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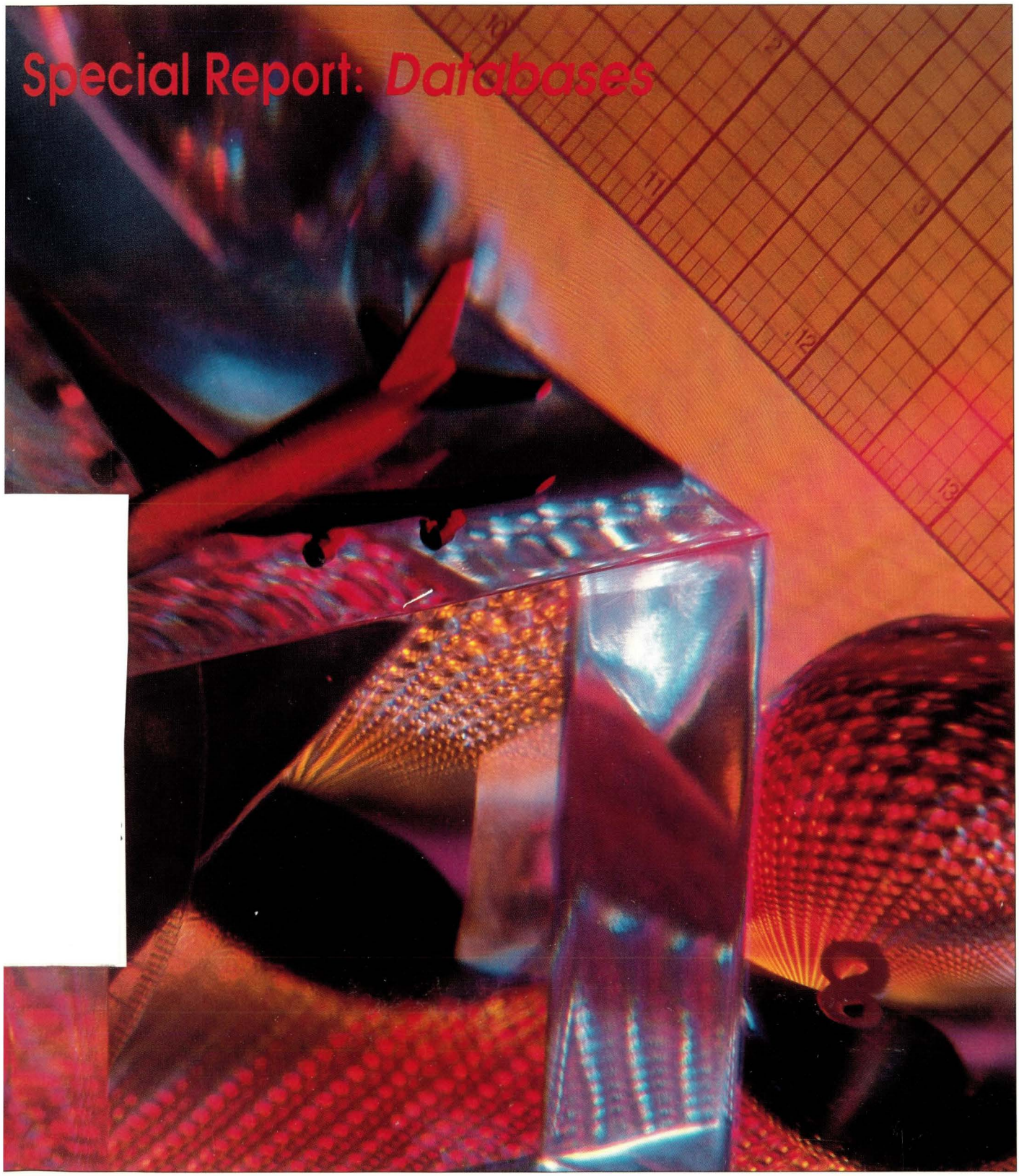

Special Report: *Databases*

eview: S-PLUS

News: Sun's MP Plan

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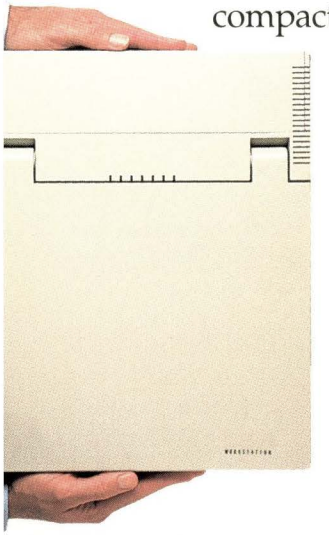

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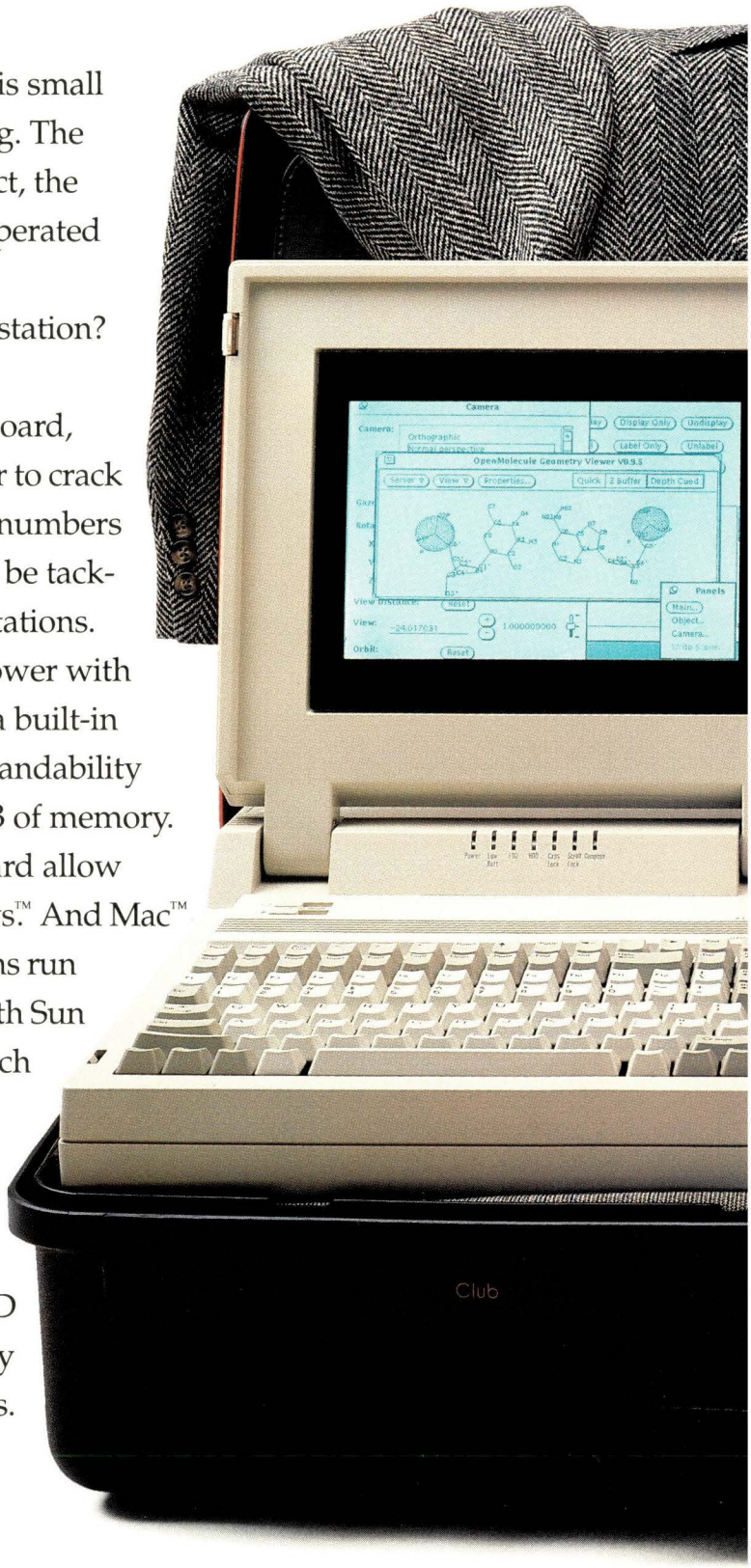

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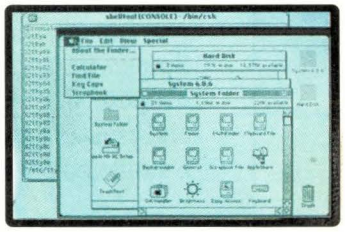

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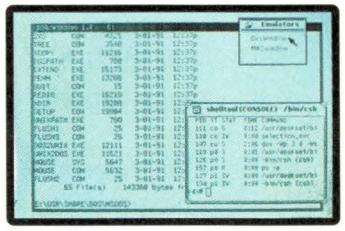

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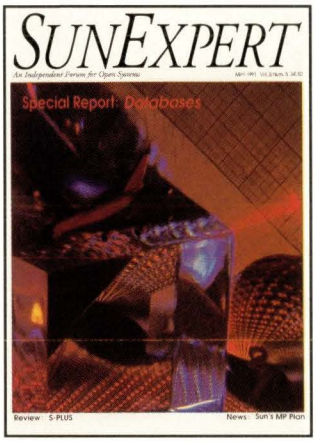

Cover Photograph
by Steve Edson

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

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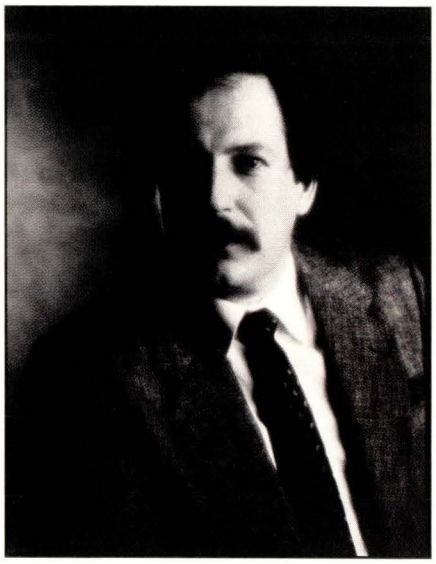
Editorial



Something Old, Something New

Old business: Thanks to all the responses to the informal survey in the February editorial, our old curiosity about SPARC shoppers has been satisfied for awhile. Our staff was a little surprised that 96% of you would consider buying a SPARC-compatible and that 81.3% would insist on SPARC International's seal of approval. We were not jolted by the fact that 78.7% of you wanted to save 20-30% before you would buy a compatible. I'll leave it to you to figure out why 63% need DOS compatibility and 32% MacOS. Perhaps the response reflects more or less a wish rather than a requirement. But the most unexpected result is the reply to "Will you wait for SPARCstation 2-compatibles?" More than 53% of you say there's no need to wait, 44% will wait and 2.7% did not have an opinion. That gives all of us something to think about the next time we debate the performance issue.

New business: This month's Special Report on database management systems looks at the topic from various perspectives: the state of object-oriented technology, the growing importance of multimedia and new definitions for "distributed." Check out the listing of DBMS vendors, Page 63. The variety and range of product offerings is truly staggering. If we missed your favorite vendor, let us know.

Also in this issue, and very much related to database management, Smoot Carl-Mitchell of Texas Internet Consulting explores what network engineers can learn from database designers; see "Cultivating the Synergy Between Networks and Databases" on Page 71.

Doug Pryor

Doug Pryor

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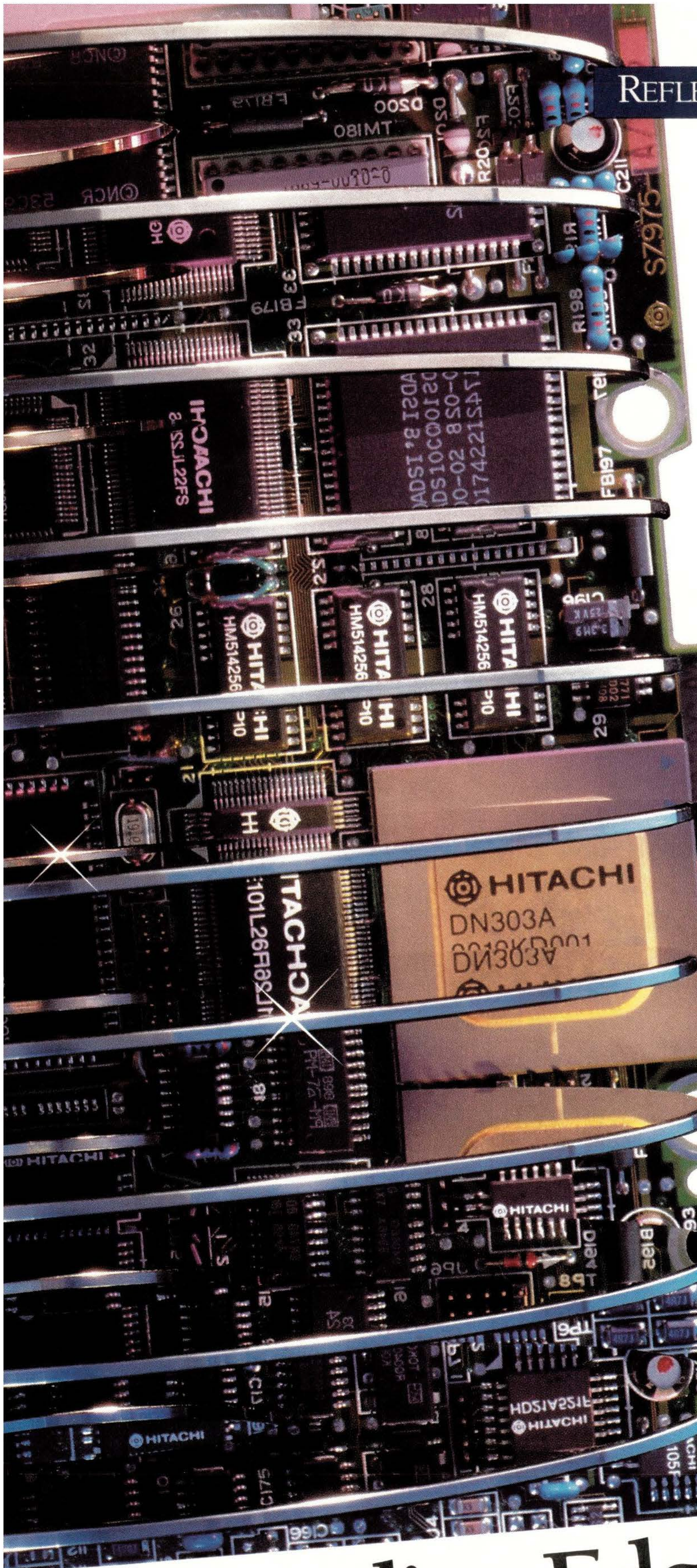

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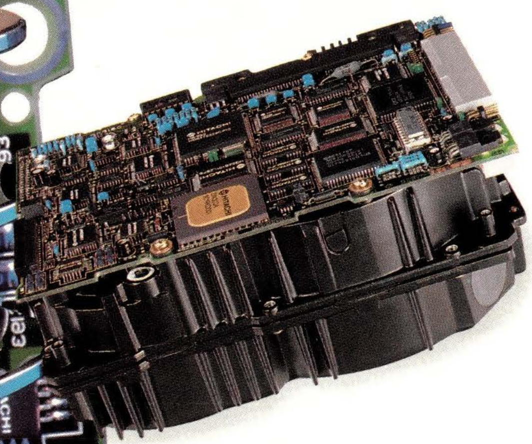

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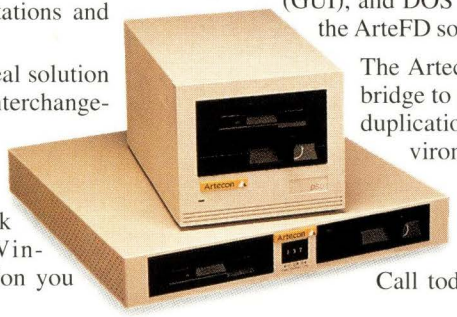

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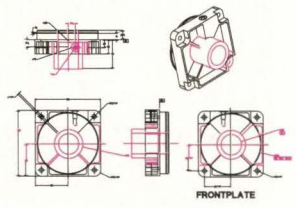

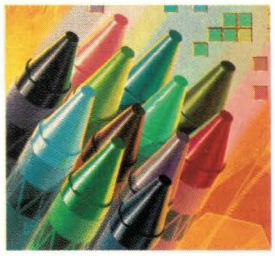

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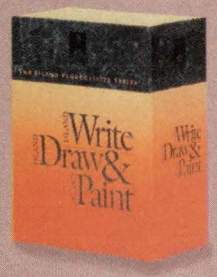

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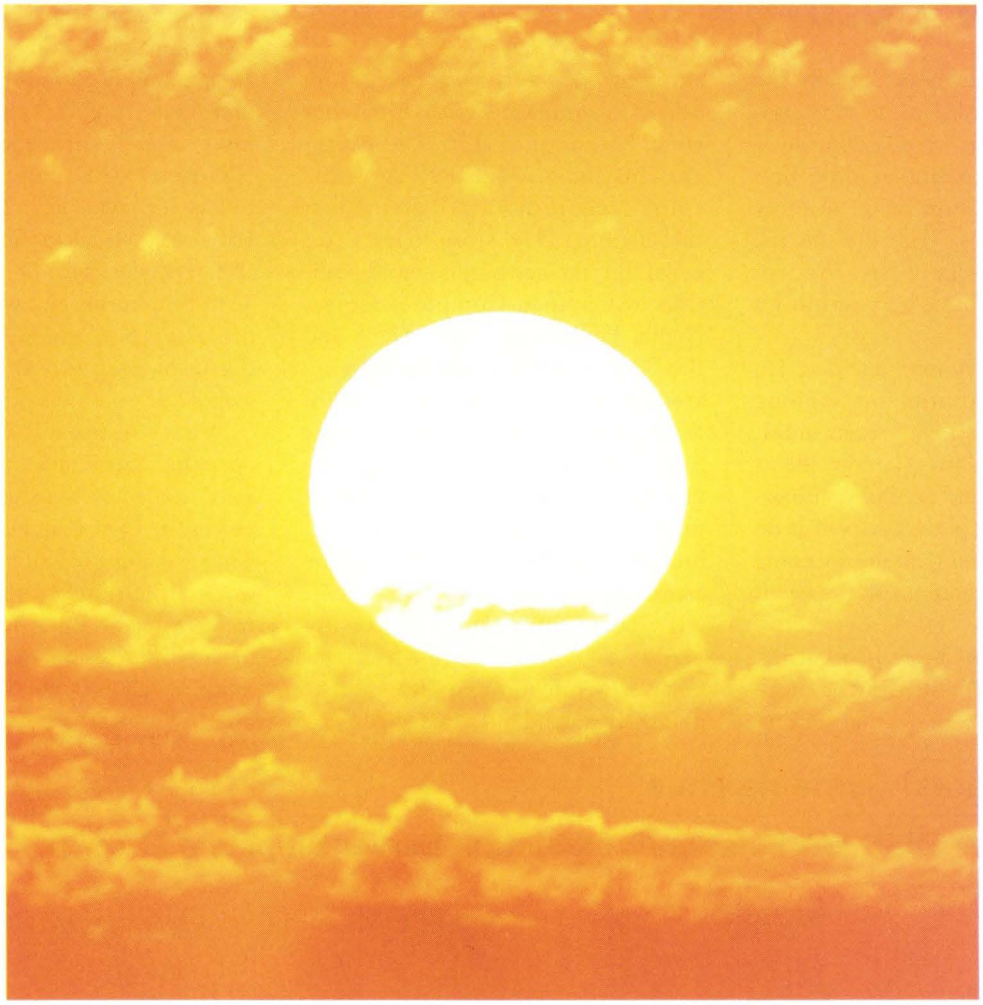

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NEWS

Is There A Multiprocessor In Your Future?

Sun Microsystems Inc. finally has shown the first card of its multiprocessing hand. This "card" is, literally, a card–a plug-in MBus module that coordinates processor, cache, memory and I/O functions. With this one fell swoop, the company has done an about-face regarding its position on multiprocessing.

Formerly, Sun sent packing (to Solbourne Computer Inc., among others) customers that needed multiprocessing capabilities. It now claims that users are in dire need of multiprocessing on their desktops, as well as on their servers. The first multiprocessing server from Sun should make its debut this fall.

Sun's change of heart is occurring none too soon. Granted, 66% of all RISC workstations and servers shipped in 1990 were based on SPARC, compared with 17% that were based on MIPS Computer Systems Inc.'s MIPS RX000 RISC chip, according to the latest International Data Corp. figures (see table). But the newly announced coalition of Compaq Computer Corp., Digital Equipment Corp., MIPS and the Santa Cruz Operation rallying around the multiprocessing R4000 MIPS chip could give Sun and the SPARC camp some competition. The first shipments of the 40-MHz R4000 processor are expected by year-end, but the first R4000-based systems aren't expected until mid-1992.

By comparison, multiprocessing SPARC chips already can be had from Cypress Semiconductor/Ross Technology Inc. and LSI Logic Corp. Next-generation 40-MHz multiprocessing designs, many of which also will offer superscalar capabilities–meaning they'll be able to execute two or more instructions simultaneously, rather than only one instruction at a time–are expected to be announced during the summer/fall time frame. Among the anticipated suppliers are: Cypress/Ross, with its "Pinnacle" CPU; Fujitsu Microelectronics Inc., with its S-25; the team of LSI Logic, Metaflow Technologies Inc. and Hyundai, with "Lightning;" and Texas Instruments Inc., with its "Viking" processor. Sun has been monitoring closely the progress of all of these silicon makers.

What's noticeably lacking is the operating system and applications software needed to make SPARC multiprocessing more than just a buzz word. There's been no word from Sun on when a multiprocessing SunOS may make its debut. But, the first symmetric multiprocessing version of UNIX Systems Laboratories' SVR4 is scheduled for a summer unveiling. (The

SPARC-Based Systems Rule

Source: International Data Corp.

Worldwide RISC Workstation/Workstation Server Shipment Growth

	1989		1990		Growth
	Units	%	Units	%	89-90 %
SPARC	46,055	55.4	140,565	66.0	205.2
MIPS RX000	17,508	21.1	35,695	16.8	103.9
IBM POWER	3,700	4.5	17,000	8.0	359.5
Clipper	13,000	15.6	14,470	6.8	11.3
MC 88X00	1,355	1.6	3,990	1.9	194.5
HP-PA / Prism	1,260	1.5	850	0.4	(32.5)
Other Prop. RISC	190	0.2	425	0.2	123.7
Total	83,068	100.0	212,995	100.0	156.4

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International Spotlight

Suns In Space?

Thanks to its Sun Microsystems Inc. Sun-4 SPARCstation environment, the development staff at Computer Resources International A/S, Copenhagen, is on top of its schedule for completing the Software Development Environment (SDE) for the European Space Agency (ESA). The SPARCstations will also be used to run the SDE, which will be used in all aspects of building and operating the space station Columbus. Columbus is scheduled for launch some time in the mid-1990s.

The preliminary version of SDE, which was developed using the SunView interface and related tools, has been completed and deployed at various Columbus project sites within ESA and at software subcontractors around Europe. Lars Peter Johansson, manager of CRI's CASE systems division, says that the final version may be finished by year-end, ahead of its original target of 1992.

SDE will be used exclusively on Sun systems until the space agency names a secondary platform. "A requirement in the specification says that SDE must run on an alternative platform, but it has not been selected as yet," Johansson says. Once another platform has been chosen, subcontractors for the Columbus project, such as Norsk Data (Oslo, Norway), Grupo de Mecanica del Vuelo (Madrid, Spain) and Inteos (Pisa, Italy), will be able to choose which they want to use.

Rumors abound that IBM Corp.'s RS/6000 could be a prime candidate.–*mwj*

full-fledged, threaded multiprocessing version is slated for a 1992 release.) Since the next version of SunOS will be SVR4-compliant, rudimentary multiprocessing capabilities should be available to Sun users by the time Sun rolls out its first multiprocessors.

One piece of the multiprocessing pie about which Sun has been surprisingly forthcoming, however, is MBus. Sun describes MBus as being not an I/O-only bus, like SBus, but as a "multiple-vendor, multiple-generation open CPU microprocessor/module interface." There are two components of the MBus specification: uniprocessor and multiprocessor. Sun was the originator of MBus, but the current version was devised by both Sun and other members of the SPARC International Architecture Committee. Currently, SPARC International, rather than Sun, owns the MBus standard and is responsible for its evolution.

LSI's and Cypress/Ross' existing multiprocessing SPARC implementations are compliant with the MBus spec. All of the next-generation SPARC chip manufacturers are incorporating the MBus interface into their designs. The spec is written to accommodate up to 320-MB-per-second bandwidth and a 36-bit physical address space, as well as a 40-MHz, 64-bit synchronous interface.

At the same time that Sun turned over MBus to SPARC International, SPARC International announced an update to the SPARC architecture spec (known as SPARC Architecture Version 8). Marking the first revision of the SPARC manual since 1987, Version 8 reportedly simplifies SPARC-based system design by spelling out more completely various aspects of the SPARC architecture. Among the details made specific are multiprocessing memory-management standards and instructions that improve multiprocessing capabilities.

Now that Sun's made its first public multiprocessing revelation, it's starting to talk big. Within five years, Sun says, we'll see 200-MHz SPARC chips, with up to 10 million devices per chip, and 1,000 MIPS (yes, that's four zeros) on

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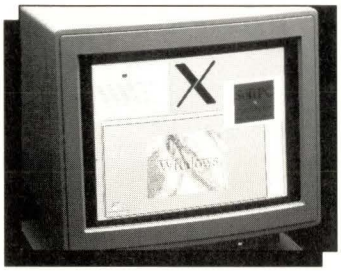

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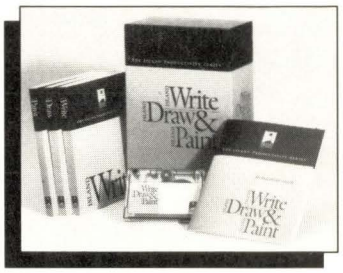
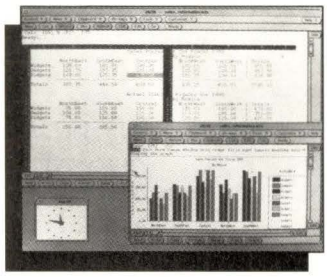
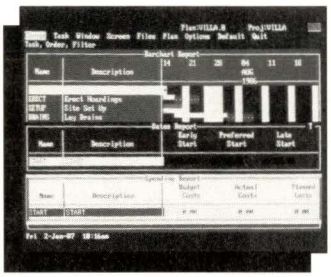




Access 20/20 for OpenLook
20/20 OpenLook for Sun is a joint engineering effort between Sun and Access Technology and the only fully implemented OpenLook spreadsheet available on Sun workstations. 20/20 makes full use of push buttons and pull-down menus. Database connections are available. This is the very latest in spreadsheet technology and comes highly recommended.



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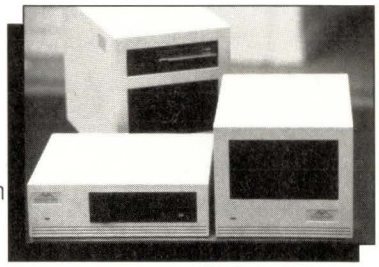
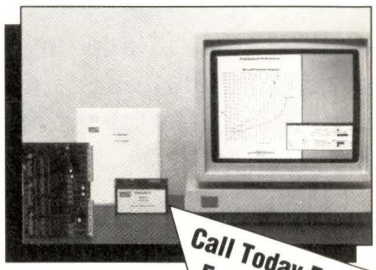
A true POSTSCRIPT laser printer available with either 35 fonts (PS35) or 17 fonts (PS17). Both print up to 6ppm at 300 dpi and come standard with 1.5 MB of memory. An excellent value. Includes cable. microLaser PS 35, **$1699**, microLaser PS17, **$1359**.

Hewlett-Packard SCSI Hard Disk Subsystem
From Bridgeway Technology comes this 793MB HP SCSI hard drive. The drive is packaged in an advanced enclosure with forced air cooling, power cable, and an easy to set SCSI ID switch on the back of the unit. Tested and formatted with Sun OS and includes a 5-year warranty. 24-hour replacement of drive, at an additional cost. **$2699** including cable.



XP27 TekXpress XWindow Terminal by Tektronix
The XP27 is the new performance standard for color Xstations from the leading manufacturer of color Xstations--Tektronix. It offers Sun-compatible high-quality 1152 X 900 resolution in a 19" 256-color display. Comes standard w/5MB memory (expandable to 21 MB), dual processing architecture, X11 R.4 server, 8-bit planes and great international 3-year warranty. Other models available.

Legato-Prestoserve NFS Accelerator
The Prestoserve is an accelerator board that significantly enhances the throughput and responsiveness of Sun NFS fileservers. It provides 50% more NFS server throughput by reducing I/O bottlenecks. This product could save you the cost of an additional server.



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the desktop. Will all users want or need to run multiprocessing versions of their favorite word processors? Stay tuned, says Sun.–*mjf*

Solbourne Squashes S4000 Rumors

Leave it to Solbourne Computer Inc. to pull off a major coup, especially at a time when some not-so-nice rumors about its S4000 SPARCalike are floating around.

Solbourne has announced that it has signed PC vendor Tandon Corp. to OEM its desktop SPARC-based system, the S4000. Solbourne actually recruited the Moorpark, CA, PC powerhouse to OEM its entire line. Tandon's first effort will be to resell S4000s in Europe. But in time, Tandon will be putting its name on all Solbourne systems and reselling them throughout the United States, Europe and the Pacific Rim.

Solbourne has also added two new distributors–Delphi S.p.A. and Kontron Elektronik GmbH–bringing to twelve the number of companies distributing Solbourne's entire SPARC-based line in Europe. Delphi, part of the Olivetti group, is headquartered in Viareggio, Italy, and is the largest reseller of SPARC systems in Italy. Its three-year contract with Solbourne is valued at $40 million ($U.S.). Kontron, a German-based subsidiary of BMW Deutschland that distributes computer systems primarily in the scientific/technical niches, signed a three-year contract with Solbourne, for $30 million ($U.S.).

It may take more than command of distribution channels to sell the Solbourne box, however. More than one industry source is questioning whether the S4000, based on a Panasonic processor codeveloped by Solbourne and Matsushita Electric Industrial Co. Ltd., can deliver 12 SPECmark and 25.5 MIPS levels.

"If it [the Panasonic MN10501] is such a good chip," points out International Data Corp. analyst David Card, "how come it isn't in their servers?"

One former Solbourne executive claims the company intentionally turned down the clock on the S4000 processor. Further compounding matters, rumor has it that recent layoffs at Solbourne were in fact meant to completely remove the design team responsible for the chip.

Solbourne CEO and chairman Doug McGregor says that the stories do not even begin to reflect the truth. "Rumors have had us going out of business for years now," he says. He adds that the chip's performance is well within advertised limits and depends on the application. As for the reported layoffs, he says that the company was letting go of engineering staff in order to gain marketing expertise. "We lost about 40 people, and we added 20," McGregor claims.

Of the 40 lost, however, "one was a designer of the chip." But, he says, Solbourne didn't have many people involved with the processor's design in the first place. Rather, Matsushita did most of the design. "Our group was only five people," McGregor claims. "And you know that you don't design a processor with only five people."

–*mjf and mjt*

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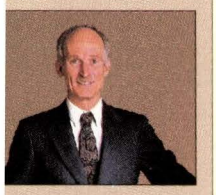
Much better. Because the truth is, most everyone working in a UNIX environment needs us. Some just don't know it yet. And won't find out until it's too late.

Too late to avoid wasted money, wasted time and no small amount of frustration.

So if you're convinced you don't need us, read on. And discover all the reasons why you do.



"In real estate, it's ocation, location, ocation. In UNIX, it's implify, simplify, implify. Try us, and ou'll see how we've sed that philosophy o make installing and orking with UNIX eripherals easier han ever before." — John Cornelius, ndataco Technical irector, and former anager of the niversity of California, an Diego research eam that pioneered NIX in 1974.

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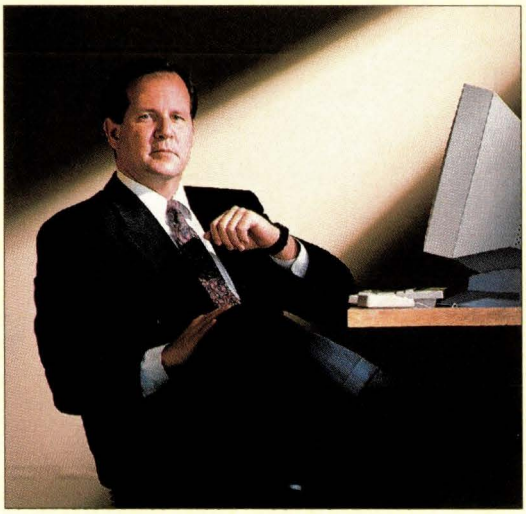
But no more. Now, SPARCstations are talking to Macs. Silicon Graphics machines are transferring data to and from IPCs. Older Sun workstations are interfacing with newer systems.



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Sun Networking Enhancements Debut

Connected with Connectathon–Sun's version of the InterOP trade show–Sun and several third-party vendors have introduced a wide range of new networking tools and packages. While the majority of announcements are geared toward improving Sun connectivity in the TCP/IP environment, there is evidence that Sun and its partners are thinking seriously about OSI links, too. Among the recent highlights:

• Five TCP/IP network-software vendors have announced they will pool resources to create new network applications based on Sun's Open Network Computing/Network File System (ONC/NFS). The five are: Bearne & Whiteside Software Ltd. (Dundas, Ontario), FTP Software Inc. (Wakefield, MA), InterCon Systems Corp. (Herndon, VA), Interlink Computer Sciences Inc. (Fremont, CA) and TGV Inc. (Santa Cruz, CA). Among the new applications expected to emerge from this collaboration are electronic-mail systems, printer-support applications, database connectivity tools and system-backup software.

• Sun has introduced new versions of its SunLink DNI and SunLink TE100 that improves interoperability between Sun workstations and servers and Digital Equipment Corp. VAX/VMS-based systems. The latest release of SunLink DNI (7.0) enables application, data and management-level interoperability between Sun and DEC systems. Version 6.1 of SunLink TE100 allows Sun workstation users to interactively access applications on systems from DEC and other vendors that support VT100 terminal emulation.

• Sun also revealed enhancements to its PC-NFS networking family. Introduced were new releases of PC-NFS (Version 3.5) and a companion product, PC-NFS LifeLine Mail and Backup. Sun also rolled out PC-NFS Advanced Telnet, a new terminal-emulation product Sun developed with Walker Richer & Quinn Inc. PCs equipped with PC-NFS can access any system that utilizes ONC/NFS. The latest version includes support for the Simple Network Management Protocol (SNMP), as well as the 3Com/Microsoft Network Driver Interface Specification (NDIS).

• Interphase Corp., Dallas, TX, unveiled a new intelligent Ethernet controller and software. The new product, the NC400 network coprocessor, improves NFS throughput of Sun's SPARCserver 470 and 490. The NC400 off-loads the entire NFS protocol stack from a server's processor to the network coprocessor. Each NC400 can handle 10 to 40 client workstations.The VMEbus product works in conjunction with the Sun version of Legato Systems Inc.'s Prestoserve.

• UniPress Software Inc. introduced PC-Connect Version 6.01, a Microsoft Windows 3.0-based interface to UNIX. PC-Connect contains a set of UNIX utilities with the same look and feel as their Windows counterparts. The product supports Microsoft's Dynamic Data Exchange (DDE), allowing UNIX and DOS applications to be "hot-linked" for automatic updating. PC-Connect can be used with RS232C serial lines, Ethernet or

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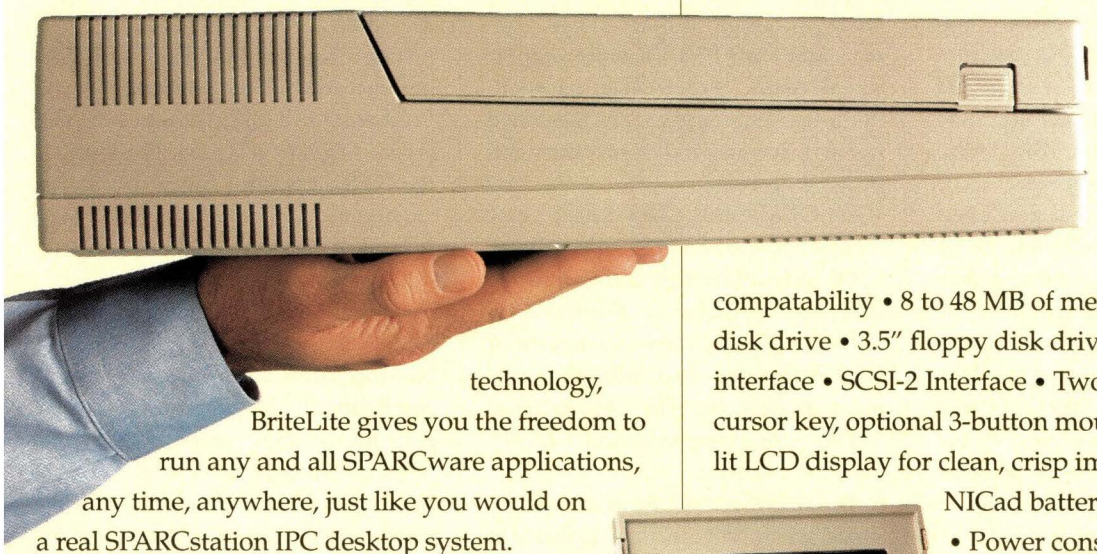
(monitor included)

The BriteLite laptop workstation from Andataco, your UNIX Technical Distributor, gets its power and versatility from a real Sun SPARCstation IPC motherboard. This is not a SPARC-based clone. With its compact laptop packaging and advanced screen technology, BriteLite gives you the freedom to run any and all SPARCware applications, any time, anywhere, just like you would on a real SPARCstation IPC desktop system.



BriteLite Packages Your IPC "To Go"

Other laptops can't compete with BriteLite's power and SPARCware compatability. Just turn the unit around. It's like looking at the back of a standard SPARCstation IPC, with two SBus slots, an ethernet port, two serial ports, a SCSI-2 interface, external video and mouse connectors.

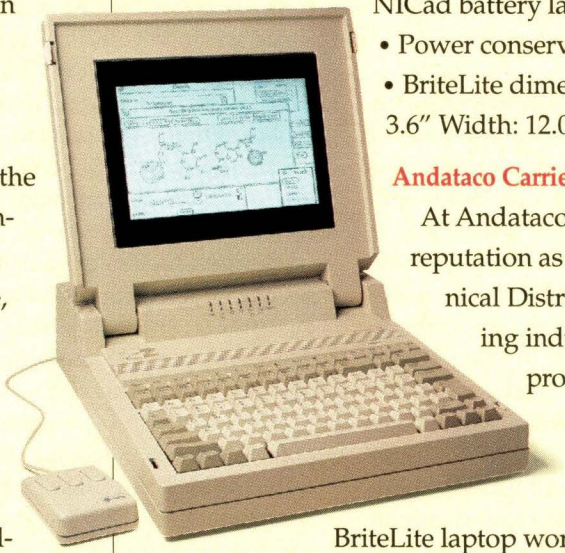
BriteLite's unique new thin-film, super-twist screen technology lets you carry all this power, and display clean, crisp images – even outdoors. And the powerful NICad batteries assure you of two solid hours of continuous performance and six hours in standby mode before recharging.

BriteLite Features add up to SPARCstation IPC Power

Each BriteLite is packed with features that add up to less than 14 pounds (including batteries). So you travel light, without sacrificing any of the performance you've come to expect from your Sun workstation.

BriteLite Highlights

• Uses Sun SPARCstation IPC board • 103 full-size keys • Complete SunOS and OpenWindows compatability • 8 to 48 MB of memory • 120 MB hard disk drive • 3.5" floppy disk drive • Built-in ethernet interface • SCSI-2 Interface • Two serial ports • 4-axis cursor key, optional 3-button mouse • Anti-glare back-lit LCD display for clean, crisp images • Rechargeable NICad battery lasts up to six hours • Power conservation mode • BriteLite dimensions: Height: 3.6" Width: 12.0 " Length: 15.6"



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token ring. The product also supports a host of TCP/IP networks. UniPress is based in Edison, NJ.

• On the OSI front, Sun introduced a new release of SunNet OSI (Version 7.0). The latest incarnation supports international OSI services and protocols, including GOSIP. SunNet OSI enables users to move from TCP/IP to OSI by using dual-stacking ("coexistence"), protocol gateways and/or transport-independence methods. Sun also announced enhancements to two companion products–SunNet X.25 network connectivity software and SunNet Mail Handling System (MHS) software. SunNet OSI and MHS allow for file transfer and mail between Sun, DEC and IBM Corp. systems in a variety of formats.

• Sun also announced that developers can now access the source code for its transport-independent remote procedure call (TI-RPC) for free over the Internet. This means that applications written for TCP/IP networks will be able to run unmodified over OSI-based networks. TI-RPC is identical to the RPC code in SVR4, with the addition of an asynchronous call facility.–*mjf*

This Just In...

• The SunOS/SVR4 development and test platform has been awarded the XPG3 BASE seal of approval from X/Open Company Ltd. Sun's end-user release of SVR4, which will be available by the end of the year, also will carry the XPG3 BASE brand, signifying 100% compliance with the foundation level of the XPG3 (X/Open Portability Guide 3) specifications. OpenWindows, several components of SunOS 4.1 and various Sun compilers, as well as some third-party applications developed specifically for Sun platforms, already have been awarded the XPG3 brand.

• Sixteen companies–Sun among them–which comprise the "Rock Ridge Group" have submitted two preliminary CD-ROM specifications to the National Institute of Standards and Technology as proposed standards for the distribution of data and software on CD-ROM media. The two specs are for the System Use Sharing Protocol (SUSP) and the Rock Ridge Interchange Protocol Specification (RRIP). The SUSP extension to the current standard format for CD-ROMs (the ISO 9660) would allow multiple file-system extensions to coexist on a single CD-ROM disk. The RRIP, built on top of SUSP, would allow POSIX files and directories to be recorded to CD-ROM without modification.

• Sun Microsystems Inc. and Star Technologies Inc. have signed a joint marketing and sales agreement for cross-promotion of Sun's SPARC systems and Star's 910/VP supercomputing network server. Star, based in Sterling, VA, supplies SPARC-based network servers, array processors and image generators.

• Sun OEM Xerox Corp. added a new member to its SPARCstation 2-based 6500 series. The new Xerox 6540 is bundled with Xerox' GlobalView Software. GlobalView is a family of fully integrated document-management applications. The 6540 starts at $17,995 for a grayscale, and $22,995 for a color version.

• Another Sun OEM that has its sights set on document-management is Philips Information Systems, a division of the Dutch firm, N.V. Philips. Philips Information Systems has signed on to resell Sun's complete line of SPARCstations and SPARCservers as the platforms for its new, integrated document-management system targeted toward commercial customers. Philips said it will announce the introduction of the new system later this year.

• On the heels of its announcement to port its electronic-design automation software to SPARC-based systems, Intergraph Corp. also has decided to port a suite of mechanical engineering software and its MicroStation CAD and drafting software to SPARC-based workstations. Nonetheless, the Huntsville, AL, company maintains that it will continue to manufacture and support its full line of workstations based on Intergraph's own Clipper RISC processor.

• Sun users aren't the only ones benefitting from the cross-platform porting wars. Now, Digital Equipment Corp. VAX users will be able to run many of their VMS-based applications on IBM Corp. RS/6000 workstations, thanks to a new VMS emulator for the RS/6000. The vaxpax emulator was developed by Boston Business Computing Ltd. (Andover, MA) and Ki Research Inc. (Hanover, MD). The product includes a VT 320 emulator; a VMS command shell and utilities, mail interface and text editor; and DECnet and LAT networking capabilities. All components are available today.

• Legato Systems Inc., Palo Alto, CA, has introduced an SBus version of Prestoserve. This product complements Legato's VMEbus Prestoserve, the NFS accelerator for SPARCserver computers. Sun resells the VME version with its SPARCserver 470 and 490 products. Sun could choose to market the SBus version for the SPARCserver 2 in a similar fashion. No word from either company on the possibility of such an agreement. List price for the SBus version is $2,300.

• Network-server vendor Epoch Systems Inc. (Westboro, MA) has partnered with Storage Technology Corp. (Louisville, CO) to codevelop and market a new class of storage system that will provide common storage facilities and services for all classes of internetworked computers–workstations through supercomputers. The resulting products will combine Epoch's Renaissance storage-management architecture with StorageTek's automated library and storage products.

• Motorola Inc. is continuing its aggressive push to keep its Delta Series of 88000-based UNIX machines in the public eye. The Cupertino, CA-based computer group announced that it has signed Personnel Data Systems Inc. as a systems integrator. PDS, of Plymouth Meeting, PA, sells turnkey human resources/payroll and financial-management systems

• DSP Development Corp. of Cambridge, MA, has announced that its DADiSP technical spreadsheet now supports X Windows across heterogeneous workstation environments.

DADiSP supports the X.11 version of X Windows and a menu-driven graphical user interface. DADiSP runs on Sun Microsystems Inc. Sun-3, Sun-4, 386i and SPARCstations; Concurrent Computer Corp. Series MC5000 and MC6000; Digital Equipment Corp. MicroVAX II, VAXlab, VAX 2000, VAX 3100 and VAX 3200 workstations; Hewlett-Packard Co. 9000 Series 300 and 800; and IBM Corp. RS/6000, PC, XT, AT, PS/2 and compatibles. Single-unit prices range from $895 to $6,995.

• The European Commission (EC) has selected the Distributed Computing Environment (DCE) from the Open Software Foundation (OSF) for inclusion in its Informatics Architecture. This architecture is designed to specify the framework for an open, multivendor environment for the 1990s. Release 1.0 of DCE is slated for mid-1991 for general availability. The DCE Developers' Kit is available now from the Cambridge, MA-based OSF.

• Two multivendor networking experts (Cabletron Systems Inc. and Cayman Systems Inc.) have announced a development alliance to integrate Cayman's AppleTalk gateway technology into Cabletron's Multi Media Access Center intelligent-wiring hub. The resulting new products will combine Cayman's gateway know-how with Cabletron's network-management and hub capabilities. Cabletron is headquartered in Rochester, NH, and Cayman is based in Cambridge, MA.

• More Apple gateway news: Shiva Corp., the Cambridge, MA, network-communications vendor, has signed an agreement with InterCon Systems Corp. of Herndon, VA, to market and distribute NFS/Share. NFS/Share is software that allows a Macintosh to function as a client on an NFS network. As part of the agreement, all Shiva FastPaths (Ethernet-to-LocalTalk gateways) will ship with a coupon for a free copy of NFS/Share through May 31, 1991. NFS/Share will also be available directly from Shiva or InterCon systems for $295.

Other Open Systems News

Data General Corp.

Making good on its stated intent to reposition itself as a server vendor, DG introduced two new additions to its AViiON systems line. Both have at their heart a new quad-processor board that includes four 25-MHz Motorola Inc. 88100 chips and eight of Motorola's new 88204 cache/memory-management chips. Both of the servers run DG/UX 5.4 and deliver up to 117 MIPS performance. The AViiON AV 8000, configured with DG's 24-GB disk-array subsystem, can support up to eight LANs and up to 1,275 asynchronous terminals. The AV 7000 is a deskside office configuration with the disk-array subsystem offered as an option. Pricing for the 7000 starts at $96,000.

Digital Equipment Corp.

DEC introduced four new fault-tolerant VAX systems. In mid-March, it rolled out the VAXft Models 110, 410, 610 and 612. As part of the rollout, DEC announced that users can upgrade its VAXft machines on-line. The Model 110 becomes the new entry-level machine in DEC's VAXft family. (DEC introduced the VAXft Model 310 last year.) The 110 offers 2.4 VUPS and 6 transactions per second (TPS). Pricing is dependent upon configuration. At the uppermost end of the line, the 612 achieves 12 VUPS and 25 TPS. Pricing ranges from $275,567 to $1 million, depending on configuration.

New benchmarks for DEC's workstations and servers are in. And, thanks to the DEC-developed FORTRAN and C compilers introduced in January, the performance of DEC's RISC family has improved measurably. Specifically, SPEC FORTRAN performance for the entire family increased 11.4%, and MIPS performance, 15.9%. As a result, DEC claims, new SPECmark results show DEC's midrange DEC-system 5500 is now 8% faster than Sun's SPARCserver 2.

In addition to offering better performance, DEC stations and servers also are now available for fewer dollars, as a result of newly announced price reductions and configurations. The DECstation 3100, DEC's current entry-level machine, is now priced at $4,995 (for a monochrome version). Color versions begin at $7,495 for a 16-inch model, and $8,995 for a 19-inch model. The 3100, which runs at 11.7 SPECmarks, can run the currently available version of OSF/1. DEC's mid-range DECstation 5000, which clocks at 19.9 SPECmarks, is now priced starting at $12,495.

DEC has begun shipping he latest version (4.2) of its Ultrix operating system. The new release supports VAX 9000 "mainframes." New features of 4.2 include improved screen display (including support for multiple display monitors), the incorporation of a new version of Adobe's Display PostScript and inclusion of DEC's graphical on-line documentation-access tool, Bookreader. Ultrix/SQL Version 2 database software is included with the new Ultrix release. A two-user Ultrix license is available free with a system purchase. Eight-user licenses sell for $1,180; an unlimited-user license goes for $20,980.

Hewlett-Packard Co.

Not to be outdone by long-time rival DEC, HP has announced a development tool for OSF/1. The new version of the HP Domain Software Engineering Environment (DSEE 4.0) includes support for the OSF/Motif interface and the X Window system, as well as for configuration management on multivendor networks. DSEE may be used with HP's SoftBench CASE-integration framework. DSEE 4.0 sells for $2,020 for a single-user license and $300 to $1,000 for corporate-development licenses. It requires a minimum configuration of at least one workstation on a network running Domain/OS with 16 MB of RAM.

TOM Software Inc., the leading independent supplier of database software for Wang Laboratories Inc. systems, has developed its first UNIX application for the HP 9000 Series 800 business system. The Seattle, WA, company now offers APPlication Xcellence (APPX), an application-development environment that combines business software and CASE tools in a single package. APPX is slated to begin shipping some time this spring.

IBM Corp.

IBM has introduced upgraded models of its RS/6000 POWERstation and POWERserver 320. The new version of the 320-class machines–called the 320H–is essentially the company's low-end product, but with a clock-rate increased to 25 MHz, up from the 320's 20 MHz. The 320H boasts a 32.4 SPECmark rating. Pricing on the 320H workstation is $17,972, while the server version is $20,572. IBM officials are saying that the RS/6000 line will extend still further downward by the end of the year.

IBM also unveiled the POWERserver 950, a rackmount version of the company's POWERserver 550. The 950 comes standard with 32 MB of memory and 957 MB of disk storage. Like all RS machines, the 950 will continue to run IBM's own AIX. Company spokespersons did not discuss when or if the machines also will support OSF/1. Pricing for the 950 begins at $165,000.

Another new and noteworthy product from Big Blue is the Xstation 130, an X-terminal based on an Intel 80186 and a Texas Instruments Inc. display processor. An entry-level 130 with a 12-inch screen and 2.5 MB of memory will be priced at under $3,000. What is remarkable about the system, though, is that it comes with the option of its own 30-MB hard-disk drive for local storage of fonts and frequently used bitmaps. The 130, rather like the recently debuted Hewlett-Packard Ltd. RISC-based X-terminals (see "New Products" section), causes some confusion over just what constitutes a computer. The new Xstation actually boasts more computing power than some PCs. ⊸

Easy Data Management Has Now Found Its Place In The Sun.

Introducing dBASE IV® for Sun.

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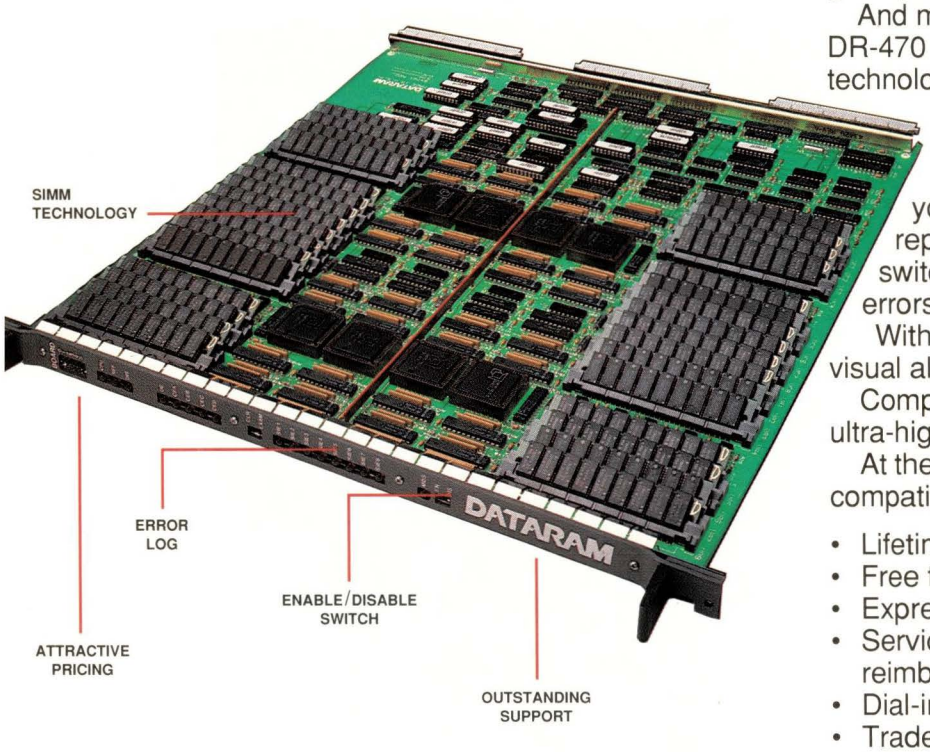

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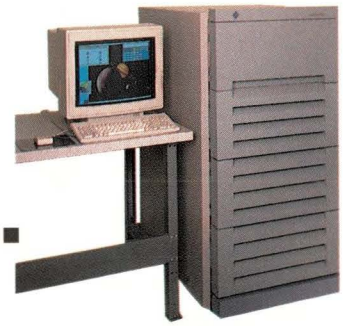

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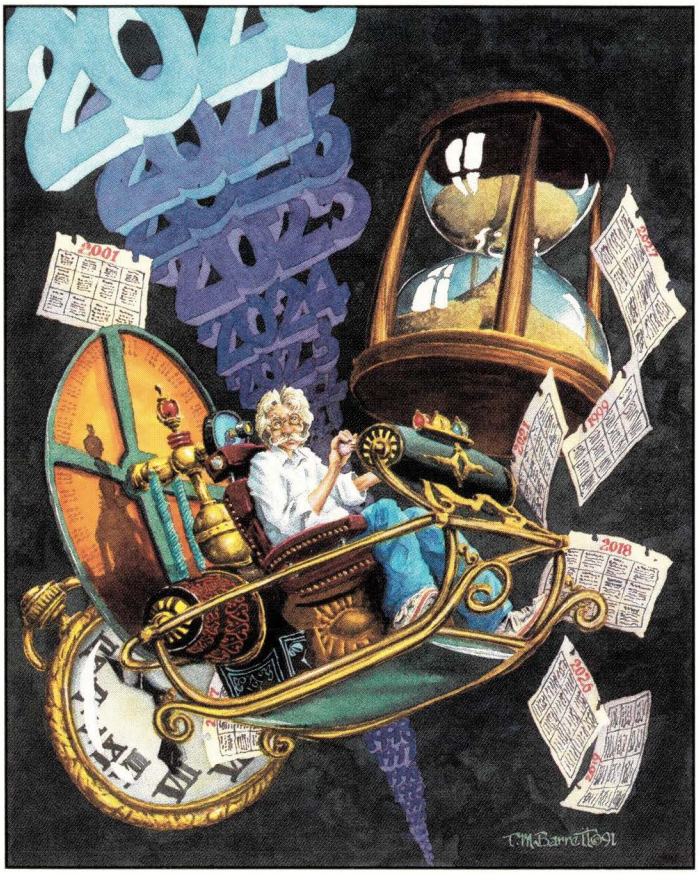


ILLUSTRATION BY TOM BARRETT

Things To Come:
Mr. Protocol Meets Mr. Wells

by MICHAEL O'BRIEN

"...though what if Earth Be but the Shaddow of Heav'n, and therein Each to other like, more than on Earth is thought?"
–Milton, *Paradise Lost*, V.571

"This divine beauty is evident, fugitive, impalpable, and homeless in a world of material fact; yet it is unmistakably individual and sufficient unto itself, and although perhaps soon eclipsed is never really extinguished: for it visits time and belongs to eternity."
–George Santayana

"The gods perhaps move to action late but in the end they show their strength."
–Euripides, *Ion*, 1615

Q: What's that Mr. Protocol is reading?

A: Well, it might be *A Fish Dinner In Memison*, by E. R. Eddison, but it isn't. In fact I can't tell you what it is. Mr. Protocol sometimes gets pre-release copies of protocols, and this is one of them. This one is very much pre-release. It appears to be dated 2027, which is probably why there are moving pictures on the pages. This is evidently an official publication, since it's old-fashioned enough that it still has pages.

But this gives us an opportunity to examine the future state of computer networking, near-term and far. Mr. Protocol has definite opinions on this, doubtless colored by these odd anachronistic bits that keep dropping in.

As many a Gentle Reader will know, there have been mailing lists created since the beginnings of the Arpanet, on most imaginable topics (and a few unimaginable ones). One of Mr. Protocol's very favorite lists was the HUMAN-NETS Digest. This digest was devoted to serious speculation about the architecture, aims and purposes of the Worldnet, which the list members saw as an inevitable development. The traffic on this digest was wide-ranging and diffuse, and ever fascinating.

Now, there's a reason why Mr. Protocol is in charge of this column. Mr. P. is well-nigh incomprehensible

most of the time, but he does see things much more clearly than his amanuensis. The HUMAN-NETS Digest came to an end when its members realized that, to borrow the phrase used to describe a school of photographers early in this century, "they became what they beheld." The network over which the Digest was propagated had become the Worldnet being discussed. Reality having overrun the visionaries, the Digest was folded. What many of the list members, including Mr. Protocol, had realized all along was that the creation of the Worldnet would be evolutionary and not revolutionary in nature. What no one realized was that the biggest and most spirited controversy on it would be the volume of traffic generated by `alt.sex.pictures`.

Many folks who like to read science fiction point to its supposed predictive powers. A favorite tale is that of John W. Campbell, editor of *Astounding Science Fiction* (now *Analog*), who was visited by the FBI during WWII because of a story which appeared therein. It was uncomfortably close to certain doings in a rather hush-hush endeavor known as the Manhattan Project and just what was he doing publishing national secrets in his magazine anyway? Mr. Campbell succeeded in pointing out to the FBI that a) anyone with a slide rule and a background in college physics could work out the premise, and b) if he quit printing stories like that it would be a dead giveaway that there was a reason why he'd had to quit printing stories like that.

The fact is that science fiction hits the truth because it aims at everything. A shotgun will hit the bullseye on a rifle target every time. One has only to enjoy such wonderful '40s stories as the one that had a radio relay station in equilateral orbit with Venus, and described in loving detail the gigantic triode tubes in the transmitter room. Or the supercomputer that had a memory consisting of a mercury-vapor shock tube several miles long. Mr. Protocol, being the sort that he is, thinks that such things *ought* to be built, if only because they're so wonderful to contemplate.

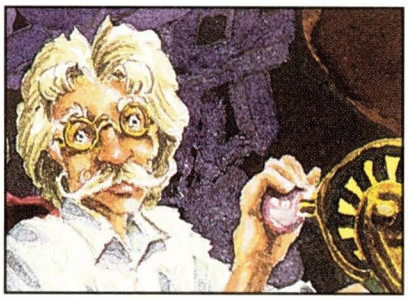
That said, we can proceed to wonder about the shape of networking to come, in the full assurance that in ten years, or even five, this column will probably make very silly reading indeed.

What will it be like? Mr. Protocol is glad you asked.

One thing Mr. P. feels is almost certain is that the Worldnet will not be a single network. There are strong reasons of both marketplace and security for this. A single, integrated network would be easier to maintain, and the sheer expense of its construction mitigates against an explosion of parallel, competing networks. Still, the current climate of deregulated competition is liable to remain around at least long enough to cause the creation of several national networks, each providing a different mix of services to businesses and private customers. Note that services like GEnie, Prodigy, Compuserve and the like do **not** fill the bill, because they are in fact centralized services masquerading as networks. True networks will only arise when there are geographically dispersed resources large enough to be linked. The

European community is less likely to generate competing networks–with the creation of the EEC and the advent of a loosely united pan-European government in the wings, they seem to have a horror of plurality–but unless the American business world collapses under its own weight, each of the independent American networks will compete for a world-market share.

The second factor in the creation of parallel networks is that of incompatible service requirements. The transaction-based, high-security nature of the financial world is antithetical to that of a more highly interactive, more widespread home-based network. These networks will meet only at specialized, tightly controlled gateways, Mr. P. feels certain. The U.S. govern-



ment also seems certain to create a parallel network, just as it has created a parallel telephone system. This network will be the direct descendent of the MILNET.

Still, there is liable to be an "everyday" network, just as there is an "everyday" phone system. One would be tempted to say that it would *be* the "everyday" phone system in an evolved configuration system, but there remain stiff political, regulatory and economic barriers to overcome. The likely players in a competitive network environment are scared silly by the size of the various post-diaspora phone companies, while all involved stand amazed at their incompetence at entering the networking world. Their biggest advantage is their entree: They already have a phone in everybody's home. The infighting will be fierce and no clear winner can be predicted in advance. What does seem clear is that the pressures of a potentially huge, but as yet ill-defined, market will cause

even more boardroom ulcers than usual, as well as a number of surprising partnerships, some of which have already been formed.

Sun Microsystems (bet you thought we'd never get around to them) has allied themselves most closely with the telephone side of things, given their business arrangements involving AT&T. Now, embedded UNIX systems have been involved in the operation and diagnosis of telephone-switching networks for many years, so it would be odd indeed if various back rooms at Sun were not involved in attempts to extend this dimension of networking to include hookups to such services as ISDN.

These marriages can be seen to bear fruit in the near to middle term, but what does the future hold further along the line?

The first observation is that the headlong rush of technological development will be slowed greatly by the immense drag created by universal availability. The underlying standards involved in telephone technology have been frozen since the 1920s, when the nationwide telephone system was first installed. Terms such as "tip, ring and sleeve" remain from those days, and describe electrical characteristics of components that have not changed since, though the actual hardware has undergone considerable evolution. Central offices are marvels of computational efficiency, but the telephone handset hasn't changed much. Oh yes, back in the 1950s they came up with some buttons to replace the dial. Two of the buttons didn't do diddly for about twenty-five years, and they're just now phasing out the extra charge for actually using the buttons instead of a dial. The dial was invented, oh, when? In the late '20s or early '30s or so? Mr. Protocol's home town didn't get them till the '50s, which made them obsolete upon introduction, or very nearly.

The same is true of electrical power distribution, or natural gas, or television broadcast standards (don't expect to see true HDTV around soon, if ever). Once a technology is made available to EVERY home in the country (or the world!), the gargantuan cost of change-out essentially freezes the technology.

As a result, the introduction of networking technology is, paradoxically, being delayed by its own rapid development. Whoever takes the plunge and starts wide-scale introduction of the physical layer necessary for a true Worldnet will be stuck with that technology for a very long time. If a new technology of clear enough superiority receives sufficient financial backing from a competitor, the entire installed base could be rendered obsolescent. Consumers would be slightly irritated by this, to say the least. We no longer remember the days when one needed to have two or three telephones in order to talk to everyone in town.

What does seem crystal clear is that the installed "Worldnet" will consist of technology that lags far behind what is actually current. This may result in the creation of specialized subnets that can provide the more advanced services made possible by technology developed after the original widespread

technology is frozen. Gateways and gateway functions will be the key to distributing this technology. Telephone lines are currently being used to carry many things besides the voice information for which they were designed, all by the creation of carefully crafted "gateways"...such as modems.

Let us not forget that a great deal of today's computer usage is entertainment. We can expect this trend to continue, with few surprises. Whatever else Worldnet provides, it will provide entertainment, for this is what people will buy: discussions, games, shared worlds, interactive movies, the works.

Finally, Mr. Protocol would like to toss a special-issue chocolate-chip cookie in the direction of a current buzzword: virtual reality. This is the polite term used to introduce a concept which in a darker and more advanced form has been referred to as "cyberpunk." In this view of the world, the network becomes the city of today, back alleys, intrigue and all. Individuals and corporations are viewed as having no more choice about dealing with and inhabiting the network than they have today about inhabiting the city. Security forces are replaced with "black ICE"–Intruder Countermeasures Electronics, which can kill unauthorized data thieves, descendents of the crackers of today. It's the American West, transplanted, and bears about as much resemblance to the real future as the Western does to the environs of Phoenix, circa 1880.

Such is the hair-raising stuff on science-fiction shelves today, and it's enlightening reading, as much for the clear vision it presents of what we can expect as for the mistaken assumptions it makes. The nets, after all, are and will be "human nets." The seductive power of a full sensory interface is, Mr. Protocol strongly feels, sufficient to assure that this line of development will continue. He doesn't think we'll be "jacking in" directly, dramatic as this seems. The problems associated with implants are too severe–and besides, our sensory organs give us a several-billion-year jump in data-input engineering. Full auditory, visual and tactile interfaces are natural, in that they present us with data in the same way we have gathered it from birth, as an integrated whole. The mistake is in assuming that "cyberspace" will be presented as a consensual hallucination, in which everyone sees everything the same way. Different views of the same data are the key to insight, and "insight-inspiring environments" are the key to real power in computer interfaces. Not that everyone will create their own view of cyberspace from scratch. Oh no. That difficult task will be the province of an entirely new breed of business. Think of them as "data opticians," or "cyber-set designers." They'll provide a view that we will buy, each of us assembling our own unique view of the Worldnet from the pieces they provide us. They will provide the real look and feel of cyberspace, combining the capabilities of a clipping service and a movie production company.

Mr. Protocol once read a book with a soundtrack. The author opened each chapter with a listing of the music that he'd listened to while writing it. That won't be very unusual on Worldnet. Just give it time. More time than you'd think, and less than you'd fear. Or the other way around. ⊸

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.

ILLUSTRATION BY MANUEL KING

Manuals

by **PETER COLLINSON**, Hillside Systems

It used to be the case that a new UNIX user was plonked down in front of a terminal, shown how to log on and told to play. The person who was showing them, the guru, was inevitably busy, but mostly in need of a cup of coffee. Before the guru left caffeine-wards, the bewildered trainee was further confused by "you'll find all you need to know by typing `man` followed by the name of the command you are interested in." If you were lucky, you were given a copy of *UNIX for Beginners* or pointed in the general direction of `learn files`.

The advice to look in the manuals is always to be recommended, but should be accompanied by something like: "The manuals are not intended to help you to learn; they are there to tell you how to *use* the facilities." The manual pages that came out of the UNIX room in AT&T Bell labs were intentionally terse. Detractors claim they were written in a form of UNIX-speak. It's probably true to say that you needed to have some UNIX context to understand what they were saying.

Don't get me wrong; I am not criticizing the style of the manuals. They were written *by* people with a lot of UNIX knowledge *for* people with a lot of UNIX knowledge. They were written to answer the question "How do I do that?" and not "How should I go about doing that?" They were not written as training documents.

Not Terse Enough?

In some ways, I have always felt that the manual pages are not terse enough. When typing in commands, I often want to answer the question: "What's the option that does *this*?" When programming, I often need to know: "What are the parameters to that routine?" or "What does it return?" For example, I can never remember whether it's `gets` or `fgets` that puts the newline in the returned string or not.

You can get this information from the manual page, but you have to wade through lots of other stuff that gives too much detail. To help with this, I once decided to implement a command called `how`. Its function was to copy a single file onto the screen; the file was taken from a database similar to the `man` pages. You gave `how` the same arguments that you would give to `man`. However, the displayed file was small because I thought the data must fit into a standard screen.

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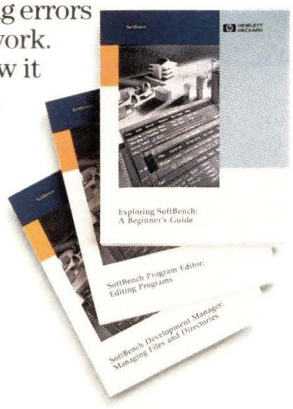

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At the time I did this, a screen was 80 columns by 24 rows, or so. No processing or formatting was allowed.

Here is a sample how page for the rm command:

```
rm (1) remove (unlink) files,
     remove directory

     rm [-][ -fir ] file ...
     rmdir dir ...

-    all following arguments are files
          (allows removal of file called -f)
-f   Ignore access permissions, remove anyway
-r   recursively remove files & directories
          (argument is a dir)
-i   interactively remove files

See also: unlink(2)
```

If you go and look at your manuals, you will see that this information is a distillation of the manual page. It contains all the essential information but no verbiage.

How did I generate the files? Well, I went through each manual page and created a parallel database. I used an expert system: my eyes, brain and hands. Every time we installed a new version of UNIX, I took a week to create the how pages. There was one benefit in doing this; afterwards I *really* knew what the manual pages contained.

After the initial push to create the database, it's not difficult to keep it up to date. There was a site rule that command installers must produce a manual page and a how page. Grumble. Grumble. After a bit, the whimpering stopped, because the users complained bitterly if they found that there wasn't a how page for a command or routine.

Was it worth it? Yes, most people used how in preference to man as a first approximation to getting information about aspects of the system. I think that a major factor here is speed. It's faster to get the how page on your screen and it's faster to extract the information from it.

Help From Commands

Another way of getting this sort of information across to users is via options to commands. The D-Tree software from David Tilbrook (now with Sietec Open Systems) provides a set of tools that run consistently on many varieties of UNIX. All the commands have a -x switch that generates how-style information. I notice also that the Microsoft C products for the PC can produce this kind of abbreviated help.

In these days of windowing systems, users are supplied with help buttons to be pressed. Mostly they throw the user into a browsing facility that enables access to yet another set of instructional files. Microsoft Windows 3 is an example of this, as is the help system for Sun OpenWindows 2. For me, these systems often fail because there is simply too much information. It is hard to find the answer to the question that I am asking at the time. There is a fine line between learning about how to use the system and asking specific questions about what is happening now.

I always want to be able to switch off the training system when it stops being useful, and replace it by a terse aide-mémoire. In the last year, I put a little X application out to the net–a calendar program called xcal. It is furnished with help buttons. The information presented is there to aid the casual user; the person who wanders along and just types xcal. The information is advertising. The help buttons in xcal remove the thing I hate most about window systems: the magic key-press syndrome. Many commands seem to have some combination of keys or mouse movement that will generate an effect–except I instantly forget what the combination is unless I can see it.

My xcal help buttons are intended to describe the avail able controls, or at least those that are not visible. If you begin to use the program more frequently, I expect you to set the X resource saying "no help." At this point all the help buttons disappear from the image, removing clutter that you don't use. Hopefully by then you have learned the "spirit" of how the command works and no longer require prompting.

If you forget something, you can always consult the manual page. Read The Fine Manual; all bugs are now features. Of course, the manual page for xcal is immense since there are zillions of X resources to be documented. Still, you can have it thrown up onto your screen to find out all about the command, assuming that you have remembered to install it.

The man Command

The job of the man command is to find a file that corresponds to the user's arguments, process the file and display the results.

Finding the file is easy. All the files live in subdirectories of /usr/man. If the user has typed man command, then the file is assumed to be in section 1 of the manual and the file will be named:

```
/usr/man/man1/command.1
```

The user can specify a section, say 5, by typing

```
man 5 command
```

The command will look for

```
/usr/man/man5/command.5
```

Things are a little more complicated than this because the files sometimes have suffixes showing some particular subsection of the manual. For example, pg is a System V command and Sun places this into section "1v" of the manual, so the file can be found in

```
/usr/man/man1/pg.1v
```

The man command hides all that nastiness from the user.

In the above explanation, I have assumed that you knew that the manuals came in several separate sections. On BSD-derived systems, the original UNIX conventions have been maintained. Sections are numbered from 1 to 8 with each

section covering a different broad area of documentation. We have user commands in section 1, system calls in section 2, user-callable routines in section 3, descriptions of devices and device drivers in section 4, descriptions of file formats in section 5, games in section 6, miscellaneous pages in section 7. Finally, system-administration commands and subsystems can be found in section 8.

This is expanded by section `n`, for *new* commands. This section was added on the Berkeley releases to provide a known place to put documentation relating to externally supplied sources that they distributed along with their own code. You may also find a section `l` (the letter *ell*) for *local* commands. This is where you can put manual pages for any commands that are written on your site, or perhaps imported from the net.

Processing the File

We can find the file, but what's in it? Manual pages are all `troff` source. This means they need to be processed before delivery to the user's screen or printer. For screen use, they are usually passed through `nroff` to generate an image using fixed-width characters with fixed spacing. This is suitable for viewing on most terminals or terminal emulators.

Since manual pages are often more than one page, the output from the `nroff` is passed into a pager, by default `more`. You will find that `more` understands the character sequences that `nroff` outputs to display text set in italic or bold fonts. These features will be displayed by using highlighted or reversed characters depending on the `termcap` entry for the terminal.

You choose your own pager by setting the environment variable, `PAGER`. Perhaps (in `csh` syntax):

```
setenv PAGER /usr/local/bin/less
```

This is a public-domain program that is really a superset of the `more` command. The primary reason for using `less` is that it permits you to go back up the text. I notice that Sun's current version of `more` implements this anyway.

Another candidate is `pg`, System V's pager. It should be found lurking in `/usr/5bin` on your Sun, so you can say (in `sh` or `ksh`):

```
PAGER=/usr/5bin/pg export PAGER
```

Running `nroff` every time you want to look at a manual page is time consuming. The `man` command can be persuaded to cache the output from `nroff`, and after that it simply has to display the file on the screen. Creating the cache is simple. If `man` finds a directory called:

```
/usr/man/cat1
```

when processing a section 1 command, then the `nroff` output is moved into the `cat1` directory. Later calls to `man` will see the cached copy and simply transfer the file to the screen. Update time on the file is used to see whether the cached copy needs to be replaced. You can create `cat` directories for all other sections.

Up to this point, the facilities in the `man` command have been available in all BSD-derived systems. If you are running OpenWindows on your workstation, you have the ability to display PostScript on the screen using the `pageview` command. It would be nice to be able to process the manual page with `troff` generating PostScript showing a better representation of the printed page with the different fonts, variable spacing and line drawing.

Running `nroff` every time you want to look at a manual page is time consuming.

This can be done using the `-t` option to the `man` command. The option tells `man` that the page will be passed through `troff` so the `cat` cache should not be utilized. The standard shell script `psman` uses this to display a manual page in a `pageview` window. It does assume that you can do the `troff` to PostScript conversion. This is not a standard feature of SunOS, although it's easy to get hold of.

The formatted output from the `troff` command can be cached by creating directories like

```
/usr/man/fmt1
```

On my system, these are symbolic links to my emptier disk partition. The `-t` option adds two new environment variables. The variable `TCAT` is the final output filter. If unset, it defaults to `lpr -t`, firing the manual page at the `troff` filter in the line printer system. To see the output on the screen, this can be set to `cat`. Secondly, the variable `TROFF` contains the command used to process the file. If unset, the command `troff` is used. This can be set to `psroff` or whatever.

Aside from any cunning screen-display use, the command

`man -t` *something*

causes the page to be prettily printed on your main system printer.

Using Text Preprocessors

The manual pages sometimes contain sections that are supposed to be passed through some standard text preprocessor like `eqn` or `tbl`. This has always been a problem.

I have always felt there should be a generally recognized way to make a file contain the sequence of commands needed to process the file. I guess this is an object-oriented need. I want to be able to pass the file through one command and

have that program work out what preprocessors are needed to mess with the data and generate output.

One way of storing command sequences is to use `make`, but it's a pain to have that `makefile` lying around the file system just to process a single document. Also, I often store many different documents in the same directory and this just complicates things.

I do have a private way of making source control the actions that are needed to generate output. I have a program called `xtx` (for eXecute TeXt) that looks in a file for an embedded shell command. The command is preceded by a magic control string. The `xtx` program scans the text looking for the string and when it finds the magic, it executes the command that follows it. All my documents have the correct string embedded in them. Producing printer output from any one of my stored documents is easy. I simply quote the filename as an argument to `xtx`, it looks for the needed commands and executes them.

Sun has spotted this difficulty and has a `troff` convention to allow the definition of preprocessors. A `troff` comment is inserted at the start of the file that contains some key letters. These letters denote that different preprocessors are to be used for the `man` command. The first line of the manual page starts with:

`'\"` *chars*

–a quote, a backslash, a double-quote and a space. The *chars* field can be any combination of: `e` for `eqn`, `r` for `refer`, `t` for `tbl` and `v` for `vgrind`. If the `man` command finds one of these magic lines at the start of a manual page, it will pass the data through the appropriate preprocessor.

Finding What's There

There are around 2,500 files in the manual system on my Sun. It can often be hard for newcomers to UNIX to find out what is available. Worse, you may know what you want but it can often be difficult to guess what it is called. There are two commands that can help.

Both commands use a database `/usr/man/whatis`, which is simply the concatenation of all the `NAME` lines from all the manual pages. In normal nasty UNIX fashion, it is created as a side effect of the `/etc/catman` command. This command is supposed to fill in the `/usr/man/cat?` cache from all the available manual pages. As it is scanning all the manual pages, it might as well create the `whatis` database as a side effect. Yuck.

The first command, called `apropos`, is hard to type correctly. It is given a keyword and searches the `whatis` database. It is equivalent to

```
grep -i keyword /usr/man/whatis
```

It doesn't use `grep`. The command is really the `man` command with the `-k` switch set. The `apropos` command is a link to the `man` binary. The `man` command looks at the name of the command by which it is being called to decide on how it should behave.

Why this command is not just `grep` sitting in some shell script eludes me. If `grep` was used, there would be the

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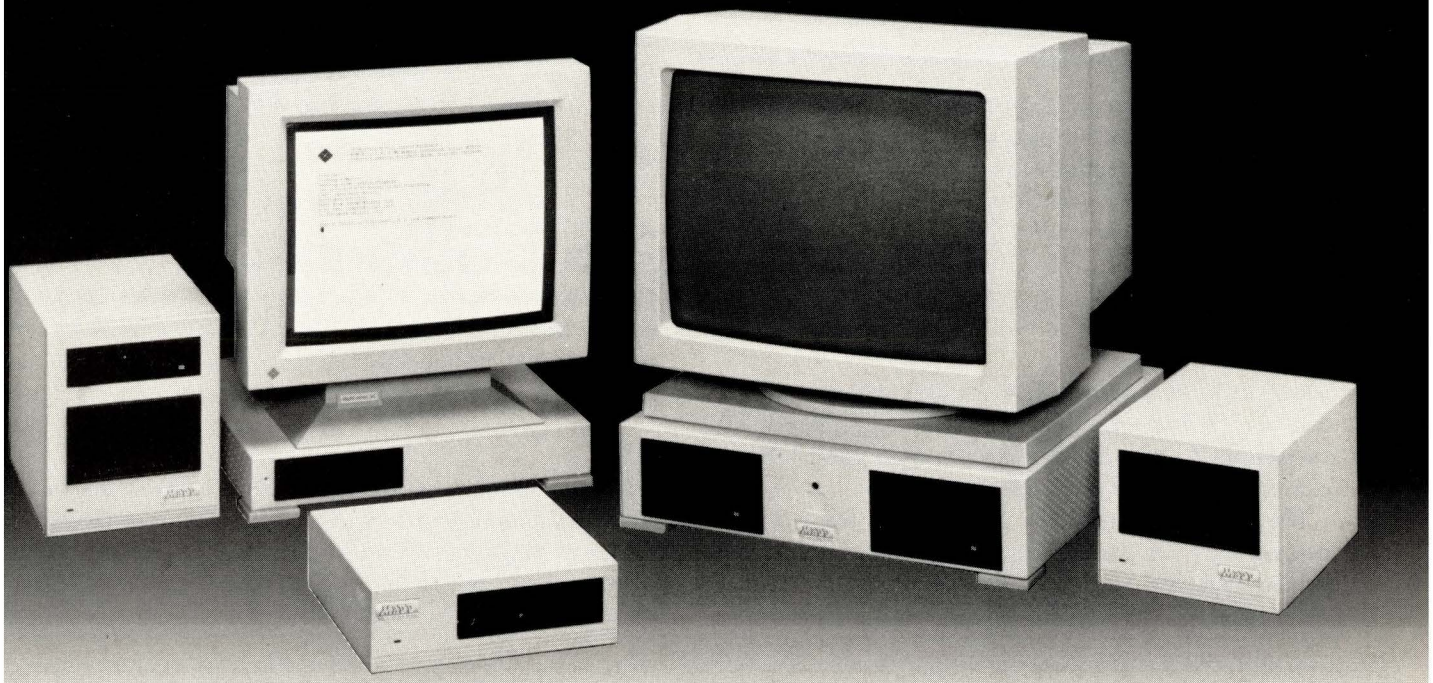

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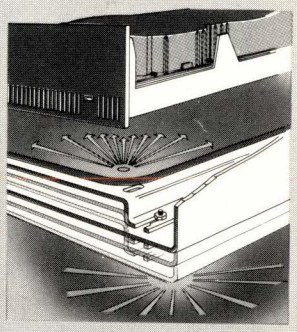

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added benefit that the search string could be a regular expression. Perhaps permissions on files may be a reason.

Anyway, if you can think of a keyword that appears in the NAME line, then you can find a manual page that might have some bearing on the topic. It's a case where knowing UNIX jargon helps. Typing

```
apropos delete
```

when looking for how to get rid of a file is a little fruitless. The word *delete* doesn't appear in a NAME line for any useful command. You have to type *remove* or *unlink* for the rm command to pop out of the database lookup.

The second command, whatis, searches in the whatis database for a line that matches its argument. Rather than looking anywhere in the line, only the command name part of the NAME line is matched. This command is designed to help you answer the question "What does this file do?" when looking in one of the various depositories for binaries.

Finally

If you are really trying to learn what is in the manual pages, my best advice is to get a printed set and just flip through it. Don't learn every golden word by heart, don't even *read* every word. Instead do what I call "looking at the pictures"–you scan the pages looking for things that seem interesting. This is not really a book-reading exercise; it's best done in those odd moments when nothing much else is happening. So mute the TV during the commercials and leaf through a UNIX manual instead; you'll only miss the latest installment of that annoying coffee ad.

Acknowledgements

The excellent *UNIX for Beginners* was written by Brian Kernighan of AT&T Bell Labs. Mark Seiden (Seiden and Associates Inc.) updated it for the 4.3 BSD manual set.

The idea for xtx is not mine. I got it from David Tilbrook who, in turn, got it from Tom Duff (AT&T Bell Labs). I put this out to the net some time ago, so it's probably in a comp.sources.unix archive somewhere. ⊸

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+. Email: pc@expert.com.

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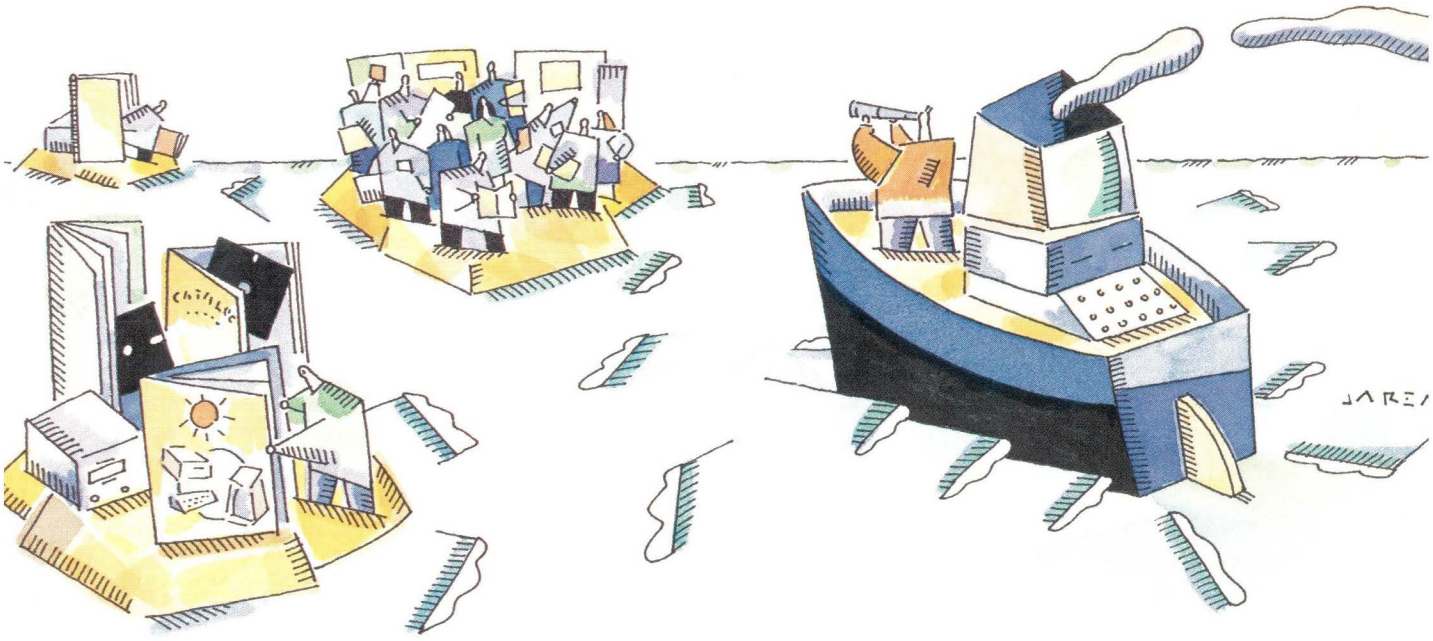

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Sources for Sun Information

by **RICHARD MORIN**, Technical Editor

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

The larger problem, sifting the data for useful information, is a bit harder. One person's gold is another's dross, so the final selection must be done by each individual. Much of the selection can be performed by choosing the appropriate data channels, however, and the descriptions below may help in that process.

Catalogs

The 1991 *UNIX Products Directory*, published by UniForum, is the premier catalog for UNIX products. Volume 1 contains 990 pages of software listings and indices. Volume 2, a mere 614 pages, contains hardware, publication and service listings, and yet more indices.

The *Catalyst* catalogs, published by Sun, list third-party hardware and software for Suns. Several versions are available, including the 1,233-page comprehensive catalog, a smaller catalog of SPARC-related products and brochures covering specific market segments.

Sun will issue a new comprehensive catalog this summer. Because of Sun's increasing emphasis on SPARC, information on other architectures may be limited. Consequently, some (Sun-3, etc.) owners may wish to get a copy of the current catalog, which lists all Sun architectures equally.

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

Magazines

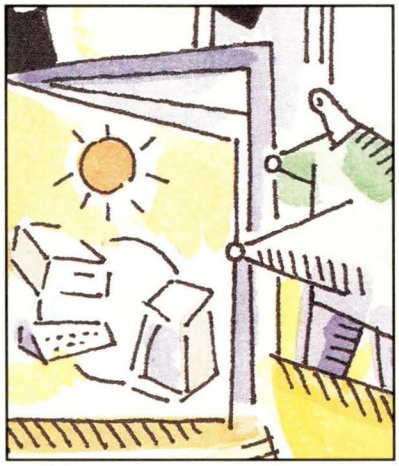
There are several magazines that cover UNIX in general and Sun in particular. Some of these, like *SunExpert*, are complimentary to qualified readers. Others are only available via paid subscriptions. Some are sent only to members of specific organizations.

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

ones best meet your needs.

UNIX Review, *UNIX Today*, and *UNIX World* are trade magazines serving the general UNIX community. *SunExpert*, *Sun Observer* and *SunWorld* fill the same niche for the Sun community. *Sun Observer* and *UNIX World* require paid subscriptions; the others are complimentary (controlled circulation).

UniForum members receive *CommUNIXations*, a monthly magazine containing organization and industry news, technical articles, etc. Following a major redesign in early 1990, the magazine has gained a new, upscale appearance and increased technical content.



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

I have avoided discussing Sun and UNIX books, for fear of getting lost in that substantial topic. (See "I/Opener," October 1990, for a discussion of UNIX books.) The Usenix version of the 4.3 BSD manual set warrants an exception, however.

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

The Usenix manual set is convenient, economical and amazingly useful. Unfortunately, it is also going out of print, and a BSD 4.4 set may or may not emerge. Consequently, you should order a set while it is still available.

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

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

UNIX Conferences, etc.

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

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

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

The C++ event, originally held as a workshop, has now grown into an annual conference. The Summer and Winter conferences tend to focus on the UNIX kernel, but other aspects of UNIX are also discussed. The Summer conference is accompanied by a small trade show.

UniForum holds a massive conference and trade show each Winter. With over 20,000 participants, it is the premier venue for UNIX exhibitors. The conference sessions are also substantial, but are not exclusively technical. Instead, they concentrate largely on the commercial side of UNIX, from standards issues through market projections to (occasional) product promotions.

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

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

Sun Conferences, etc.

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

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

This June, SUG is holding an experimental Summer conference on "SPARC: Hardware & Software." There will be no accompanying trade show, and the limited attendance (500-1,000) will allow a workshop-like atmosphere.

Finally, SUG assists Local User Groups in holding occasional regional conferences. These are short (one to two days), intimate and allow Sun users to "network" with others in the same locale. Local User Group meetings are, of course, an excellent way to meet other Sun users, exchange gossip and get up-to-date information about Suns.

Instant Gratification

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

The *Sun-Spots* newsgroup (`comp.sys.sun`) carries questions, answers and commentary on a variety of Sun-related issues. Topics include hardware, software, networks, SunOS, source and miscellaneous.

Bob Greene, the group's valiant

moderator, keeps down the noise by trimming redundant postings, answering some questions directly, etc. Despite this, the newsgroup is large and growing larger. Volume 9, covering 1990, occupies almost 8 MB, or about 20 KB per day. The collected back issues take up nearly 25 MB.

Sun-Spots, available on most Usenet feeds, can also be received via email. Recent back issues are available via anonymous ftp from `titan.rice.edu`. Older back issues are available on various network archives and on the 1989 SUGtape. Contact `sun-spots-request@rice.edu` for more information.

Sun-Managers, although unmoderated, is a remarkably clean source of system-administration folklore. Questions are posted directly to the group, but answers are not. Instead, they are sent to the initial poster, who takes on the job of summarizing the responses.

The volume is substantial, about the same as *Sun-Spots*, but much more tightly focused on administrative issues. Back issues (about 5 MB to date) are available by anonymous ftp. Contact `sun-managersrequest@eecs.nw.edu` for more information.

For a mix of Sun press releases and assorted technical notes, try the SunFlash mailing list. The volume is relatively small (under 10 KB per day), and the articles are frequently quite interesting. Subscription requests should be sent to `sunflash-request@sunvice.East.Sun.COM`. FTP archives (currently around 4 MB) can be found on `solar.nova.edu` and `paris.cs.miami.edu`. ⊸

Richard Morin may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044. His electronic address is `apple.com!cfcl!rdm`, or he can be reached at `rdm@expert.com`.

Sun Sources

Catalyst catalog
Software Technical Bulletin
Sun Microsystems Inc.
1550 Garcia Avenue
Mountain View, CA 94043

CommUNIXations
UniForum Conference
UniForum
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Computing Systems
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Usenix Association
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SunExpert Magazine
SunExpert Inc.
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The Sun Observer
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12416 Hymeadow Drive
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Sun User Group Conference
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SunWorld
IDG Communications/Peterborough
80 Elm St.
Peterborough, NH 03458

UNIX Expo, UNIX Expo/West
National Blenheim Exhibitions Inc.
15 West 39th St.
New York, NY 10018

UNIX Review
Miller Freeman Publications Inc.
600 Harrison St.
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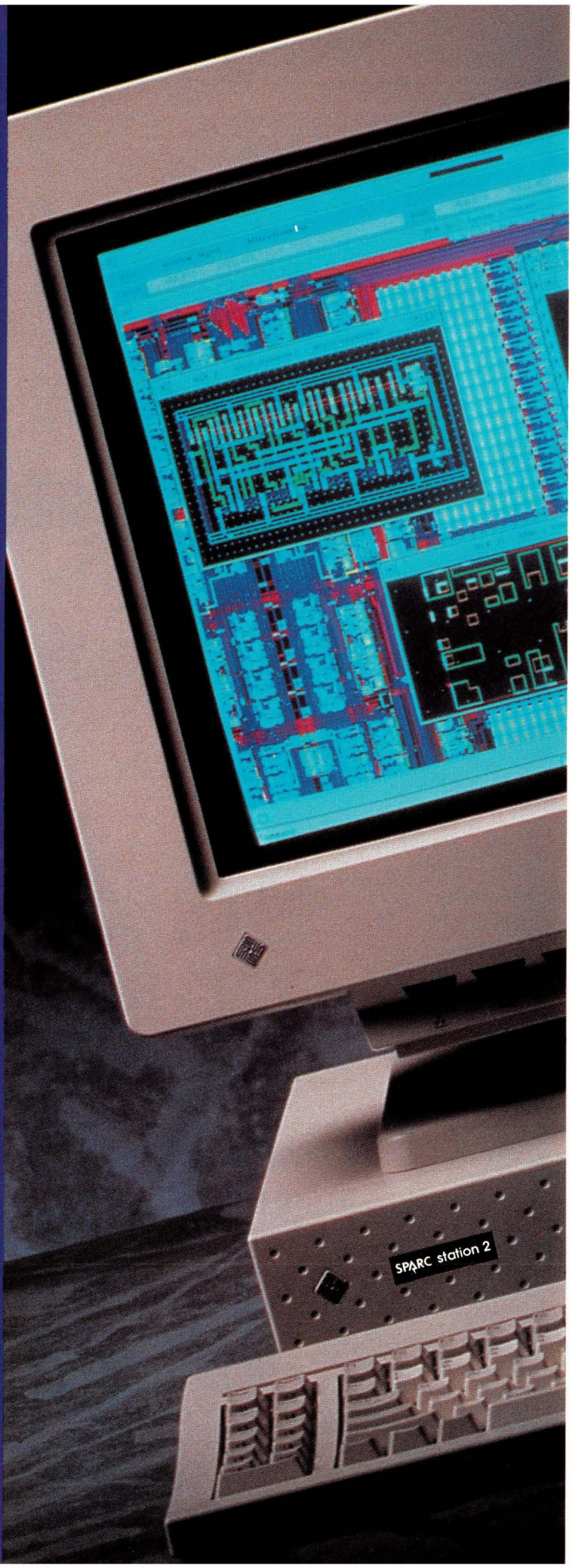

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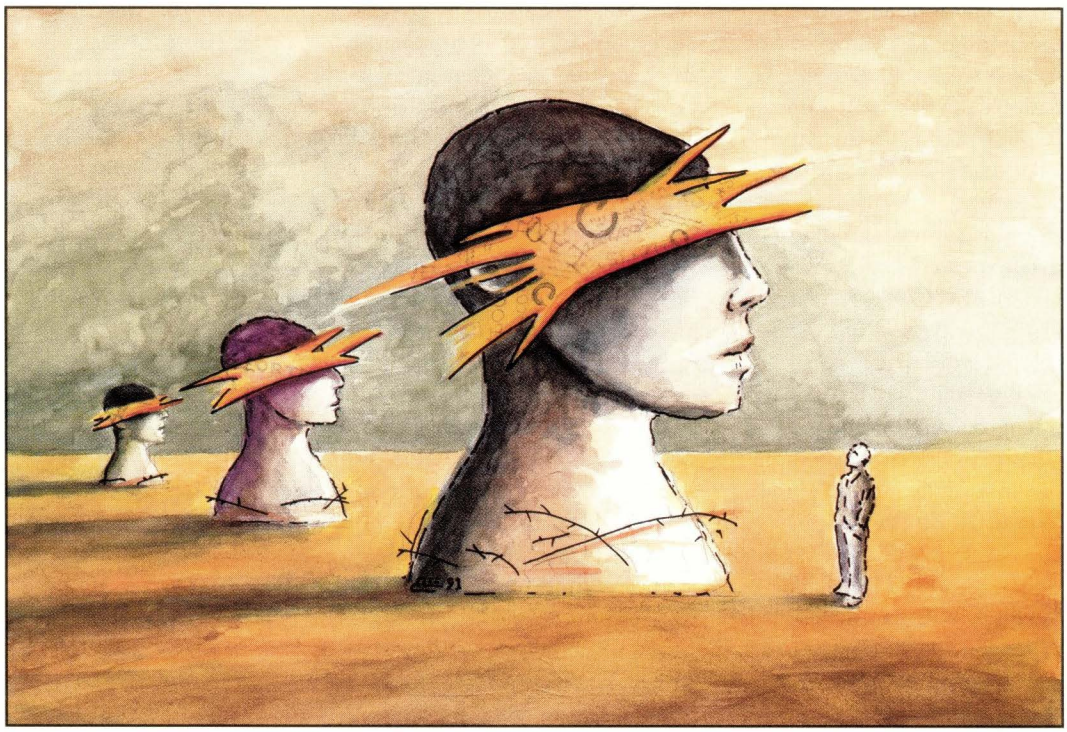

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Language Independence

by PETER H. SALUS

The original POSIX standard, IEEE Std. 1003.1-1988, is written in terms of the C programming language. It makes some attempt to address the issue of multiple programming languages by distinguishing between Common Usage C and Standard C, and by definitions of conformance and compliance that are not tied to a specific language. (You can have a POSIX system that doesn't have any language translator at all.) Nonetheless, all the interfaces of 1003.1 are defined in terms of C.

This is a major problem, as ISO's WG15 has made it clear all along that language-specific standards are unacceptable. The POSIX committees have accepted that judgment in principle, but not a single POSIX "dot" has written a document that complies with what WG15 wants.

The language-independence (LI) issue came to a head at the June 1990 Paris WG15 meeting, when WG15 refused to accept the IEEE 1003.4 document (and several others) for consideration as an international standard because it was not language independent. This put the Standards Executive Committee (SEC) in a tough position.

An SEC subcommittee to examine the LI issue subsequently reported back a motion to require all Technical Committee on Operating Systems (TCOS) committees to incorporate an LI part before ballot approval. The LI notion was not greeted with enthusiasm by some of the SEC members, particularly not by 1003.2.

It is an historical accident that the C programming language and the UNIX operating system developed in such close association. The initial standards for both have only been partially successful in separating them, in defining requirements for C-language implementations regardless of the operating-system platform and for UNIX implementations regardless of the programming-language interface.

Elsewhere in the standards world, it is common practice to specify system services (such as database, graphics or networking services) in an abstract manner, independent of the particular programming language syntax used to access those services. The specific syntax used by application programs written in particular programming languages are specified in separate standards called language bindings. This separation of language standards, language-independent service standards and language-specific service bindings allows for the independent development and maintenance of each type of

standard, and has been recognized as good standards engineering practice.

Recognizing the value of rapid publication of a UNIX standard, the international standards community agreed to accept the initial UNIX standard (now called POSIX) in the form of a C-language binding, on the promise of the United States (which had been granted national development authority for POSIX standards) to quickly provide a revision of the POSIX standard that clearly separated the language-independent from the language-specific requirements. In spite of this promise, the IEEE TCOS (which had been subdelegated as the POSIX standards development body by ANSI) continued to maintain a parochial attitude–that language bindings for POSIX other than C were either uninteresting or impossible, in spite of the fact that two IEEE TCOS working groups were developing POSIX language bindings for FORTRAN and Ada. For a couple of years, the WG15 U.S. TAG acted to shield IEEE TCOS from ISO pressure to complete the language-independence work, and IEEE TCOS consequently made little progress.

As recently as the January 1990 POSIX meeting in New Orleans, one volunteer (Jeff Kimmel from Data General) who was working on a guidelines document that had been abandoned by a succession of earlier volunteers, announced his imminent withdrawal from POSIX activities. Since May 1990, Paul Rabin of OSF, Cambridge, MA, has been working with the IEEE and ISO POSIX groups in the development of language-independent POSIX standards. In July 1990, Rabin and Steve Walli (of EDS, Canada) wrote a draft white paper on programming-language independence. This was expanded into a full document by Walli last October.

During Rabin's tenure as "LI champion," the attitudes within IEEE TCOS to LI have changed from suspicious to cooperative. A major challenge was to break through the WG15 U.S. TAG to get clear directions from WG15 to the SEC regarding LI work. At the October 1990 WG15 TAG meeting, Rabin got a strong endorsement of the LI guidelines and project scope, and a series of explicit resolutions specifying WG15 expectations for language-independent international POSIX standards. The newer working groups are developing their standards in language-independent form first. The working groups that have already made a substantial investment in C-language-binding development, or have commenced balloting, have a difficult problem scheduling the switch to language-independent work. But their commitment to solve this problem has substantially increased.

The FORTRAN and Ada binding groups have been the most frustrated, as WG15 made it clear that they did not wish to see language bindings other than C until the language-independent standards had reached the draft international standard (DIS) level. The unfortunate result was that these groups decided to pursue U.S. standardization only for their current drafts, and to revise them for ISO standardization when the language-independent POSIX standards (and the revised language standards) are available. This decision, and the resulting decoupling of projects, has reduced tensions a great deal.

In spite of this general improvement, progress on the language-independent revision of 1003.1 has been slow. Groups like 1003.4, 1003.6 and 1003.8, are specifying extensions to 1003.1, and cannot complete their language-independent standards until the 1003.1 document is available.

The SEC has passed a resolution authorizing the use of TCOS funds to pay a contractor to complete initial drafts of the language-independent version of 1003.1 and the new C-language binding to it. Rabin, Walli and Donn Terry wrote an RFP and a contract has been awarded to Hal Jespersen to complete the drafts of the language-independent revision to IEEE Std. 1003.1-1990 and the new C Language binding to it. Work seems to be proceeding well. It is hoped that by this means, drafts could be completed by the POSIX meeting that was held last month (April) and that they might be balloted this fall.

It appears that the POSIX standards will end up complying with ISO requirements after all. I award the lion's share of the credit to Rabin and Walli, making this a truly international effort. ➸

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`.

A Bibliography on Language Independence

1. Paul Rabin and Stephen Walli, "Draft TCOS-SS Programming Language Independent Specification Methods," Draft 1, July 15, 1990.

2. Dominic Dunlop, comp.std.unix, Volume 20, Number 110, Usenet, July 5, 1990.

3. "Proposed DTR 10182 on: Information Processing Systems–Guidelines for Language Bindings," ISO/IEC JTC1/SC22 N754, International Standards Organization, Geneva.

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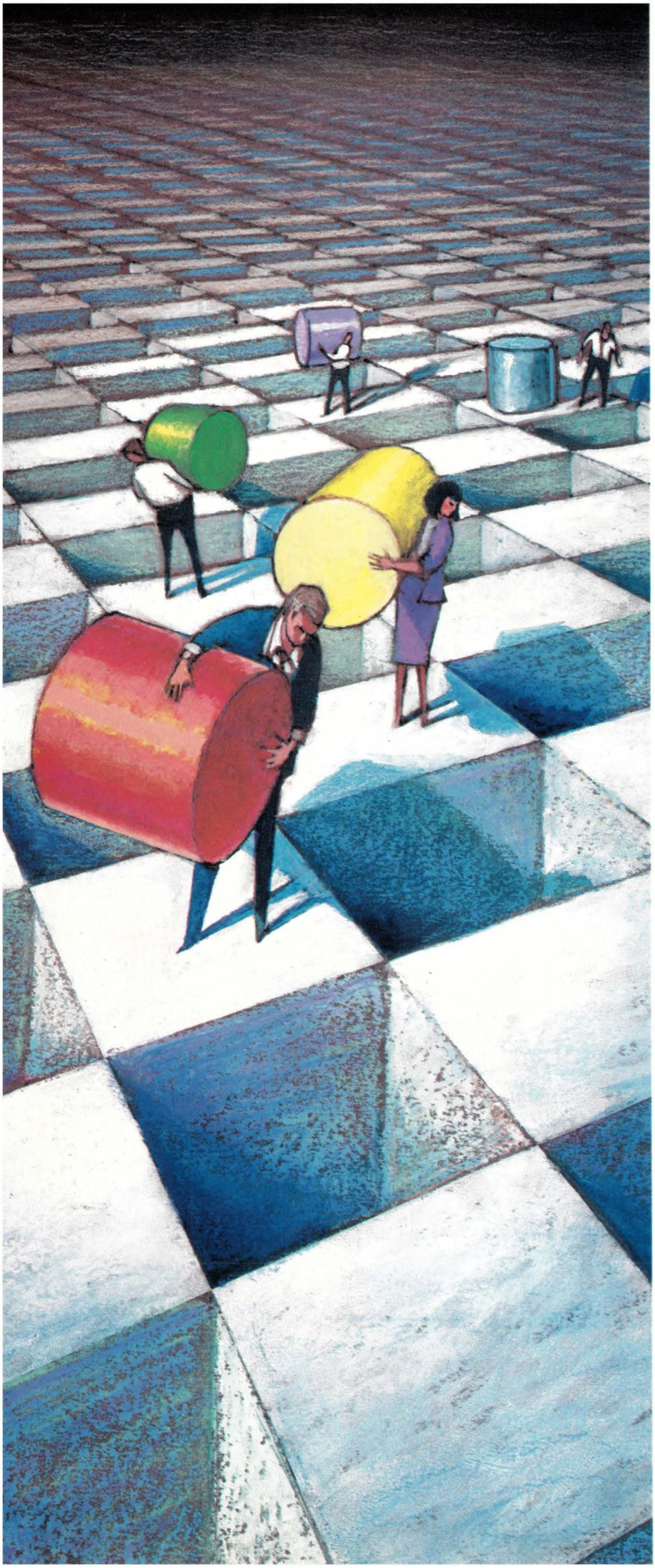
5. David Blyth, et al, "The Case for Formal Methods in Standards," *IEEE Software*, Volume 7, Number 5, September, 1990.

6. "JTC1 Statement of Policy on Formal Description Techniques," ISO/IEC JTC1 N145, and ISO/IEC JTC1/SC18 N1333, International Standards Organization, Geneva, 1987. This latter reference was pointed to in ISO/IEC JTC1 N145 and I have not yet been able to obtain a copy.

7. Jeannette M. Wing, "A Specifier's Introduction to Formal Methods," *Computer*, Volume 23, Number 9, September 1990.



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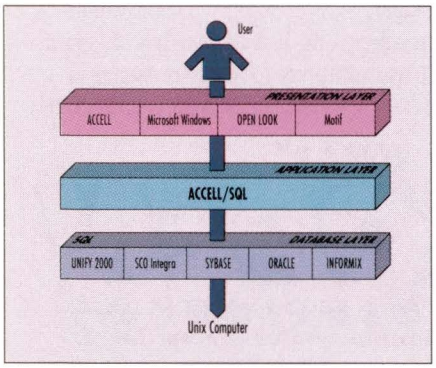

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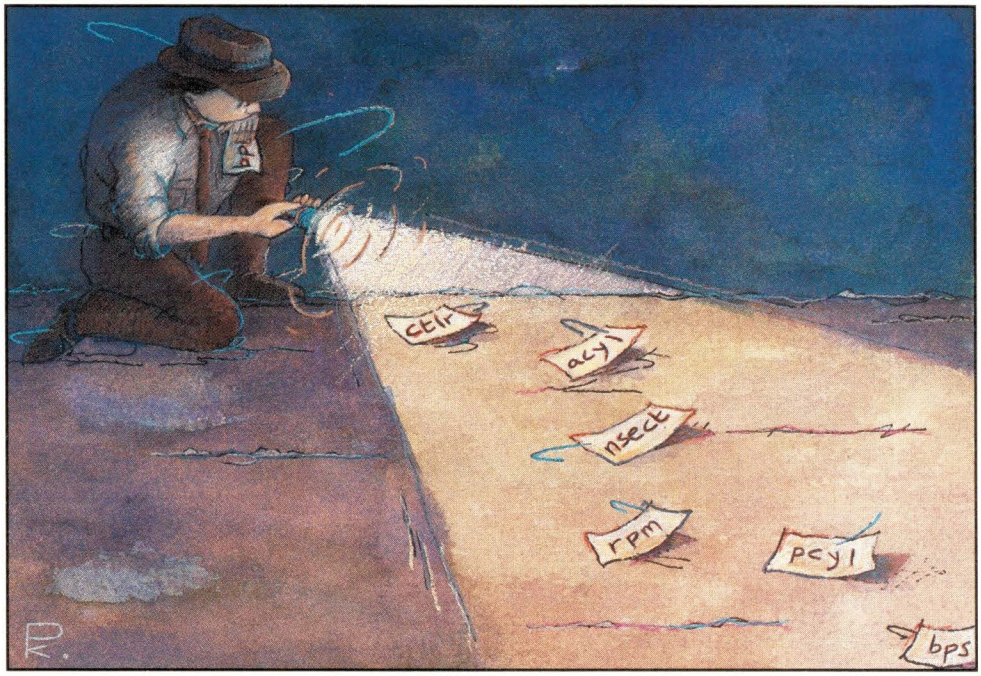


ILLUSTRATION BY PETER KALABOKIS

Where Did All The Bytes Go?

by DINAH MCNUTT, Technology Transfer Associates

Disk drives are probably one of the biggest headaches administrators will ever run across (aside from unreasonable users, that is). My experience has been that the number of disk drives increases significantly the support effort needed. One of the reasons is the amount of time involved in installation and reconfiguration of disk drives. The process of backing up and restoring files on existing drives is very time consuming, not to mention the amount of time it takes to figure out how to configure the drives in the first place.

This month I will discuss how a Storage Module Device (SMD) disk drive is physically laid out and why a formatted drive actually has less usable file system space than the manufacturer-specified number of bytes. (For instance, you really do not get 1.2 GB of UNIX file-system space from a CDC-9720-1230 Sabre disk drive.) Then, in June, I will describe in more detail how to calculate the format parameters for an SMD drive, and what role your choice of controller plays in the final configuration.

Background

Standard hardware interfaces (de facto as well as official) have helped create a market in which users can pick and choose different combinations of disk drives and controllers. On Sun systems, you even have your choice of disk technology: SMD, Small Computer Systems Interface (SCSI) or Intelligent Peripheral Interface (IPI). There seems to be a trend toward SCSI and IPI, but because there is a large installed base of SMD drives and they are a little more complex to configure and install, I will focus on how to configure an SMD drive.

There are several VME/SMD controller manufacturers (Xylogics and Ciprico, for instance) and many SMD drive manufacturers (CDC, Fujitsu, etc.). Not only does this hardware work on Suns, but also on other systems supporting VME and SMD technology. So you can see that vendors need to make the hardware as functional as possible, but also flexible enough to be able to work with different operating systems and hardware configurations.

Many Sun customers purchase disk drives and controllers directly from Sun and have Sun maintain the hardware. If so, they are home free, and Sun takes care of all the details. Not all customers can afford this luxury, however. I once found myself in a situation where I needed to purchase larger disk drives than Sun currently offered and the drives (Fujitsu 2372) were too fast to work with a Xylogics 451

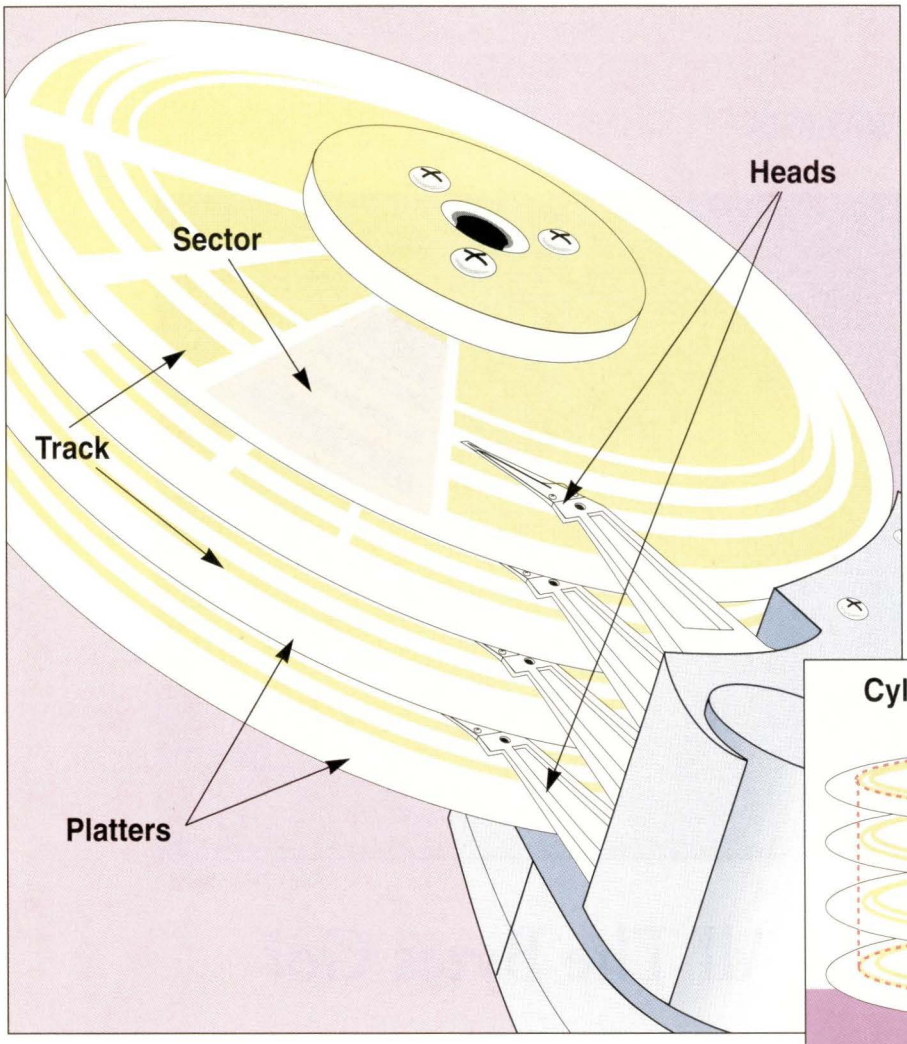


Figure 1

Disk Geometry

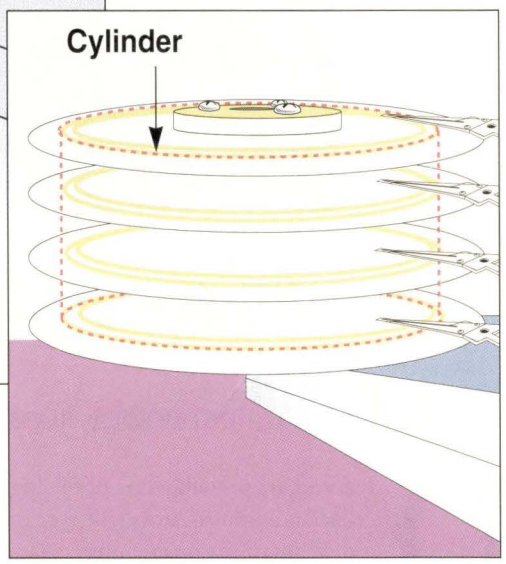


Figure 2

disk controller (the disk controller Sun offered at the time). The Xylogics 7053 was still a few months from being available, so I purchased a controller from Ciprico. The configuration worked just great, but I had to spend time figuring out how to configure the disk drive to work with the controller. Luckily, Ciprico has good technical support and the installation went fairly smoothly. Despite the additional manpower required to install the drives, the business needs justified the effort. Open systems means choices, but it doesn't mean they are always easy.

Disk Geometry

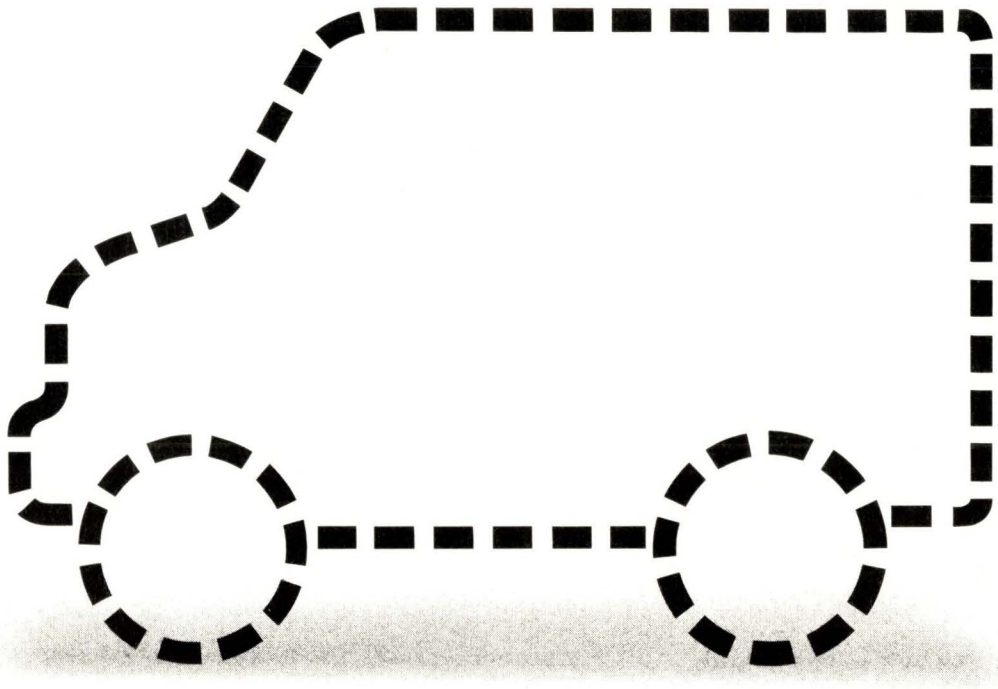
A disk drive is composed of one or more circular platters that are coated with metallic oxide. Most platters can be written on both sides, and the drive has as many recording heads as it does usable surfaces. The heads move radially across the platters and may be connected independently or on a single arm. Each radial location is called a track and each track is divided into smaller sections called sectors as shown in Figure 1. A group of tracks located radially the same position from the center of the platter is called a cylinder. (See Figure 2.) Contiguous cylinders compose a cylinder group. A bad sector is a sector that contains a physical portion of a platter that the controller has determined to be unusable. The whole sector must be labeled as unusable.

Configuring the Drive

The configuration we are going to use is a Xylogics 753 (or 7053) VME/SMD controller with a CDC 9720-1230 Sabre V disk drive. (Note that the basic difference between the 7053 and 753 controller is that the 7053 is a full 9U VME form factor, and the 753 requires an adapter card. The 7053 is the controller distributed by Sun.)

The goal is to figure out the parameters required for an entry in the `/etc/format` file. This file is accessed by the format program, and the parameters are used to format a disk drive. Formatting is the process by which address

How to see less of your service company.



And more.

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information and timing marks are written on the disk to define each sector. The entries required for a Xylogics 7053 controller (per the *Sun System and Network Administration* manual) are:

ctlr controller type
ncyl # of usable data cylinders
acyl # of alternate cylinders to be used for storing information like the defect list
pcyl # of total physical cylinders, usually ncyl+acyl
nhead # of heads
nsect # of data sectors/track, excluding spares for slipping bad sectors
rpm rotational speed of disk
bpt bytes/track
bps bytes/sector, including overhead

The disk manufacturer provides tables of sector-select switch settings that list values for the number of sectors/track and the corresponding switch settings and sector lengths. Therefore, there are three different ways to approach configuring an SMD drive. If you already know the number of sectors/track, then you just need to use the tables to look up the settings for the sector switches. If you know how large you want to make each sector, then you need to look up or calculate the corresponding sector switch settings and number of sectors/track. If you have an existing drive that works and want to configure another drive to match, then you need to calculate the sector size from the existing drive settings by either performing the actual calculations as shown in the disk drive manual or by looking up the settings in the table.

I almost always use the second method because taking the time to calculate the exact sector size is usually rewarded by maximizing the number of bytes available for UNIX file-system space.

Determining the Sector Size

I am going to cheat here. There are quite a few issues in this process and to address them adequately would require a whole column. Therefore, I will look at this process in more detail next month. For now, we will look at a simple case.

UNIX expects data to be stored on disk in block sizes of 512 bytes. Therefore, it makes sense that the data portion of the sector should also be 512 bytes. In addition, there is disk and controller overhead for storing such information as the sector ID. This overhead can occupy around 100 additional bytes, which is approximately 16% of the total sector, so taking the time to figure out the exact size of the overhead is probably worth the effort.

The *Xylogics 753 User's Manual* states that the minimum size of the sector overhead is 88 bytes/sector, and this value should work with most drives. Let's use 88 bytes/sector overhead for a total sector size of 600 bytes (512+88).

Summary of Disk Geometry

From the *Seagate Sabre Drive User's Manual* for the CDC disk drive and the work done above, we now know:

ctlr XD7053 (This is true whether you are using a 7053 or 753.)
ncyl 1633
acyl 2 (At least two are recommended for all disk drives.)
pcyl 1635
nhead 15
nsect # of data sectors/track, excluding spares for slipping bad sectors
rpm 3600
bpt 50400
bps 600

You may have to browse through the manual carefully to locate all the values. They are not necessarily listed in one location.

The nsect value can be calculated from the following: (50,400 bytes/track) / (600 bytes/sector) = 84 sectors/track. Note that this will not always result in an integer. If we had used 604 bytes/sector, the result would have been 83 sectors/track with 268 bytes/track remaining. The sector with only 268 bytes is called a runt sector. The smallest usable runt sector for this hardware configuration is 8 bytes. (Again, more on this next month.) For our example, there is no runt since there is no remainder.

Not every disk is physically perfect and a portion of each disk must be allocated for moving good data from bad sectors. Therefore, one sector on each track and a portion of the two alternate cylinders are allocated as spare sectors. When a bad sector is identified by the system, the format program can be used to "slip" it. What actually happens is the bad sector is added to the defect list (list of locations on the disk that are not usable), and the data gets moved to the spare sector on the same track. (The mechanics of this process are controller-dependent. Some controllers rewrite the whole track so that the data blocks are still contiguous.) If no spare sector is available on that track, a sector on one of the alternate cylinders is used. In summary, the number of sectors/track we will use is 83 (84 sectors/track – 1 spare sector/track).

Now we can create an entry in the `/etc/format.dat` file:

```
disk_type="CDC 9720-1230"\
     :ctlr=XD7053 \
     :ncyl=1633:acyl=2:pcyl=1635:nhead=15:nsect=83\
     :rpm=3600:bpt=50400:bps=600
```

How Much Disk Space?

This is simple arithmetic. Keeping in mind that there are only 512 bytes of usable data in each sector, and that tracks equate directly tothe number of heads, you can multiply: (1633 cylinders)*(15 heads/cylinder)*(1 track/head) to find 24,495 tracks. The overall capacity, then is equal to (24,495 tracks*(83 sectors/track)*(512 bytes/sector) or 1.04 GB

When you make a UNIX file system on the disk, additional space is used up for inodes, etc. There is also a percentage of the file system called the minimum free space threshold that is reserved from normal users. This thresh-

old helps prevent file systems from becoming full. A full file system can cause performance degradation, and the threshold is a safety margin designed to help preserve disk performance. The value is 10% by default. On large disk drives, you might consider lowering the value (especially if you plan to configure the disk as one large file system).

The above calculation also does not take into consideration the number of disk defects identified at the factory. Sectors containing these defects are identified when the disk is formatted, stored in the manufacturer's defect list and never used. (Depending on the controller, they may be slipped to either the spare sector on the track or to one of the sectors in the alternate cylinders.)

The disk manufacturer specifies 50,400 bytes/track, so if you could use every byte on the disk you would have (50,400 bytes/track)*(15 tracks/cylinder)*(1635 cylinders) or a total of 1.24 GB.

Using the optimistic number of 1.04 GB for usable disk space, we have only 84% of the total bytes on the disk available. When purchasing a disk drive, it is important to find out if the capacity is formatted or unformatted and, to be conservative, assume the capacity is unformatted. Sun usually provides both numbers. As you can see, there can be a big difference. One reason manufacturers advertise the raw capacity is because so many factors determine the formatted capacity (controller type, operating system, etc.), the raw bytes/disk is the best way to truthfully advertise to a wide range of potential customers. Asking about formatted capacity for your configuration and requesting a manual will help prevent surprises down the road.

For More Information

I would like to thank Ciprico for supplying documentation and for providing technical support by answering my many questions.

Nemeth, Synder, Seebas, *UNIX System Administration Handbook,* Prentice Hall, 1989, **Circle 167**.

Sabre Drive ST8741J, ST8851J, ST81123J, ST81236J User's Manual (SMD Interface), Seagate Technology Inc., Publication No. 83325710-F, **Circle 168**.

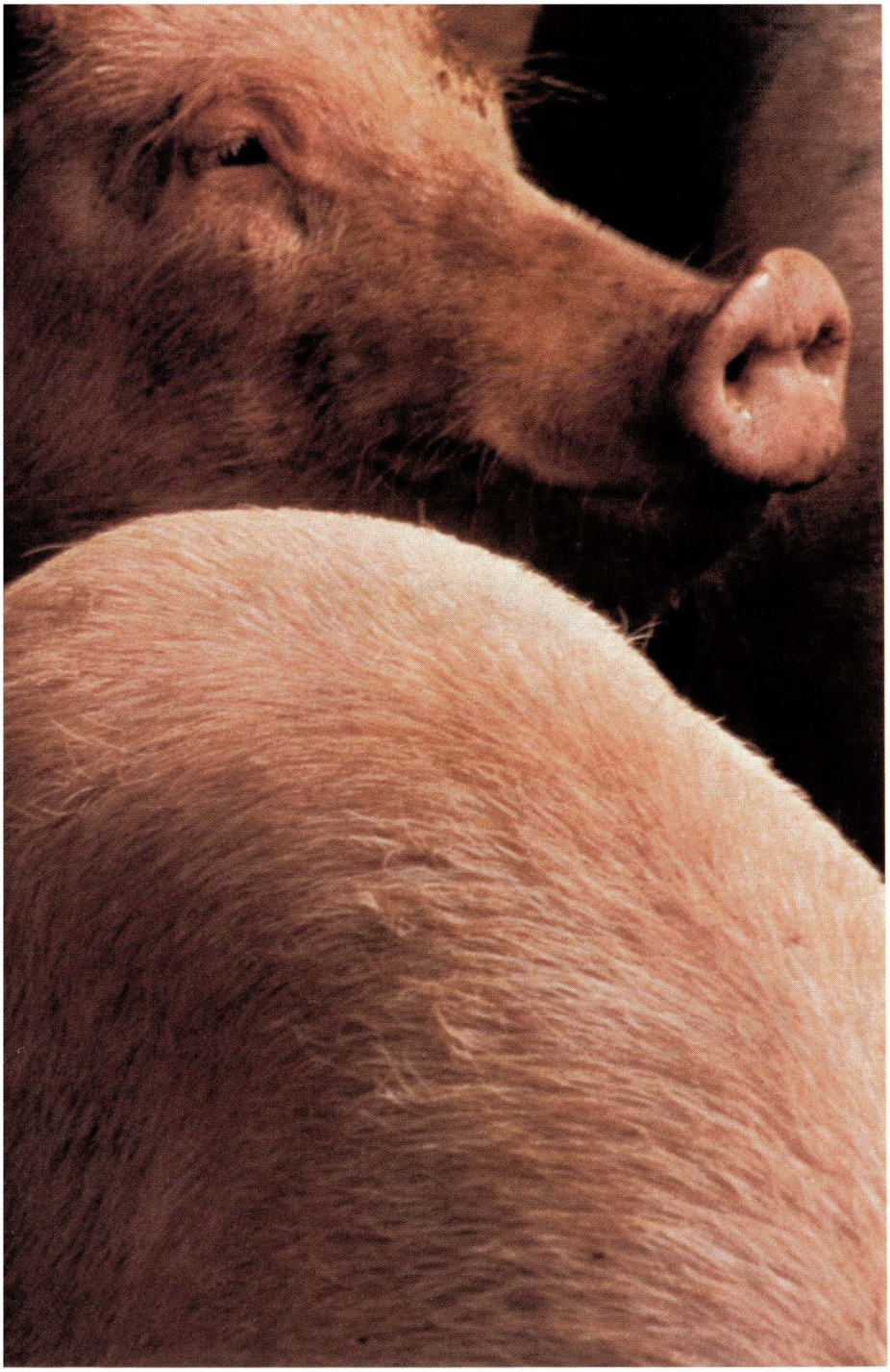
Xylogics Model 753 VMEbus to SMD Disk Controllers User's Manual, Xylogics Inc., 166- 753-001 Revision B3, March 1, 1989, **Circle 169**.

Rimfire 3200/3400 VMEbus SMD Disk Controller Sun End User Installation Guide, Ciprico Inc., Revision 01, November 17, 1989, **Circle 170**.

Then, there is always the manual. See Chapter 10, "Maintaining Disks" from the *Network and Systems Administration Manual* in the SunOS 4.1 documentation. ⊸

Dinah McNutt is one of the founders of Technology Transfer Associates, an open systems consulting organization. She is on the board of directors of the Sun Users Group and is the newsletter editor of the Houston Users Group for Suns. Her email address is `dinah@expert.com`.

What we know about C compilers and pork bellies.



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LUCID

SPECIAL REPORT

DBMS

DATABASE

The Future Is Now

Leading-edge object-oriented, multimedia, distributed products can be had today for a variety of Sun platforms. Intelligent DBMSs aren't far behind.

Databases are a lot like microprocessors in that their developers are perennially one (or two or three) generations ahead of their users. While database administrators are patting themselves on the back for finally upgrading from their tried-but-true network or hierarchical database management system (DBMS) to a relational model, vendors already are obsessing over object-oriented, multimedia and distributed-management features.

Especially in the Sun Microsystems Inc. environment, database technology seems to be outstripping most customers' ability to assimilate it. Because of Sun's inherent client-server orientation, DBMS vendors find the combination of Sun workstations and servers to be ideal platforms on which to create, roll out and run their relational and object-oriented packages. As a result, Sun machines are many times the first, or among the first few, systems for which cutting-edge DBMS products are available.

Such rapid evolution makes it difficult to separate existing, state-of-the-art database technology from yet-to-be-developed or -implemented technology. Yet these days, it's safe to say

by MARY JO FOLEY,
Senior Editor

that if a Sun user can imagine an application, there's probably a database package, or at least a prototype, that can accommodate it.

Currently the DBMS market leaders in the UNIX–and by association, the Sun–arena are companies that sell relational systems. The top three vendors, in terms of revenues last year were Oracle Corp., Informix Software Inc. and Ask Computer Systems Inc.'s Ingres division, according to the Framingham, MA, market-research firm International Data Corp. But vendors of hybrid relational/object-oriented systems, such as Empress Software Inc. and Sybase Inc., are coming on strong. Further complicating the picture are databases sporting the descriptors "distributed" and "multimedia." (See "How 'Distributed' is Distributed?" and "The Muddled Meaning(s) of Multimedia," the latter of which is in the "Features" section.)

Sun Goes Public

Sun itself has been noticeably mute on its database directions until recently. In late February Sun announced it was developing, in conjunction with Hewlett-Packard Co., a distributed object-management broker (OMB) in response to a request for technology from the Object Management Group (OMG). The OMG is the Framingham, MA-based trade association that's creating and overseeing standard object-oriented database (OODB) terminology and technology.

An OODB is designed to handle software packets that include both data and the methods, or procedures for operating on the data. A relational database management system (RDBMS) handles data and methods separately.

The OMB is the core of OMG's object-management architecture. It is the infrastructure that will allow objects to communicate, independent of platforms and implementation techniques.

"OMG's [database architecture] concept is independent of particular databases," says Christopher Stone, president of the association. "The application is the problem. Some are more suited to relational and others, to object [databases]. The issue now is to put politics aside and do the right thing technically."

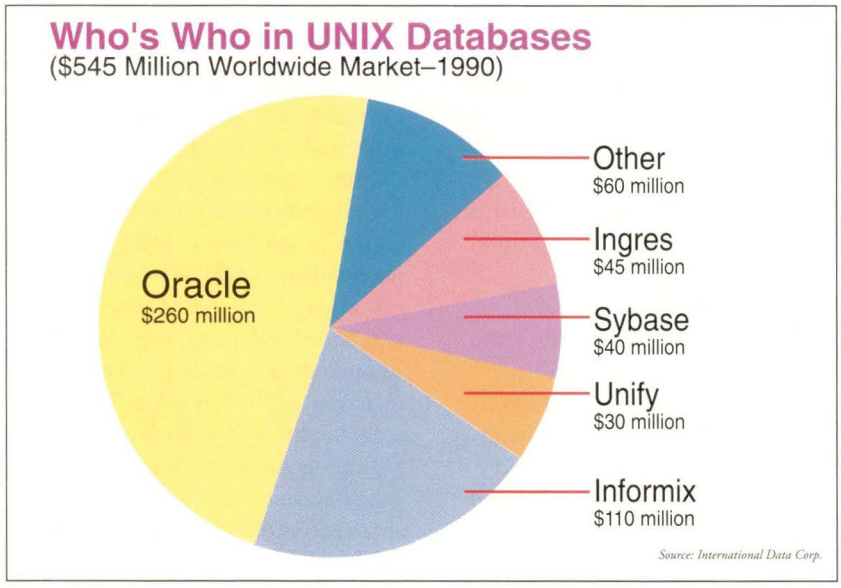
The joint Sun-HP submission, according to the two, unlikely partners, will incorporate HP's NewWave environment and Network Computing System (NCS), as well as Sun's Open Network Computing (ONC) system. Engineers on both sides are reportedly working around the clock to meet the OMG's requirement for existing (as opposed to promised) products and services. The evaluation deadline is June. The Sun-HP submission is only one of seven OMB proposals. But even if they fail to make the grade with the OMG, Sun and HP have promised to make the technology licensable to other interested companies.

At the same time, Sun, which was a founding member of the SQL Access Group (in addition to being a founding member of OMG), is acting as a galvanizing force in bringing standardized structured query language (SQL) technology into existence. The ultimate goal of the Long Beach, CA, organization is to develop a common SQL programming interface, which will allow one vendor's SQL-based application to access data in another vendor's SQL-based server. The SQL Access spec was released in March 1990. The first working prototype is expected to make its debut this summer. And among the platforms expected to participate in the multivendor SQL showcase are servers from Sun.

While all parties eagerly anticipate the results of the OMG's and SQL Access Group's efforts, independent software vendors haven't been waiting around for standards to magically appear. They've forged ahead. For some companies, this has meant adding object-oriented features or modules to their relational products. For others, it has meant working on bridges between their object-oriented databases and the installed base of relational databases and tools.

Few, if any, DBMS players seem to see the relational/object-oriented world view as an either/or proposition anymore. "RDBMS technology isn't obsolete," says Frank Ingari, chairman and CEO of OODB vendor Ontologic Inc. "Each wave of databases brings unique capabilities to the market. But relational databases are geared mostly toward handling numbers and fielded text. OODBs are for complex data types.

"Rather than becoming obsolete, certain database types won't get the new applications that will emerge over the coming five to ten years," Ingari continues. According to Ingari and other OODB leaders, these emerging applications include CAD/CAM (computer-aided design and manufac-



turing), CASE (computer-aided software engineering), imaging and financial modeling. Interestingly, these are all hot spots Sun is targeting actively.

"In the short term, we don't see the situation as RDBMS vs. OODB," concurs Tom Atwood, president of Object Design Inc. "Right now, the two systems complement one another. But RDBMSs and OODBs will clash in the traditional MIS markets, starting next year."

As one might expect, companies with roots in the relational world have a different take on the evolving DBMS marketplace. "Object-oriented databases are appropriate to specific niches," says Maggie Alexander, database product manager for Progress Software Inc. "But OODBs are at the stage RDBMSs were at 10 years ago. They're not a general-purpose solution."

So, what is the "all-purpose" solution? "Distributed-database technology will allow everyone to choose and use the most appropriate database," Alexander says.

Many Paths To Nirvana

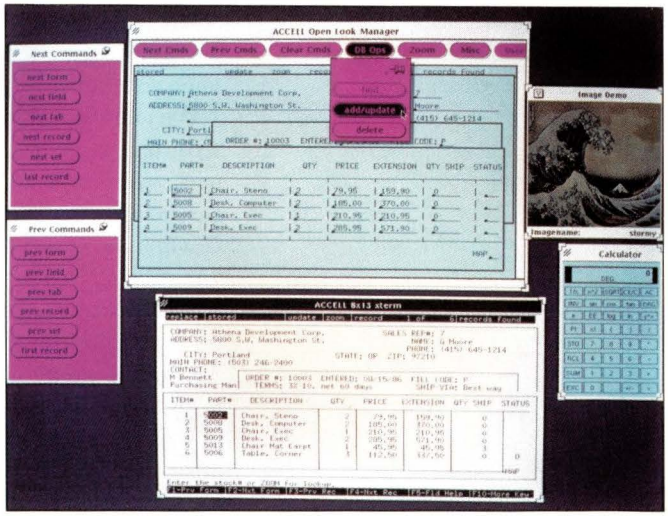
A company's relational or object-oriented orientation also is likely to determine how it attempts to reach database nirvana: transparent data sharing across multivendor platforms. Progress, for example, is focusing on distributing its database tools–rather than its database itself–across RDBMS and OODB environments.

The company has put on hold its strategy to develop gateways to other companies' databases. (To date, it has developed interfaces to Oracle Corp.'s Oracle and Digital Equipment Corp.'s Rdb and RMS products.) It now is hoping that the SQL Access Group SQL interface will result in a more generic way for all SQL-based DBMSs to share information.

RDBMS vendor Unify Corp., too, is concentrating on distributing tools, rather than its Unify 2000 database, across computing environments. Three years ago, the company–which can claim to have developed the first DBMS for Suns–shifted its priorities from being an RDBMS vendor to being a top-flight UNIX tool vendor. It is marketing its Accell fourth-generation tool as the first and only development environment to support multiple vendors' DBMSs running graphical user interfaces, character-based interfaces, or both. The company still sells Unify for customers with large, mission-critical applications. In the longer term, Unify will incorporate object technologies into its tools and database both, says vice president of marketing, Karan Eriksson.

Relational vendors aren't the only ones honing cross-platform tool strategies. OODB vendor Ontologic offers object-oriented SQL, called Ontos SQL, as one of several languages supported by its Ontos database. Its Schema Designer C++ design tool is shipping. And its Studio user-interface design tool is in the final beta stages. While the company is "interested in building gateways," according to Ingari, there are no firm plans yet to do so. For the time being, the company is focusing on making Ontos a "reliable, quality, deployable industrial-strength" DBMS. It will be optimized for a homogeneous environment with a moderate number of clients and servers, Ingari says.

Another OODB contender, Servio Corp., is making RDBMS/OODB coexistence its campaign. It has built gateways between its GemStone database and Sybase's Sybase product. And by this summer, its interfaces to Oracle's Oracle and Ask's Ingres should be commercially available, says director of marketing, Ed Horst.



Unify's Accell/SQL 4GL tool supports multiple vendors' DBMSs running various GUIs. Here, it's running on Sun hardware under Open Look.

Servio claims to have the only "active" OODB on the market. (See "OODBs: Now Available in Two Flavors.") In order to make good on this "active" claim, the company has linked data and "live" methods inextricably, rather than maintaining the two in separate repositories. This design–which, in Servio's case, makes use of the SmallTalk language–is just a step away from being an "intelligent" DBMS. By Servio's definition, an intelligent OODB is one that maps expert-system-type capabilities onto an active object database.

But even more important than intelligence to a state-of-the-art DBMS are the more mundane features such as full-backup capabilities and data-integration tools designed to connect OODB-resident data with that stored in RDBMS systems, Horst says.

At the same time as OODB vendors are working to make their products more "relational-like," RDBMS vendors are busy extending their products with "object-like" and/or object-oriented features. "We're trying to provide object-oriented benefits to our relational-database customers in commer-

How 'Distributed' is Distributed?

Hardware and software vendors play fast and loose with the term "distributed." While nearly all database management system (DBMS) vendors–relational and object-oriented alike–claim their packages are distributed, they vary on the strictness of their definition.

According to Thomas Bond, manager of technical services at Empress Software Inc., "Distributed means you can run across multiple nodes." He continues that there are two kinds of distributed: homogeneous and heterogeneous. The Empress database currently runs only on a homogeneous network, but the company is in the process of generating a heterogeneous DBMS version.

An Ashton-Tate Corp. spokesperson says that the strictest definition of distributed is to be able to not only read, but also write across a network. Ashton-Tate's dBASE IV cannot join relational tables deployed across a network (i.e., it cannot read distributed data) and thus is not called by its maker a distributed database.

To others, a distributed database encompasses by definition "the ability to pull together diverse pieces [of the database], view them separately...and be able to change them without having to go through a centralized control," in the words of David Root, vice president of development for Interbase Software Corp., an Ashton-Tate subsidiary.

Similarly, Tom Atwood, Object Design Inc.'s chairman, differentiates between relational and object-oriented distributed databases. He says that a relational distributed DBMS sends a request to the server and "the query moves [through the server] to the data." In ODI's object-oriented ObjectStore, "the data moves to the site of execution," or in other words, to the client, and "all data traversal and update happens on the client."

At the same time, not all distributed systems are created equal. Bill Osberg, director of product marketing for Unify Corp., says, "The first step is client/server architecture and providing access to other nodes on the network. The second step is distributed query–the ability to include a single SQL statement that gathers [data] from two different tables [across the network]." This is the difference between the client-server-type Unify 5.0 RDBMS and the distributed Unify 2000 RDBMS, he says.

According to Sherri Osaka, product line manager for connectivity for Informix Software Inc., Informix' definition of distributed is "pretty loose. [It is] a group of computers on a network with data [located all over] that needs to be accessed by a user."

Roger McPeek, product manager for V.I. Corp., concurs that "the user should not be concerned where the data is. The database application worries where it physically resides." And according to Information Builders Inc., distributed is what Focus, the company's DBMS, does. It can "access data from any database on any UNIX hardware," according to product manager Robert Seppanen. And with IBI's FOCNET, this definition is extended to non-UNIX hardware, up to and including IBM mainframes.–*Mojca Rijavec*

cial environments," says Gilbert Wai, vice president of product marketing for one such vendor, Informix Software Inc. Informix is betting the store on object-oriented tools, rather than full-fledged OODBs, as the way to go.

Rather than writing entirely new tools from scratch, Informix plans to graduate its users slowly, by folding object features into its Informix-4GL, Wingz and other related products, Wai says. In taking this approach, the company is putting into practice lessons it learned during its forays into multimedia environments, he says. (Informix claims to have brought to market the first on-line transaction processing/multimedia DBMS in 1989.) "People in multimedia are building with traditional DBMS tools. [They] aren't interested in stepping forward in lots of new directions all at the same time," Wai explains.

"People are looking for an evolutionary, rather than a revolutionary, approach," agrees Perry Mizota, marketing manager for relational-DBMS-vendor Sybase. Because so many of its customers are using Sybase for high-demand, large, transaction-processing jobs, the company is especially attuned to issues like performance, reliability and data integrity. "These are tough to balance with object-oriented technologies," Mizota admits.

As a result, Sybase has concentrated more on perfecting its client/server relational approach than on migrating to an object-oriented one. But it continues to add object-like features to its products. Its Sybase SQL Server is programmable, to the extent that users can program commonly used transactions and business rules in the server itself, Mizota notes. "We don't allow users to define their own data types and procedures or modify kernel code, like an Ingres does," he says. Nonetheless, Sybase's use of these stored procedures, or "triggers," –enabling it to achieve a degree of reusability–has led a number of industry watchers to characterize its product as a hybrid RDBMS/OODB.

Concurrently, Sybase is "focusing on doing strong interfaces to object[-oriented] manipulators," Mizota says. Its Open Client/Open Server application programming interfaces allow users to tie other DBMS products, as well as third-generation languages, into Sybase. Sybase itself has done gateways between its DBMS and data stored on IBM Corp. mainframes running CICS/MVS and/or DB2. In addition, various third-party vendors are using Open Client/Open Server to do gateways between Sybase and Rdb, Oracle and Ingres DBMSs.

Although Sybase initially dragged its feet about joining the SQL Access Group, it is now a member and, like a number of DBMS vendors, is counting on the group to eliminate the need for DBMS vendors to do multiple individual gateways to multiple vendors' products. In fact, the SQL Access Group spec is based heavily on Sybase's Open Client technology, Mizota says.

OODBs: Now Available In Two Flavors

by PAUL BUTTERWORTH, Servio Corp.

Object-oriented databases are no longer (if they ever were) a monolithic force. Two distinct flavors are beginning to figure prominently in distributed data environments: passive and active.

Passive-object databases are those that store the structure of objects but do not implement their behavior, whereas active systems allow objects to execute and interact right in the database. A user of a passive-object database must maintain methods, or procedures, separately from the database–usually in a file system. The user must remove an object from the database and place it in another application before the object's behavior can be invoked.

By contrast, active-object databases store objects with "live" methods that can be activated directly in the database. Active databases include all the facilities of a complete programming language in order to execute methods in the database. By supporting method execution in the database, active databases bring the full power of object-oriented technology to bear on stored information. Since active databases can be used by any application program, object-oriented or not, they are more general purpose and are beginning to play an important role in the creation of new information systems.

While some researchers argue that a true object database must, by definition, store methods as well as objects, others argue that a passive database can be supplemented by a complex code-management system to give the database the appearance of storing methods. By and large, this strategy of supplementing passive databases to give them active functionality has not been successfully implemented.

For maximum effectiveness in distributed environments, the methods in an object database must be accessible by other applications. Object databases that are the most flexible are those which support all of the major object-oriented programming languages, including C, C++ and SmallTalk.

Paul Butterworth is vice president of engineering for Servio Corp.

Empress Software is another company which is straddling the RDBMS/OODB fence. "We're beyond relational in some ways today," says president John Kornatowski. "We can do all the things OODBs can do today, as well as offer customers relational features."

Empress calls its Empress DBMS "extensible." The company itself has added a number of "hooks," such as the ability to manage variable length text and binary data types. Users can add their own functions and operators to Empress and/or the Empress 4GL fourth-generation language, which in turn becomes available in the product's SQL-based query language. In the future, Empress will be integrating interfaces developed by its value-added resellers to the Empress product. For example, it will incorporate technology perfected by VAR Prime Inc.'s Bedford, MA-based Computervison subsidiary for an object-based geographical-information system.

Where To From Here?

And then there are the RDBMS vendors that feel relational technology doesn't need any spiffy object-oriented additions, thank you very much. These companies, too, say they see a place for object-oriented technologies. But it's neither here nor now.

This purist stance doesn't seem to be hurting these companies much, considering that Oracle and Ashton-Tate Corp. both fall into this camp. "Oracle wants to stay compatible with its existing technology," says Stan Tims, who was, until recently, senior director of marketing for Oracle's UNIX division. "We haven't added any object-oriented technology yet," Tims continues, although the company has been scruti-

Something For Nothing

Who says there's no such thing as a good, free database management system (DBMS)?A comprehensive and cutting-edge product, also available as public-domain software, is Postgres. Postgres is Michael Stonebraker's research project at University of California at Berkeley, designed to explore new horizons for relational databases. The Postgres design includes extensible data types, operators and access methods, rule-based triggers and alerters, a simplified crash-recovery scheme, object-oriented implementation methods, and a view towards exploiting workstations, optical disks, multiprocessors and other modern computing advances.

Extensible and complex data objects in Postgres allow for the definition of new data types that can be efficiently processed (query optimized). For example, one might want to store geometric objects into a database (circle, line, polygon) with relevant properties (color, scale, location) and later look these up (find all the blue circles in the upper-left hand quadrant with scale of 1.0). Postgres facilitates this sort of design even though it has no notion of geometric objects. Commands for defining the object, attaching customized input and output procedures and other operations are all part of the Postgres object-definition system.

Rules can be created within Postgres that form constraints within the database. Suppose you needed to ensure that two employees always have the same salary. You could define a rule within Postgres that ties these two salaries together and enforces that within the database. Similarly, you could define a rule that refuses tc list certain types of information based upon some set o conditions. These rules would be stored in the databas and automatically triggered whenever they're needed.

The object-oriented style arises from object (data type) definition and facilities that will enhanc this capability within Postgres. When you define a nev data type, you can attach to that data type operator and procedures specifically designed to manipulate thi new data type (in object-oriented parlance, "meth ods"). A special set of operators–send and receive–car be used to resolve any storage format differences tha may occur when transferring this new data typ between different machine architectures.

A future extension to these type definitions propose to build types out of query statements, so a typ "elder" might be defined in terms of "retrieve employ ee.name where employee.age > 50." Rather than just new type to hold information literally, this sort of typ would go out and gather its value from the databas when you access it.

The current version of Postgres is available fo anonymous ftp transfer from `postgres.berkeley.edu`. A collection of technical papers and referenc manuals for Postgres may be ordered from the Jef Wilkinson, Electronics Research Laboratory, 253 Cor Hall, University of California, Berkeley, CA 94720 (415) 642-2301.–*Barry Shein*

nizing object technology advances for more than two years. When and if the time comes to do so, Oracle will probably work through the ANSI (American National Standards Institute) channels, rather than via OMG, Tims says.

Ashton-Tate is content to focus on the neglected low-end of the market, where "state-of-the-art means you deliver product that the customer needs," in the words of Ken Rhie, group product manager for dBASE system products. In the Sun environment, the newly released dBASE IV operates as more of a fourth-generation language than a database, he says.

Companies Mentioned In This Special Report

Ashton-Tate Corp.
20101 Hamilton Ave.
Torrance, CA 90509-2833
Circle 101

Ask Computer Systems Inc.
Ingres Products Division
1080 Marina Village Pkwy.
Alameda, CA 94501
Circle 102

Clarity Software Inc.
2700 Garcia Ave.
Mountain View, CA 94043
Circle 133

Commodore Business Machines Corp.
1200 Wilson Drive
West Chester, PA 19380
Circle 134

Empress Software Inc.
6401 Golden Triangle Drive
Greenbelt, MD 20770
Circle 104

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
Circle 135

Informix Software Inc.
4100 Bohannon Drive
Menlo Park, CA 94025
Circle 107

Interbase Software Corp.
209 Burlington Road
Bedford, MA 01730
Circle 109

Microware Systems Corp.
1900 N.W. 114th St.
Des Moines, IA 50322
Circle 136

Object Design Inc.
One New England Executive Park
Burlington, MA 01803
Circle 115

Ontologic Inc.
Three Burlington Woods
Burlington, MA 01803
Circle 117

Oracle Corp.
500 Oracle Parkway
Redwood Shores, CA 94065
Circle 118

Parallax Graphics Inc.
2500 Condensa St.
Santa Clara, CA 95051
Circle 137

Paradise Software Inc.
RD 1, Box 467A
Lambertville, NJ 08530
Circle 138

Progress Software Corp.
5 Oak Park
Bedford, MA 01730
Circle 120

RasterOps Corp.
2500 Walsh Ave.
Santa Clara, CA 95051
Circle 166

Servio Corp.
1420 Harbor Bay Pkwy., Ste. 100
Alameda, CA 94501
Circle 139

Sun Microsystems Inc.
2550 Garcia Ave.
Mountain View, CA 94043
Circle 140

Sybase Inc.
6475 Christie Ave.
Emeryville, CA 94608
Circle 127

Tiger Media
5801 E. Slauson Ave., Ste. 200
Los Angeles, CA 90040
Circle 141

Unify Corp.
3870 Rosin Court, Ste. 100
Sacramento, CA 95834
Circle 129

V.I. Corp.
47 Pleasant St.
Northampton, MA 01060
Circle 132

Ashton-Tate doesn't even call dBASE "relational," even though it has SQL, as well as Ashton-Tate's own dBASE language, embedded in it.

"Object-oriented [techniques] require a total change in programming habits," Rhie says. "Are we really ready for this?" (It bears noting that Ashton-Tate is hedging its bets a bit, since it owns 51% of Interbase Software Corp., an OODB vendor.)

However, one point upon which Oracle, Ashton-Tate and even the most forward-thinking OODB vendors concur is the importance of image-storage and -manipulation capabilities to DBMS vendors. Nearly every DBMS company claims it can store and retrieve still images from its database. Some companies claim this feature makes their products multimedia DBMSs; others go so far as to say this capability makes their database object-like, if not object-oriented.

But, "there are differences between understanding, and storing and retrieving data," points out Servio's marketing director Horst. The latter capability, by which RDBMS types seem to mean the ability to accommodate up to 2-GB BLOBs (binary large objects), is the limit for most, if not all, RDBMS vendors. OODB vendors are working to add that elusive quality of "intelligence" to products, enabling their databases to perform operations automatically on stored data. A database that stores image and other types of complex information intelligently would be able to handle a request such as "Make the upper left quadrant of this picture more blue."

These kinds of intelligent databases–which will make use of technologies as far-flung as full-text retrieval, expert systems and multimedia access and manipulation–mark the start of the next wave of DBMS technology. Next will come smart, vertically focused OODBs, such as the computer-integrated manufacturing (CIM) database, a five-year project upon which Empress has just embarked with 25 Japanese partners.

But for Sun users, even truly intelligent DBMSs aren't pie in the sky. ⊸

SPECIAL REPORT

DBMS *Survey*

compiled by MOJCA RIJAVEC

Company, Address / Product	Memory requirements (MB)	Data types	Characters per field	Fields per record	Files per database	Query language	Advanced features	Systems supported	4GL interfaces	Data access methods	Distributed?	Object oriented?	Maintenance fee *	Documentation/ Manual cost	Price
Abacus Software Ltd., 13 Pall Mall, London SW1Y 5LU, England. **Circle 100**															
UniVision	8	text, graphics, photo-image, page-based	page-based	page-based	page-based	–	keyword access, dynamic menu generation, videotex character set, editors	SunOS, 13 variants of UNIX	–	various	n	n	15	–	$8,400-$93,700
Ashton-Tate Corp., 20101 Hamilton Ave., Torrance, CA 90509-2833. **Circle 101**															
dBASE IV for Sun	4	numeric, float, date, logical, memo, character	254	255	10	dBASE, SQL	query by example, application generator, template language, run-time module, user-defined functions	SunOS, 386 UNIX, VMS, DOS, Mac OS	Control Center	B tree	n	n	20-25	included	$995-$2,995
Ask Computer Systems Inc., Ingres Products Div., 1080 Marina Village Pkwy., Alameda, CA 94501. **Circle 102**															
Ingres Intelligent RDBMS	4	text, numeric, image	2,000	300	unltd	SQL, QUEL	transparent access to IMS, DB2, Rdb, RMS; application code generator	VMS, DOS, UNIX	Ingres, Focus, GQL, other ISVs	B tree, heap, hash, Isam	y	y	15	included	$1,600-$420,000
Automated Systems (HK) Ltd., 4/F Jubilee Court Centre, 2-18 Lok King St., Fo Tan, Shatin, Hong Kong. **Circle 103**															
CRDB (Chinese relational database system)	–	text only	255	128	20	none	C interface, compiler w/ library, linker, dBASE III & CRDB conversion program	SunOS 3.5 or higher	none	B tree	y	n	20	–	$4,000
dBplus	–	text only	255	128	20	none	C interface, compiler w/ library, linker, dBASE III & dBplus conversion program	SunOS 3.5 or higher	none	B tree	y	n	20	–	$1,500
Empress Software Inc., 6401 Golden Triangle Dr., Greenbelt, MD 20770. **Circle 104**															
Empress RDBMS	1	text, image, voice, bulk data	2 billion	9,999	9,999	SQL	application generator, FORTRAN interface, C interface, Ada interface, report writer	UNIX, VMS, DOS	C, Ada, COBOL, FORTRAN	B tree, sequential	y	y	–	contact vendor	contact vendor
INFODAS GmbH, Rhonestr. 2, D-5000 Cologne 71, Germany. **Circle 105**															
PISA	1	ASCII, float, text, binary	8,000 bytes	4,000	8,000	SQL	real-time orientation, object-oriented data dictionary, fail safe	SunOS, UNIX	CL	B tree, direct	y	n	12	$1,281	$10,000-$167,000
Information Builders Inc., 1250 Broadway, New York, NY 10001. **Circle 106**															
FOCUS	1	text, numeric	256	unltd	unltd	Focus	transaction processor; read/write interface to Sybase, Oracle, Ingres, Informix, Net-Isam; graphics, statistics package, etc.	SunOS 4.0.3, 4.1	–	B tree, proprietary	y	y	opt., 15	included	$3,000
Informix Software Inc., 4100 Bohannon Dr., Menlo Park, CA 94025. **Circle 107**															
Informix-OnLine, version 4.10	.483 +.05 per user	text, image, varchar, char, smallint, etc.	32,767 bytes	unltd	unltd	SQL	Informix, C, FORTRAN,COBOL, Ada, Wingz interface; etc.	All UNIX, Netware 386	Informix	B tree, sequential	y	n	18	included	$3,000-$115,000
Informix SE, version 4.10	.476	see above	32,767 bytes	unltd	unltd	SQL	see above	DOS, OS/2, all UNIX	Informix	B tree, sequential	n	n	18	included	$1,095-$86,250

* % of license per year.

Company, Address / Product	Memory requirements (MB)	Data types	Characters per field	Fields per record	Files per database	Query language	Advanced features	Systems supported	4GL interfaces	Data access methods	Distributed?	Object oriented?	Maintenance fee *	Documentation/ Manual cost	Price
Interbase Software Corp., 209 Burlington Road, Bedford, MA 01730. **Circle 109**															
Interbase	.025	integer, float, char, varchar, date, BLOBS, nulls, multi-dimensional arrays	32,000	16,000	unltd	SQL, GDML	multimedia data handling, multivendor connectivity, triggers, event alerters, multi-user architecture for concurrent reads/writes, two-phase commit	SunOS, AIX, SCO XENIX, DG-UX, DomainOS, HP-UX, VMS, Ultrix, IRIX	Power-house, proprietary GDML	B tree, sequential	y	n	12	$500	$6,000-$200,000
InterSystems, One Memorial Dr., Cambridge, MA 02142. **Circle 110**															
Open M/SQL	.025	date/time, text	510	700	unltd	SQL	application generator tools, windows report writer, embedded SQL, transaction processing, incremental backup	SunOS	–	B tree	y	n	–	–	–
Itasca Systems Inc., 2850 Metro Dr., Minneapolis, MN 55425. **Circle 111**															
Itasca	12-16	array, atom, bignum, bit, char, complex, float, integer, fixnum, etc.	unltd	unltd	n/a	pro-prietary	dynamic schema modification, methods stored within DB, fully distributed w/no central server, etc.	SunOS, HP-UX, DomainOS, Ultrix, VMS, AIX, IRIX	none	B tree, sequential, direct reference	y	y	18	$100	$3,995
Jaybe Software, 2509 N. Campbell, Ste. 259, Tucson, AZ 85719. **Circle 112**															
C DBMS Toolkit	2	dollar, date, float, text, integer, etc.	unltd	unltd	unltd	SQL, awk, by example	UNIX-oriented application-building tools	all UNIX	SQL	random, sequential	n	n	contact vendor	$30	$695/ CPU
Micro Data Base Systems Inc., KG Software Division, P.O. Box 5268, Lafayette, IN 47903. **Circle 113**															
GURU	4	integer, float, character, logical, BLOB, fuzzy	2 billion	255	unltd	extended SQL, nat. lang.	expert-system shell, compiler, debugger, text editor/ processor, etc.	SunOS 4.1, VMS,OS/2, DOS	GURU	B++ tree, ISAM, sequential	n	y	13	included	$9,900 and up
Knowledge-Man	4	integer, float, character, logical, BLOB	2 billion	255	unltd	SQL, extended, nat. lang.	see above	SunOS 4.1, VMS, OS/2, DOS	Knowl-edgeMan	B++ tree, ISAM, sequential	n	y	13	included	$6,995 and up
MINEsoft Ltd., 165 South Union Blvd., Ste. 510, Lakewood, CO 80228. **Circle 114**															
TECHBASE	4	real, integer, date/text, calculated, enumerated, metric	128	32,000	unltd	query by forms	advanced graphics, statistics, 2D & 3D modeling; integration w/ dBASE III, dBASE IV, etc.	SunOS, DOS, Mac OS, X Windows, VMS, HP-UX, Primos, XENIX, etc.	n	–	n	n	10	included	$1,460-$21,520
Object Design Inc., One New England Executive Park, Burlington, MA 01883. **Circle 115**															
ObjectStore	8-12	all C++ or C describable types	n/a	n/a	n/a	object query language	graphical schema designer, database browser, C and C++ API	SunOS	n/a	n/a	y	y	15	$200	$2,000-$6,000
Objectivity Inc., 800 El Camino Real, Menlo Park, CA 94025. **Circle 116**															
Objectivity/DB	8	text, image, numeric	4 billion	n/a	n/a	n/a	64-bit addressing, support for hetero-geneous platforms, distributed data	SunOS, HP-UX, AIX, ULTRIX	n/a	B tree	y	y	n/a	n/a	$3,000-$30,000
Ontologic Inc., Three Burlington Woods, Burlington, MA 01803. **Circle 117**															
ONTOS	8	string, real, integer, user defined	unltd	unltd	unltd	C++, object SQL	client/server, C++ inter-face, object-oriented data models, triggers, denotable schema, etc.	–	–	B tree, hash	y	y	–	included	$9,950

* % of license per year.

Company, Address / Product	Memory requirements (MB)	Data types	Characters per field	Fields per record	Files per database	Query language	Advanced features	Systems supported	4GL interfaces	Data access methods	Distributed?	Object oriented?	Maintenance fee *	Documentation/ Manual cost	Price
Oracle Corp., 500 Oracle Pkwy., Redwood Shores, CA 94065. **Circle 118**															
Oracle RDBMS	8	char, numeric, date, long, raw	255	unltd	255	ANSI SQL	Oracle CASE, SQL Forms, SQL Menu, SQL Reportwriter, SQL Textretrieval, add-in for Lotus 1-2-3, precompilers, SQL Net, etc.	SunOS, >100 UNIX ports	SQL Form,SQL Menu,SQL Report-writer, all major ISV's	modified B tree	y	n	–	–	contact vendor
Persistent Data Systems Inc., P.O. Box 38415, Pittsburgh, PA 15238. **Circle 119**															
IDB Object Database	4	user defined	unltd	unltd	unltd	–	optional display manager and browser, program-mable in C, exception handling	SunOS 4.1, SR 10.2, DOS	–	object-oriented	y	y	15	$50	$6,000
Progress Software Corp., 5 Oak Park, Bedford, MA 01730. **Circle 120**															
Progress 4GL & RDBMS	.64	character, decimal, integer, logical, date, text, float	32,000	32,000	1,023	embed-ded SQL, Progress 4GL	application builder, query-report tool, data import/export, HLI, automatic crash recovery	SunOS	Progress	B tree	y	n	15	included	$4,850-$42,800
Raima Corp., 3245 146th Place S.E., Ste. 230, Bellevue, WA 98007. **Circle 121**															
db_VISTA III DBMS	.38	all C data types	32,000	32,000	16.7 million	SQL	C interface	DOS, UNIX, DS/Z, VMS, Ultrix, etc.	n/a	B tree	n	n	15	–	$1,895 and up
RSW Inc., 131 Rathburn Way, Santa Cruz, CA 95062-1035. **Circle 122**															
/rdb	.64	text, image, etc.	unltd	unltd	unltd	shell	report writer, VisiCalc interface, C subroutine library	all UNIX and UNIX-like	shell	hash, binary, inverted, B tree, sequential	y	y	–	included	$2,495, multiuser; $1,295, single user
Xve	.26	text, image, etc.	unltd	unltd	unltd	shell-based 4GL	custom reports, 4GL integration, C interface	SunOS, SPARC/OS	–	see above	y	y	10	included	$2,495, 8 users; $495, 1 user
The Santa Cruz Operation Inc., P.O. Box 1900/400 Encinal St., Santa Cruz, CA 95061. **Circle 123**															
SCO FoxBASE+	1.5	char, numeric, date, logical, memo	256	128	10	dBASE III Plus	3,600 memory variables, 128 procedures per procedure file	SCO XENIX, SCO UNIX, SVR4, SunOS	3rd-party	B tree, sequential	n	n	15	$35	$1,295, Sun-3, 386i; $2,495, Sun-4
Servio Corp., 1420 Harbor Bay Pkwy., #100, Alameda, CA 94501. **Circle 124**															
GemStone	8	alphanumeric, var. length arrays, text, graphics	unltd	256	–	Gem-stone DML	Sybase SQL gateway; C, C++, Smalltalk/V, Smalltalk 80 inter-faces; extensible	SunOS, AIX, Ultrix,News OS, VMS; MacOS, & DOS (client)	Facets	B tree	y	y	15	$250	$20,000, 4 users and up
ShareBase Corp., 14600 Winchester Blvd., Los Gatos, CA 95030. **Circle 125**															
Server/8000 Model 250, 350, 450, 550	n/a	SQL types, date/time, time stamps, bcd, varchar	2,000	32,765	2 billion	ANSI '89 SQL	cost-based optimizer, support for referential integrity, compiled commands	SunOS 4.x	JAM, Freeform, Smartstar, Focus	B tree	n	n	12	$250	$200,000-$850,000 incl. server hardware
SIR (USA), 707 Lake-Cook Road, Ste. 120, Deerfield, IL 60615. **Circle 126**															
SIR	2	alphanumeric, integer, real, categorical, date/time	254	4,095	unltd	PQL, SQL	point & shoot query, 3 GL interface, forms, statistical package interfaces, report painter, full screen	SunOS, DOS, VM/CMS, MUS/TSO, VMS, AOS/VS, Primos, etc.	PQL	KSAM, B tree	n	y	varies	included	varies

* % of license per year.

Company, Address / Product	Memory requirements (MB)	Data types	Characters per field	Fields per record	Files per database	Query language	Advanced features	Systems supported	4GL interfaces	Data access methods	Distributed?	Object oriented?	Maintenance fee *	Documentation/ Manual cost	Price
Sybase Inc., 6475 Christie Ave., Emeryville, CA 94608. **Circle 127**															
Sybase	8-12	all standard, text, image	unltd	250	2 billion	SQL	two phase commit, programmable server, application generator, interfaces to non-Sybase systems, referential integrity	UNIX, VMS, SunOS, VOS, OS/2, MVS	Sybase, other 3rd party	B tree	y	part-ially	10-15	included	$3,750-$53,000
TeamOne Systems Inc., 710 Lakeway, Ste. 100, Sunnyvale, CA 94086. **Circle 128**															
TeamNet 2.0	4	text, image, graphics, source code, CAD, etc.	1024	unltd	unltd	SQL	distributed object-oriented project repository for concurrent engineering, transparent file system interface, etc.	SunOS 4.1	none	hash	y	y	15	incl.	$2,000-$5,000/user
Unify Corp., 3870 Rosin Court, Sacramento, CA 95834. **Circle 129**															
Unify 5.0 RDBMS	1	text, numeric, binary, float, string, amount, etc.	unltd	256	256	SQL	application generator, DOS-UNIX integration, supports MS Windows	SunOS and other UNIX	Accell IDS	B tree, sequential, link, hash	n	n	15	$240	$940-$178,420
Unify 2000 RDBMS	4	date/time, long date, huge amount, text, string, etc.	unltd	unltd	unltd	SQL	see above	see above	Accell SQL	direct, sequential, B tree, link, hash	y	n	15	$380	$1,770-$395,880
Versant Object Technology, 4500 Bohannon Dr., Menlo Park, CA 94025. **Circle 130**															
Versant ODBMS	12	text, images, object pointers, sound	unltd	unltd	unltd	Object SQL	C, C++, Smalltalk interfaces; programmer & end-user tools; integrated object technology w/other relational databases	SunOS, IBM AIX v. 3.1 or up, HP-UX 7.0.3, Ultrix, IRIX, System V	Versant Object	B tree, sequential	y	y	–	$150	$6,000
Versasoft Corp., 4340 Almaden Expressway, Ste. 110, San Jose, CA 95118. **Circle 131**															
dBMAN	.64	char, date, logical, numeric, memo	254	128	unltd	dBASE III Plus Syntax	windowing support, over 320 extended commands & functions, Clipper-compatible, compiler, relational report writer	SunOS 4.0 or higher	no	B tree	n	n	varies	–	$995, 386i; $1,495, Sun-4, SPARC
V.I. Corp., 47 Pleasant St., Northampton, MA 01060. **Circle 132**															
DV-TekBase	8	char, real, complex, date/time,string, short, long	60	248	240	Technical Query Language	integrated 2D/3D graphics, document processor, report generator, statistical & signal analysis libraries, support for array storage & manipulation	SunOS, HP-UX, Ultrix	–	B tree	y	n	varies	$150	contact vendor

* % of license per year.

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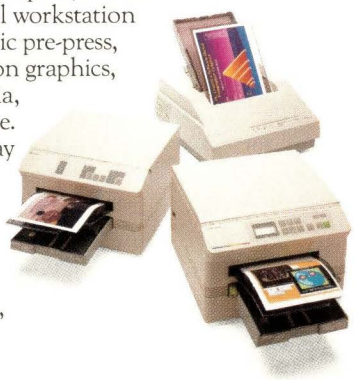

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SPECIAL REPORT

DBMS

The Muddled Meaning(s) of Multimedia

Databases are likely to be the first commercial test-beds for image, video and voice applications.

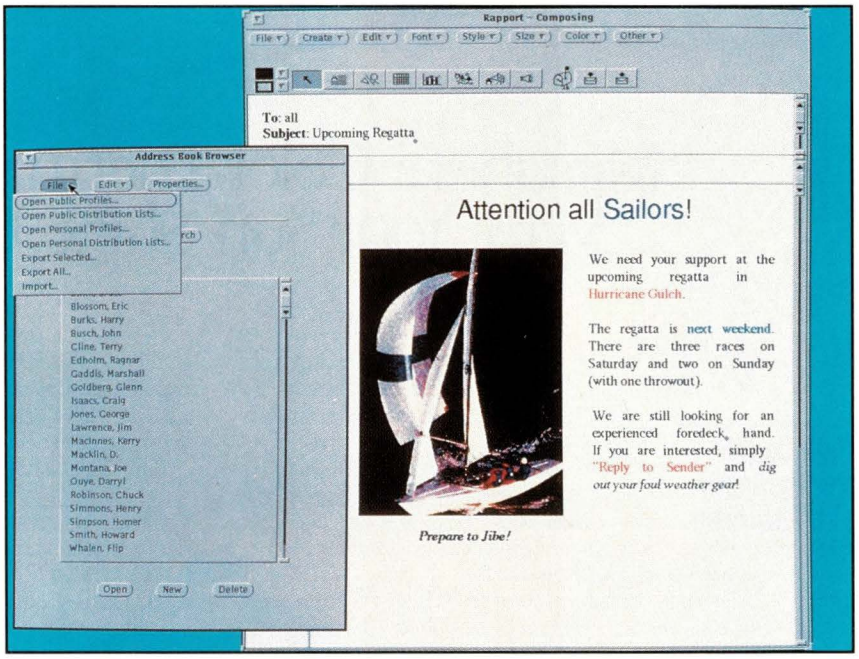
by **MICHAEL JAY TUCKER**, Executive Editor

Database vendors have plans for multimedia. "The distinction between multimedia and database technology will decrease and decline with every passing year," foretells Michael Davison, imaging market manager at Informix Software Inc. "In the end, that distinction will be so small as to be insignificant."

All of the major database vendors are including some kind of multimedia technology in their products. How much and what kind will vary from vendor to vendor–Sybase Inc., Interbase Software Corp., Informix Software Inc., Empress Software Inc., and so on, are mentioned most often–but today almost all of them give their customers the ability to store images, voice, etc., along with textual data.

Why? Because the betting is that *in time* their customers will want to store more and more material that isn't the collection of records and numbers that make up commercial databases. "Document imaging is one [application]," notes Informix's Davison. "Geographical information systems is another."

Adds John Kornatowski, president of Empress, "Much of the most advanced stuff is going on in Japan."



Multimedia can have a communications bent. For example, Rapport, from Clarity Software Inc., is a suite of mixed-media applications, including image-oriented email.

He cites, in particular, an application at an auto maker in which information about vehicles under development that was stored in an Empress database had to interact with simulation and testing programs. "They needed animation," he says, "particularly as the car undergoes deformation and stress tests."

Live action real-time animation, though, is something of a rarity, as is live-action video. The most common application the database vendors mention is still image and document processing–where, for example, hard-copy text and graphics are replaced by the more manageable electronic form. "Certainly in Europe, that's where the interest is," says Kornatowski. "Companies need to manage all those paper records in some better way than

'The difference between hypertext and multimedia is getting kind of gray.'

just sliding them into a filing cabinet."

So, there already is a market for multimedia in the commercial world, and it is using the most commercial of all software–databases–as its foundation. Or is there?

What Do You Mean, Multimedia?

The problem is: Does the presence of still photographs and even voice in an application really constitute "multimedia?" It used to be that you could say so without fear of going beyond the popularly accepted definition of the term. Now, though, it's not so clear.

"The difference between hypertext and multimedia is getting kind of gray," notes Mike O'Dell, a member of the technical staff at Bellcore, Livingston, NJ. He notes that at recent conferences on the subject, the multimedia gurus have begun to abandon the term "multimedia." Instead, they talk about "continuous media," that is, applications where video or whatever comes into an application in real time, as a continuous flow–and which may then be accessed interactively.

Increasingly, it may be that the database vendors will find the definition of multimedia shifting out from under them. Instead, "multimedia"–if the term survives at all–might come to mean "real time," "continuous" and "interactive."

There are problems with that, though. First, all three characteristics can be difficult to put on existing UNIX platforms. Second, even if you do, it isn't clear that there's a market for them. "While it would be cute to watch

Leave It To Beaver during `make` runs," says O'Dell, "it probably isn't something many people would pay for."

In fact, it isn't really clear that there is a multimedia market, any more than there is a *UNIX market.* People are not buying it as something unto itself. "I think that people haven't looked at multimedia as an enabling technology," says Janis M. Machala, a market-development manager for Sun Microsystems Inc. "They've tried to make it a market, and it really isn't." Instead, she suggests, it is an underlying technology–like UNIX or X.11/NeWS–that supports applications. It is the applications, not the technology, that sells.

Indeed, Darlene Yaplee, Sun's product line manager for multimedia products, says multimedia will have a unique role in Sun-oriented networks. "I think the thing which is key about us," she says, "is that our concept of multimedia is geared toward communications between people."

There are already applications that demonstrate that. Clarity Software Inc., for example, introduced this year a suite of multimedia applications–including a mixed media email–that run on a variety of UNIX platforms, among them, Sun, Silicon Graphics Inc. and Digital Equipment Corp.

Good CD and Bad TV

But what about the long term? Is there a market for continuous, interactive multimedia on Suns?

Certainly the tools for such applications are coming into being. Boards and software from such vendors as Paradise Software Inc., RasterOps Corp., Parallax Graphics Inc. and RGB Spectrum (Berkeley, CA), have increasingly given Sun workstations the ability to deal with multimedia of all sorts. In fact, several years ago, Sun itself joined with Phillips N.V. of Eindhoven, Netherlands, and Microware Systems Corp. to develop a comprehensive multimedia authoring system.

Sun, however, has largely withdrawn from that particular effort. "It's languished," says market analyst Nick Arnett, president of Multimedia Computing Corp., Santa Clara, CA. Sun's Yaplee puts it another way: "What happened was that Sun began development of that four years ago...Sun was a different company at the time." She says that Sun felt it was better to leave the development of dedicated media machines to third parties who'd take existing Sun workstations and modify them accordingly.

Still, Sun may find itself in multimedia anyway–as a development platform. Over the next year and a half, a number of companies and consortia are expected to introduce interactive video-disk products. Phillips, for example, is expected to debut CD/I. Commodore Electronics Ltd., meanwhile, is expected to introduce Commodore Dynamic Total Vision (CDTV) in the fall. CDTV is basically an Amiga computer, stripped of its keyboard, but equipped with a CD-ROM drive and connectors for standard televisions.

Both products offer buyers the ability to exploit CD-ROM-based interactive games and instructional programs. One CD/I title, for instance, is an interactive guided tour of the selected exhibits of the Smithsonian.

The platform for developers of these applications is frequently the Sun workstation. Tiger Media, for example, is a developer of CD-ROM titles for several formats, including CDTV. It does almost all its development on Suns. "We knew we needed an excellent development system," says Ann Lediaev, a marketing associate at Tiger, "and that turned out to be the Sun."

But the Sun was never considered a target in its own right. "Our titles are available on Suns because they're there already," explains Lediaev. "But the idea is to do the development on Sun...and then have excellent conversion tools." In fact, Tiger is now selling its authoring and conversion tools, as well as its CD-ROM titles.

The target platforms still have some limits, though. For instance, while both CD/I and CDTV can deal with full-motion video, they can only do so within a limited capacity. Therefore, Tiger has chosen to avoid it. Says Lediaev, "We'd rather make good CD-ROM than bad TV." ➸

Cultivating the Synergy Between Networks and Databases

Network managers and engineers can learn much from studying relational data models and schema design.

by SMOOT CARL-MITCHELL,
Texas Internet Consulting

Successful technologies often result from creative synergy between seemingly unrelated fields. Desktop publishing, made possible by the combination of xerographic reproduction, lasers and low-cost graphics workstations, illustrates how three technologies can merge into one booming market. This synergy has forever obsoleted older ways of creating high-quality printed images.

Networking technology should not be an exception to this rule. The synergy of low-cost microprocessors, coupled with high-speed network hardware/software and the growth of UNIX-based systems has resulted in the explosive growth of the TCP/IP Internet with 100,000-plus computer systems and several million users interconnected in a global internetwork.

Network research in the development of TCP/IP and its subsequent commercialization was one key element in the growth of networking. Sun itself has declared, "The network is the computer." Network researchers can rightly be proud of their work. TCP/IP is elegant engineering. The system works well, and has proven reliable and extensible across a wide variety of networking hardware, ranging from multi-megabit-per-second LANs and WANs to slow-speed dialup connections.

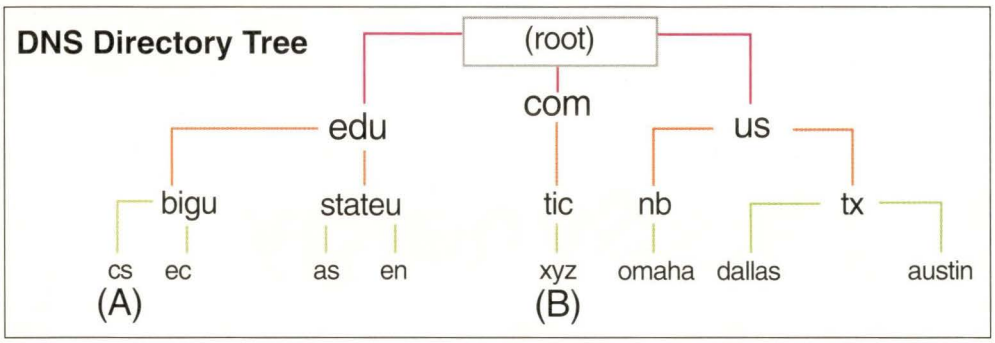
While network-protocol implementors know how to engineer complex and reliable protocols, such as TCP, they have not been as adept at engineering systems to help manage networks. Network management is, in many respects, an information and database-management problem, and when designing solutions to this problem, networkers have generally failed to learn from the experience of database researchers. A better synergy between database systems and networking is needed or the growth in networks will be slowed because the systems needed to manage large networks will not be in place and will not scale well.

Directory Services and Database Systems

A fertile area for synergy between networking and relational database theory is the field of directory services. The Internet Domain Name System (DNS) and OSI's X.500 are designed to fill the need for the comprehensive and distributed directory service essential to maintain network usability. A close look at each of these systems shows the problems they solve bear a strong relationship to the more general database management problem.

A directory system attempts to organize and maintain a set of data and provide consistent access to that set of data. These attributes are hallmarks of generalized database management systems (DBMS). One of the key paradigms in a well-structured database system is a clear separation between the data model used to structure the information and the implementation of that model. As database experience has shown time and time again, a data model that is closely tied to implementation techniques proves to be more difficult to maintain and is less flexible. This is a primary reason for the success of the relational data model used by almost all modern DBMSs.

The relational model logically describes data as one or more relations or tables with a well-defined set of abstract operations on those tables. The query languages that implement the operations do not explicitly include the details of how the operation is carried out, but rather these details are hidden from the application. This allows the implementations to change over time without impacting the application or the logical organization of the data. This technique is very



similar to the layering found in network protocols. Curiously, in the definition of DNS and X.500, this implementation-hiding principal was not followed, as we shall see. The following discussion of DNS illustrates that thinking about the system from a database perspective could have avoided some of the current problems with DNS.

DNS was developed to replace the old `HOSTS.TXT` file that mapped host names to IP addresses. On UNIX systems, `HOSTS.TXT` was retrieved from `sri-nic` and a small program transformed it into the standard `/etc/hosts` file. `HOSTS.TXT` also contained information about network names and numbers, and this information was transformed into the `/etc/networks` file. `HOSTS.TXT` was centrally managed and maintained. If a new host name was needed, it had to be unique across the entire Internet and entered into the central table.

As the Internet grew beyond several hundred hosts, it became cumbersome to manage host names centrally using the `HOSTS.TXT` method. The size of the file was becoming too large to transmit effectively and updates were coming too frequently to keep all copies on all hosts up to date. DNS was adopted as the standard and required protocol in the Internet for mapping host names to IP addresses. DNS also added support to map other resources, such as mail exchangers, user mailboxes and mailing lists. Other proposed extensions allow DNS to become a general-purpose "yellow-pages" server.

The Problem with Domain Trees

DNS defines a name space called a *domain tree*. This tree structure assigns a unique label to each node in the tree. This unique label is called a *domain name*. A sample of the DNS directory tree is shown above. A node in this tree is referenced by a series of tokens separated with periods (.). The node name is essentially the concatenation of the node to be named followed by a series of tokens that are the names of the nodes crossed on the unique path to the root of the tree. Node "A" is referenced by the unique string `cs.bigu.edu` and node "B" is referenced by the string `xyz.tic.com`. Each node in the tree contains typed resource records. The most common resource type is an "A" record which is an IP address. The meaning of the "A" type record is that it is the IP address of the corresponding domain name that names a host system. A simple DNS query simply states the domain desired and the resource record types of interest.

DNS's power comes from its ability to distribute the resource records across many hosts in the network. The domain tree may be divided into an arbitrary number of subtrees. The resource records defined for each subtree may reside on different hosts on the network. Also at any point in time a subtree may be further subdivided and the resource records further distributed.

One problem with this model is the complete lack of a schema (i.e., data-type parameters) associated with the DNS tree. Each node of the DNS tree has no explicitly defined meaning. A user must know that the top-level node `edu` refers to educational organizations, such as universities or colleges. The top-level node `us` refers to a country, the United States. And the top-level node `arpa` (not shown in the example) is a special case all unto itself. From a database perspective, this lack of a defining schema can lead to confusion about the meaning of each node and also leads to contorted special cases whose meaning can only be determined by looking at the code that implements DNS.

An example of this problem is the `in-addr.arpa` domain. This domain and its subtrees is a special case for doing IP address-to-domain name mappings. This mapping is the reverse of the most common DNS query: mapping a domain name to an IP address. The node `1.1.81.158.in-addr.arpa` contains pointer resource records to the domain name for host with IP address 158.81.1.1 in the conventional dotted quad notation of IP. For example, the resource record

```
1.1.81.158.in-addr.arpa IN PTR xyz.somewhere.com.
```

means that host `xyz.somewhere.com` has network address `158.81.1.1`. A normal "A" record for this address is assumed to exist:

```
xyz.somewhere.com IN A 158.81.1.1
```

On the other hand, the node `0.0.81.158.in-addr.arpa` contains pointer records to the name of network (not host) 158.81.0.0. For example

```
0.0.81.158.in-addr.arpa IN PTR net.somewhere.com.
```

means that the name of network `158.81.0.0` is `net.somewhere.com`. The forward domain record for the network number is:

```
net.somewhere.com IN PTR 0.0.81.158.in-addr.arpa.
```

The query semantics must recognize these special cases. For example, when looking up a network number given a network name, the query semantics must recognize that a

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pointer record found anywhere except in the `in-addr.arpa` portion of the tree that points into the `in-addr.arpa` domain points to a network number.

The reason for having these special cases is DNS has a limited number of built-in resource record types, and the DNS hierarchy has a typeless nature. Also, there is no really well-defined notion of an index in DNS. As a result, the meaning of pointer records is overloaded and can mean different things depending on the value of the pointer record and where the pointer record is located in the DNS hierarchy.

A Relational DNS?

A relational-database view of DNS could have resulted in a better overall solution. Consider the simple case of doing host-name-to-host-address mappings. We can logically organize this mapping as a simple relation called "address," which is a table with the following fields:

address

domain_name	IP_address

Looking up an IP address for a host becomes the following query:

```
select address.IP_address where\
       address.domain_name = xyz.somewhere.com
```

Finding a domain name given an IP address is simply:

```
select address.domain_name where\
       address.IP_address = 158.81.1.1
```

Obviously, it is easy to determine where the address-table resource record is stored for the first query, given the DNS hierarchy. It will be on the host that is authoritative for the domain `xyz.somewhere.com`. The second, or inverse query, is more problematic, since from the IP address `158.81.1.1`, it is not obvious who is authoritative. Logically, it should be the same host that is authoritative for `xyz.somewhere.com`, since that is the location of the record for the first query. The current DNS method for doing this is to create the `1.1.81.158.in-addr.arpa` domain and have a pointer record that points back at the domain whose address is `158.81.1.1`. This works, but it embeds semantics within the DNS implementation at a high level within a DNS query. A closer examination shows that you can think of the DNS hierarchy as an index structure. Once this extrapolation is made, a consistent way of generating an index for the `IP_address` field can be developed. The creation of this index is independent of the query language and never explicitly shows up as part of any query.

Almost all DBMSs do exactly this. They hide the fact that indices exist and set up access methods that are used to resolve a query and use an index when appropriate and when such an index exists. With this methodology for index creation in place, the more general "yellow-pages" problem becomes relatively trivial, since to create a "yellow-pages" map, simply means adding indices to the DNS.

Another area DNS can learn from DBMS technology is by understanding the power of a *database schema.* A database schema is simply a description of the types of values allowed within database fields. It also names the fields that give semantics to the field values. DNS does not really have a well-defined schema. It has resource record types, but these resource records can take on different meanings depending upon where they are used. We have already seen the pointer record type is overloaded and used differently depending upon where it is used. The "A" record type can be used to represent a host address or a network address, or a network mask. This name overloading means that the semantics of a value can only really be understood by actually reading the implementing code, since the meaning is embedded in how a query is processed.

This is very bad practice from a database perspective. It is similar to what happened with old file-oriented applications before the advent of DBMSs. The application code understood how to process its files and, as a result, one application could not use another application's files or a new file structure could not be implemented easily because details of the old file structure were embedded in the application itself. Therefore, the cost to maintain these applications was high and they could not adapt well to change.

Another problem with DNS not having a schema is that the addition of new resource record types is difficult. At the present time, adding a new record type requires adding it to the DNS implementations, which means everyone must have a new implementation. Obviously, to add a resource-record type to support, say, mapping from domain name to OSI address, is not trivial, but may be required in the future. What is really needed is an extensible way of doing this. A database-schema facility is one way of allowing this extensibility. In fact X.500 does have a schema that is a big improvement over DNS in that respect.

Directory services are becoming an increasingly important part of managing large networks. As networks grow in size and complexity, the management of these servers is very similar to the management of a large database. As we have seen by a few examples, directory servers can learn from database-management techniques to enhance reliability, increase flexibility, and improve maintainability. Network researchers need to focus more on the database aspects of solving network-management problems and create a synergy between state-of-the-art ideas in database management with state-of-the-art work in networking. By so doing, the management of large networks can become a much more manageable task. ⊸

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S-PLUS:

An Interactive Programming Environment for Data Analysis and Graphics

by IAN F. DARWIN

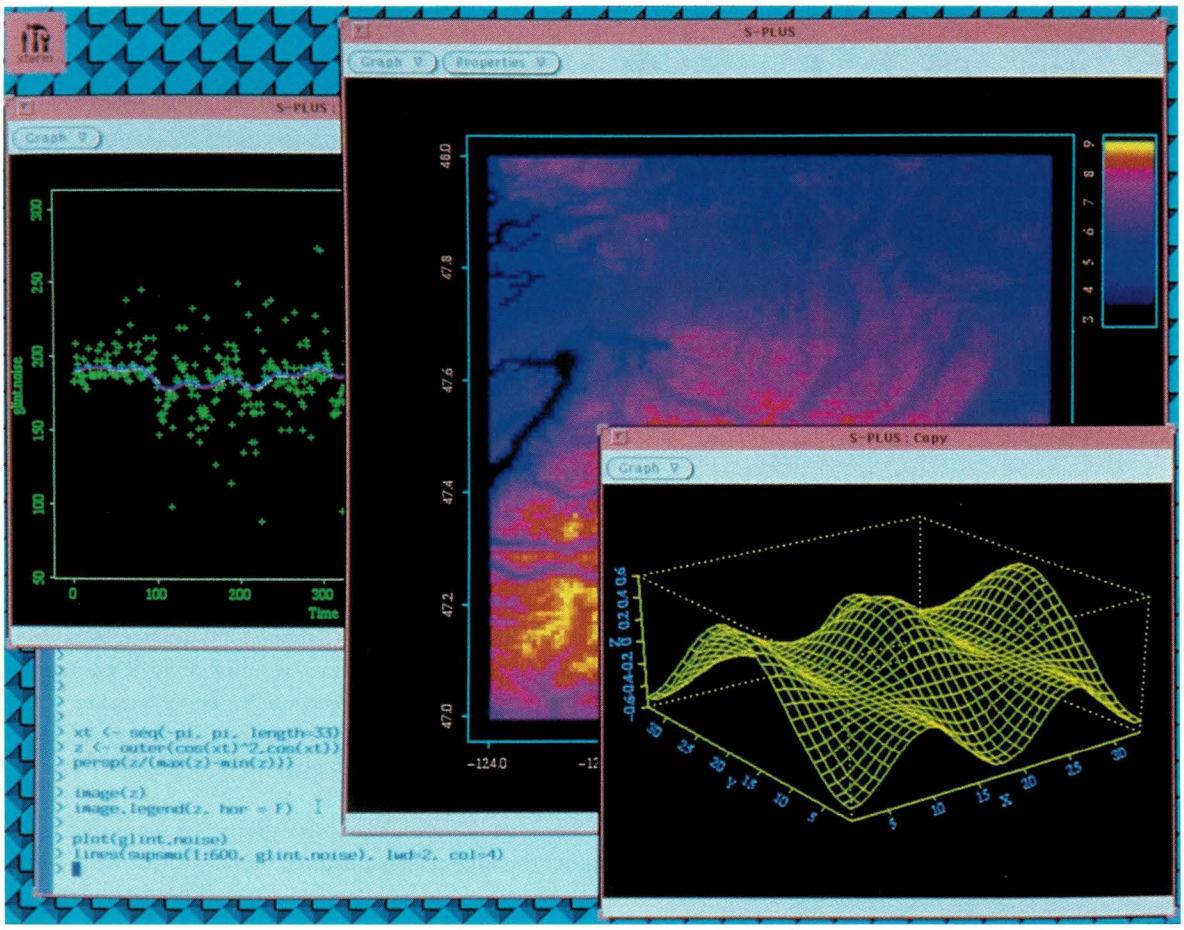
If you were originally attracted to UNIX because of the power it derives from careful combinations of a few well-chosen primitives, then the S language is for you. S is to spreadsheets as the UNIX shell is to simple-but-limiting, menu-driven canned applications. Rather than blather on about it, though, I thought I'd start with a real-world example, that of trying to get rich with your computer. Let's say we have last year's winning numbers from the "Pick 3" lottery (run by the Ontario Lottery Corp.) in a file called `pick3.raw`, and we want to look for regularities (or irregularities) that will help us pick winning tickets. You can start up the S-PLUS package by typing the command `S-PLUS`. Users of older versions of S will likely add a link name of S, which I did.

Pick3 is the name of an S variable in which we'll hold the data. (S uses "<-" or "_" as its normal assignment operator, since "=" means something else.) The `read` function reads data from a UNIX file, while `ts` makes the variable data a time series, starting at the beginning of 1990, with daily (365) data. I printed the array to proof-read some of the leading data points (see Listing, opposite page). The first seven points are NA (not available) just because I don't have data for them. S allows "NA," for missing values, in most places that data is allowed. This is to account for the real-world nature of statistical data.

Once we have this data read-in to S, we can plot it using a high-level graphing language:

```
> X11()
> hist(pick3)
> title(main="Ontario Pick3 Lottery — Jan 8, 1990 - Oct 6, 1990")
```

The first line tells S which graphics device to use–others include `suntools()`, `pscript()`, `hplj()` and various graphics terminals–and starts up the display if it's an online device like X11. The parentheses are needed because everything in S is a function call. (Indeed, my only problem in getting used to the syntax of S was remembering the parenthesis. The overall syntax is otherwise suggestive of a fully interactive version of `awk`.)



Although S-PLUS makes light work of plotting data, its real strength is statistical analysis.

The second line plots the histogram shown in Figure 1, and the last line sets a top title on the graph. What can we infer from this graph? There are three digits in each number; if they were evenly distributed, and the sample were large enough, you'd expect a straight line across the top. But in this sample, winning numbers beginning with "9" are substantially more likely than those beginning with "8," for example.

If S were just a plotting package, you'd never have heard about it, for I wouldn't review it on that basis alone. S also harnesses the power of a modern computer to tame the tasks of analyzing and graphing data. For this reason, S is often viewed as a statistical-analysis language, though there is much more to it than that.

S includes a rich library of statistical operations, as well as a simple extension language, which lets you write S functions by building on the work of others, exactly the way shell programs leverage on the availability of other programs. The S-PLUS statistical functions provide almost all statistical analyses in common use, including simple descriptive statistics, classic multivariate statistics, time-series analysis and ARIMA modeling, survival analysis, linear regression and more. In addition, S-PLUS contains an emphasis not present in most statistics packages, an emphasis on "robust statis-

Listing

```
% S
S-PLUS : Copyright (c) 1988, 1989, 1990 Statistical Sciences Inc. S : Copyright AT&T.
Version 2.3 Release 1 for Sun3 under SunOS 4.0.x : 1990
Working data will be in /home/darian/ian/.Data
> pick3 <- ts(read("pick3.raw"), 1990, freq=365) Read 245 items
> pick3

      1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18
1990: NA  NA  NA  NA  NA  NA  NA 892 319 967 455 672 543  NA 286 419 700 777

     19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36
1990:641 729 777 715 369 936 840  35  NA  37 347  39 380 878  61  NA 482 743

... etc ...
```

According to the latest official figures, 43% of all statistics are totally worthless.
–Berkeley fortune file

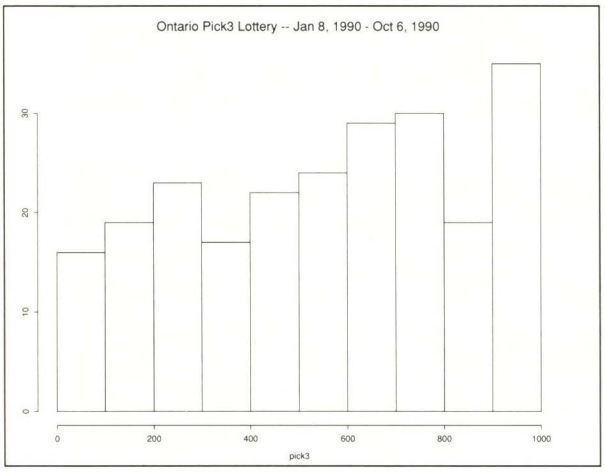


Figure 1

tics." Robust statistics is a relatively new field, and Statistical Sciences Inc. (StatSci) has been aggressive in bringing the latest in robust statistics into its package.

It's been about a decade since the S language first appeared. Written by Richard Becker and John Chambers of AT&T Bell Laboratories, S was sold by AT&T in source form only. Most of the purchasers were universities, who (as with UNIX itself) got the source at a radical discount. This led to a widespread but informal "S community" of users, primarily in universities, research institutes and the like.

Recently the second major version of S, called "The New S Language," was put together by Becker, Chambers and Allan Wilks, along with a textbook of the same name. AT&T decided to allow binary sublicensing of S to make it more widely useful in the UNIX community. Enter StatSci, which began enhancing, debugging and supporting the S language in 1987. Its product, S-PLUS, is a complete superset of the S package from AT&T, but it is a less expensive, binary-only package available for most UNIX platforms (and even some DOS platforms). AT&T continues to enhance its version of S, and StatSci continues to track and incorporate new versions from AT&T. S-PLUS Version 2.3 was reviewed on an 8-MB monochrome Sun-3 running SunOS 4.1 and OpenWindows. S-PLUS Version 3 is being released around the time this issue of *SunExpert* goes to press; it was not reviewed but the highlights of it are included in "S-PLUS Release 3."

Since many people use spreadsheets like those sold under the suit-spangled banner "Lotus 1-2-3," we'll start by comparing the S package to a spreadsheet's way of doing things. We'll also look at how the S language and the S-PLUS implementation fit in with UNIX and with OpenWindows. And finally there's an overall evaluation of the strengths and weaknesses of S and S-PLUS.

It's Not a Spreadsheet

It's not a spreadsheet. It's a line-based interpreter, and it's open-ended. Nowadays spreadsheets claim to be programmable, what with having a macro processor and all. But S is really programmable; you can (on most versions of UNIX) dynamically draw in functions from C or FORTRAN ".o" files, and make them part of the language. This is used, for example, in some of the device-

Figure 2

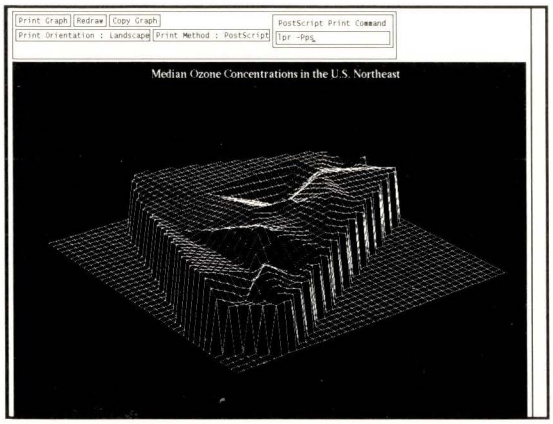
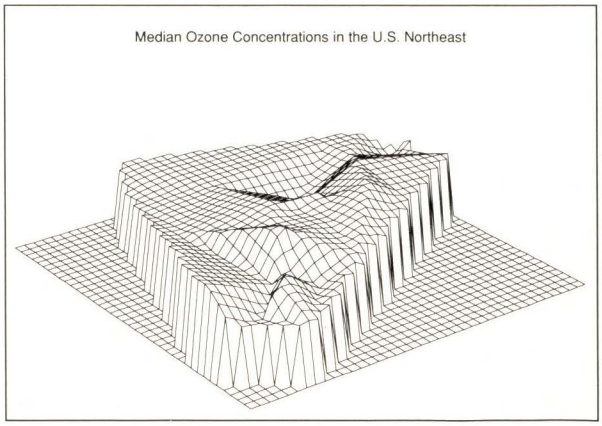


Figure 3



S-PLUS Release 3

Release 3 of S-PLUS from Statistical Sciences Inc. is scheduled to become available as this issue of *SunExpert* goes to the post office. The following information, obtained from 3.0 beta documentation provided by the vendor, is included to show the extent of work that has been done to the product since Release 2.3. Also, a new textbook entitled *Statistical Modelling in S* is being produced by the S developers at AT&T, and will be included with the new version.

Release 3.0 incorporates new graphics features. You can have several graphics devices active at one time, instead of just one. There is a generic function to copy a plot from an active device to a hardcopy device. Other graphics highlights include full support for Open Look and Motif, similar to the generic X11 device in 2.3. Generic X11 is still available for those who don't care. Open Look and Motif allow dynamic colormap changes (editing of colors). The persp function has been extended and the contour function can save coordinates of contours for later plotting. The legend function lets you scale the legend. StatSci has also embedded a window-based data editor, a spreadsheet-like window for X11 (Open Look and Motif shortly). This release edits (fixed-sized) vectors, matrices and a new thing called a Data Frame object (see below). It also supports arrow key use, tabbing and entry/changing of values. In subsequent releases, StatSci will be handling other object types (lists, multidimensional arrays), and have more capabilities, such as adding/deleting rows/columns, etc. The new version also features a SAS interface. You can now import data from SAS via ASCII files.

New statistical and mathematical functions (these terms will make sense if you are a statistician; if not, they don't count) appear in Release 3.0. The binomial, hypergeometric and Wilcoxon rank sum distributions now have density, cumulative probability, quantile and random-number generators.

A variety of classical statistical inference functions are added. These include binomial, Person's chi-square, correlation, Fisher's exact test for count data, Friedman and Kruskal-Wallis rank sum tests, Pearson's, Mantel-Haenszel and McNemar's chi-square tests for count data, Proportions test, Student's t-tests, F-teset to compare two variances, Wilcoxon rank sum and signed rank tests.

Also added is a wide range of new statistical modeling capabilities drawn from AT&T's latest release of S, including enhancements to ANOVA, General Linear and Additive Models, Loess modeling, Tree-based models and non-linear models.

S-PLUS now supports some features of object-oriented programming, including classes, inheritance and methods; these are described in the additional textbook mentioned above.

S-PLUS also sports a new object type, Data Frame, which is like a matrix but with each column having an arbitrary type, meant for use with new statistical modeling features. Other enhancements include a paginator for large data objects (default is the *less* paginator), a way to dump and restore your S data between different machines, changes to IEEE arithmetic, minor changes to .C and .FORTRAN and numerous bug fixes.

96.37% of all statistics are made up.

–attributed to Kevin D. Quitt,

kdq@demott.com

specific graphics routines, and many of the mathematical operators. Thus the vast library of routines written over the years in C and FORTRAN can be considered to be directly available in S. There is no need to pipe data out to a program nor to leave your environment.

On the other hand, there is no full-screen, X-Y-based spreadsheet data editor included with S. The S community might argue that none is needed, since you can edit a file with `vi` or `emacs` and read it in. Further, if you really need the spreadsheet-like data-editing capability, you can always write one. In fact, StatSci has recently done so–again, see "S-PLUS Release 3." S is a very "open" system, not in the marketing sense, but in the sense that you can interconnect it with a large variety of existing software. And the standard textbook describes what you need to know to interface your own C-language functions. To demonstrate, consider this simple bit of C code (function `tse`, stored in file `tse.c`) that takes two longs and multiplies them. All arguments are passed as pointers since they are usually arrays. The normal convention in S is that the answer is returned as part of the argument list, so we store it in place of "x."

```
/*
* Try out the .C interface in S.
*/ tse(x, y)
long *x, *y; /* integer in S */
{
*x *= *y;
}
```

To use this with no fancy packaging, I need only `make tse.o` in a shell window, then go back into S and type

```
dyn.load("tse.o")       # load tse.o into S
# tse(4, 8);
.C("tse," x=as.integer(4), y= as.integer(8))
```

The function .C calls an external C function named by its first argument, with the remaining arguments passed to the C function. This particular call prints out both the "32" (result stored in place of the 4) and the "8" that was input. To get just the answer, I use the S convention of appending a dollar sign and the component (analogous to C's use of -> and field names):

```
.C("tse," x=as.integer(4), y= as.integer(8))$x
```

which prints 32. For anything more realistic, I would probably write a `tse` function in S, like this:

```
tse <- function(x, y)
   .C("tse," x=as.integer(x), as.integer(y))$x
```

Then I can just say `tse(4,8)` and get the same answer.

As this example just begins to show, the programming language is very versatile, much like the UNIX shell. On the other hand, it does not do the same level of hand-holding a spreadsheet does. Just as with the UNIX shell, you are expected to learn to use the system's features if you want to make good use of it and develop new functions.

Again, as with the shell, you can package up functions for others to use, and your function becomes just another function that is part of the environment for others to use without having to learn the inner workings. Thus both S and UNIX encourage users and programmers to build on the work of those who have gone before.

But there's more. S comes from a background of "exploratory data analysis." This suggests that you are willing to think about statistical analysis. Now I know a little about statistics, but I am not a statistician. I do know some professional statisticians who use it in preference to other packages they have access to. And to help you out in learning to use the analytical tools, S comes with a library of 50 or so datasets. These can be used to try out the examples in the documentation.

No Rough Edges

Unlike some mainframe statistics packages, the S package originated in the UNIX environment: It fits in well and feels like a part of UNIX. It can read or write UNIX files, call UNIX processes from the S command line (or within an S function), etc. It uses the UNIX editor (default `vi` in this version) to edit functions, to edit command recall and so on.

The textbook is full of examples of clever uses of S, and many of these demonstrate methods for using the rest of UNIX to advantage. Page 188 of the textbook, for example, features the source for a `tbl` function that writes objects of any shape into a file suitable for processing by the `troff` pre-processor `tbl`, to make neatly printed tables in a formatted document.

The graphics modes provide a very convenient way of quickly visualizing data and also producing publication-quality graphics. The screen modes (X11 and Suntools) cooperated just fine with OpenWindows 2.0. The X version uses X resources as it should, and includes an app-defaults file that the installation procedure installs. The X window shows a spiffy little graph icon when you close it, under `olwm` and `twm` at least. The two common hardcopy modes (hplj, pscript) can be accessed directly from within S-PLUS, or can also be called from within one of the two screen modes. Since S keeps graphics objects as a display list, a drawing can be rescaled, drawn to a different device, and so on. The pscript version emits conforming Encapsulated PostScript that `pageview` was happy with. Other hardcopy devices supported include HPGL for Hewlett-Packard HP-GL plotters and pic for the `troff` preprocessor of the same name. The only problems with the drivers were minor. The first time I tried X11 under OpenWindows, I got this flurry of flames:

```
> X11()
Client is not authorized to connect to server
X11 Toolkit Error : Can't Open display
Bailing out!
X11 driver could not start
Try again after changing something
Dumped
>
```

This is basically "permission denied" for opening the X connection, apparently because the X11 function (`splus/x/dev.X11`) is not linked with an X library supporting the `MIT_MAGIC_COOKIE` authorization protocol, which OpenWindows and other modern versions of X11 use. And it's linked statically against the X libraries, so it won't take advantage of any newer X libraries you may have. A simple bypass is to either use `xhost` to enable clients from your host to access its display without Xauth, or (if you are very brave) use `openwin -noauth`. Later releases of S-PLUS will certainly fix this. Later releases will also offer the Open Look and Motif interfaces under X.

White On Black

In both X11 and Suntools graphics modes, the default screen is white lines on black background, which is fine. But, in Suntools, the cursor in the graphics window is only printed in black, so to see the cursor you have to flip to white on black. Then you get a lovely "S+" cursor, with the hot spot on the + sign, of course. In X11, you always get an X11-ish arrow cursor that is visible because of cursor masks. This is a non-trivial buglet for some users, who wish to use the cursor for, say, pointing at particular points and getting their coordinates. S calls this "identifying the outliers."

The screen graphics have an extra provided by Statistical Sciences: You can print a graph just by clicking on a button. For example, this simple perspective graph from the persp help file was previewed on the X11 driver:

```
> i <-
interp(ozone.xy$x,ozone.xy$y,ozone.median)
> # set NA's to zero
> i$z <- ifelse(is.na(i$z),0,i$z)
> persp(i$z/200)       # plot it
> title(main="Median Ozone Concentrations in
the U.S. Northeast")
```

Figure 2 shows the graph, as it looked on my screen. When I clicked the "Print Graph" button, I got the PostScript output in Figure 3, which uses PostScript fonts, line drawing, etc. The S graphics language is extensible. If you have some odd-ball plotter or other display, you can write your own driver for it (though you would likely lose the "click-to-print" feature). Several drivers are available from the S mail list server.

Finally, StatSci has added some significant value in visual analysis of multivariate data. Two functions that only work on X11 or similar devices are brush and spin. Brush takes a matrix of multivariate data and displays a matrix of all possible 2D scatter plots. It can optionally have histograms and a 3D spinning plot. Once the data display is up on your screen, you can use the mouse to select datapoints (or names), and the corresponding data is immediately highlighted in all the scatterplots, histograms, etc. It is very impressive! Spin is used to rotate multivariate data so that the 3D interrelationships between the variables can be seen and analysed. Unfortunately, these two graphics devices do not currently support hardcopy under X11. And anyway, they are interactive graphics, so they have to be seen to be appreciated.

Overall Evaluation

The S-PLUS package measures up to expectations. It is reliable, robust, self-documenting and comprehensive, yet extensible.

The documentation is comprehensive: You get a copy of the Becker, *et al*, textbook, which is a good introduction both to interactive exploratory analysis and to S. The original S package was "self-documenting" in the same sense as UNIX and `emacs`. Its documentation takes the form of "help files" that are remarkably similar to the traditional UNIX man-page format. These are reprinted in Appendix 1 of the textbook. With S-PLUS, you also get two binders, one full of the updated help files to supplant the Appendix of help files printed in the Becker textbook. The other binder provides some introductory material and examples written by StatSci, information on the X11 interface and on some contributed statistical routines. A final note gives you the address of an email archive server for S routines. The archive is run by the Statistics Department at Carnegie-Mellon University for

more

S-PLUS, Release 2.3

System Requirements: 8 MB of memory; Sun-3, SunOS 3.2X or higher; SPARC, SunOS 4.X

Pricing: Single user, commercial – $2,800; substantial academic, non-profit and quantity discounts are available.

For availability on other UNIX platforms, contact the vendor.

Statistical Sciences Inc.
1700 Westlake Ave. N., Ste. 500
Seattle, WA 98109
Circle 171

the S community, not by StatSci. StatSci's inclusion of documentation on it is a sign that StatSci is in touch with the rest of the S community, and that the company's not afraid of having users extend the software using code contributed by others.

Competition?

Of course, anyone who reads computer magazines knows there is no end of excellent statistical analysis packages available. Two commercial offerings regularly advertised in UNIX magazines are SAS and PV-Wave.

SAS from SAS Institute Inc., Cary, NC, is a mainframe statistical analysis system that has been ported to MS-DOS PCs and to some UNIX platforms. SAS includes most of the classical statistical routines as well as reasonable graphics. One surprise for people in the UNIX community is that you cannot buy SAS. You can only rent it. That is, you are required to pay a yearly fee in order to continue to use the software. With this in mind, SAS is substantially more expensive than S-PLUS.

PV-Wave Point-&-Click, from Precision Visuals Inc., Boulder, CO, is a less programmatic, more pre-packaged package for visual data analysis that might be easier to get started with. Effective May 1, 1991, PV-Wave Point-&-Click runs under SunView (i.e., no NeWS or X11 support) on Sun-3 and Sun-4/SPARC, and costs $4,500, roughly double the cost of S-PLUS. It supports PostScript, HPGL, PCL and several other output formats. ⊸

Ian Darwin has been using UNIX since 1979. He has developed publishing software for SoftQuad Inc., and has taught UNIX and C for the U of T (that's Toronto) Department of Computer Science and for Learning Tree International. Ian wrote the O'Reilly book, *Checking C Programs with Lint*, and can sometimes be reached at `ian@sq.com` or `uunet!sq!ian`.

NEW PRODUCTS

RISC-based X-Terminals

Calling it the first "legitimate" family of RISC X-terminals, HP has introduced the Series 700/RX line of color X-display terminals. The machines are based on the Intel i960 processor, a processor that is actually larger and more powerful than the CPUs of some workstations.

The 700/RX machines currently consist of four models. At the top of the line is the 19Ca, at $5,995, with an i960 running at 22.7 MHz, to provide 73000 Xstones to a 19-inch color display. At the bottom is the monochromatic model 19Mi, at $2,995, with an i960 running at 20 MHz to provide 60,000 Xstones performance.

Between these two poles are two 16-inch color display X-terminals: the 16Ca, at $5,195, with a 22.7-MHz i960; and the 16Ci, at $4,495, with a 20-MHz i960.

All four machines come standard with a PS/2-style keyboard port, a PS/2 mouse port, an HP-HIL port, an RS232C port, a Centronics parallel port, thinwire and AUI LAN ports, a ROM card slot, assorted cables and support for up to 16 MB of DRAM.

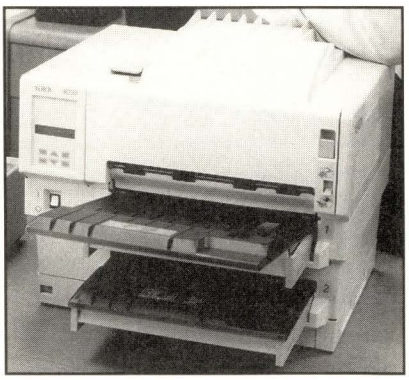
There have been other X-terminals based on RISC processors–notably the AMD 29000. However, HP says that this is the first complete X-terminal family to be based on a processor that demonstrates RISC design features.
Hewlett-Packard (Canada) Ltd., Panacom Automation Division, 20 Lexington Road, Waterloo, Ontario N2J 3Z3, Canada.
Circle 142

Asterix Version 1.1

Applix has released Version 1.1 of Asterix, an open suite of desktop productivity tools for UNIX workstations and X-terminals.

The new version expands Asterix's compound document capabilities to include audio for voice annotation, color-pixel editing and live links to third-party applications. It also provides fax support via macros and adds interprocess communications capabilities to the extension language facility. Enhancements include additional spell-checker options, dynamic accelerator key help, and graphics and pixel zooming.

Prices are $695 and $995 (includes spreadsheet).
Applix Inc., 112 Turnpike Road, Westboro, MA 01581.
Circle 143



Xerox's Desktop Laser Printer

The 11-ppm 4030 II desktop laser printer for business applications offers six standard resident printer emulations, including the HP LaserJet Series II, making it compatible with most personal-computer-software programs.

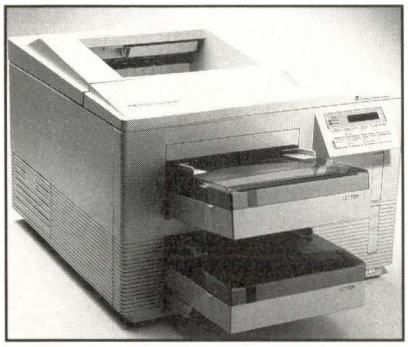
Features include a serial RS232C/RS422 port and a parallel Centronics

interface port, 512 KB of memory, 300 by 300 dpi, 11 resident fonts and two slots for additional font and/or printer-emulation cartridges. The product has a monthly print volume of up to 20,000 pages, using two high-volume consumable cartridges–one for dry ink and one for the photoreceptor.

Single unit price is $2,995.

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

Circle 144



HP Shows LaserJet

HP has introduced a 17-ppm, 300-dpi desktop printer. Called the HP LaserJet IIISi, the laser printer comes with two 500-sheet input trays and a formatter based on the AMD 29K RISC processor.

The company claims IIISi demonstrates improved print quality due to a series of newly introduced technologies, including microfine toner that creates images from toner particles roughly half the size of standard toner for similar machines.

Pricing begins at $5,495.

Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014.

Circle 145

X Spreadsheet for Star

Applied Information has introduced Xess, an X Windows spreadsheet, for the STAR910/VP SPARC-based network server.

Xess is a spreadsheet-like product meant for technical users. In addition to traditional spreadsheet features, the product offers support for scientific and engineering functions, such as matrix and vector math.

Pricing begins at $595 per workstation.

Applied Information Systems Inc., 500 Eastowne Drive, Chapel Hill, NC 27514.

Circle 146

NCD's 14-inch X-terminal

The NCD14c 14-inch-diagonal flat-screen color X-terminal will replace color 3270 terminals in many transaction-processing and office applications where conserving desk space is more important than a large screen.

The product uses a 20-MHz MC68020 microprocessor and two custom ASIC graphics engines to offer geometry rendering, raster operations, and text and window manipulation. The use of eight bit planes provides 256 simultaneously displayable colors selected from a palette of 16.7 million. The flat screen is based on Sony Trinitron display technology, enhanced by a 70-Hz non-interlaced refresh rate, 0.26-mm dot pitch and 100-dpi resolution.

Price is $3,000.

Network Computing Devices Inc., 350 N. Bernardo Ave., Mountain View, CA 94043.

Circle 147

User-Interface Builder

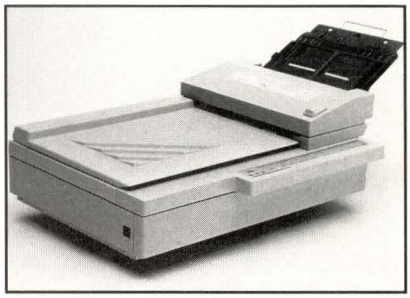
Open Interface is a user-interface development tool that provides users with windowing system, operating system and hardware independence. The product supports the native look and feel of all major windowing environments: Macintosh, Windows, Presentation Manager, Motif and Open Look.

Open Interface consists of a Layout Editor and a set of libraries for each windowing environment. The Layout Editor is WYSIWYG and is used to draw the application interface. It generates portable C code and resource files for the execution and description of the interface.

General operating systems supported are Macintosh, DOS, OS/2, VMS and UNIX. Development licenses are priced at $7,000 for DOS and Macintosh; $9,000 for OS/2; and $12,000 for UNIX and VMS. Run-time licenses, quantity one, are priced at $250, $350 and $500 respectively. Quantity discounts, site licenses and VAR/OEM licensing programs are available.

Neuron Data, 156 University Ave., Palo Alto, CA 94301.

Circle 148



Xerox Scanner For Suns

The Imaging Systems division of Xerox has announced ScanWorX, a scanning system that provides high-speed text recognition and image capture to Sun workstations.

ScanWorX consists of a 400-dpi scanner, an automatic document feeder and associated software.

Pricing begins at $17,950.

Xerox Imaging Systems Inc., 185 Albany St., Cambridge, MA 02139.

Circle 149

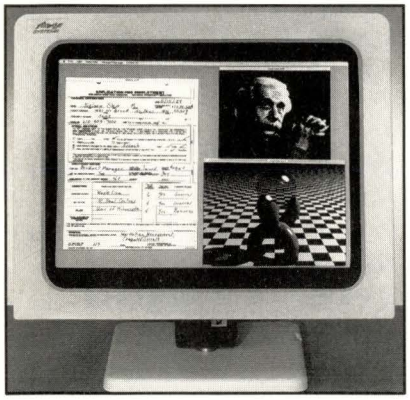
Multimedia Authoring Tools

Tiger Media has introduced Cats MEOW, a multimedia authoring tool for Sun workstations. MEOW–which stands for Multimedia Environment for OpenWindows–is an interactive tool for sequencing audio, graphics and scanned images in multimedia presentations.

The company says that MEOW is compatible with the VideoPix SBus board recently introduced by Sun as a low-end workstation video platform.

MEOW is priced at $995 for a single-user license.

Tiger Media, 5801 E. Slauson Ave., Ste. 200, Los Angeles, CA 90040.
Circle 150



HRMS Monitor

The M21LMAX is a 21-inch landscape high-resolution, high-brightness and -contrast monochrome/grayscale monitor. The autosynchronous product, with HRMS (Hi-Res Multi-Sweep) circuitry, adjusts dynamically to horizontal scan frequencies from 48 to 108 kHz and vertical frame rates from 60 to 80 Hz.

This versatility enables compatibility with high-resolution display controllers for PCs, PS/2s, Macs, Sun, Apollo, DEC, Silicon Graphics and other workstations with resolutions ranging from 1024 by 768 to 2048 by 1536.

The monitor is geared toward medical imaging, scientific and document-imaging applications due to the 21-inch screen, brightness (65 footlamberts nominal), high contrast and crisp definition.

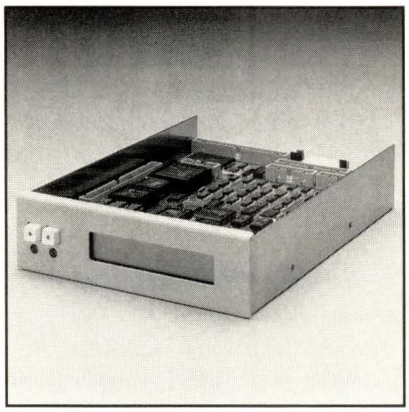
Suggested list price of the M21LMAX is $1,895.
Image Systems Corp., 11543 K-Tel Drive, Hopkins, MN 55343.
Circle 151

Sun To Mac Software

Information Presentation Technologies has introduced Sun-Partner, software which allows Sun-to-Apple Macintosh peer-to-peer networking. The company says that Sun-Partner allows file transfer and interactivity between some applications via LAN protocols. For example, a Wingz application on a Mac could swap data with a Wingz application on a Sun.

Apple networking protocols supported include LocalTalk, EtherTalk, AppleTalk Filing Protocols and the Apple Data Stream Protocol. On the Sun side, Partner supports TCP/IP, ARP, RARP and NFS.

Prices begin at $695.
Information Presentation Technologies Inc., 5000 N. Parkway, Ste. 304, Calabasas, CA 91302.
Circle 152



RAID On VME

DILOG has announced two new RAID (redundant array of inexpensive disks) cache controllers for SCSI devices.

The SA607 and the SA617 both

allow machines with SCSI ports to connect to two high-performance ESDI disk drives. The two drives can then act as a mirrored pair, as two separate logic units, or they can be concatenated as one logical unit. The SA607 interfaces with a single-ended SCSI while the SA617 interfaces with a differential SCSI.

The SA607 is priced at $2,900 with a 4-MB cache, $2,200 with 2 MB, and $1,500 without cache. The SA617 is $3,150 for 4 MB, $2,450 for 2 MB, and $1,750 without cache.
DILOG, 1555 S. Sinclair St., Anaheim, CA 92806.
Circle 153

Seven-Key UNIX Keyboard

Using a new chordic data-entry system called "The BAT," UNIX workstation users can simultaneously enter text and input designs from digitizers, mouse systems or other data-entry devices without looking at the keyboard. The BAT also lets users create a library of commonly used words and phrases that can be entered with a single keystroke.

The product consists of two identical, seven-key, 7-by-7-inch units that plug into the serial port of any workstation. The standard keyboard remains active. Each unit of The BAT is a complete keyboard. Data entry is accomplished by pressing various key combinations or "chords."

The BAT lists for $495, and provides source-level drivers for Open Windows 2.0 for UNIX platforms.
Infogrip Inc., 812 North Boulevard, Baton Rouge, LA 70802.
Circle 154

Sun Real-Time Systems

A system that links Sun workstations with VMEbus-based real-time systems has been introduced by Matrix.

Called the Solar System, the product is a standalone VME system supporting a choice of Motorola 680X0 processors that run the VXworks real-time OS. The Solar System can then network to a Sun workstation, or it can itself house a SPARCengine VME board.

Pricing begins at $27,595 for a development system; $7,995 for a target system.
Matrix Corp., 1203 New Hope Road, Raleigh, NC 27610.
Circle 155

DEC Shows NAS On Sun

DEC has introduced components of its Network Application Support (NAS) software for Sun workstations.

They are the DECwindows version of Motif and the DEC Visual User Interface Tool (DEC VUIT). DEC VUIT is a tool for building Motif GUIs for applications.

While Motif has been available for Suns for some time, this is the first time that DEC has displayed its own version of a commercial product for Suns, and never before has VUIT been available on hardware other than DEC's own.
Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571.
Circle 156

WAN/LAN Controller for SBus

A high-performance X.25 wide area network (WAN) controller for SBus has been introduced by Themis Computing.

Called the SXCM, the product is a high-performance, data communications front-end processor for Sun and other SBus-based systems. It provides control and interface for three full-duplex serial channels on a single card.

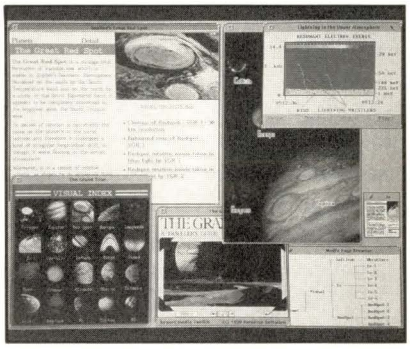
Pricing begins at $1,800.
Themis Computer, 6681 Owens Drive, Pleaston, CA 94588.
Circle 157

New Inks, Screen Angles for Printers

Newly developed ink rolls for the QMS ColorScript 100 Model 10 printer produce brighter, deeper colors. For all ColorScript models, new screen-angle software has been developed to provide smoother color patterns, eliminating the circular "rosette" pattern seen when four-color halftones are used at maximum coverage. The addition of the ink and screen-angle options allows ColorScript users to tailor their color output to their specific application.

For business presentation, users may choose the new ink rolls that provide brighter color. For electronic publishing and graphic arts, users may require the original inks for accurate color simulations for the Pantone Matching System.

A package of two four-color, letter- or A4-size rolls, each producing 100 prints, has a U.S. suggested list price of $105. The screen-angles utility is included, free of charge, with all ColorScript printers purchased after November 1.
QMS Inc., One Magnum Pass, Mobile, AL 36618.
Circle 158



Hypertext On Suns

hyperCmedia, a hypercard-like hypertext product for Sun workstations, allows developers to produce online documents that can be linked together in much the same way that Hypercard is on the Apple Macintosh.

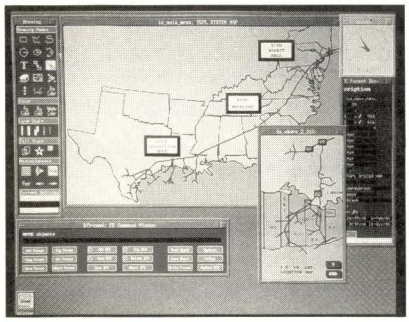
Each page of a hyperCmedia document can support multiple forms of media, including text, images, audio and, on the SPARCstation, video.

Pricing begins at $495.
Paradise Software Inc., Rt. 1, Box 467, Lambertville, NJ 08530.
Circle 159

Focus Under Open Look

Information Builders, makers of the Focus 4GL and database, have ported the product to Open Look on Sun workstations.

Focus is a database language that allows developers to build applications atop several RDBMS products. While it had been on the SPARCstation before, it was not supported under Open Look.
Information Builders Inc., 1250 Broadway, NewYork, NY 10001.
Circle 160



Graphical Environment On Sun

A graphical user environment for UNIX systems has been introduced by Kinesix.

Called Sammi, the product allows users to interactively present, organize, manipulate and interpret information from multiple applications and databases without complex coding. It currently operates on a number of UNIX systems, including Sun workstations and compatibles.

Pricing ranges from $12,500 to $25,000.

Kinesix, 10333 Richmond Ave., Ste. 1100, Houston, TX 77042-4122.
Circle 161

5.3-kVA UPS

The new 5.3-kVA FERRUPS unit is being added to Best Technology's product line to meet the needs of users whose power-protection demands fall between the existing 4.3-kVA and 7-kVA FERRUPS units.

Advantages for users include artificial intelligence built into the units and true two-way communications between the FERRUPS unit and the critical load it supports. The 5.3-kVA range is for midrange computers such as the IBM AS/400, and workstations from Apollo, Sun, Pyramid, as well as for protecting large local area networks that include multiple servers, nodes and terminals.

The price varies with options, but the unit lists at $5,500.

Best Power Technology Inc., P.O. Box 280, Necedah, WI 54646.
Circle 162

Load Balancing For Sun Networks

Software, which is said to automatically allocate and administer systems resources in a network has been introduced by VXM.

Called BALANS, the product is meant to facilitate distributed-applications development. VXM says that the product will be available in the third quarter of 1991, and will cost $6,000 for a starter system.

VXM Technologies Inc., 30 Gardner Road, Brookline, MA 02146.
Circle 163

New UPS Models

Four new on-line UPS products have been announced by Sutton Designs. The MM-0.5kVA, the MM-1.0kVA, the MM-3.0kVA, and the MM-5.0kVA provide 500 VA, 1000 VA, 3000 VA and 5000 VA respectively.

The company says that the products provide ± 2% voltage regulation, less than 3% total harmonic distortion of the output wave, a small footprint (in the case of the MM-0.5kVA only 5.6 inches high by 7.5 inches long by 17 inches deep), and an MTBF of 100,000 hours. Pricing ranges from $1,290 to $7,990.

Sutton Designs, 215 North Cayuga St., Ithaca, NY 14850.
Circle 164

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SUNEXPERT Magazine

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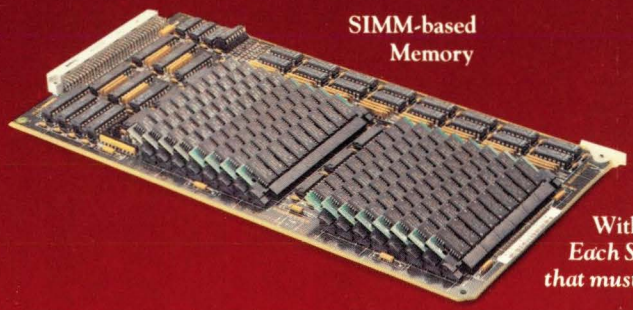
Circle No. 31 on Inquiry Card

For SPARC 330/370/390 Systems:

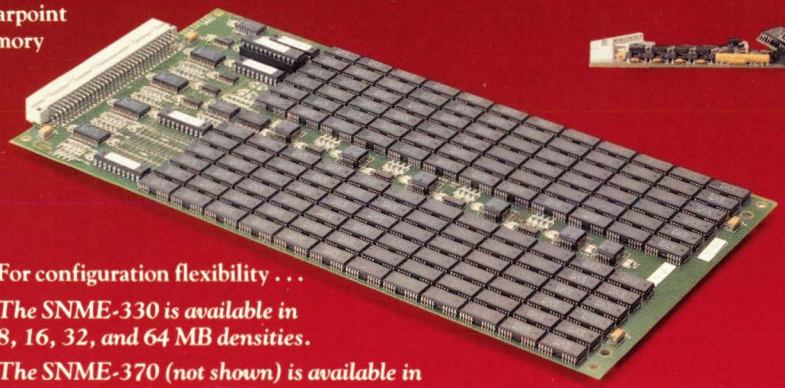
Clearpoint's Better Alternative to SIMM-based Add-in Memory



SIMM-based Memory

With SIMM-based memory, *Each SIMM has 30 'fingers' that must make solid contact . . .*

Clearpoint Memory



You need 48 SIMMs, with 30 connections per board, to reach 192 MB.

For configuration flexibility . . .

The SNME-330 is available in 8, 16, 32, and 64 MB densities.

The SNME-370 (not shown) is available in 24, 48, 96, and 192 MB densities.

Clearpoint does it with a single board!

Engineered for Greater Reliability and Flexibility!

Clearpoint's design philosophy strives for maximum reliability and flexibility, and superior value. Our SNME-330 and SNME-370 memory for Sun 330 and 370/390 systems uses discrete, hard-soldered DRAMs instead of SIMMs because fewer components and connections means higher reliability.

The Reliable Alternative

Clearpoint's hard-soldered DRAM solution provides a significantly better Mean Time Between Failure rate than a SIMM-based board. Each SIMM has 30 'fingers' that must make solid contact with the connector's spring assembly. On a 48 MB board, that's 1440 mechanical connections subject to corrosion and faulty contacts! Clearpoint's design avoids the need for SIMM connectors.

The Easiest, Most Flexible Way to Upgrade

The fully-configured Clearpoint solution:

- More flexible – a wide range of capacities meets your precise application needs. Full credit trade-in means no lower-capacity boards are left unused.
- More reliable and faster – our single-board swap means less downtime; you don't have to handle as many as 96 SIMMs.

Full Credit On Upgrades

Clearpoint's new lower pricing and aggressive upgrade program assures superior customer value. Users of SNME-330 or SNME-370 boards can expect to receive full credit for their initial boards towards the purchase price of a higher-capacity board.

Call or write for more information!

- ❒ Product spec sheets
- ❒ *The Designer's Guide to Add-in Memory*
- ❒ *Pointers* newsletter
- ❒ *Commitment to Quality*, Clearpoint's QA procedures

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