox. It uses optical-disk jukeboxes, magnetic disks, RAM and Exabyte tapes in conjunction with hierarchical migration, backup and archiving software. These pieces are integrated into a complete storage-management solution.

The Epoch does provide a complete

backup solution. The Epoch-1 is the only system that backs itself up. As a matter of fact, it is the only system available that can back up large-scale systems (up to a terabyte) overnight. It can back up to Exabyte tape, 12-inch optical media and 5 1/4-inch optical media. What the Epoch is not designed to do is to be backed up by another system, such as is the case with LSI's Delta System.

It is true that the low-end Epoch-1 can only load two platters at a time. However, since active data always resides on the Epoch's magnetic disks while inactive data is migrated to optical jukeboxes, the number of drives is rarely an issue.

Andy Hettinger, Marketing Manager
Epoch Systems Inc.
8 Technology Drive
Westboro, MA 01581

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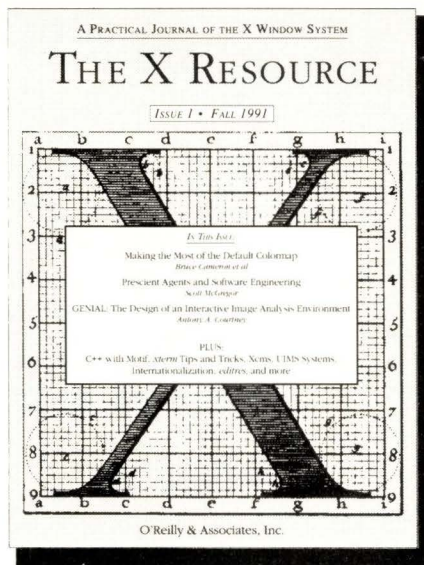
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Call or write for more information.



Object Lesson

Dear Richard Morin:

Thank you for an excellent introduction to object-oriented programming (*SunExpert*, August, Page 39). I'm new to the OO software world. Your article was a sight for sore eyes and a fogged mind! The list of resources was great!

I've just started here at Datacube as a technical writer with hardware and software tasks. Our software is definitely C, and object-oriented. We make pipe-line image processing products for OEMs. My new position requires a lot of background reading, usually done on my own time. Your article was, is, first rate!

Chuck Dasaro

uunet!datacube!charles

FYI

"Letters to the Editor" may be edited to conform to *SUNEXPERT* style-guide and space requirements. The views expressed are those of the author and not necessarily those of *SUNEXPERT*.

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NEWS

The New Universe, According to Sun



The 600MP Series represents Sun's long awaited foray into multiprocessing.

Galaxy Multiprocessors (Finally) Make Their Debut

Ending months of speculation and following several well-publicized delays, Sun Microsystems Computer Corp. has finally announced its long-awaited line of multiprocessor servers, plus associated system software. The new machines, collectively known as the SPARCserver 600MP series, are expected to sell into commercial MIS/DP computing settings as well as various electronics design applications—both markets where Sun has met significant competition from multiprocessor SPARC-system vendor Solbourne Computer Inc.

The specific 600MP models are the SPARCserver 630MP, 670MP and the 690MP. All the machines support a two-processor Mbus module and can be expanded up to four processors via a second module. The machines are shipping with 40-MHz Cypress Semiconductor Inc./Ross Technology SPARC modules, but will be able to be upgraded with plug-in 100-MHz SuperSPARC (Texas Instruments Inc.'s Viking) modules early next year. Their

operating system is SunOS 4.1.2, which is based on standard SunOS, recently re-christened as SunSoft's Solaris 1.0, but with multiprocessing extensions. Significantly, these multiprocessing extensions will not be made available to SPARClike vendors.

The most dramatic aspects of the 600MPs, however, may not be in their multiprocessing technology at all. Rather, it is in their network performance and their packaging. As network machines, the 600s are said to offer some 800 NFS I/O operations per second. This rivals specialized network accelerators.

In terms of packaging, the 600s are identical to older rack-mount Sun uniprocessors—specifically, the Sun 3/180, /280, /480 and 4/280. Owners of those machines can upgrade to a multiprocessor with a board swap. Not even the power supply needs to be upgraded.

Moreover, the MPs are VMEbus machines. In fact, they are essentially single-board VME systems that can plug in and out of the standard VME Sun chassis. However, they are also

SBus devices, having connectors that allow SBus cards to plug directly onto their surface. As a result, Sun server users can exploit the growing numbers of SBus cards.

In terms of specs, all three 600s offer 55 MIPS in dual-processor configuration, and 100 MIPS with four SPARCs. The 630MP has 64 to 128 MB of memory, 26 GB of SCSI disk, 5 VME slots and 4 SBus slots. The 670MP has 64 to 640 MB of memory, 26 GB of SCSI disk, 12 VME slots and 4 SBus slots. The 690MP has 64 to 640 MB of memory, 52 GB of IPI disk, 16 VMEbus slots and 4 SBus slots.

Pricing for the 600MPs depends on the number of processors. A dual-processor 630MP is \$45,000, or \$57,500 for four processors. The 670MP is \$60,000 as a dual processor, or \$27,500 in the four-processor model. The 690MP is \$92,000 or \$104,500.

Sun also is stressing the low cost of ownership with the MPs. Company officials say, for instance, that disk costs only \$4.08 per MB. Sun also says that the MP's CPU modules can be easily swapped for new ones, as more advanced SPARC processors become available.

In terms of market, meanwhile, Sun says that it hopes to sell MPs in competition with Solbourne boxes into the technical-design markets. The lack of a large, multiprocessor server has hurt Sun in places like aerospace and electronics, where designers need to drop simulations to centralized servers.

However, the target that Sun talks most about is commercial MIS and data processing. Sun stressed the fact that the machines offer between 120 to 150 transactions per second, which is important for OLTP applications.

Sun calls the box an "open departmental server," and says that it is meant to fit between desktop systems and corporate mainframes. In other

words, it is meant for precisely the same mission as the middle, minicomputer-based segment of the "three-tiered model of computing," which has been widely discussed within the MIS community over the last decade.

In a three-tiered model, mainframes provide a repository for corporate data and computer services, PCs and personal workstations provide desktop business tools and a middle class of servers acts to link the two and manage their relations.—*mjt*

Solaris Also Rises

Since it was unveiled at SunSoft's Catalyst Developers Conference, Solaris has won endorsements from hardware and software vendors alike. The biggest surprise about what SunSoft calls the "industry's first 'shrink-wrapped' distributed computing environment" is that it will be available on not only SPARC-, but also Intel Corp.-based platforms. The biggest yawn: End users won't have access to a UNIX-System-V.4-based operating environment until the middle of 1992. And application-accessible threads that enable the development of true synchronous multiprocessing applications will not be available until late 1992, with the Solaris 2.1 release.

Solaris 1.0, which is shipping now, consists of SunOS4.1.1, OpenWindows 2.0 and DeskSet 2.0. In shrink-wrapped form (a compact disk plus documentation), Solaris 1.0 retails for \$1,395 for full-fledged workstations and \$795 for "low-cost commercial systems, such as laptops," according to SunSoft.

Version 2.0 will incorporate SunOS 5.0 (based on SVR4 and including enhanced ONC), OpenWindows 3.0 and DeskSet 3.0. Developers also receive SunSoft's object-oriented environment, ToolTalk, with 2.0. Developer copies of 2.0 are available

now. End-user pricing for 2.0 will be announced next year.

Solaris' SunOS 5.0 will comply with major industry standards, including POSIX 1003.1, XPG3, ISO 9660, SVID 3 and SPARC International's SCD 2.0, says SunSoft. But as of press time, SunSoft had yet to announce its strategy to adhere to the Intel Binary Compatibility Standard (IBCS) 2.0, notes Scott McGregor, vice president and general manager for the distributed corporate computing business unit at the Santa Cruz Operation Inc.

With the announcement of Solaris, SunSoft has thrown down the gauntlet right in front of SCO with its Open Desktop environment. Open Desktop and Microsoft Corp.'s NT (New Technology) Windows are the operating systems that make up the Advanced Computing Environment (ACE) foundation.

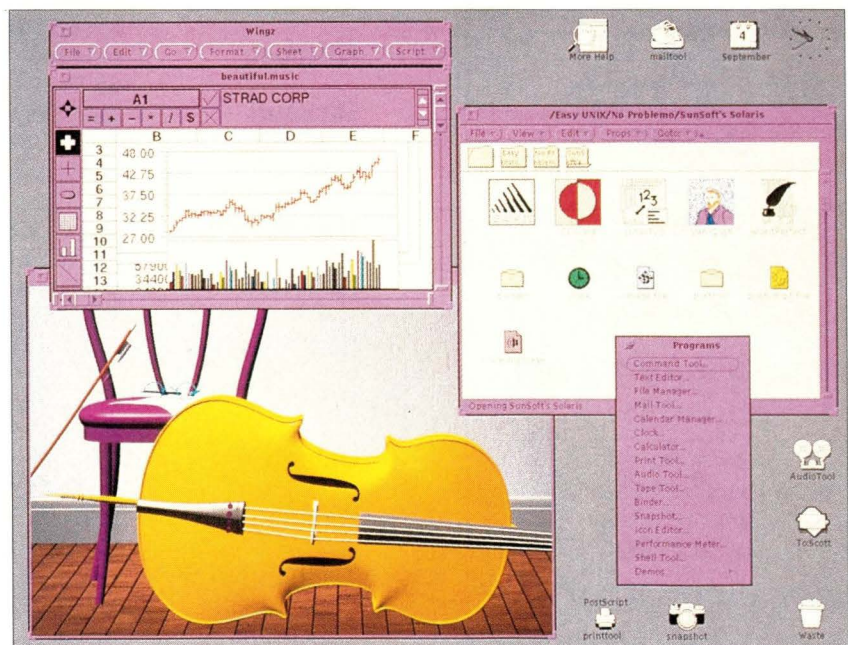
Like their ACE rivals have done before them, SunSoft and the Solaris endorsees must find a way around byte-order differences (big endian vs.

little endian) between SPARC and 80X86 applications, McGregor points out. Currently, there are no Sun-based application packages that have been written to take advantage of the multitasking, multithreading capabilities promised in Solaris, he adds.

Comparatively, there are more than 2,000 Open Desktop-compliant applications, McGregor says.

SunSoft isn't just kicking back and waiting for Solaris to magically catch on. Sun has acquired the Systems Products Division of Santa Monica, CA-based Interactive Systems Corp. from Eastman Kodak Co. This division developed PC/IX and AIX for PCs and is a principal publisher of SVR4 for Intel 386/i486s. It is the entity that is doing the port of Solaris 2.0 from SPARC to Intel. The Naperville, IL-based Services and Technologies Division of Interactive, meanwhile, will continue to operate independently and act as the primary SunOS supplier for the SPARC clone market.

SunSoft Inc.'s Solaris: True symmetric multiprocessing is still a year away.



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Already, numerous Catalyst vendors have committed to making their products Solaris-compliant. And manufacturers of SPARC and Intel platforms, including AST Research Inc., CompuAdd Corp., Dell Computer Corp., NetFRAME Systems Inc., Opus Systems, Star Technologies Inc., Tadpole Technology plc, Tatung Science & Technology Inc. and Toshiba Corp., have promised that they will make Solaris available on their systems.

ICL plc and Solbourne Computer Inc. also have come out in support of Solaris. Interestingly, neither of these vendors has yet committed to making Solaris available on its systems. Both already have their own symmetric multiprocessing operating

systems—ICL with its SVR4-based DRS/NX and Solbourne with its SunOS 4.1.1-based OS/MP. Rather, they are assuring users of future interoperability (and, in Solbourne's case, binary compatibility) between the systems.—mjf

X11R5 Hits the Servers

Release 5 of the X Window System, Version 11, is available worldwide. Users may ftp the code, or obtain 6250-bpi or QIC-24 tape directly from the Massachusetts Institute of Technology. Users need about 100 MB of disk space to hold all of the sources.

A partial list of North American ftp distribution sites is featured in the box below.

X11R5 Distribution Sites

Location	Address	Directory
California	gatekeeper.dec.com 16.1.0.2	pub/X11/R5
California	soda.berkeley.edu 128.32.131.179	pub/X11R5
Indiana	mordred.cs.purdue.edu 128.10.2.2	pub/X11/R5
Maryland	ftp.brl.mil 128.63.16.158 (good for MILNET sites)	pub/X11R5
Massachusetts	crl.dec.com 192.58.206.2	pub/X11/R5
Massachusetts	export.lcs.mit.edu 18.24.0.12 (crl.dec.com is better)	pub/R5
Michigan	merit.edu 35.1.1.42	pub/X11R5
Missouri	wuarchive.wustl.edu 128.252.135.4	packages/X11R5
Montana	ftp.cs.montana.edu 192.31.215.202	pub/X.V11R5
New Mexico	pprg.eece.unm.edu 129.24.24.10	pub/dist/X11R5
New York	azure.acsu.buffalo.edu 128.205.7.6	pub/X11R5
North Carolina	cs.duke.edu 128.109.140.1	dist/sources/X11R5
Ohio	ftp.cis.ohio-state.edu 128.146.8.52	pub/X.V11R5
Ontario	ftp.cs.utoronto.ca 128.100.1.105	pub/X11R5
Washington DC	x11r5-a.uu.net 192.48.96.12	X/R5
Washington DC	x11r5-b.uu.net 137.39.1.12	X/R5

Need Small Stuff Fast?

Just when you thought you had the Sun Microsystems Inc. empire down pat, Sun throws you a curve ball. But, in this case, users are unlikely to balk at Sun's delivery.

Now, in addition to SunSoft Inc., Sun Tech Enterprises Inc. and SunLabs, there are Sun Microsystems Computer Corp. (the hardware company) and SunExpress. Like the other aforementioned companies, SunExpress is a wholly owned subsidiary. Its mission is to improve Sun's infamously poor product-delivery times.

SunExpress comprises 60 telesales staff members, half of whom are located in the SunExpress headquarters in Methuen, MA, and the rest in California. (International expansion is planned for FY 1992.) The telesales force is instructed to take orders for more than 700 "low-ticket," non-system products. These include items such as SPARCprinters, disk and tape drives, memory-expansion boards, keyboards, cables, manuals, communications software and some software-development tools and utilities. Sun has acknowledged that products costing less than \$5,000 generated 66% of its fourth-quarter business during fiscal 1991.

To reach SunExpress, existing or new customers should dial (800) USA-4SUN. Currently, 91% of orders placed through the subsidiary are delivered within three days, according to SunExpress president Dorothy Terrell. All orders are guaranteed for delivery within five days, maximum. At press time, 90% of SunExpress' customers were resellers, OEMs and distributors, Terrell says.—mjf

GL To be Licensed

Silicon Graphics Inc. has announced that it will freely license its Iris Graphics Library to the computer industry. Among early licensees are Digital Equipment Corp., Compaq Computer Corp., Intel Corp. and Microsoft Corp.

Iris GL is a set of 440 software calls that reside between graphics applica-

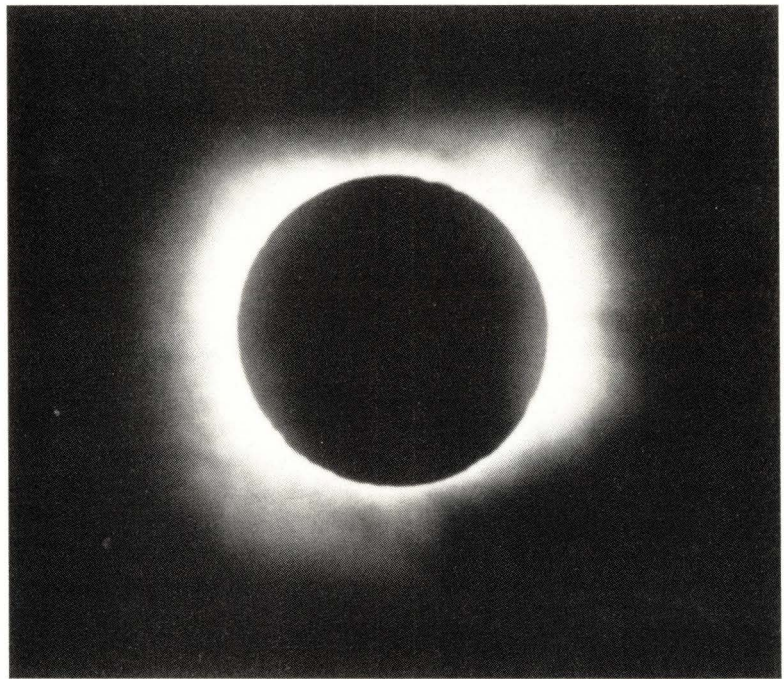
tions and graphics hardware. SGI says that more than 1,400 applications are currently based on it—including products from some of the biggest names in graphics, such as Alias Research Inc., Thomson Digital Inc. and SoftImage Inc. Those applications were restricted to SGI's own hardware until IBM bought the right to use Iris GL on its own RS/6000 machines. However, recent IBM announcements have not emphasized GL.

The new licensing agreements are

being described as generous. There will be multiple levels of GL licensees—ranging from the right to be GL-conformant, to the right to use source code. While pricing was not available at press time, SGI executives have talked about starting costs of \$5 for lower levels of participation. A vendors and users consortium will oversee licensing.

Compaq, which has already invested \$137 million in SGI, says it will endorse GL and has said that GL will

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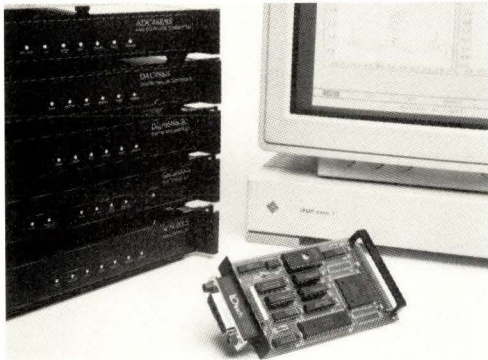


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NEWS

be the standard for 3D graphics programming for the Advanced Computer Environment (ACE) UNIX operating system. DEC says it will work with SGI in developing a GUI that will include IRIS GL, X, PEX (the PHIGS extension to X) and Display Postscript. Intel Corp. says it is interested in GL because of the i860 processor, which is being widely used as a graphics accelerator. Microsoft has "issued a statement" in support of GL, saying that it will facilitate developers working with NT Windows.

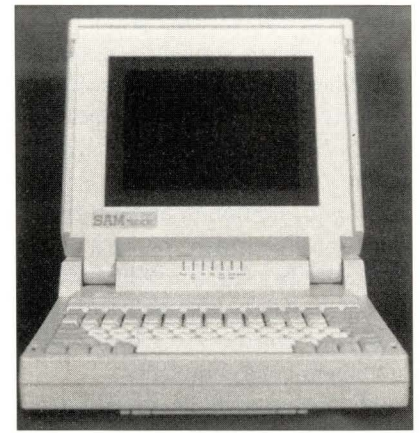
As of press time, Sun Microsystems Inc. had not voiced support or otherwise for GL. Sun has recently introduced XGL, which it says brings GL-like programming to Sun X-based displays.

Meanwhile, GL emulations exist, and the effect that GL's release will have on their vendors remains to be seen. Du Pont Pixel Systems, for example, has a GL-compatible environment for the i860. After the SGI announcement, Du Pont put out a release saying that it, too, supported GL as a standard and saw it as a means of extending its own GL-compatible business.—*mjt*

HiTech Laptop: Neither Fish Nor Fowl

It's not a repackaged RDI Inc. Britelite. Nor is it a clone of the TriGem Corp. SLT-100. It's the newest SPARC laptop and it's being manufactured by PC-cloner extraordinaire HiTech International.

The SAM3001 looks and acts an awful lot like the Britelite and TriGem boxes. The system, which weighs in at 13.5 pounds, is based on the LSI Logic Corp./Opus Systems 20-MHz SparKIT. Base configuration includes 8 MB of memory, 120 MB of hard disk, a 10-Mb/s Ethernet interface, a SCSI-2 interface, two serial ports and a 640-by-480-pixel backlit LCD screen. In fact, HiTech is buying a lot of its components from the same sources that TriGem uses in Korea. The company is doing its own final assembly in San Jose, CA. Neither Samsung Electronics Co. Ltd. nor Hitachi Ltd., HiTech's partners in the



HiTech International's SAM3001: It looks like the Britelite, but it's not. ...

PC arena, are working with it on its SPARC project, says company president Ken Kim.

The HiTech, which is scheduled to ship before the end of the year, also will be able to emulate the Apple Computer Inc. Macintosh and IBM Corp. PC, according to Kim. Kim says that HiTech is working directly with the creator of the Mac-emulation technology for SPARC, Xcelerated Systems Inc., as well as with Insignia Solutions Inc. and Borland International Inc.'s Ashton-Tate division, to provide software for the system. Kim says HiTech is looking at bundling dBASE with the SAM3001.

HiTech has priced the machine at \$8,995 (street price) and \$6,500 (reseller price). The company is seeking VARs and dealers that might be interested in carrying the product.—*mjf*

The X-Terminal Make-Over Contest

Models do it. Race cars do it. Even desktop devices do it. Sooner or later, they get a make-over.

But X-terminal manufacturers want to make later sooner. After all, there are 12 million aging ASCII/ANSI units out there, ripe for a relaunch into the brave new world of open computing. Furthermore, X-terminal makers believe they can go head-to-head against diskless workstations with faster speeds, video displays and the capability to run a mix of existing user programs at less cost.



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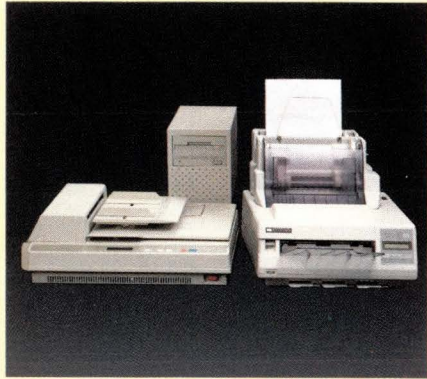


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Major vendors such as Digital Equipment Corp., Hewlett-Packard Co. and IBM Corp. are expected to offer X-terminals to their installed base as a matter of course. But Eileen O'Brien, a market analyst with International Data Corp., Framingham, MA, observes that while the Big Three may offer their users the advantage of "one-stop shopping," the X-terminals from IBM and DEC will be over-priced and under-featured.

Into this seemingly captive market, therefore, can step the likes of smaller, independent vendors such as Network Computing Devices Inc. and Tektronix Inc. to offer better and cheaper X-terminals. And they have committed sizeable budgets to marketing their advantages, she adds.

Leading the charge of "MIS here we come," the Network Displays Division of Tektronix, located in Wilsonville, OR, has become the latest manufacturer to unveil X-terminals aimed at commercial data-processing users. To date, the company has 7,000 color-monitor X-terminals installed in the technical community worldwide.

The four-member XP10 Series includes a 15-inch monochrome unit for \$1,695, a 15-inch grayscale at \$1,995, a 14-inch with 16 pixels at \$2,495 and a 14-inch with 256 pixels at \$2,895. As part of its marketing effort, Tektronix is also targeting networked installations and has established a Network Services program, offering consulting to help integrate X-terminals into a LAN environment.

By 1994, according to IDC's O'Brien, the combined forces of the Pacific Rim and RISC will bring the cost of X-terminals down to \$500. Stephen King, network displays division marketing director for Tektronix, estimates that in one to two years, the X-terminal "window" will become a "push market." With the prolonged recession, there could be an even more immediate price decrease in an attempt by vendors to shore up sagging revenues. —hcp.

Other Open Systems News

Digital Equipment Corp.

DEC unveiled its target dates for supporting the Open Software Foundation's Distributed Computing Environment (DCE). A starter kit for software developers will be available on OSF/1 in early 1992, DEC says. End users will be able to make use of "full" DCE capabilities on OSF/1 by mid-1992. Over the next 18 months, DEC will deliver DCE on its various Network Application Support (NAS) platforms, including VMS, PC and multivendor system platforms, according to the company. Customers currently implementing DEC's Enterprise Management Architecture (EMA) solutions, including DECmcc Director, will be able to add OSF's Distributed Management Environment (DME) capabilities as they become available, DEC adds.

DEC and Mountain View, CA-based Silicon Graphics Inc. announced a joint agreement to develop a common, integrated graphics environment. The environment will be based on SGI's IRIS GL programming libraries, as well as PHIGS/PEX, X and Display PostScript. DEC and SGI will jointly develop a reference implementation for a graphics server.

DEC has announced it will be offering a single-user license of Lotus Development Corp.'s 1-2-3 bundled with each DECsystem and DECstation platform sold through March 1992. The spreadsheet is called Lotus 1-2-3 for DEC's Ultrix for RISC Systems.

Hewlett-Packard Co.

You'll be able to buy your Series 700 workstations from various MicroAge Inc. and Intelligent Electronics Inc. franchisees beginning in January 1992, thanks to HP's new Certified Workstation Reseller (CWR) program. HP will be adding 100 dealers to its indirect-channel ranks. HP has been

selling its PCs, scanners and printers through the dealer channel for about 10 years. HP is talking about increasing its CWR pool to 300 (franchisees plus independents) by the mid-1990s.

HP announced Release 5.1 of RTAP/Plus, its industrial-automation enabler. RTAP/Plus 5.1 features HP-UX 8.0 compatibility; a Motif 1.1-based GUI; a display server that interconnects schematics, control panels and the RTAP database without programming; and HP Apollo 9000 Series 700 and HP 700/RX X station compatibility. In other real-time news, HP has selected Wind River Systems Inc., Alameda, CA, to provide real-time capabilities for its HP 700/RX X stations. VxWorks now runs on the station's Intel Corp. i960 processor.

HP has unveiled disaster-recovery services for its UNIX systems. HP has opened a disaster-recovery facility in Valley Forge, PA. Included in the offerings are risk analysis, training, rehearsals, temporary backup-computing facilities and restoration of computer operations.

IBM Corp.

IBM rolled out more than 100 new hardware and software products designed to "integrate the enterprise." The majority involved its S/390 and ES/9000 architecture. But a number of the announcements also revolve around IBM's client/server plans. IBM revealed database enhancements enabling OS/2, DOS and Windows users to better access mainframe data; new LAN products; distributed file-management and data distribution for NetWare servers from an MVS mainframe; and promises of future DCE compliance. In the network- and systems-management areas, IBM unveiled its Workstation Data Save Facility, which can back-up, restore, archive and retrieve workstation data (from Sun Microsystems Inc. and Apple Computer Inc. Macintosh platforms, among others) to a VM host.

The first packaged, disk-mirroring product for the RS/6000 family is available from Cambex Corp. The

Certainty 6200-MD Series is designed as a RAID Level 1 disk-mirroring subsystem. For \$7,950, users receive two 3 1/2-inch SCSI disk drives packaged in a single enclosure, along with a SCSI cable, Certi-STOR disk-mirroring software and an installation and operation manual. Cambex is based in Waltham, MA.

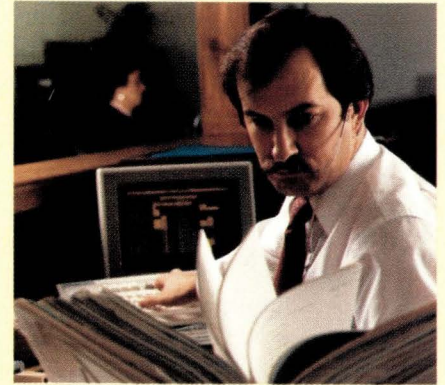
This Just In...

- **Saber Software Inc.**, Cambridge, MA, has, in one fell swoop, changed its name and enhanced its C++ product. Saber is now called CenterLine Software Inc. Its Saber-C product is known as CodeCenter. And its C++ product is called ObjectCenter. The newest release of ObjectCenter is 1.1. In 1.1, CenterLine has integrated pre-processor support for Versant Object Technology's OODB. ObjectCenter 1.1 also now supports Cfront 2.1, the standard version of C++ from USL. The product supports dynamic shared libraries in the Sun environment, too. The price remains \$395 for a single license.

- **SPARC International**, in conjunction with Carrollton, TX-based VMELaboratories, has announced it will begin offering testing and branding of SBus products. At present, the Menlo Park, CA, trade association is testing first-company-ship boards on 21 different SPARC systems that are SCD 1.0-compliant and six systems that are 2.0-compliant in order to determine if the products live up to their vendors' performance claims. Next, SPARC International plans to add a timing verifier to its peripheral test suite. Finally, along with VMELabs, SI will develop real hardware, device-driver and kernel-interface specs against which SBus boards will be tested and branded compliant. The cost of testing: \$1,500 per board, with \$995 for subsequent retestings.

- Beating Sun Microsystems Inc. to the punch, **Network Peripherals** has announced an FDDI SBus card. The FDDI adapter implements burst-mode DMA and comes with drivers for SunOS 4.1.1. The product provides a fully compliant Single Attach Station for use with FDDI hubs.

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• Going down memory lane: **Sun Microsystems Inc.** has unveiled its 4- to 16-MB memory upgrade path. Sun says that SPARCstation IPX customers now can replace one or more of their four 4-MB SIMM boards with 16-MB boards. Sun says that 16- and 4-MB SIMMS can be used together in combination, but only so long as it's all Sun memory. According to Sun, any combination of Sun and non-Sun 16- and 4-MB boards is likely to cause parity errors. One 16-MB SIMM upgrade lists for \$2,495.

• Other memory news: **Camintonn Corp.**, a memory provider in the Digital Equipment Corp. marketplace and **Parity Systems**, a Sun and Silicon Graphics Inc. memory vendor, have announced a strategic alliance. The agreement covers joint marketing, sales and engineering of minicomputer and workstation memory products. Camintonn is based in Irvine, CA; Parity is headquartered in Campbell, CA.

• As part of its show of force designed to counter the Open Software

Foundation DCE/DME announcement this fall, **UNIX International** has announced more of the technologies that have been selected to fill out its UI-Atlas framework. Predictably, **SunSoft Inc.** was a big winner. At the core of Atlas is ONC, SunSoft's Open Network Computing platform, comprised of enhanced NFS, the NIS+ naming service and the distributed object-management facility (OMF), developed jointly by SunSoft and Hewlett-Packard Co. Notably, ONC wasn't the only RPC selected. UI is promising that it will support multiple RPC protocols, at least one of which will insure compatibility with the OSF's DCE environment.

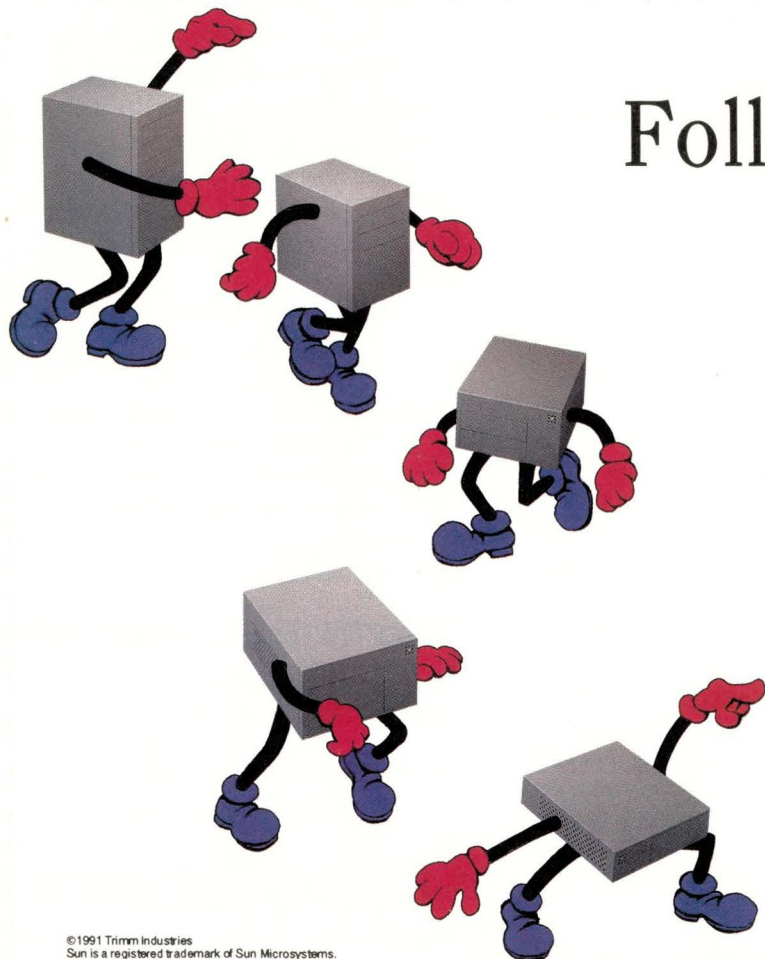
• DBMS tidbits: Burlington, MA's **Cognos** has completed the port of its PowerHouse fourth-generation language and StarBase relational database to Sun's line of workstations and servers. PowerHouse and StarBase together are priced from \$6,000 to \$222,500, depending on the number of users. **Progress Software Corp.**, Bedford, MA, has released Progress

Results, an interface and query tool for end users and developers. The tool is said to enable users with no programming experience to query, report and work with information stored in various databases, including Progress, Oracle, Rdb and RMS. The product is available in two versions—developer and end user/systems administrator—and sells for \$400 to \$134,000, depending on machine class.

• **Sun Microsystems Inc.** has selected disaster-recovery and maintenance provider NPA West, Fairfield, CA, to install, maintain and service Sun equipment at state and local government sites in California. NPA has provided similar services in the Data General Corp. marketplace. ➔

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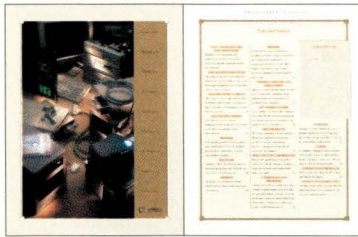
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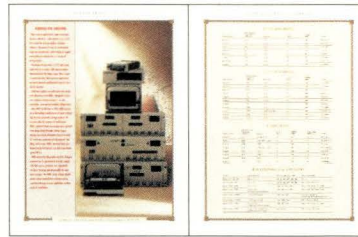
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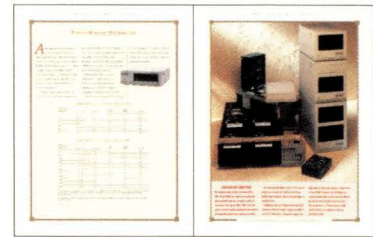
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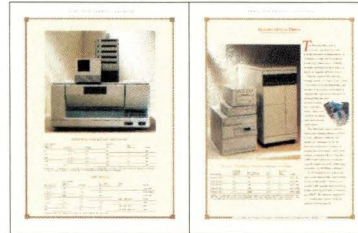
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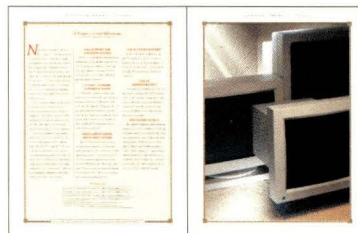
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ILLUSTRATION BY TOM BARRETT

by MICHAEL O'BRIEN

The Other X: International Cooperation and Its Horrors

“Q: What do you get when you cross a gangster with an international standard?”

A: You get someone who makes you an offer you can't understand!”

—The Cynic of the Internet, as reported by Marshall Rose

“Standard (n)—1. A document describing how everyone ought to do something. 2. A flag waved before troops going into battle.”

—The Bit-brain's Dictionary

Q: Mr. Protocol always seems to be smiling. Is he really such an optimistic, happy fellow?

A: All things are relative, even Mr. P. (But thank heavens he's no relative of mine.) Mr. Protocol is smiling all the time because he lives in a world where network protocols work all the time, and where technology is the main driving force behind new developments. In other words, he lives a.) in the past, and/or b.) in fantasy land. He regards this as one of the chief benefits of his particular brand of irrationality. You see, he has seen how the other half lives. He has seen OSI, and lived.

Right off the bat, Mr. Protocol would

like to acknowledge a very valuable source of information, *The Open Book*, by Marshall Rose. In addition to being an excellent technical introduction to the world of OSI protocols, Mr. Rose also develops a personal perspective on the workings of the OSI standards community that's almost enough to wipe the smile right off Mr. P's mug. Mr. P. gratefully acknowledges Mr. Rose's contribution to what follows. Mr. Protocol is generally incomprehensible even when rational topics are being discussed. Listening to Mr. Protocol discuss OSI is not an experience to be entered into lightly, and Mr. Rose's assistance in lending clarity to the subject has been invaluable.

What is it, then, this thing called



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Circle No. 28 on Inquiry Card

OSI, which seems to start everything off with the letter "X?"

Mr. Protocol is glad you asked.

Briefly, OSI is many things. To some, it represents the future. To others, it represents "the competition." Still others regard it, more simply, as disaster on the hoof. If Britain and America are two nations divided by a common language, they say, the OSI protocol suite represents a brilliant extension of this principle to include the rest of the world.

OSI stands for Open Systems Interconnection. This doesn't mean that the systems themselves need to be open, merely that the method used to connect them is open, as opposed to proprietary. And it certainly is open. Everybody gets a vote, in fact. And that, as we shall see, is the main problem.

The OSI protocol suite is the joint work of the International Standards Organization (ISO) and the CCITT, which is the acronym for a French title that translates as the International Telephone and Telegraph Consultative Committee. The CCITT is the international regulatory body whose member organizations are the Post, Telephone and Telegraph administrations of the countries of the world. Those few countries (like the United States) where the telephones and the post office are not run by a single government body are represented by a government agency of that country's choice. Although the protocols in the OSI suite are often referred to as ISO protocols, the names with which most of us are most familiar, such as X.25, are actually CCITT terms.

The OSI protocol suite and the TCP/IP protocol suite are of about the same age. Their genesis differs, though, and the difference is most enlightening.

The TCP/IP protocol suite was created because the existing national research net, the Arpanet, was having growing pains. Various (Dare we say it? Yes...) cockamamie schemes were being promoted to allow at least some machines that were not directly connected to the Arpanet to communicate with other machines. The pressures to

do this increased as local networks were assembled by the Arpanet's member organizations. Local nets were fairly new at this time, and the protocols and hardware implementations of those networks were often a matter of local invention. The result was the creation of a real Internet Protocol, and a suite of transport and application protocols on top of it, by a group that had had real experience in the area, and a firm grasp of the problems involved—as well as a clear field in which to put forth their ideas.

There were two factions at work in designing the lower levels of the OSI protocols.

The OSI protocol suite, on the other hand, was created by a string of large international committees, and it shows. It is not as simple as claiming relative levels of technical competence; it is a matter of orientation. The TCP/IP architects were focused on matters of data interchange using computers, while the OSI-protocol-suite architects were focused on the task of data interchange, period. They represented telephone and telegraph enterprises, and that orientation colors the result. There is a heavy odor of Telex and teletype about the lower levels, at least, of the OSI protocols.

The further problems were political in nature. There were two factions at work in designing the lower levels of the OSI protocols, which are devoted to "end-to-end" data transport. One group of people believed that data should be transferred via a virtual cir-

cuit. In the virtual circuit model, a route is negotiated through the network at the beginning of the transfer and resources are committed to the connection. All packets follow the route established at the time the connection is first made. There are several advantages here:

- 1.) The resources remain committed, so that network transit times are insensitive to network loading.
- 2.) Per-packet routing is a no-brainer: the route is figured out once, at the beginning of the connection.
- 3.) Routing, therefore, follows the well-established and well-understood principles already at work in telephone systems.

There are disadvantages too, though, such as loss of the ability to build survivable connections. If one of the intermediate nodes involved in the connection goes down, the connection is aborted, even though multiple routes may exist between the source and destination. Also, because of the necessity of committing resources at the time of connection establishment, the overhead of making a connection becomes quite high, and can take some time.

The alternative is the connectionless data-transfer model, where each packet finds its own way from source to destination. If this sounds familiar, it should: This is the way IP works. The downside of this arrangement, of course, is that per-packet routing overhead is much higher, and packets can arrive out of order.

The OSI protocol designers were never able to resolve this question. They included both specifications in the design of the lower-level OSI protocols. The result is an extra set of specifications that allows these differently flavored transport layers to communicate. The problem is that the real-world circumstances under which this interworking can actually take place is quite limited. For the most part, the OSI protocols have two incompatible end-to-end data transfer specifications, for purely political reasons. So it goes with international

standards operations.

Certainly one of the problems with the creation of such international standards is the necessity for consensus and political compromise which is found in any sort of international negotiation. The TCP/IP designers came from a single country and similar backgrounds—far from the case in the OSI world. However, it is also the case that the OSI designers had, and have, a tendency to standardize in advance of experience, which is always a dangerous undertaking. The Internet community does not declare anything to be a standard until it has been implemented and used...at least, so it has always been. This attitude is beginning to erode as Internet technology finds wider and wider acceptance in the commercial world, and larger and larger amounts of money are spent on TCP/IP networking (and networking products!). Internet technical decisions are becoming infected with politics, but there is a long way to go before matters become as grave as in the OSI world.

The Internet domain has always remained unified. There is a single low-level protocol, which is IP, and IP has a single addressing scheme. In the OSI world, addressing is specified by CCITT "Recommendation" X.121, which specifies several ways of expressing an address. The connection-oriented protocol X.25 then uses these addresses to move data around the network. The OSI equivalent of TCP is rather simpler than TCP because the connection-oriented X.25 service provides the reliability that TCP itself provides over the unreliable IP. However, even here there are several transport protocols—in fact, no less than five of them, each providing some additional services such as retransmission and multiplexing of several system-to-system channels over a single X.25 connection. (X.25 connections are treated like telephone connections, and billed accordingly. If you can multiplex several streams over a single connection, you save on the setup charges. These are definitely telephone companies we're dealing with here.)

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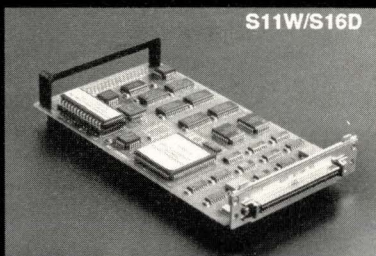
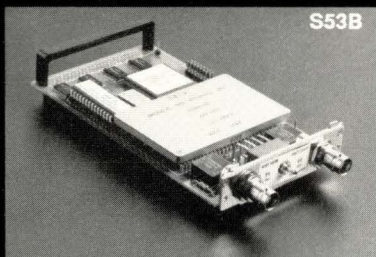
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There are two areas that serve to point up the difference between the Internet and the OSI ways of doing business, Mr. Protocol feels. The first instance is that of network routing. It is explicitly specified that the X.121 addressing scheme is independent of the geographical location of the systems (except for the branch that uses country codes). Still, routing must be accomplished in the OSI networks. How this is to be accomplished is still a matter for discussion. In the Internet world, it's also a matter for discussion...endless discussion. The problems of intra-network routing gave way to the problems of inter-network routing, which gave way to problems of routing in truly huge networks, which gave way to problems of enforcing policy differences between domains. This is all virgin territory for OSI.

Similarly, although OSI specifies the existence of both connection-based and connectionless network services, there are almost no applications that use the connectionless services (which puts something of a theoretical cast on the schemes to allow the two types to interoperate). The Internet sports several such services, including NFS and the network management protocol SNMP...which is based on specifications that originated with OSI!

Why, then, should any of us bother with any of this? There are several reasons. The first is, like much of OSI, political. The weight of world opinion on networking—"the way we do business"—is based on the PTT model. The national nets of most of the countries of the world are already based on the OSI protocol suite, and they are not about to switch to TCP/IP just because it is more robust and reliable. In addition to the Not-Invented-Here syndrome, in the end they would be limiting themselves, and that's the second reason. There is a large amount of ugliness about the lower levels of the OSI suite, but the application services at the higher levels are better than the equivalent Internet services, in most cases. Whether this is because Internet types joined in the design, or because OSI designers just got better at the

job, or for some other reason, is moot. The fact is that the X.400 Mail Handling System and the X.500 Directory Services specifications beat our own Internet features all hollow in many respects. The fact that they are also much larger, more unwieldy, and difficult to implement goes with the territory. Many folks feel they're just better, and the sooner we move over to using them, the better off we'll all be.

So, in future columns, Mr. Protocol will look at these OSI applications. Why? Because they will probably arrive long before the day that IP gives way to X.25. The smart money now says that, in the short run, the higher-level OSI applications will be deployed over a TCP/IP network, since TCP/IP has much more robust transport and routing protocols, at least for now. People are playing with these high-level applications now. We'll be peeking into that playpen—there are some great toys in there. →

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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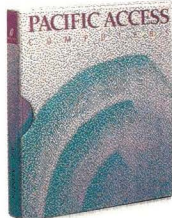
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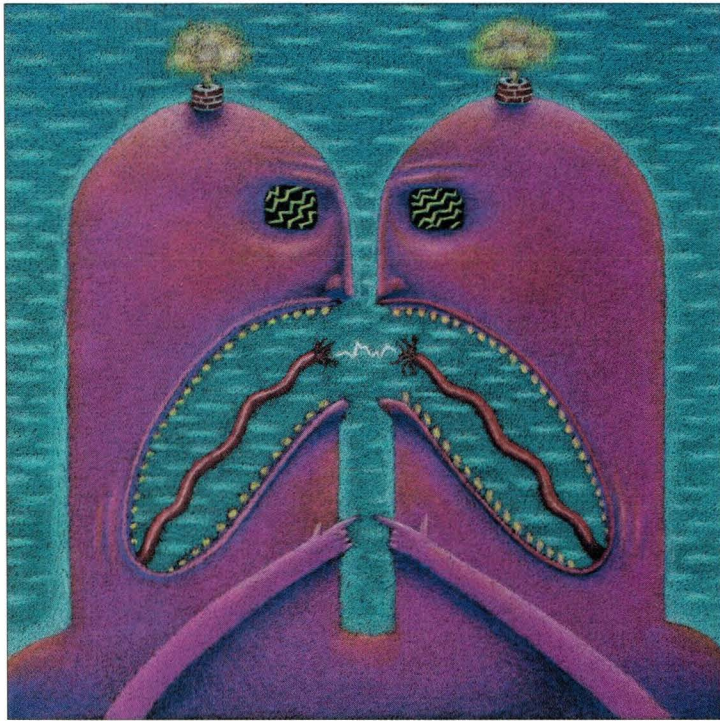


ILLUSTRATION BY KEITH GRAVES

by **PETER COLLINSON**,
Hillside Systems

Program Arguments

One feature that has made UNIX approachable by programmers is the notion that the entire command line is supplied to the running process. A UNIX process is handed a set of text strings containing data that the user has just typed. It is the job of the process to decode the strings and ascribe meaning to them. As a rule, the programmer is free to use the command line in any way that makes sense.

Freedom has meant that typed input varies widely for different commands. Luckily complete anarchy has never quite broken out. Commands on the early UNIX systems mostly followed the convention that an unadorned string was a filename, and an option to the program was preceded by a hyphen. Options are usually a single character.

There are some notable exceptions to this, `find` and `dd` being the ones that readily spring to mind. Many commands dictate that the first argument must always be an option or a set of options.

The `tar` and `ar` commands use this convention. Many commands make the order of arguments on the command line significant, `cp` for example. Others do not.

In BSD-derived systems, it's often possible to omit the preceding hyphen from the list of options. For example, you

can type:

```
% ps ax
```

rather than:

```
% ps -ax
```

The ability to do this depends on the whim of the programmer whose code makes sense of the options. The `ps` command *knows* that the first argument is always a set of options and so the hyphen can be omitted. Also, the `ps` command is one of the commands that uses the order of the arguments to imply what they mean. This is convenient, but counter-intuitive. If you separate the options:

```
% ps -a -x
```

which you might think is reasonable, then you get the mysterious message:

```
ps: cannot open -x: No such file or directory
ps: could not read kernel VM for -x
```


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because `ps` knows that argument 2 is a program binary.

The potential for anarchy was held somewhat in check by a dictum of AT&T. Sometime in the early 80s, a piece of paper fluttered down stating that from henceforth all command line input will obey some rules. These particular commandments were later enshrined in the System V Interface standard, the SVID. By the process of standards osmosis, the rules are now part of POSIX.2, the shells and utilities standard. This isn't a standard yet, but they are balloting it. It's the natural order of things that the rules are slightly different in POSIX.2 from the version in the SVID.

From the beginning, the rules have not been mandatory. They have always stated that people must use them in the future but need not change existing programs. They are not even mandatory in POSIX.2. Both the SVID and the standards text make heavy threatening hints about the consequences of ignoring the guidelines when constructing commands. However, the rules have often been ignored. Ten years of habits are hard to break and I expect that people will continue their own merry way.

Mechanics

Where does this flexibility come from? How does all this work? Let's look at the creation of a new process. The `fork` system call is used to make a new process. It creates an exact copy of the calling process.

After a `fork`, there are two identical processes running in the machine. The newly made process invokes the `exec` system call to load and run a new program. The `exec` call throws away the bag and baggage of the old process: the program area, the data segment and the stack. It starts to make a completely new process image. There are many variants to the `exec` system call, all presenting a slightly different interface to the caller. The term "exec system call" is generally used to refer to the whole family. On a Sun, there is only one real system call, `execve`, and all the other routines call that. The actual implementation is system dependent and it's easier to think of the whole `exec` family as a set of system calls.

The `execl` variant of `exec` is convenient for use in C programs. If a process wished to become the `echo` program with some arguments, then the calling C program might look like:

```
execl("/bin/echo", "echo", "These", "are",
      "program", "arguments", 0);
```

The arguments to the routine are all strings. The end of the argument list is shown by a zero value. The first mandatory parameter to the `execl` call gives a pathname to the file that contains the binary image of the new program. The second parameter is mandatory by convention. It contains the name of the program being run. The remaining strings are all arguments to the program.

The system arranges that all arguments but the pathname are parcelled up and passed into the target command. By convention, all C programs start with a routine called `main` that has two parameters. The source for programs that

decode arguments will look like:

```
main(argc, argv)
int argc;
char *argv[];
```

The first argument is an integer giving the number of arguments that are passed into the program. The system creates this by counting the strings that it has been given. The second argument is a pointer to a vector of pointers to strings. This is perhaps a bit plainer if you look at the figure below. The name of the command finds its way into the first argument. In C it is numbered zero, so we think of it as the zero'th argument.

Having this name may seem unnecessary, after all the programmer doesn't need to be told the name of the command. It turns out to be useful. For example, several programs on the system are actually the same binary but behave differently when started with a different name. The editor, `vi`, has several variants: `ex`, `view`, `edit` and `vedit`. These are all links to the same binary that uses the name to give different behavior when the program is run.

The Kernel

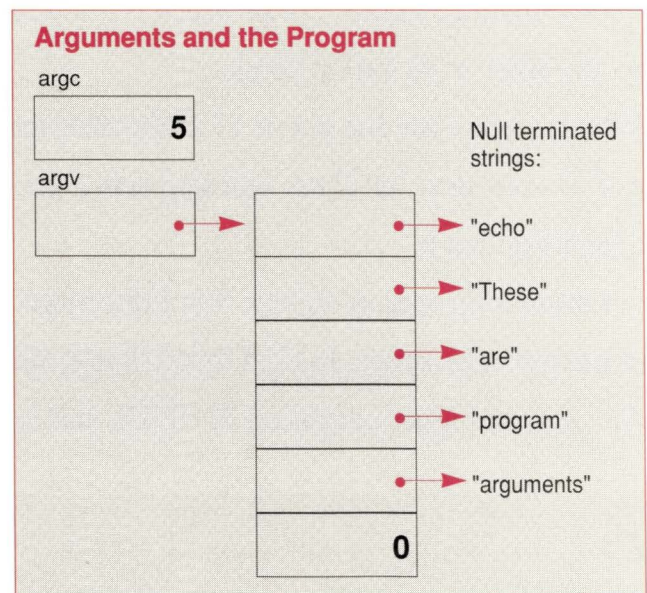
In reality, the `exec` system call passes two sets of strings into the new process. As we have seen, the first set is the program arguments. The other set forms the environment of the process containing information like:

```
SHELL=/bin/sh
```

I won't dwell on the environment strings. They are treated in the same way as the program arguments.

The argument strings are passed like the `argv` form that is shown in the figure below. The `execl` routine in the caller has to do some work to create the vector of pointers to be passed into the actual `execve` system call. What happens next involves some work for the kernel.

The kernel needs to make sure that the arguments arrive



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in the new process looking like arguments to the `main` routine. When we are compiling a program, the C compiler will not do anything special for the main routine. The code that is generated will expect to access its arguments in the same way as any other routine in the program. This means that the kernel has to fake a routine call with appropriate arguments. This is architecture dependent but often means that the arguments will be placed at the base of the stack of the new process.

The other problem that the kernel has to resolve is one of address space. The `exec` call throws away all the address space of the old process and needs to create a new one for the new command. The program arguments have to be moved from the old address space to the new. This is done by copying the arguments from the caller process into the kernel before the old caller address space is destroyed. A new stack segment is made and the arguments are then copied from the kernel into the new process.

It is hard to avoid this two-stage operation because the `argv` vector in the caller can point to strings spread throughout the caller's data area. It is also not possible to know how much space is needed to store each argument.

Early systems copied this argument data into empty kernel space provided by the disk-buffering system. The `exec` system call allocated some swap space for the copying exercise. Data was then copied into kernel disk cache and written to disk if buffers were scarce.

There was a top limit of 10 KB of argument list data. This was often easily exceeded by using the shell's file name expansion mechanism. Failure could result from typing something like:

```
$ ls /some/long/path/name/*
```

where the target directory contained many files. There was not enough space to store the arguments to the `ls` command. The strategy was to not use the argument line:

```
$ cd /some/long/path/name
$ ls
```

This worked for listing the directory with `ls` but could fail if you wanted the shell to generate an argument list for some random command. You had to use commands like `xargs` to reduce the number of bytes in the argument list.

As you might imagine, `exec` failure due to insufficient argument space can be embarrassing, especially for shell scripts. They will work fine until one day a file will be created that pushes the argument list byte limit over the top resulting in the death of the script. Groan.

Current systems use virtual memory to provide "infinite" storage for argument lists being passed in the `exec` call. There is some upper limit on the number of bytes that may be passed, but the limit is rarely reached.

Decoding Arguments

Having got the arguments safely from one process into a new one, the kernel will start it running. The main routine

of most programs contains a section that decodes arguments. In the early systems there was no routine supplied to do this. People wrote their own decoding code. This was the reason for the proliferation of different styles of arguments.

These days most people will use the routine `getopt` to decode arguments. This removes some (not all) of the drudgery of programming argument decoding routines. The routine looks for program options, argument strings starting with a hyphen. The rules state that program options should precede any other arguments. The `getopt` code expects to be used like this and will stop when it finds an argument that does not start with a hyphen.

The `getopt` routine takes three arguments. The first two are simply passed in from the `main` module; they are `argc` and `argv`. The last argument is a selection string containing a letter for each option that the program expects to find on its command line. If we want to create a command that permits the letters "i," "p" and "r" as options, then we would call `getopt` like:

```
rv = getopt(argc, argv, "ipr");
```

When called, the routine looks in the `argv` for a legal program option. If it doesn't find one, it will return minus one. We expect to use `getopt` in a loop so that it will scan several arguments until it finds one that doesn't start with a hyphen.

When a legal option is found, the routine will return the letter that matches a character in the selection string. If the option is `-p` then `getopt` will return the character "p." If the character in the argument list is not present in the selection string, then `getopt` will return the question-mark character and will also (optionally) print an error message. Here is the beginnings of a template to use this:

```
main(argc, argv)
int argc;
char *argv[];
{
    int rv;

    while ( (rv = getopt(argc, argv, "ipr")) != 1)
        switch (rv) {
            case 'i':
                /* got i */ break;
            case 'p':
                /* got p */
                break;
            case 'r':
                /* got r */
                break;
            case '?':
                /* error */
                break;
        }
    /* working code */
}
```


The comments are intended to represent working code, setting some variables to remember that the particular option had been used. The operation of the code is simple. The `getopt` routine is called repeatedly until no more options exist on the command line. Each time a legal value is found, it is returned into the `rv` variable. This is passed into the switch statement for decoding.

This program will accept arguments like:

```
-i -p
-ip
-p -i -p
```

In the first line, the options will be in separate strings, pointed to by different entries in the `argv` vector. The `getopt/switch` loop can happily ignore that. In the second line, all the letters are bunched in one argument. This is equivalent to the first line. The appropriate cases in the switch will be executed however the data is input. The ability to use both forms is common and the rules about arguments have always protected this right to redundancy. On the third line, the `p` option has been used more than once. The `getopt` routine will not treat this as an error. If you consider this an error, then you should arrange to have some code in the switch complain bitterly.

End of Arguments

The original set of rules postulated that a special argument, `--`, ends the interpretation of options. For example:

```
% touch -g
usage: touch [-amcf] file ...
```

will not make a file called `-g`, because `-g` is treated as an option to `touch` and rejected. But when the magic end-of-option marker is used:

```
% touch -- -g
% ls
-g
%
```

the `-g` string becomes an argument to the program and is treated as a file name.

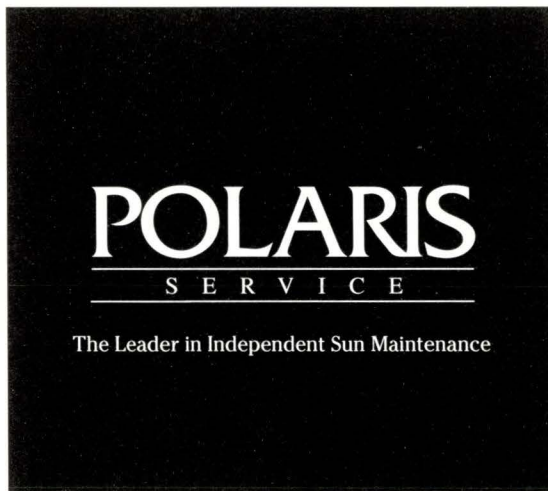
The `getopt` routine implements this, but many programs still exist that do not follow this rule. When trying to delete the file, you might fall into the trap of thinking that a `--` argument to `rm` might work. It doesn't.

```
% rm -- -g
usage: rm [-rif] file ...
```

The `rm` command is already blessed with a way of removing files that start with a hyphen:

```
% rm -g
```

We must conclude that `rm` on the Sun doesn't use `getopt`. All this discussion of creating and deleting files that start



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with a hyphen may seem irrelevant, since it is something that you will never *seek* to do. The `--` operator is occasionally useful and can be worth knowing about. It's always good to have ways to circumvent conventions that might prohibit some action or other.

Options With Arguments

We sometimes want to give an option that requires additional information. Perhaps we want to say "start logging into this file" something like:

```
% mycmd -l /usr/adm/log srcfile
```

The `getopt` routine deals with this by allowing you to add a colon into the selection string after the appropriate character. The colon means "this option is always followed by an argument." To add our new logging argument into the example above, the `getopt` selection string is changed to:

```
"il:pr"
```

Alphabetic order is not mandatory but can save grief later.

If the user supplies a `-l` option, the calling routine needs to know the value of the argument to the option. The `getopt` routine employs an external character pointer called `optarg` to point to the current value of the option argument. To decode the option, we will add something like:

```
case 'l':
```

```
log = optarg;
break;
```

into our switch statement. The value from the arguments is picked up and stored in something that we will use later. We don't need to worry about storing the string pointed to by `optarg` because it already exists in static storage in the argument vector.

The version of `getopt` on my Sun allows you to give an argument to an option without intervening white space. For example:

```
-l/usr/adm/log
```

Grouping options is permitted, so

```
-il/usr/adm/log
```

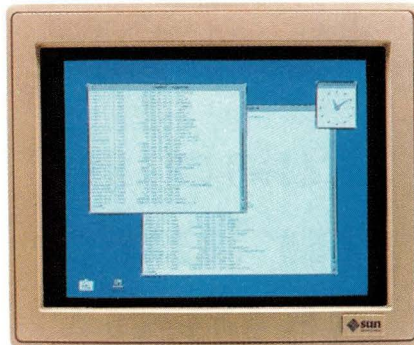
is allowed. However, the option with an argument must appear as the last entry in the string on the input line.

Dealing with Other Arguments

When `getopt` finds a string that doesn't start with a hyphen, it will assume that it has arrived at the end of the program options. This enforces the rule that program options must come on the command line before any other program arguments.

When this happens, there may be other arguments to decode and the programmer needs to know where they start.

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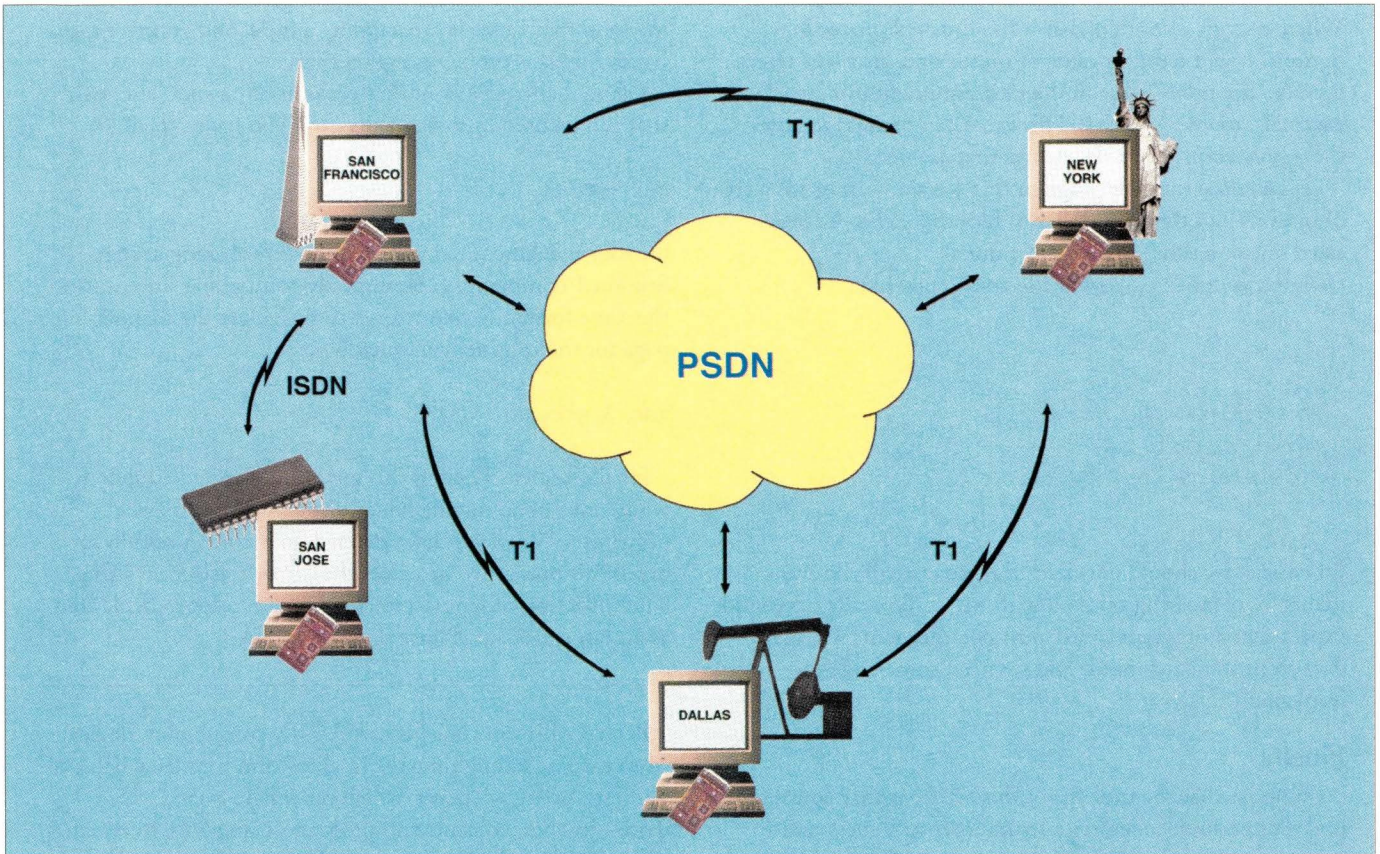
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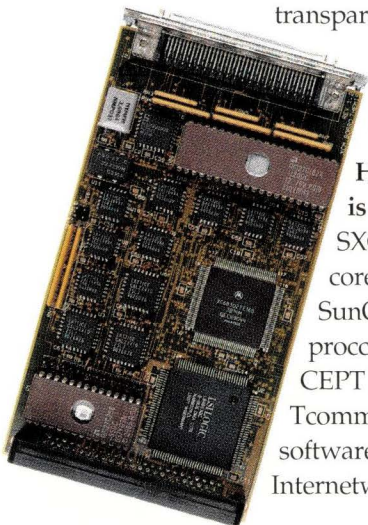


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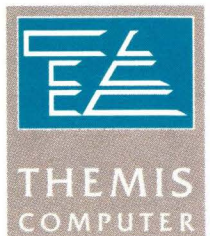
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When `getopt` considers that it has finished processing options, it will return a value of minus one. As a side effect, it places the index value of the next argument into another external variable: `optind`. This value can be used to access the `argv` vector to get the strings that are needed.

Let's assume that the program that we are writing has a set of options and then a number of files that are to be processed one at a time. After the comment `/*working code*/`, we will add some code like:

```
...
...
/* working code */
while (optind < argc)
    doit(argv[optind++]);
}
```

Of course, we should check for the presence of the arguments by comparing `optind` with `argc`. Typically we would expect that a program called with no arguments will take data from standard input, and we need some code to implement this.

Finally

I suppose that the message of this article is that you should use `getopt` to decode program arguments. I guess that I sometimes do. I should use it more often. The trouble is that it doesn't offer much more to me than the usual decod-

ing loop that I use. It saves typing a little, and enforces the "rules." This is probably a good thing.

I should also point out that versions of `getopt` also exist that can be used in shell scripts, so if you have typed

```
man getopt
```

on your machine, then you are probably looking at the Section 1 command. It is culturally compatible since it uses the same format for selection strings. To get the manual page for the routine, you must type:

```
man 3 getopt
```

Finally, a plea. There is this guy in the United Kingdom whose idea of an intelligible error message is somewhat unhelpful. When you have entered an incorrect option to one of his programs, he prints the `getopt` selection string. The collection of letters and colons leaves a lot to be desired as an error message. Please don't do it. ➡

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 1+. He is the Usenix Standards Liaison. Email: pc@expert.com.

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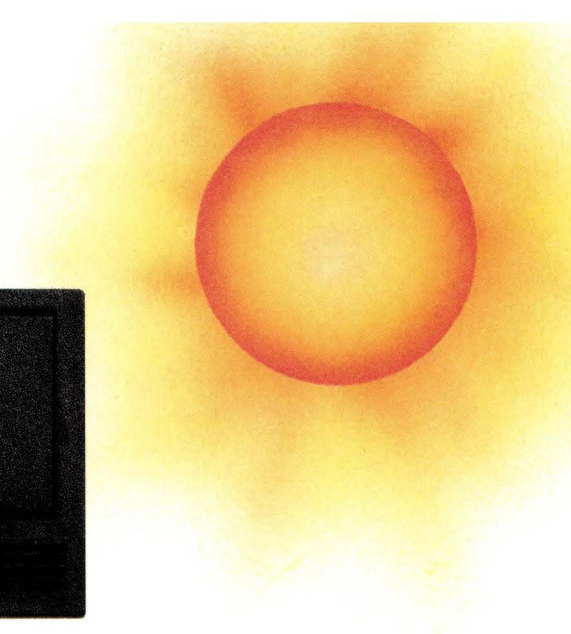
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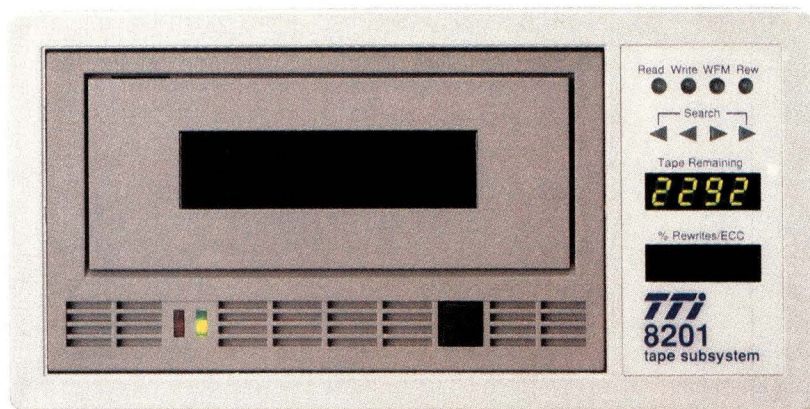
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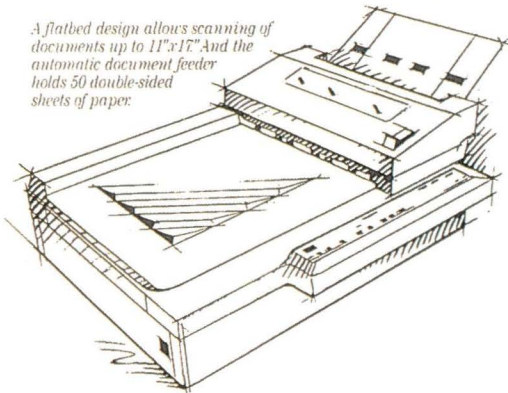
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ILLUSTRATION BY ROBIN JAREAUX

A Look at Software Distribution

by RICHARD MORIN, Technical Editor

A great deal of software is given away. The Internet archives contain tens of gigabytes of downloadable data, much of which is computer software. The Free Software Foundation (FSF), Sun User Group, UUNET and several other institutions distribute collections of redistributable software.

None of this software is supported by the distributors, however, and most of it requires a fair amount of installation, customization and support. In addition, new versions come out occasionally, and should be installed, tested and released to the local user community. Sites normally delegate one or more programmers to keep their freeware running and current, accepting the cost of this labor.

Alternatively, individual consultants and organizations are available to support some of these packages, for a fee. Ron Guilmette is a Sunnyvale, CA-based consultant specializing in C programming tools. He provides development and porting services for freeware tools such as GCC and GDB, as well as for commercial packages such as AT&T's Cfront (C++ to C converter).

Ron makes an interesting comparison between the software and automobile industries. Commercial software is similar to an automotive lease. The vendor provides a great

deal of service, and the customer has few responsibilities.

Freeware is more like an automotive purchase. The customer is responsible for more, but has far greater freedom in using or modifying the product. Ron's position is thus similar to an independent garage, save that most garages don't contribute design features back to the factory. Indeed, freeware is characterized by the fact that its supporters also tend to be its developers. Cygnus Support, using the same analogy, is an authorized dealer. The company's principals are major contributors to a number of FSF packages. In addition, some of Cygnus' employees are the official maintainers for several FSF packages, including G++, GCC and GDB. Cygnus offers commercial support for various FSF (GNU) packages. The service is not inexpensive, but the firm is very good at what it does.

Several large sites now substitute Cygnus' efforts for their own. In addition, vendors such as 3Com, AMD, Intel, Sun, Telebit and Wind River have chosen to have Cygnus support all or part of their GNU code. Notably, all code developed by Cygnus goes back to the FSF for possible integration into GNU releases.

Complying with Cygnus' motto ("If it isn't source, it isn't software"), most UNIX freeware is distributed in source

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form. This provides flexibility and portability, at some cost in effort by the recipient. In addition, source code allows the recipient to scan the program for possible security problems. In an effort to combine convenience with the virtues listed above, the Sun User Group has issued a CD-ROM containing both source and binary versions of hundreds of popular UNIX freeware packages. Contact SUG at (617) 232-0514 for more information.

The availability of a substantial amount of real, free use will justify the effort of installing a desired software package.

Outside of formal freeware distribution, the path can get a bit muddy. It can be difficult to find the current version of a useful package. The archive wizards of the Internet are working on solutions, however, and things should improve substantially over the next few years. Automated archive indices, package reviews and registration of version are being discussed and/or tried.

Priceyware

In any event, freeware is not the norm in software distribution. Most commercial sites purchase (lease, etc.) the software they need for mission-critical tasks. They demand (and usually get) on-call support for installation, and sometimes, continuing operation of the packages.

Historically, this purchase involved a complex set of interactions between the buyer and seller. With thousands of dollars at stake, buyers needed to be thoroughly convinced before purchasing a package. A ritual of literature exchange, telephone or personal calls, demonstrations and contracts thus ensued. Unfortunately, the client seldom had any real access to the package.

The advent of CD-ROM software distribution, however, has changed the game a bit. A prospect pops in the CD-ROM disk and tries out a sample version of the software. If satisfied, the prospect can purchase the software over the telephone, in a matter of minutes.

In some cases, the customer must then wait for the software and documentation to be shipped. More frequently, they are given a key that unlocks a real copy of the package. Mary Jo Foley's article, "Need UNIX Apps?" (*SunExpert*, October, Page 60), surveys mass-market distribution channels for UNIX software.

Licensing

In the simplest case, the client gets the indefinite right to use the package on a single machine. More complicated arrangements may allow use on all machines at a given site, perhaps with a limit on total simultaneous usage. The proliferation of network-licensing systems attests to the desire (at least by vendors) for this sort of control.

Briefly, network-licensing systems provide secure, reliable control of software-package usage. One or more license servers give out usage tokens, monitor whether the packages are still running and generally keep track of how many copies are currently in use on the network. Alan Pope's article, "An ISV's Overview of SunNet License" (*SunExpert*, October 1990, Page 60), is a technical look at Sun's network-licensing system.

Network licensing fits well with clients' needs to control their budgets. The client "buys" the right to have N copies of the software running at the same time. If usage is relatively even, no major hassles result from this scheme. The available licenses cover typical needs, and most conflicts can be handled by a bit of scheduling and/or cooperation among the users.

The system falls down, however, if usage is peaky. Suppose that a company uses a desktop-publishing package to develop sales literature, user documentation, training materials, etc. Months may pass with little usage, followed by a frenzy of usage when a new product is being finalized. Should the company buy for the low spots, the crises or what?

Alternatively, a very small company may need a package only infrequently. A consultant may need a package for several weeks, then never use it again. If the cost is too high, the user will choose to do without the package. Nobody is happy in this scenario. The company loses the use of the package, and the vendor loses possible revenue.

Pay-As-You-Go

A solution exists, although I have not seen it proposed, let alone offered commercially. By a simple modification of the licensing software, clients can be allowed to purchase usage as desired. An initial phone call gives the client a trial period, perhaps 40 hours. Support, beyond a modicum at installation time, can be charged separately.

The availability of a substantial amount of real, free use will justify the effort of installing a desired software package. If the package serves the client's needs, the initial allotment will soon be used up. Local users will then demand an extension of the contract.

The client can buy further usage allotments as needed. The allotments will tend to converge on a comfortable size fairly rapidly, balancing hassle against cash flow. By keeping a moderate amount of usage available at all times, the client can have continual availability of the package, at minimum cost.

If demand stays high, the client and vendor may wish to switch to a more conventional licensing agreement. Some form of lease-option might even be written into the initial contract. By adjusting costs to clients' needs, vendors can

gain clients who might otherwise be lost. Clients gain economical access to desired packages, increasing their productivity. This seem like a win-win situation, and I predict that something like it will emerge soon.

A closely related idea, time averaging, takes care of peaky usage, while preventing runaway usage. A license server can start with $10 \cdot D$ tokens, give out D tokens per day, and deduct H tokens per hour of usage. Tokens accumulated during periods of low usage automatically balance the needs of high usage periods. Over time, the D s and H s must stay in line, but the constraints are much more congenial than those of current "N simultaneous user" regimes.

Pay-as-you-go can be combined with time averaging in a useful manner. Let's say a site has an unusually high need for a package for a limited period of time. Rather than increase its license, it can buy blocks of tokens. These supplement the normal supply, carrying the site through the crisis. If the increased need continues, the site can upgrade its license.

Security

Many companies are now starting to police their (mis)use of commercial software. The advent of punitive damages for intentional misappropriation of software may have something to do with it. Then again, it might be caused by a maturing of users' attitudes. In either case, it is a welcome change.

Regardless, there are some companies and individuals who still regard all software packages as fair game. In retaliation, some vendors use complicated (nay, baroque) sets of files, keys and processes to ensure that their software will never be used by an unauthorized party. This seems to me to be an over-reaction.

Most commercial sites will not spend significant effort on breaking the security provisions of software packages. They may try a few simple tricks, but they will give up long before disassembling the package. The return simply does not justify the effort and risk involved. (It is hard to explain how you accidentally used `adb` on a commercial package, disabling its security checks.) Any organized effort to break the security of commercial software would fall prey to RICO statutes and the like.

Consequently, security provisions do not normally need to be totally bulletproof. This means that they can be optimized for the convenience of system administrators. Vendors should examine their installation and maintenance procedures, changing those that are excessively difficult or tedious. Customer satisfaction will outweigh any probable loss to pirates.

Another Idea

Truly secure network licensing cannot be based on software that runs on general-purpose computer systems. There are far too many forms of attack for this method to be reliable. I therefore suggest (for those vendors that care) that a separate box be made available to serve as a license server.

Hermetically sealed, it could only be accessed by `rlogin`,

and would totally control its own internal environment. Using encryption keys, etc., it could provide a wide range of licensing services for a large number of packages. The necessary hardware is minimal: A microprocessor, some non-volatile memory and an Ethernet interface. I suspect that the units could be sold (in reasonable quantities) for a few hundred dollars each. ➔

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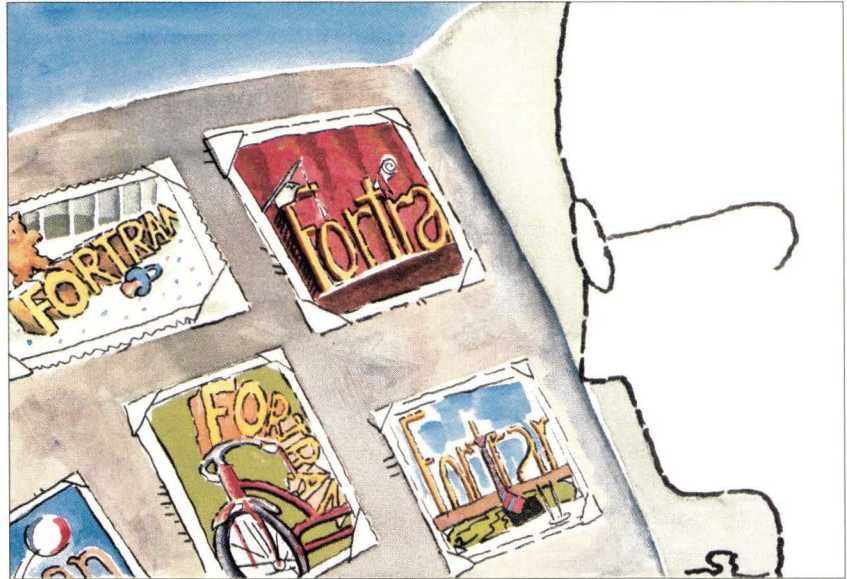


ILLUSTRATION BY S. H. LEE

by PETER H. SALUS

FORTRAN? Yes, FORTRAN

In the mid-1950s, a group headed by Jim Backus at IBM Corp. in New York was investigating an “algebraic language translator.” By the end of 1956 we had FORTRAN (for FORMula TRANslator) 0. It was not the FORTRAN we know today (though it was the first programming language I studied, over 30 years ago). Among other things, there were no FORMAT statements and no user-defined functions.

Just about the time the FORTRAN 0 compiler was being completed, FORTRAN I and FORTRAN II were being designed. Backus and his colleagues announced FORTRAN at the 1957 Western Joint Computer Conference of AIEE (now IEEE), and it achieved instant popularity. (Backus has outlined the history of FORTRAN I, II and III in Sigplan Notices (August 1978), and I refer anyone

really interested in the history to that 15-page article.)

POSIX and FORTRAN

While POSIX started with UNIX as a model, POSIX standards are not limited to UNIX. For example, DEC has announced a program that will incorporate some of the POSIX standards into VMS. Once adopted and implemented, POSIX standards will define a broad range of compatibility both within the UNIX family of operating systems and between other operating systems.

ISO requires that functionality be specified by language-independent standards. That is, standards specify functionality without specifying interfaces or syntax. Thin binding standards are then produced for each language to provide access to the functionality. Because of the wide use of FORTRAN in computing generally, P1003.9 was established

to provide access to the POSIX-defined, standard operating system interface and environment directly from the FORTRAN language. In the last year, ISO has relaxed its restriction to allow thick C bindings that define new functionality, but has excluded all other language bindings that do not reference a language-independent standard. Even though .9’s proposed FORTRAN binding is a thin binding, it is based on the thick C binding and not a language-independent specification as required by ISO. (This is because there is no language-independent specification and such a specification could be a year or more away.)

As a consequence, the .9 working group will forward its draft to IEEE and to ANSI for processing when its work is complete. The group intends to ask ISO whether it wishes to adopt the IEEE standard at that time. This

will give ISO another chance to say yes or no. In the event that ISO says no, it may be several years before a language-independent standard is developed and a binding to it can be produced. The proposed binding will be of use to the FORTRAN community today, as will an ANSI standard, even in the absence of an ISO standard.

Which FORTRAN?

One of the issues confronting .9 a year ago was which FORTRAN to use. The obvious choices were:

1. FORTRAN 77 [ANSI X3.9-1978, ISO 1539-1980 (E)],
2. a codification of common extensions/enhancements to FORTRAN 77, or
3. the revised FORTRAN standard emerging from the ANSI X3J3 committee—previously referred to as FORTRAN 8X, but now called Fortran 90.

The committee chose the first.

For FORTRAN 77 versus Fortran 90, the determiner was that FORTRAN 77 is currently the only adopted standard. (Fortran 90 is scheduled to be adopted as an ANSI standard after P1003.9 goes to ballot.)

Thick Versus Thin

The FORTRAN binding to POSIX is referred to as a "thin" binding. That means that it defines the FORTRAN interfaces to access the POSIX system services, but does not define the functionality of those services. Instead, the FORTRAN binding references the POSIX.1 standard for the functional definitions. The Ada binding to POSIX is also nearing completion. It is a "thick" binding in that it defines both the Ada interfaces and functionality. (I do not intend to devote a column to Ada in the future.)

There are advantages and disadvantages to each approach.

Because all the information required is contained in one document, thick bindings are easier to read. Furthermore, if one uses the thick approach, it is easier to map the functionality into native-language constructs. (The Ada-bindings group (P1003.5) has

done this, and been praised for producing a binding that is very Ada-like—I don't know whether this can be thought of as complimentary.)

Thin bindings are more conservative. Because functionality is not defined in thin binding, there is no opportunity for errors or inconsistencies to be introduced. Moreover, thin bindings are easier to adapt to changes in the base document. For example, the FORTRAN binding currently references the 1988 version of POSIX.1. But POSIX.1 has been updated (1990) with several changes to functionality. The .9 group determined that the FORTRAN binding requires only one substantive change to reference the 1990 standard as the base document.

Work To Be Done

There is still much work to be done. At the April meeting, .9 processed responses to the public ballot. The group received a wide range of opinions that were discussed in Santa Clara in July. If all goes well, there might be a proposed standard by December.

My bet is that it won't run on an IBM 704, the way FORTRAN I did. -->

Peter H. Salus is the executive director of the Sun User Group. He has attended both ISO and P1003/P1201 meetings and expects remission of time in purgatory as a result. Email: peter@sug.org.

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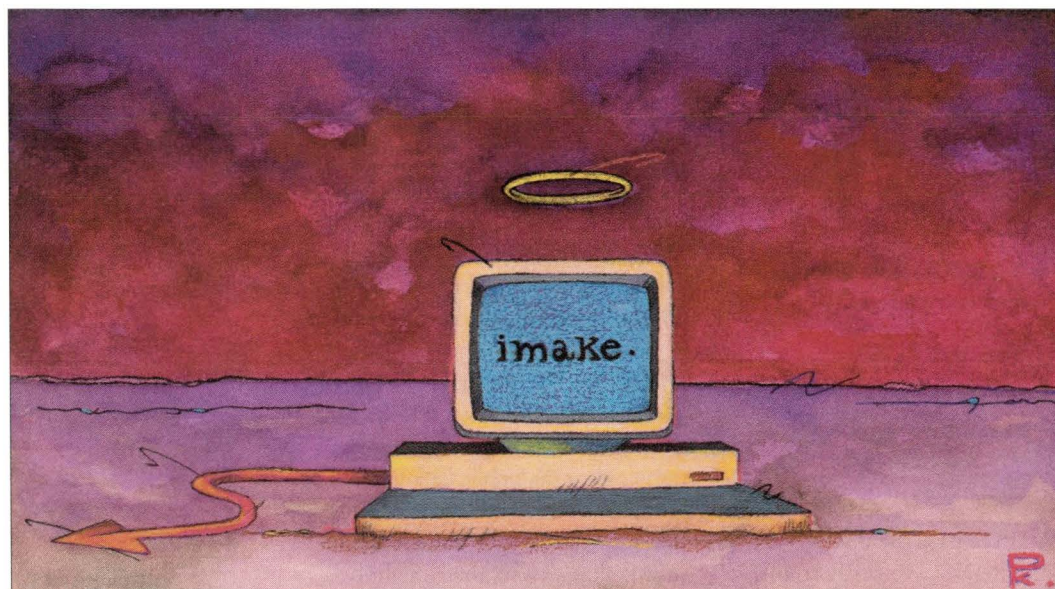


ILLUSTRATION BY PETER KALABOKIS

Imake: Friend or Foe?

by DINAH MCNUTT, Pencom Software Inc.

This month Miles O'Neal and I will provide a tutorial on `imake`—a useful tool for managing your Makefiles. If you have already encountered `imake` and have learned to despise and curse it, hopefully this column will help you better deal with its idiosyncracies.

Motivation

`make` (and variations of `make`) are valuable tools for compiling and installing software. `make` uses commands (usually stored in a file named `Makefile`) to determine which programs to compile, what to name the executables and where to install the software. Maintaining the `Makefiles` is usually pretty straightforward, as long as you have a small number of program directories and are only dealing with one computing environment.

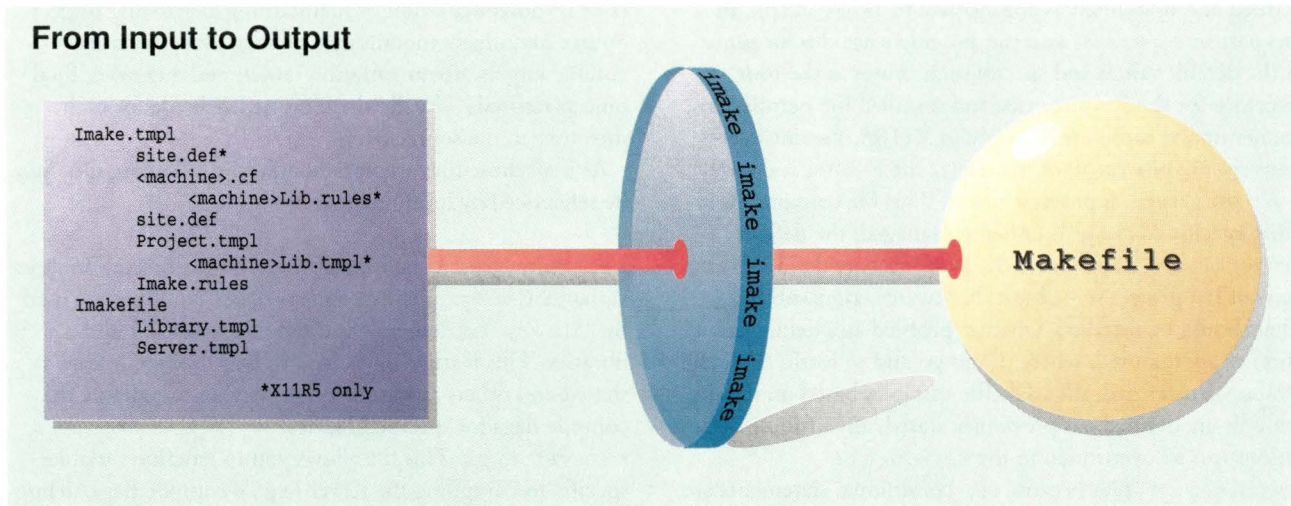
However, what do you do when your vendor comes out with a new version of the operating system and you now need to maintain two versions of your software? Not only do you want to install the binaries in different locations, but

the `Makefiles` must all be modified in order to add a flag for the new C compiler. You could keep two copies of everything or get real creative with your `Makefiles` in order to solve this problem, but these solutions are awkward and difficult to maintain.

You can see where the problem becomes even more complex if you add different architectures, several hundred program modules and a few directory trees. The effort to maintain the software can become staggering.

A utility that addresses this problem, `imake` uses configuration files that define default values for variables like `c` compile flags and directory locations for software installation. If you need to change a compiler option, you only have to change one or two files instead of several hundred. All the `Makefiles` have standard targets like `all` and `install`, so compilation and installation procedures can now be the same for all systems.

So why should a system administrator care about this? If you are a typical SA, chances are you may be involved in the support of X and have to deal with `imake` on a daily basis.



In addition, most SAs have a good understanding of what it means to deal with a collection of heterogeneous systems and may want to advocate the use of `imake` for supporting and maintaining local programs.

Imake

Developed at MIT as part of the X Window System project to address the problem of configuring X for different architectures, `imake` is included with the X11 source distribution and is provided as standard system software by several vendors. Software packages that use `imake` include programs that comprise the Project Athena distribution (`kerberos`, `zephyr`, et al.).

`imake` is short for “include make.” It uses the include-file and macro-processing capabilities of the `c` pre-processor, `cpp`, in order to generate Makefiles. Centralized configuration files are used to define the rules that govern how the Makefile is created with the capability to override pre-existing rules for special cases. The end result is a working Makefile.

In general, the process works as follows: You must create an `Imakefile` for each program or program directory. The `Imakefile` contains the `cpp` macro functions that indicate what program targets should be built. The script `xmkmf` is then used to bootstrap a Makefile using the `Imakefile` and centralized configuration files. `xmkmf` stands for X make Makefile and is located in `$TOP/util/scripts` where `$TOP` is the location of your X11 source tree. (Note, `xmkmf` is only available with X11R4 and X11R5. If you are still using X11R3, you will have to write your own version of `xmkmf`.) Finally, `makedepend` (another tool from the X Window development effort at MIT) is run to generate header file dependencies for C source code. Once you have a working Makefile, updates may be made by specifying the Makefile target that is common to all the Makefiles. Let’s look at this process more in depth starting with the configuration files.

How Imake Works

All of the central configuration files mentioned below (with the exception of the `Imakefile` that is located in the

same directory as the source code) are located in `$TOP/config`. `imake` processes the configuration files in the order shown in the figure above. The steps described below each result in a portion of the Makefile being created until the final result is a working Makefile.

`Imake.tpl` is the master template as indicated in the figure. It has several sections. The first section uses the `cpp` machine-specific trigger symbol to define the system-dependent configuration file. On Suns, the `cpp` trigger symbol is “sun” and the configuration file is `sun.cf`. You may ignore this part of the file unless you are adding support for a new system. The files described below are included in the `Imake.tpl` file via the `cpp` `#include` directives.

Therefore, the `site.def` file is processed next. Here, you can define variables specific for your site. The X11R5 version is divided into two parts. The first half contains the variables that should be defined before the `<machine>.cf` file is used. Any variables that the `<machine>.cf` needs should be defined in this section (such as whether or not you have the GNU C compiler.)

After processing the first half of `site.def`, `imake` then processes `<machine>.cf`. This file contains the platform-specific variable definitions such as:

- OS major and minor numbers,
- OS dependencies such as System V or BSD compatibility,
- whether or not the system supports Saber C,
- compiler flags,
- on Suns, whether or not you want to include SunView support.

The `sun.cf` includes support for all the Sun architectures including Sun 3s and 386i’s.

The `<machine>.cf` file includes `<machine>Lib.rules` (X11R5 only). This file contains the definitions for whether or not the system supports shared libraries and rules for creating libraries.

After processing `<machine>.cf`, `imake` returns to `site.def` and checks for the `cpp` symbols `BeforeVendorCF` and `AfterVendorCF` in order to determine which part of the file to execute. These symbols are

defined and undefined as appropriate in `Imake.tmpl`. In this part of `site.def`, you can provide overrides for some of the default values and specify such things as the root directory for the X source tree and installed file permissions. As mentioned earlier, this is only in X11R5. Previous versions simply process all of `site.def` after `<machine>.cf`.

`Project.tmpl` is processed next. This file contains everything specific to the project being managed; the default `Project.tmpl` is, of course, X. Symbols here define the parts of the project to be built, backwards compatibility, what should be installed, whether profiled and debugged libraries are required, where things go and so forth. After the symbols are defined, the Makefile variables based on these symbols are defined. As previously stated, any of these definitions can be overridden in the `site.def` or `<machine>.cf` files because `cpp` conditional statements are used to check if a variable has already been defined.

`Project.tmpl` includes `<machine>Lib.tmpl` (X11R5 only). (Actually, it includes `ShLibIncludesFile`, which is defined in `<machine>Lib.rules`.) This file contains the variables for building shared libraries.

`Imake.rules` is processed next and includes the macros (rules) to make all the targets, as well as the dependencies between the rules. These rules are not documented anywhere except within this file. The rules provided should be sufficient for most projects, but this is where you would add your own if required.

Now, the local Imakefile is processed. This step is the important part from the standpoint of someone developing

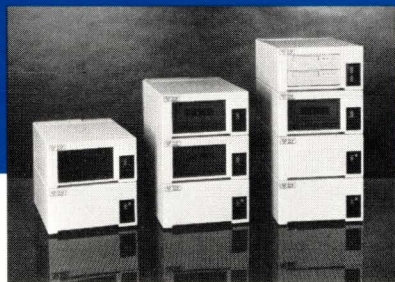
code or documentation or maintaining an existing project. Source and object modules are defined along with executable targets, documentation targets and any other final objects desired. (Usually there is one Imakefile for each directory in the source tree.)

As if all those files are not enough, the following files may be referenced by local Imakefiles:

- `Library.tmpl`: The Imakefile can define several Boolean variables (`DoNormalLib`, `DoSharedLib`, etc.) that are used by `Library.tmpl` to redefine variables used to build libraries. This feature allows you to build some libraries as shared and others as static without having to redefine the compile flags for specific libraries.
- `Server.tmpl`: This file allows you to redefine variables specific to compiling the server (e.g., `c` compile flags, debug flags, etc.).

Finally, rules common to all Makefiles are defined. These include subdirectory rules, notifications that installs are finished, etc. The `makedepend` program is run separately from `imake` (as one of the Makefile targets); it appends its output to the Makefile. The header dependencies generated by `makedepend`, if any, are the final statements in the Makefile.

In practice, you will usually only have to edit `<machine>.cf`, `site.def`, and the individual Imakefiles. The README file provided in the `$(TOP)/config` directory describes which variables are set in each of the configuration files.



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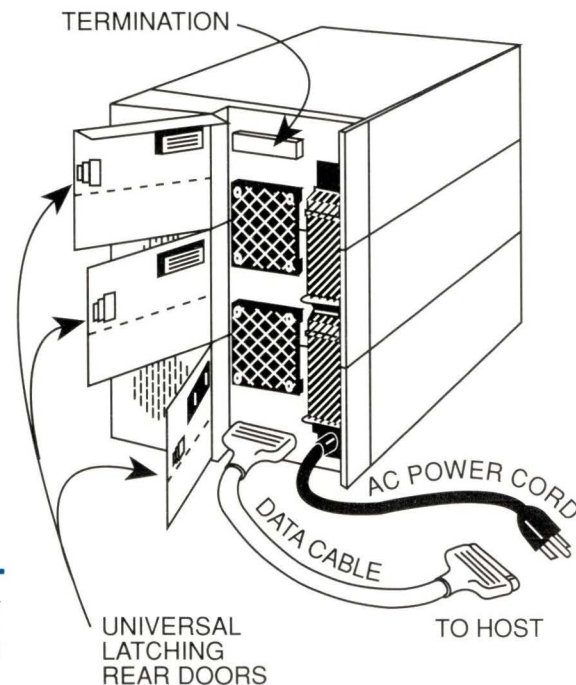
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Writing Imakefiles

Many people avoid writing Imakefiles out of fear or ignorance. They are actually quite easy to create and maintain. The following examples should work with all standard MIT versions of Imake, except where noted.

An Imakefile for a program with only one source is simplicity itself. The following example shows an Imakefile for a simple maze program. It uses only one macro call:

```
SimpleProgramTarget (maze)
```

Running this through `imake` will produce a Makefile containing all the targets (`all`, `clean`, `install`, etc.) plus one for `maze`. An equivalent, clean, portable Makefile with a few minor system dependencies and the targets `all`, `clean` and `install` would typically run 30 to 50 lines.

A more complex program with multiple source files is almost as simple. The Imakefile shown below introduces two new variables to be defined, `SRCS` and `OBJS`, and uses a different macro.

```
DISABLE_ROOT = 1

SRCS=main.c maze.c scrnsaver.c password.c
OBJS=main.o maze.o scrnsaver.o password.o
SYSLAST_LIBRARIES = -lm
```

```
ComplexProgramTarget (maze)
```

This example also introduces the variable, `SYSLAST_LIBRARIES`, which defines the libraries needed at the end of the `ld` line in the Makefile. User variables may be defined for the source code as well as with `DISABLE_ROOT` in the preceding example.

Libraries may be built with similar ease. Here is an example that demonstrates building a simple library named `libmaze.a`. It shows how to use the library to build an executable.

```
LIBOBJS = maze.o scrnsaver.o password.o
NormalLibraryTarget (maze, $(LIBOBJS)
SRCS=main.c
OBJS=main.o
NormalProgramTarget (maze, $(SRCS), libmaze.a, , ,)
```

Versions of `imake` through X11R3 did not have `NormalProgramTarget()`. For these, `SingleProgramTarget()` should be used. The calling sequence is the same; however, no dependent library parameter—the third parameter—is included.

To test an Imakefile, run `xmkmf` in the directory in which the Imakefile resides. You can then run `make -n` against the new Makefile to check syntax, options and so on.

Many more targets are available. A complete list for any version of `imake` should be available in `$(TOP)/config/make.rules`. Some common types of targets to build include `lint` and profiled libraries, man page installs, and subdirectories.

Hints and Gotchas

Instead of writing Imakefiles from scratch, find one that is close to what you want and modify it. You can also copy a working Makefile from another directory on the same level of the source tree hierarchy and type `make Makefile` in order to create a Makefile from your Imakefile. This is usually easier than using `xmkmf`, but you have to “touch” your Imakefile if you copy the Makefile after you write the Imakefile.

Another hint: Initial scrutiny of the X11R5 config directory will uncover the following enhancements to the X11R5 `imake` process:

- Support for new hardware including Convex,
- The addition of new central configuration files: `<machine>Lib.rules`, `<machine>Lib.tmpl`,
- Extensive shared library support.

`imake` is not just for X and it is not just for source code. You can use `imake` to install shell scripts, for instance. One idea that comes to mind: use `imake` with other tools I’ve discussed in this column (`watcher`, `rdist`, `expect`, etc.) in order to distribute and install utilities for system administration. Because each system is a little different, you can write your own macros to handle exceptions and weirdness.

Acknowledgments

This was the most difficult column I’ve written so far. It would have been more difficult without the help of Miles O’Neal, fellow Penncommer. Miles claims to have been working with X forever: He can be reached at `meo@pen-com.com@cs.utexas.edu`.

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Dinah McNutt is on the board of directors of the Sun User Group and is employed by Pencom Software Inc., a consulting and software-development company headquartered in Austin, TX. Her email address is `dinah@expert.com`.

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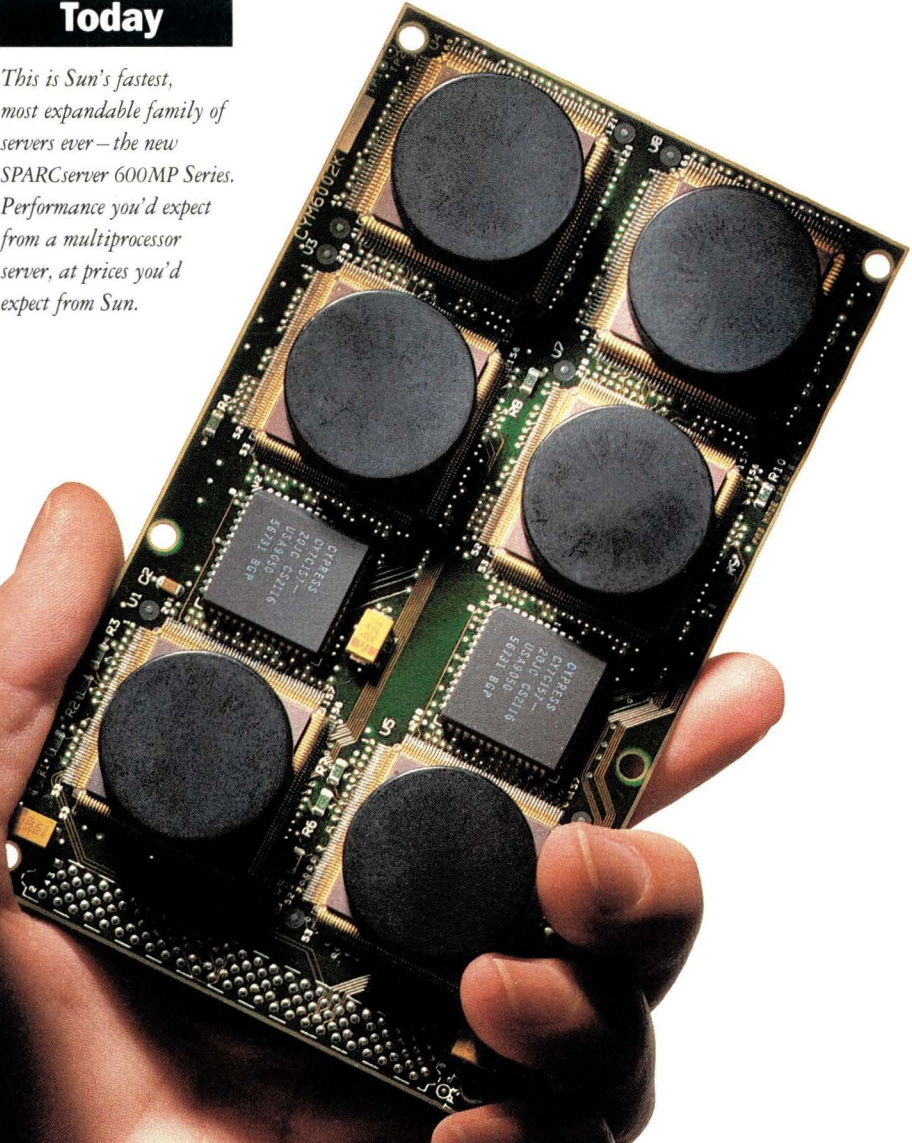


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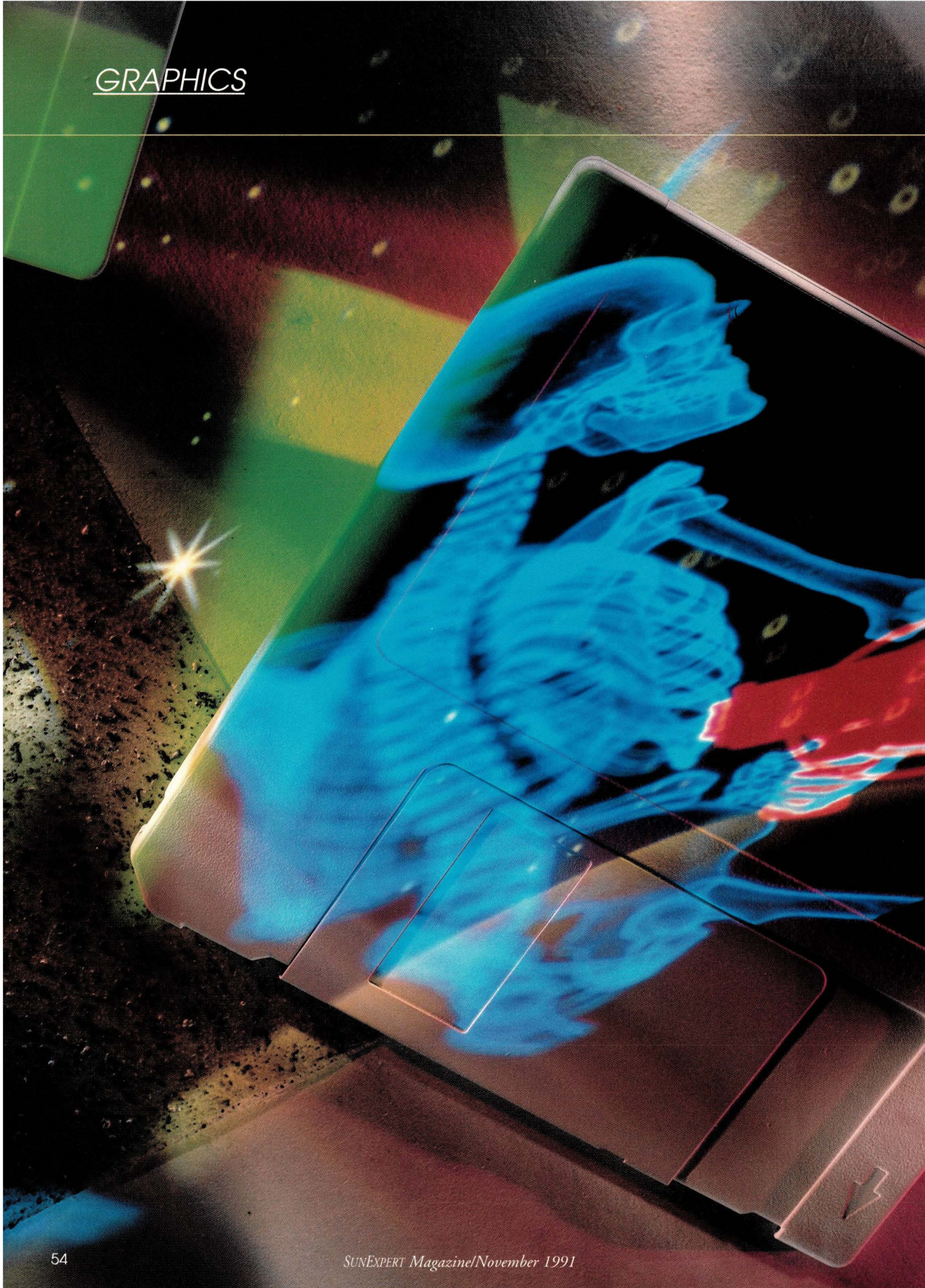


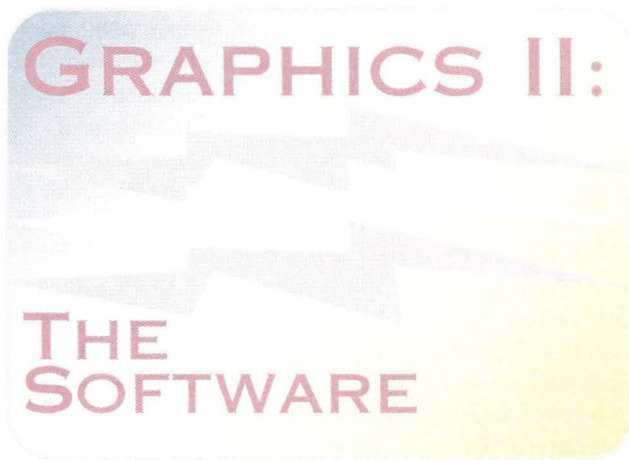
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*The next generation of UNIX servers will yield even more powerful capabilities with the arrival of the next generation of client-server system software.**



GRAPHICS





No where was the essentially ambivalent relationship between Sun Microsystems Inc. and graphics revealed more clearly than at this year's Siggraph. The 1991 keynote speaker at that preeminent graphics show, which manages to somehow combine the flavor of Comdex with that of the Cannes Film Festival, was none other than Sun's CEO, Scott McNealy.

In his speech, McNealy made reference to the fact that high-end graphics had been the making of his company. It was, he recalled, at exactly such a graphics show that a very young, very small Sun had been identified as the machine to which Pixar rendering machines were being attached, and with which the special effects of Star Wars were being done. Instantly, the company's booth had been filled with customers. "Now," said McNealy, "we send 150 employees to make sure that the booth's packed at all times."

But, in the same speech, McNealy also made it clear that he came not in homage. His audience was filled with graphics gurus, to whom his company owed much, yet he made it clear that high-end graphics remain only a passing interest for Sun. "There is always a trade off between what is fun and what is useful," he said. And the very-high-end graphics that otherwise dominated the show—the liquid-metal android of Industrial Light and Magic, the virtual-reality exhibits at the back of the hall, the strange and wondrous art forms of the electronic theater—these did not seem to rate high on his list of the useful.

Suns are not supposed to be graphics boxes. Yet, they are increasingly a favorite of graphics ISVs.

by MICHAEL JAY TUCKER,
Executive Editor

Indeed, said McNealy, in the age-old confrontation between art and commerce, maybe computer graphics should really focus on the latter. "I think it is fun to hang out in a lab and invent something," said the Harvard Business School-educated McNealy to the computer scientists of the room, "but I think it is a total blast to have a channel of distribution and a customer base that wants to use it."

Yet, if he said things that seemed—at first blush—absolutely antithetical to the fundamental beliefs of his audience, then so, too, did he present them with a vision—an inexpensive, standardized platform most of them

could afford, and for which all of the software developers among them could write in relative safety.

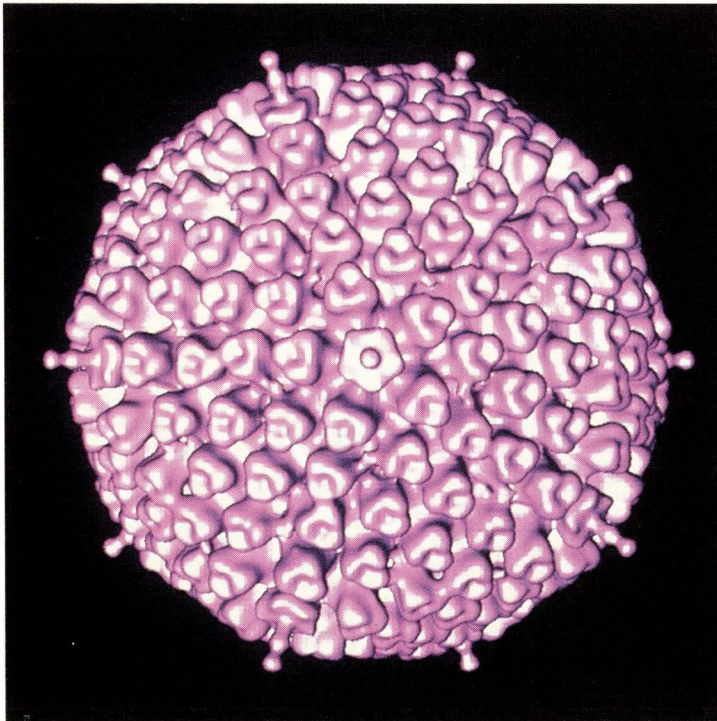
'I'm Bah-ack'

The unquestioned champion for high-end graphics among workstations is Silicon Graphics Inc. It is the company that, more than any other, realized the promise that Sun seemed to make back with Star Wars. Not only are the company's workstations used in virtually every application where very-high-end 3D graphics are a requirement, but also its Graphics Library—GL—has become effectively the standard for graphics applications. When IBM Corp.

debuted its RISC System/6000, for example, it did so with GL as a licensed part of the product.

Moreover, GL is at the heart of many vendors' offerings. Graphics-technology analyst Ron Roncarelli, publisher of *Pixel* newsletter, identifies the top names in the very-high-end graphics software as "Alias Research Inc., Wavefront Technologies, Soft-Image Inc. and Thomson Digital Image Inc. (TDI)." Of these, only Wavefront is on Suns.

There is only the remotest of possibilities that the other three will ever make that transition. "We depend on SGI," explains J. Peter Goldie, mar-



Courtesy of The Wistar Institute

Visualizing A Killer

One user of Stardent Computer Inc.'s AVS is Phoebe Stewart, a post-doctoral fellow (supported by the Helen Hay Whitney Foundation) at the Wistar Institute of Philadelphia. She is involved with a visualization effort headed by Professor Roger Burnett, with collaborators Stephen Fuller and Marek Cyrkaff of the European Molecular Biology Laboratories, Heidelberg, Germany, to visualize the Adenovirus. "It isn't the most deadly virus in the world," she notes, "but it is very large and complex."

But, she explains, there is deadly and there is deadly. While the virus itself isn't a vicious brute on the level of, for example, AIDS or plague, it can still be a killer. It causes conjunctivitis and dysentery. In developed countries, such things are only mild diseases. In the Third World, though, where clear water may not be readily available, the virus can cause death by dehydration. In fact, it is a leading cause of death among children in the Third World.

Thus, there is real motivation to find drugs that could control the disease. To this end, Stewart's group is visualizing the virus with AVS. "It turns out that the virus is held together by a relatively small number of cementing components," she says. "And those may be ideal targets for an antiviral drug."



keting director for Alias. "We've always been on SGI. No one else had the graphics performance." And, no one else had GL, at least not until now. "We're tied into GL," he notes. "When IBM introduced the RS/6000, it was easy for us to port to it."

Yet, those who have Suns but want GL don't have to abandon all hope. GL has recently been made available for license...though it isn't yet on SPARC. Moreover, GL emulations exist. One of these is PX/GL from Du Pont Pixel Systems. It does not currently run on the SPARC processor itself, but rather on Du Pont's own i860-based graphics boards for Sun workstations. However, company officials hint that the product could migrate to the SPARC, if there were sufficient incentive to do so.

In addition, Sun has itself recently introduced XGL, which the company says brings to its X-based environments a GL-style of programming.

Wavefront Technologies is the only member of the Graphics Gang Of Four to run on Sun Microsystems Inc. equipment. The image, "Clockscape," was created with Wavefront graphics software and data supplied by Seiko, the famed maker of time pieces.

Beyond GL, there is Wavefront, the only member of the high-end Graphics Gang of Four to port directly to Suns. The company did so not because of any particular admiration for Sun's technology, but because it recognized there was a vast population of Suns out there whose users might wish to do graphics. "It is important," explains the company's vice president of market development, Ian Reid, "to make our products available on the platforms the

customers actually have." In particular, the company is promoting its scientific-visualization products on the Sun.

Another big-name graphics company that Sun users can consider is Intelligent Light Inc., which offers a suite of several visualization and rendering products. The company differs from the Big Four in that it tends to focus on scientific, technical and engineering applications. At this year's Siggraph, Intelligent Light stressed its products' ease of use, as well as their power and functionality.

Then, there's Pixar, the company whose very name is in some ways synonymous with high-end graphics. It was Pixar that first put Suns in the graphics business when it built its Pixar Image Computer processors to run off them. Later, Pixar had sold its hardware business to Vicom Systems Inc. and today divides its time between producing computer animation for the commercial and enter-

tainment industry, and providing software and software services to the computer industry.

Among other things, Pixar has spent the last few years promoting the RenderMan interface, a comprehensive 3D scene-description specification. This defines the way that software should describe objects, lights, scenes, etc. It allows a RenderMan-compliant package running on one

machine to write files that can be read and rendered by a RenderMan-compliant package on another machine.

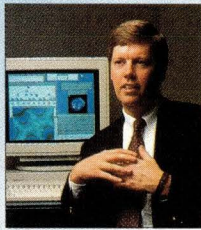
Several companies, including Sun, have embraced the interface. Moreover, Pixar sells a RenderMan Toolkit—software for OEMs that wish to incorporate RenderMan-compliant functionality in their own products. “What we have, basically, is a toolkit for developers who want to use the

interface. It is a sales tool for an OEM relationship,” explains M.W. Mantle, Pixar’s director of 3D graphics.

Thus, Sun users can get RenderMan code from such companies as Autodesk Inc., which uses the product. However, Pixar is more than just a technology supplier to ISVs. At least some sophisticated end users are buying the RenderMan Toolkit and using it on Suns straight out of the box. “We’re finding

Just Imagine Imaging

Sun Microsystems Inc.’s CEO and president, Scott McNealy, began his Siggraph '91 keynote address with a videotape parodying himself. At the beginning of the tape, McNealy is shown at golf. He scores an improbable hole-in-one thanks to an image-processing application that causes the ball to zoom into the cup with the deadly accuracy of a cruise missile.



The tape was purportedly comic, but McNealy’s, and by extension, Sun’s, interest in imaging and image processing—at the expense of graphics—was evident throughout this year’s Siggraph. In his talk, McNealy said bluntly, “In the past, we’ve spent on graphics. In the future, though, perhaps we will spend more on imaging.”

And, given Sun’s market direction and focus, that actually makes sense. Imaging tends to be the business of pattern recognition. As a very rough rule, imagers are interested in taking pictures and then making sense of them afterwards. Typical applications range from machine vision to military intelligence.

Some companies are offering software-only solutions—such as Paragon Imaging Inc. Paragon products include the Visualization Workbench, image-analysis software for Sun and other UNIX workstations. Traditionally, though, imaging is done with specialized hardware.

Among imaging hardware vendors is Datacube Inc., which offers among other things the MaxVideo 20. “This is an off-the-shelf image-processing solution,” says Susan Snell Solomon, director of the university program at Datacube. “It is a two-slot, 9U VME image-processing board...a real-time, 60-frame-per-second video digitizer and display.” It can link to SBus system via a connector.

Yet another board maker is Imaging Technology

Inc., whose product line is made up of some 15 VME boards. Typical of these is the VSI-150/151 Variable-Scan Interface. This board is made up of a camera interface to digitize images from standard cameras and a display controller. It, too, can link to SBus systems via a connector.

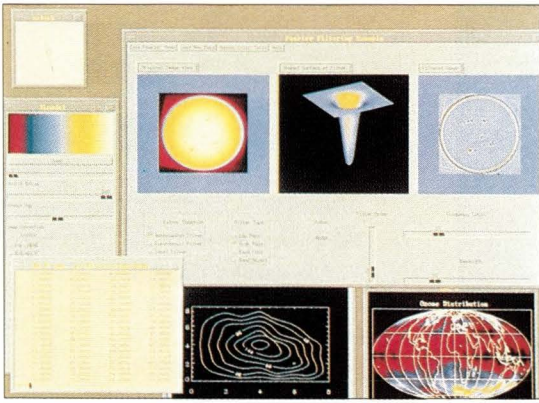
For those uninterested in a board-level solution, there are several add-on image processors on the market. Visual Information Technologies Inc. (VITec), for example, offers a PICAbbox, an enclosure that houses the company’s image-processing boards separately from the user’s system. The PICAbbox-50, for example, fits under a SPARCstation.

In addition, VITec has recently introduced the VXA raster accelerator, a single-slot SBus card that provides a SPARCstation or SPARClike with 24-bit true-color display, an 8-bit pseudocolor display, eight configurable overlay tag bits, two lookup tables, and double and triple buffering of pseudocolor windows. The product thus has applications in graphics, imaging and video.

Another imaging vendor is Vicom Systems Inc. Vicom, which says it is the largest independent supplier of imaging hardware, recently introduced the Master Image Data Server. This is a tower-configured system based on Sun’s own GX/MVX i860-based products.

Vicom has essentially remade itself over the last year. The company offers a number of different products from a number of different sources. When Pixar, for instance, decided to get out of the hardware business, it was Vicom that picked up the Pixar image-processing hardware line. Today, though, the company is attempting to gradually focus its efforts on the i860-based product line, and on its relationship with Sun. The two companies seem to be becoming very close indeed.

Meanwhile, Ramtek Corp. offers a SPARC-based imaging workstation, the Millennium. It is, in effect, a vertical SPARClike devoted to image-processing applications.



Scientific visualization may be the most active field for Sun Microsystems Inc. in graphics. Products include IDL (above) from Research Systems Inc.

that people are buying it...for their own rendering," says Mantle.

The Vast Middle

Software such as that from Alias and TDI is at the very top of what can be done with graphics on computers. However, this does not necessarily mean they represent the broadest possible market. Rather, their users tend to be an elite group. Individually, the purchasing power of such people can be staggering, but as a group, it is rather tiny relative to everyone else. "There is a tremendous market [for graphics] out there," asserts market analyst Roncarelli. "But it is not at the high-end. It is in the middle."

And, in fact, for Suns and SPARC-like, there is already considerable activity at the low-end—at what might be called the level of personal graphics. While ISVs still favor PCs and Apple Computer Inc. Macintoshes, and even Commodore Amigas, for such software, workstations are beginning to catch up. For instance, Island Graphics Corp. has marketed for some time a suite of products—IslandDraw, Write, and Paint—that gives UNIX systems capabilities like those of Mac and Windows-based systems. "We are not trying to be the Quark [Inc.] Xpress of workstations," explains David Newman, Island Graphics' marketing manager. "Rather, we are going to people

who are bringing graphics into an existing situation." In other words, the customers already have workstations, and now long to bring some sort of graphics functionality to an existing application. In addition, Corel Systems Corp. announced in September that it is shipping its CorelDRAW program for Sun under Motif. CorelDRAW is an illustration program formerly confined to PCs.

Ficor Inc., meanwhile, offers AutoGraph, a graphics package consisting of a charting program, a drawing program and SlideShow, a display facility. Other graphics products are supposed to be coming soon. Computer Support Corp. says that it will shortly be porting its PC-based composition and

drawing package to Suns. It already sells a clip-art package for Suns, as does T/Maker Research Co., whose ClickArt Volume contains some 1,000 images.

But, in general, the products showing up now tend not to be graphics products per se; rather they are applications with some aspects of graphics to them. With the exception of CAD/CAM and other design-oriented applications, a field so broad that it requires quite a separate article, the graphics products coming on line for Sun are now frequently vertical applications—geographical information systems, imaging applications, desktop-publishing packages and so on.

Of all these vertical markets other than CAD, the one with the most potential for growth may be business-oriented graphics. Already, companies as diverse as Applix Inc., Informix Software Inc. and Clarity Software Inc., provide various charting and plotting facilities.

But, at the moment, the leading

“ If you’re looking for a scientific computing and visualization environment, you owe it to yourself to check out IDL.”

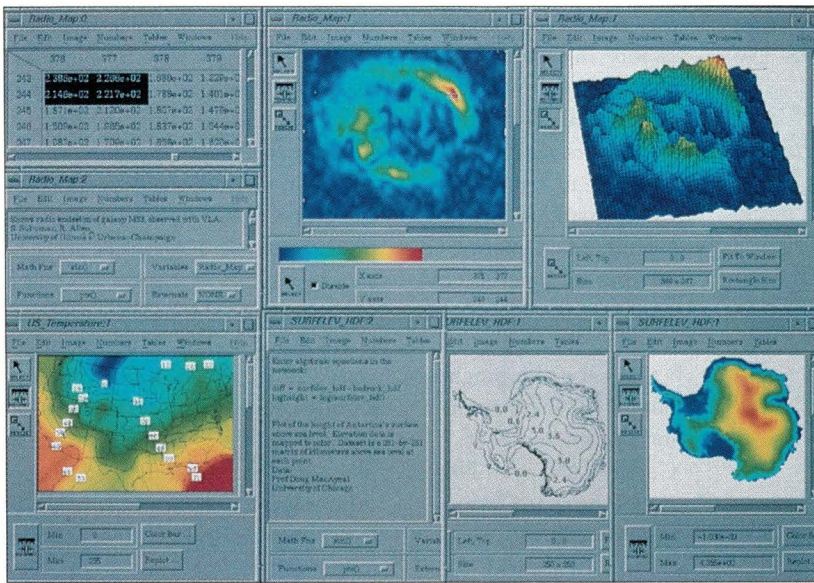
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Companies with university connections promise to be a source of very cost-effective scientific-visualization software. Spyglass Inc., for example, says that its products are meant for visualization on a budget.

graphics market for Suns seems to be visual data analysis. For example, Precision Visuals Inc.'s products include PV-Wave, a suite of several different software packages for "reading, displaying, reducing, analyzing and re-displaying large...datasets." PV-Wave is a quick and reasonably easy way to tabulate data into readable charts. It isn't going to compete

any time soon with high-end animation packages, but PVI doesn't care. "For every one of the high-end guys, there are 10 or 12 at the low end," explains Brian Ritchie, PVI's vice president of marketing. In fact, right now, he sees his company's future in the application of PV-Wave to business graphics—that is, to the business professional who must quickly inter-

pret large amounts of data.

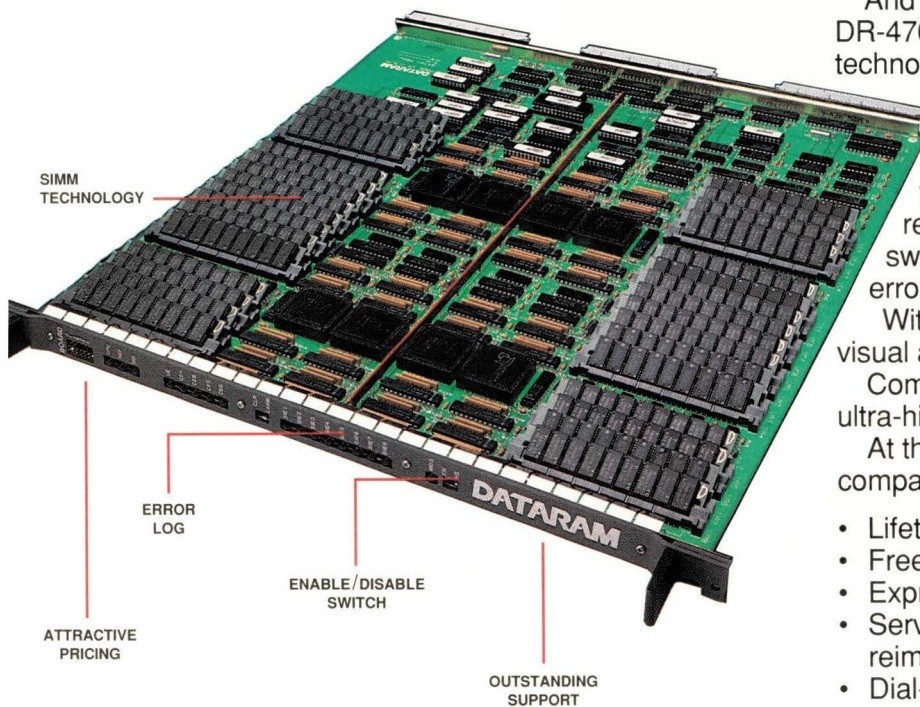
PVI's approach to the market has been to offer scientific visualization with an absolute minimum of fuss. In effect, it is scientific visualization for scientists who don't wish to program. A company with which PVI has some connection, but which has taken quite a different approach is Research Systems Inc. RSI's product is IDL, a

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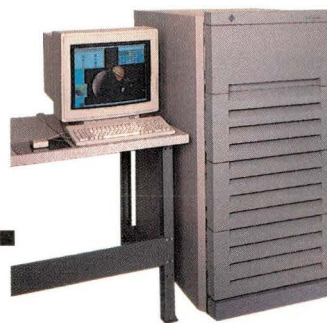
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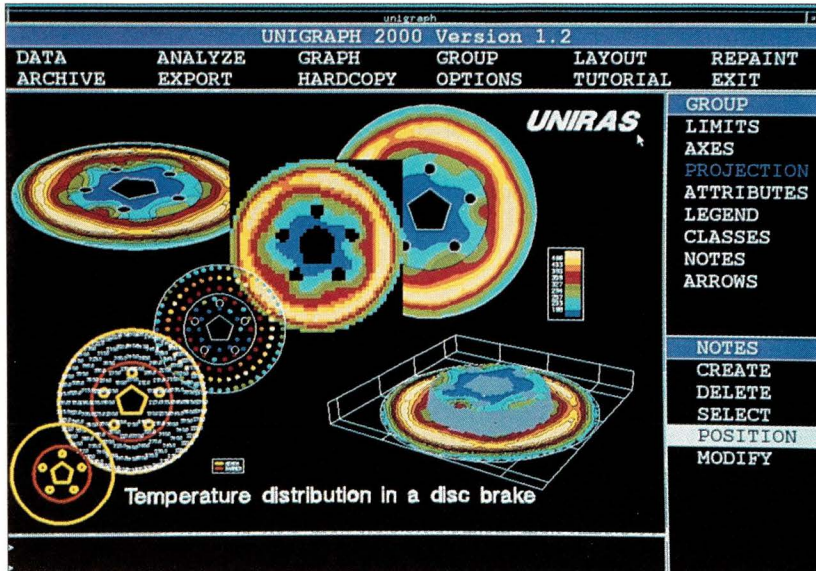
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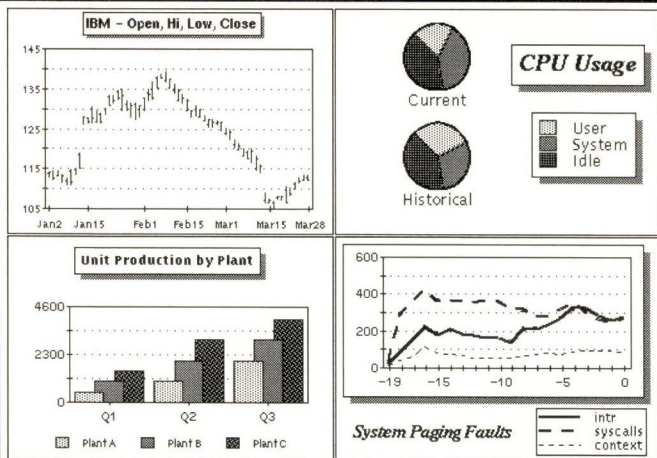
Unigraph+2000, from Uniras Inc., blends numerical analysis with data visualization. Here, an engineering application shows temperature distribution on disk brakes.

graphical environment for the rapid analysis and display of data.

RSI says that it supplied some of the source code that went into PVI's original products. Now, however, there is no connection between the two companies on their products. Where PVI stresses the ease of use of its products, RSI promotes its products on power and programmability. IDL users range from NASA to Oak Ridge National Laboratories.

Several other vendors have recently gotten into the field, sometimes by design, and sometimes almost by accident. Stardent Computer Inc., for instance, markets its own line of visualization-oriented workstations and servers. As part of its sales efforts, it developed the advanced visualization system (AVS). This was an easy-to-use scientific-visualization package, somewhat like PV-Wave. Rather to the company's surprise, AVS proved popular. Stardent ported the software to a variety of systems—including Suns—and is now selling it (see "Visualizing a Killer").

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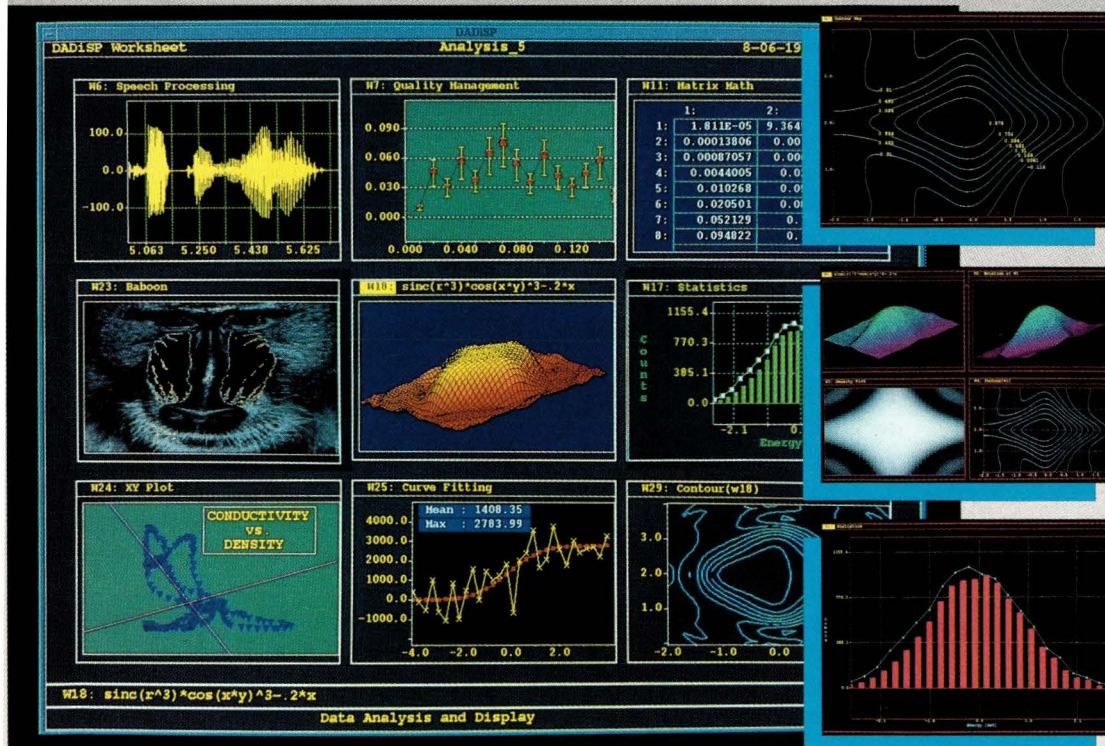
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Despite recent upgrades, Sun workstations remain middle-of-the-road graphics boxes.

Meanwhile, what could be particularly cost-effective sci-viz products are coming from the universities and research establishments. Over the last few years, academics developed a variety of scientific-visualization packages as a by-product of their research. Now, several of those are coming to the commercial market. The Ohio Supercomputer Center, for instance, developed a visualization package known as apE. At Siggraph '91, TaraVisual Corp. announced that it had come into business expressly to commercialize apE.

Another product with a university background, though one not yet on Suns, is Spyglass Transform from Spyglass Inc. Like PV-Wave, the Spyglass products provide inexpensive, easy-to-use visualization to researchers who don't wish to program. "Basically, our goal is to be the MacWrite of visualization," says Brad Fortner, the company's director of research and development. The Spyglass products are on SGI workstations and Macs; however products for Suns are said to be on the horizon.

Meanwhile, graphically oriented software for Suns is showing up in numerical processing and analysis, as well. Mathematica, from Wolfram Research Inc., is arguably the most

widely used software package for technical computation on PCs and workstations. In its more recent incarnations, Mathematica has consistently added more and more graphics functions.

Statistical Sciences Inc., meanwhile, offers S-Plus, an interactive programming environment for data analysis and graphics—with a particular focus on statistics.

A new entry into the numerical-processing business is Uniras Inc., with its Unigraph 2000 and agX/Toolmaster, both programming tools for numerical data visualization and analysis in the X Window System environment. The company says that its products are geared toward engineering and scientific applications.

And finally, Sun itself has—if not exactly product—then a means to products. It has SunVision, a "software platform" for ISVs and some end users. This is a set of visualization functions that can be incorporated in applications aimed at such markets as image processing, volumetric data display, 3D interactive graphics and rendering.

Several vendors are also offering developer's tools with a graphics orientation. KL Group Inc., for instance, sells XRT/Graph, a charting and plotting library for XView developers. KL says that the product is the first commercial XView extension of the market.

The UnFun Stuff

There are, of course, other players and other markets in Sun graphics. In fact, you would be hard pressed to find a vertical application on a Sun—ranging from geographical information systems to preprocess to digital signal processing (DSP)—that

isn't incorporating more and more graphics with every passing revision. But, suffice to say that Sun workstations are seeing a bit of a boom when it comes to graphics software. Not a big one, perhaps, but still a boom-lette all the same.

And that's odd. Despite recent upgrades in their graphics performance, Sun workstations remain middle-of-the-road graphics boxes. And, McNealy's comments at Siggraph suggest they're going to stay that way for, essentially, ever.

But, that may be the very reason for their success. Consider the IBM PC. The PC, and its successors, were always little more than ASCII terminals with a local CPU. For graphics tasks they were and still are far inferior to, say, the Commodore Amiga, or even the Mac. Yet, because it was so generic, so unspecialized, so...in other words...standard, it could be almost infinitely modified by third parties. Thus it is today that the PC is easily on par with the Macs and Amigas of the world in graphics tasks—because of, rather than in spite of, its limitations.

That, clearly, is what Sun hopes will now happen with its workstations. The machines will never be optimized for graphics or any other application. Sun will always provide just the minimum in graphics power that its buyers can tolerate. Then, someone else, third parties, can provide the special powers, in hardware and software, that go beyond that bare minimum—and everyone, Sun included, will benefit. At least that is the strategy, and neither Sun nor Scott McNealy seem to have any doubts at all about it. "We just have to be able to have the discipline not to go off and do the fun stuff," says McNealy. ➔

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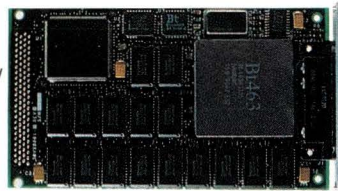
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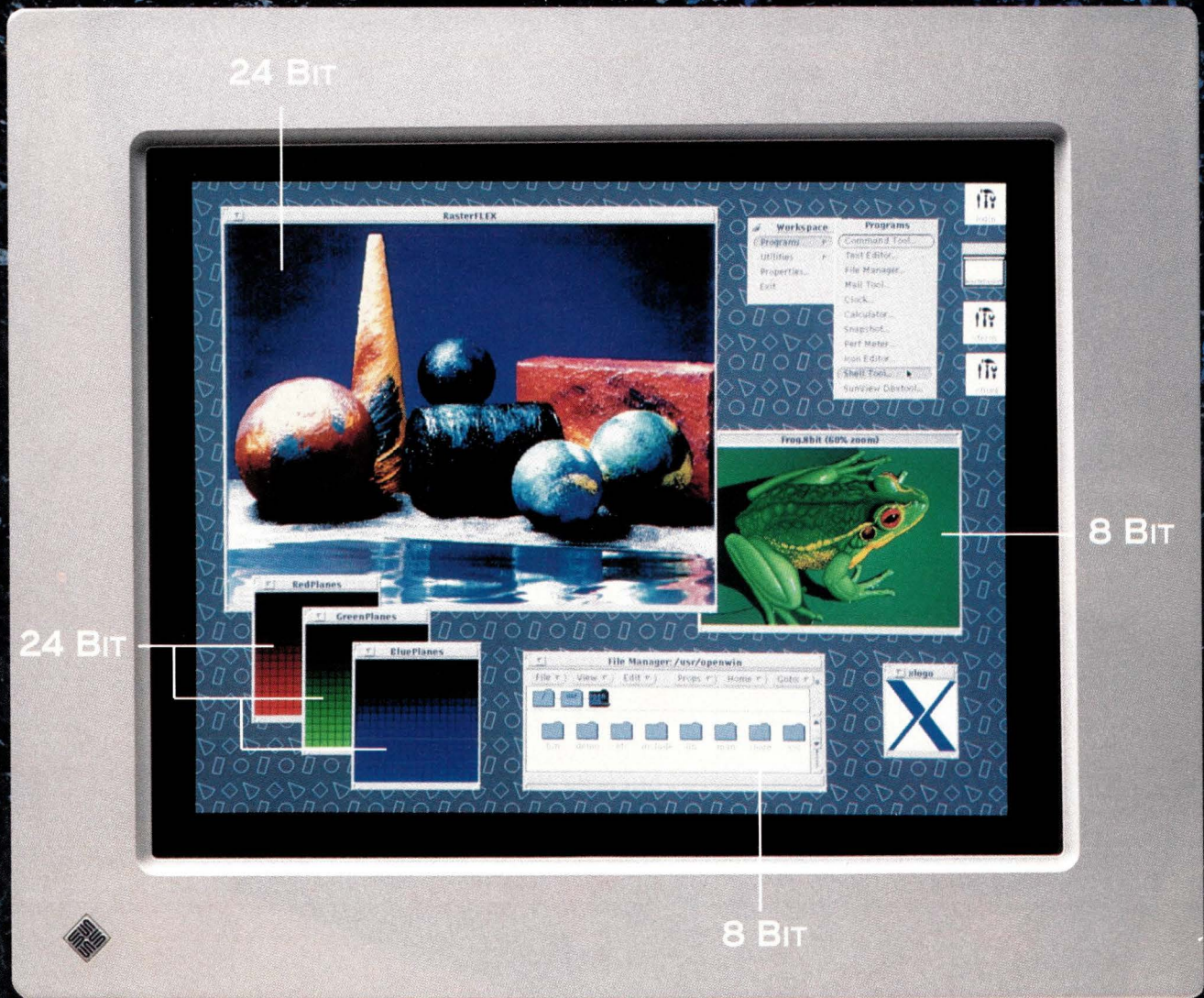
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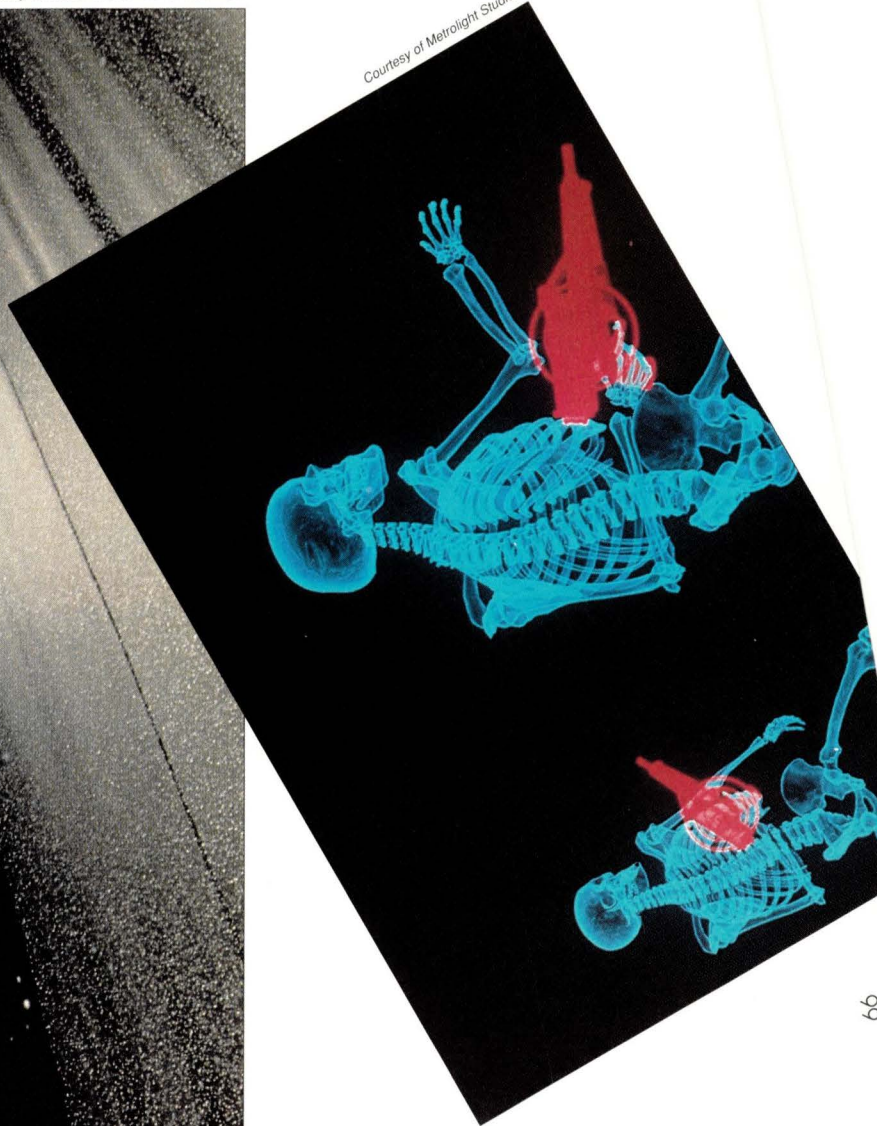
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Courtesy of Kleiser-Walczak Construction Co.

Courtesy of Metrolight Studios



That's Entertainment!

by MICHAEL JAY TUCKER,
Executive Editor

For a machine that's not supposed to be a graphics platform, Sun Microsystems Inc. workstations show up in the darndest places. The movies, for instance.

Computer animation for major motion pictures is among the most glamorous, demanding and expensive of modern computer applications. While there is a growing number of firms offering such services, those which do so successfully on a long-term basis remain a mere handful. Among that tiny few, almost none uses Sun workstations for the actual production of animation.

That is not to say that Suns and other SPARC-based systems are absent. For, if they are not being used in animation, they are being used for almost everything else. They are, in effect, the general-purpose machines that hold together networks of more specialized graphics devices.

Professional Smoke and Mirrors

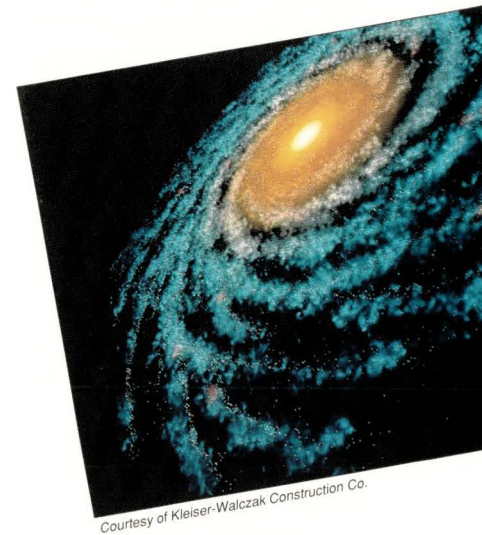
Thomas R. Schroeder is systems manager, administrator and programmer ("basically I'm the UNIX guru around here") at a company that can-

not be named. His firm's public-relations department has recently instituted a policy of strict non-cooperation with the computer-oriented press. But, Mr. Schroeder volunteered to be interviewed, anyway. To protect him from the wrath of his own PR department, *SunExpert* will not identify his company directly.

However, suffice to say that his firm is perhaps the most famed of all the special-effects operations in Hollywood today. For over 15 years, it has provided visually stunning images for dozens of hit films. It has created battling space ships, extra-terrestrials on flying bicycles, poltergeists, exploding Nazis, and, in this past summer's hit, a killer android composed of molten metal.

"Here," says Mr. Schroeder, "we do most of the heavy-duty rendering on Silicon Graphics [Inc.] boxes." But, he notes, there are Suns in place as well. "They're our generic workhorses." They are the machine on which general-purpose computing is regularly done. If it is computing, but it isn't rendering, then it's usually done on a Sun.

More importantly, the Suns per-



*A*mong the most demanding applications of computer graphics are film and video. Even here, SPARC-based systems are finding a role.

form an interface role. "We use them," says Schroeder, "basically for what you might call image processing." But, he means by this something different from traditional imaging. The company uses multiple clusters of SGI machines to do the actual animation. But, Suns then act as the link between the individual clusters and the world at large. In effect, the Suns are the oracles that put data into the clusters, and take finished images out.

Schroeder says that his biggest concern is his network, which must pump huge amounts of data through many different nodes. "We've done such things as collapse gateway boxes just because of the level of traffic," he says. "We had one that collapsed every day at just about 3:30 in the afternoon. We had people taking bets—would it go down today at 3:29? Or 3:31?"

What would make his life easier?

"Well, sub-netting helps," he says. If he could advise workstation makers, though, he'd tell them, "To have a stronger hold in graphics they should change their architectures a bit and move toward multiprocessing. It seems to help a bit. You don't have one function grab the whole CPU." And he should know. "We have SGIs that are running so hard they shut down their own accounting operations."

MetroLight and SPARC

A company that is not using Suns, but is using SPARC, is Metrolight Studios. Metrolight is another of the leading lights of the movie industry's computer-graphics providers. "We've sort of veered away from broadcast graphics," says Tim McGovern, the company's director of production. "It is kind of boring for us. We like the challenges of film work."

Mr. McGovern has dealt with challenging technical assignments on a regular basis. Prior to Metrolight, he was one of the animators on the now-famed "Sexy Robot" animation seen at virtually every graphics show. At Metrolight, he directed the computer effects for the recent thriller, *Total Recall*.

Like Mr. Schroeder's company, Metrolight uses SGI machines for its animation. But, for much of everything else, it uses Solbourne Computer Inc. systems. "Solbourne does most of our true computing," McGovern notes. "We use them as file servers, and to link to our film recorder."

Metrolight bought Solbournes because they are standards-based products. "We decided to go with something like a Sun, because it would connect to so many other things," he explains. Connectivity was a major

Video Ventures

If film isn't a field Sun Microsystems Inc. itself finds particularly interesting, video is quite another story. Video fits in with Sun's stated intention to enter the commercial markets. At Siggraph '91, Sun CEO Scott McNealy envisioned every business office equipped with video servers, pumping information to executives' workstations. "People won't write reports any more," he predicted. "They are going to produce *60 Minutes* segments."

While business executive as video producer remains still some ways off, there are already several products that put video on Sun screens. Sun itself offers an inexpensive route to at least some video functionality in the form of the VideoPix board.

A number of third parties offer higher-end solutions. Parallax Graphics Inc. is one such, and it has just released a new product, the Xvideo SBus board. "Basically, it allows you to display photorealistic images combined with video input and output," says John Ricketson, Parallax's vice president of marketing. At a price of \$5,995, the product integrates real-time video digitizing, graphics and image compression. Ricketson says that the product may be particularly useful to corporate media

divisions, in that with it, "you could do video editing in the computer...you could generate a reasonably professional tape with nothing more than a VCR."

Another player in the same market is RasterOps Corp. RasterOps has multiple products for SPARCstations, as well as a long history in bringing video to the Apple Computer Inc. Macintosh. In May 1991, the company purchased yet another firm, Truevision Inc., one of the more important names in graphics and video for PCs.

Still another vendor is RGB Spectrum, which offers both video boards, and boards that support specialized video functions. Last July, for example, RGB introduced a high-resolution video mixer, which combines the video outputs of two or more computer displays.

For users who don't want additional hardware, a software solution exists as well. Paradise Software Corp., for example, offers a set of several software products that allows users to put limited motion video on their Suns without additional hardware. "Ultimately, every computer will have native video hardware," says John A. Melleo-Roach, the company's managing partner. "But, until we have hardware on every machine, we have a low-cost, software-only approach."

Putting It On Film

To get computer graphics from the computer to film, you need a film recorder. The problem is, most film recorders are expensive. Now, however, low-cost options are starting to appear. Last July, for instance, Polaroid Corp. and Apunix Computer Services announced an agreement under which the two companies would provide digital-film-recording capability for Sun Microsystems Inc. workstations.



Courtesy of Polaroid Corp.

Polaroid's side of the bargain is the Digital Palette CI-5000. Apunix, then, has developed the SCSI driver, NeWSprint driver and raster file filter that makes the CI-5000 compatible with Suns. Apunix is also marketing the product.

With the CI-5000, users can create 35mm slides, overhead transparencies, prints or chromes. Pricing begins at \$5,995.

necessity, given the fact that the company has a very heterogeneous network.

McGovern isn't sure where he will go next for hardware. He admits that Suns are starting to have at least some appeal, even in animation. "The Suns are interesting," he says, "because they're getting faster."

As for software, McGovern says that Metrolight now uses mostly its own internal applications, though that might not last forever. The company originally used software from Wavefront Technologies, but developed its own after 1988. "People began to feel that the ISVs weren't developing as fast as they should have."

However, he says, the ISVs are now hurrying to catch up, and McGovern thinks they soon will. "I mean, you have to compare their horde of 70 programmers to our five."

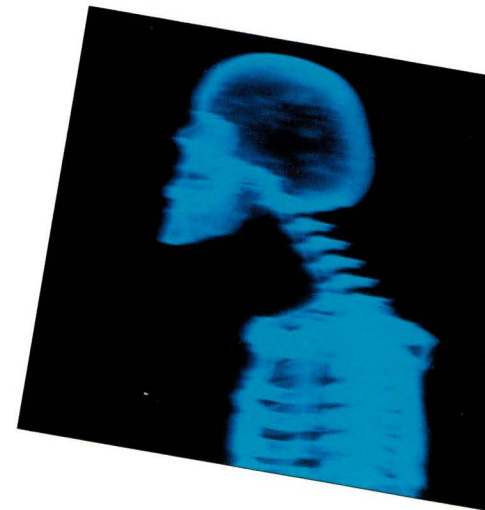
Vaster Than Worlds

At the very opposite end of the spectrum from Mr. Schroeder's company is Kleiser-Walczak Construction Co. It is quite small—just two peo-

ple—and has no Suns or SPARC-based systems at all. However, the company's own history, and particularly its use of inexpensive, general-purpose hardware, may say much about the future of computer animation.

"We started this company in 1987," says Jeff Kleiser, who is 50% of the company; the other 50% is Dianna Walczak. "We decided to form a small company...and thought we could be competitive if we made some rules...and stuck to them." Specifically, they decided to keep their company as small as possible, to keep their hardware costs to an absolute minimum, and to limit their assignments to one or two projects, but to do those very well.

Walczak and Kleiser had complementary skills. Kleiser had a background in computer graphics. In fact, at another firm, Kleiser had done many of the computer-generated special effects on the film *The Flight of the Navigator*. Walczak was a sculptor. She created clay images, which Kleiser then digitized. The result was a computer-generated character—"we call them syn-



Courtesy of Metrolight Studios

thespians"—which can be manipulated electronically. One of these, a female figure, "starred" in the Kleiser-Walczak production *Don't Touch Me*, which was selected to be shown at the 1989 Sig-graph graphics theatre. In the computer-animation business, this is like saying it received an Oscar.

More recently, the team was selected to do the computer-generated effects for the KCET series, *The Astronomers*, which was broadcast nationally on PBS. Along with collaborator John Grower of Santa Barbara Studios, they did a series of photorealistic images showing such cosmic phe-

nomenon as black holes, the Milky Way and the sulfuric volcanos of Io.

What are they doing all this on? Says Kleiser, "Well, we've got an old SGI, an HP 835...which is obsolete now, but was top-of-the-line in 1989, and...oh, yes, we also have a Tektronix workstation." They got it cheap when Tek pulled out of the workstation business. "Tektronix says they'll only support it for two years, but hey! In two years anything we bought would be obsolete, anyway."

Suns are cheap, too. Why, then, didn't they consider them for their development? The answer is software.

"We own three Wavefront licenses," Kleiser says. "And Wavefront has only recently ported its product to Suns."

That's Show Biz

What, though, is the commercial 3D business like? For one thing, it is growing. "When I started in this business, there were maybe 15 companies in the world who did computer graphics," says Kleiser. Computer-graphics people seem to delight in that. "It is the kind of business you're in because you love it," says Metro-light's McGovern. "It is not going to make you a ton of money." ➔

Companies Mentioned In This Article

Alias Research Inc.

110 Richmond St., East
Toronto, Ontario
Canada M5C 1P1

Circle 100

Applix Inc.

112 Turnpike Road
Westboro, MA 01581

Circle 101

Apunix Computer Services

5575 Ruffin Road, Ste. 110
San Diego, CA 92123

Circle 102

Clarity Software

2700 Garcia Ave.
Mountain View, CA 94043

Circle 103

Computer Support Corp.

15926 Midway Road
Dallas, TX 7524

Circle 104

Corel Systems Corp.

The Corel Building
1600 Carling Ave.
Ottawa, Ontario
K1Z 8R7 Canada

Circle 192

Datacube Inc.

4 Dearborn Road
Peabody, MA 01960-3851

Circle 105

Du Pont Pixel Systems

2000 Edmund Halley Drive
Ste. 590

Reston, VA 22091-3436

Circle 106

Ficor Inc.

10250 Chester Road
Cincinnati, OH 45215

Circle 107

Imaging Technology Inc.

600 West Cummings Park
Woburn, MA 01801-6343

Circle 108

Informix Software Inc.

4100 Bohannon Drive
Menlo Park, CA 94025

Circle 109

Intelligent Light Inc.

P.O. Box 65
Fair Lawn, NJ 07410

Circle 110

Island Graphics Corp.

4000 Civic Center Drive
San Rafael, CA 94903

Circle 111

K L Group Inc.

134 Adelaide St. E., Ste. 204
Toronto, Ontario
Canada M5C 1K9

Circle 112

Paradise Software Inc.

RD 1, Box 467A
Lambertville, NJ 08530

Circle 113

Paragon Imaging Inc.

171 Lincoln St.
Lowell, MA 01852

Circle 114

Parallax Graphics Inc.

2500 Condensa St.
Santa Clara, CA 95051

Circle 115

Pixar

1001 West Cutting Blvd.
Point Richmond, CA 94804

Circle 116

Precision Visuals Inc.

6230 Lookout Road
Boulder, CO 80301

Circle 117

Ramtek Corp.

1525 Atteberry Lane
San Jose, CA 95131-1412

Circle 118

RasterOps Corp.

2500 Walsh Ave.
Santa Clara, CA 95051

Circle 119

Research Systems Inc.

777 29th St., Ste. 302
Boulder, CO 80303

Circle 120

RGB Spectrum

2550 Ninth St.
Berkeley, CA 94710

Circle 121

Silicon Graphics Inc.

2011 N. Shoreline Blvd.
P.O. Box 7311
Mountain View, CA 94039-7311

Circle 122

SoftImage Inc.

3501 Blvd. St-Laurent, Ste. 214
Montreal, Quebec

Canada H2X 2V2

Circle 123

Spyglass Inc.

701 Devonshire Drive, C-17
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Circle 124

Stardent Computer Inc.

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521 Virginia Road

Concord, MA 01742

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Statistical Sciences Inc.

1700 Westlake Ave. N., Ste. 500
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Sun Microsystems Inc.

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Circle 127

TaraVisual Corp.

929 Harrison Ave.
Columbus, Ohio 43215

Circle 128

Thomson Digital Image Inc.

1270 Ave. of the Americas
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New York, NY 10020

Circle 129

T/Maker Research Co.

1390 Villa St.
Mountain View, CA 94041

Circle 130

Uniras Inc.

5429 LBJ Freeway
Ste. 650, LB 144

Dallas, TX 75240

Circle 131

Vicom Systems Inc.

46107 Landing Parkway
Fremont, CA 94538

Circle 132

Visual Information Technologies Inc.

3460 Lotus Drive
Plano, TX 75075

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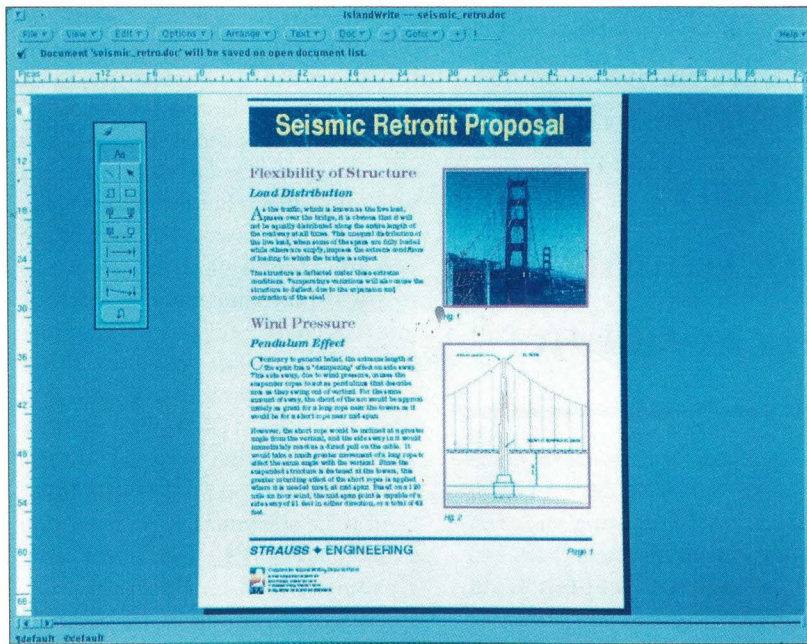
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IslandWrite, a WYSIWYG text processor; IslandDraw, an "object-oriented" drawing package; and IslandPaint, an "object-oriented" drawing package, are three separate programs designed to work together and share many resources (such as their fonts directory).

Full-color text and graphical editing, along with a reasonably sophisticated WYSIWYG text processor, make IslandWrite, Draw and Paint a powerful document mill.

Island Graphics Corp. has done a service for the Sun community with three very capable yet low-cost tools: IslandWrite, IslandDraw and IslandPaint. Most likely you first heard of these products under the names SunWrite, SunDraw and SunPaint. Island Graphics has taken these products, originally developed by them and marketed through Sun, back in-house, enhanced them and produced new manuals; yet the price has stayed the same.

Most of us need to produce documents as part of our work. Some documents lend themselves to a simple text editor, e.g., the quick electronic mail message. At the other extreme are large documentation projects that demand sophisticated tools. Between these two extremes lies a vast middle. These modest documents range from one to perhaps a hundred pages and need some diagrams or a little pizzazz to get their point across. In other words, they are what most of us who don't prepare documents exclusively for a living do most of the time.

IslandWrite, IslandDraw and IslandPaint are three separate programs designed to work together and share many resources (such as their fonts directory). IslandWrite is a WYSIWYG text processor, reminiscent of Microsoft

A n Island in the Sun

by BARRY SHEIN, Technical Editor

Corp.'s Word. IslandDraw is used to draw structured pictures. You can change or move the objects later. IslandPaint is a bitmap-oriented tool intended to be used for touch up, editing or creation of bitmapped images.

I view these three tools as a hierarchy with IslandWrite at the pinnacle, and IslandDraw and IslandPaint as tools to be used to create graphical inclusions for documents. Don't be confused by this. The three tools can also be used independently, but this view of the tools matches well with most projects I have been involved in: A text document is created and, as you go along, you realize it would be nice to have a diagram, picture or chart to illustrate some point. In Island's work model you would fire up either IslandDraw or IslandPaint (or both), create the figure you want, and cut and paste it into the document. This is very easy to do: You just select all or part of the drawing, click Copy, create a container (more on these later) in your text document and paste the figure.

IslandWrite

IslandWrite is the main tool in this trinity. It is a handsome, WYSIWYG word processor with many of the features I would expect in a more expensive desktop-publishing tool. Operations chosen from the menu are organized in two ways. First, the familiar File, View, Edit, Options, etc., menu bar choices. Second, the logical organization of operations on different sets of objects: character, paragraph and document. Characters have qualities such as font, size, style and color. Paragraphs have justification, indents and leading. Whole documents have attributes such as page styles, tables of contents and indices, and footnote styles.

The central object in an IslandWrite document is the container. A container in IslandWrite is similar to a window placed in the text with its own boundaries for filling and clipping. It can either be rectangular or irregularly shaped.

To create a container, you choose one of the container tools (either rectangular or polygonal) in the tool

The central object in an IslandWrite document is the container

palette and draw your container much the same as you would draw a box or other object with a drawing tool. You can then paste another item (such as a figure created and copied from IslandDraw) into the container, or type text directly into the container. The figure in the container can be repositioned within the container area. The container itself can be moved around or resized. The picture within it will be clipped if necessary. Text in IslandWrite can optionally flow around containers.

You can also create containers within containers, useful for creating more complicated inserts. Text within containers will flow around containers within them. You cannot have both text and graphics in the same container. (You can have a graphics container within a text container, although they'd just be different containers. The distinction is almost academic.)

Another operation you can do with containers is link them. This causes text to flow from one container to the other. One simple use of linked containers is to create a document with multiple columns. This particular application, multiple columns, is common enough that there is an entry in the Page Attributes pop-up specifically for this. But you can also create multiple-column documents directly through manipulation of containers and their links.

IslandWrite supports several character fonts, styles, sizes, etc., as you might expect. In addition, you can specify text color from a simple palette menu of 30 colors and 20 shading

options. (This menu is used for other objects as well, so don't wonder too long why you might want a stippled text character.) For those of you accustomed to Apple Computer Inc. Macintosh word processors, Island doesn't offer those outline and shadow fonts. I won't miss them, but perhaps you will.

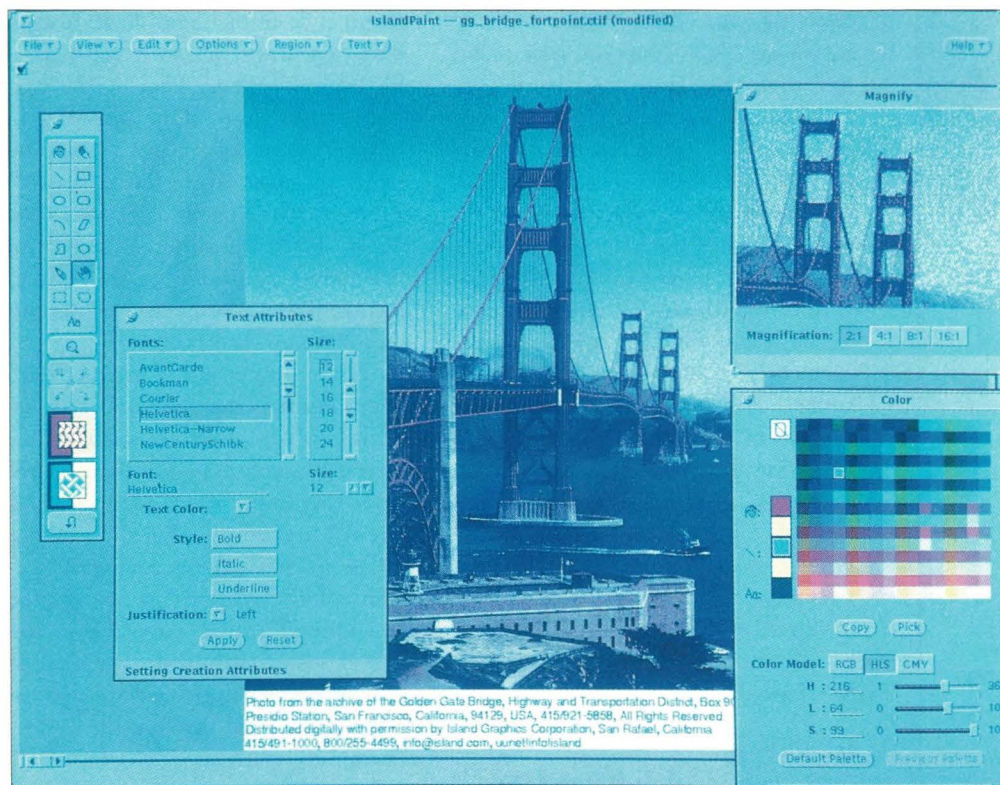
To bypass having to go through potentially multiple levels of menus to do something simple, such as insert a character from the symbol font, IslandWrite has something called the Incremental Command Line Interface (ICLI). This is their way of saying that you can use the keyboard for certain commands.

All ICLI operations begin by hitting a function key (F4...F8). In response, a prompt, such as Enter Symbol, appears near the top of the window and your next keystrokes are interpreted as ICLI commands. It will complete any unambiguous abbreviation so, for example, you can just type H for Helvetica. No other font name starts with the letter H.

The operations covered by ICLI are symbols, typeface (font), size, style (bold, italic, etc.), or paragraph attributes (center, left, first letter large, etc.).

Although better than no keyboard interface at all, I'm not very impressed with this particular approach. There's far too much reaching for function keys and interruption of the smooth flow of text entry. I'd prefer some sort of shift approach, perhaps using combinations of Control and Alt keys with mnemonic choices (e.g., Alt-B for Bold, Alt-I for Italic, etc.). Microsoft Word on the Mac uses this approach and it's nearly usable. OK, I don't know the perfect solution to this problem, but something more oriented towards the main keyboard area would be appreciated. Emacs-like motion controls would also be nice (e.g., Control-N for next-line), perhaps even a customizable method for assigning such functions to keystrokes.

There are four control sequences available from the keyboard (e.g., Control-S saves the current file) and many international characters can be inserted via Compose followed by a character.



IslandPaint is a bitmap image editor. It can be used to draw a picture or manipulate a bitmap image (i.e., scanned).

One Control character, Control-N, kept biting me. I would hit this mindlessly to move to the next line (an old Emacs habit) and my document would disappear! Control-N means open a new document. The first time it took about 10 minutes to figure out how to get back to my document, and for a while I was sure it was lost forever. (IslandWrite doesn't automatically update the Open File directory menu, so the document you were working on does not appear for reopening.) This part of the interface could use some more thought.

If you use equations in your documents, you will find creating equations in IslandWrite plausible, but weak. You can get to many common math and Greek symbols and cause characters to be subscripts and superscripts. But notions such as stacking (e.g., putting the limits above and below a summation) are non-existent. I assume some playing around can produce adequate results, but this is not IslandWrite's strong card. It is probably adequate for the occasional equation only. (Island Graphics will be adding equation-editing and table-handling tools in the first quarter of 1992.)

There are optional vertical rulers and guides to help you position objects on a page. You can move tab markers around visually for different layout needs. These are handy and have become fairly standard in this sort of text processor.

The IslandWrite file format on disk is plain ASCII with markup commands (resembling SGML) embedded. This is suitable for inclusion in electronic mail with little or no preparation. I don't know if Island Graphics lists this as a feature of the product, but I certainly would!

IslandWrite can import documents from files in text (plain UNIX ASCII files), EPS, TIFF (a color bitmap encoding format) images, Lotus Development Corp. 1-2-3 and IslandDraw formats. Files can be saved to or opened from any of the following formats: SunWrite and other earlier IslandWrite formats, Frame MIF, Interleaf, MS Word (PC) and WordPerfect 4.2 or 5.0.

IslandDraw

IslandDraw is an "object-oriented" drawing package. This means that it remembers objects such as circles,

lines and boxes as whole or grouped units, and can operate on them at any time (e.g., change their size, move them around, change their color, etc.). This is reminiscent of the Macintosh's MacDraw program. IslandDraw seems like a competent tool with most options you would expect in a program like this.

The IslandDraw tool palette offers lines, boxes, ovals, lozenges, splines, polygons, text, etc. You can also choose among line sizes, fill and line colors and patterns and other attributes. Lines can have arrows at one or both ends. Drawing diagrams is a natural application of a program such as this. A fair amount of attention has been given to the bezier tools. These are algorithms for connecting a set of points with curves. There is an entire separate tool palette devoted just to tweaking your beziers.

An object editor (pop-up) lets you go back and tune various attributes of a selected object, such as changing its color or specifying mitred versus beveled joins.

Graphics created in IslandDraw can be copied into a clipboard buffer. Just

Just a Matter of Perspective

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select the part of the picture, or all of it, choose Copy from the Edit menu and then paste into an IslandWrite container. It's very simple, and your intuitions will work. An image created in IslandDraw or IslandPaint can be put into an IslandWrite document either by copying it or by reference (in the latter case further changes within IslandDraw will show through to the IslandWrite inclusion). IslandDraw can import files in EPS (Encapsulated PostScript) and TIFF. Files can also be converted to and from the following formats: PostScript, EPSF, EPSI, CGM (a popular CAD format), SunDraw and earlier IslandDraw formats, and HPGL (Hewlett-Packard Co.). Files can be prepared for direct printing on Postscript (both black and white and color) and HP LaserJet and PaintJet printers.

IslandPaint

IslandPaint is a bitmap image editor. It can be used to draw a picture or manipulate a bitmap image (i.e., scanned), and presents a distinctly dif-

ferent style from IslandDraw. Images, once laid down, are no longer separable from the whole. They're just more bits on the page. For example, in IslandDraw, you can put a circle on the page and come back later to stretch it or change its color with a few clicks. With a tool like IslandPaint you cannot again refer to the circle as a circle, though you can alter the bits that make up the circle.

The typical way to interact with IslandPaint is via the Tool Palette, which offers a fairly rich set of operators including fill area, brush, line, rectangle, oval, lozenge, arc, parallelogram, polygon, convex polygon, and pencil. Arbitrary sections of the screen can be selected and rotated, scaled, moved, etc. You can choose from either two, 240 or 256 colors via the command line at start up, or later, through the Preferences pop-up.)

IslandPaint supports conversion from GIF, Group 3 fax, MacPaint, SunRaster and X11 bitmap and window dump. Files can be converted to TIFF, Group 3 fax, MacPaint, black and white or Color PostScript, HP LaserJet, HP PaintJet, SunRaster and X11 raster or window-dump formats.

We did have one small problem on the color IPC we used to try out IslandPaint. It seemed to be using a private-screen color map, so moving the mouse cursor to and from the tool palette caused rapid color changes. These almost certainly did not affect the actual image or file, just their appearance on the screen momentarily, but something wasn't perfect.

Summary

At a \$995 list price, these three tools represent an excellent value for the features they provide. Their support of full-color text and graphical editing, along with a reasonably sophisticated WYSIWYG text processor, makes them a great value. You can certainly find fancier products (at fancier prices). But for most people with general document and presentation needs IslandWrite, IslandDraw and IslandPaint fills the niche, and fills it quite nicely. ➡

more

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Island Graphics Corp.

400 Civic Center Drive
San Rafael, CA 94903

Circle 136

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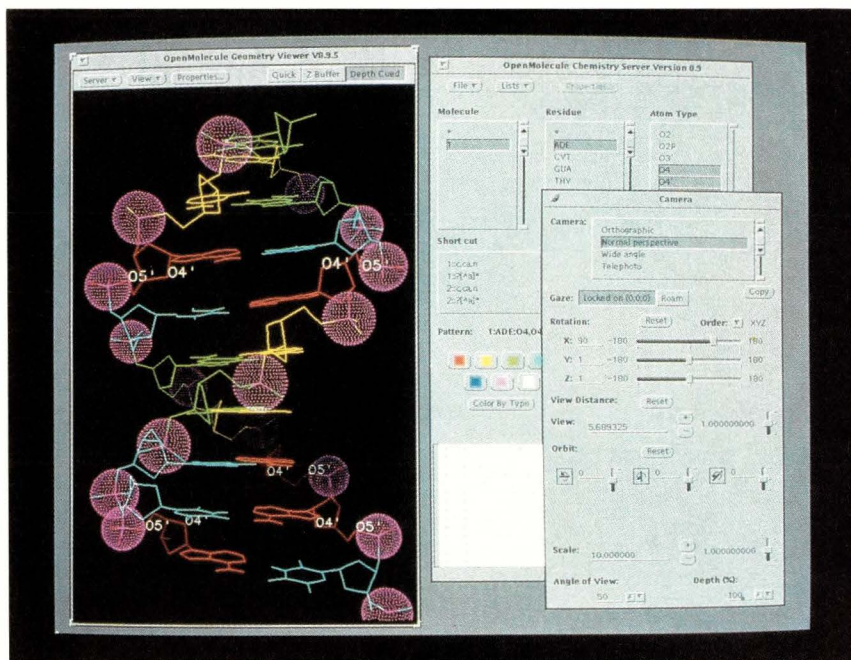
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NEW PRODUCTS



3D Molecular Modeling

anDATAco has introduced a software package for molecular modeling on Sun SPARCstations. Called OpenMolecule, the product allows researchers to dissect, display and measure complex chemical structures interactively.

OpenMolecule allows viewing of molecular dynamics trajectories and simultaneous display of multiple molecules, all with user-specified color coding, labeling and rendering. Up to nine molecules, each with its own local graphics transformation, can be displayed at one time. The software allows for the manipulation of up to 10,000 atoms per molecule and supports eight colors.

The product runs on OpenWindows and utilizes the XGL graphics library. The software adheres to the Open Look GUI. It also supports a distributed network protocol that allows for a program anywhere on a TCP/IP network to connect to the graphics server and generate graphics output.

OpenMolecule runs on SPARCstations, SPARCservers and

compatibles. Pricing begins at \$4,995. anDATAco Computer Peripherals, 9550 Waples St., San Diego, CA 92121.

Circle 137

VME Graphics Card

A graphics controller for VME-based systems has been introduced by PsiTech. The Graphics/1 is a 6U device based on the Fujitsu MB86990 graphics system processor. In its base configuration, the product features rendering speeds of up to 500,000 2D vectors per second and fill rates of over 100 million pixels per second.

A frame grabber can be plugged into an expansion slot of the board, making it able to accept NTSC, PAL and RFB video inputs. Another option is an i860-based accelerator, the Turbo CARD, which can increase the board's performance to 80K polygons per second. The Graphics/1 supports the X Window System and PHIGS software. Prices start at \$2,000 in quantity.

PsiTech Inc., 18368 Bandilier Circle, Fountain Valley, CA 92708.

Circle 138

Graphics Toolkit

Template Graphics Software has introduced FIGraph, a 3D charting and graphing toolkit for graphics software developers. FIGraph, which is based on PHIGS (Programmers Hierarchical Interactive Graphics System), provides software developers with a range of 3D formats, including scatter plots, function plots, splines, histograms, frequency polygons, pie charts, vector and contour plots.

FIGraph is based on Figaro+, TGS's implementation of PHIGS, which also provides an application programming interface to PEX, the 3D extension to the X Window System protocol. Pricing on the FIGraph toolkit varies.

Template Graphics Software Inc., 3510 Dunhill St., San Diego, CA 92121.

Circle 139



Scalable SBus Multiport

A group of SBus multiport cards for SPARCstations has been introduced by Helios Systems. Called HeliosPORT+, there are two products in the line: the SDM-4 with 4 asynchronous serial ports and one parallel port, and the SDM-8 with eight asynchronous serial ports and one parallel port.

Each serial port operates at 38,400 bps and uses RJ45 connectors. The SMD-4 is \$695; the SMD-8 is \$995.

Helios Systems, 1996 Lundy Ave., San Jose, CA 95131.

Circle 140

SUN USER GROUP

Ninth Annual Conference & Exhibit

December 9-11, 1991
San Jose Convention Center
San Jose, California

For the past eight years, the Sun User Group (SUG) has produced *THE* Sun user event of the year. The conference provides the opportunity for engineers, scientists, third-party vendors, end-users, developers, executives, and others to listen, share experiences, and learn how to better deal with both hardware and software decisions facing Sun and SPARC® users today.

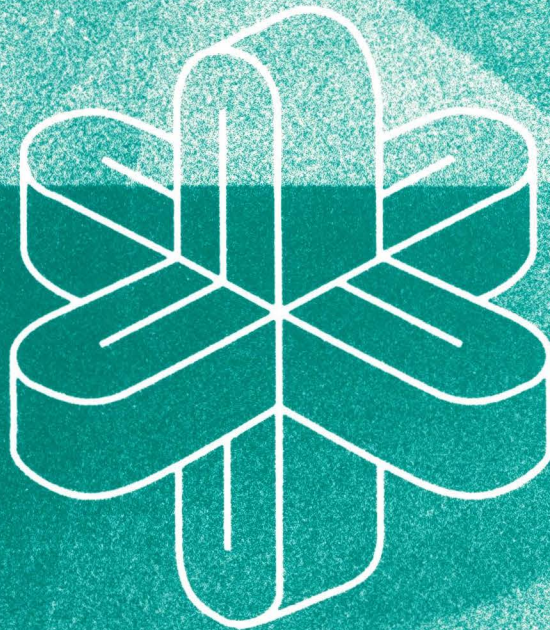
The theme for this year's conference is, "Distributed Applications and Multiprocessor Technology" and will feature...

... Nearly 100 sessions and panels. In addition to presentations centering on the theme of the conference, also featured will be talks in the following five categories: Instructional, System Administration, Performance Analysis, Scientific Computing, and Commercial Applications.

... Tutorials will run all day Sunday, December 8. There will be eight tutorials which will run concurrently. Tutorial topics are:

- ▶ PERL
- ▶ Writing Distributed Applications Using the ONC Platform
- ▶ Micro-Kernel Technology
- ▶ Basic X Concepts
- ▶ Introduction to the Domain Name System
- ▶ UNIX Administration for VMS System Managers;
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- ▶ X and the Administrator
- ▶ Topics in UNIX Security

... Over 200 exhibits housed in a 100,000 sq. ft. convention center will make this year's exhibit the largest in our history, doubling the size of last year's show. See the latest Catalyst and third-party vendor products ported to Sun. Also included will be vendors from the SPARC® community.



For registration or exhibit information please contact:
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HDTV Video Disk

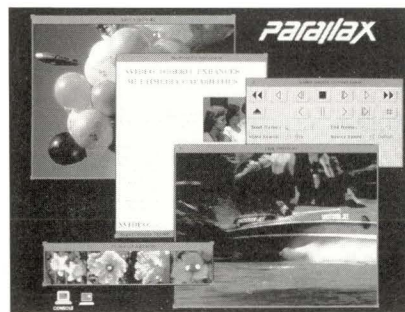
Recognition Concepts has introduced High-Definition TV (HDTV) models of its DataSTORE digital video disk product line. The devices allow users to store and display between six and 44 minutes of digital video in real time.

The DataStore HDTV models offer a variety of options to record and replay a number of different standard signals, including 32-bit digital RGB at a sustained bandwidth of 210 MB/s and 8-bit monochrome video at 70 MB/s.

Prices begin at \$223,000.

Recognition Concepts Inc., 341 Ski Way, P.O. Box 8510, Incline Village, NV 89450.

Circle 141



Video Options for SBus

Parallax Graphics has introduced two add-in cards that enhance its XVideo videographic controllers.

Designed for professional- and consumer-grade video formats respectively, the RGB and VIO option cards allow Sun workstations to display two live, full-sized video inputs simultaneously in separate windows on the workstation display.

The RGB option card is designed for use with component video formats, typically in professional video-production applications. The VIO option card is meant for consumer-video applications that use such video for-

mat as composite, Y/C and Super VHS. Both are daughter boards for the XVideo SBus card and are sold as an option on the XVideo product.

Price for both is \$7,990.

Parallax Graphics Inc., 2500 Condensa St., Santa Clara, CA 95051.

Circle 142

TV on Suns

RasterOps has announced the SPARC CARD TV, a single card that



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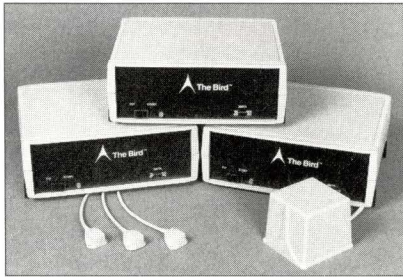
provides integrated video capability in one SBus slot. The Card provides a video window that can be re-sized and positioned on a Sun workstation screen.

The product supports NTSC, PAL and SECAM. Video signals can be used from such sources as TVs, VCRs, cameras and medical scanners. Since it occupies a single slot, SPARC CARD TV can coexist with Sun's own 8- and 24-bit graphics cards. Further, the CARD TV can use any standard Sun frame buffer.

Pricing begins at \$2,000.

RasterOps, 2500 Walsh Ave., Santa Clara, CA 95051.

Circle 143



Birds Flock For Suns

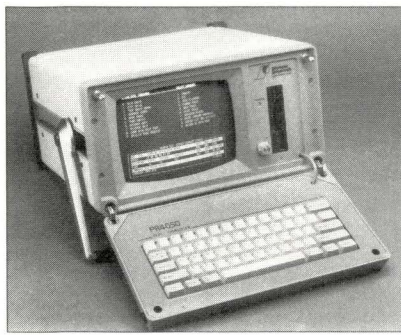
A six-degrees-of-freedom input device for workstations, A Flock of Birds, has been introduced by Ascension Technology. Flock of Birds simultaneously measures the position and orientation of six receivers that are referencing their whereabouts to one or more fixed DC pulse transmitters. The product can be attached to the object being measured, including the computer user, for virtual-reality applications.

Other applications include the manipulation and control of multiple images on a graphics workstation, tracing multiple body parts for biomechanical analysis, and interacting with telerobotic controls. Bird receivers can be up to 36 inches from the transmitter. However, with an extended-range option, the transmitter can be up to eight feet from the product.

Pricing for A Flock of Birds begins at \$5,020. The extend-range transmitter is \$8,515.

Ascension Technology Corp., P.O. Box 527, Burlington, VT 05402.

Circle 144



SCSI Disk and Tape Tester

Pioneer Research has introduced a portable SCSI disk drive tester that can also test tape drives as well as passively monitor a system SCSI bus.

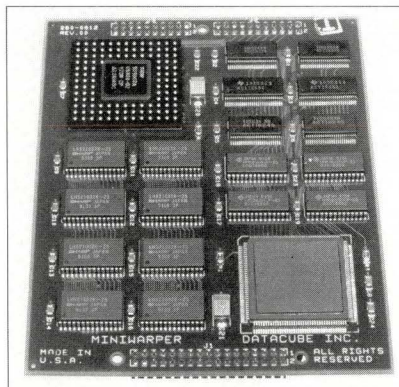
The PR4050 Qualifier is a self-contained unit based on the Motorola 68K. With several built-in diagnostic programs, it can evaluate single-ended and differential SCSI disk drives, tape drives, and optical drives per ANSI SCSI-1 and SCSI-2 definitions.

The PR4050 can also be used as a passive bus monitor to log events on a system SCSI bus. It can sequentially test several peripherals at once. Results can be output on a printer or stored on IBM PC-compatible, 3 1/2-inch floppy disks.

Pricing begins at \$12,850.

Pioneer Research, 1745 Berkeley St., Santa Monica, CA 90404.

Circle 145



Sun Gets MiniWarped

DataCube had introduced an add-in module that provides video warping for its MaxVideo 20 image-processing system.

Called the MiniWarper, the product allows the MaxVideo to perform complex spatial warps of live video images.

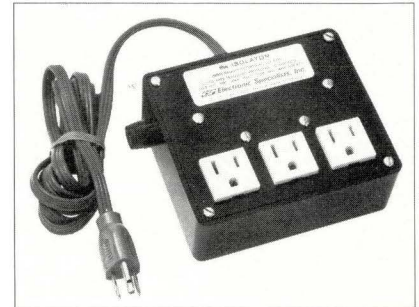
Applications range from machine vision to photo re-touching.

MiniWarper performs first- and second-order polynomial warping of images up to 1K by 1K pixels at a rate of 20 million pixels per second.

Pricing begins at \$5,000.

DataCube Inc., 4 Dearborn Road, Peabody, MA 01960.

Circle 146



Network Power Protector

A surge protector has been introduced for networks by Electronic Specialists.

The Isolator protects networks from interference and damage caused by common-mode ground-surge current via ground chokes within the product's circuit control cable. The product also contains high attenuation, wide-band interference filters and high-energy 39,000-amp surge suppressors.

The Isolator offers suppressor response time of 1 pico-second. Options include power-fail interrupt, remote power switching and 20A capability. Options can be specified in commercial, industrial and laboratory grades.

Prices begin at \$100.

Electronic Specialists Inc., 171 South Main St., Natick, MA 01760.

Circle 147

Imaging on X-Terminals

XIE, the proposed imaging software standard for X Window System devices, is now available on NCD X-terminals. XIE extends the capabilities of X to include a set of image-rendering facilities, supporting bi-tonal, gray-scale and color images. It operates as an extension of the core X server, where the product provides conversion functions needed to match the characteristics of an image with those

of a display.

XIE is available on all new NCD terminals from the company. Owners of existing NCD terminals can purchase XIE for \$495 from NCD's software partner, Congruent Corp. of New York.

Network Computing Devices Inc.,
350 North Bernardo Ave., Mountain View CA 94043.
Circle 148

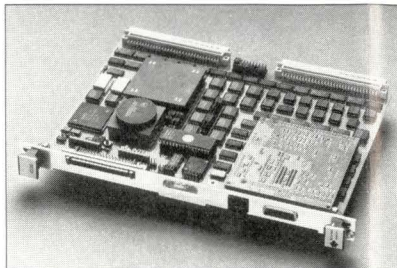
Studio Video On Suns

Studio-quality video output is now available for Sun SPARCstations. Applied Visual Computer has announced that it will adapt Tektronix's video-board system for Silicon Graphics machines, the Avanzar, for Sun workstations. Called the Solarzar, the device will allow workstations to produce very-high-quality video output in several different digital and analog formats.

Solarzar will provide real-time filtering and encoding. It will support several video formats, including digital component, digital composite (D2) in

parallel and serial formats, analog RGB, Betacam, MII, S-Video, and composite NTSC and PAL. Software tools include flipcard animation and ChromaMetrix, which analyzes images for color saturation and luma transitions.

Applied Visual Computing Inc., P.O. Box 3015, 149 Commonwealth Drive, Menlo Park, CA 94025.
Circle 149



VME Controller With Fast Ports

Interphase has announced two products that combine storage, network and other I/O technologies for the VMEbus or VME64 bus.

The V/SCSI-2 4220 Cougar con-

trollers are 6U cards based on an intelligent SCSI-2 host bus adapter. The V/SCSI-2 4420 Cougar offers either one or two FAST SCSI-2 channels. The V/SCSI-2 4220 with Ethernet, the second product, is a single-channel FAST SCSI-2 adaptor with an intelligent Ethernet networking controller.

Both Cougars support FAST SCSI-2 data rates of 10 MB/s and the extended SCSI-2 command set. In addition, there is a dual SCSI-2 channel option on the Cougar. The single-channel Cougar is \$2,790; the double-channel Cougar and Cougar with Ethernet are \$2,790.

Interphase Corp., 13800 Senlac, Dallas, TX 75082.
Circle 150

Fujitsu's 2 1/2-inch Winchester

Fujitsu has entered the laptop/notebook storage market with its M263x product line. These drives offer low-profile (17mm) and proprietary power-management technology that maximizes battery life.

All four 2 1/2-inch Winchester disk

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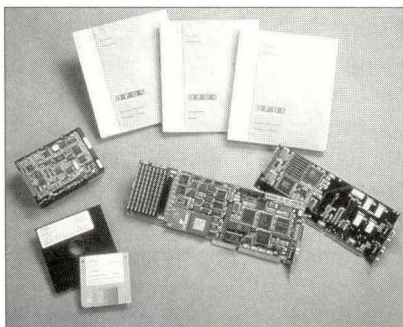
drives are backed by a 150,000-MTBF rating and a comprehensive warranty program. Maximum storage capacity is 90 MB, average seek time is 18 msec and data-transfer rates are 5 MB/s and higher.

The configuration process is handled through the drives' SCSI and PC-AT interfaces using the company's Configuration Capable (C2) technology. C2 is a through-the-interface feature that facilitates rapid qualification and design-in.

Evaluation unit pricing begins at \$395.

Fujitsu America Inc., Computer Products Group, 3055 Orchard Drive, San Jose, CA 95134.

Circle 151



Presto: Your PC Is Now A Workstation

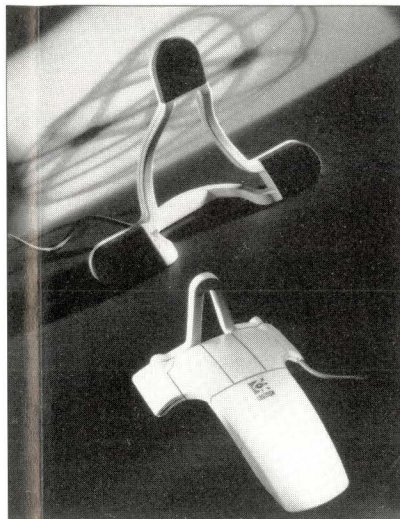
The Opus SPARCard Kit is a fully configured package designed to upgrade PCs to workstations with full Sun SPARCstation functionality. The kit includes all the necessary hardware, software, cables and documentation for end users to handle the complete integration.

Primary components of the kit are the SPARCard PC/AT add-in board, with a 25-MHz RISC chip, on-board Ethernet and two SCSI connectors; the PC3 color frame buffer, which occupies one SBus slot and supports PC fixed-frequency and multisync monitors; DOS interface software for file transfer between SunOS and DOS and switching icons to be switched between SunOS and Windows 3.0; and a 213-MB 3 1/2-inch hard-disk drive with SunOS 4.1.1 pre-installed.

A diskless configuration of the kit lists for \$4,495; the hard drive sells for \$1,135.

Opus Systems, 329 North Bernardo Ave., Mountain View, CA 94043.

Circle 152



A New Breed of Mouse

Logitech has created a five-button, 3D mouse input device. The Logitech 3D Mouse supports multidimensional spatial graphics, such as CAD/CAM and virtual-reality workstations.

The mouse uses ultrasonic speakers and microphones to position itself. It can be used in multiple dimensions by raising it by hand or in a head-tracker unit off of the 2D plane or desktop. The 3D Mouse also can work as a conventional Microsoft/Logitech-compatible three-button mouse. The unit uses a standard RS232C connector.

Logitech Inc., 6505 Kaiser Drive, Fremont, CA 94555.

Circle 153

SPARCengine Board Includes Graphics

SMCC has introduced the SPARCengine IPX, a board-level product that includes a SPARC processor and Sun's GX graphics chip. In effect, it brings the newly defined graphics performance of Sun's desktop products to the emerging embedded SPARC-based system market.

The SPARCengine IPX is powered by a new 40-MHz SPARC microprocessor that combines integer and floating-point units on a single chip. The SPARCengine IPX squeezes all components (CPU, I/O, cache, mem-

ory, SCSI, audio, Ethernet, two SBus slots and GX graphics) into a 9-by-9.7-inch CPU board. It comes with 16 MB of memory, expandable to 64 MB.

The SPARCengine IPX runs Solaris 1.0 operating-system software as well as Sun's ONC networking software. It also supports the OpenWindows environment, which features the intuitive Open Look GUI and 15 DeskSet productivity tools.

Sun Microsystems Computer Corp., 2550 Garcia Ave., Mountain View, CA 94043-1100.

Circle 154

Imaging Products Appear

Fujitsu America has introduced three products as part of its document-imaging line. The M3096E+ is a high-performance scanner that offers 11.5-inch-by-17-inch paper-handling capability. The product shortens time between scans and allows for 20-ppm scanning of letter-size documents at 200 dpi.

Optional features include a dynamic-threshold circuit, which gives the scanner advanced OCR and document-reproduction qualities; an image-processing circuit, which improves image quality; a multilevel output interface, which offers the ability to extract true gray-scale at 8 bits per pixel; and a single connector interface, which enables OEMs and VARs to use one cable instead of two. List price for the M3096E+ is \$6,720; options are priced separately.

The company also announced its M3098A image scanner for very-high-speed scanning of large documents (up to 34 inches by 44 inches). The product has selectable standard resolutions of 200, 240, 300 and 400 dpi, and the ability to recognize 64 levels of gray scale. List price is \$59,995.

Fujitsu America Inc., 3055 Orchard Drive, San Jose, CA 95134-2022.

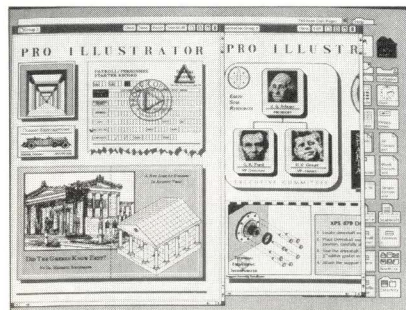
Circle 155

VME-To-SPARC Upgrade Plugs In

XINC Electronics' SPARCplug Lite provides a 28-MIPS upgrade path for VME-based Sun 3 or 4 systems.

The product provides users with a SPARC CPU and three available SBus slots. The resulting system supports both VME and SBus peripherals. SPARCplug Lite also supports up to 128 MB of SIMM RAM.

The product lists for under \$10,000. XINC Electronics, 3193 Tech Drive North, St. Petersburg, FL 33716-1006.
Circle 156



Highlight Color Laser Printer

Xerox has introduced its production-speed 4850 highlight color-laser printing system.

Using simple commands, businesses

can use color to highlight variable information such as names, account numbers, etc. The printer, which allows simultaneous printing of black plus one color, can be utilized as a black-only printer as well. The 4850 prints at 50 ppm with a resolution of 300 dpi. A 32-Mb font memory is expandable to 128 Mb. Average monthly print volume is 100,000 to 750,000 pages. The printer module measures 114 by 35.7 by 40.8 inches, and the system control module measures 48 by 28 by 41 inches.

List price is \$140,500. Xerox Corp., P.O. Box 24, Rochester, NY 14692.
Circle 157

Desktop Publishing for UNIX

Elan Computing Group has upgraded Avalon Publisher, the company's word-processing/desktop-publishing product for UNIX. The 2.0 version features color support, a mail-merge utility, enhanced graphics and filters for importing most major word-processing and DTP packages.

Publisher 2.0 runs under Open Look or Motif user interfaces and is available on such major UNIX platforms as the Sun 3, Sun 4, 386/486 PCs and RS/6000.

Price is \$995 per license. Elan Computer Group Inc., 888 Villa St., 3rd Floor, Mountain View, CA 94041.
Circle 158

Tek's X

Tektronix has unveiled a low-cost family of X Window System terminals. The XP10 Series brings plug-in network connectivity and windowing to workstations, ASCII terminals, PCs and Macs. All models include 4 MB of standard memory, 128 KB of ROM, an IBM 101 keyboard and a three-button mouse. TI's TMS 34020 was the graphic processor chosen and the series also features two custom ASICs. The performance rating for the monochrome XP11 is 44K Xstones. All four units feature 1024-by-768-pixel resolution (100-dpi) monitors with a 70-Hz refresh rate. Color dis-

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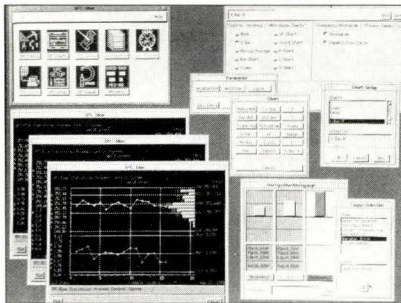
Circle No. 6 on Inquiry Card

plays are also available. Networking users can choose from most major options: Ethernet, DECnet, etc. Terminals measure 15.75 by 14.25 by 14.75 inches and weigh 31 pounds. All are covered by a one-year warranty.

List prices for the X10 series begin at \$1,695 and run to \$2,895.

Tektronix Inc., P.O. Box 500,
Beaverton, OR 97077.

Circle 159



NEW Stat Software Debuts

NEW Technology has enhanced its SPC-Blue statistical process-control system with the X Window System and the Open Software Foundation's Motif. Version 2.0 makes use of object-oriented menus that guide users through definition and configuration.

The package includes all of its former features: automatic data collection, electronic digital gauge interfaces, bar-code data input, automatic warning alarms, full network support, short-run deviation from target spec, an SQL database and SPC report generator, full audit trail for data, assignable cause, and simple import and export of characteristic data. SPC-Blue runs on Sun SPARCstations, the IBM RS/6000 and Intel 386/486 machines running the Santa Cruz Operation's Open DeskTop.

DEC Ultrix and VMS versions will be available during the first quarter of 1992.

NEW Technology Associates Inc.,
P.O. Box 9227, Evansville, IN 47724.
Circle 160

Fusix For i860s

Du Pont Pixel Systems has announced that it will market Fusix, its real-time operating environment and microkernel for attached Intel 80860 processors.

Fusix includes not only a complete software environment, but also interfaces to the company's PX/GL, an emulation of Silicon Graphics' GL graphics library. PX/GL can be purchased separately.

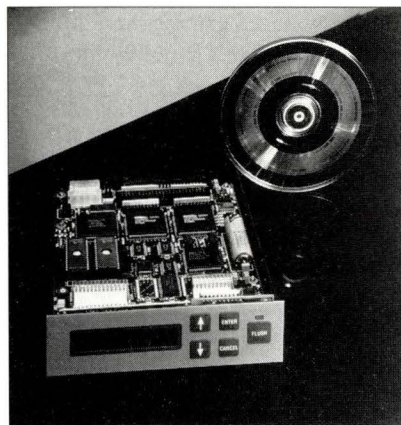
Fusix provides a set of object-oriented concurrency paradigms, including locks, semaphores, events, messages, threads and processes. It contains several UNIX-compatible functions, and the company says that most C and FORTRAN can be compiled and run with no changes.

DuPont is making Fusix available in a variety of ways. The API definition is free. Source code is \$10,000.

Prospective users can evaluate the product with a \$495 run-time package called Fusix Prototyper.

Du Pont Pixel Systems, 2000
Edmund Halley Drive, Ste. 590,
Reston, VA 22091-3436.

Circle 161



Optical Hardware Caching Interface

Ten X Technology unveiled the OCU 300, an optical-disk interface that utilizes hardware data compression for increased storage capacity and enhanced performance.

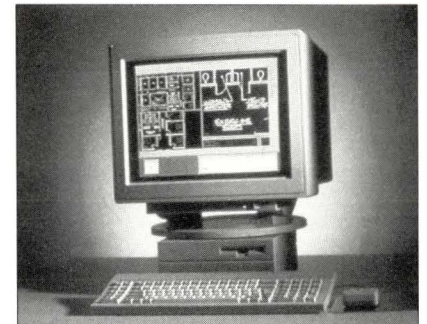
The interface implements the QIC-122 compression standard for optical drives and is capable of 1.5-MB/s compression and 5-MB/s decompression rates. The host computer communicates with the OCU-300 using standard operating-system commands for easy installation and operation.

System-specific software drivers are not needed to connect the OCU-300 to most writable optical drives, com-

puters and operating systems. List price is \$1,895.

Ten X Technology Inc., 4807
Spicewood Springs Road, Bldg. 3, Ste.
3200, Austin, TX 78759.

Circle 162



ESP On Open Look

An enhanced release of software that allows raster editing inside AutoCAD has been introduced by Image Systems Technology.

CAD Overlay ESP 3.5 views, edits and plots canned paper drawings in AutoCAD. The new version supports Open Look Release 11 and SunView, Release 10 or 11.

The product offers such raster-editing features as cut, copy and paste. In addition, it has a bidirectional converter for Sunraster (PIXRECT) binary format. This means a scanned image can be edited using ESP and AutoCAD, and can then be exported for presentation in a technical publication package. Pricing begins at \$2,495.

Image Systems Technology Inc.,
Rensselaer Technology Park, 165
Jordan Road, Troy, NY 12180.
Circle 163

Managing Documents on Suns

Xerox' GlobalView workgroup and document-management applications are now available on Sun SPARCstations. The Xerox Document Search and Retrieval (DSR), DocuTran automated translation and Xerox DocuTeam workgroup software are all available for the first time on UNIX, as are Xerox' Pro Illustrator, Chemical Illustrator and Equations packages.

All of the packages use Xerox' GlobalView icon-based GUI. At the same time, Xerox is delivering an

upgrade to its GlobalView networked desktop environment, VP 3.1. The upgrade provides uniform functionality for all Xerox platforms, including the Xerox 6500 UNIX workstations, 6085 workstations and OS/2 PCs.

Pricing is based on licenses and modules desired.

Xerox Corp., Xerox Centre, 101 Continental Blvd., El Segundo, CA 90245.

Circle 164

Aviator Runs On SPARC

Aviator Flight Simulator now runs on Sun's SPARCstation IPX and 2 GX plus accelerated color-graphics workstations.

The application allows users to interactively operate a simulated F/A-18 aircraft in real time against other users on an Ethernet network. The terrain is generated from data acquired from the U.S. Geological Survey.

Floating licenses can be ordered from software distributor Qualix Group Inc. for \$150. The product is available on CD-ROM or quarter-

inch tape. The company says it will make Aviator source code available during this quarter.

Aviator Horizons Inc., P.O. Box 51847, Palo Alto, CA 94303-0725.

Circle 165

Engineering for SUN

Varimetrix has announced Varimetrix Modeling, a 3D engineering-design product running on Sun workstations, which is aimed toward the engineering and manufacturing arena. Built around a Unified Parametric Geometry architecture, the product integrates wireframe, surface and solid geometric entities.

A special feature allows users to apply parameters to a model during the construction process or after initial design. A "spatula modeling" feature allows quick sculpting of solids. Full undo and redo operations are available and both NURB and analytic geometry are supported. The modeler provides complete on-line help.

List price is \$3,995.

Varimetrix Corp., 2350 Commerce

Park Drive, Ste. 4, Palm Bay, FL 32905.

Circle 166

Mac/PC Connectivity Software

Digital Instrumentation Technology has introduced FloppyWorks file-transfer software for SPARCstations and compatibles.

FloppyWorks allows a workstation to format, read and write Macintosh, MS-DOS and OS/2 3 1/2-inch diskettes. FloppyWorks supports SPARCstation internal drives. A command-line version of the product is currently shipping; an Open Look Version is planned for the year end.

Pricing is \$295.

Digital Instrumentation Technology Inc., 127 Eastgate Drive, #20500, Los Alamos, NM 87544.

Circle 167

FYI

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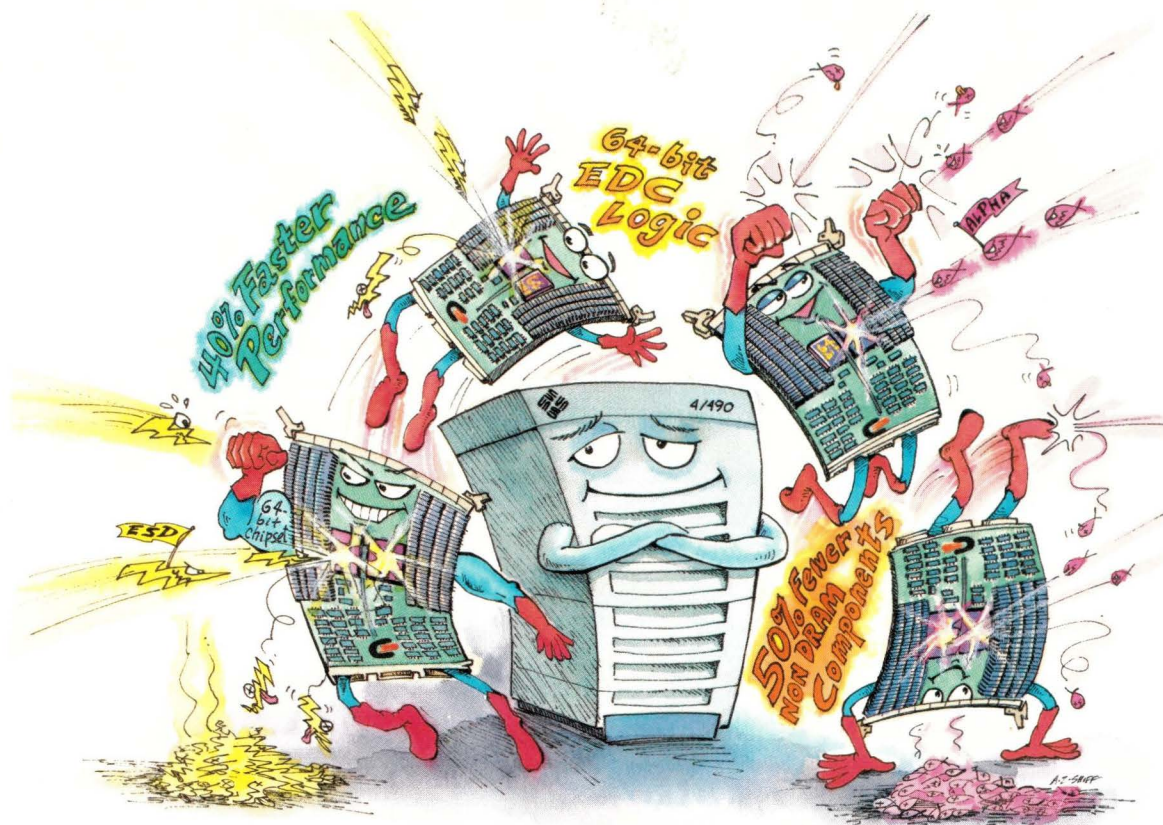
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The Only Fault-Tolerant Memory for SPARCserver 490 Systems



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Clearpoint's design philosophy strives for maximum reliability and superior value. Our SNME-490 memory for SPARCstation/SPARCserver 470 and 490 systems, available in 32 and 128 MB densities, is the only fault-tolerant solution for Sun servers.

Dynamic Bad-Bit Replacement
The Clearpoint 64-bit EDC chip set with dynamic bad-bit replacement provides fault tolerant operations. If the logic identifies a hard error, a spare DRAM is immediately swapped in to prevent the possibility of a system-stopping double-bit error. The chip set then reallocates the address range to the spare DRAM. If a soft error occurs – caused by ESD or alpha particles, for example – the EDC logic corrects the data and scrubs the location. All correction and remapping operations are transparent to the user.

Increased Performance

The SNME-490 operates up to 40% faster than Sun's 4/490 memory boards. Clearpoint takes full advantage of the Sun 64-bit memory bus by implementing a 64-bit EDC chip set (Sun uses 32-bit), allowing faster data transfers.

Increased Reliability is Built In
Clearpoint's hard-soldered DRAM solution provides a significantly better Mean Time Between Failure rate than a SIMM-based board.

Additionally, state-of-the-art components and high-level design integration have reduced the non-DRAM chip count on the SNME-490 by over 50%. A lower component count insures fewer field failures and less downtime.

Call or write for more information!

- SNME-490 spec sheet
- The Designer's Guide to Add-in Memory
- Pointers newsletter
- Memory Applications Casebook



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