SUNEXPERT

An Independent Forum for Open Systems

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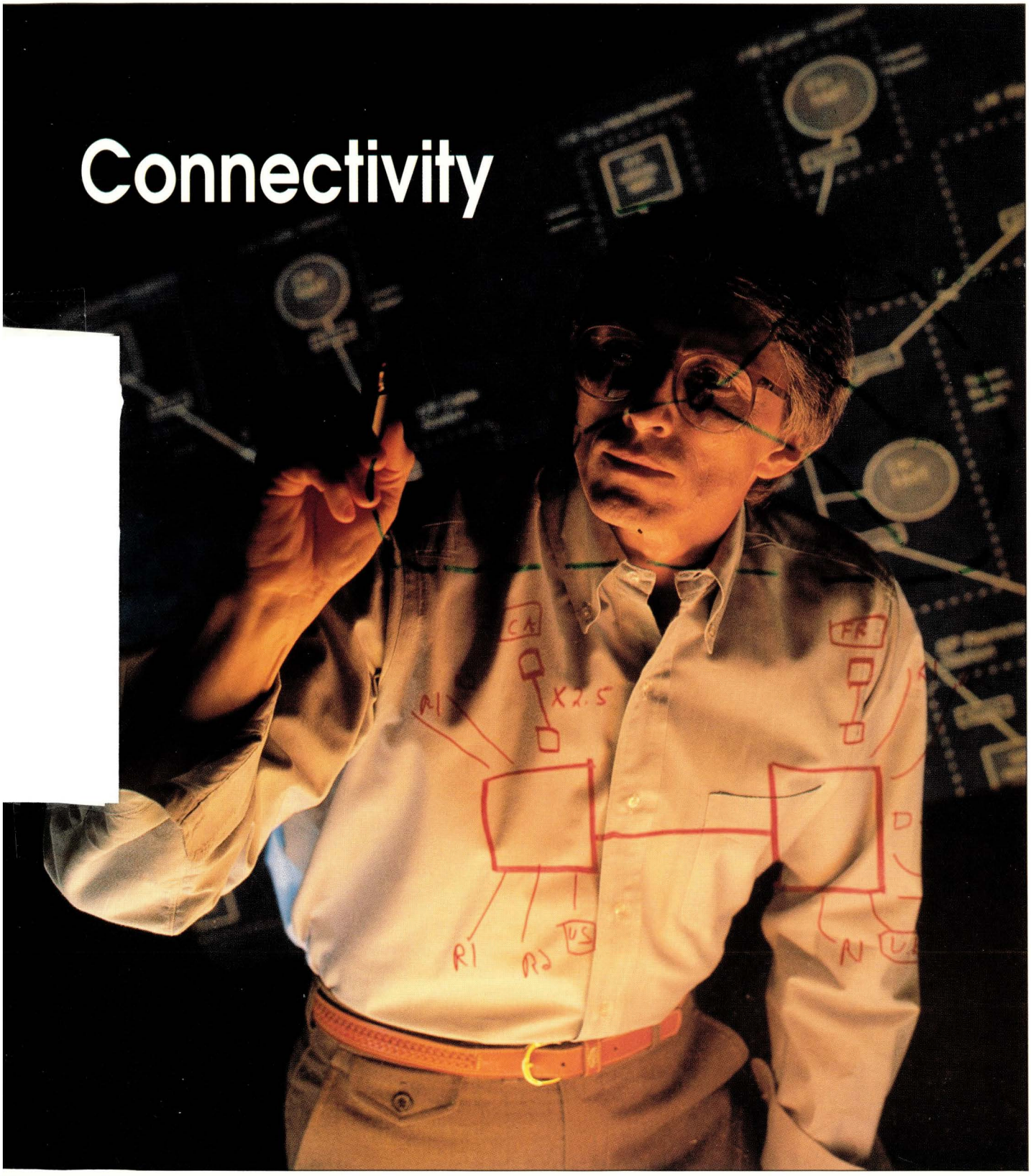

Naming Systems

UNIX Basics: sed

UNIX Security

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It has all the advanced capabilities of the new dBASE IV version 1.1 for DOS. The data manager that *Software Digest* rated as the number one PC multiuser database (Oct. 1990). And that PC users have made the number one best seller (source: Audits & Surveys, Oct. 1990).

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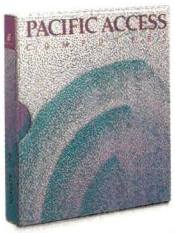
EZ-ADMIN sends new Sun users a clear message

Announcing the menu-driven package that makes Sun's SPARCstation administration a welcome asset.

The processing power and brilliant displays of the Sun Microsystems SPARCstations are attracting new users to the world of UNIX workstations every day. This transition has usually meant frustrating hours with a UNIX manual or expensive visits from consultants. Now, for the first time, newcomers to the Sun SPARCstation can set up and administer their own systems from the first day.



A few of the tasks that EZ-ADMIN makes easy:

By using an intuitive, menu-driven approach, EZ-ADMIN lets you easily:

- Connect to hosts and peripherals.
- Add, update or delete users and access controls.
- Perform network administration.
- Manage mass storage systems more easily.

EZ-ADMIN automatically checks for a broad range of errors. And, there are two levels of password protection to minimize the risk of unauthorized changes to your system.

Pacific Access® Computers regularly updates EZ-ADMIN plus you can easily customize the package to meet your site's needs.

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Get It Together

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WordPerfect
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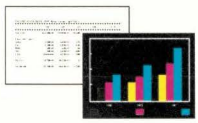
Compatibility is Key to Productivity

Unix's natural networking abilties make it an ideal OS for users who want to assemble documents from a variety of sources. *Getting the information together is where Island Write, Draw & Paint come in.*

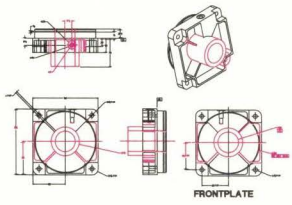
Bring in images and text from the popular spreadsheets, WP and tech pubs packages with IslandWrite. Then using Write's powerful layout functions, flow text around your image, or annotate it with Draw or Write.

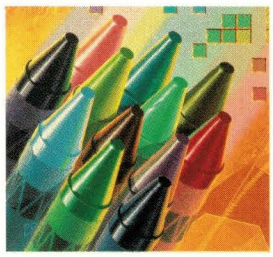


useful for your daily word processing needs as well as presentations and any other document. Create or import raster images with Paint and edit them. Then place them in your Write document.

If you use AutoCad or Cadam or any other program that outputs HPGL, CGM or PostScript, adding your image to an IslandWrite document is simple.

This sample document was created using IslandWrite. The text was typed in using Write's WYSIWYG word processing tools. The illustrations were added after the text, but with Write, you can easily add or delete illustrations at any time. The text will automatically reflow. Use IslandWrite, Draw & Paint to get your documents, presentations and reports together.





Include CAD drawings in your presentations, reports and documentation. If you have a change or annotation, do it using Draw or Paint without having to alter your original drawing.

Of course, IslandWrite isn't only an assembler. It is a full-featured desktop publishing package

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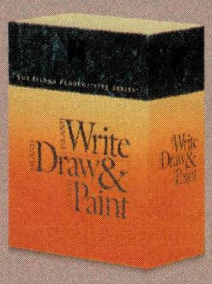

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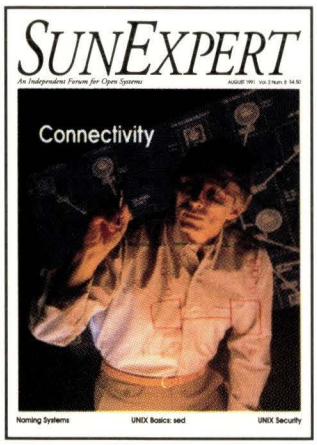

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by Doug Mindell

FEATURES

NEWS

COLUMNS

DEPARTMENTS

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

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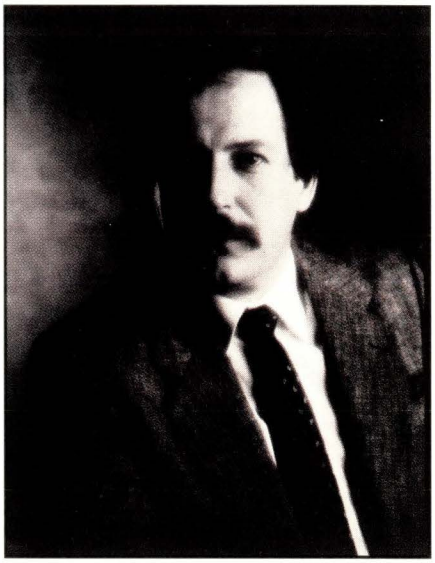

Editorial

The Right Connections

This month's cover story, "There's More Than One Way to Network a Sun," by Mary Jo Foley drives home the point that experience is the best teacher. That's why we profile four network installations: LSI Logic, the Department of Atmospheric Sciences at the University of Washington, the TAT-9 undersea cable project and Howard Publications. Mary Jo reveals through the experience of these users at very diverse sites how adaptable Sun-compatible hardware and software can be. In fact, these network adventurers demonstrate that with a little technical know-how, a lot of patience and some equipment investment, the maze of TCP/IP, X.25, SNA, LU6.2, DECnet and AppleTalk protocols can be transformed into a communications thoroughfare.

Also in this issue, veteran networker Smoot Carl-Mitchell of Texas Internet Consulting explains "What's In A Naming System?," Page 62. His practical advice for administrators outlines no-nonsense approaches to naming resources and establishing naming authorities using DNS (Domain Name System). He deals with the political realities as well as the technical issues.

After you connect and name network resources, security concerns become more important. Take a look at this month's installment of "Practical UNIX Security," Page 68. If your system can be reached from the ether, it can be compromised–unless you take the right precautions to protect the right connections.

Doug Pryor

Doug Pryor

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Letters

The Road Not Taken

Dear Editor:

I'm writing to generally praise your publication. For those of us who have either made, or are contemplating making, a commitment to SPARC-based systems, *SunExpert* is fantastic. However, I have begun to notice an increasing coverage of non-SPARC/Sun clone-oriented systems. I sincerely hope this is not a trend. If so, I hope enough readers will comment to insure you rethink your direction.

After all, your publication's title is *SunExpert*. Including all SPARC-based and Sun-compliant clones is perfect. However, the increasing coverage of DEC, IBM, HP, etc., is not warranted. If DEC wants to advertise (as it has) in *SunExpert*, fine, but including articles about DEC's most recent attempt at industry obfuscation (ACE) is as unjustified as ACE itself.

We have plenty of general-industry publications from which to choose (*Unix Today!*, *Byte*, *Computerworld*, *Workstation Week*,–the list is nearly endless). We turn to you for Sun, Sun clone and SPARC coverage–both in-depth technical articles and general articles/news of interest to managers.

Your path would seem to befit a Frost poem. Either take the "path less traveled by" and give us interesting news about the Sun-based world, or quit playing games with your title and change it to avoid false advertising. Do not become as confused about your market as Digital did–the result might be the same.

John Neubert
Director, Academic Computing
Drew University
Madison, NJ 07940
jneubert@drew.edu

The Editor replies: Like Frost's protagonist, we would like to travel both roads, but, for now, our attention is on the Sun and Sun-compatibles market. Yet, our editors do feel that coverage of systems our readers are likely to encounter in an NFS environment is important.

Object Objections

Dear Editor:

My compliments for the report on DBMSs (*SunExpert*, May, Page 56). I have a few comments, however, on the DBMS Survey. Several RDBMSs have been cited as "object-oriented." Being an avid programmer and user of the O-O paradigm, I think that such comments are ludicrous.

Object-oriented programming is a philosophy, and an OODBMS is a database-management system that truly implements the object-oriented data model. The O-O data model is far superior to the relational data model, and greatly enhances the power of the DBMS. Just because an RDBMS has a spurious O-O front end, does not make it "object-oriented." Calling them object-oriented is just a sales gimmick. Certainly, I expected *SunExpert* editors to know better.

On the topic of "free" DBMSs, Postgres has been cited. An excellent public domain OODBMS is Observer/ENCORE developed at Brown University.

Shamim Ahmed
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FYI

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

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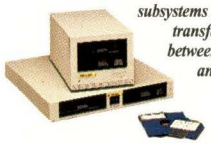

2.0 Gbyte, 4mm DAT drive: a faster, easier way to search for files.

Add serial ports to your SPARC system with our new SBus boards.

Removable DataVault is now available in a 2-slot desktop configuration with up to 4 Gbytes.

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430 Mbytes half-height, high-performance disk/tape enclosure.

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Move your monitor, keyboard and mouse up to 150 feet from the CPU with the Workstation Extender.

The Artecon family of disk and tape (1/4", 8mm) drives are available in capacities ranging from 150 Mbytes to multiple Gbytes.

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Add 16 additional serial ports and one parallel port with our EP-16 serial multiplexor board.

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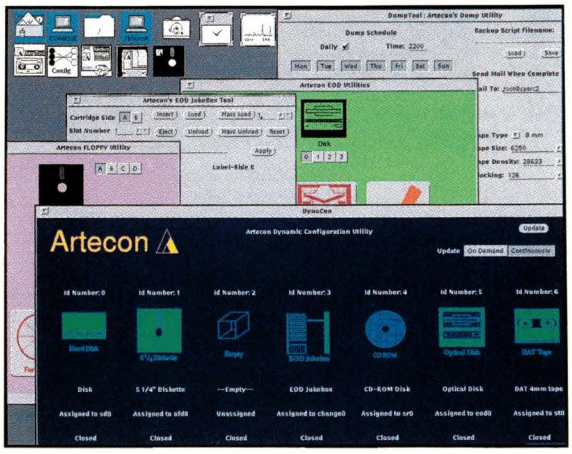

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And with our unique Active Backplane™ you have true on-line removability. It allows you to remove any device, while the system is up, without creating errors or impacting other devices on the system.

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You'll find this revolutionary technology in the broadest range of removable products for your Sun. From SLCs to 4/490s. From 200 megabytes to 8 gigabytes, available in our full line of enclosures, from desktops to rackmounts.

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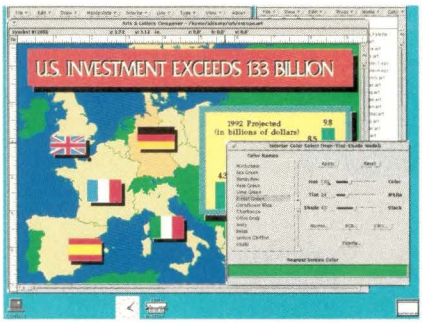

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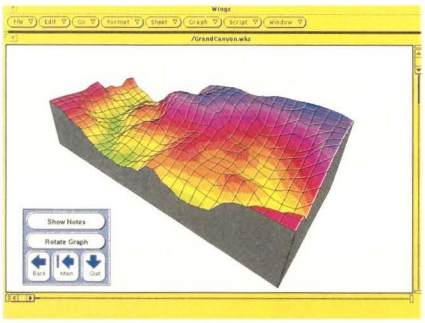

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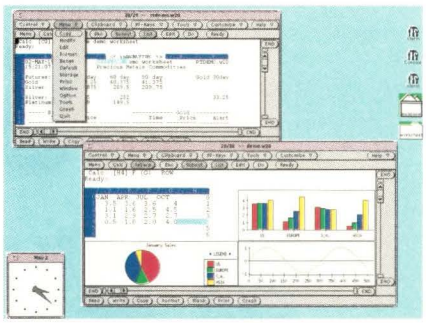

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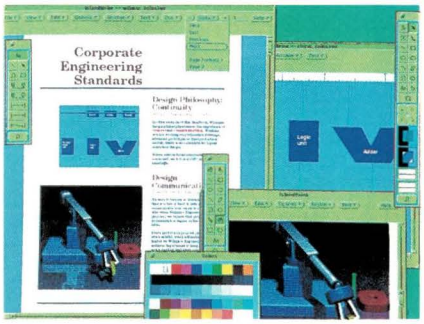

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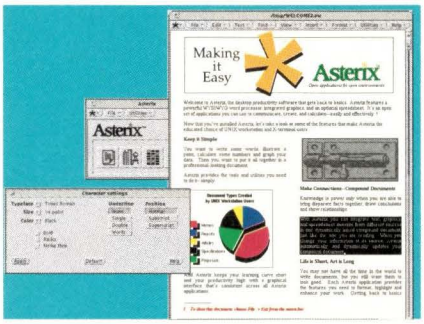

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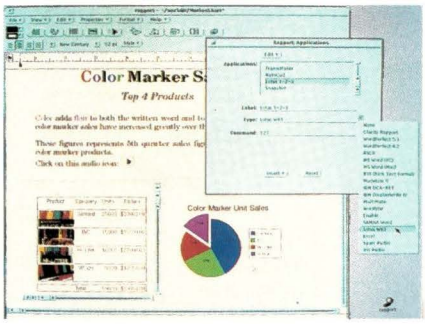

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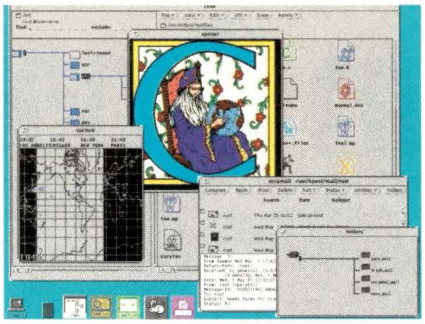

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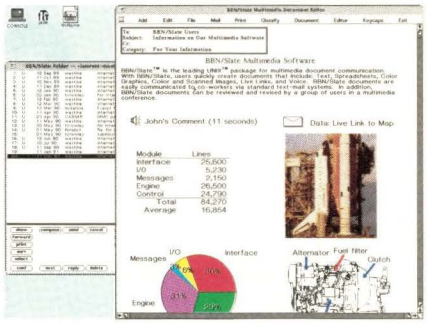

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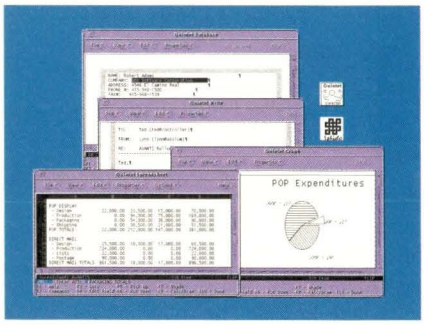

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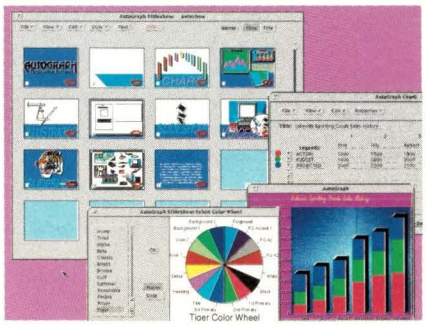

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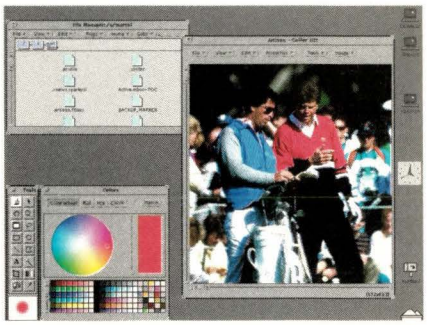

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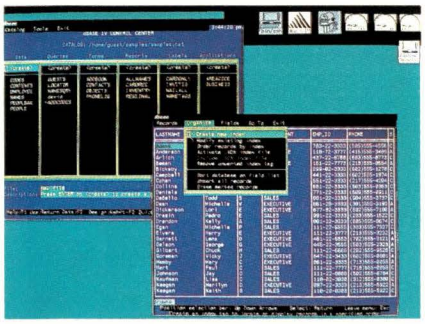

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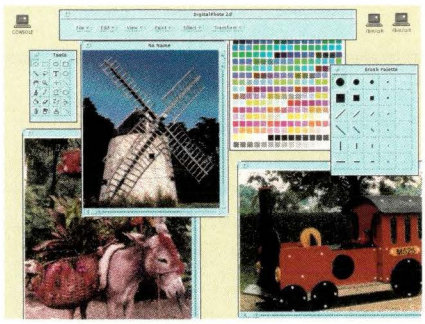

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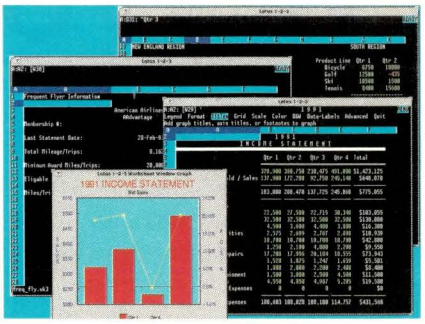

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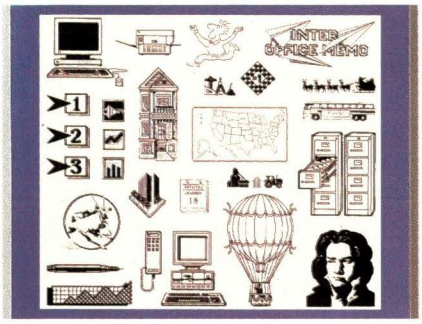

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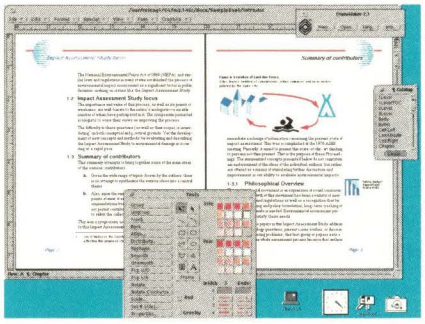

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A misunderstanding we'd like to correct.

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There's also software for drawing, publishing, and presenting. For clip art, faxing, and office automation. More than 60 business programs available now, and dozens more on the way (CorelDRAW, Ventura® Publisher, and Norton Utilities,® among others).

Okay, now that you've lowered your expectations, prepare to raise them again. Because you can actually be more productive on a SPARCstation than on any PC. Even using the same software.

SPARCstations are designed for multitasking; so you can prepare a set of overheads while your computer is recalculating spreadsheets and searching databases in the background. Our built-in networking makes it easier to collaborate with others — even if they're working on DOS or Macintosh® computers. Our OPEN LOOK® graphical interface brings a welcome level of consistency to software from dozens of vendors. You'll also be working on a larger screen, and with sharper graphics, than most PC users ever see.

If you have questions, or want to place an order for software, call one of the resellers listed below. For SPARCstation information and our new desktop applications brochure, call us at (800) 233-7472, ext. 480.

Then, perhaps we should talk about the three thousand other programs you can run.

sun microsystems

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NEWS

Yes, Virginia, There Is A SPARCalike Market

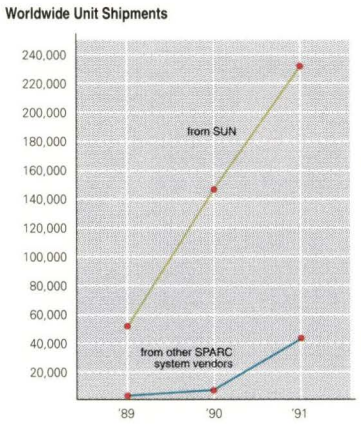
Naysayers take note: There *are* companies shipping SPARCalikes, or SPARC-based, Sun Microsystems Inc.-compatible workstations. And there *are* people buying them–not (usually) by the hundreds, but by the twos, threes and fours, for certain. And, for the most part, these customers seem tickled pink with their purchases.

Opus Systems, Mountain View, CA, claims to be the number two SPARC workstation vendor (after Sun itself). The company says it has shipped "in excess of 1,000 desktop units" between the end of October 1990 and June 1991 to both end users and resellers. Mars Microsystems Inc., Mars, PA, says it shipped 80 Mariner 4i's to end users and resellers between September 1990 and June 1991. SPARC laptop vendor RDI Computer Corp. says it has placed between 25 and 65 BriteLites with 30 distributors worldwide since the machine began shipping in March. (The San Diego company claimed it had 8,500 orders as of June.) CompuAdd Corp. is rumored to have made a couple of sales of more than 100 each of its SS1s to two major universities. Of the handful of other vendors that can claim to be shipping product, few will discuss units or revenues.

But some buyers *are* talking. Powerstation Technologies Inc., Randolph, MA, is both a reseller and an end user of the Mariner 4i. The company bought two machines in February for use in-house as combination office-automation/design and test platforms. "We were interested in the Mars box because emulating DOS on a SPARCstation is a joke," claims president Lawrence Genovesi.

With its IBM Corp. PC-AT bus and SPARC/OS (SunOS) system software, the Mariner also is proving to be a useful DOS-to-UNIX transition machine, Genovesi says. "The Mars can talk to two nets simultaneously," he points out. And for large companies with installed bases consisting of a mix of Novell Inc. NetWare, TCP/IP, token-ring and Ethernet, the Mars can act as an interconnectivity hub.

As of the end of June, Genovesi says, Powerstation Technologies had sold 12 Mariners, with a single deal for 30 units pending. "The only problem with the box is its newness," he says.



This year, SPARCalikes could comprise 15% of SPARC workstation shipments. Source: SPARC International

"Customers love them and want to play with them. So they're taking demo machines for 15 to 30 days." Another benefit of carrying Mars rather than other SPARCalikes is that Sun doesn't consider the Mariner to be a clone. Consequently, Sun isn't ignoring or threatening resellers that have opted to carry the machine, as opposed to its treatment of resellers of other SPARCalike systems.

Another contented Mars reseller is Mega Comm Technologies (MCT) Inc., San Diego. For the past seven months, MCT Inc. has been acting as both an OEM and VAR of Mars systems. While MCT won't reveal shipment numbers, demand has been "reasonable," says vice president of operations Bill Morgan. The typical buyer is a $25+ million firm purchasing "multiple seats," he claims.

Besides selling Mariners into typical design-automation niches, MCT is repackaging the systems by adding custom chassis, rack-mount capabilities and such for the industrial process-control marketplace. As both an OEM and VAR supplier, Mars has been "superb" on service and support, Morgan says.

At Columbia University's Law School, CompuAdd is the favored SPARCalike brand. The school took shipments of "numbers six and seven, or so," from the Austin, TX-based company, says Willem Scholten, director of computer systems and research for the school. "We took them out of the box and they worked. We built X from scratch using the MIT X tapes on them," says Scholten. The school is using the pair of SS1s for a custom archival presentation project involving complex database retrieval, compression and decompression.

"We considered [IBM's] RS/6000s for the project, but they were too much money. And I'm not that keen on AIX [IBM's UNIX]," Scholten says. CompuAdd's SS1, like the majority of the SPARCalikes, seems to more than adequately fit the bill.–*mjf*

SGI's Indigo: 3D graphics for less than $10,000.

SGI Does It Again

The second machine to be billed as "ACE (Advanced Computing Environment)-compatible" is the IRIS Indigo, a 3D graphics gem available for less than $10,000 from Silicon

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Graphics Inc. The Indigo differs in several ways from the first ACE system, Digital Equipment Corp.'s DECstation 5000/100. (See *SunExpert*, July, Page 18.)

First, the machine is a radical departure from SGI's existing systems. The Indigo marks the new low-end of SGI's line. It is based on the MIPS Computer Systems Inc. 33-MHz R3000A CPU, which clocks at 30 MIPS, 26 SPECmarks and 4.2 MFLOPS. The system supports 2D and 3D 8-bit graphics, 16-bit CD-quality audio and real-time video with its five audio, one parallel, one SCSI II, one Ethernet and two serial ports. Base price is $7,995 for a diskless system with a 16-inch color monitor and 8 MB of memory. A system with a 236-MB formatted disk drive added goes for $9,995. Volume shipments are scheduled to begin in September.

Like the rest of SGI's computers, Indigo runs IRIX 4.0, with compatibility with the Santa Cruz Operation's Open Desktop and Microsoft Corp.'s OS/2 3.0 promised once the ACE versions are completed. In the operating environment, X11R4 is merged with the IRIS GL graphics package and Adobe Systems Inc.'s Display PostScript. The GUI, IRIS WorkSpace, is based on Motif.

SGI is positioning Indigo as "the RISC Personal Computer for engineers, scientists and creative professionals." The company anticipates that the system will compete against Sun Microsystems Inc.'s IPC and SPARCstation 2, Apple Computer Inc.'s Macintosh family, DEC's DECstation 5000, IBM Corp.'s PS/2 and RS/6000 and Hewlett-Packard Co.'s HP 720, among others.

On other fronts, SGI continues its breakneck pace of unveiling new products. The company made its debut as a provider of file servers by announcing three IRISserver models–workgroup, department and campus-wide systems. The symmetric multiprocessing systems can accommodate 1.6-GB SCSI disks, come with 1/2-inch SCSI tape drives and feature dual-channel VME/SCSI controllers. All are configured with network-backup, mirroring and network-archiving software, in addition to IRIX 4.0.

Within the past few months, SGI also introduced IRIS Explorer, a visual application-development environment for use on SGI's entire line of hardware. It made its first foray into the CASE market, announcing its CASEvision strategy and its first product, CodeVision, a toolset consisting of a static analyzer, a debugger and a performance analyzer. It formed a strategic alliance with Oracle Corp. And to top it all off, SGI unveiled version 1.1 of its NetVisualizer network-monitoring and diagnostic tool.–*mjf*

Lotus Gets (Even More) Serious About UNIX

Once again, Lotus Development Corp. has made an effort to jump out of the DOS pan and into the UNIX fire. More than 18 months after it unveiled its first UNIX version of 1-2-3 to run on Sun Microsystems Inc. platforms, Lotus introduced a "real-time" software upgrade of its UNIX spreadsheet in June.

Lotus developed the product, in part, with the help and then public endorsement of EJV Partners L.P., a joint venture of six Wall Street financial houses, including Citibank N.A. and Salomon Brothers Inc., aimed at establishing a standard computing platform in order to transmit continuous market data.

The new UNIX version of 1-2-3 is called Lotus Realtime. On a single SPARCstation, it can manage feeds from up to 16 servers and as many as 12 spreadsheets. Additional features include 3D modeling, relational database functions, network file reservations and external data access through Lotus' DataLens product. With these capabilities, Lotus is expected to go beyond wooing Wall Street traders, insurance analysts and retail bankers–its initial target customers.

A product manager confirmed Lotus will also aim its new UNIX release at non-commercial users, or more to the point, the leading workstation vendor's traditional installed base–the Sun engineering and scientific community. If Lotus succeeds in winning over this market, it will be the first time it will have provided scientists and engineers with a spreadsheet they can really use. It was six years ago that Lotus first discovered that engineers had been rigging DOS versions of 1-2-3 to achieve, among other feats, statistical process control.

Additionally, Lotus is readying an upgrade of this UNIX 1-2-3 version for AT&T's System V, as well as a version of Lotus Realtime to run on Digital Equipment Corp.'s Ultrix.

To take advantage of Lotus Realtime features, Sun users must buy 1-2-3 for SPARC systems ($695 or the upgrade for $180) with 8 MB of RAM and 10 MB of hard disk running under SunOS 4.1.1 (or a later version) and OpenWindows 2.0 or X11R4. The real-time engine ($1,600) requires an additional 1 MB of hard-disk space. A C add-in toolkit ($25,000) is available for customized applications, including the server feeds.

Lotus Realtime also comes bundled with a Sybase Inc. SQL server DataLens driver that provides users with access to data stored in a Sybase SQL RDBMS and with an improved network-licensing utility.–*hcp*

SunSoft
A Sun Microsystems Company

SunSoft Takes Wraps Off Product #1

SunSoft, Sun Microsystems Inc.'s software subsidiary that began operating as an independent entity last month, has introduced its first product. Called ToolTalk (not to be confused with PizzaTool), the software is "a network-spanning interprocess message system," according to SunSoft.

In simpler terms, ToolTalk is the first layer of SunSoft's forthcoming framework for application interoperability. When it ships at the end of the year, ToolTalk will be available for SPARC-based applications, as well as for packages running on other UNIX workstation vendors' hardware, SunSoft claims. (Developer copies of ToolTalk are available today.)

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SOFTWARE

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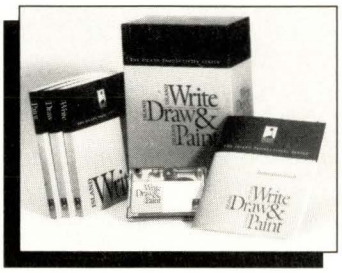
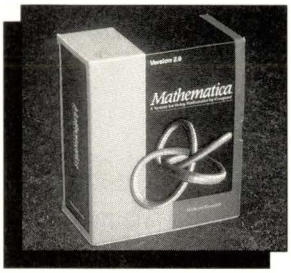
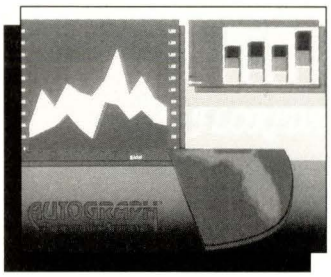
Wingz has been improved and is now available under a new true OpenLook version and also Motif for all Sun workstations. With Wingz you get powerful graphic, text processing, programming language, spreadsheet and presentation software in one highly integrated package. Takes advantage of OpenLook controls.

Island Graphics Productivity Series
Includes Island Write, IslandDraw, and IslandPaint. This is an affordable, streamlined set of publishing and graphics tools that let you create and illustrate memos, letters, specifications, and newsletters. Choose from SunView or new OpenLook version for Sun 3,4 and 386i-single user.





Mathematica 2.0 from Wolfram Research
A software system for doing numerical, symbolic, and graphical computation used both as an interactive calculation tool and a programming language. Numerical capabilities include arbitrary arithmetic and matrix manipulation. Users can create "Notebooks" that mix input, graphics, text and sound.

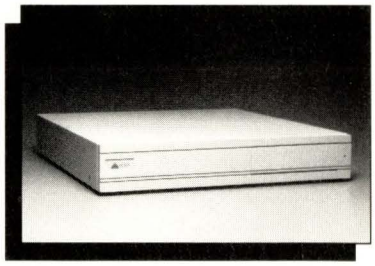


Autograph 3.2 from Ficor, Inc.
This graphics tool will give Sun users under OpenLook similiar capabilities to those using PowerPoint or Harvard Business Graphics on PC's. Included is Chart; a tool with over 25 chart styles, Illustrator; a free-style drawing and composition program and Slideshow; which is used to create slide presentations. Add voice-overs.

HARDWARE

Texas Instruments microLaser Printer
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**.

The SBox Expansion Chassis from Aurora
The SBox Expansion Chassis is a fully integrated enclosure that provides four additional Sbus slots (slaves), an internal power supply, cabling and provision for up to two 1/2 ht. SCSI devices. The SBox external dimensions match the "pizza box" form factor of the SPARCstation.



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.

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Other Open Systems News

Digital Equipment Corp.

Just when you thought you had heard all of the possible "open" buzzwords, DEC launches yet one more: Open Advantage. As part of the campaign, DEC announced a slew of new products and extensions to its Network Application Support (NAS) software. Among the offerings are NAS transaction-processing software; NAS compound-document architecture facilities; NAS enterprise-management modules; FDDI products; multiprotocol network routers; a new network-licensing program; token-ring products; OSI software; X.25 gateways; and network consulting, management and training services.

DEC rolled out a new version of its PowerFrame design-data-management software. New features include additional support for both the Ultrix and VMS operating systems; a "transfer manager," enabling workgroups to share design data; a non-graphical, terminal-based user interface for PC and terminal users; increased customization capabilities; and increased performance via improved algorithms, reduced program size and optimal use of the design-manager server. Four new partners joined the PowerFrame Synergy Program–Applied Information Systems, NEC Electronics, Sherpa Corp. and Swanson Analysis Systems.

On the database front, DEC debuted its Data Integration Server for client/server computing that involves multivendor database access. It also rolled out a new version of Rdb with higher performance and B-1-level security. Under SQL/Services (Rdb's client/server protocol) support for TCP/IP, Sun Microsystems Inc. workstations and Microsoft Corp. Windows 3.0 has been added. The Integration Server brings data-integrating services down to desktop users in client-server configurations. It includes all hardware and software needed to access remote, multivendor databases. Pricing begins at $31,000.

Along the lines of SunSoft's new ToolTalk product, DEC unveiled object-oriented software for building and integrating VMS and Ultrix applications in a multivendor environments. Called Application Control Architecture (ACA) Services for VMS and Ultrix, the products are the first to implement DEC's ACA. ACA is the DEC technology being incorporated into message-delivery software being developed by the Object Management Group. The new DEC products will be available next month.

Hewlett-Packard Co.

HP has announced not one, not two...but 16 new business systems and servers based on its PA-RISC technology. Included are eight HP-UX-based 9000s and eight MPE/XL-based HP 3000s. Prices range from $12,895 for an HP 9000 Model 807S, to $170,000 for an HP 3000 Model 967. The new 9000s will begin shipping in August and September; the 3000s will commence shipping in October.

The HP 4990S LanProbe network-analysis system for LANs now has protocol-analysis capabilities. HP has achieved this by adding a decode facility called Option 200 to LanProbe. The optional facility permits protocol analysis of all data packets captured by segment monitors from a central console at a remote site. The decode facility can analyze protocols including TCP/IP, XNS, DECnet, IPX, OSI and AppleTalk.

Another new HP product is a VMEbus expander for HP Apollo 9000 Model 425s and 433s running HP-UX. The product is a 32-bit, general-purpose backplane for customers using customized cards to develop and support their own applications. The expander offers eight 6U VME slots, twice the power and more functionality than its predecessor. It offers driver compatibility with the HP 9000 Series 300 VME bus. List price: $7,500.

IBM Corp.

IBM has announced several new network-management products, one of which also will run on Sun's SPARCstation family. Among the offerings are two new releases of NetView Performance Monitor, which now support X.25 environments; IBM AIX NetView Service Point, the UNIX equivalent of IBM's NetView/PC for OS/2 and DOS; IBM NetView Graphics and Automation Offering, which encompasses software, installation services, training and support; and enhancements to NetView Call Accounting, which now includes a centralized tariff database for telephone-company customers. AIX NetView Service Point will run on both the RS/6000 and SPARCstation.

Providing a way to link IBM mainframes and RS/6000s is Firesign Software Inc., with its 3270ix emulation software. The package is designed to give RS/6000 users access to IBM mainframe and AIX-workstation applications on a single screen. The software offers SNA connectivity, Systems Application Architecture (SAA) compliance and features that enable users to design their own communications systems. The product is available for $795 directly from the Ridgefield, CT, company.

More connectivity software news: Spectrum Concepts Inc. has rolled out a version of its XCOM 6.2 file-transfer software for the RS/6000. Users can share data over an APPC/LU 6.2 session with a range of other systems from IBM and other midrange, PC and UNIX vendors. The New York, NY, vendor claims the product is the first LU 6.2 file-transfer package on the RS/6000.

Maximum Strategy Inc., San Jose, CA, plans to market with IBM its Strategy RS/6000 RAID Storage Server, which is a turnkey Redundant Array of Inexpensive Disks. The server makes use of up to 40 5 1/4-inch ESDI hard-disk drives. The product delivers 18 MB-per-second sustained data-transfer rates and up to 43.2 GB of storage. The product may be attached as a standalone server for a single RS/6000 or attached to an RS/6000 file or compute server to service a cluster of RS/6000s. Prices start at $112,750.

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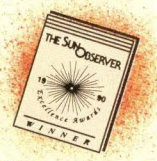
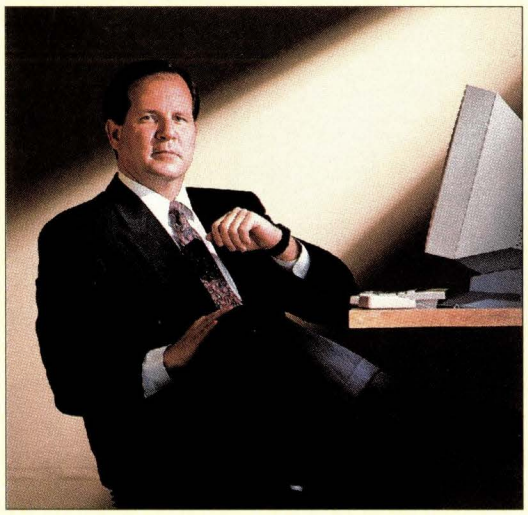


But no more. Now, SPARCstations are talking to Macs. Silicon Graphics machines are transferring data to and from IPCs. Older Sun workstations are interfacing with newer systems.

On and on it goes. And, well, you can imagine the problems of integrating such disparate systems: Printers that won't always print. Software that works over here, but not over there. Cables that fit this, but not that . . . There's got to be a better way.



In 1986, Dave Sykes saw four things missing from the UNIX peripheral market: service, price, performance and availability. No wonder he founded Andataco.

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International Spotlight

Sun Belgium: An Indirect Sales Test Lab

As Sun Microsystems Inc.'s first 100%-indirect-sales subsidiary, Sun Microsystems Belgium, which began operations last month, is "a test balloon, a probe, a laboratory," says general manager Lieven Jaspaert.

Sun Belgium will try to measure the impact of a lean, indirect sales organization on its "business metrics," such as its rate of revenue per employee. "We're doing a lot better [on revenue per employee] than IBM, DEC or HP, but we're way beneath Apple or Compaq," Jaspaert says. "[So] we're setting up just like Apple Belgium or Compaq Belgium. I'm not hiring any salesmen or support people, and we won't do training ourselves–all activities that have direct impact on end users will be sourced from our partners."

This format fits perfectly in Belgium where, he says, "we have service partners that are much more professionally organized than I could [have] set up as an organization, so why not use that additional leverage?" Allied with his partners, Jaspaert says his plan for capturing new markets "boils down to one simple question, 'Where is Apple today?'" He says Sun is in the position Apple was in five or six years ago, with products ready to tackle certain markets like the publishing industry.

"Practically all of the high-end printing industry in Belgium is Apple," Jaspaert says. "But Apple is currently taken up with promoting the Classic, its low-end product, and is leaving the publishing market wide open for us to go into. That's my target for this year."–*mwj*

Open Network Computing (ONC) Remote Procedure Call (RPC) facility. Applications can access ToolTalk directly, by calling functions from the ToolTalk application-programming interface (API) library to create, send and receive messages. Or applications can use ToolTalk by going through an "application service" residing between ToolTalk and an application. This way, the application services use ToolTalk as a communication backbone and object manager.

ToolTalk is "a step toward" the object-request broker technology codeveloped by Sun and Hewlett-Packard Co., which the two firms jointly submitted to the Object Management Group recently. SunSoft is calling ToolTalk a "transition path" from procedure-oriented applications to object-oriented applications.

ToolTalk has been endorsed by a number of application vendors, including Cadence Design Systems Inc., Cadre Technologies Inc., Clarity Software, Interactive Development Environments, Lotus Development Corp., Saber Software and the CAD Framework Initiative (an industry consortium promoting the standardization of interfaces between CAD and various framework design environments). These developers will be adding ToolTalk APIs to their applications.–*mjf*

Solbourne Publicizes Revenues

Ever wonder how big Solbourne Computer Inc. is? For the first time in its history, the company is getting the word out.

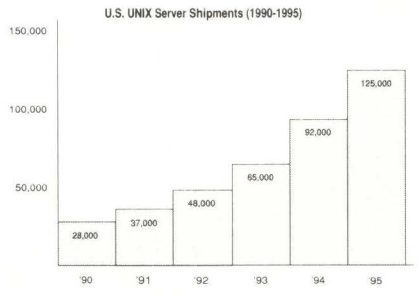
According to a company spokesperson, Solbourne is a profitable firm with an installed base of 3,000 units (not including the miscellaneous S4000 workstations it has sold since it began shipping them last December). The company's revenues have more than doubled between FY '90, when Solbourne was a $29 million company, and FY '91, when it reached the $64 million point. Solbourne expects to break the $100 million mark in FY '92. Each year, about half of its revenues and unit shipments have been attributable to international sales, the spokesperson adds.–*mjf*

Ross Unleashes Multiprocessing SPARC

Cypress Semiconductor Corp.'s Ross Technology Inc. subsidiary is the first of the SPARC CPU vendors to make good on its multiprocessing promises. Ross's multiprocessing version of its CY7C605 (code-named Pinnacle) can link up to four tightly coupled SPARC microprocessors. The MP version offers a cache controller and memory-management facility on the same chip. The new CPU sells for $1,200. Ross is promising versions that can execute more than one instruction per cycle some time next year.–*mjf*

UNIX Servers Come Into Their Own

Growth in the UNIX-server marketplace will outpace growth in the UNIX-workstation arena over the next five years, predict market researchers at Forrester Research Inc., Cambridge, MA. UNIX-server shipments will grow more than 30% per year during that time, Forrester says.



UNIX server shipments will climb more than 30% per year. Source: Forrester Research Inc.

The reasons: UNIX's multiprocessing and scalability are more important for servers than desktop clients, where single-tasking operating systems still dominate. And "the installation, configuration and training hassles that bedevil UNIX on the desktop are minimized at the server," Forrester claims. Finally, UNIX servers will be in demand as machines supporting DOS and Windows clients, the firm says.–*mjf*

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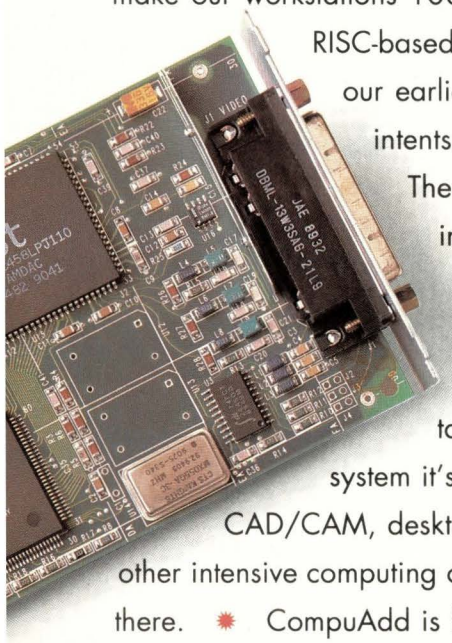

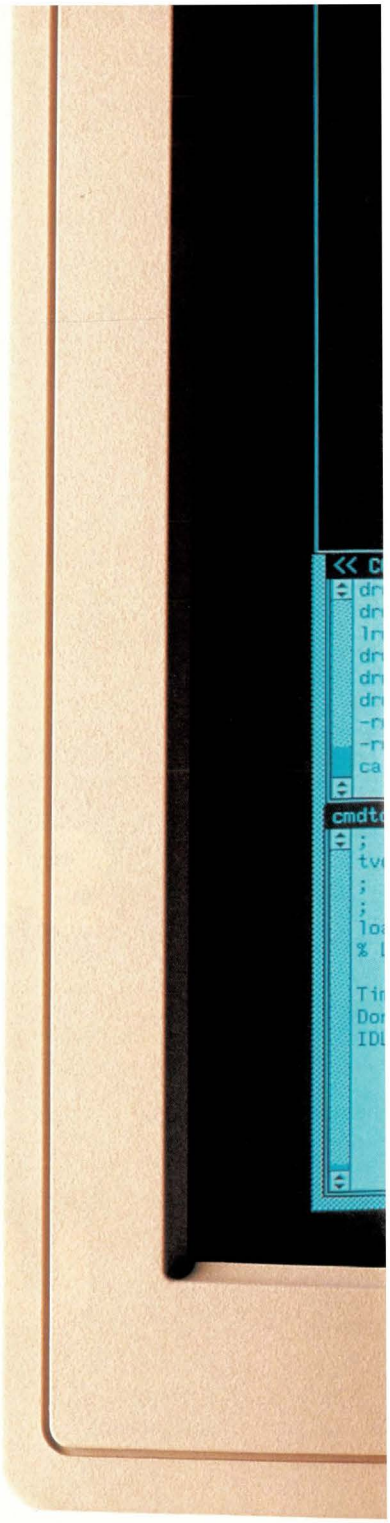

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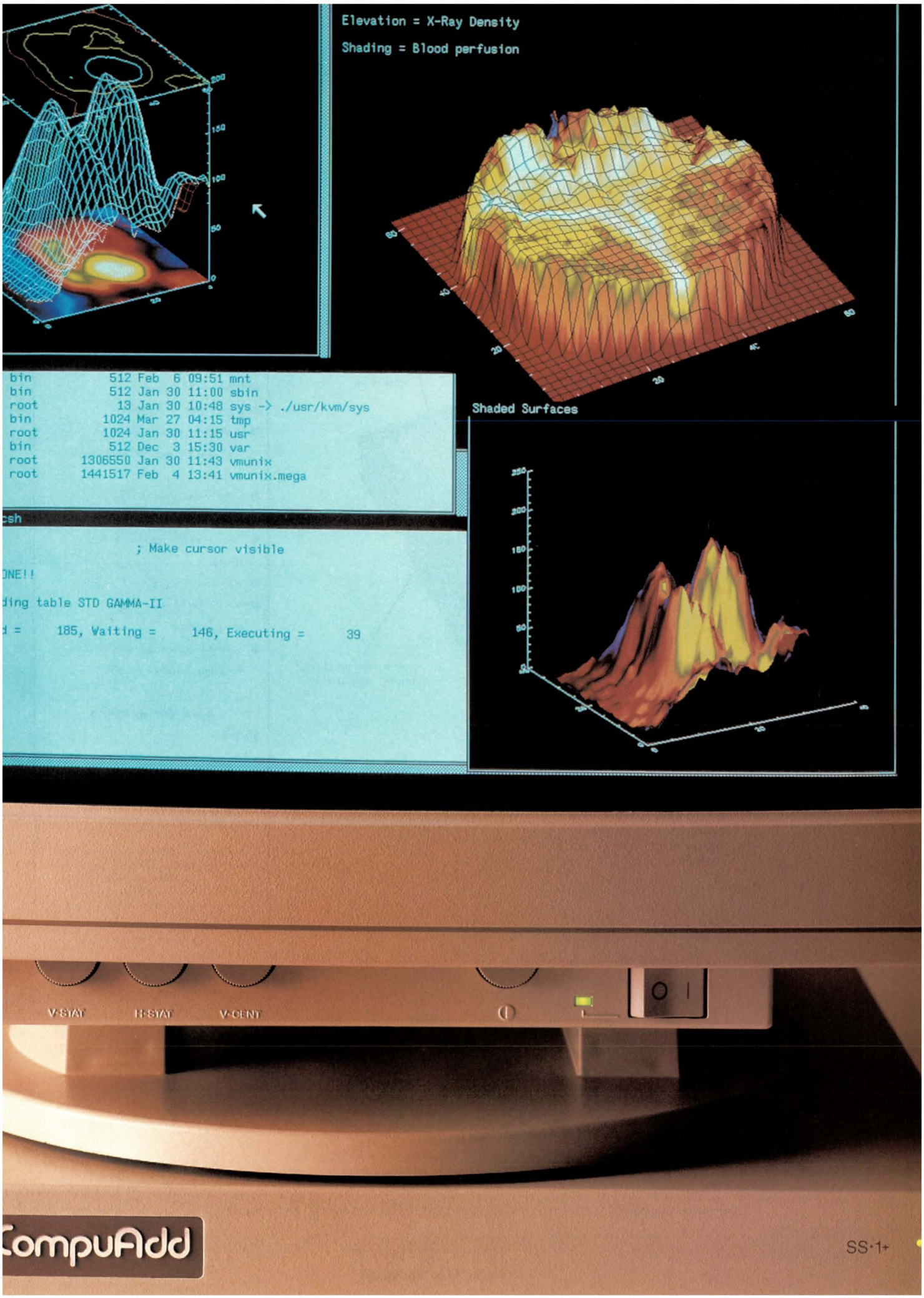
Elevation = X-Ray Density
Shading = Blood perfusion
bin 512 Feb 6 09:51 mnt
bin 512 Jan 30 11:00 sbin
root 13 Jan 30 10:48 sys -> ./usr/kvm/sys
bin 1024 Mar 27 04:15 tmp
root 1024 Jan 30 11:15 usr
bin 512 Dec 3 15:30 var
root 1306550 Jan 30 11:43 vmunix
root 1441517 Feb 4 13:41 vmunix.mega
csh
; Make cursor visible
ONE!!
ding table STD GAMMA-II
d = 185, Waiting = 146, Executing = 39
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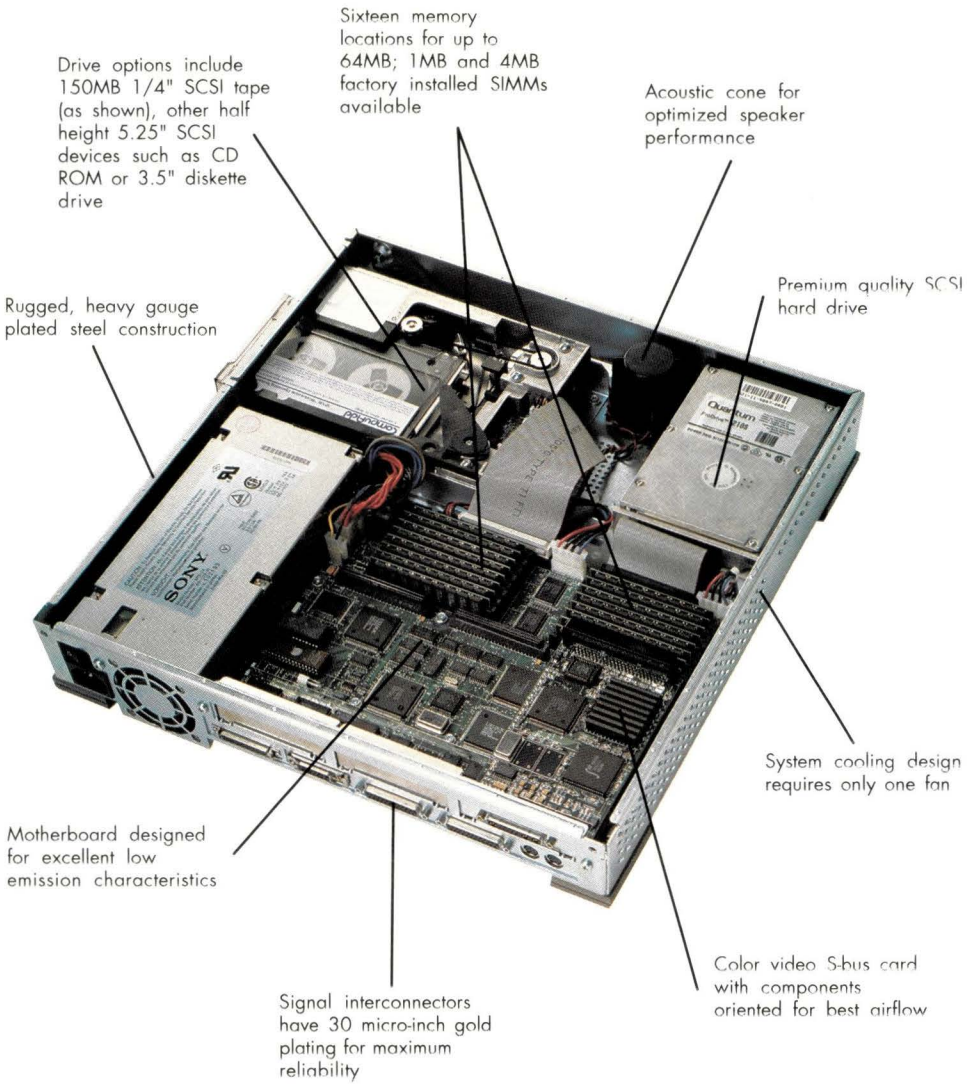

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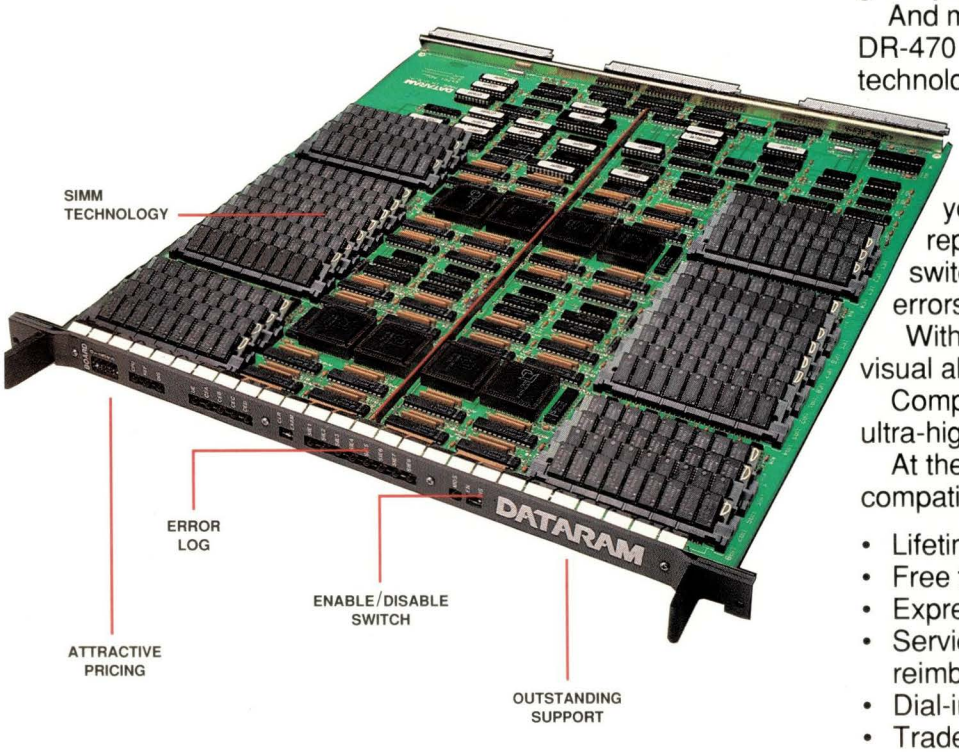

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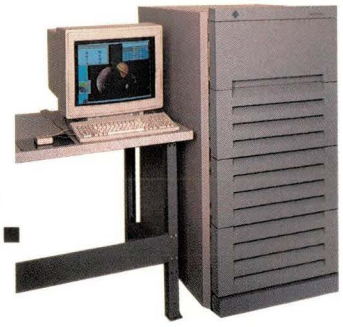

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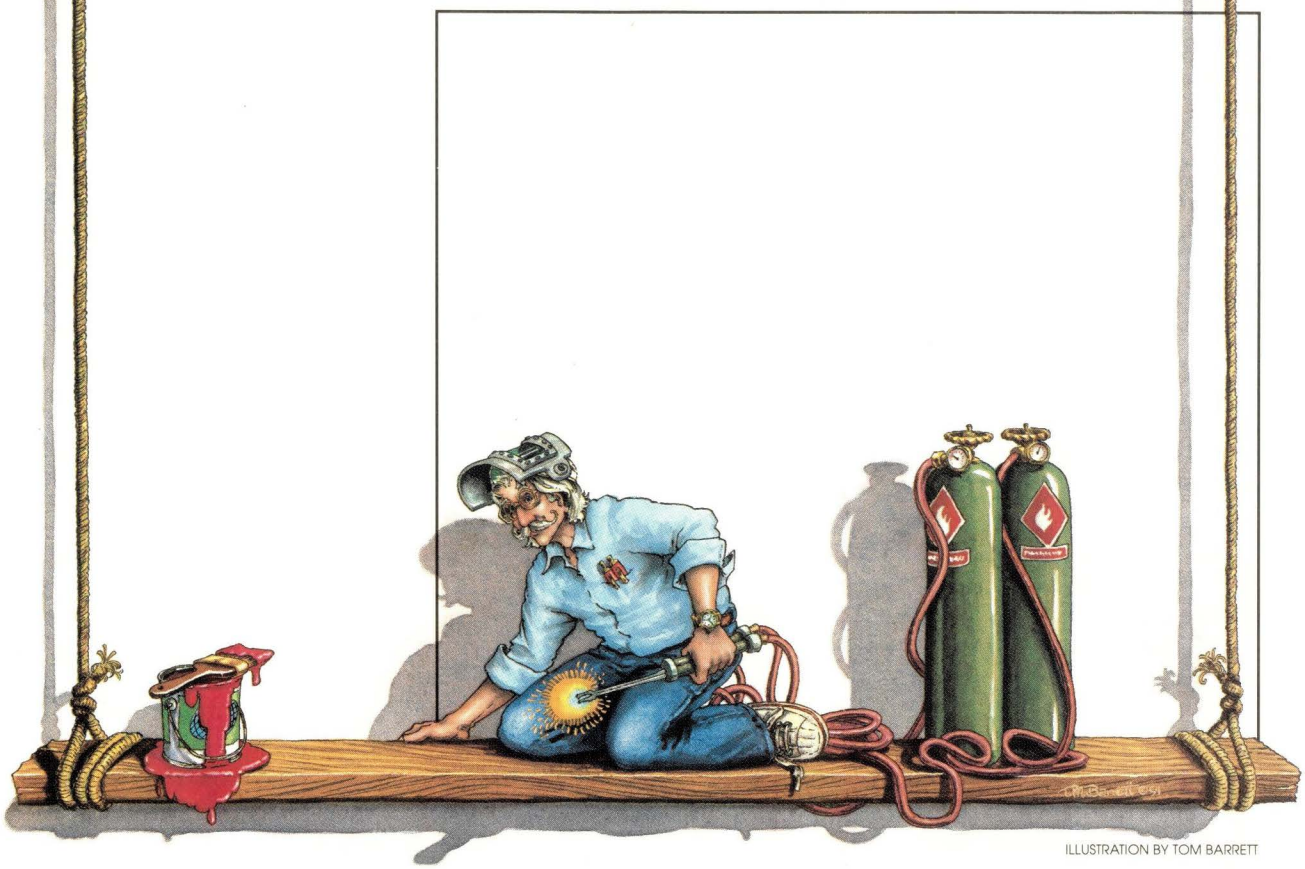

ILLUSTRATION BY TOM BARRETT

What To Do With Characters After They Leave Your Keyboard: Part II

by MICHAEL O'BRIEN

Almost anything looks profound if it's typeset well enough.
–a distant relative of Baron Inchiquin

I do not want what I haven't got.
–Sinéad O'Connor, who obviously doesn't do much text processing

100 FORMAT(9HFORGET IT)
–a tribute to Prof. Hollerith's contribution to text formatting

Q: Huh? What? I don't have to come up with another question, do I? Not for a two-parter?

A: That'll do nicely, thank you. That large capital Q-and-colon was spot-welded into place years ago, and we have to sort of work around it. And we'll be getting back to that later, as a matter of fact, to inquire into just what sort of welding rod was used.

First, though, let's recapitulate. Last month we discussed more editors than people ever wanted to deal with. This month we'll discuss even more of them, but with a special twist: The accent will be on advanced formatting packages. To do that, we have to look at another brand of editor, though; what Mr. Protocol calls mouse-based editors.

It is possible to do productive work on a Sun workstation without ever bothering to run a window system, and there are probably people somewhere who do exactly that. Mr. Protocol would probably be one of these if it weren't for the fact that the Sun console emulator appears to be implemented in chips based on molasses rather than silicon. (Molasses is a semiconductor: Things pushed into it generally go only halfway.) It's not that he hates windows, mind you; it's just his usual back-to-basics attitude again. He likes to sit on the Ethernet counting IP packets as they

go by, using one of those hand clicker counters. Just another reason why you don't want to deal with him. He wouldn't use the window system when the raw console would do, except that the window system runs about 25 times as fast. Funny thing about that.

Now, the reason I bring this up is that UNIX doesn't get along particularly well with window systems. It didn't grow up with them, it doesn't understand them, it doesn't use them, it doesn't like them.

This means that the text-processing systems that have been on UNIX these past twenty years have all been based on the technology of the ASCII terminal. At first, as with `ed` and `troff` and the other Model 33 Teletype-compatible packages, they were strictly line-oriented. In fact, at dialup speeds less than 9600 baud, this is still a time- and effort-effective interface...but it's a royal pain to become comfortable with, since so much has to be done in one's head in terms of integrating what the real document is supposed to look like.

Cursor-addressable CRT terminals gave us our first window-based editors. The first was `e`, the Rand multiwindowing editor; `vi` came later, and Emacs, which is older than either, was ported from its native PDP-10 environment later still. It was ported by rewriting it completely, but never mind. It's still Emacs. (I'm tempted to write that as "Emacs, the Great and Powerful," but Mr. Protocol says I shouldn't make fun of my betters. I'm not sure if he's talking about the original author, or James Gosling, or Emacs itself. I'm not sure if he's sure.)

Now, this native inhospitality to window systems does make it easy to use the old CRT hardware in dialup mode, which is cheap and darned handy, because all the old software is still around to deal with them. But it also means that most of the old editors, and the `troff` text processor, are still basically line-oriented. One looks at, say, a Macintosh, and one sees a different approach entirely. The window system was integrated with the OS from day one, and all of the editors are mouse-based. Instead of using cursor keys to move around, and typing commands to select text, the mouse is used for both purposes.

This form of mouse-based editing was first invented and then frittered away by Xerox in the form of the Bravo editor and the editor in Smalltalk. It was, obviously, picked up (in somewhat modified form) by Apple, and is also supported (in yet another form) by Sun Microsystems. Sun supports a rather standard mouse-based text editor called `textedit`.

The line-oriented text-processing tools act like programming languages.

The X Window System comes from MIT with an editor called `xedit`, and John Ousterhout at Berkeley has demonstrated his embeddable command language, TCL, by basing a mouse-based editor on it. Mouse-based versions of both `e` and Emacs have also been created. These come with variable philosophies regarding how to use the mouse buttons, how selections should behave, etc.

There is an elegant simplicity to this "point-and-shoot" interface that drives many people nuts. They *want* to be able to type commands. They *like* the old interfaces.

The truth is that, conceptually, the older line-oriented interfaces are actually easier to use in some circumstances. One of the few really general principles that has been established in human-factors research is that inexperienced users are more comfortable navigating a deep tree of choices, with relatively few choices at each level, while experienced users prefer a very shallow tree with a very wide variety of choices, because they already know their choices and can navigate more quickly in such an environment. There is more to it than this, however. There are people, very experienced and comfortable in these older environments, who nevertheless prefer the point-and-shoot mouse-based interaction style.

Mouse-based editors under UNIX, unlike those on the Macintosh, generally have some sort of character- or word-based command structure available for more complex operations. Sometimes this is just as complex as a line-oriented editor; sometimes it is simpler.

The result of this split in editors is an even more profound split in full-text-preparation packages. There are two types of such packages, the line-oriented package like `troff`, and the more integrated, mouse-based packages.

What are the main differences between them? How can they usefully be compared? Mr. Protocol is glad you asked.

The line-oriented text-processing tools act like programming languages. In fact, Mr. Protocol once witnessed a demonstration of a TECO macro that calculated Fibonacci sequences, and some astounding and frightening things have been programmed in `troff`. The fact is that these really are programming languages. One does not format a document when writing it; one provides instructions, at varying levels of detail, on how the document should be formatted. These instructions are embedded in the text, usually as printable ASCII commands.

At one extreme of this spectrum lives `troff`. Its commands are extremely primitive, but it does include one extremely powerful, though simple, command. This is the *macro*, which enables one to write a whole sequence of commands, salt it away under a newly invented command name, and invoke it later. It can be invoked with arguments, which are then available to the commands inside the macro defi-

nition. This permits operations of arbitrary complexity to be boiled down to a minimum, and is the only reason why `troff` is useful and usable at all. A number of reasonably powerful macro packages are widely available, and these actually represent the text-processing package that one uses.

Other similar packages include Scribe, by Unilogic Ltd. Scribe, like `troff`, works by embedded commands, but these are at a much higher level than those even of `troff` macros. Gorgeous documents can be produced with relatively little effort. The problem is that Scribe is relatively inflexible: Changing its notion of what it will do in response to one of these commands ranges from difficult to impossible.

This represents the tradeoff seen across the spectrum of these command-based processors. They are either flexible, or easy to use, but not both.

One middle-of-the-road solution that has proved highly popular is LaTeX, written by Leslie Lamport, which is in the public domain. This package is in fact a preprocessor and macro library for the TeX formatting package written by Donald Knuth. TeX has many ardent admirers, but is too low-level for everyday use (like `troff` in this respect, though many would blanch at any comparison between the two). LaTeX provides a functional, high-level set of formatting commands, and in fact supports libraries of macros, but permits TeX commands to be interspersed to modify its behavior. The trick is in figuring out exactly *what* TeX commands one actually wants to use. This can be a sobering experience.

Finally, on the other side of the fence, one has the mouse-based formatting packages. In a sense, these are not too different from the command-oriented packages. One must, somehow, indicate how the text is to be treated, and where to insert footnotes, and so forth. However, fancy graphics are usually used to show the inserted commands, and a great deal of effort is used to provide a user interface that shows, as directly and immediately as possible, the result of whatever the user does, as soon as it is done. Such systems are generally menu-based. On the Sun, the menus are generally augmented by a command interface, sometimes duplicating and sometimes extending the features available via the menus.

One salient feature of this type of package is that it attempts to wrap as many services as possible into a single package. Scribe, LaTeX and `troff` just format text. One uses whatever editor one wants to enter the text, `spell` or `ispell` to check spelling, and so forth. The mouse-based packages have much slicker packaging. They have integrated spell checkers, document previewers, full graphics draw and paint programs, and so forth, all available from within the application and all delivered as part of it.

Partly this is due to the ancestry of these packages, which were developed conceptually, if not actually, in Mac and PC environments where software tools are scarce and applications do not interact. Partly it is due to the

"cradle-to-grave" support they attempt to give the users. In any event, they tend to be quite large and slow, which is one good reason to run them on a Sun as opposed to a Mac.

These packages are less easily compared one to another than the command-based packages. For one thing, they each have rather different styles of interaction. For another, they often aim in slightly different directions, to capture slightly different markets. Consider, for example, The Publisher, by ArborText Inc. Here, one edits text using a rather typical mouse-based editor, which acts as if `textedit` and `xedit` had been rammed together at high speed (in fact the package acts slightly differently under SunView and under X, but in most ways it is identical). Menus (and key escapes) are used to place "tags" within the text to indicate footnotes, emphasis, section divisions, etc. Tags are placed in pairs, and must be deleted pairwise, so that it is not possible to have mismatched beginnings and endings, which is the bane of the command-based processors' existence.

Once enough text has been entered to make it less than boring, a preview may be requested. This is an interesting fact of life: It is not possible to truly represent on the screen what a printer will do, since the screen and the printer have different resolutions. The best one can do is an approximation, which is generally ugly enough that one doesn't want to have to look at it more than is absolutely necessary. Certainly one wouldn't want to actually edit something that looked like that. Most certainly Mr. Protocol does not. Instead, a loose representation is provided in the editing window, which gives a feel and flavor of relative placement, while still looking highly readable on a CRT.

Interestingly, The Publisher is actually a front end to a turbo-charged TeX interpreter, which does the final formatting. This means The Publisher is aimed at, and is useful mainly for, the same sorts of things one does with TeX: papers, books and reports.

Now consider another package, Interleaf from Interleaf Inc. This looks much more like a computerized paste-up kit, and is used by graphic designers and editors more than by self-publishing authors. Its usage and style are completely different.

Sadly, it is usually impossible to interchange documents between any of these packages, of either type. The command-based processors have input files chockfull of commands peculiar to their own "language," and output only formatted text. The mouse-based packages keep their data in highly proprietary binary files. Sometimes, they will be able to output something like an SGML file (Standard Graphics Markup Language, an ANSI standard), but even in such a case, the structure of the document is lost and must be inferred by the package reading it in.

Macro libraries in these packages are replaced almost universally by "style sheets," which amount to the same thing, but which must usually be created using some arcane programming language from which the user is completely insulated during ordinary edit-

ing. It seems likely that it's one of these style sheets that is responsible for the gigantic letter "Q" that has been welded to the top of each of these columns since Day One.

So, where do networks come in? The startling and horrible answer is: hardly anywhere! There are practically no Internet protocols devoted to the interchange of highly structured text, though there are commercial packages available such as BBN's Slate multimedia mail product. The fact is that neither UNIX, nor any of the other operating systems on the Internet, nor the Internet itself, has yet really managed to shake off its character-oriented past enough to interchange much more than RFC 822-style mail. Other packages always seem to be in the offing, but never quite arrive in wide distribution, despite continual experiments in carrying everything from speech to live video over the Internet.

Mr. Protocol is waiting, though. When it does become widely available, he'll probably have to write and format these columns himself. He therefore awaits the Brave New World with modified rapture. ⊸

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

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

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

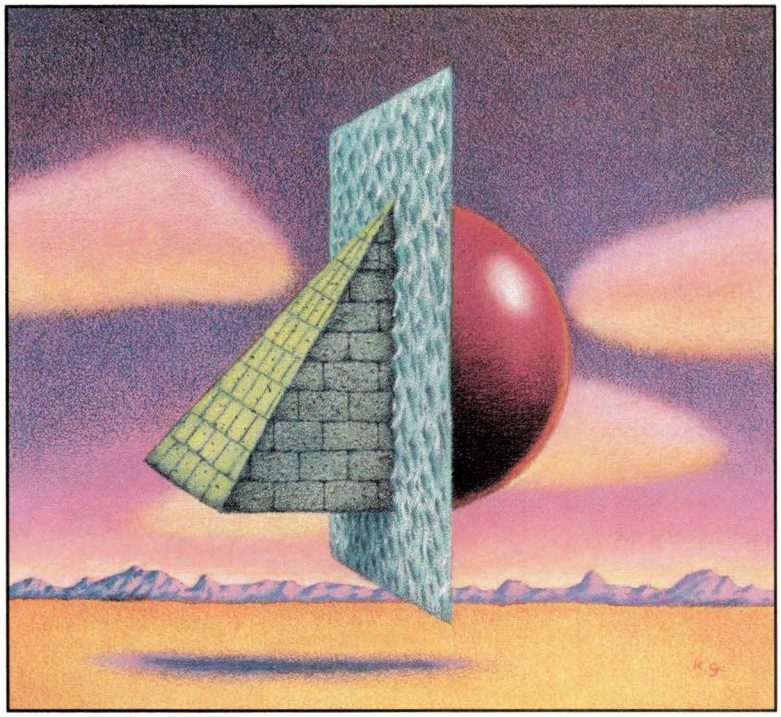

ILLUSTRATION BY KEITH GRAVES

Sed

by PETER COLLINSON, Hillside Systems

The ancient Egyptians had a ceremony that was intended to renew the power of their rulers, the Pharaohs. It was used when the Pharaoh had been incumbent for over 30 years and needed a supernatural battery recharge. It was thought to derive from the earlier practice of killing the ruler when they were old and infirm. The ceremony was called the "Sed Festival."

It would be nice to think that the name of the UNIX `sed` command was derived from this ancient ceremony. The truth is more mundane. The name of the `sed` command is an acronym for "Stream Editor" or perhaps "Stream version of `ed`."

The idea is reasonably simple. In a "normal" editor like `ed`, `vi` or `emacs`, data is read into the editor and commands entered to modify it. Finally, the altered data is written back to disk. In a stream editor, commands are read into the editor and the data is passed through the program. The commands are applied to the data as it goes by, perhaps transforming it into other forms, perhaps not.

This works well with the UNIX notion of a filter. A filter receives bytes on standard input, does some operation of the data, and writes the result on the standard output. The `sed` program is a programmable filter allowing you to control the transformation that is being applied to the data. With `awk` and the modern `perl`, `sed` is a UNIX super tool.

Using sed

It's not surprising that commands for `sed` owe a lot to the commands used for `ed`. If you are a `vi` user and have used the colon-command mode, then you will find that `vi` has a lot in common with `sed` too. The common ancestry from `ed` means that your `vi` knowledge will port into `sed`.

Commands have the general format of

<address><function>

or

<address>,<address><function>

or simply

function

Some functions are followed by optional arguments.

In normal operation, `sed` copies a line of input into an

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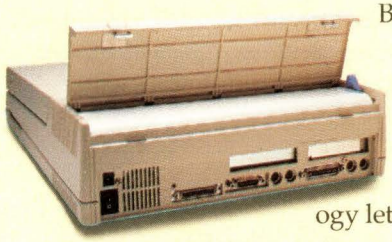

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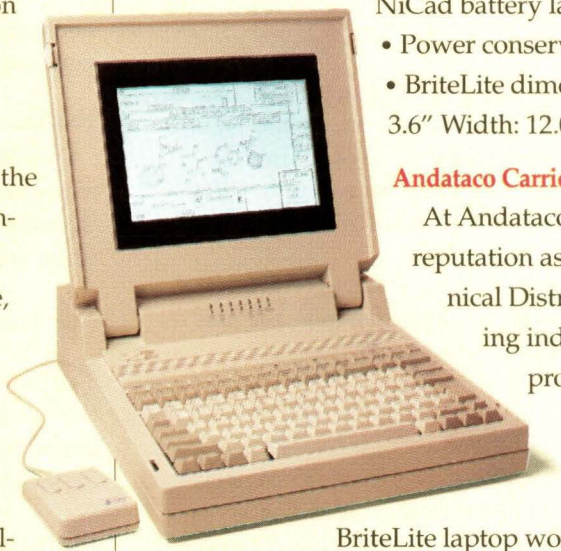

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The Bourne shell is much friendlier about handling newlines and will include them in a quoted string.

internal buffer called the *pattern space.* It then applies all the commands with addresses that match the pattern space until reaching the end of the script. A command with no explicit address is always applied to the pattern space. The pattern space is then copied to standard output, deleted and the whole process starts again. Commands can be supplied on the command line:

```
% sed 10q infile
```

This is a simple script that invokes `sed` on the file `infile` using the program `10q`. This is an address, the line number 10 and a function, `q`, that will cause the editor to cease when the address is matched. The effect is that the editor will read the first 10 lines of the file and place them on standard output. It's a `head` command.

Supplying `sed` with the `-n` flag will suppress the normal default behavior of writing to standard output. You have to request output by using the `p` command:

```
% sed -n 15p infile
```

will print line 15 of *infile.* The `l` (the letter *ell*) command prints the contents of the pattern space expanding any non-printing characters into an ASCII form. This can give you an alternative to `cat -v`:

```
% sed -n l infile
```

Strictly, a script on the command line should be preceded by the `-e` option letter, but this is waived when there is only one command or one sequence of commands.

If you want to create a complex multiline script, you can place it in a file and use the `-f` flag to say "take commands from file:"

```
% sed -f sedscript infile
```

I personally don't like doing this if the `sed` command is part of a larger shell script. It's boring to have to worry about moving several files to perform just one task. I prefer to place the script in-line with the remaining shell commands. So, using `-e` for emphasis:

```
#!/bin/csh
sed -e '1,10d\
       20q' infile
```

This script deletes lines 1 to 10 inclusive, and stops at line 20. It will ignore the first ten lines of the file and print the next 10. This is a `csh` version and you will notice that a backslash is needed to continue the script over several lines. The Bourne shell is much friendlier about handling newlines and will include them in a quoted string, so the script becomes:

```
#!/bin/sh
sed -e '1,10d
       20q' infile
```

Dropping this last backslash can considerably improve script readability, and is another compelling reason for using `sh` for scripts and not `csh`. If you insist on using `csh`, then you should perhaps realize that `sed` can take several arguments preceded by `-e`, and the script can be written

```
sed -e '1,10d' -e '20q' infile
```

I don't much like this. In the rest of the article, I am going to ignore this problem and just show the `sed` program.

Replacement

I would guess that `sed` gets used most to perform repetitive replacement. There are many cases where you want to zip quickly through a file changing all occurrences of one string into another. This uses the substitute command:

```
s/old/new/
```

The first occurrence of `old` in the pattern space is replaced by `new`. To ensure that all instances of the string within each line are replaced, you must add the *global* flag at the end of the command:

```
s/old/new/g
```

Like many strings in UNIX editors, the left-hand side text is a regular expression and can be used to match complex strings. You have to be aware of this because sometimes what you see is not what you get. Regular expressions add great power to the replacement command because you can more accurately describe the source text. This can be important. It's too easy to give a string that appears to match but will fail in some cases.

For example, I habitually write the word *disc* when you

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folks in the United States would prefer me to say *disk*. I have a script that I use to massage my text before I send it in for publication, so I added the line:

```
s/disc/disk/g
```

until I managed to use the word *discussion* and caught it as *diskussion* in a proof-reading phase. My script now uses the regular expression syntax that says: Match the beginning of a word "\<", the four characters "disc" and the end of a word "\>":

```
s/\<disc\>/disk/g
```

Other useful metacharacters are: "." (dot) that matches any character, "*" (star) that matches any number of the characters that precede it (including none), "^" (up arrow or caret) that matches the start of the pattern space, and "$" (dollar) that matches the end of the pattern space. As usual, a backslash (\) removes the special meaning from any character that follows. You can give alternates using the vertical bar:

```
s/unix|UNIX/Unix/g
```

Here the left-hand regular expression matches the string "UNIX" *or* the string "unix."

If the left-hand side can be one of several things, then it is often useful to be able to reinsert the matched text. This can be done by using the character "&" (ampersand) on the right-hand side of the substitution. So

```
s/UNIX|Unix/& system/g
```

will produce "UNIX system" or "Unix system" depending on what string was originally matched on the left-hand side of the statement. Character ranges can be specified by use of the square-bracket syntax.

```
s/[Uu][Nn][Ii][Xx]/UNIX/g
```

ensures the capitalization of the word UNIX. If the first character after the opening square bracket is a caret, then the character range means *not* these characters. This is useful if you are dealing with data that contains known delimiters, like the colons in the password file.

```
[^:]
```

means any character that is not a colon and

```
[^:]*
```

means any sequence of characters that is not a colon, or a column from the password file.

Regular expressions can be grouped and identified by `\(` and `\)`; the replacement text can then refer to the matched string. This example prints the uid and login name of users from the password file.

```
s/^\([^:]*\):[^:]*:\([^:]*\).*$/\2 \1/
```

The initial caret anchors the expression to the start of each line. It is followed by an expression in `\(\)`

```
\([^:]*\)
```

The group will become the contents of `\1` on the right-hand side. We have met the string inside the brackets before; it's the expression that matches a column in the password file.

This is followed by some stuff to consume the bit of the line we don't want: a colon, the expression to eat the password field and colon. Next, a bit we are interested in, the second bracketed expression that will be referred to as `\2` on the right-hand side. Finally, the dot/star/dollar will consume the rest of the line. The whole pattern space is matched and will be replaced by the right-hand side. This is simply `\2`, the second matched pattern followed by `\1`, the first pattern. This is much harder to explain than to write, and much easier to write than read. Try playing with `sed` and see what you can produce.

More On Addressing

A regular expression can also be used to form the address part of a `sed` statement. The string selects a particular line or lines to which the command is applied. My "disc" example should really be written:

```
/\<disc\>/s/\<disc\>/disk/g
```

or using even more shorthand

```
/\<disc\>/s//disk/g
```

The line address is stored and an empty left-hand side replacement pattern will use the stored regular expression.

Any command can be placed after a regular expression being used as an address. This gives us a replacement for `grep`:

```
sed -n '/look/p' file
```

and also `grep -v`:

```
sed '/look/d' file
```

The quotes around the argument are not really needed here, but `sed` uses so many metacharacters that are also used by the shells that I have got into the habit of quoting regular expressions in `sed` commands.

It's occasionally useful to be able to say "apply this command to all lines *except* this address." This is done by adding an "!" (exclamation mark) after the address. So

```
5!p
```

will print all lines except line 5 and

```
5!d
```

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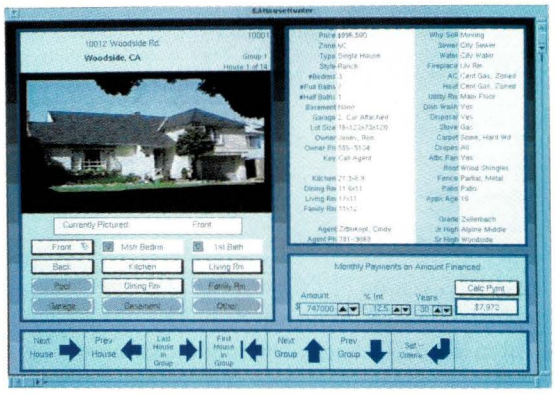

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will print only line 5 (think about that one). The address that is negated can be a range, so you can apply a command to all *but* a section of a file.

Address ranges can mix line addresses and regular expressions:

```
1,/\.TL/d
```

will delete all the lines from the start of the file up to and including a line containing .TL. There is a magic line number "$", used to mean the last line on the file, so

```
/\.TL/,$d
```

will delete from the line containing .TL to the end of the file.

If you want to carry out several actions on a single address or range of addresses, you can bracket the commands with curly braces:

```
/tty05/,/tty0e/{
/off/s/off/on/
/secure/s/ secure//
}
```

This looks for a section of the /etc/ttytab file. It controls the lines attached to the machine. The section we are interested in starts at a line containing the string tty05 and ends at the line containing tty0e. The commands within the curly brackets will ensure that any line marked "off" is turned "on." We also ensure that the system will not permit root access from that line by removing the "secure" keyword should it be present. Notice how strings are deleted, simply by replacing them with nothing. The opening brace must be at the end of a line, and the closing brace must be placed on a line by itself.

Adding Sections of Text

You can append some text after the addressed line by using the command a:

```
/see this/a\
New text
```

This will add the line New text after any line containing the string see this. Note that the backslash after the a is part of the command; the intention is to escape the new line. The new text must appear on a line by itself, and is terminated by an unescaped newline. To add multiple lines of text, each line must also be terminated with a backslash:

```
/and this/a\
New line added\
Another added line
```

You can use the insert command i to place text before the current line and the change command c to replace the pattern space with some new text. Only the change command can be given a line range; the other two commands must only have one address.

Dealing With More Than One Line

There are many times when you want to join lines together and do some further edits to the resulting line. To create a pattern space of more than one line from the input data is not difficult. You just use the N command; think "Next." The script

```
/thisone/{
N
d
}
```

finds the string thisone in the source data. Remember that this will be loaded into the pattern space. The N command reads the next line of input into the pattern space. The d command deletes the whole pattern space consisting of both lines. The effect is to delete the line containing the string thisone and the line that follows.

You can join lines by removing newlines from the pattern space. The substitute command understands that backslash n (\n) on the left-hand side means newline, so the script

```
/thisone/{
N
s/\n//
}
```

will look for the line containing thisone and read the next line into the pattern space. The pattern space now contains two lines separated by a newline character. The substitute command replaces the newline with nothing. The two lines are now joined. You probably want a space to replace the newline character.

Unfortunately, you cannot use \n on the right-hand side of a substitute command if you want to split a line. Instead you have to insert a newline on the right-hand side, preceded by yet another backslash. We can make a start on a script that removes hyphenated words from a text processor output by writing something like:

```
/-$/{
N
s/-\n\([^ ]*\) /\1\
/
}
```

The script matches all the lines ending in a hyphen. On these lines, we pull in the next line using the N command. We have the line pair in the pattern space. We want to remove the hyphen to rejoin the split word and then replace the next space character by a newline. So on the left-hand side we match a hyphen, a newline and a group that matches any number of non-space characters. This is the piece of the word that needs adding to the end of the first line in

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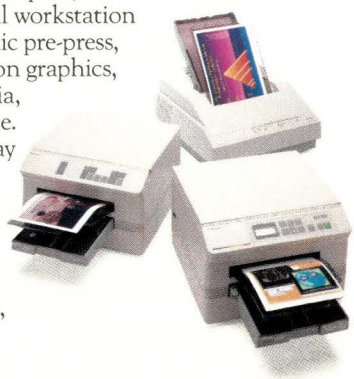

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place of the hyphen. Finally we match the space that will be turned into a newline. All this is replaced by `\1`, the remainder of the word that we matched and a newline. This script is far from robust and will only work in the most common case. It does begin to give the hint to how powerful `sed` can be, however.

Debugging and Limitations

You will not see many different error messages from `sed`. The ones that are printed are also accompanied by the offending piece of text. This is usually enough to work out what has gone wrong. All the same, wise `sed` programmers build up their scripts in pieces, making sure that each new statement works as expected and doesn't interfere with previously created parts of the script. Scripts for `sed` can get very long, even for the simplest of operations, especially when the original data is coming from human input.

You should be aware that many implementations of `sed` have hidden limits on the size of the program that you can give it. Long ago I had an immense shell script that took all the available information about mail sites in the world, mashed it, squeezed it and flavored it delicately with lemon. After considerable mastication, it generated a set of tables that were used to drive the mail system.

A key part of this script was `sed`. When I placed a site in one file for the mail system, I added a line like: `/site/d` to a long script that was eventually used to generate a list of the sites that I had not dealt with. You can perhaps imagine how long this list became. I think that the script lasted for around a year (enough time to have forgotten how it worked) and then mysteriously broke one morning. Mail was scattered to the four winds. The `sed` part of the script had failed. It had finally been given one too many sites to deal with and had expired rather ungracefully.

Luckily we were a source site then and the remedy was in our hands, and we replaced the static tables in `sed` by areas obtained using `malloc`. The virtual memory on the system took the strain. Unfortunately, not many people releasing UNIX utilities have bothered to do this and so you may find that you have to resort to dirty tricks to split `sed` scripts into manageable chunks. Beware anyway.

Reading

Don't think that I have covered `sed` in great detail in this article; I haven't. There is a lot more. Many basic UNIX books have sections on `sed`. The best book that I have come across is a joint book on `sed` and `awk` in the O'Reilly & Associates Nutshell series. The book is provocatively entitled *sed & awk*; it's by Dale Dougherty and sports an ISBN of 0-937175-59-5. Worth the money. ⊸

Peter Collinson runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests; doing whatever, whenever, where ever.... He writes, teaches, consults and programs using SunOS running on a SPARCstation 1+. He is the Usenix Standards Liaison. Email: `pc@expert.com`.

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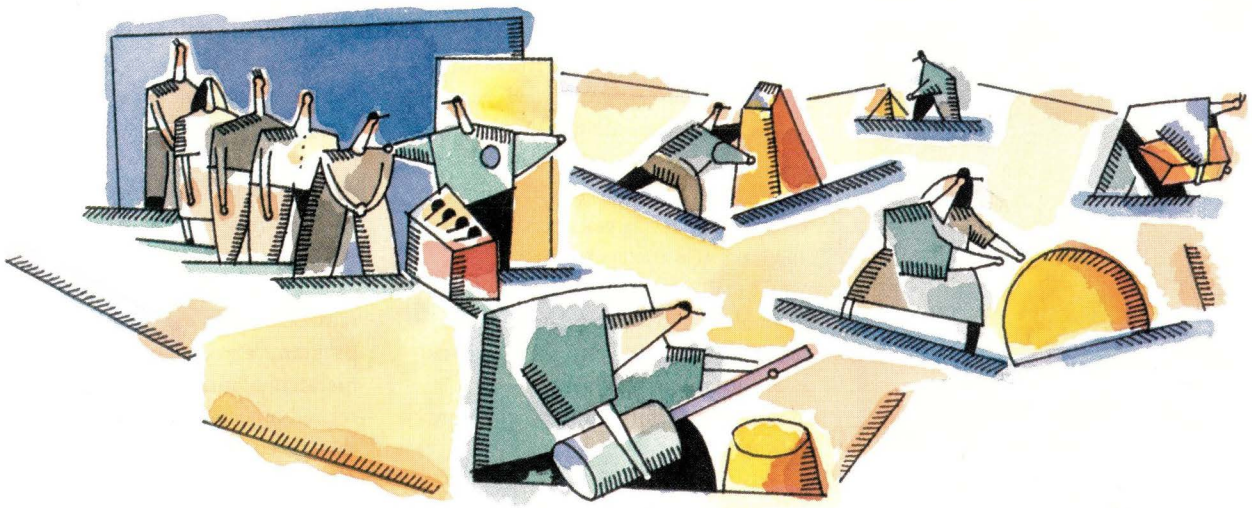

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Fundamentals of Object Orientation (FOO)

by RICHARD MORIN, Technical Editor

The computer press is currently full of Object-Oriented Hype (OOH). Lest you feel like a Great Object-Oriented Fool (GOOF), you should learn some of the basic buzzwords, if not the concepts behind them. This column is a modest attempt to help you in that direction.

The first thing to understand is that there isn't all that much to understand. Although it can have great complexities in implementation, object orientation is a pretty simple idea: Localize knowledge and authority.

Let's say you need to get the fender repaired on your car. You take it in, asking something cogent like: "How much to fix it?" The mechanic comes back with a bid, which you can accept or reject. You do not, however, inspect the repair company's financial records or workshop.

If you accept the bid, the mechanic may hunt around for a replacement fender by looking in a couple of catalogs, making a few phone calls, etc. The fender in question may be a thousand miles away, requiring several truck journeys. None of this is of interest to the mechanic; the price and delivery schedule are sufficient.

In order for this to work, each party must be willing to give up a certain amount of knowledge and authority. In trade, they are allowed to ignore a great deal of complexity, relying on a contract to ensure satisfactory execution of the task. This arrangement can be a problem for control freaks, but it allows most of us to live in a substantially simpler universe.

A SCSI Simile

Moving closer to the world of computers, let's look at the Small Computer System Interface (SCSI). Early Sun workstations had separate controllers for disks, open-reel tapes, cartridge tapes, etc. The disk-driver software contained code to calculate head selection, bad-block management, and a host of other details.

With SCSI, most of these details are handled by the device itself. The commands are abstract: format unit, read buffer, write buffer, etc. The driver issues a request, gets the result and proceeds. Well-documented parameters specify what is to be done, but no attempt is made to specify how.

Nosy higher-level system software can be satisfied by convenient lies. Details like the number of heads, sec-

tors per track, and so forth are built into kernel algorithms. To keep this code happy in a world where a "disk" may have variable numbers of sectors per track or no heads at all, Sun fills `/etc/format.dat` with fictional entries. The numbers multiply out to the proper capacity and allow reasonable performance, so everything works just fine.

A few things are lost in the SCSI world of object-oriented devices. Older tape drives allowed users to read past double EOFs, salvaging parts of overwritten archives. If a SCSI tape drive thinks it has reached the end of the data, it is useless to cajole it. It won't read any further, no matter how valuable the following data may be. This is a direct result of the object-oriented interface contract; all legal actions are performed, but others are rejected.

Object-Oriented Software

Fortunately, the world of software has a bit more flexibility, at least when source code is available. A software object contains all of the algorithms and data needed to do its job(s). A dictionary, for instance, might be able to create, delete, edit and look up entries. Its internal data structures and algorithms are of no concern to the rest of the program, as long as requested actions are handled as promised.

If two separate dictionaries are needed, the programmer creates two instances of the dictionary class. Instances share everything except their own private data and execution state. Specifically, the algorithms, data structures, and so forth are used twice, but for separate purposes.

If more than one kind of dictionary is needed, related classes can be created. A programmer might create a generic dictionary class, then create specialized subclasses for given purposes. A rhyming dictionary, for instance, might support extraction of words with specified endings. It would inherit some methods (commands) from its base class, its dictionary, and by adding or substituting its own as needed. The internal data structures would very likely be somewhat different, though similar.

Assume that the programmer wants a dictionary to save a copy of itself on disk. In C++, the command might be `thisdict.save()`. Note that the programmer does not have to specify how this is done, merely that it be done. The object (`thisdict`) is responsible for the method used.

Using late binding, the programmer can defer the choice of methods until run time. If wombat can be any of several objects, `wombat.save()` must examine `wombat`'s nature, then employ the correct method. Most object-oriented languages support this, at some cost in run-time performance.

Finally, because an object can contain (references to) other objects, a programmer can set up collections, hierarchies and even networks of interrelated objects. A dictionary might thus be constructed as a cross-linked structure, allowing traversal via defining words, synonyms, etc.

Data Abstraction

Data abstraction, not supported by all "object-oriented languages," extends the notion of objects. Generally implemented in conjunction with operator overloading, it provides new data types that act as if they were built into the language.

Let's say that a software project needs to employ arbitrary-precision arithmetic. Without data abstraction, an addition might look like `cnt.add(1)`. With it, the C++ expression could be `cnt++`. This allows programmers to write cleaner code, replacing long sequences of function calls with shorter, more comprehensible expressions.

Data abstraction hides messy implementation details (coercion, construction, destruction, etc.). Only the desired set of data types and operators are visible in the actual application code. This customizes the language, optimizing it for the problem domain.

Persistent Objects

Sadly, most object-oriented languages must live in a non-object-oriented world. In UNIX, they encounter a file system that maintains only mini-

mal information about the nature of files. Should it really be necessary to have `file(1)`, whose only purpose is to make enlightened guesses about the nature of files?

What if, instead, data could be stored in persistent objects? Any desired action–adding a record, editing a field, retrieving a value–could be handled by built-in methods. Should a new field be needed, add it; existing programs won't see it until they start to ask for it.

Generic utilities quickly become a possibility. A report-writing utility can ask an object about its contents, set up appropriate formatting and labeling, and issue a report. Indeed, many classes of filters can be written in an adaptive manner. By knowing a bit about the data, a program can be much more intelligent about how to handle it.

OODBs

By combining persistent objects with traditional database-management systems (DBMSs), vendors are now creating OODBs, or object-oriented databases. OODBs provide the traditional virtues of DBMSs (arbitrary views of data; consistency, integrity, security, etc.) while allowing sophisticated access methods to be stored along with the data.

One might, for instance, wish to access geographic points on a designated spiral path. By placing the appropriate method(s) in the DBMS, any program can access data in this fashion, without embedding specialized code. Further, if an access method is improved, all programs using the method benefit automatically.

Database and object-oriented enthusiasts argue over the exact definition and utility of OODBs. Can a relational DBMS be made into an OODB by adding an appropriate front end? Are OODBs efficient enough for "practical" applications? Time will tell. Meanwhile, see the May *SunExpert* ("Databases: The Future is Now," Page 56) for more discussion on OODBs.

Further Reading

Literally dozens of books are available on object-oriented analysis, design, programming, etc. By hitting a good technical bookstore and browsing a bit, you should be able to find object-oriented books having almost any desired approach, topic and level. This section, in any case, discusses some books that I have found enlightening.

As the title suggests, *Object Orientation: Concepts, Languages, Databases, User Interfaces* (Khoshafian and Abnous, Wiley, 1990) covers many of the topics touched on in this column. The book is not strongly technical, but gives a very readable overview of the major topics in the object-oriented arena.

C++ is the dominant object-oriented programming language at present, and looks like it will have a substantial tenure. Balancing its flaws (and there are more than a few), it has enormous momentum from the large "installed base" of C programmers. In any event, there are about three dozen C++ books currently on the stands.

If you are already comfortable with C, try *C++: A Guide for C Programmers* (Hekmatpour, Prentice-Hall, 1990). Aside from a rather garish cover and a small typographic nit (two-character operators need a bit of separating space), I can find very little to criticize. Dr. Hekmatpour is very readable, somewhat opinionated and doesn't waste the reader's time.

For a more congenial introduction, with no assumptions about familiarity with C, try *C++ Primer* (Lippman, Addison-Wesley, 1989). It is quite readable, cleanly organized and formatted, and is a good introductory work. It is not intended to teach C++ as a first programming language, but then I'm not sure I would suggest C++ as a first programming language. ...

The *Annotated C++ Reference Manual* (Ellis and Stroustroup, Addison-Wesley, 1990) matches its title precisely. Any serious user of C++ will want to have this book on the shelf, to answer those tricky little questions C++ seems to generate. Conversely, it is pretty formidable as an introduction to C++. If you are serious about C++, however, you should buy this book.

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a free collection of useful C++ classes. In *Data Abstraction and Object-Oriented Programming in C++* (Gorlen, et al., Wiley, 1990), the authors use NIHCL as the basis for their presentation. This makes the book immediately useful, while giving it a sound base of C++ example code.

To keep up with current and upcoming changes in C++, try the proceedings from the (1987, 1988, 1990, and/or 1991) Usenix C++ Conferences. They are inexpensive, and contain interesting and authoritative papers from leaders in the C++ community. (Usenix Association, 2560 Ninth St., #215, Berkeley, CA 94710.)

Object-Oriented Design with Applications (Booch, Benjamin-Cummings, 1991) walks the reader through medium-scale design and implementation efforts in Ada, C++, CLOS, Object Pascal and SmallTalk. As usual, the author does an excellent job of presenting detailed material in a readable fashion.

For a more conceptual approach, try *Designing Object-Oriented Software* (Wirfs-Brock, et al., Prentice-Hall, 1990). The first half is an excellent intuitive presentation of language-independent, object-oriented analysis and design. The last half details a rather complex diagramming methodology. ➸

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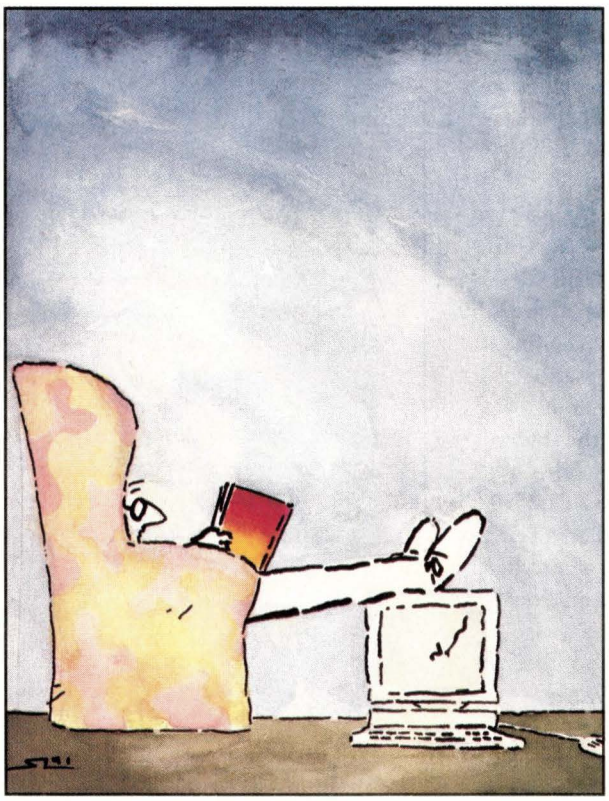

ILLUSTRATION BY S. H. LEE

Tour Guides

by PETER H. SALUS

Despite the fact that it is but a few months since the International Standards Organization adopted POSIX .1 as ISO/IEC IS 9945-1:1990, spring has brought us two commercial "programmer's guides" to POSIX.

In alphabetical order they are: Donald Lewine, *POSIX Programmer's Guide* (O'Reilly & Associates), and Fred Zlotnick, *The POSIX.1 Standard: A Programmer's Guide* (Benjamin/Cummings Publishing Co.).

Despite the similarity in title and in (one would hope) subject matter, these books are far from identical to one another. Lewine's is the heftier one–around 600 pages to Zlotnick's not-quite 400, and it is readably written. Though it is adequate where explanations are concerned, Lewine fails in the areas of job control, sessions and explanation in the brief mentions of just which system calls exist.

On the other hand, Lewine's book may ultimately prove indispensable to any POSIX-compliant programmer, as it contains a complete listing of all the library functions in the ISO (formerly ANSI) C and the 9945-1 library. As this 300-page list is in strict alphabetical order, you need not try to remember whether the function you're interested in is a macro, a system call or a true library function. The listings run from `abort()` (p. 211) through `write()` (pp. 513-515).

Lewine's book also contains some valuable appendices: header files (pp. 519-550), data structures (pp. 551-557), error codes (pp. 559-563), and a listing of the functions in BSD and System V that aren't in ISO C or POSIX (pp. 565-568).

If I disregard this tabular information (which makes up all but 200 pages of Lewine), Fred Zlotnick's book is far more complete. It supplies the reader with more background than Lewine's rather cursory first chapter does, and it supplies at least some explanation of how the various committee decisions were made. Zlotnick also gives the reader a more satisfying comparison with V.3 (not V.4!) and 4.3BSD. Zlotnick's volume also supplies POSIX and C functions, error numbers and headers, but not in as

nicely executed a format as Lewine.

Lewine, on the other hand, writes well and his volume is easier to read than Zlotnick's.

All of this aside, let me now talk about purpose and use.

If what I want is a smallish technical volume that explains the concept of the international standard for operating systems, so that (a) my company's vice presidents and (b) my colleagues in programming and hardware can comprehend just what is going on, then Zlotnick's is the book I'm going to throw at them. It is complete, it contains lots of information, and it contains just enough on internationalization for the uninitiated.

On the other hand, while Lewine does not do a satisfactory job with history or explanation, he supplies the programmer with a superb piece of reference material. As I alluded above, the alphabetical listing of the library may in itself make Lewine's book worth buying. I cannot imagine a programmer producing a POSIX-compliant system without this volume sitting next to her/his workstation.

In the end, it may be that you will buy both volumes: Each has virtue; neither is perfect. Zlotnick's actual text is (for my money) better than Lewine's; Lewine has the better reference material.

One other thing: The last page of Lewine is headed "Other Documents of Internet"–it should read "of Interest." Zlotnick's list of sources is slightly more extensive.

Continuing the GUI Wars

In June, I ran some late-breaking remarks about what the Standards Executive Committee (SEC) did in the GUI Wars. I have received several comments on what I wrote, everyone concurring with the SEC's (and my) point-of-view. An interesting note came from Chris Hermanson in Vancouver, B.C.:

"I think the SEC did the right thing too, for a couple of reasons.

"First, as Ran [Atkinson, University of Virginia] noted, this GUI war stuff is just marketing bafflegab. In fact, from what I've seen, both GUIs (Motif on DG, Open Look on Sun) are about equally user friendly, both seem to consume an absolutely unbelievable amount of CPU resources (more on this later), and moving from one to the other is really no big deal.

"As for CPU resources, it really annoys me that my 12-MB, 12-MIP SS1 spends such a huge amount of its cycles doing the GUI rag. Imagine! More horsepower used up than a Macintosh SE *has*, and does anyone really think that Open Look (or Motif) is any better than the Mac (from a user-friendly point of view)? I'd hate to see POSIX get dragged into this boondoggle. Let's wait until there are a few more corpses on the floor."

I'm still interested in other readers' opinions on these (bloodless) GUI Wars.

Another New IR

Finally, this is to let everyone know that as DECUS has taken an increasingly active role in POSIX, it received institutional representative (IR) status to the TCOS-SS SEC at its recent meeting. The DECUS IR and his alternate are:

Representative
Joseph J. King, Ph.D.
Genetics Computer Group
575 Science Drive, Ste. B
Madison, Wisconsin 52711
Jking@gcg.com
(608) 231-5200
DCS: KING

Alternate
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buhl@xrt.upenn.edu
(215) 662-3084
DCS: BUHLE

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.

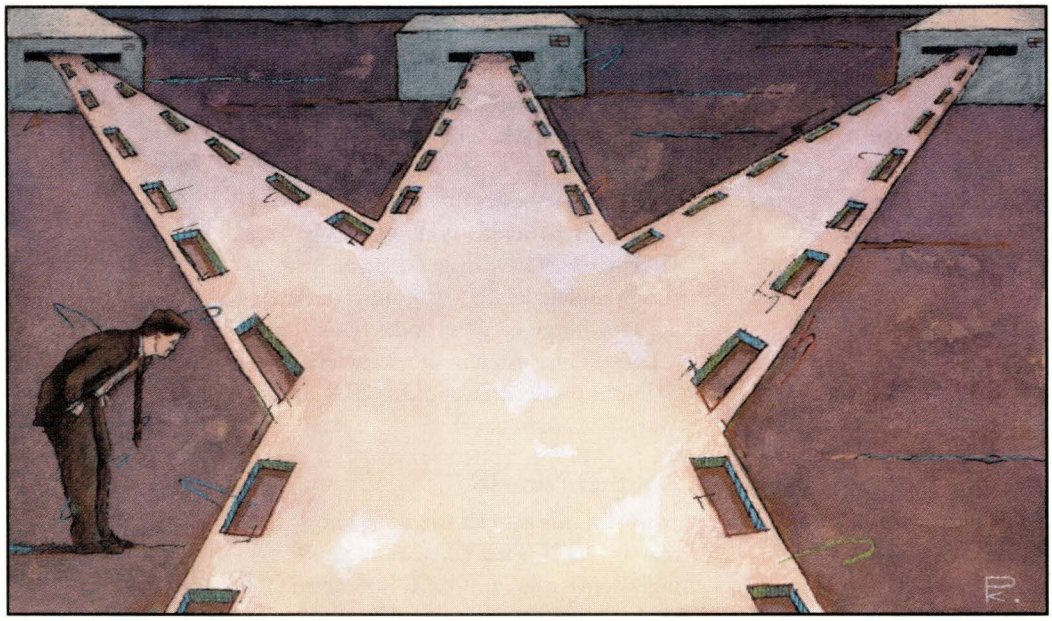

ILLUSTRATION BY PETER KALABOKIS

Printers and /etc/printcap

by DINAH MCNUTT, Pencom Software Inc.

Most system administrators I talk to agree that printers are basically a pain to administer. Since the paperless office seems to be always just around the corner, printers are a necessary evil in most environments. This month, I will discuss how to set up printers with a focus on effectively using the `/etc/printcap` file.

The UNIX printer-spooling system allows users to print to many different printers on the network. Some of the features of this system are:

- automatic queuing (spooling) of jobs
- local and remote queues
- access control to prevent others from removing your jobs

The following files and commands make up the printing environment in SunOS:

`/usr/ucb/lpr` – Program used to send a job to the printer. It uses command-line arguments and environment variables from the executing processes and the system to determine how to process the job. An example is using the `-P<printer>` or the environment variable PRINTER to specify the printer.

`/usr/lib/lpd` – The `lpd` daemon does most of the work involved in printing a file. (One definition of a daemon is "a program that emerges to do your bidding when it's needed, and then disappears, as if by magic.") It receives notification that the job has been spooled and consults the `/etc/printcap` file to see how to process the job. You can have more than one `lpd` daemon running on your system (one for each printer request being processed).

`/etc/printcap` – The printer-capabilities database.

`/usr/ucb/lpq` – Program for examining the printer queue.

`/usr/ucb/lprm` – Program for deleting jobs from a specific queue.

`/etc/lpc` – Administration program for making changes to the queues.

`/dev/printer` – Socket on which `lpd` listens for network requests.

`/usr/spool` – Traditional location for creating printer-queue directories.

Although this column will give you an overview of the

Many programs (such as `lpd` and `lpq`) use `lp` as the default printer if no printer is specified.

`/etc/printcap` file along with some hints and tips for administering your network of printers, you should refer to the on-line manual pages for more information on the commands listed above. The Sun *System and Network Administration* manual is also a good reference.

Format Of /etc/printcap File

The format for the `/etc/printcap` file is similar to that of `/etc/termcap`. Each entry describes a printer (although more than one entry may be used for a single physical device as we'll see later). A sample printcap entry can contain a lot of information about devices:

```
# LaserWriter Printer
printer|ps|lw|lp|Default printer in Room 201:\
   :lp=/dev/ttya:br#9600:\
   :ms=-parity,onclr,ixon,decctlq:\
   :sd=/usr/spool/lpd/printer:\
   :lf=/usr/adm/lpd-errors:mx#0:
```

The first line is a comment that starts with a pound sign "#." The second line lists the different names that can be used for the printer. Every printcap file should contain one entry with a name of `lp`. Many programs (such as `lpd` and `lpq`) use `lp` as the default printer if no printer is specified. Note that the last name entry is traditionally a descriptive name.

Next comes the printcap variables, designated by a two-character code. The `printcap(5)` man pages contain a comprehensive list of all these variables, but we will examine the more popular ones here.

Printcap Variables

The file name to be opened for output is `lp`. In the example, it is the serial port `/dev/ttya`. The default value is `/dev/lp`. The `br` entry controls the baud rate (set to 9600 baud here). The `ms` variable supports `stty(1)` options. This printer is set for no parity, carriage return/line feed pairs, XON/ XOFF flow control, and XON controls are only accepted after an XOFF.

The spool directory is called `sd`. This directory can be located anywhere, but traditionally, it is usually somewhere under `/usr/spool`. (Of course, these days `/usr/spool` is a symbolic link to `/var/spool` and either name is acceptable.) The most important factor in deciding where to put your spool directories is disk space. Large print jobs can fill up a file system. By making `/var`, located in the root file system (/) by default, a separate file system, you can prevent your system from hanging or crashing because the root file system is full. The `-s` option on `lpr` causes `lpd` to create a symbolic link from the spool area to the data file rather than copying the file. This option is only valid for local queues, however.

Spooler errors are logged in a file called `lf`. This file can be very useful for debugging problems. The `mx` variable defines the maximum size in blocks that can be printed. The default value is 1,000 and a value of 0 indicates there is no limit.

Remote Printers

Setting up remote printers is relatively easy once you have the printcap file configured for the host directly controlling the printer. All the printcap entries on all the other hosts will look like:

```
# LaserWriter Printer
printer|ps|lw|lp|Default printer in Room 201:\
   :lp=:rm=printer_host:rp=printer:\
   :sd=/usr/spool/lpd/printer:mx#0:\
   :lf=/usr/adm/lpd-errors:
```

Here, `lp` is set to null. The name of the remote host is `rm` and `rp` is the name of the printcap entry on that remote host.

Setting Up Spool Directories

Getting the permissions correct on the spool directories is important to assure that the access controls for printing and removing jobs work properly. The daemon `lpd` runs setuid root and setgid daemon (an `ls -l /usr/ucb/lpd` command will show you this). Therefore, you should create your spool directories as follows:

```
mkdir /usr/spool/printer
chmod 775 /usr/spool/printer
chown daemon.daemon /usr/spool/printer
```

Note that you can make the directory mode 770, but I like to set it to 775 so I can view the spool directory without becoming root.

Filters

Output filters can be used to process the data being sent to the printer. The following printcap variables are used for

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specifying various types of output:

- `if` – plain-text jobs
- `rf` – filter for printing FORTRAN text files
- `tf` – troff data filter
- `nf` – ditroff data filter for device-independent troff
- `df` – TeX data filter (DVI format)
- `cf` – cifplot data filter
- `gf` – plot data filter
- `vf` – raster-image filter

For most PostScript printers, you can include several different types of filters as shown below:

```
# Local Sun SPARCprinter NeWSprint printer
# lp|pl|ps|sparc|Sun SPARCprinter NeWSprint
# printer:\
   :mx#0:sf:sb:\
   :lp=/dev/lpvi0:\
   :sd=/usr/spool/sparc:\
   :if=/usr/local/newsprint/lpd/if:\
   :gf=/usr/local/newsprint/lpd/gf:\
   :nf=/usr/local/newsprint/lpd/nf:\
   :tf=/usr/local/newsprint/lpd/tf:\
   :rf=/usr/local/newsprint/lpd/rf:\
   :vf=/usr/local/newsprint/lpd/vf:\
   :cf=/usr/local/newsprint/lpd/cf:\
   :of=/usr/local/newsprint/lpd/of:
```

You specify which filter to use with `lpr` command-line options. For instance:

```
lpr -v -Psparc ~dinah/my_file
```

will cause the filter `/usr/local/newsprint/lpd/vf` to convert the raster image `my_file` to PostScript, which will be sent to the printer "sparc."

Writing Your Own Filters

Writing your own filters is easy. The main thing to be aware of is that you must return the appropriate exit code:

0 – no errors
1 – if the job should be reprinted
2 – if the job should be thrown away

In addition, when `lprm` is used to remove a print job, it sends a kill signal to the `lpd` process controlling the printing of that job. The `lpd` then sends a SIGINT to the filters and their descendants. The filters should trap this signal so that cleanup operations, such as removing temporary files, can be performed.

A simple filter follows:

```
#! /bin/sh
/usr/local/lib/lp/filter_it - |\
   /usr/ucb/lpr -Premote_printer
exit 0
```

This filter processes standard input with the program `filter_it`, which can do anything from reversing the order of the lines in the file, to sorting the file, to converting from EBCDIC to ASCII. After executing the `filter_it`, the script queues the result to another printer `remote_printer` where it will actually get printed. The printcap entry looks like:

```
doit|lp|My personal filter queue:\
   :lp=/dev/null_doit:\
   :sd=/usr/spool/doit:\
   :if=/usr/local/lib/lp/doit.if:\
   :mx#0:
```

In this case, `lp` is `/dev/null_doit`, which is simply a copy of `/dev/null`. Since this printer is not remote, you must specify a device. Usually `/dev/null` is a handy device to use. However, `lpd` supports printing to one device from several different printer queues by placing a lock on the device while a job is printing. The other jobs will be queued until the device is free. If you have several printers wanting to access `/dev/null`, your jobs will get queued waiting for the device. This seems kind of silly since you are not actually printing yet, so make a copy of `/dev/null` and reference it instead. You can do this for each printcap entry that references `/dev/null`.

One gotcha to be aware of when creating your own filters: You cannot specify a filter for a remote printer. The job gets submitted directly to the remote queue and your filter will not be executed.

NeWSprint

Sun's NeWSprint software has removed many of the headaches of installing PostScript printers. The menu-driven program `add_np_printer` makes it easy to install a new printer. It creates the spool queues and the printcap entry (while saving a copy of the previous one). However, you still need to have a good understanding of the printcap entries in order to troubleshoot problems. Also, while NeWSprint seems to do a pretty good job with common printers, every large site is going to have its share of oddball printers that will force you to install them the "old-fashioned way."

References

1. Fiedler and Hunter, *UNIX System Administration,* Hayden Books, 1986.
2. Chapter 12: "Maintaining Printers and Print Servers" from the *Network and Systems Administration Manual* in the SunOS 4.1 documentation set.
3. Nemeth, Snyder, Seebas, *UNIX System Administration Handbook*, Prentice Hall, 1989. ⊸

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

There's More Than One Way To Network A Sun

Here are four users with four distinct approaches to configuring a multivendor computing environment.

by **MARY JO FOLEY**, Senior Editor

As every Sun Microsystems Inc. user is well aware, even when your network is the computer, networking computers–especially those not made by Sun–isn't an effortless task. But, according to many of you in Userland, networking and internetworking seem to be getting easier. I had one pair of programmers claim–are you ready for this–that networking under UNIX is easy and almost fun, at least compared to networking in the PC/Mac worlds.

Third-party vendors are developing more and more hardware and software products designed expressly to aid Sun users and non-Sun users in exchanging information. And Sun itself continues to crank out advances and improvements to its Open Network Computing (ONC) environment.

This isn't to suggest that hooking up Suns to other vendors' systems and peripherals is a snap. An employee at one very large ISV admitted that her company stills stumbles when trying to get its Suns to talk to its Hewlett-Packard Co. LaserJet printers.

In spite of it all, users carry on, gerry-rigging NFS and SunNet and winding their ways through the maze of TCP/IP, X.25, SNA, LU6.2, DECnet and AppleTalk protocols. OSI still is fairly far from the minds and plans of those surveyed. Many seem to share the opinion of one network administrator who said that until the Internet runs over OSI, he isn't worrying about transitioning to OSI. Yet a handful of internetworking vendors continue to develop gateways and services, readying themselves for that time when (or if, as some are starting to admit) UNIX users transition from their beloved TCP/IP to OSI.

What follows are profiles of four Sun sites, with details on their evolving heterogeneous networks.


CA
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CA
X2.5
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LSI Logic Corp.

Semiconductor vendor LSI Logic Corp. is one of the biggest Sun Microsystems Inc. shops around. Worldwide, the company's 3,000 employees have access to 1,500 Suns. But there are more than just Suns on the LSI net.

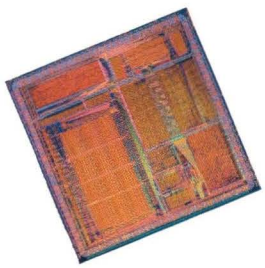
At the San Jose, CA-based Microprocessor Products Group alone, for example, there is an 11-GB Auspex Inc. NS5000 server, a 32-platter M22 Epoch Systems Inc. optical jukebox, and several MIPS Computer Systems Inc. systems, not to mention four Sun 4 servers and 120 SPARC-based workstations distributed over various subnets. This network is connected over a Shiva Corp. FastPath 4 gateway to a parallel LocalTalk Ethernet network of 50 to 60 Apple Computer Inc. Macintoshes.

Circuitry design–for the SPARC and MIPS RX000 chipsets, among others–is done primarily on the SPARC workstations, which include IPCs, SPARCstation 1s, 1+s and 2s, as well as a couple of Solbourne Computer Inc. stations. Technical documentation is generated and maintained primarily on Sun 3s. The Macs are used by marketing and support personnel for administrative purposes. The MIPS M/120s are used primarily for software development. The Epoch jukebox is the resting place for "stale" designs and home directories. And the Auspex, besides providing good tools, according to group software manager, David Gluss, also acts as a router, when needed.

Microprocessor Products is linked to other nets at LSI locations in the United States and abroad. Via an eight-way Wellfleet Communications Inc. Link Node router, the group can tie into an international network of IBM Corp. 3090 mainframes. Using Sun's SunLink Channel Gateway, the group can upload/download information to/from an IBM mainframe in the next building. The group's central design database and several design libraries are stored there. Consequently, almost all of LSI's workstations are diskfull, but dataless.

The main program that Microprocessor Products runs across its net is Modular Design Environment (MDE), an LSI-developed environment for the automation of the entire chip-design process. LSI designers also run other in-house-developed tools and various UNIX tools. Frame Technology Corp.'s FrameMaker electronic-publishing software runs on most of the Suns and some of the Macs.

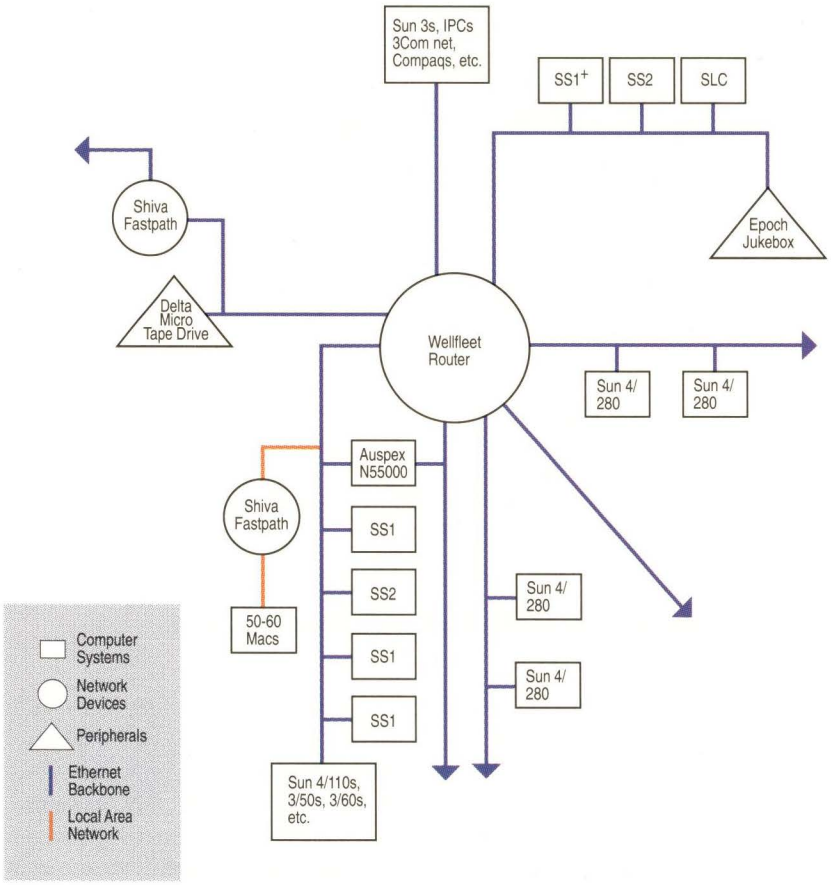
Integrating the various components of the Microprocessor Products segment of the network wasn't much of a problem–until the company began to focus on network backup. Currently, the group backs up its data on a Sun SLC, which is connected to a Delta Microsystems Inc. 8mm-tape drive and R-Squared 200-MB disk. When the group attempted to back up its Epoch jukebox to the Delta system, it rapidly discovered that the Epoch

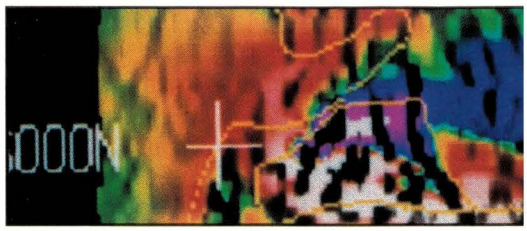


doesn't support backup. "We're writing the driver ourselves. It's very painful," Gluss says. Another limitation, he says, is that the Epoch can only load two platters at a time.

But the group's biggest headache, at this point, is more of a marketing than a networking concern. As both a Sun user and Sun OEM (LSI resells Suns loaded with MDE), "we're a little nervous about Sun's software unbundling strategy," Gluss admits. "When we sell to customers, they may not have all the tools necessary" to run MDE, he says. "This creates a distinction like the one that exists in the Mac world–between users and developers." In anticipation of Sun's increasing emphasis on unbundling, Microprocessor Products already is adopting and integrating more and more GNU tools into its computing environment.

Linking Up at LSI Logic Corp.

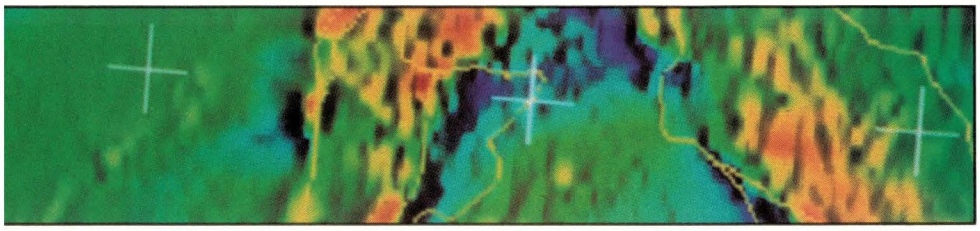




It takes a lot of compute power to do a realistic model of an ocean or the atmosphere. Luckily, for the graduate students at the University of Washington (Seattle, WA) department of atmospheric sciences, access to various model Cray Research Inc. supercomputers is just an Internet connection away.

The department relies on Internet for access to machines at the San Diego Supercomputer Center, as well as at the National Center for Atmospheric Research (NCAR) in Denver, CO. Students work on various X-terminals, IBM Corp.-compatible PCs and Apple Computer Inc. Macintoshes; 12 Digital Equipment Corp. DECstations and VAXstations; and/or 22 Sun Microsystems Inc. workstations (ranging from SPARCstation SLCs to SPARCstation 2s). These machines are organized into three subnets, two of which are located in the same building as the department, and the third–connected by a T1 link–in a separate building on campus. The

University of Washington, Department of Atmospheric Sciences



subnets are linked to the campus-wide Ethernet backbone using Cisco Systems Inc. AGS-2/AEM routers with Cisco Ethernet cards.

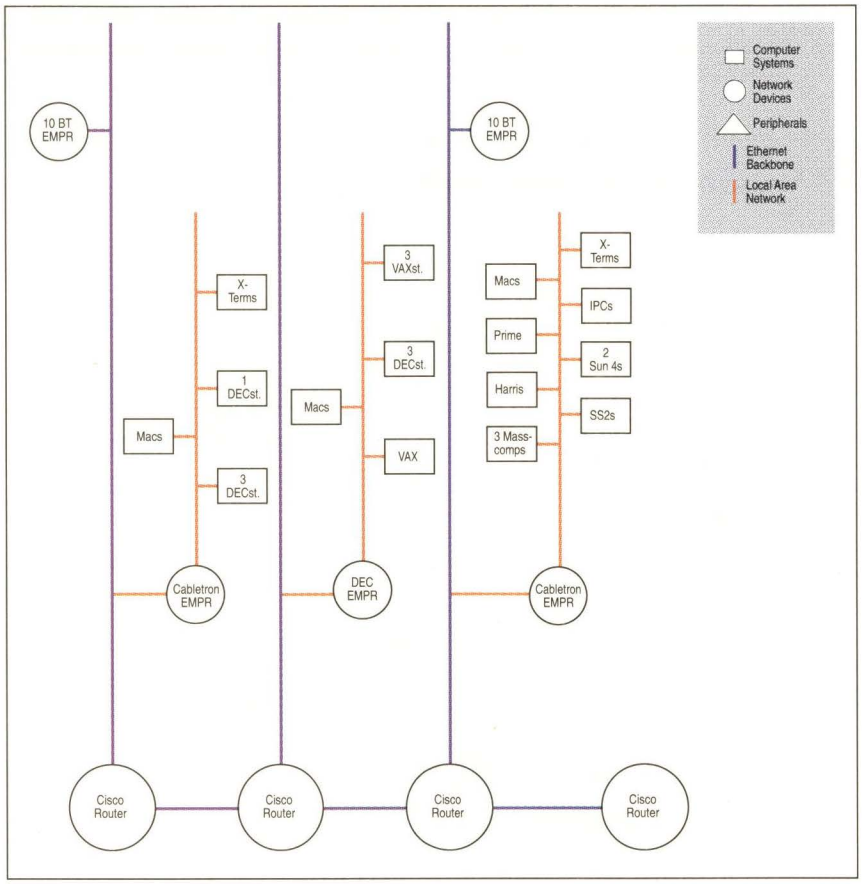
The remotely located subnet consists of five DECstations–four 3100s and one 5000. The second subnet, with a thinwire backbone, is made up of a VAX 4000, three VAXstation 3100s and four DECstation 3100s. The third subnet, connected by thickwire, is where the bulk of the Suns reside. It also is home to miscellaneous terminals and PCs, a Harris Corp. 800 mini, a Prime Computer Inc. 9955, three Masscomp Computer MC 5520s and a pair of Sun 4 servers. All three nets have various 4mm and 8mm DAT devices, 9-track tape drives, QIC tape drives and laser printers on them.

Devices on subnets two and three are connected by an MMAC-3 Cabletron Systems Inc. Ethernet multinet repeater (EMPR). Various DEC systems on subnet two are linked by a DEC DEMPR-AA repeater. And some systems on subnet three also are connected over a 10-Base-T EMPR from Hewlett-Packard Co., the HP 28688A.

When devising the network, the department's original plan was to run TCP/IP and DECnet simultaneously. Compatibility problems quickly cured them of that notion, says Dr. Harry Edmon, director of the department's computer facility. The university's networking group had deemed that the Internet Protocol would be the one and only protocol supported on the campus-wide backbone. For the atmospheric sciences department, TGV Inc.'s MultiNet, a product that enables encapsulation of VAX/VMS data for TCP/IP transmission, saved the day.

MultiNet is a multiprotocol environment that runs on the VAX and supports TCP/IP, Xerox Corp.'s PUP protocol and the CHAOSnet protocol. TGV offers NFS Client and NFS Server options for the product. At the atmospheric sciences department, the VAX is used to store real-time and historical data downloaded from the aforementioned supercomputers, satellites and other sources. Along with the Masscomp, Prime and Sun 4 servers, the VAX also stores some of the "home-brewed" modeling and graphics software written by members of the atmospheric sciences department. Other applications available on the network include Lotus Development Corp.'s 1-2-3, Frame Technology Corp.'s FrameMaker and Interleaf Inc.'s Technical Publishing Software.

The toughest nut to crack has been networking the non-UNIX boxes to the rest of the systems, Edmon says. PCs and Macs have been tough to accommodate, as has the Prime system on occasion, Edmon admits. Most of the rest of the department's networking headaches have been your run-of-the-mill, everyday sysadmin bugaboos: erroneously assigning a Mac the Sun server's IP address; twisted-pair wiring problems that were eliminated by switching to 10-BaseT. "We even got bit by the Internet worm [virus]," Edmon recalls. But for the time being, the net is chugging along just fine.



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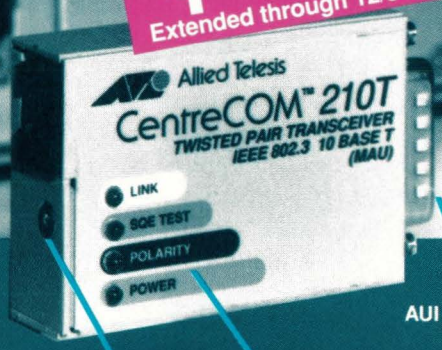

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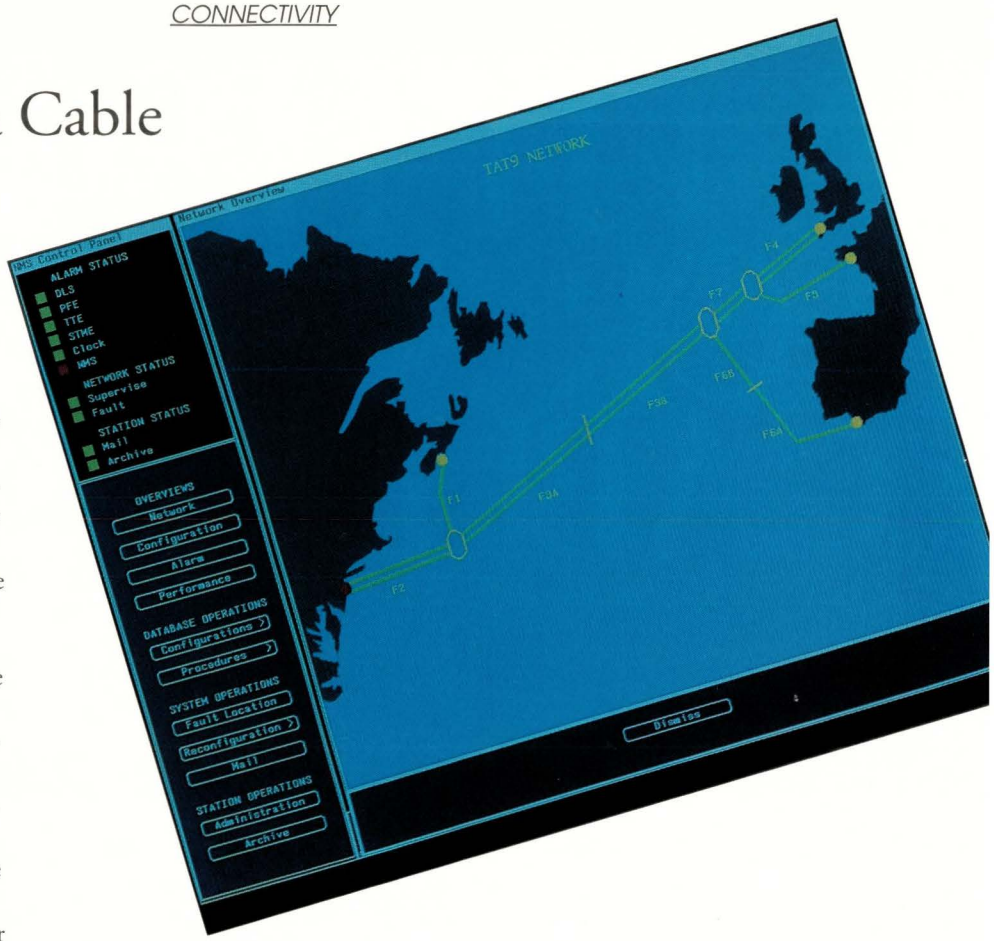


TAT-9 will link five countries, and TAT-9 NMS will monitor traffic on the undersea cable, when the two go online later this year.

When the TAT-9 transatlantic fiber-optic cable goes into service this year, a network designed to monitor performance and traffic across the cable also will go on-line. This network will provide information on how the TAT-9 is operating, including error rates and other parameters, and will help reroute traffic if a cable segment goes down. Operators in any of the five countries connected by TAT-9 will be able to see what's happening at any site on the network. And all of the 14 cable monitoring stations will be running Sun 4/370s, SPARCstation 1/1+'s or IPCs.

The force behind the TAT-9 NMS (Network Management System) is the consulting group of Memotec Datacom Inc., North Andover, MA. Under the auspices of the TAT-9 NMS contract, the consulting group is installing a number of datacom products manufactured by Memotec Data Inc., the group's Montreal-headquartered parent company, along with products from several third-party connectivity vendors.

The five primary landing stations, each running a Sun 4, are interconnected via a private X.25 packet-switching network. In the United States and the United Kingdom, the consulting group has installed a Memotec SP 9000 X.25 switch. At each end of the cable, the consulting group has installed a 9.6K-bps modem. In some cases, these modems are Memotec DA-296s; in others, they are OSI8396 modems from Octocom Systems Inc. (The one exception is the U.S.-to-U.K. link that is connected by a leased, rather than dial-up, line.) At the same time, there are one or two remote sites linked over leased or dial-up lines to each of the five main stations.

Even though all of the primary and remote sites are running Sun hardware, this installation has taken on many of the qualities of a multivendor network–mainly as a result of the IPCs located at several of the remote monitoring stations. "Our first intent was to use [Sun Microsystems Inc.'s] SunNet X.25 exclusively," explains Steve Esposito, a principal engineer with the Memotec consulting group. "We managed to use the product on all of the Sun 4s, SPARCstation 1s and 1+s, since [SunNet X.25] enables you to run TCP/IP over X.25."

But when the consulting group attempted to add IPCs to the net, problems arose, Esposito says. While IPCs come standard with 8-pin RS232 connectors enabling them to handle asynchronous communications, the synchronous X.25 protocol makes use of more than eight leads. Sun itself recommends use of an SBus card for X.25 networking.

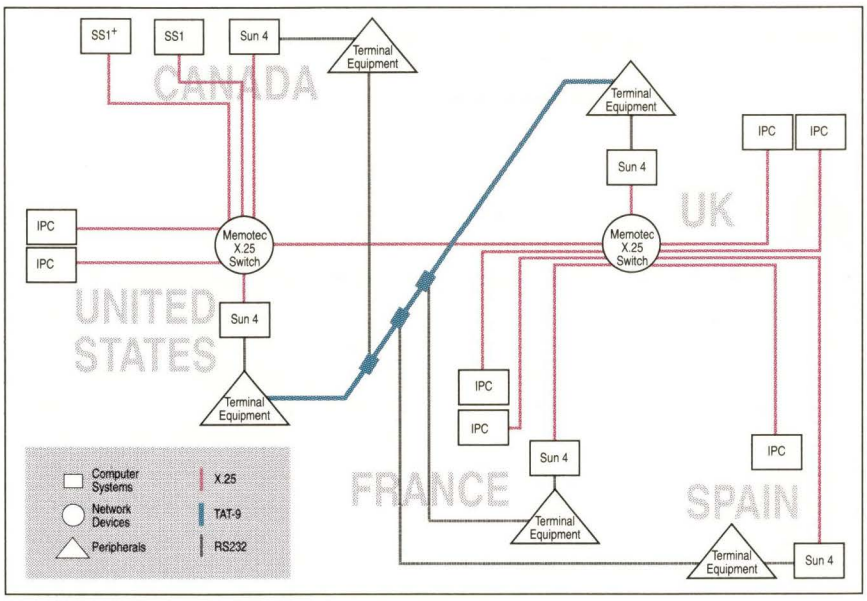
Fortunately, right about this time, the consulting group happened upon Brixton Systems Inc., an internetworking vendor with a product connecting TCP/IP over X.25 using software and an SBus card (in this case, one manufactured by Aurora Technologies Inc.). Memotec installed Brixton's BrxX25 product on its six IPCs, after engineers at Brixton managed to retrofit the software, which normally operates over SunOS 4.1, to work on the SunOS 4.0.3-based TAT-9 NMS.

Memotec's choice of SunNet X.25 also resulted in the consulting group's eventual choice of a double-star network topology for TAT-9 NMS. The group's version of SunNet X.25 can link up to eight devices, but Memotec needed to link 14. "That's why the remote stations are connected the way they are," says Esposito.

Besides running Memotec consulting's in-house-developed NMS software, the group runs the Ingres Corp. Ingres database (and IngresNet on the remote stations), as well as several other programs on the net. All stations feature SunView as their GUI of

choice, and have access to V.I. Corp.'s DataViews rendering package. At each station, there are IBM Corp. 4019E PostScript laser printers that operators can use to print mail, alarm data and other information generated by the net management system.

There's another multivendor aspect to the TAT-9 NMS network, centering around the connections between the monitoring systems and the two Sun ALM-2 VMEbus asynchronous multiplexor cards that handle most of the data-acquisition chores. The multiplexors collect data from the various power- and TAT-9-multiplexing systems and terminal equipment that are made by a wide range of vendors, including Alcatel N.V., AT&T, STC plc and others.



Monitoring Traffic on the TAT-9

The Problem With PCs...

With a fair amount of ease, you can make your UNIX system emulate a DOS-based PC. Or you can run DOS as a guest on top of UNIX. And there are a slew of programs that let DOS PCs and UNIX systems transfer files between them.

But if you want your PC to be a full-fledged player–not just a could-have-been-contender–in your networking environment, your options are much more limited.

Let's say you've got a SPARCstation 1+ acting as an NFS server for a group of IBM Corp.-compatible PCs. You've got something like Beame & Whiteside Software Ltd.'s BW-NFS for DOS or FTP Software Inc.'s PC/TCP enabling your DOS machines to access NFS, as well as make use of various TCP/IP utilities, such as file transfer, terminal emulation, email and remote backup. All the pieces are in place, but the setup just won't perform as promised.

That was the problem at the University of Chicago (Midway) Library Computer Systems department, where there's a test network of four AST Research Corp. 386-based PCs tied to a SPARCstation 1+ using PC/TCP and 3Com Corp. Ethernet cards.

"Something like Microsoft [Corp.] Windows cannot load over the network because the memory requirements of the NFS-related software chew up a lot of conventional memory," explains Charles Blair, systems librarian for microcomputing applications. "We've made some attempts to be creative about memory allocation on the PC, but frankly, we are pretty discouraged by the amount of effort required in tweaking DOS-based PCs to get them to work effectively in UNIX-based networking environments."

That's why Library Computer Systems is in the process of choosing an X server. The department intends to switch its DOS PCs to UNIX PCs (running something like Santa Cruz Operation UNIX) and make X the unifying element between the PCs and the server.

"We are not attempting to fit a few UNIX boxes into a PC network," Blair adds. "Rather, we are attempting to fit PCs into a UNIX network. What we are testing is what it takes to do that."

Howard Publications, South Coast Newspapers Inc.

A growing number of newspapers across the United States are turning on to Sun Microsystems Inc. hardware. Because publishing companies consist of different divisions with different computing needs, they almost always end up establishing multivendor networks, replete with Apple Computer Inc. Macintoshes in the design departments, IBM Corp.-compatible PCs in editorial and a range of scanning, typesetting and printing equipment in between.

South Coast Newspapers Inc., a five-regional-paper chain that is part of the Howard Publications empire, fits this model to a T. Together, the five papers are running a network of more than 85 Sun workstations and servers and 40 Macs. The Oceanside, CA, Blade-Citizen is the hub of the group. It is connected via a 56K-bps and a T-1 line to other regional offices. These other offices are running scaled-down versions of the Blade-Citizen net.

The Blade-Citizen editorial department consists of 60 SPARC-station 1s–where editors and reporters do their work on ArborText Inc. The Publisher software–linked to a SPARCstation 1 server, where home directories and wire feeds are stored. Also part of this subnet are two SPARCstation 1+ servers acting as gateways, each with two Ethernet cards, linking editorial to the electronic-design and art departments. The 56K-bps line connecting the

OSI? Don't Hold Your Breath

Many vendors–including Sun Microsystems Inc.–are making available Open Systems Interconnection (OSI) products and services. While a growing number of UNIX users are dabbling with these OSI offerings, most claim that TCP/IP is alive and kicking at their sites, and that it won't be going away anytime soon.

Sun, for its part, rolled out Version 7.0 of SunNet OSI this spring. The product, which supports a number of international protocols, including the United States and United Kingdom GOSIP (Government OSI Profile), is designed to help users transition from TCP/IP to OSI. Sun says that Version 7.0 simplifies this transition by incorporating dual-protocol stacking, protocol gateway and transport-independence features.

Because driver-interface specifications aren't yet part of the OSI standard, developers are concentrating on designing Streams drivers for UNIX. ISVs taking this approach are Racal InterLan Inc., Retix, Touch Communications Inc. and the Wollongong Group Inc., to name a few. Racal sells a UNIX System V.3 Streams Device Driver. Retix offers OSI FTAM server and client software, an OSI application interface to TCP/IP, OSI transport services and various X.400 products. Wollongong has developed FTAM, directory services, an FTAM FTP, MHS/X.400, an OSI protocol stack and OSI for Streams, among other connectivity products. And Touch sells X.400 gateways for various mail packages, including SMTP, UUCP and MHS.

Touch, for one, claims that nearly 75% of the X.400 gateways it currently sells are for UNIX mail packages. Consequently, the company no longer attempts to convince TCP/IP customers that they should replace TCP/IP with OSI. The approach Touch and the majority of the OSI pack are now advocating is protocol coexistence, not as an interim strategy, but as the ultimate networking result.

While this kind of talk should make OSI more palatable to TCP/IP devotees, so far only the largest of the Fortune 1000 seem to have done much in the way of OSI development–or even planning. UNIX software developers point out that few contracts specify OSI. And Internet runs over TCP/IP, not OSI. One UNIX user says his company will worry about OSI if and when it becomes an integral part of the UNIX kernel, and not before. UNIX users agree: Even though they've been hearing about OSI for years, it's still too soon to do much about it.

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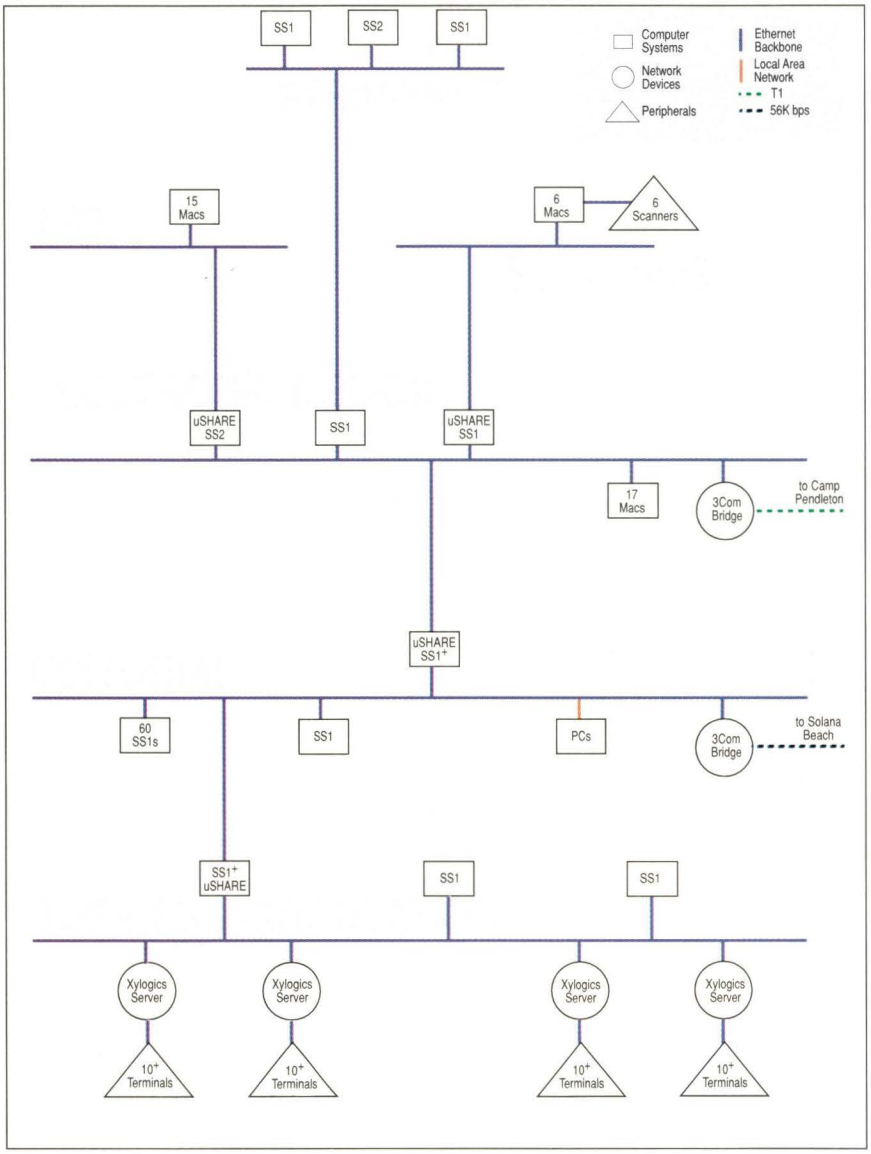
Solana Beach field office to Oceanside is tied to the subnet by a 3Com Corp. IB/3 bridge.

The subnet serving the electronic-design staff consists of three SPARCstation servers (two SS1s and one SS2). Seventeen Macintosh cx, ci and fx systems running Quark Inc.'s QuarkXPress also are part of this net. The Macs all have MacCon Ethernet cards from Asante Technologies Inc. to allow them to tap into the Ethernet directly. The Camp Pendelton group, another division of South Coast Newspapers, is linked to the electronic-design subnet by a T-1 line and 3Com IB/3.

The art department runs off of the SPARCstation 1 server on the editorial subnet. This server powers 15 Macintoshes running QuarkXPress, Adobe Systems Inc.'s Illustrator and Aldus Corp.'s FreeHand.

The electronic-design group is connected over a SPARCstation 1 gateway to the camera-scanning subnet. There, six Macs with scanners from Hewlett-Packard Co., Nikon Inc. and Truvel Corp., generate images that become the artwork and photos for the newspaper. These images are spooled onto one of the Macs that acts as a server, and then spooled to another subnet where two SPARCstation 1s and a SPARCstation 2 are running Hyphen Inc.'s Raster Image Processor (RIP) software. RIP outputs the image to positive or negative forms that are used to burn in plates for printing.

Editorial also is networked to the business/circulation department via a SPARCstation 1+ gateway. The business department subnet consists of three SPARCstation 1 servers and four Xylogics Inc. Annex Three terminal servers. The Annexes link more than 40 terminals to the net. The terminals include various Data General Corp., Digital Equipment Corp. and Wyse Technology Inc. models, among others. There are also a number of DOS PCs running Sun's PC-NFS that handle business and circulation chores. The business/circulation group runs a wide range of software, including Codapro Corp.'s office productivity software, Access



Sharing Resources at Howard Publications

Technology Inc.'s 20/20 spreadsheet, Fox Software Inc.'s FoxBase+ DBMS, Vision Data Equipment Corp.'s Newspaper Circulation and Business System and WordPerfect Corp.'s WordPerfect word processor.

This mega-network is the handiwork of two Howard Publications' employees–systems administrator Ernie Basener, and plant operations manager Dutch Greve–Sun, and computer and peripherals distributor anDATAco Computer Peripherals of San Diego. For a number of years, the publishing company was locked into a proprietary editorial system from a single vendor. Once the company decided that its goal would be to use as much off-the-shelf hardware and software as possible, UNIX looked like a natural choice.

"We're on the bleeding edge of technology," says Greve. But "neither of us [Greve or Basener] has a UNIX background." As a result, lack of thorough hardware and software documentation, especially regarding how various products work in tandem, has been a real hardship, he says.

But the real stumbling block has been the myriad Macs, they claim. "Macs bomb a lot. They're inefficient. Using Macs as file servers is really overtaxing them. Macs were never intended to be networked products," laments Basener. Yet, because so much of the best design and layout software runs on Apple platforms, Macs have become an unquestioned part of the publishing landscape.

The San Diego operation originally went with Sitka Corp.'s TOPS/Sun file-server LAN product in an attempt to tie their Macs to their Suns. TOPS is designed to allow Macs and PCs to retain their own interfaces, while gaining access to UNIX disk storage, backup and security. The product just didn't measure up, claim Breve and Basener. So, they switched to uSHARE from Information Presentation Technologies Inc. uSHARE makes a Sun file system look like AppleShare to Mac users, explains Basener. The product, which runs on Suns, as well as Macs under A/UX, allows up to 15 Macs or PCs to have access to UNIX file, print, communication and mail-service capabilities. uSHARE hasn't turned the network's designers into Mac bigots, but it's making net administration a lot easier.

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What's in a Naming System ? Decisions

by SMOOT CARL-MITCHELL,
Texas Internet Consulting

ions

Decisions about how to manage and name resources in a networked environment need to account for future growth.

The Domain Name System (DNS) is a flexible tool for naming resources and establishing naming authorities that can be delegated to different groups within a single organization. When deciding upon a naming scheme, non-technical considerations often overshadow technical issues: Should a naming structure be organized by department or by geography? Should all names be centrally administered? What effect will going to DNS-style names have on the user community? Sometimes the best a network administrator can hope for is an imperfect solution based upon these non-technical issues.

Naming Network Objects

The naming of objects is fundamental to computing. It has been said that the major function of programming is to give meaningful names to objects and translate those names into numbers that can be manipulated by the machine, and then translate those numbers back into meaningful names so the machine's user can understand what the computer did. We see "naming" in everything from simple table lookup functions, to compiler symbol tables, to complex database management systems.

Networking is no stranger to this phenomenon. The network and transport protocols of TCP/IP know nothing about names. All they know about is network addresses, port numbers and protocol numbers. This is perhaps an oversimplification, but the mnemonic names given to network objects, particularly host names, are not a necessary part of moving bits from one computer to another through a complex network.

Some network objects, such as TCP and UDP port numbers, are relatively static and can be adequately managed using static tables. The number of ports used and named is also relatively small, so the tables are also small.

The most common network object is the IP network address that is a four-byte number, usually written in dotted decimal notation (i.e., 134.128.12.3). Since people do not like to remember numbers, these addresses are given names that associate them with a particular host on the network. Most of the applications that interface to the network code use these mnemonic names and translate them to network addresses using a mapping function. In its simplest form this mapping function can be handled by a simple table lookup.

Since these host names are often used across the network, distributing this information can be handled by a naming protocol. On Sun systems one of two protocols is often used: the Network Information Service (NIS formerly YP) or DNS. If the network is connected to the TCP/IP Internet, it must support DNS. SunOS allows the use of DNS or NIS for host/address mappings. There is also a way for DNS and NIS to coexist.

DNS is the preferred mapping method, since it allows delegation of naming authority and supports an extensible hierarchical naming structure. A typical Sun network uses both DNS and NIS, but has its NIS servers communicate with the DNS servers for name lookups that are not in the local NIS tables. DNS can also be used without NIS for name lookups (see *SunExpert*, August 1990, Page 56).

Names in DNS

DNS defines a hierarchical naming structure. A host name is a series of tokens separated by periods that defines a unique path in the naming hierarchy. This path is called a domain name. Strictly speaking, the host name

Do not under estimate network growth. Most enterprise networks easily double in size every year.

to address mapping is accomplished by means of an address record associated with a domain name. For example, the name `tic.com` defines the unique path from the root of the tree that traverses the node named `com` and ends at the node named `tic`, which is a child of the node `com`. This path is often called a subdomain. DNS insures uniqueness of names by this strict hierarchical structure. A person given authority for names under the `tic.com` subdomain can add a name such as `longway.tic.com` and be assured that that name is unique. The uniqueness of `tic.com` is insured because the naming authority for `com` insures that each child of `com` is unique.

DNS also allows the person who has authority for the `tic.com` subdomain to delegate authority for any branch under `tic.com`. So names under `accounting.tic.com` can be delegated to somebody else. This delegation can continue down the tree to any level.

While DNS allows delegation it does not define how to delegate this authority or even whether it should be done at all. So to subdomain or not to subdomain is a relevant question in any organization building a TCP/IP network. The major reason for the creation of domain names was that a flat namespace was simply too cumbersome to manage centrally. As the Internet grew beyond a few hundred machines, it became too difficult to keep up with the growth from one central location. The same principal applies to most enterprise networks.

Even if your network has just a few machines now, and even if your network is not connected to the Internet, it is a good idea to plan ahead for both possibilities. The first thing to do is insure that you have a registered network number and domain for your organization. This is very important to avoid network "flag days" where you have to change all the names and all the addresses of the machines on your network.

The next thing to do is decide on a potential subdomain naming structure and prepare your network growth for it. Both of these steps are easier said than done.

The Politics of Naming

Early domain naming users complained that machine names were too long and unwieldy. "My workstation is named foo. If I give it a domain name, will I have to type `foo.mycompany.com` when I `telnet` into it?" Fortunately, while the machine names may get longer, the DNS can be made to understand that `foo` is really `foo.mycompany.com`. A way of avoiding the complaints is to select as short a name as possible for your main domain. Usually three or four letters is all that is needed to be reasonably mnemonic. If your company's name is "Acme Computing Inc.," then a domain like `aci.com` is usually adequate and is better than something like `acmecomputer.com`. Of course, you have to select something that is unique from all the other names under `com`. Today thousands of companies have registered names under `com`. A short domain name will save a lot of grief later and softens the "longer name syndrome" within your user community.

Dividing your domain into subdomains may seem unnecessary in a small network, but can save a lot of time as your network grows. One southwestern university, when it converted to domain names, decided initially not to use subdomains. It would have been natural to divide the university's domain along departmental lines, but would have required longer names and therefore would be more cumbersome. Besides, it was thought, there would not be that many machines on the network, anyway. The first problem was true, but the second prediction proved to be wildly pessimistic.

Today this university has several thousand machines on its network. The namespace is divided into subdomains along departmental lines, as originally recommended. Of course, host names had to be reshuffled in the process and some aliases left in place for historical purposes. The lesson of this story is: Do not underestimate network growth. Most enterprise networks easily double in size every year.

Another client, a Texas-based graphics company, decided not to divide into subdomains for many the same reasons. One reason: The company decided to use NIS to do host-name-to-address translation at the central site. Users could continue to type `foo` when accessing the machines on the network. If subdomains by department had been established in this company, it would have been more cumbersome to maintain the NIS tables, or the network managers would have had to convert host-name lookups to use DNS exclusively. Because the software the company develops gets shipped without depen-

dence on DNS, management did not want to use DNS exclusively.

Although it could be demonstrated that using DNS in the development environment has no adverse effect on the software product, management and developers were still uneasy about using just DNS, primarily because it was something new. DNS had to be run in parallel because the company had Internet access.

Eventually the company established remote locations and decided to split them off into their own subdomains. The decision to run DNS in parallel was a fortuitous one because it allowed a division into subdomains that went relatively smoothly. The remote sites created subdomains in a seamless manner with access to all the resources of the central site, as well as the resources of the Internet itself.

The design of this system has the central site with machines under the domain, `aci.com` (not the real subdomain to protect the innocent). Each remote site has its own domain name: i.e., `sub.aci.com`. All sites run NIS in parallel with DNS. Each ypserver is run with the `-i` option which says to hand off lookups to DNS for hosts not found in the NIS table.

Both the central site and each remote site maintain local host tables. The way this is actually done is to maintain a separate database of host names and addresses that is updated and scripts then generate the NIS and DNS tables. These host tables contain the names of hosts at that particular site. Each NIS host table also contains the "short" name without domain extension for each host. That is, an entry in the table for host `foo` appears as:

```
138.132.10.2 foo.sub.aci.com foo
```

Using this scheme, users access other machines within their own subdomain by simply typing the simple host name. The canonical name of the host is always the fully qualified host name `foo.sub.aci.com`. Each remote site is also a separate subnet of this firm's Class B network number, so DNS also maintains the reverse `in-addr.arpa` subdomain for each applicable subnet. The system also employs redundant DNS and NIS servers to insure reliability. For example, the central site's Internet gateway serves as a secondary for all the subdomains.

The interesting aspect of the evolution of this company toward domain names was the way in which the initial reluctance was overcome by demonstrating that using domains would not inconvenience the user community or upset their development cycle. The users in this environment are primarily software developers. Their job is to develop new software quickly and stay on schedule. They are not interested in the nuances of network administration. They only care (and rightly so) that the network works and they can easily and conveniently access the resources they need to get the job done. Any change in the way they access the network, such as domain names, needed to be approached very carefully.

One of the driving forces behind going to domain names was Internet access. Access requires the use of

domain names. It was interesting watching the expressions on the programmer's faces when Internet access was demonstrated online! That simple demonstration was enough to convince most of them of the real value of domain-style naming.

Naming Thoughts and Rules

How do these examples apply to your own network? Several rules of thumb come to mind. If you already have a network set up without domain-style names, then your task is more difficult. If you can implement domain names from the time the first machine is installed, do it. It will save an enormous amount of time later on.

Unless you really are the network god (and very few network administrators are) and can impose your will by fiat, go slowly when trying to introduce domain names into an existing network. Point out the benefits of using domain names; i.e., we will be getting Internet access and can avoid changing host names later, or we should really come up with a plan to use subdomains to better handle future growth. Remember, if you cannot convince your management or user community to change, then at least do some contingency planning on your own to minimize the potential headaches later on.

At least get your management to allow you to register a domain name for your organization. Explain to them that it will allow an orderly path to connect to the Internet at a later point in time or at least allow the exchange of electronic mail. Usually, this approach will work, since registration is free. Also get a registered network number, as well. You can almost always get a Class C network that is sufficient for most small networks. If you can get a Class B because of your network size, by all means do so.

If you get this far, then it is usually easy to convince management to use real domain names. If you can come up with a subdomain scheme implement it as quickly as possible. Remember that a common way to divide an organization into subdomains is by department. Another approach is to organize your subdomains geographically.

Subdomain assignment by department is natural for organizations such as universities, where departments tend to be long-lived entities. Assignment by department is also common in some companies. However, it may not be suitable for all circumstances. Companies undergo periodic reorganizations, and departmental boundaries may change over time. It is a hassle to change host names when reorganizations occur, but that may just be a necessary cost of any reorganization. In companies that reorganize often, it may be better to divide along geographic boundaries. This is also convenient for companies with a large number of geographically dispersed offices.

DNS will allow you to do both and intermix geographical and departmental subdomains. Remember that DNS does not assign any meaning to a subdomain name. The meaning comes from how it is used. You can also divide subdomains along subnetwork boundaries, although this is not required. A subdomain may span subnetworks or be just a subset of the hosts on any given subnetwork.

If you are in a quandary about whether to divide along geographic or organizational lines, take a look at how other organizations have done it. Also leave yourself the flexibility to do both. It is often the case that remote sites, if small, should be in their own subdomain, while a large central site may be divided along departmental lines.

Mail Addresses and Domains

Electronic mail addresses are impacted by the use of domain names. Since mail is the most often used network service, it is important that mail addresses be as stable as possible. It is bad practice to send mail to an address like,

```
myname@mymachine.aci.com
```

First of all the host `mymachine` may go away and then there will be a lot of old, unusable mail addresses. Changing your electronic mail address is a bit like changing your real mailing address. A much wiser structure is to

address mail to myname@aci.com. The name aci.com does not even have to correspond to a real machine, but can be a Mail Exchanger (MX) record that points to a mail relay.

The same principles apply when organizing subdomains. If subdomains are departmental, then mail to a particular department should be addressed to soandso@acct.aci.com. The domain part of the mail address should be generic and allow you to move mail gateways around or change relay mail machine names without impacting mail addresses.

It is even possible to organize subdomains geographically for administrative control and to organize mail addresses by department. This is accomplished by setting up MX records in DNS for each department to send mail to. These MX records point to mail relays in the proper geographic locations for that particular department. Also the judicious use of aliases to properly deliver the mail to the final destination helps in such an environment. For example, if a central mail relay is set up that it accepts mail addresses like soandso @aci.com, then the mail relay can use the mail alias file to point to the workstation where soandso's mail box exists. Also, mail aliases can be used to establish a standard format for recipient addresses, such as first initial followed by last name.

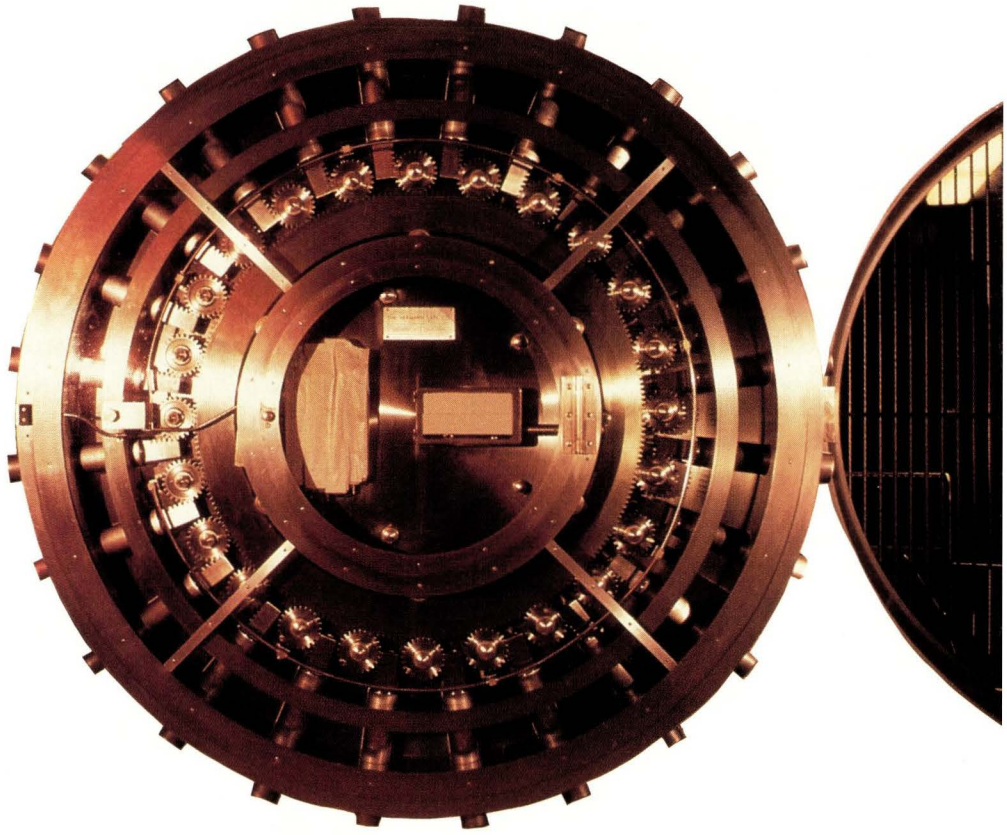
Conclusion

Establishing domain names in a networked environment is a wise investment. Registration is free and easy. The hard part is to convince your management and users of the advantages of the changes. Subdividing your domain, once it is established should also be carefully planned to take into account future growth of your network. With forethought, a little persuasion and some common sense, making the transition should be technically and politically painless. The key ingredient is flexibility. Networks are much like living organisms. They tend to grow and evolve in a complex and, at times, seemingly chaotic manner. With care those chaotic growth spurts can be managed and can result in a thriving, productive and manageable environment. ⊷

Smoot Carl-Mitchell consults on network management and presents tutorials about mail systems for Texas Internet Consulting, where he is the Managing Partner. He can be reached by voice mail at (512) 320-9031, by email at tic@tic.com and by fax at (512) 320-5821.

BOOK EXCERPT

Practical UNIX Security:
The Perils of Call-in



by SIMSON GARFINKEL and GENE SPAFFORD

Remote connections exploit networking in the fullest sense of the word but make a net more vulnerable to intruders.

Editor's note: Last month, our network sleuths explored some of the security problems of UNIX systems. This month they go remote. They give you some scripts and tips to help protect systems that can be reached from the ether. After a brief discussion of `telnet`*, July's installment left you at the login prompt. This month's feature takes up the story at that point.*

The `rlogin` and `rlogind` programs provide remote terminal service similar to `telnet`—`rlogin` is the client program, `rlogind`, the server. There are two important differences between `rlogin` and `telnet`:

• `rlogind` does not require the user type his or her username; the username is automatically transmitted at the start of the connection.
• If the connection is coming from a "trusted host" or "trusted user," (described below) the receiving computer lets the user log in without typing a password. `rlogin` is used both with local area networks and over the Internet. Unfortunately, it poses security problems in both environments.

`rsh/rshd` are similar to `rlogin/rlogind`, except that instead of logging the user in, they simply allow the user to run a single command on the remote system. `rsh` is the client program, while `rshd` is the server. `rsh/rshd` only work from "trusted hosts" or "trusted users."

Both `rlogin` and `rsh` are designed for communication only between Berkeley UNIX systems. Users who want to communicate between UNIX and TOPS, VMS or Tenex systems should use the `telnet` protocol, not the `rlogin` protocol.

A Question Of Trust

Trusted host is a term coined by the inventors of the Berkeley UNIX networking software. If one host trusts another host, then any user who has the same username on both hosts can log in from the trusted host to the other computer without typing a password.

Trusted users are like trusted hosts, except they refer to individual users, not hosts. If you designate a user on another computer as a trusted user for your account, then that user can log into your account without typing a password.

The UNIX system of trusted hosts makes it easier to use the network to its fullest extent. `rlogin` makes it easy to jump from computer to computer, and `rsh` lets you run a command on a remote computer without even having to log in!

Trust has a lot of advantages. In a small, closed environment, it often makes sense to have all of the computers "trust" each other. Practically, what "trust" means is that once a user logs into one machine, he or she can use any other machine in the cluster without having to provide a password a second time. If one user sometimes uses the network to log into an account at another organization, that user can set up the accounts to "trust" each other, making it faster to jump between the two machines.

Unfortunately, "trusted hosts" and "trusted users" have been responsible for many security breaches in recent years. Trust causes breaches in security to propagate quickly: If `charon` trusts `ringworld` and an intruder breaks into `ringworld`, then `charon` is also compromised. Nevertheless, system administrators set up computers as "trusted" to make it easier for users to take advantage of the network environment. In many computing facilities, administrators decide that the benefits outweigh the risks.

The `/etc/hosts.equiv` file contains a list of trusted hosts for your computer. Each line of the file lists a different host. If you have Sun's NIS, you can also extend or remove trust from entire groups of machines.

Any hostname listed in `hosts.equiv` is considered trusted; a user who connects with `rlogin` or `rsh` from that host will be allowed to log in or execute a command from a local account with the same user name without typing a password. With Sun's NIS, a line of the form `+@hostgroup` makes all of the hosts in the network group hostgroup trusted; likewise, a line of the form `-@anotherhostgroup` makes all of the hosts in the network group `anotherhostgroup` specifically not trusted. The file is scanned from the beginning to the end; the scanning stops after the first match.

Consider this example file:

```
gold.acs.com
silver.acs.com
platinum.acs.com
-@metals
+@gasses
```

This file makes your computer trust the computers `gold`, `silver` and `platinum` in the `acs.com` domain. Furthermore, your computer will trust all of the machines in the

gasses netgroup, except for the hosts that are also in the metals netgroup.

After scanning the hosts.equiv file, the rlogind and rshd programs next scan the user's home directory for a file called .rhosts. A user's .rhosts file allows each user to build a set of "trusted hosts" applicable only to that user. For example, suppose the ~keith/.rhosts file on the math.harvard.edu computer contains the lines:

```
prose.cambridge.ma.us
garp.mit.edu
```

With this .rhosts file, a user named keith on prose or on garp can rlogin into keith's account on math without typing a password.

A user's .rhosts file can also contain hostname username pairs extending trust to other usernames. For example, suppose that keith's .rhosts file also contains the line:

```
cunixc.columbia.edu cohen
```

In this case, the user named cohen at the host CUNIXC could log into keith's account without providing a password.

.rhosts files are powerful and dangerous. If a person works at two organizations, using a .rhosts file allows that person to use the rsh command between the two machines. It also lets you make your account available to your friends without telling them your password. (We don't recommend this as sound policy, however!)

However, .rhosts files are easily exploited for unintended purposes. For example, crackers who break into computer systems frequently add their usernames to unsuspecting users' .rhosts files so they can more easily break into the systems again in the future. For this reason, you may not want to allow .rhosts on your computer.

The Search For rhosts

Because of the obvious risks posed by .rhosts files, many system administrators have chosen to disallow them entirely. One approach is to obtain the source code for the rshd and rlogind programs and remove the feature directly. This is easy to do. Another approach is to scan your system periodically for users who have these files and to take appropriate action when you find them.

You can find all of the .rhosts files on your system using a simple shell script:

```
#!/bin/sh
# Search for .rhosts files in home directories

PATH=/bin:/usr/bin:/usr/ucb:
export PATH

case $# in
1)
   if test -f $1/.rhosts; then
     echo There is a .rhosts file in $1
   fi
   ;;
0)
  (ypcat passwd; cat /etc/passwd) 2> /dev/null | \
    awk -F: '{print command, $6}' command=$0 - | \
    sort -u | sh
   ;;
*)
  echo "usage: $0 [home directory]"
   ;;
esac
```

If you are using NetInfo, change the ypcat passwd to nidump passwd.

To delete the .rhosts files automatically, change the echo in the shell script to an rm:

```
#!/bin/sh
# Search for .rhosts files in home directories
# And delete them.

PATH=/bin:/usr/bin:/usr/ucb:
export PATH

case $# in
1)
   if test -f $1/.rhosts; then
     echo "The .rhosts file in $1 has been deleted"
     rm -f $1/.rhosts
   fi
   ;;
0)
  (ypcat passwd; cat /etc/passwd) 2> /dev/null | \
    awk -F: '{print command, $6}' command=$0 - | \
    sort -u | sh
   ;;
*)
  echo "usage: $0 [home directory]"
   ;;
esac
```

Many Sun systems have been distributed with a single line containing only a plus sign as their hosts.equiv file. The plus sign (+) has the effect of making every host a trusted host, which is precisely the wrong thing to do. This is a major security hole, because hosts outside the local organization (over which the system administrator has no control) should never be trusted. If you have a plus sign in your host.equiv file, REMOVE IT. This will disable some other features, such as the ability for other machines to print on your printer using the remote printer system. In order to retain remote printing, follow the steps below.

Normally, the UNIX lpd system allows only trusted hosts to print on your local printer. However, this presents a security problem, because you may wish to let some computers use your printer without making them equivalent hosts.

The way out of this quandary is the /etc/hosts.lpd file.

By placing a hostname in this file, you let that host use your printers without making it an equivalent host. For example, if you want to let the machines `dearth` and `black` use your computer's printer, you can insert their names in `/etc/hosts.lpd`:

```
% cat /etc/hosts.lpd
dearth
black
%
```

The remote execution daemon `/etc/rexecd` allows users to execute commands on other computers without having to log into them. The client opens up a connection and transmits a message specifying the username, the password, and the name of the command to execute. Because `rexecd` does not use the trusted host mechanism, it can be used from any host on the network. However, `rexecd` requires that the password be transmitted over the network. As a result, it is susceptible to the same password snooping as Telnet.

Unlike `login` and `telnet`, `rexecd` provides different error messages for invalid usernames and invalid passwords. If the username that the client program provides is invalid, `rexecd` returns the error message "Login incorrect." If the username is correct and the password is wrong, however, `rexecd` returns the error message "Password incorrect."

Because of this flaw, a cracker can use `rexecd` to probe your system for the names of valid accounts (presumably as a prelude to intensive break-in attempts). Of course, electronic mail and `fingerd` (described below) provide easier ways for attackers to probe your computer for the names of valid accounts. If you do not expect to use this service, disable it in `/etc/inetd.conf`.

Let finger Do the Walking

The `finger(1)` program has two uses:

- If you run `finger` with no arguments, the program prints the username, full name, location, login time and office telephone number of every user currently logged into your system (assuming that this information is stored in the `/etc/passwd` file).
- If you run `finger` with a name argument, the program searches through the `/etc/passwd` file and prints detailed information for every user with a first, last or user name that matches the name you specified.

Normally, `finger` runs on the local machine. However, you can find out who is logged onto a remote machine (in this case, a machine at MIT) by typing:

```
% finger @media-lab.media.mit.edu
```

To look up a specific user's `finger` entry on this machine, you might type:

```
% finger gandalf@media-lab.media.mit.edu
```

The `/etc/fingerd` program implements the `finger` protocol, which makes `finger` service available to anybody on the network.

`finger` provides a simple, easy-to-use system for making personal information (like telephone numbers) available to other people. Novice users are often surprised, however, that information available on their local machine is also available to anyone on any network to which the local machine is connected. Thus, users should be cautioned to think twice about the information they store using the `chfn` command, and in the files printed by `finger`. `finger` makes it easy for intruders to get a list of the users on your system, which dramatically increases the intruders' chances of breaking into your system. For these reasons, some system administrators have disabled the `fingerd` network server.

Many sites disable `finger`. This can often be a nuisance to outsiders trying to determine mail addresses or phone numbers. Don't just disable it without considering this effect–the gain in security may not be very great, and the increase in inconvenience large. `fingerd` programs that are older than November 5, 1988, include the security hole that was exploited by the Internet Worm. If your `fingerd` server is older than November 5, 1988, replace it with a newer version.

Email and Security

The Simple Mail Transfer Protocol (SMTP) is an Internet standard for transfering electronic mail between computers. The UNIX program `/usr/lib/sendmail` implements both the client side and the server side of the protocol. Using `sendmail`, mail can be:

- Delivered to individual users.
- Distributed to mailing lists (of many users).
- Automatically sent to another machine.
- Appended to files.
- Provided as standard input to programs.

Mail addresses (also called aliases) are established by the `/usr/lib/aliases` file, which can sometimes be found in `/etc/aliases` or `/etc/sendmail/aliases`.

`sendmail` also allows individual users to set up an alias for their accounts by placing a file with the name `.forward` in their home directories.

Another file, `/usr/lib/sendmail.cf`, controls the configuration of `sendmail`. (There are many other network mail programs, including MMDF and PMDF. However, Berkeley's `sendmail` is by far the most common mailer on the Internet.)

`sendmail` has been the source of numerous security breaches on UNIX systems. For example, early versions of `sendmail` allowed mail to be sent directly to any file on the system, including files like `/etc/passwd`; `sendmail` supports a "wizard's password," set in the configuration file, that can be used to get a shell on a remote system without log-

ging in; and sendmail allows "trusted users," who are allowed to forge mail. sendmail can be compiled in "debug mode," which in the past has been used to allow outsiders unrestricted access to the system it is running on.

Because of its design, sendmail runs as the superuser, making its security holes significant problems for the entire system. Woe to the reputation of sendmail: Berkeley, Sun Microsystems Inc. and Digital Equipment Corp. have all sent out versions of sendmail with some or all of these security holes compiled into the programs and enabled, as have many other companies. Over time, however, most UNIX vendors have become more vigilant about sendmail security.

As one of the primary reasons to be connected to a network is to be able to receive electronic mail, few system administrators will wish to disable sendmail. You should, however, check the program to make sure that your sendmail does not have any of the obvious, well-known security holes. The three steps described below will help.

First, make sure that your sendmail program does not support the debug, wiz or kill commands. You can test your sendmail with the following command sequence:

```
% telnet localhost smtp
Connected to localhost.
Escape character is '^]'.
220 prose.cambridge.ma.us Sendmail 5.52 ready
at Mon, 2 Jul 90 15:57:29 EDT
wiz
500 Command unrecognized
debug
500 Command unrecognized
kill
500 Command unrecognized
quit
221 prose.cambridge.ma.us closing connection
Connection closed by foreign host
%
```

The command telnet localhost smtp opens up a TCP connection between your terminal and the smtp part of your local computer (which always has the alias localhost). You are then able to type commands to your sendmail's command interpreter.

If your sendmail responds to the debug or wiz command with any of the following messages–or any message other than "command unrecognized"–replace the version of sendmail that you are running:

```
200 Debug set
200 Mother is dead
500 Can't kill Mom
200 Please pass, oh mighty wizard
500 You are no wizard!
```

Second, delete the "decode" aliases from the alias file. The decode alias is a single line that looks like this:

```
decode: "|/usr/bin/uudecode"
```

The decode alias allows mail to be sent directly to the uudecode program. This ability has been shown to be a security hole. Examine carefully every alias that points to a file or program.

Third, make sure that the "wizard" password is disabled in the sendmail.cf file. If it is not, then a person who knows the wizard password can connect through your computer's sendmail daemon and start up a shell without logging in. If this feature is enabled in your version of sendmail, the wizard password is a line that begins with the letters OW (uppercase O, uppercase W). For example:

```
# Let the wizard do what she wants
OWsitrVlWxktZ67
```

If you find a line like this, change it to disallow the wizard password:

```
# Disallow wizard password:
OW*
```

Another cautionary step would be to make sure that your version of sendmail is 5.65 or greater, because earlier versions are known to have certain security holes. Your program should print its version number when you telnet to it. If it does not, there is no easy way to determine what version number it is. If your sendmail program is older than this, get the new one from your vendor or from the University of Berkeley anonymous FTP facility on the Internet host ucbarpa.berkeley.edu. Unfortunately, some vendors make proprietary changes to the sendmail program, so you may not be able to use Berkeley's unmodified version on your system.

Your system is now sufficiently secure to explore one of the major benefits of networking: sharing files between systems via the File Transfer Protocol. Next month's article rejoins the tale at this point. ⊸

***Next month's installment** will begin with an in-depth look at the security implications of FTP.*

This article is excerpted from material in *Practical UNIX Security*, by Simson Garfinkel and Gene Spafford, ISBN 0-937175-72-2, published by O'Reilly & Associates, Sebastopol, CA. For further information, contact Linda Lamb, director of marketing, O'Reilly & Associates.

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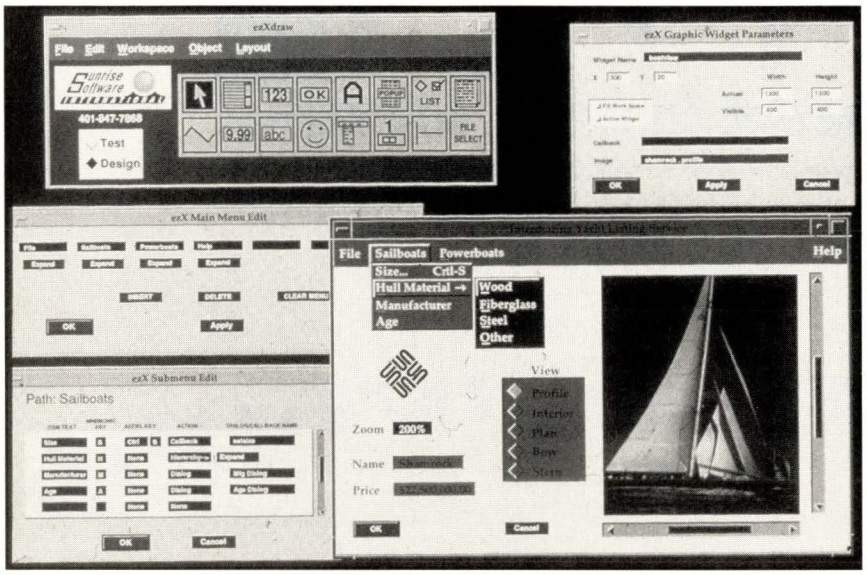


GUI-Development Kit

Sunrise Software International has announced ezX 3.0, a tool for the rapid development of application interfaces that exploit the Motif interface from OSF. Similar in philosophy, though not in design to NeXT Inc.'s NeXTStep, ezX 3.0 allows non-programmers, such as graphics designers, to put together user interfaces that then link to completed application code.

The company says that this allows software developers to focus their programmers' time on the actual production of application software, rather than debugging the behavior of Motif widgets. In addition, ezX allows developers to attach scripts to widgets, much like attaching executable programs to cards in a Hypercard stack. Thus, widgets can be made to directly execute UNIX shell scripts, query databases, and so on.

The product also includes a WYSIWYG graphical editor used to manipulate windows and Motif widgets. Moreover, ezX gives users the ability to generate UIL files, X Resource files, and C source code. ezX is available for a variety of UNIX machines supporting Motif, including Sun workstations. Pricing varies according to the installation.

Sunrise Software International, P.O. Box 329, Newport, RI 02840.
Circle 123

SBus Graphics Subsystem

An SBus card that provides GX-style acceleration has been introduced by Tech-Source.

The GXTRA 1280 SBus graphics subsystem can drive displays with up to 1280 by 1024 resolution. It also has an 8-bit color frame buffer and its own Sun-4-style keyboard and mouse port. The GXTRA runs all Sun software, including OpenWindows 2.0.

The company says that GXTRA supports multiple graphics users on a single SPARCstation, or it can drive multiple displays. Pricing begins at $2,250.

Tech-Source Inc., 442 S. North Lake Blvd., Altamonte Springs, FL 32701.
Circle 124

X-Window Accelerator

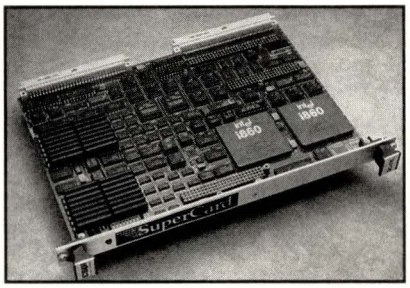
Megatek has debuted an X-window accelerator for SBus. A two-slot board set, the X-Cellerator offloads parts of the X environment from a workstation CPU, and thus improves overall performance.

Designed for Sun SPARCstations and SBus-based SPARCalikes, the product includes X software drivers and a dedicated graphics coprocessor. The product also has local memory (of 2 MB, 6 MB or 10 MB) and 8-bit color frame buffer.

X-based applications, OSF/Motif and Open Look can be accelerated with the product. Moreover, it supports SunView, OpenWindows and applications that run on a Sun CG3 color frame buffer.

Pricing begins at $3,500.

Megatek Corp., 9645 Scranton Road, San Diego, CA 92121.
Circle 125



160-MFLOPS Processor for VME

An i860-based vector processor for VMEbus has been introduced by CSP. The SuperCard 2C-2XL/VME is a 6U VMEbus module supporting up to 160 MFLOPS via two Intel i860 processors. The product offers 16 MB of memory and a 40-MB-per-second VSB interface. It is targeted at such signal-processing applications as sonar, radar, seismic, simulation and real-time processing.

Software available for the machine includes signal, image and seismic processing libraries, along with C and FORTRAN compilers. In addition, the product supports the pSOS real-time OS, and the Unison UNIX-workalike OS.

Pricing begins at $8,500.

CSP Inc., 40 Linnell Circle, Billerica, MA 01821.
Circle 126

Gold Line Power

The Accupower Gold AU1000 and AU1500 UPS systems for LANs and workstations produce 1000 VA and 1500 VA, respectively. Both have an RS232 serial communication port that provides an intelligent interface to networks for reporting UPS status, and for remote control and shutdown of the products.

The products accept line voltage as low as 90 VAC before going to battery. They will operate at temperatures to 35°C, at altitudes to 3,000 meters, and humidity to 95% (non-condensing).

The AU1000 is priced at $1,499 and weighs 36 pounds; the AU1500 is $1,999 and weighs 59 pounds.

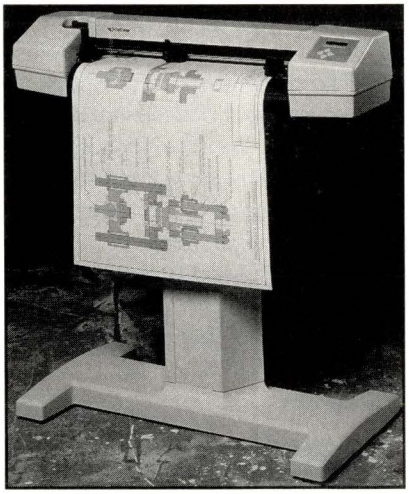
Emerson Computer Power, 15041 Blake Parkway, Ste. L, Irvine, CA 92718.
Circle 127

Wrist Rest For Workstations

JMJ has introduced a wrist support that helps protect workstation users from carpal tunnel syndrome (CTS) and repetitive strain injury (RSI).

The Komfort Wrist Rest is a two-piece assembly consisting of a base and an adjustable foam support. The product fits just in front of a computer keyboard and provides additional support for users' wrists and forearms. Typically, the arms of typists and keyboarders are unsupported, resulting in such white-collar job injuries as CTS (the compression of the median nerve in the wrist) and RSI (strains and sprains of the upper limbs over a long period of time).

The product is priced at $35.
JMJ Enterprises, 22855 Lake Forest Ave., Ste. E202, Lake Forest, CA 92630.
Circle 128



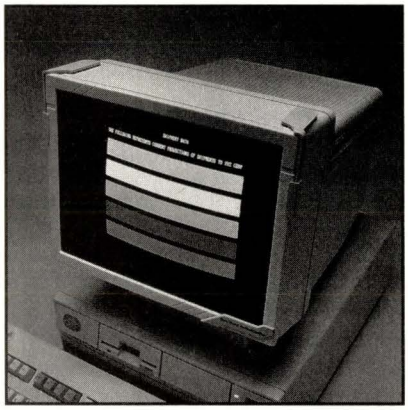
High-Speed Pen Plotter

The Pacesetter Model 2024 and Model 2036 high-speed pen plotters accommodate plot sizes ranging from A to D, and A to E, respectively. Both are eight-pen plotters and both accommodate liquid ink, liquid ball, plastic and fiber-tip pens and plot on bond, polyester film, translucent and vellum.

The two machines can plot at speeds up to 42 inches per second for quick

plots, and 20 inches per second in final mode. There is also an optional 1-MB memory-expansion module that allows users to download entire plot files from the host computer, which frees up the host for other tasks. The Pacesetter machines each come with an RS232C serial interface.

Pricing on the 2024 begins at $4,295 and on the 2236 at $5,595.
Calcomp, 2411 West La Palma Ave., Anaheim, CA 92801.
Circle 129



Glare Guards Debut

OCLI has redesigned a line of glare and radiation filters for PCs and workstations.

The Glare/Guard line of filters snap onto a screen via a patented two-point side-mount suspension hanger. The various filters screen out between 90% and 98% of the low-frequency radiation associated with computer screens and terminals.

Pricing ranges from $24.95 to $249.
Optical Coating Laboratory Inc., 2789 Northpoint Parkway, Santa Rosa, CA 95407-7397.
Circle 130

Multifunction Optical Subsystem

The OptiXchange 940 multifunction optical subsystem supports both write-once and rewritable 5 1/4-inch disks. Moreover, the company says that the product incorporates phase-change technology.

The OptiXchange 940 uses a Panasonic 7014 multifunction optical drive with the company's own SCSI interface–the Ten X OCU, which makes the optical drive appear as a magnetic disk drive to the host system without the need for unique optical-disk software drivers. The product supports up to 1 GB per platter of magneto-optical media, and up to 940 MB per platter of write-once media.

Pricing begins at $5,495.
Ten X Technology Inc., 4807 Spicewood Springs Road, Bldg. 3, Ste. 3200, Austin, Texas 78759.
Circle 131

Suns Have Inertia

Modern Computer Aided Engineering has released the Inertia engineering-system-software package for Sun SPARCstations and SPARCalikes.

Inertia is a computer-aided engineering package that integrates finite-element analysis, and large-displacement kinematics and dynamics analysis. The company says the product gives users the ability to model complex mechanical components and building structures. It has a 3D mesh generator that can place a grid pattern on almost any type of component, regardless of its irregularity.
Modern Computer Aided Engineering Inc., 1231 Cumberland Ave., Ste. A, West Lafayette, IN 47906
Circle 132

DOS and OS/2 Server

Logicraft has introduced an MS-DOS server and an OS/2 server that can be accessed by almost any UNIX RISC system.

Called 486Ware/ 386Ware and Omniware, the products are PC or PS/2-class devices that reside on a network and can then be accessed by UNIX machines. The products run MS-DOS, OS/2 or SCO UNIX applications, and then provide those applications to displays on non-Intel machines.

The products provide the above operating systems to DEC DECstations and VAXs, Sun-3 and Sun-4 workstations, SPARCstations and SPARCalikes, HP Apollo 9000 Series 400 workstations, IBM workstations, and Intergraph machines. Multiple PC windows can be opened simultaneously with native UNIX windowing systems such as DECwindows, OpenWindows, OSF/Motif, HP VUE, and SunView. Users can copy and paste between UNIX and PC windows.
Logicraft Inc., 22 Cotton Road, Nashua, NH 03063.
Circle 133

SBus Expansion Box

The Model 9100 SBus expansion box provides four SBus slots that will perform both master DMA functions and slave functions. In addition, the Model 9100's internal expansion can accommodate four SCSI devices, such as fixed disk, optical disk, 1/4-inch tape and so on.

The 9100 links to a SPARCstation 1, 1+, 2 or IPC. It does not require host driver software and comes equipped with a host adapter card and cables. Up to three 9100s can be added for a total of five, six, eight, nine or 12 usable slots.

Pricing begins at $2,595.
Texas Microsystems Inc., 10618 Rockley Road, Houston, TX 77099.
Circle 134

C Development Environment From IDE

IDE has introduced a new C Development Environment. New modules include reverse engineering and code generation, which enable engineers to synchronize code and design.

There are also improved facilities for querying the shared repository and navigating through designs, code and documentation. The complete environment includes IDE's flagship product, Software Through Pictures, Saber-C, FrameMaker or the Interleaf Technical Publishing System, and the new modules. The environment runs on the SPARCstation under SunOS 4.1.1, as well as the DECstation, HP 9000 and IBM RS/6000.

Pricing varies, based on number of users and modules purchased.
Interactive Development Environments Inc., 595 Market St., 10th Floor, San Francisco, CA 94105.
Circle 135

Language Translation For SPARCstations

Logos has brought out version 7.0 of its foreign-language translation software for the SPARCstation 2.

The Logos Intelligent, Automatic Natural Language Translation Software package is available with English and German as source languages and English, German, French, Spanish and Italian as output languages. The package provides support for user dictionary, semantic updating and post-editing functions.

Pricing is based on number of language pairs purchased and ranges from $75,000 to $150,000.

Logos Corp., 333 Elm St., Dedham, MA 02026.
Circle 136

Small, Secure UPS

Best Power Technology has introduced what it is calling "the smallest, smartest true no-break" UPS.

Called Fortress, the system is available in 360, 460 and 660 VA models. It provides alarm, battery and line-status lights, as well as a lighted-digital reader that displays load-dependent runtime, percent loading, voltage in/out and battery-voltage readings. Fortress also comes with a smart communications port that allows computers and LANs to interface directly with the UPS.

Best Power Technology Inc., P.O. Box 280, Necedah, WI 54646.
Circle 137

Trackball for Sun, SGI Systems

The latest versions of the S-TRAC trackball for Sun and Silicon Graphics systems are now available from MicroSpeed.

S-TRAC is compatible with the Sun-3, Sun-4, SPARCstation and 386i workstations, and the entire spectrum of SGI workstations. The trackball is available in three versions: RJ-11 and Din 8 for Sun and DB9 for SGI. Improvements have been made to the design of the product, in areas such as button location and access, and wrist-angle position required during use.

Suggested retail price is $199.

MicroSpeed Inc., 44000 Old Warm Springs Blvd., Fremont, CA 94538.
Circle 138

Open Look For HP 9000

MJM's version 4.0 of the Open Look Intrinsics Toolkit (OLIT) is now available for the HP 9000 family of workstations running HP-UX 8.0.

The company also has announced the availability of Open Look and Open Look/Native Language Support (NLS) 2.0 for HP-UX. All versions will run on the new HP 700 series machines. The MJM products implement AT&T's OLIT version 4.0 and Sun's OLIT 2.5.

A single-user license for OLIT 4.0 is $2,660 for the HP 720; Open Look/NLS for the 720 is $3,995. Volume discounts apply.
MJM Software, 17 Clyde Road, Ste. 202, Somerset, NJ 08873.
Circle 139

Image Processing For Earth Sciences

ER Mapper (Release 2.0) is an image-processing software product that processes and integrates raster and vector data for geoscience applications.

A product of Earth Resource Mapping, ER Mapper supports real-world coordinate systems and processing of very large data sets. Images may be displayed on any 8-, 24-, or 32-bit high-resolution X-displays or X-11-based workstations on a network. The system runs under Open Look and Motif.

For $14,000 a single user gets ER Mapper, 120 MB of more than 20 sample datasets, a four-volume set of manuals, more than 20 standard algorithms and drivers for more than 30 hardcopy devices. Evaluation licenses for $200 and education licenses for $2,000 are also available.
Earth Resource Mapping, 4370 La Jolla Village Drive, Ste. 400, San Diego, CA 92122.
Circle 140

Plotter/Duplicator

The HCS 536-XL plotter/duplicator boasts print speeds of 10 ips at 400 dpi. Print media includes plain paper, vellum, polyester or Mylar.

Features include multiple prints (up to 99), multiple roll feeding (up to three rolls of paper), interface to folding machines, continuous scaling, paper cutting (manual override) and set collation.

An optional LAN interface provides access to several CAD workstations and digital archiving systems, while the standard parallel and serial interfaces provide connection to existing equipment.

The product supports most common graphics languages, including Calcomp 906/907, 95X, HPGL-2 and VRF formats. Base price is $129,500.
HSC/Savin Engineering Systems, 9 W. Broad St., Stamford, CT 06904.
Circle 141

PostScript Accelerator

The Mustang PostScript Accelerator interface is a printing accessory for the HP LaserJet series II and III laser printers.

Features include a National Semiconductor 32-bit 32CG160 processor and special coprocessor running at 25 MHz that outputs 10 times faster than existing LaserJet cartridges. An Intel FLASH ROM and the company's Update Program provides in-the-field upgrading via printer cable. The product includes 35 Type 1 PostScript fonts and supports downloaded Type 1, Type 3, Bitstream Fontware and others.

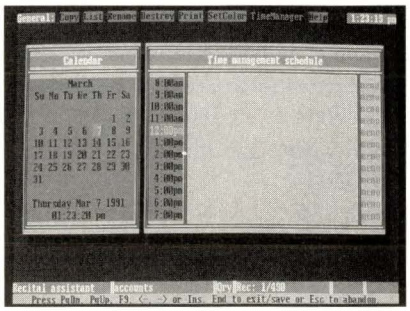
Introductory price is $1,590 and includes 2-MB FLASH ROM and 2-MB RAM. Another $350 gets you a 4-MB RAM version.
Pyramid Computer GmbH, Bötzinger Str. 60, D-7800 Frieburg, Germany.
Circle 142

QMS Printers

QMS introduces two new members of its ColorScript family. The lower-end 4-MB ColorScript 10*p* printer supports letter-size paper and transparencies. The top-of-the-line 12-MB ColorScript 30*si* can print 11-by-17-inch full bleeds for color proofing and graphic arts.

The 10*p* model offers a choice of two ink rolls: one for busines presentations and a second for Pantone-approved colors. In addition to the large-size, 11.75-by-19.3 paper, the 30*si* supports letter and 11-by-17 paper and transparencies.

The 10*p* sells for $6,995. The next-in-line 5-MB 10, which prints legal-size documents, sells for $8,995. The price for the 8-MB 30*i* model has been reduced to $10,995. Lastly the 30*si* sells for $12,995.
QMS Inc., One Magnum Pass, Mobile, AL 36689.
Circle 143



New Version of Recital

Recital 7.0 offers enhanced database-management capabilities for application developers and added productivity features for users. The company has added such features as a built-in "dynamic compiler," a pop-up time-management scheduler, relational multirecord table fields in forms, split-screen relational browse; database, form and report triggers.

Recital is a fourth-generation development environment with a relational database management system for VAX/VMS and over 70 UNIX platforms. Its client/server architecture facilitates information management across both homogeneous and heterogeneous networked environments. The Recital server interface is independent of database architectures and supports transparent database management for a number of database engines such as Rdb, RMS and Oracle.

The Recital development environment provides a visual user interface utilizing pop-up choice lists, pull-down menus, dialog boxes, and other intuitive interfaces for developers and users. At the core of the Recital engine is the Applications Data Dictionary that takes an object-oriented view of application development.

A single-user UNIX license is $995.
Recital Corp., 85 Constitution Lane, Danvers, MA 01923.
Circle 144

Tempest-Compliant SPARCstation

The 2GX graphics workstation has nearly twice the speed of the Tempest SPARCstation 1+, maintaining Sun's compact design. All of the system's electronics, including mass storage, are contained within Sun's small "pizza-box" CPU enclosure. The product is aimed at RISC/UNIX government users and contractors requiring secure hardware capabilities.

The Tempest-compliant packaging features 16 MB of memory and accelerated 2D graphics, including fast windowing and text. The system enclosure has a key-lockable front door to allow controlled access to the power switch, the floppy drive and removable hard-disk drives. Up to two optional 207-MB hard-disk drives can be included in the system enclosure. An optional Desktop Storage Pack with a 150-MB, 1/4-inch SCSI tape and an optional Desktop SunCD Pack with a 644-MB CD-ROM drive are also available.

The system's 40-MHz CPU offers 21 SPECmarks, 28.5 MIPS and 4.2 MFLOPS. The standard product includes a 19-inch, high-resolution color monitor, 8-bit accelerated 2D/3D graphics (using the GX graphics accelerator), a 3 1/2-inch DOS-compatible floppy drive, a keyboard and mouse. It also has integrated external ports for Ethernet, serial RS423 and SCSI-2 peripheral support.

Prices start at $29,995.
Sun Microsystems Inc., 2550 Garcia Ave., Mountain View, CA 94043.
Circle 145

FYI

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

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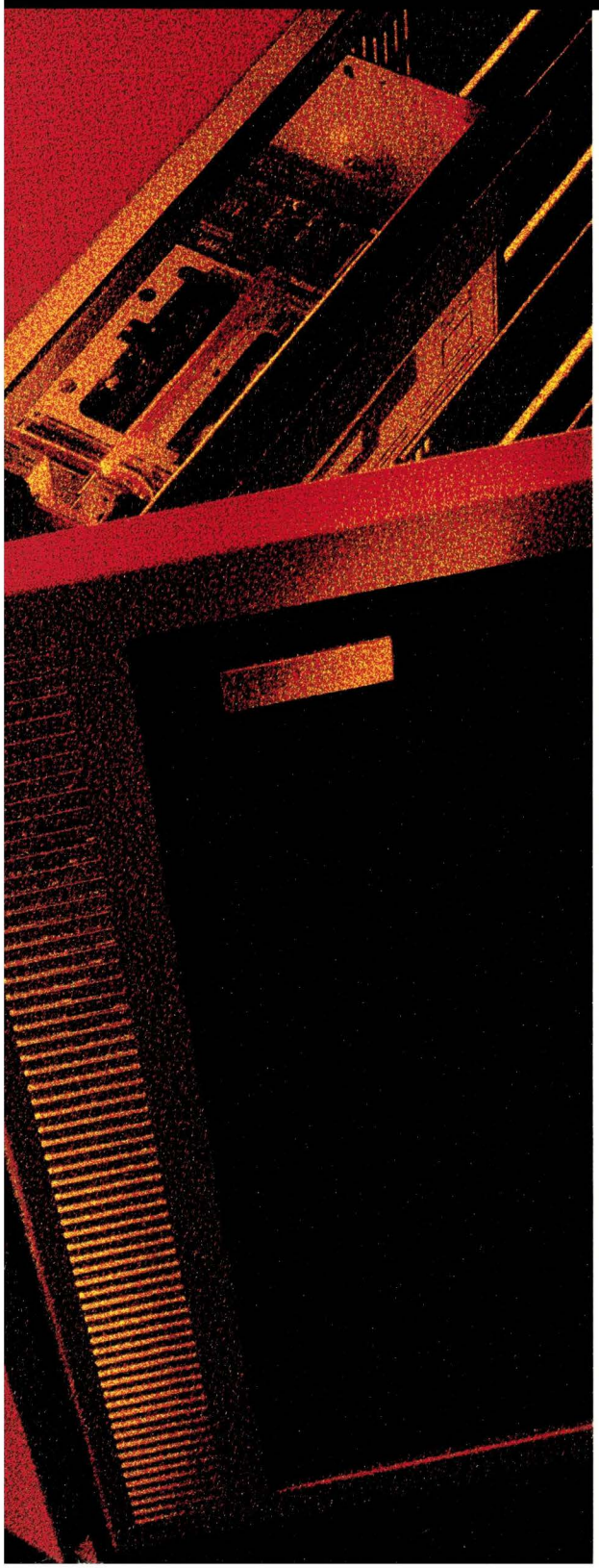
Introducing the cost-effective subsystem designed to grow when you do.



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The Parity PS5900™ Tower is the only hard disk and tape subsystem that's made to your specifications! That's right, you choose the size, speed, and configuration that fits your Sun, IBM RS6000, Solbourne or Silicon Graphics workstation needs. Because we configure the Tower specifically for you, our subsystem capacities range from 4.8 to 39 GB.

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Our enclosures feature self-contained slide-in drawers for easy product upgrades. Simply add Winchester disk, tape (DAT, Streaming, 8mm), or optical drives when you need them. Service is a breeze, and our 5-year warranty on disk drives is unbeatable.

Now Shipping.

For more information on how you can be up and running with our Parity PS5900 Tower subsystem, call today **408/378-1000**.

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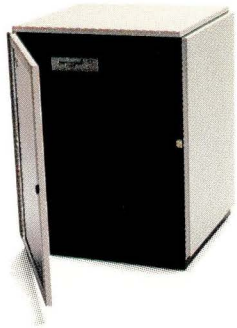
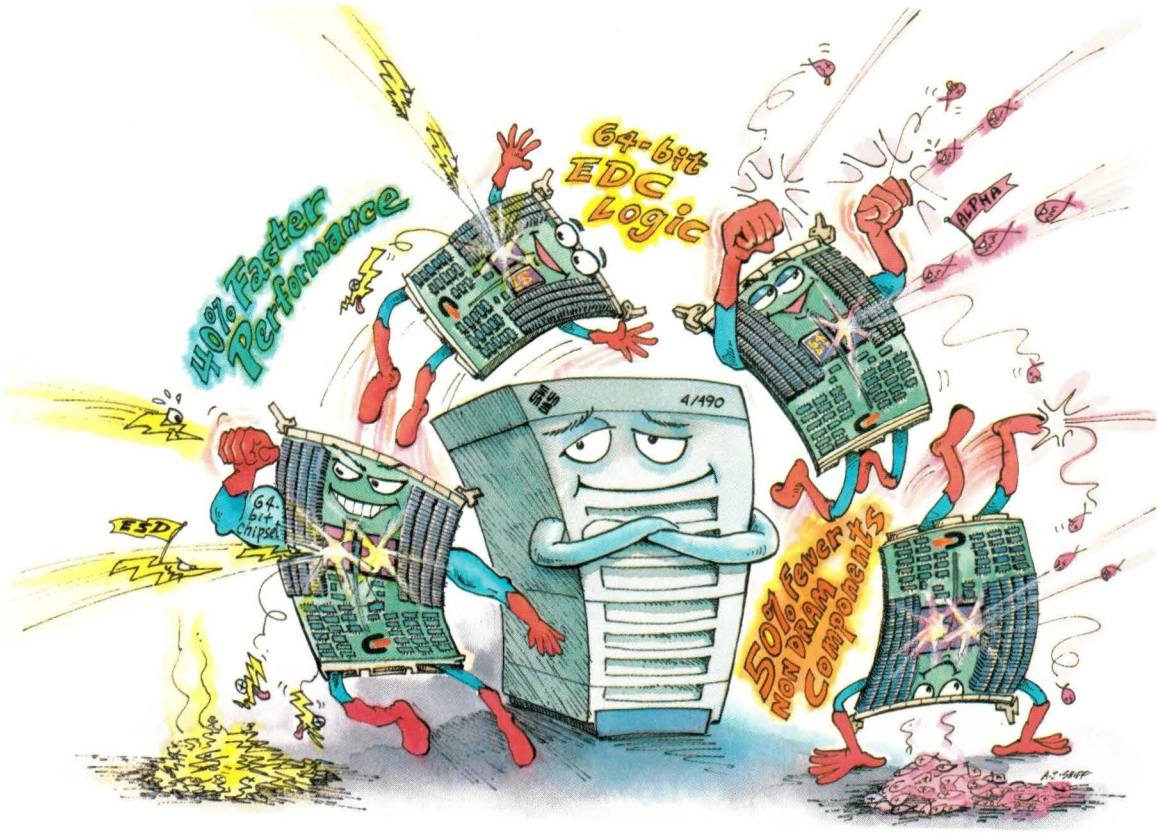


The Only Fault-Tolerant Memory for SPARCserver 490 Systems



Unstoppable Memory from Clearpoint, of course!

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

Dynamic Bad-Bit Replacement

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

Increased Performance

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

Increased Reliability is Built In

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

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

Call or write for more information!

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

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