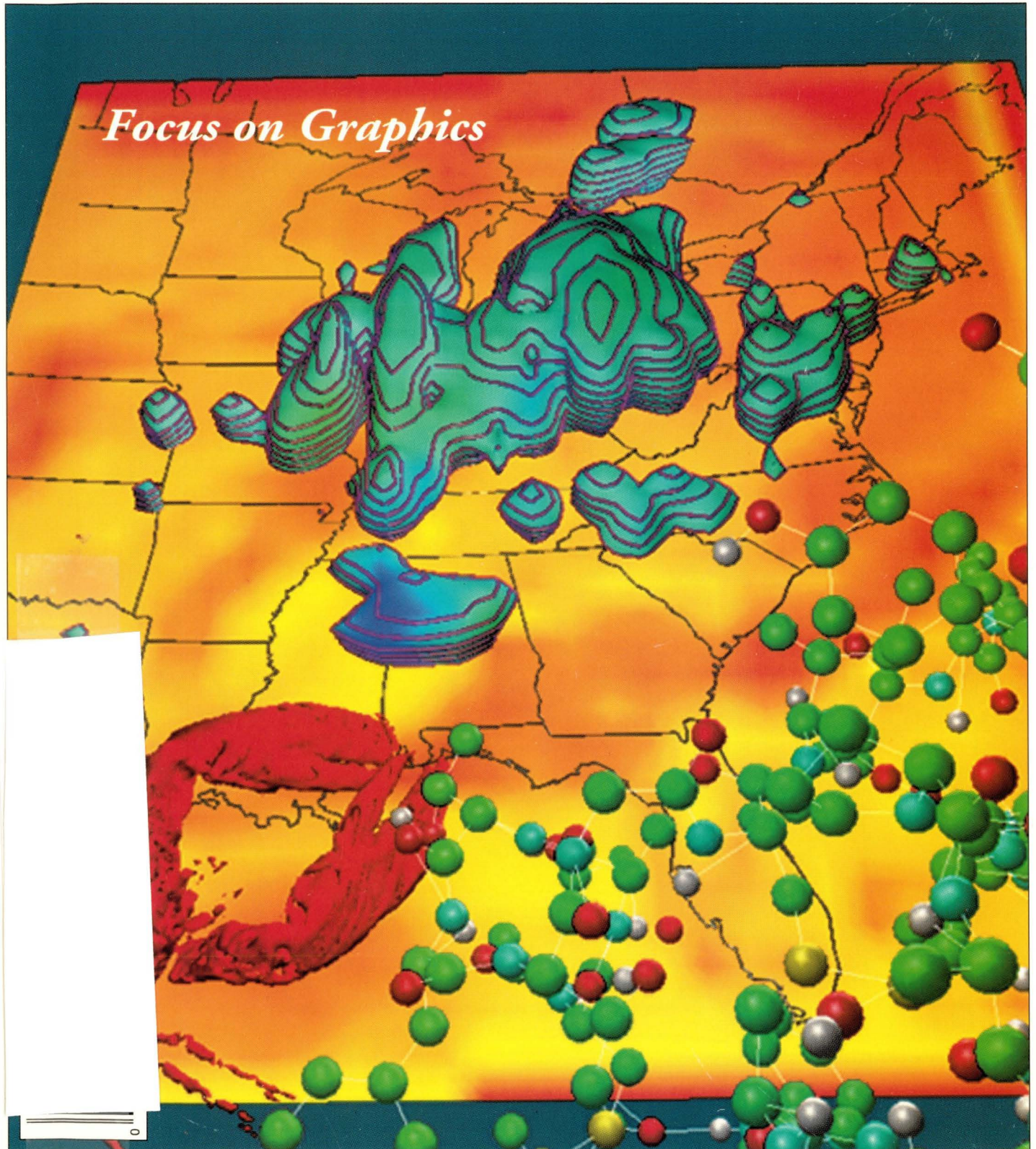


# SUNEXPERT

Serving the Solaris/UNIX Workstation Network

JULY 1993 Vol. 4 No. 7 \$5.50



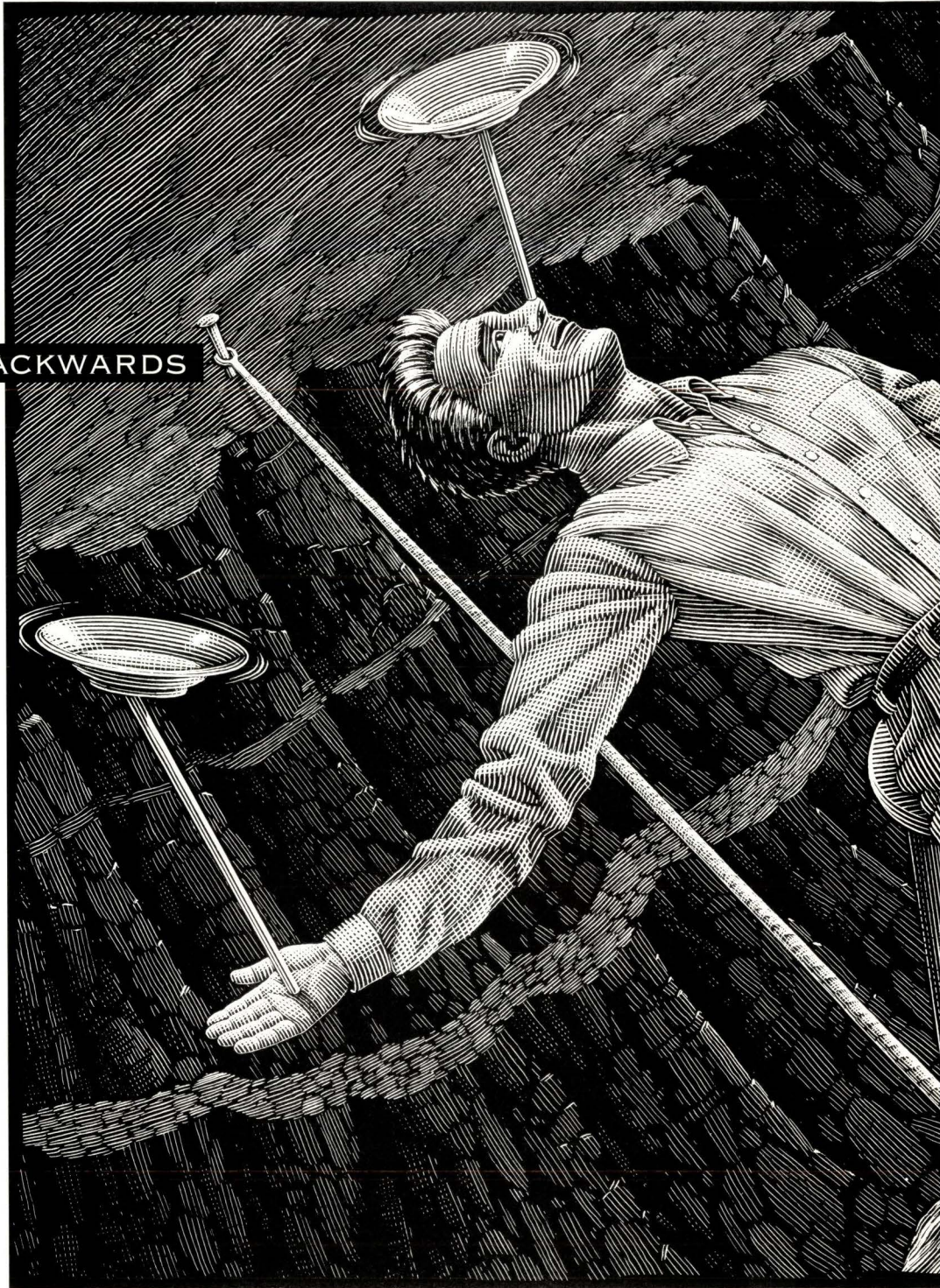
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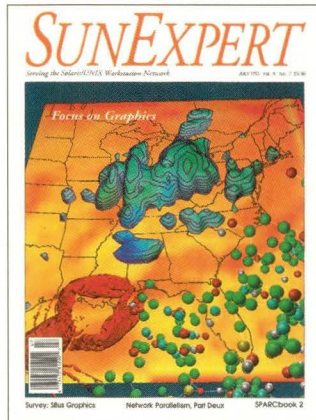
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Cover generated by Advanced Visual Systems in Waltham, MA. Regional acid deposition model from the U.S. Environmental Protection Agency, ball-and-stick representation of a protein molecule, lobster produced from Magnetic Resonance Imaging (MRI) data.



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### SUNEXPERT

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

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# Editorial

## Dinosaurs in a Noonday Sun

This issue of *SunExpert* takes "Sun and graphics" as its theme, a notion that can be a bit difficult for many of us. As everyone knows, Sun workstations simply aren't celebrated for the flashy technicolor pictures that show up in blockbuster movies and the like.

The closest we've come to finding something really glitzy is a rumor (which we've not been able to confirm) that somewhere in *Jurassic Park*, this summer's megahit movie complete with a slam-dancing T. rex, there might be a Sun workstation.

But even though Suns aren't known for their pretty pictures, it is amazing how much graphics and imaging gets done on them just the same. Quite simply, as open, inexpensive and yet powerful machines, Sun workstations have become *the* choice of people who want to do both graphics/imaging and general-purpose computing.

Thus it is that there may not have been a Sun used in the animation of the dinosaurs in this summer's hit. But readers will remember that last February, *SunExpert* ran a story about a project that used a Sun to visualize CAT scans of dinosaur eggs and diplodocus skulls.

And maybe there's something symbolic in that. Other systems, and dedicated devices, can have their imagined dinosaurs. The Sun community, however, will be quietly content with the real thing.

If you're looking for a little graphics muscle, be sure to check out our SBus graphics survey. While the vendors in the survey may not offer the product variety found in the PC or Macintosh add-on market, SBus options are growing.



Michael Jay Tucker  
Executive Editor

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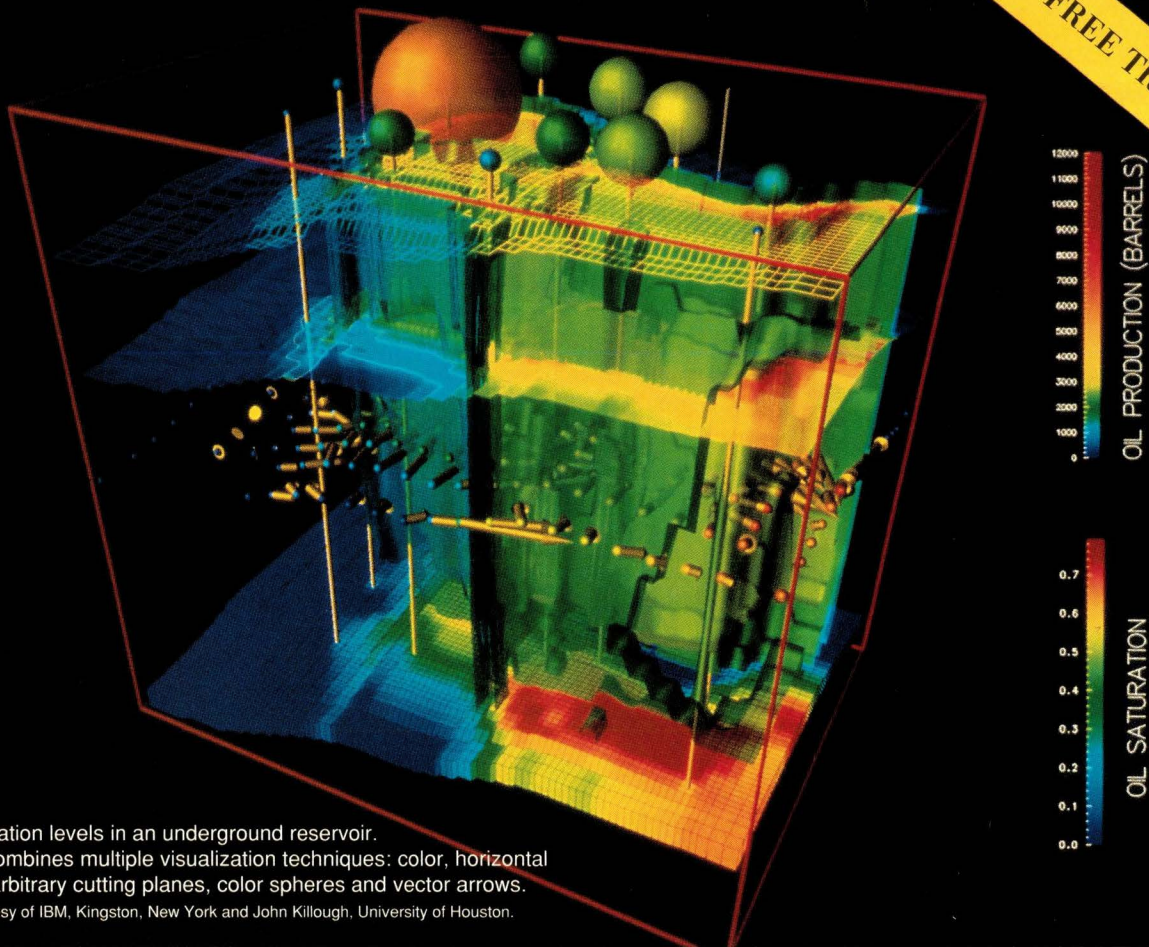
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# LETTERS

"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

## The Rest of the Story

Dear Editor:

I found the SPARClike update (*SunExpert*, April, Page 48) interesting and informative. However, the article was seriously lacking in that there was no discussion of either SPARC International (SI) or the SPARC Compliance Definition (SCD).

The author says, "As many resellers—and customers—have found out the hard way, sometimes 'clones' and 'compatibles' have proven to be neither" but then failed to inform the readership how this problem can be avoided.

The SCD trademark, the cornerstone of SI's program, lets buyers know that SPARC systems, application packages, board-level products and chips that carry the trademark have been tested by SI and are compatible with each other at specific levels of SCD. This eliminates the need for buyers to depend solely on the claims of manufacturers, representatives or resellers that their products are compatible. Produced cooperatively by many leading SPARC platform and software suppliers (including Sun), the SCD is the most broadly accepted and endorsed binary specification in the computer industry.

Brian McIntosh  
Vice President  
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hcc-uni!bjm@uunet.ca

## Costly Switcheroo

Dear Editor:

Regarding Sun's switch to Motif, I have a suggestion for Sun. If Sun wants to keep all of the customers who

are developing code using XView happy, how about providing, FREE, one of the XView-to-Motif converter packages to those customers. We have a big investment in source code written under XView. It will be very difficult, if not impossible, to convince company management that rewriting all of our code to run under Motif is a cost we have to pay to be compatible. I also do not understand why we have to pay for a third-party package to do XView-to-Motif conversion when Sun provided SunView-to-XView conversion tools with the first versions of OpenWindows.

Alternatively, how about making a version of XView that supports the Motif look and feel? At least we could preserve our investment in source code. Newer software could be developed with the more traditional Xt tool kits, but existing software would still be maintainable.

Of course, we aren't worried right now, because we haven't begun to schedule a port of our software to Solaris 2.0, another massive change that has been forced upon us. Believe it or not, our company would prefer to update our software to fix bugs and add new features, not to rewrite it just to keep up with all of the turmoil in the UNIX/GUI wars.

Merle F. McClelland  
Project Engineer  
Biomagnetic Technologies Inc.  
9727 Pacific Heights Blvd.  
San Diego, CA 92121

## Thanks for UUCP

Dear Peter Collinson:

I am Vladimir Zaborovski from St. Petersburg Technical University (Russia), but now I am in Stockholm at the Royal Institute of Technology. I derived great pleasure from your article about UUCP in such an authority as *SunExpert*. The January article on UUCP [Page 24] has convinced many of my friends that UUCP didn't die and that TCP/IP is not the only option. I successfully used UUCP in my network activity in Russia, and I'm now trying to organize a UUCP infor-

mation exchange (for research, education and ecological problems) between Swedish and Russian universities. Thank you very much for your interesting article.

vladimir@nada.kth.se

## A Different Version

Dear Editor:

Thank you for featuring Softool in "Checking Out SCM" (*SunExpert*, March, Page 71). We enjoyed the article very much but would like to point out an erroneous statement about Softool made by Mr. Adam Zais from Atria Software. Mr. Zais says, "We are also different from SCCS and RCS and the companies whose products are based on them, like TeamOne and Softool."

If he had done his homework, Mr. Zais would have found that SCCS and RCS are equivalent to a very small subset of the functionality and power of the Softool products.

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# NEWS

## Scorpion Shows its Sting

Sun Microsystems Computer Corp. has taken the wraps off the long-awaited Scorpion server. Now officially titled the SPARCserver 1000, the middle-range system offers mainframe-style computing in a box that could fit comfortably on a coffee table. Pricing begins at \$36,700.

The 1000, a multiprocessor device, supports up to eight SPARC processors. Sun says that its maximum, eight-way configuration offers 400.8 transactions per second (tpsA), when measured with the Transaction Processing Performance Council Benchmark (TPC-A). The server's SPEC numbers

*The SPARCserver 1000 is Sun Microsystems Inc.'s newest middle-range, departmental system. It can provide up to eight processors in a package small enough to fit onto a coffee table.*

are similar—with a SPECint92 of 10,113 and a SPECfp92 of 12,710. Its NFS file server performance, meanwhile, is 1,400 NFS operations per second.

The TPC-A numbers are important given that the machine is meant for commercial, database-intensive applications. The SPARCserver 1000 got its 400.8-tpsA number while running Oracle7, the new version of Oracle Corp.'s RDBMS. However, Sun says that "all the leading relational database management products" will be available for the system. This claim speaks volumes about how and where Sun expects to sell the machine. Sun says it will promote migration tools designed to bring DB2 and CICS applications to the SPARCserver 1000.

Like all of Sun's new system products, the SPARCserver 1000 runs Solaris 2.2.

The Scorpion is designed to be upgraded easily. Apparently, Sun assumes the buyer will probably start small and work up as the need arises. Thus, a single processor system, offering 135 MIPS, can grow to a total of 1,000 MIPS by simply plugging in additional SPARC-based modules. Similarly, the server's memory and storage can be upgraded with relatively simple add-ins. The machine can sup-

port up to 2 GB of memory, 8.5 GB of internal storage and 100 GB of external storage.

The SPARCserver 1000 also supports up to 12 SBus expansion slots and four I/O channels, the latter giving an aggregate throughput of 200 MB/s. Internally, meanwhile, it uses the XDBus for processor communication.

Sun says the product is meant for commercial settings of 50 to 1,500 users. It expects to see the SPARCserver 1000 in such applications as manufacturing, retail, branch automation, decision support, information publishing, engineering and other commercial settings.

The SPARCserver 1000 has already garnered some significantly good reviews from the critics. "Sun has done a marvelous job of packaging an enormous amount of power into a very small box," says Peter S. Kastner, vice president of the Aberdeen Group, a Boston-based market research and computer consulting firm.

In fact, Kastner thinks that the 1000's only real problem will be that buyers will have some psychological problems adjusting to the fact that so much computer is packed into so tiny a box. "People may be a little taken aback being asked to pay so much for such a little space," he says. Still, he adds, "We think they [SPARCserver 1000s] will do well...particularly in the commercial market."

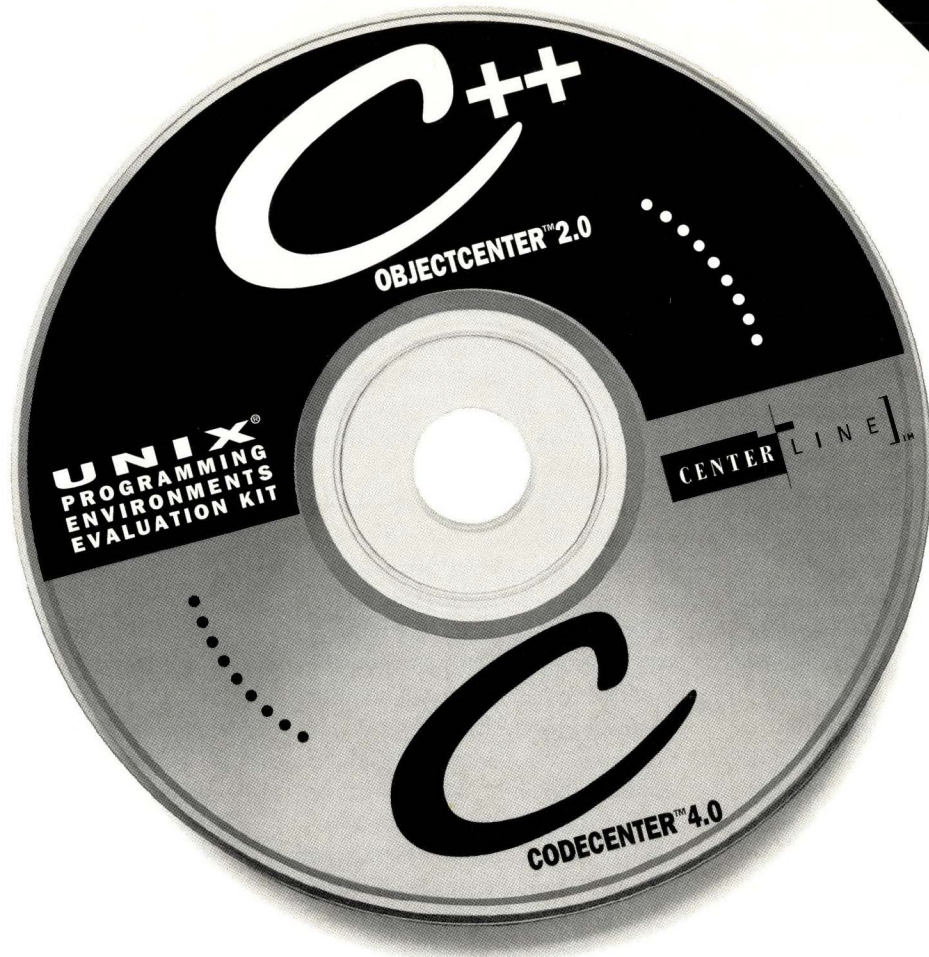
## Sun to Show Imaging

This month, Sun Microsystems Inc. revealed two new graphics products (see "Suns In the Picture"). It also signalled a new "technology direction" for imaging. This will be a chip-level device, fitting on the motherboard of a SPARCstation 10, that would give standard workstations an imaging ability exceeding some, far more expensive, dedicated devices.

Tentatively called SX, though code-named "Spam," the chip would fit on the motherboard so that it could quickly and easily manipulate large amounts of data from memory—something that more leisurely graphics applications don't need to do. This would give a SPARCstation 10 with SX the ability to quickly and (relative-



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ly) easily take in, process and display photos, medical images, graphics and even live video.

Sun says that SX will be an option rather than a feature, available on SPARCstation 10s at an additional price, for users whose daily work requires image processing. The company expects to find markets for SX in such applications as photo retouch, desktop publishing and page layout, desktop video, geographic information systems, geophysical imaging, medical imaging and so on.

SX is already running and is being shown to potential customers. It is expected to ship "sometime before the end of 1993."

The long-term market consequences of SX for the imaging industry could be significant. While manufacturers of very high-end systems, such as Danvers, MA-based Datacube Inc., will be unaffected by the introduction, several low-end vendors will. If users can get the kind of performance they need by simply penciling in an SX option on a Sun purchase order, rather than buying a board, they will. Some vendors who had hoped to bring their imaging technology up from PCs may find they have no market.

The SX also represents a continuing strategy on Sun's part. While the workstation vendor has always declined to enter the high-end (and high-priced) graphics market, where buyers can be few and far between, it has always maintained an interest in imaging and imaging processing. In those fields, volume markets are a bit easier to come by.

### **Wild Ride at Siggraph**

No graphics issue would be complete without mention of Siggraph, the industry's flashiest computer graphics show. Cosponsored by the ACM and IEEE, the computer world's equivalent of Cannes will meet this year in Anaheim, CA, from August 1 to 8.

The advance program of this year's show suggests that Siggraph will be its usual combination of the wild and the woolly, with courses and technical sessions ranging from tutorials on programming with PEXlib to a panel entitled "Nan-o-sex and Virtual Seduction."

However, attendees interested in (literally) E-ticket applications, may wish to check out a Friday panel, "Digital Illusion: Theme Park Visualization." The session will examine the use of computer graphics and digital imaging in one of the most glamorous of industries—the theme park. While most researchers have been only thinking "virtual reality" for less than a decade, places like Disneyland have been doing it for years. And, now, theme parks are turning to computers to make their illusions more realistic, more entertaining and less expensive.

They have powerful reasons to do so. Conventional rides, like roller coasters and such, are very big ticket items, costing in the multiple millions. "Here are the economics of all this," says panel chair, Clark Dodsworth, a producer at Chicago-based computer consulting group Rising Star Graphics. "It costs a theme park \$3 million to \$5 million to build a conventional iron coaster. Another X annually to run and maintain it, and a great deal of money for liability insurance. Both a roller coaster and a motion-platform attraction, for example, have the same cost per unit of capacity, about \$5,000."

But a ride that makes use of computer graphics of the virtual-reality type might cost \$1 million to \$2 million, and take up far less space. "That kind of ride takes less than an acre, instead of several acres, costs much less to maintain, and the insurance is significantly less, perhaps half. In addition, you can refresh the experience by doing a new four-minute film and reprogramming the platform," explains Dodsworth.

Which is not to say that merry-go-rounds and their ilk are endangered. "Theme parks will always have traditional rides," says Dodsworth. "But in the mix of attractions, new sorts of rides are useful." And theme parks the world over are exploring computer media and establishing relationships with movie companies whose productions can provide both themes and film clips for new rides.

The panel itself will be composed of some of the leading names in the computer-based theme-park-ride business.

While the program is subject to change, as of press time, the panelists will include Kevin Biles of Kevin Biles Innovative Artists; Richard Edlund, president of Boss Film Studios; Michael Harris of the NCR Human Interface Technology Center; Phil Hetteema, vice president of Attraction Development at Universal Studios; Mario Kamberg of MCA Recreation Services; Brenda Laurel of Interval Research Corp.; Sherry McKenna of Rhythm & Hues; and Allen Yamashita of Entertainment Design Production Group.

### **Sun Curls with Vines**

Sun has gained yet another alliance in the world of PC networking. In May, SMCC announced a relationship with Banyan Systems Inc., Westboro, MA. Under the terms of the agreement, the two companies will cooperate in porting Banyan's Vines networking technology to Solaris on SPARC. Sun and Banyan say that Vines will be on SPARC by the first half of 1994.

Vines is one of the premier network operating systems on personal computers—both PCs and Macintosh systems. Its presence on SPARC (where it joins Novell Inc.'s NetWare) will mean that Sun systems and networks will have access to almost the whole range of PC LANs now in place—an advantage Sun executives are quick to point out. "Our tag line at Sun is 'the network is the computer,'" said Sun CEO Scott McNealy. "Or, as we've recently dusted it off, 'the network is *still* the computer.'"

Once in place, Vines will provide Sun users with not only networking but also connectivity. With it, SPARC systems will be able to share data, files, applications and print services with similarly equipped systems running MS-DOS, MS-Windows, OS/2, Mac OS and UNIX systems. The two companies say they believe that this alone will make Vines on SPARC particularly attractive to such markets as telecommunications, financial services and the federal government.

In some ways, the Banyan-Sun agreement is similar to Sun's arrangement with Novell. Like Novell, Banyan must feel some concern over NT, which is

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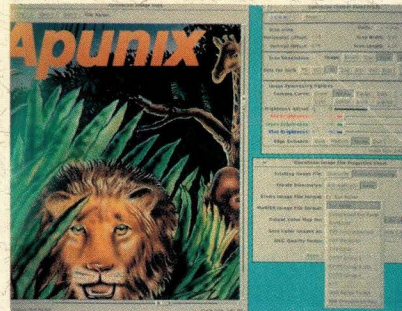
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The color scanner for commercial production and 4-color separations. This state-of-the-art commercial-quality color scanner allows scanning of reflective and transparent originals up to 11" x 17". The JX-610, against which others are measured, can scan at resolutions up to 1200 DPI (600 DPI optical). The JX-610 includes Sharp's patented One-Pass Scanning Technology and offers users Color Enhancement, Edge Emphasis, Gamma Correction, and 12 bit oversampling providing the widest possible dynamic range for differentiating between very subtle color shades. By strobing three colored fluorescent bulbs through filters, the Sharp system ensures optimal color accuracy and eliminates misregistration.



## Apunix OpenScan Software Kit \*

Both scanners include Apunix's industry leading OpenScan Software Kit for Sun Workstations. The software kit consists of several components: the OpenScan Open Look Graphical User Interface (GUI), ScanGamma Table Creation and Downloading Tool, Command Line Scan Utility, Network ScanServer Daemon, User Callable Programming Libraries, and the SCSI device Driver.

**\* Product of the year**  
-Sun World Magazine-



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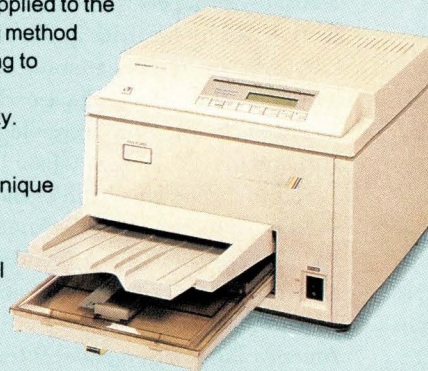


## The JX-7000 dye-sublimation printer

This state-of-the-art printing method heats the dye, changing it from a solid into a gas. The dye then reverts back into a solid when applied to the paper. This sublimation printing method creates subtle shades of coloring to achieve vivid, clear prints with unparalleled photographic quality.

**Drum Hook Paper System**  
The JX-7000 employs Sharp's unique Drum Hook System to provide precision paper control during printing. This control is essential for avoiding color blur caused by misregistration between print passes.

**High Resolution Printing**  
300 DPI High Resolution Print Head and 24-bit color control {3 color planes of 8-bit} combine to reproduce the finest detail and subtle colorings of the original artwork or image.



### SCSI Interface

High speed SCSI interface transmits the large files associated with color images much faster than parallel interface printers.

### Print Both Raster and PostScript

With Apunix TruePrint, you can print Raster images from over 40 different file formats. TruePrint also provides a NeWSprint driver that allows most PostScript files to be printed when used with Sun Pic's NeWSprint.

TruePrint also supports the JX-7000's downloadable color tables for on-the-fly color correction of image data.

### Transparency Printing

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# Print



supposed to have many networking features built-in. An alliance with Sun is one way of combatting the NT threat.

Sun faces the same problem, particularly as Intel Corp.'s Pentium-based systems running NT, come on line at precisely the time when Sun had hoped to offer its alternative to PCs. Arrangements like the one with Banyan, giving Sun systems increased access to PC networks, files and applications, could make it easier to sell workstations as personal computers, particularly on the commercial desktop.

It is a point that Sun was eager to make at the announcement of the relationship with Banyan. "The distinction between a PC and a workstation is gone," said McNealy. "People talk about its [the distinction] blurring. But, it's gone."

### ***New Spring for UNIX?***

UNIX is one of the older operating systems still in commercial use. A number of industry figures have talked about what features the next generation of the operating system should have—or, perhaps, even what its successor should be like.

Now Sun has added its voice to the debate. In his keynote address at last May's SunWorld Expo in San Francisco, Sun Corporate Executive Officer Wayne Rosing detailed The Spring Project, a development effort that has been under way at Sun Labs for about five years. "It is one of the older projects at Sun Labs," says Jim Herriot, Sun's manager of business development for The Spring Project. "From a research aspect, it is fairly mature. From a product standpoint, it isn't. We don't do products here." (Sun Labs is a research organization only.)

The SpringOS has a microkernel, and it is designed to be modular and object-oriented. It has an interface definition language (IDL) that developers can use to link objects to one another, or indeed, to pretty much anything else. Spring is, in fact, designed with the idea of distributed software in mind. "One of the interesting things about Spring is that you can deploy it in pieces, on many different

machines," says Peter Christy, director of The Spring Project for Sun.

When and if SpringOS will actually be shipped on Sun workstations and servers remains an open question—though Spring's characteristics will appear in Solaris at some point. "You will certainly see a Sun box running Solaris that has features derived from Spring. As to whether Sun will sell systems with Spring on them, that falls under unannounced projects, and I don't think we're going to announce any here," says Christy.

Sun is also sensitive to the idea that Spring is some first step toward a proprietary operating system. Instead, it says, Spring would actually make Sun's OS more open in that developers could get into the operating system and use, create or discard modules as they see fit.

### ***Now! Live From Solaris!***

Meanwhile, Sun continues to push into the multimedia market. Last March, its SunSoft subsidiary announced Solaris LIVE!, an array of multimedia technologies for Solaris. At that announcement, Sun described Solaris LIVE! as a "combination of end-user productivity tools and multimedia application programming interfaces (APIs) for audio, imaging and video. "LIVE! is supposed to allow software developers to produce network-based multimedia applications.

In addition, Sun has announced that a number of developers have endorsed LIVE!—including Aim Technology, Cimlinc Inc., Gain Technology Inc., InSoft Inc., Parallax Graphics Inc., Paradise Software, RAD Technologies Inc. and SunSolutions. Moreover, Sun says it has signed agreements with Matsushita Electric Industrial, Toshiba America Information Services Inc. and Centigram Communications Corp. to create value-added extensions to LIVE!.

### ***Fujitsu Buys Ross***

Cypress Semiconductor Corp. has announced plans to sell its Ross Technology subsidiary, a SPARC-vendor, to Fujitsu Ltd., another SPARC vendor. The price is said to be roughly \$23 million.

Fujitsu says it will add Ross' hyperSPARC high-performance SPARC variant, to its own portfolio of SPARC processors. Moreover, the Ross design team is supposed to remain in charge of the high-performance SPARC development. All 75 Ross employees are supposed to become Fujitsu personnel as of the end of June.

Cypress, meanwhile, is getting out of the SPARC business completely. It will focus on the ASIC, memory and programmable logic devices that had been its traditional business.

The sale reflects ongoing changes in the SPARC industry. Originally, the SPARC was supposed to be nothing more than an interface specification. In theory, different semiconductor companies could design their own versions of the processor and Sun Microsystems Inc. would be able to pick and choose among the different types.

However, Sun didn't get the competition-driven processor improvements it had hoped for. Many semiconductor vendors were uninterested in doing processor design work. Even those who, like Ross, did get into the SPARC business found they were hamstrung by the fact they had only one real customer—Sun itself. If that one customer did not select a particular SPARC design, then development costs couldn't possibly be recouped.

This was largely the fate of the hyperSPARC. While a powerful machine, easily the equal of the SuperSPARC, which is manufactured by Texas Instruments Inc., it had no takers at Sun itself.

Sun has been largely reclaiming SPARC in recent months. It has, for instance, abandoned the fiction that the various SPARC processors are solely the products of their various silicon foundries. In official communications, it refers to SuperSPARC not as a TI product, but rather a Sun-manufactured processor.

Meanwhile, TI has announced that the 50-MHz SuperSPARC+ chip is now in volume production. The new version of the processor is said to provide performances of 65 to 68 SPECint92 and 80 to 85 SPECfp92.

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## **Micro-Hub LE**

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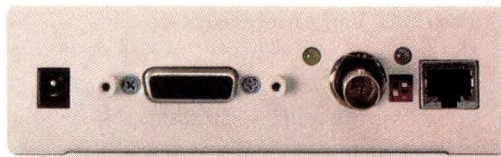
How many times have you wired a 10BaseT network only to find out that thinnet, thicknet, fiber, or non-standard twisted pair cabling is required to connect to the rest of the world. The Micro-Hub LE lets you get to the backbone at the flip of a switch because it has all the standard Ethernet transceivers built-in at no extra cost.

The Micro-Hub LE is the perfect solution for your non intelligent hub requirements. It has twelve diagnostic LEDs giving per port and global status on network conditions. And its attractive packaging features a rugged aluminum enclosure. MiLAN's Micro-Hub LE also comes standard with an unparalleled five year warranty.

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- 12 – Diagnostic LEDs
- Rugged aluminum enclosure
- 5 year warranty



*The Micro-Hub LE comes standard with all three uplink cabling types making an effortless installation in any Ethernet environment.*

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### 'Power'ful Pricing

Since Sun Microsystems Inc. announced plans to put Solaris on the PowerPC processor, SPARC-partisans have watched the chip with both interest and concern. Now, both IBM Corp. and Motorola Inc. have announced pricing, availability and associated tools for the first PowerPC chip, the 601, which comes in 50- and 60-MHz versions. The new chip offers performance comparable to Intel Corp.'s Pentium chip at lower pricing, making the PowerPC an attractive option for systems vendors. IBM, however, will also use Pentium chips for its PS/2 systems.

Motorola and IBM will each sell the PowerPC chips for similar prices but in different production volumes. Motorola's MPC601 50- and 60-MHz chips are \$280 and \$374, respectively, in production volumes of 20,000. IBM will ship its 50- and 60-MHz PPC601 chips in larger quantities of 25,000 to 50,000 for \$275 and \$380, respectively. Intel, by comparison, is shipping Pentium processors based on 1,000 units at \$878 for the 60-MHz version and \$965 for the 66-MHz version.

The first of four PowerPC chips, the 601 will be in volume production starting this quarter. It is designed for use in low-end to midrange RISC desktop systems and will be followed by the 603, 604 and 620 versions of the chip, which will span the needs of portable to high-end server systems. Apple Computer Inc., as part of the joint venture with IBM and Motorola, has already demonstrated a PowerPC system based on the 601 chip (see "Apple Ripens PowerPC Macs").

In addition to the chips, Motorola announced it will make a four-package tool set available to support the PowerPC family of chips. Motorola's bundled tool kit, for \$5,000, includes the Software Development Package (SDP), C and FORTRAN compilers, the Architectural Simulator, and debuggers and library documents, all designed to help developers reduce the time spent to create PowerPC applications. The compilers can be purchased separate-

ly for \$1,500 each, and the Architectural Simulator for \$3,500.

IBM and Motorola also jointly announced the *PowerPC Tools Catalog* to provide OEMs a list of hardware and software products for creating PowerPC applications and systems. Among the products are Motorola's tool kit described above and IBM's AIX/6000 operating system and AIX Software Development Environment/6000. Additional offerings include optimizing compilers, debuggers, logic analyzers and other offerings from more than 20 vendors such as Alsys Inc., Cadence Design Systems Inc., CETIA, Echo Logic, Hewlett-Packard Co., Mentor Graphics Corp., Ready Systems Corp. and Tektronix Inc. Companies that have already announced plans to bring out PowerPC-based systems include Apple, Groupe Bull, Harris Corp., IBM, Tadpole Technology Inc. and Thomson-CSF.—*Jane Majkiewicz*

### Apple Ripens PowerPC Macs

And, on the subject of PowerPC machines, long-time Sun competitor Apple Computer Inc. recently accompanied its demonstration of an 80-MHz PowerPC-based prototype Macintosh computer with several PowerPC proclamations.

Among the company's PowerPC plans are a delivery date in the first half of 1994, compatibility with existing applications, as well as an upgrade path for several Macintosh models. At the same time, Apple says it is working with hundreds of developers to create new applications optimized for the PowerPC. Eleven developers were at the company's Worldwide Developers Conference to announce development efforts for PowerPC Macintosh applications, including Adobe Systems Inc., Aldus Corp., Claris Corp., Frame Technology Inc., Insignia Solutions Inc., Microsoft Corp., Quark Inc. and WordPerfect Corp.

Apple intends to offer an upgrade plan for users of the Macintosh Centris 610 and 650 computers, Macintosh IIfx and IIfvi, Performa 600 and Quadra 800 systems to move to the PowerPC. The company says it

will continue to offer 680X0-based Macintosh systems in conjunction with its entry-level through high-end PowerPC line.—*Jane Majkiewicz*

### IBM Shows New Boxes

Not to be outdone, IBM Corp. has added seven new systems to its RISC System/6000 line—four of which, significantly, support Sun Microsystems Inc. 1152-by-900 color displays as an option. The systems, in other words, are meant to be sold into Sun accounts as a replacements for SPARCstations.

The four are all desktop systems—the POWERstation/POWERserver 230 (\$5,445), the POWERstation 23T (\$9,395), the POWERstation 23W (\$7,595), and the POWERserver 23S (\$9,545). All have a 45-MHz POWER processor and a 128-KB second level cache. The 230 is described as a desktop system that can be either a workstation or a server. It comes standard with 16 MB of memory, expandable to 64 MB.

The 23T, meanwhile, is oriented toward graphics. It comes with the POWER Gt1x graphics adapter, which provides 8-bit, 2D graphics without taking up a Micro Channel slot. The 23W is exactly like the 23T, but comes without a display for those customers who want to buy their own. These are the machines, as well as the 230, that support Sun-type displays.

The POWERserver 23S, finally, is an entry-level server. It comes standard with 16 MB of memory (expandable to 64 MB), a 1-GB SCSI disk drive, an eight-port async adapter, and integrated SCSI and Ethernet.

In addition, IBM showed two new technical workstations—the POWERstation 36T (\$24,720) and 37T (\$27,720). Both are optimized for graphics tasks. The 36T has a 50-MHz processor; the 37T, a 62-MHz processor.

Finally, IBM introduced a desktop server, the POWERserver 550L (\$27,450). This has a 41.6-MHz processor, 32 MB of memory (expandable to 256 MB), 2 GB of disk (expandable to 7.2 GB), integrated SCSI and Ethernet, 1.44-MB 3½-inch diskette drive, four Micro Channel slots and a CD-ROM drive. ➡



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TOM BARRETT

by MICHAEL O'BRIEN

*"People get the government they deserve."*

—A wise person

*"Trust us."*

—Our elected officials

*"Three people can keep a secret if two of them are dead."*

—Benjamin Franklin (with kudos to Lauren Weinstein for coming up with it for the *Privacy Digest*)

## Mr. Protocol Gets Clipped

**Q:** I hear the Internet isn't secure. I know the Usenet sure isn't: There are whole groups over there devoted to nothing but forged postings! Isn't there any way I can get secure communications?

**A:** Mr. Protocol has never felt anything other than a sense of perfect security. Big help he is. However, he notes that there are various solutions to this problem, and various organizations out there that are altogether willing to take your money to provide them. The world of security is perforce a shadowy one—just try getting any real information out of the Computer Emergency Response Team, for example—but standards are beginning to emerge in this area,

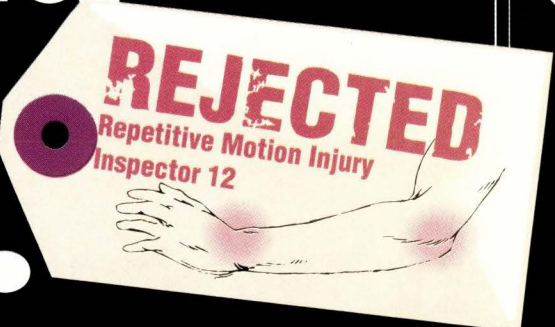
particularly in electronic mail.

Privacy-enhanced Mail, or PEM, is slowly being blended with the MIME standard, which Mr. Protocol has previously discussed (a kind word denoting "droning on at incredible length to little effect"). The Digital Signature Standard is also coming into use, which, while it does not prevent communications from being intercepted, at least acts to prevent forgeries. Both of these areas are undergoing active development. The curious, the concerned and the paranoid alike are referred to the "internet-drafts" directory at host <ftp.nisc.sri.com>, or whatever other repository suits your fancy.

However, while Mr. Protocol happily munches on his fully chipped cryptocoookies, none valid for U.S. export, others are experiencing far more

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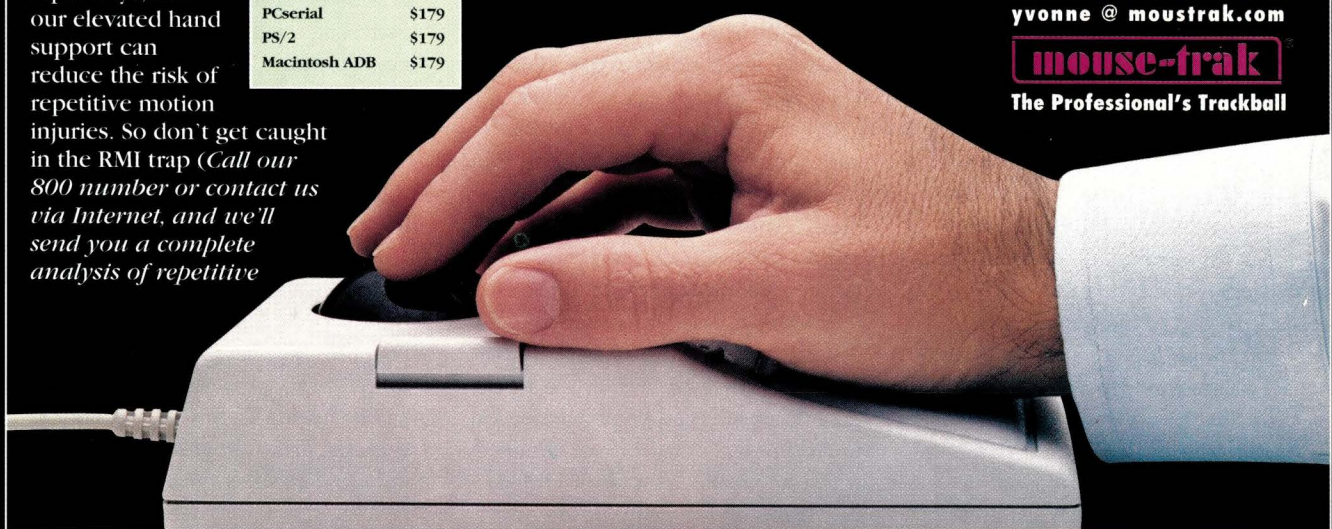
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fundamental problems, such as calling across town without having all parties in between listen in.

Even in the prosaic world of the telephone, there are interesting islands of privacy and pseudo-privacy. For example, consider the cordless phone. The original radio-frequency band allocated for these things was right around 49 MHz, and lots and lots of them are still being sold. Under unusual conditions, the signals from such units can be heard in Wyoming. (N.B. This is only impressive if you do not happen

telephones, where people have to do actual work to intercept the conversation, that is, work other than removing the right diode from a Realistic Pro-43 scanner. (If you think you're going to see a sidebar explaining just which diode that is, you don't know Mr. Protocol. Or Doug Pryor, if it comes to that.)

Well, why is Mr. Protocol such a naive twit, you may ask? I'm not even going to tell him you asked; he probably wouldn't be glad. My best guess is that he believes that encryption

In fact, it's gotten to the point where it would seem to be possible for private citizens to encrypt communications that the government cannot easily decrypt.

This is a profoundly disturbing result to many people, because there are lots and lots of people around whose communications had better be intercepted for the good of society at large. This has led to a new government initiative, which has taken most folks by surprise. A proposal has been laid on the table to provide a new form of data encryption standard: a hardware chip that provides telephone voice communications over an encrypted communication channel that cannot be decrypted...except by law enforcement agencies.

From a technical standpoint this is more than a little interesting. From a political standpoint it is a morass. From a historical perspective it is dynamite.

To be specific, the administration is proposing the adoption of a chip, called the Clipper chip that will provide secure voice-grade telephone communications, without the necessity of an externally secure exchange of cryptographic keys. The chip will encrypt and decrypt a digitized voice stream in real time. Keys to decrypt the stream will be divided in half and stored at each of two independent "escrow" agencies. When a warrant is produced authorizing a legal wiretap, each agency will release its half of the key, allowing a (possibly prerecorded) digital stream from a particular chip to be decrypted.

Let's examine the details of how this is supposed to work. Then let's look at some of the ramifications.

The sidebar indicates the algorithm used to encrypt a message stream using the Clipper chip, and it also shows how the chip's keys are generated and split. The proposal states that the keys will be held in escrow by autonomous agencies, one or both of which may be independent of the government. The Federal Reserve has been suggested as one such repository.

When a warrant is issued authorizing a wiretap, each agency coughs up its half of the unit key. This key is then

## **T**he science of cryptography has begun to yield results outside those obtained within the hallowed walls of Ft. Geo. G. Meade.

to live in Wyoming. I am assuming most readers don't. Our readers in Laramie may substitute "Missouri" if it will make them feel any better. Those using the cheaper variety of cordless phone may substitute "eight feet away" as being closer to the truth.)

Cellular phones have an allocation in the 800-MHz range. It is in the nature of things that signals at 49 MHz, even without the unusual long-distance conditions, travel further than signals at 800 MHz. This doubtless has nothing to do with the fact that, under the law, users of cordless phones have "no expectation of privacy," while users of cellular phones have every expectation of privacy, just because Congress says so. Never mind the fact that cordless phones have very weak signals, while cellular conversations are blasted over the countryside by high-level transmitters. It is legal to intercept cordless conversations; it is illegal to intercept cellular conversations.

Following this reasoning, Mr. Protocol finds it inexplicable that people are very much interested in ways to encrypt cellular telephone conversations. He finds it even more inexplicable that people are worrying about how to encrypt conversations taking place over ordinary, wire-bound

belongs where it has always resided: in the hands of the government. There has always existed a secure subnet of the Internet, living behind classified cryptological network interfaces, which has provided some Milnet users with the ability to exchange classified information over the Milnet between secure systems. Naturally, with the crypto boxes scrambling and descrambling everything going in or out, these systems can talk *only* to one another.

Time, however, marches on. The cryptological algorithms used in these boxes are based on the use of secure keys, exchanged by external means. We know this because there are people with short hair and long-barreled rifles standing outside the rooms containing these crypto boxes, who evince severe attitudes toward those who may become lost on the way to the bathroom (this is based on an actual incident; identities withheld aside from a strong personal disavowal). However, the science of cryptography has begun to yield results outside those obtained within the hallowed walls of Ft. Geo. G. Meade, and these results do not require the exchange of secure keys. Furthermore, these algorithms are becoming more and more widely available in software.

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used to decrypt the session key, and the session key is then used to decrypt the recorded message.

The most interesting thing about this proposal has nothing to do with the proposal itself; it has to do with the reaction to the proposal in nongovernmental quarters. There are a lot of paranoid people out there, and they have a lot of horrific scenarios.

On the surface, there doesn't really seem to be much wrong with the proposal. The program is voluntary. The keys are split between agencies, neither of which is a law-enforcement agency, and which may not be governmental agencies at all. The proposal solves a very serious problem. It is difficult to see how there can be any objection to it. I have land in Florida that is a good investment.

The real difficulty is that there may in fact be no problem with the proposal at all. What is being produced at this point are arguments based in fact but driven by people's perceptions, and recent history has led large segments of the population to repose little trust in authority—any authority.

It behooves us, then, to examine the possibilities for abuse in this system. The entire intent of cryptography is to prevent disclosure of information to anyone other than the intended parties, and this encryption system has a built-in mechanism for subverting that intent. Some scrutiny is definitely called for. However, at this point, all that can be raised are questions. The questions that are raised are themselves informative, for they disclose the sociological and cultural environment in which this proposal is intended to succeed.

The first and largest question is this: Why in the world would anyone in their right mind use an encryption system with a known hole in it, at least if they intended to use encrypted communications to break the law? In Mr. Protocol's mind, this question is a show-stopper. The Clipper program is voluntary. What are these people thinking? The intent seems to be to provide a technology that is so cheap and so ubiquitous that it will swamp any competition. This attitude seems

curious. "Having acquired a law degree from Harvard Law School, it is my firm and fixed intention to earn astronomical sums of money by dealing in astronomical amounts of crack cocaine, with a little white slavery on the side as a hedge against inflation. Oh! I must look to my own personal security, and be careful that my business dealings are not intercepted. Well, I will run right down to Circuit City, for I am certain that their equipment will meet all of my needs."

One point of view is that, despite years of exposure to television, no one is that stupid. The program will be voluntary only until it can be proven in the headlines that it does not work. "Why, those dastardly people appear to be using an encryption technique with which we are not familiar! Their encrypted telephone line did not loudly announce a Law Enforcement Field in its data stream. Oh heavens, oh woe, oh lack-a-day! Why, whatever shall we do? We must outlaw this criminal technology! Decent and right-thinking people with a legitimate need for privacy need only use the Clipper

chip, and may the criminal element beware, for we shall surely throw their tails in jail for an additional 20 years for using proscribed encryption technology."

What one might call the standard post-'60s outlook is that the NSA, which delights in working in the area, and which was intimately involved in the development of the Skipjack algorithm used in the Clipper chip, might not need any fool escrowed key pieces at all. It might be able to take a sufficiently large amount of data and narrow the search space down enough by knowledge of the classified algorithm to make sense of the data stream without prior knowledge of the key. This argument doesn't make too much sense, considering how easily obtained a wiretap warrant is, unless you include the companion post-'60s outlook that the NSA is after things that standard law enforcement wouldn't touch. This is a separate issue and stands or falls purely on the basis of the soundness of one's paranoia about the NSA.

One fascinating problem brought up

## Inside Clipper

The Clipper chip contains, in addition to the Skipjack algorithm, three numbers:

- F - an 80-bit family key that is common to all chips**
- N - a 30-bit serial number (this length is subject to change)**
- U - an 80-bit secret key that unlocks all messages encrypted with the chip.**

Two communicating cryptophones exchange a session key,  $K$ , external to the chip, using something like the Diffie-Hellman public-key distribution method. If  $M$  is the message stream to be encrypted, then  $K$  and  $M$  are fed to the chip, which produces  $E[M; K]$ , the encrypted message, and  $E[E[K; U] + N, F]$ , the "law enforcement field."

To implement a wiretap, law enforcement uses  $F$  to get  $E[K; U]$ . Having gotten  $U$  from the escrow agencies, they use this to decrypt  $K$ , which in turn is used to decrypt  $M$ .

The key  $U$  is generated from two secret values,  $S_1$  and  $S_2$ , each provided by one of the escrow agencies at the time and place the chips are programmed. These are combined in a complex algorithm with the unit serial number  $N$ , to produce a 192-bit key. The first 80 bits of this key are  $U_1$ , the key given to the first escrow agency, and the second 80 bits are  $U_2$ , given to the other agency. The rest of the 192 bits are discarded. The unit key,  $U$ , is the XOR of  $U_1$  and  $U_2$ .

by several people is the fact that once law enforcement has the unit key, all calls made with that device forever after are compromised. The answer to this one is that after the tap is completed, the target of the investigation must be notified of the tap and will presumably throw the phone away immediately, or at least replace the chip. The problem with this answer is that law enforcement these days seems

escrow agencies for Clipper chips inside their borders, which means the family key is spread around the world, and also not only is Saint Nick for real, he's the new host on *Good Morning America*.

Finally, there's an argument in the murky area of the fundamental right to privacy. We note that it does not seem likely that a new form of house lock, more secure than any other,

**T**he Clipper chip is crypto technology and we're not sending any of them overseas, no sir, huh-uh, forget it.

to love investigations that go on for years with no discernible results. Who knows when, if ever, the tap would be "completed"? Do wiretap warrants come with expiration dates?

Another problem, and rather an outre one at that, is that not all calls begin and end inside the United States. No doubt this will come as a shock to all but our overseas readers, for whom phone calls placed outside the United States presumably do not constitute a novelty. This presents us with several unlikely prospects. First prospect: The Clipper chip is crypto technology and we're not sending any of them overseas, no sir, huh-uh, forget it. In this case, U.S. businesses with a legitimate need for privacy, together with everybody else, will use alternate cryptographic means, *unless* this is made illegal, as in our earlier scenario, in which case all these critical proprietary calls will be made in the clear, and also there's a tooth fairy.

Second prospect: Clipper chips go overseas and foreign governments have absolutely no idea what's in that data stream that's crossing their borders, but this doesn't bother them particularly and this is all legal, and also there's an Easter Bunny.

Third prospect: Foreign governments that allow the importation of Clipper technology have coequal access to the escrow agencies through their own courts, or else they have their own

could succeed in the marketplace if two halves of every key were given over to an escrow agency. Well, actually, maybe it would...but demands on the escrow agency would be pretty low, Mr. Protocol thinks. And if that lock were made mandatory? One national hero remarked that any people willing to sacrifice liberty for security deserves neither.

Mr. Protocol acknowledges the various contributors to the *RISKS Digest* and the *Privacy Digest*, whose cogent thoughts have informed this column.

—o—

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](mailto:amp@expert.com).

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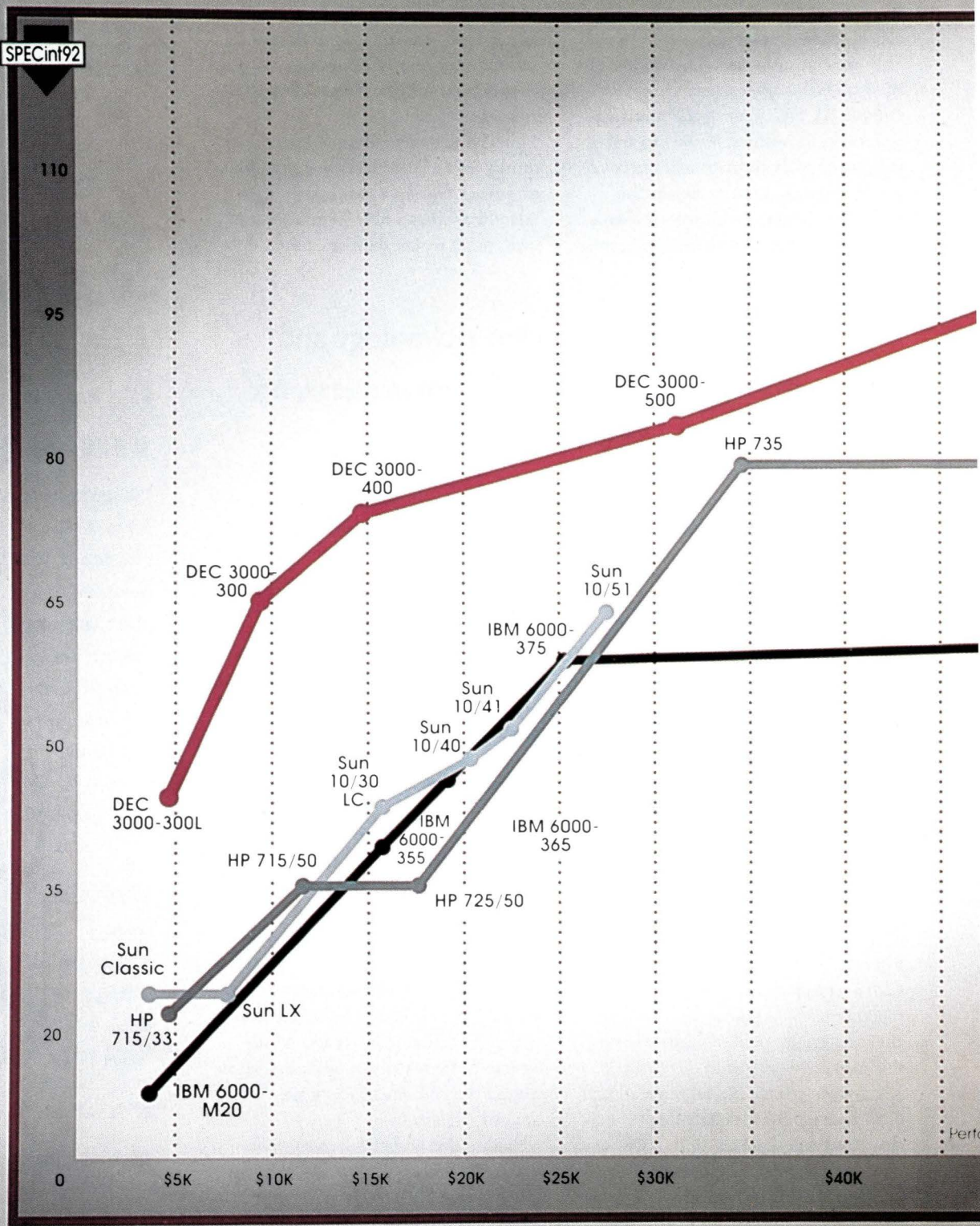


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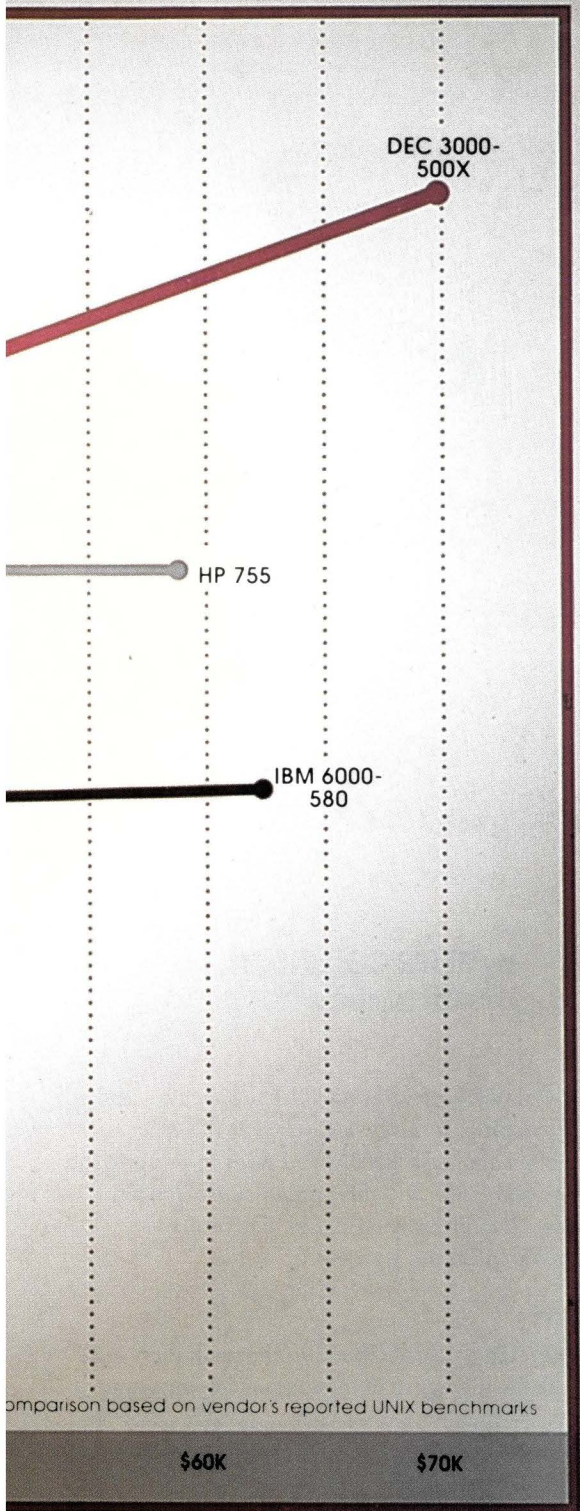
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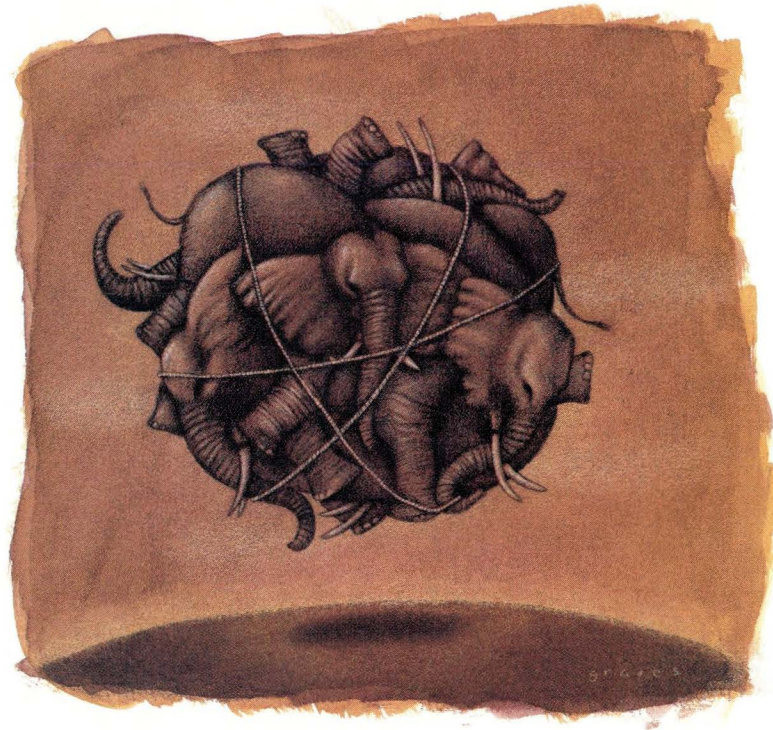
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KEITH GRAVES

## Bundling Files

by PETER COLLINSON,  
Hillside Systems

**U**NIX is great for making files. It encourages you to have a large number of small files that constitute your work. The files are arranged in a tree structure. If you are sensible, you usually make the names of the directories and files mean something. They should act as labels for the data they contain.

The `ls` command in early UNIX systems did not print file names in multiple columns. It just output a single column down the screen. You can see this behavior by adding the `-1` (that's a digit one) to the command, or by piping the output from `ls` into `cat`. Before `ls` did multicolumn output, my test for the disorganized users was to see whether they had more than a single screenful of files in their home directory.

At that point, I usually sat them down and said, "Well, my friend, it's time you learned about directories." They usually said thanks and started to create a few. They rarely tidied their home directory though. A disorganized person is always disorganized; technology cannot help them. Still, I had tried.

If you are organized, use small files and have plenty of directories, then you have a problem when you want to move your files somewhere else. This problem can be compounded if you want to email your work to someone else, or put it out onto the net for others to use. To make

things easier, you probably want to collect all the files into a single file for shipping. It can be unpacked at the other end as if nothing had happened. Ideally, you want to preserve the original names of the files and their permissions. You also want to preserve the directory structure that you have lovingly created to partition your work.

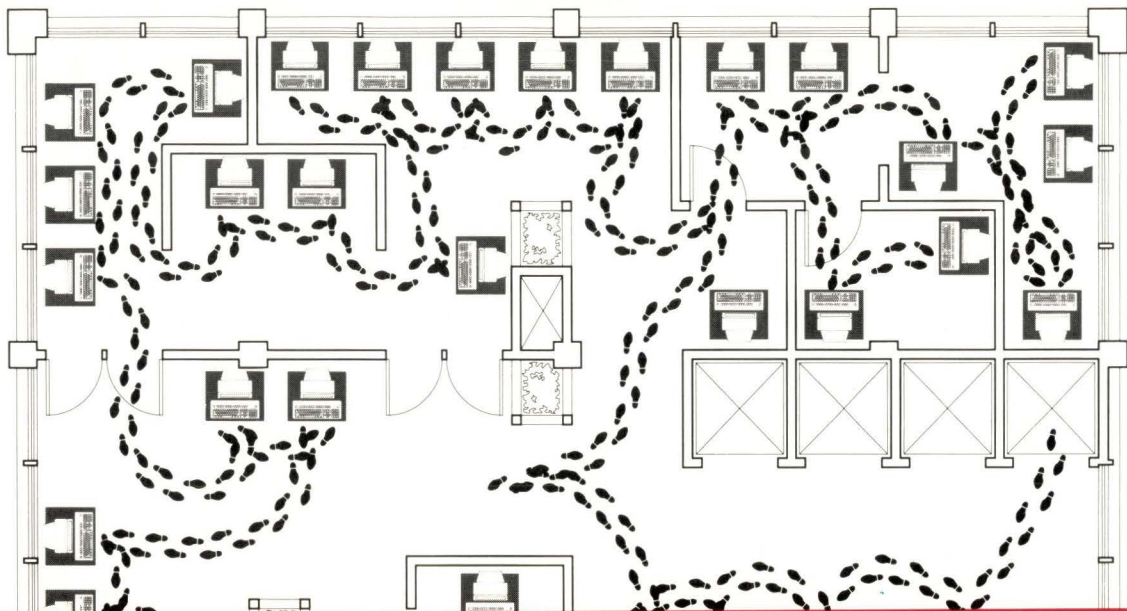
### Shell Archives

If you are shipping a file to a friend in the mail, then you can include the file in your mail message enclosed in some marks like

```
----- start of dfile -----  
Here it is  
----- end of dfile -----
```

This is fine and generally really easy to do. The recipient has to save the mail message to a file, and then trim off the bits before and after the data that they want. This gets painful if you want to ship more than one file. The recipient now has to identify the start and end of each file and split the source into several pieces.

Some time ago, James Gosling had the bright idea that it



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would be less painful if you sent the several files as a shell script. The recipient could then use the shell to unpack the data. What you send is a “here document” like

```
#!/bin/sh
cat <<\SHAReof > dfile
Here it is
SHAReof
```

The first line identifies that we should use the Bourne shell to execute this script. The second line starts the `cat` program with its standard output pointing at the output file `dfile`. The `<<` signifies the start of a “here document.” All the lines that follow the command are read and stored in a temporary file. The end of data is shown by a line containing the string that immediately follows the `<<`. When the end marker is read, the command is executed with its standard input set to the temporary file. So the `cat` command runs, moving data from the temporary file to the destination `dfile`.

**Y**ou can create the mail message by hand if you like, but it’s far easier to use a script or program to do it.

There’s a hint of magic in the example: The termination string in the `cat` command is preceded by a backslash. This tells the shell that it need not look at the data in the “here document” to try to expand variables and the like. It should just pass it into the temporary file unchanged.

This format has become known as *shar*, for *shell archive*. You can create the mail message by hand if you like, but it’s far easier to use a script or program to do it. The book *The UNIX Programming Environment* by Kernighan and Pike contains a very simple *shar* creation script called `bundle`. It illustrates how simple it is to create the format. Here’s a (slightly modified) version:

```
#!/bin/sh
# bundle files...
echo '#!/bin/sh'
echo '# To unbundle, sh this file'
for name in "$@"
do
    echo "echo $name 1>&2"
    echo "cat > $name <<\--End--of--$name"
    cat $namev
    echo "End--of--$name"
done
```

Notice how the shell is happy to parse the output file and

the “here document” marker in either order. If we have two files `f1` and `f2`, we will call the script like

```
$ bundle f1 f2 > op
```

and in the file `op` we will see

```
#!/bin/sh
# To unbundle, sh this file
echo f1 1>&2
cat > f1 <<\--End-of-f1--
file one
--End-of-f1--
echo f2 1>&2
cat > f2 <<\--End-of-f2--
file two
--End-of-f2--
```

You can pull the `op` file into your mail message and dispatch it across the world. You are well advised to move to another directory and test it before you send it—just to check that things are OK.

This simple scheme does have some problems. First, many mail systems will mess with the data. Some will “helpfully” look for lines starting with the word “From” and will insert the character `>` in front of it. You send

```
With Love
From me to you
```

Your recipient sees

```
With Love
>From me to you
```

This “feature” inspires a new game at conferences: See how many papers contain the word `>From` in the proceedings. The paper has been sent through the mail, typeset and printed with no one realizing just how helpful the mail system has been.

The mail system does this because it “knows” that all your mail messages will be concatenated into one file on delivery. Each mail message is prefaced by a line saying who the mail was from:

```
From pc@expert.com Fri May 7 23:30:29 1993
```

This line separates messages for your mail reader. It means that the mailer must check that there are no other lines starting with `From` and will preface any such lines in the body of the mail by a `>`. This is simply bad design. It should use something to separate messages that will never occur in the mail (for instance, the `mh` system uses two or more control-A characters as a separator).


Another problem is a period on a line by itself. Mail on the Internet is mostly shipped by a protocol called Simple Mail Transfer Protocol (SMTP). This uses a period on a line by itself to act as a termination character. If your mail contains

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one of these, then all the text that follows the line just containing the period will be lost. It's true that this is probably rare, but it does happen.

Avoiding these problems means that a more complex script is needed. There are two versions of a program called `cshar` on the `comp.sources.unix` that will make the necessary format. When I create `shar` files, I use the older of the two programs, by Gary Perlman. A later version exists by Rich Salz. I have no reason not to use it—just haven't got around to it yet.

The Perlman program prefaces all data files by a tab character and an X. The script that it creates uses `sed` to strip this from the resultant data. Here are our friends, `f1` and `f2` packed by the Perlman program (actually I have edited it a little to fit it onto the page).

```
#!/bin/sh
# This is a shell archive, meaning:
# 1. Remove everything above the
#    #!/bin/sh line.
# 2. Save the resulting text in a file.
# 3. Execute the file with /bin/sh
#    (not csh) to create the files:
#    f1
#    f2
# This archive created:
#       Sat May  8 16:09:09 1993
export PATH; PATH=/bin:$PATH
echo shar: extracting 'f1' '(9 chars)'
if test -f 'f1'
then
    echo shar: will not over-write 'f1'
else
sed 's/^      X//' << \SHAR_EOF > 'f1'
    Xfile one
SHAR_EOF
if test 9 -ne "`wc -c < 'f1'`"
then
    echo shar: error transmitting 'f1'
    echo '(should have been 9 characters)'
fi
fi # end of overwriting check
echo shar: extracting 'f2' '(9 chars)'
if test -f 'f2'
then
    echo shar: will not over-write 'f2'
else
sed 's/^      X//' << \SHAR_EOF > 'f2'
    Xfile two
SHAR_EOF
if test 9 -ne "`wc -c < 'f2'`"
then
    echo shar: error transmitting 'f2'
    echo '(should have been 9 characters)'
fi
fi # end of overwriting check
# End of shell archive
exit 0
```

The `Salz` program output is similar. The format has several good features. First, the recipient can look at the comments at the start and determine what files are contained in the archive. Second, the script will not overwrite any existing files of the same name. This is pure politeness and provides some modicum of safety. The files themselves are embedded in a "here document" that is processed by `sed`. There should be no problems with initial characters or words in the data because all lines are right shifted by safe text.

Finally, the script checks that the number of characters that were written equal the number of characters in the original file. This provides an integrity check that can sometimes be useful. Some "text" files contain control characters that UNIX is perfectly happy with but do not make it past some mail systems. The size check tells you that what you see is what I got.

OK then. These versions of `shar` written in C allow you to bundle a set of files and send them somewhere. You will know that the files will arrive intact. The programs can also deal with directories, making the script create directories when it is run. They will not preserve file permissions, although both programs will set execute bits on included shell scripts.

Finally, a word of caution. You are being asked to run a script that was created by someone else. You should check that the script does *only* create files. It's a perfect vehicle for someone to plant security holes in your system. However, because the file is text, you can look at it and see what it will do. However, I never run imported `shar` scripts as superuser.

## Using tar

Using `shar` is fine for text files but no good for files containing binary. If I want to pack a tree into a single file, I tend to use `tar` to create a file and then compress it to save disk space. The `tar` program is really designed to drive tape drives but can easily be used to create a file on the disk.

All the sources on my machine are stored as compressed `tar` files. I use a simple script to do it:

```
#!/bin/sh
# tpack dirname for dname in "$@"
do
    if [ ! -d $dname ]
    then
        echo $dname is not a directory
        continue
    fi
    tar -cf - $dname |
        compress > ${dname}.tar.Z
    mv $dname , $dname
done
```

This is called by something like

```
$ tpack sourcedir
```

where `sourcedir` is a directory containing the files I want to pack. The first part of the loop provides protection

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against `finger` trouble. The work is done in the `tar` line. This runs `tar`, quoting the directory to pack and putting the data onto standard output. I fire this into `compress` to make it somewhat smaller, hopefully. Finally, I move the old directory to a new name starting with a comma. This is just to jog my memory. I know that I can delete this directory and all its files later on.

Unpacking things could not be easier.

```
#!/bin/sh
# tunpack dfile
for dname in "$@"
do
    if [ -d $dname ]
    then
        echo $dname is a directory
        continue
    fi
    if [ ! -f $dname ]
    then
        dname=$dname.tar.Z
    fi
    if [ ! -f $dname ]
    then
        echo Cannot find $dname
        continue
    fi
    zcat $dname | tar -xpf -
done
```

All the early tests in the script are there to allow me to say

```
$ tunpack shar
or
$ tunpack shar.tar.Z
```

because I am lazy. Protection against overwriting things could be a little more rigorous.

The main line that does the work uses the `zcat` command to unload the compressed data and then pipe it into the standard input of the `tar` command. This extracts the archive, making sure that file permissions are preserved (the `p` option). Notice that I don't destroy the old compressed archive. I find that I often want to look at sources but rarely have to change them.

A compressed `tar` file like this is a binary file. The compression makes the file into a stream of bits, not bytes. If you ship the file using FTP, then you must select binary transmission. You cannot really inject the file into a mail message to send to someone without further translation.

A common way of doing this is to use the `uuencode` program. This was originally intended to allow you to ship binary files over links that could carry only 7-bit bytes, where the eighth bit is used for parity checking.

The operation of `uuencode` is simple. It takes three 8-bit bytes from the input data and creates four bytes from them.

The output bytes are all printable characters in the ASCII set. The program artificially imposes a line structure on the data, creating output lines of 60 characters. The file starts with

```
begin mode filename
```

where `mode` is the UNIX file permissions and `filename` is the name of the original file. The file ends with the word `end`.

The program is called in a somewhat baroque manner:

```
$ uuencode file.Z < file.Z > file.Z.uu
```

The argument is simply used to create the `begin` line. The program acts as a filter, reading from standard input and writing its data to the standard output channel.

To obtain the original binary file, you say

```
$ uudecode file.Z.uu
```

This reads the header from the `begin` line, joins each set of four characters into three bytes and writes the output to the filename found in the header.



**he `cpio` program is the standard System V way of joining many files in one.**

Of course, if you are shipping a single file, there is no good reason for using `tar`. You can simply use `uuencode` since it will pass the file name and its permissions. If the file is large and the recipient is paying for the mail transmission, then it's probably a good idea to compress the file first.

### Using `cpio`

An alternative to `tar` is `cpio`. The `cpio` program is the standard System V way of joining many files into one. For the user, it has several advantages over `tar`. It has three modes of operation. Output mode takes a list of filenames on standard input, reads the files and creates a single data stream on standard output. Input mode takes the stream on standard input and can unpack it. You can give the program arguments that are regular expressions. These are matched against the files in the data stream, and only those files are unpacked.

Pass mode is used to move directory hierarchies around the file system. This allows the `-l` option for "link if you can," making hard links from source to destination files, and is consequently faster when moving files on the same disk. To move a tree using `tar`, you will say

```
$ cd srcdir
$ tar -cf - .|(cd destdir; tar -xpf -)
```

Here the first `tar` will bundle up the source tree and write it



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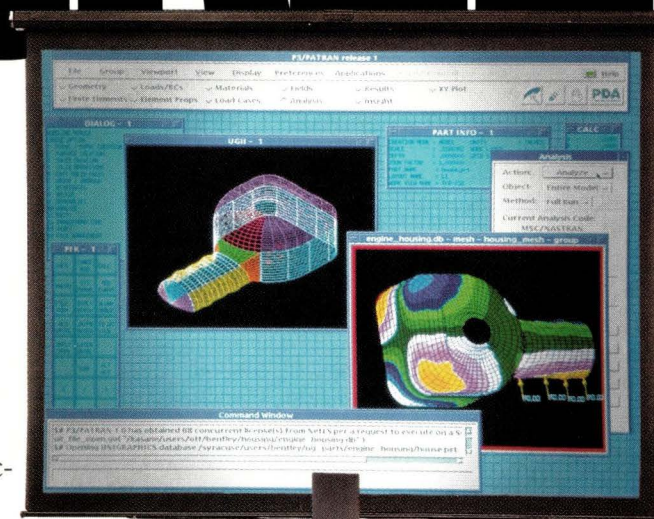
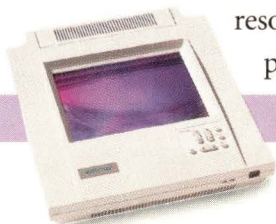
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to standard output down the pipe. The pipe is glued to a subshell that first uses `cd` to move to the new location, and then runs `tar` again to extract the data coming from standard input.

The `cpio` version of this is perhaps

```
$ cd srcdir
$ find . -print | cpio -pdl destdir
```

The `find` command is used to generate a list of files for `cpio`. The `cpio` command reads the files and moves them to the new location. However, if the new location is on the same physical file system, then it will make hard links to the old files. It will not actually move data, just create directories and file name links within the directories. This method can be much faster.

System V has tended to use `cpio` instead of `dump` and `restore`. The program has several hooks designed to make archival dumping easier. Finally, the `find` program can output `cpio` data streams directly.

The major disadvantage of the original `cpio` is that the default file format is binary. Each file is separated by a C structure that is written as binary values. Thus, there are problems with byte order when you move a standard `cpio` archive between architectures that have incompatible byte ordering rules. The header glue that `tar` uses between files contains much the same information but is written to the output as printable characters. This avoids any byte-swapping problems.

The `cpio` program can be made to use text headers by the inclusion of the `-c` option. However, this means that the program can write more than one format, and that is confusing for naive users. In practice, you should always use the `-c` option when creating archives.

The format used by `cpio` was designed at a time when file names were 14 characters long and the file system did not contain symbolic links. This means that it is hard for some versions of `cpio` to deal with current file systems.

All these problems (and some with `tar` too) caused a great argument in the early POSIX meetings. It all became known as the “tar” wars—where 3-`cpio` battled with `tar-2-d-2`. Finally, Glenn Fowler orchestrated the solution called `pax`. He noticed that the internal formats were very similar and you could automatically deduce which format you were dealing with. John Quarterman, then the Usenix Institutional Representative, convinced the Usenix board that they should fund the development of a program that could read the various flavors. This was made publicly available.

The POSIX committee also defined standard `cpio` and `tar` formats that fixed some long-standing and well-known design bugs in the two programs. Old `cpio` and `tar` format archives fit the standards, but some older programs may not be able to read new archives.

On SunOS 4.1.3, Sun provides a plethora of `tar` and `cpio` programs. The versions in the `/bin` directory produce output whose format is the same as the original Berkeley code. You will find `pax`, `paxcpio` and `ustar` in the `/usr/5bin` directories. These are the same binary, derived

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191 .....192 .....193

from the “public” `pax` program. The `paxcpio` program provides a `cpio` interface with IEEE `cpio` output format and `ustar` provides a `tar` user interface generating the IEEE `tar` format.

On Solaris 2.1, all these have gone to be replaced by new IEEE-compatible `tar` and `cpio` programs. You will find that `tar` has the old familiar options but that `cpio` is much enhanced.

### A Plea

Finally, a personal plea. I notice that people are increasingly sending mail that consists of a few very long lines. I blame Sun's `mailtool` for this. It seems to automatically wrap lines as you type text in. When you create the mail message, you blithely type away and see a set of short lines in a paragraph. Sadly, the lines do not contain any newline characters.

You send the mail to me and I see the start of your paragraph, but the rest zooms out of sight on the right-hand side of the screen. I have to put your mail through a formatter to make any sense of what you have said. The longest single line in a mail message that I have received to date consists of 700 characters.

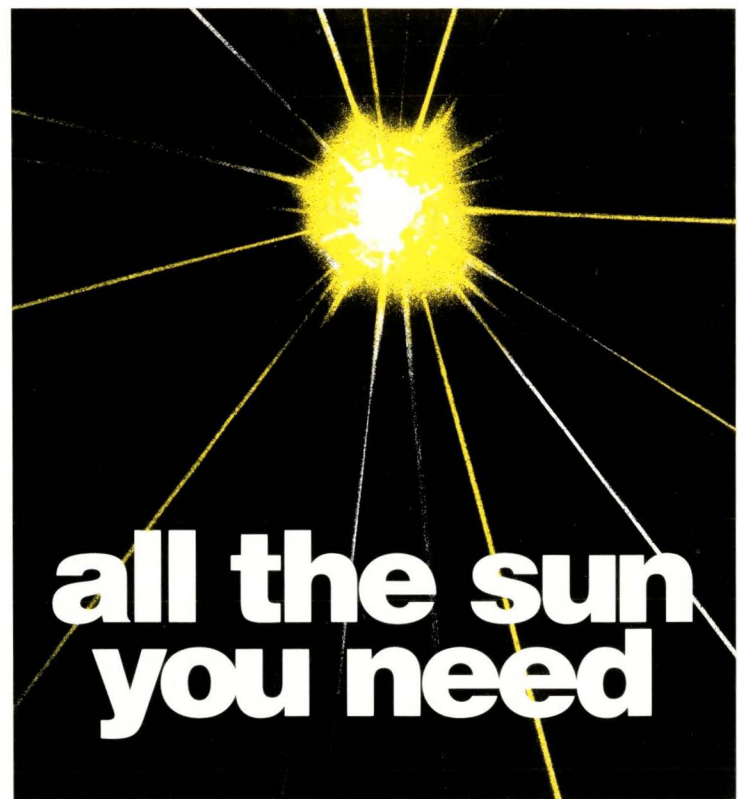
Now you may argue that this is my problem. My mail reader should wrap long lines. Naturally, I dispute this and cite some other difficulties that you are causing me. I may wish to include some context in my return message. I am not a believer in returning the whole message to you but I might pick a few lines, indent them or precede them by a `>` to allow you to understand what I am talking about. This is hard if the line that you have sent me is 700 characters long. Also, really long lines can make other tools begin to fall over. At some point, line-oriented tools like `grep` barf when they find a line that is too long.

I consciously set my mail-composition program to format mail to have lines that are a maximum of 72 characters. I type a return when the text begins to reach the right-hand margin. This inserts a newline character. Sometimes I use an editor in text mode that automatically wraps lines for me so that I don't have to type the return. I am getting my editor to insert a newline. Sun's `mailtool` gives you the impression that this is happening, but it isn't. Please type a return.

### Further Reading

Source material for this article came from *The UNIX Programming Environment* by Brian Kernighan and Rob Pike, published by Prentice-Hall (ISBN 0-13-937681-X). There is also a load of useful stuff in the excellent *UNIX Power Tools*, published by O'Reilly & Associates and Bantam Books (ISBN 0-553-35402-7). This book includes a CD with the source of Rich Salz's version of `shar`. Thanks to Jeff Haemer who helped with the `cpio` stuff. ⇨

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



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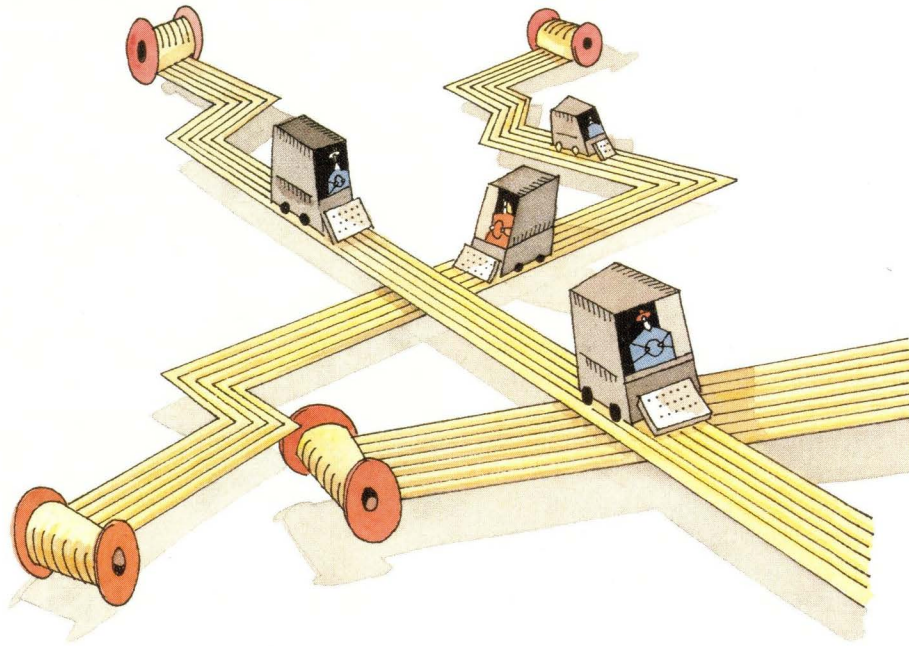
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ROBIN JAREAUX

by **RICHARD MORIN**,  
Technical Editor

## Paving the Driveway

The newspapers are full of talk about "Information Superhighways." These fiber-based data channels will carry hundreds of millions or even billions of bits per second between universities, research laboratories and big corporations. I'm sure the institutions in question will use and enjoy this level of connectivity, but I'm not at all sure what it will do for me.

These same institutions currently have T1 (1.544 Mb/s) or better links. My Internet connection is a V.32bis (0.0144 Mb/s) telephone line, offering less than 1% of a T1's performance. If all I can afford is a gravel driveway, I'm not going to get too excited by the cars zooming by on the freeway. So, what are my prospects?

### Modems

Before I start talking about modem performance, I should explain what a modem must do to support my style of use. Otherwise, some vendor is cer-

tain to drag out statistics showing how his modem is far more wonderful than any I mentioned.

The modem has to offer smooth interactive performance. This eliminates a whole raft of otherwise wonderful (e.g., PEP) modems. These switched-direction modems move bits like crazy once they get going, but they are uniformly awful for interactive (e.g., editing) use.

I'm also underwhelmed by speed ratings that include compression. Most of my long transfers are compressed or gzipped archives. The modem's compression code isn't going to reduce these much further, so compressed speeds are largely irrelevant to my needs.

In this context, modem technology appears to have squeezed most of the available juice out of the standard audio telephone line. Over the last couple of decades, modem speeds jumped from 110 b/s to 300, 1,200, and 2,400 and finally 9,600.

The next jump only went to 14,400 b/s (V.32bis), however, indicating that progress had slowed down a bit. Even today, proprietary modems offer only about 25% over V.32bis performance, so I don't see any real performance jumps on the horizon. Some brilliant engineer may be cooking something up in a lab somewhere, but it will be a few years before I can buy (let alone afford) the results. Consequently, the modem vendors have pretty much done all they can for me.

### ISDN

The Integrated Services Digital Network (ISDN) is being touted as a way to use telephone lines for both voice and data. A minimal (2B+D) configuration offers two 64-Kb/s voice/data (B) lines and a 16-Kb/s signaling (D) line. The B lines can be used together, yielding an aggregate throughput of 128 Kb/s. Sounds pretty good to me. Where do I sign?

Not so fast, buddy. First, there has to be appropriate hardware and software in your local "wiring center." This isn't cheap to install, in part because the phone companies need to keep existing service going while they change over. Many urban wiring centers now have the right equipment, however, and some suburban and even rural centers are starting to get set up.

Next, there has to be support for making connections *between* wiring centers. For quite a while, this was stymied by a lack of standards in the industry. These issues seem to have been resolved, however. All that is left is to install (even more) hardware and software. Sigh.

There is also a small question of "tariffs." The telephone companies are regulated, you see, and they have to ask the regulators for permission to offer various services. In the case of ISDN, they typically propose "business" ISDN tariffs. Unfortunately, business lines are metered, and the charges add up rapidly. Before I pay hundreds of dollars per month for an ISDN link, I will look for more economical alternatives.

### Cable TV

Many cable companies are supplementing and/or replacing their current wiring with optical fiber links. The first stage involves running fiber from the central office to the distribution hubs. This provides stronger and/or cleaner signals, and saves the cable companies money on maintenance.

The companies then upgrade the lines into the neighborhoods. Some firms keep the current wiring, replacing only the line amplifiers. The new amplifiers can handle more channels and may provide bidirectional amplification. If so, they can be used to support data links to subscribers' houses.

Keep in mind that most users don't need a lot of outbound bandwidth. I mean, how fast can you type, anyway? If you're trying to provide an FTP archive or other service, you may need a high-speed outbound link. Otherwise, you don't, and you may get a cheaper solution as a result.

Some companies are pulling fiber past the residences themselves. It costs about the same to pull a dozen fibers as one, so the companies usually pull fairly large bundles. In some communities, the extra fibers are available for rental and can provide high-speed connectivity at exceptionally low prices.

In general, however, the cable companies are still getting their act together. If your local company is on the forefront, you may be able to get useful services from it. If not, you will only hear static in response to your inquiries.

### Radio Links

Conventional radio transmissions interfere with one another unless they are separated by directionality, distance, frequency or time of usage. As a result, radio frequencies are allocated and monitored very carefully. If you have a strong need and a reasonable budget, you should be able to set up a short-range radio link between your site and another one.

This is too expensive and difficult for informal networkers like me. Fortunately, there is another solution. Spread-spectrum radio transmission allows large numbers of conversations to share a single broadcast band, with minimal interference. Originally developed for military purposes, this technology is now being sold as a way of building "wireless LANs."

The NCR WaveLAN is a spread-spectrum transceiver, packaged as a PC card. It acts like a conventional (Ethernet or token-ring) card, but it hooks to an antenna, rather than a cable. It transmits data at 2 Mb/s, which is better than a T1 link can do. It costs less than \$700 and can be used at distances up to about 1,000 feet. Best of all, *no* license is required.

If your network neighbors are very close, a regular WaveLAN may work. If not, you can buy a directional antenna (about \$1,000) that extends the range to about five miles, line of sight. I suspect that a larger antenna might extend things a ways further, but NCR doesn't guarantee such a configuration, and the FCC may not even allow it.

Nonetheless, even five-mile hops can be used to build a network, if your net

neighbors are close enough. In the techie-filled, deeper parts of Silicon Valley, even the 1,000-foot version of the WaveLAN might be sufficient. In San Bruno, however, even the five-mile version may not be enough. Gee, my mileage *does* vary (-:-).

### Putting It Together

In my neck of the woods, The Little Garden (TLG) network provides the glue for a few dozen low-budget Interneters. TLG, organized at a local Chinese restaurant, divides a T1 link into lots of affordable pieces. For less than \$100 per month, I get a full-time Internet connection. With my amount of email, FTP and netnews activity, this is a real bargain.

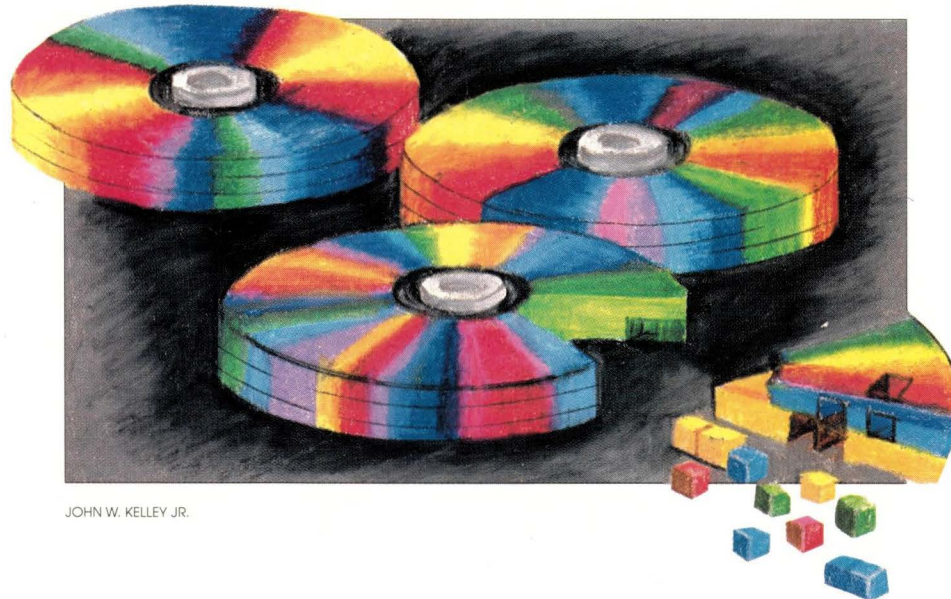
As the technologies described above become economical and available, I expect TLG to offer them. I may soon have the equivalent of a T1 link for my \$100 per month; wouldn't that be nice? If all of this sounds interesting to you, check for a similar low- or no-profit venture in your area.

If there isn't one, think about setting one up. You'll need an "anchor" site for the net, both to attach the Internet feed and to handle major capital outlays. You also need some network users who 1) want Internet access, 2) are willing to pay for it, and 3) can administer their own parts of the net. I qualify (barely) on all three counts, so TLG is glad to have me.

Networking technology and politics are undergoing rapid change. Things that were impossible quite recently are quite reasonable today and may be trivial next year. If you want Internet access soon, however, you'll have to look around and even work a bit for it. Or, you can sit there and watch the cars zoom by... ➡

---

**Richard Morin** produces Prime Time Freeware, a semi-annual CD-ROM collection of redistributable, UNIX-related source code. Between releases, he consults, writes and teaches on UNIX topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at [rdm@cfc1.com](mailto:rdm@cfc1.com).



JOHN W. KELLEY JR.

by PETER H. SALUS

## WORM File System Standards

**D**raft International Standard (DIS) 13346 is a standard defining a file system layout for random-access media for write-once or rewritable media. It is intended primarily for the interchange of files. Write-once, read-many (WORM) file systems store a fair amount of information per file, per directory, per partition and per volume. A volume is a logical address space associated with a piece of physical media.

Originally, work on file system formats for WORM (nonsequential, random-access media) was done in the ANSI X3B11 committee, which develops optical disk standards. For various reasons, this didn't work out, and so in July 1989, a new subcommittee was formed—X3B11.1. X3B11.1 has been a small, tightly focused group, and the March 1993 meeting was their 17th.

### International Committees

The two relevant international committees were also resurrected during this time. The ISO SC15 committee, which deals in volume and file structure, with Japan the secretariat, was first (in 1990). The main impact of SC15 on DIS 13346 has been in providing international feedback and in developing a reference model for information interchange via removable media. The work on the model started out on the wrong foot by basing itself on the OSI reference model, but after some fairly strong feedback from the United States at the last SC15 meeting in Denver, it looks like it will be recast into a more usable form.

The analogous committee in the European Computer Manufacturers Association (ECMA), TC15, had its first meeting in Geneva in

September 1991. TC15 was restarted largely as a result of a request from the working group involved in the Philips CD-WO device (a 5¼-inch WORM that can be compatible with CD-ROM drives). TC15 also considered a reference model for interchange, but work on this has largely shifted to SC15.

Why does the international activity matter? Two reasons: While X3B11.1 is a U.S. standards committee, the goal of its members was an international (ISO) standard, and the goal of the standards game is to have a technically sound standard adopted as soon as possible. Assume for now that X3B11.1 had a technically sound draft. How do we get a standard? One way is to go through the ANSI process, as the C standard did. Assuming no problems, hitches, objections and foul-ups, we could have an ANSI stan-

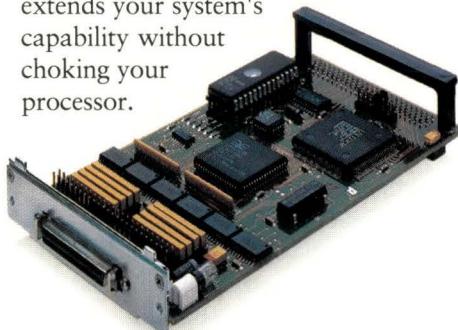


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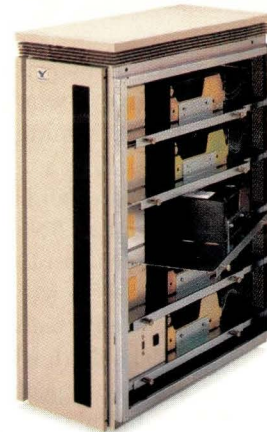
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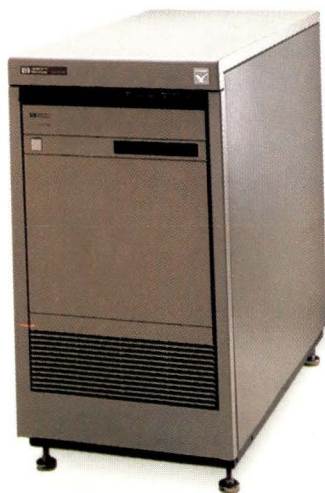


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dard within two years. And then we would have to work within the ECMA/ISO committees to ensure that they adopt a technically equivalent standard (and thus avoid the prospect of an ANSI standard that conflicts with an ISO standard). The other way is to work within the ECMA committee and produce an ECMA standard, which then, given the heavy European presence in ISO, would most likely become an ISO standard through the fast-track process.

Astonishingly enough, it seems likely that we could get an ISO standard six to nine months sooner than we could get an ANSI standard!

### On the Fast Track

So when the X3B11.1 drafts were fairly stable, they were submitted as TC15 drafts, and the final polishing and harmonization of the draft was done in parallel in both committees. (This only worked because of the heavy overlap in committee members and because the same person, Andrew Hume of AT&T Research, was editor.) The TC15 draft was approved as an ECMA standard (DIS 13346) on June 25, 1992, at the ECMA General Assembly by a vote of 30 yes, 0 no, 1 abstention (IBM). It was published last October and submitted for the fast track after the December General Assembly. ISO issued DIS 13346 with a voting period of January 28-July 28, 1993. The Special Working Group meeting for resolving comments on the draft has been tentatively scheduled for Geneva, October 11, 1993.

### What's in It?

Editorially, 13346 is arranged as five separate parts. Semantically, these form four independent standards. (Part 1 contains general references and definitions.)

- Parts 1 and 2 describe a general scheme for recognizing standards used to record the medium (is it ISO 9660, 13346, or perhaps both?) and for recording boot blocks.

- Parts 1 and 3 describe a volume structure standard, which includes

support for volume labels, volume sets, volume partitions and logical volumes (which may span multiple physical volumes).

- Parts 1 and 4 describe how to record hierarchical file systems (assuming we have a suitable underlying volume structure scheme). The file system is approximately a POSIX (ISO 9945-1) file system augmented by extended attributes and symbolic links.

- Parts 1 and 5 document the arcana of record-structured files. DIS 13346 has to support record-structured files, if only for backward compatibility with ISO 9660, and making it a distinct part allows other standards to easily use the same specification.

An important aspect of each of these parts is their interfaces. The input interface describes what the part needs in order to work. The output interface describes what the part allows you to specify (and perhaps use as input to another part). As an example, Part 5 (record structure) has a single input, the data space of a file, and two outputs, the identification of record formats and record display attributes.

### The Future

The committee's focus is now split among three areas.

The first area is voting on DIS 13346. This is fairly routine but intricate because of procedural rules and delays within the United States; documents have to get passed from ISO to ANSI to X3 to X3B11 and finally to us. X3B11.1 has voted recommending that X3B11 recommend a yes vote on 13346. X3B11, in turn, conducted a letter ballot (expected to finish around May 1) to decide its recommendation, and then that goes back up the chain. The complications involve meeting schedules, voting deadlines and making sure no one inadvertently says "no."

The second area is implementing 13346. I know of five implementation efforts; one commercial implementation is beta testing with customers. As a means of verifying X3B11.1's understanding of the

standard, and as a way of improving the level of interchange, Hewlett-Packard organized a meeting on conformance testing for 13346 last February in Fort Collins, CO. This was surprisingly popular, with about 30 companies attending. In brief, the participants agreed to work on the areas of conformance testing, and the details of how to translate between conforming media and various operating systems' interfaces.

The third area is addressing work for future standardization. This includes specific proposals for issues like compression, which 13346 supports in a generic way, and proposals for much higher performance goals, particularly for somewhat peculiar file sets such as a million files, say, in a single directory. This work is parallel to, and asynchronous with, the progress of 13346.

It seems likely that something very close to 13346 will become an ISO standard for (essentially all) random-access media. Even if you don't care about the file system aspect, you should be interested in the proposed booting and volume recognition scheme. ➔

## Acknowledgment

Most of this column derives from the superb reports that Andrew Hume has posted on the net and published in *login*: over the past three or four years. I am also indebted to Andrew for writing me immediately after the March 1993 meeting of the committee so that this column could present the latest work. The entire community owes a debt to Andrew for his extraordinary efforts on both committees.

---

**Peter H. Salus** is currently working on books on internationalization and computer communication. He has attended P1003, P1224 and ISO meetings. He can be reached at [peter@uunet.uu.net](mailto:peter@uunet.uu.net).



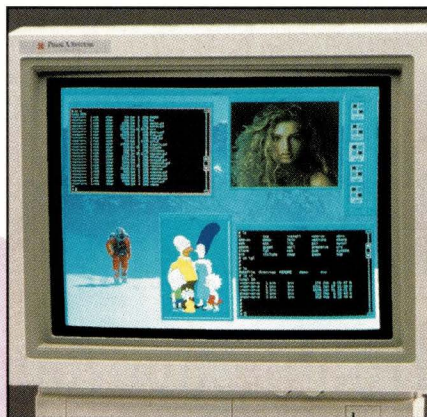
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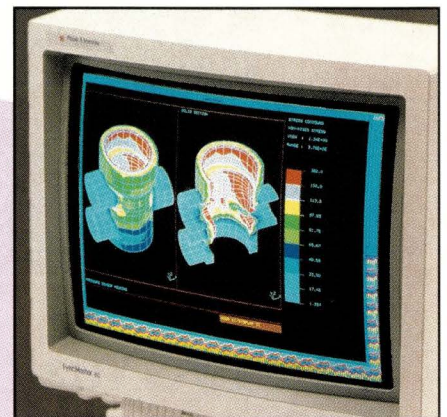
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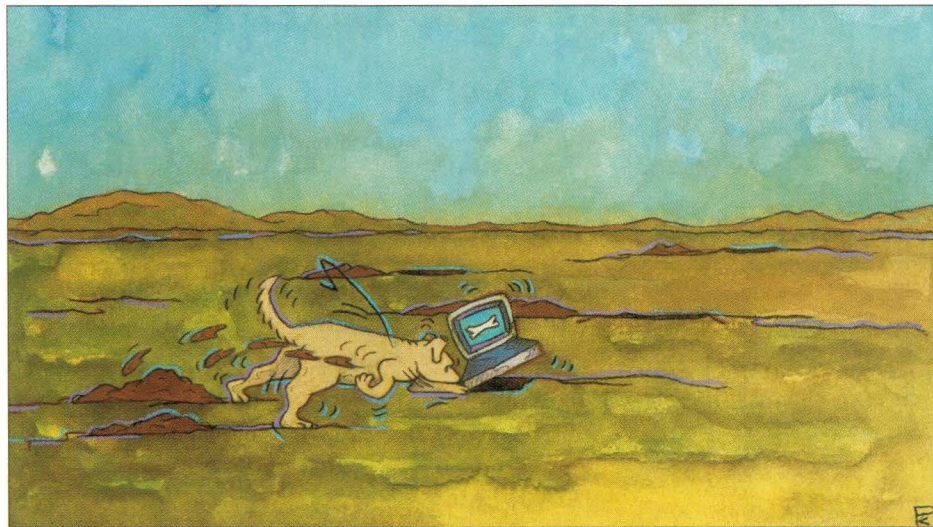
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## Everyday Troubleshooting

by S. LEE HENRY

Protocol analyzers, software network analysis packages and network management tools offer their users a lot of insight into the networks they administer. Traffic patterns, network saturation and NFS problems come to life when viewed graphically. When viewed often, they give you an appreciation for what is normal activity for your network—and what is not. For those of us not endowed with graphical tools for network analysis (especially those of us whose only entry into our networks is a dumb terminal), sensing network status on a routine basis is considerably more challenging. Challenging, but not impossible.

Much of the raw data presented by more “user-friendly” (read commercial) tools is available through use of several utilities available in SunOS. `etherfind` in SunOS 4.X and `snoop` in Solaris 2.X provide the data for sophisticated network analysis. Errors recorded in `var/adm/messages` files and statistics available through `netstat` can tell you a lot about problems you are having and some you might avert. Unfortunately, most systems administrators rely on network analysis tools only when they are chasing after an immediate problem. As a result, their ability to notice trends

and predict dramatic changes in network performance is reduced to fuzzy impressions of performance, and their ability to anticipate failures and pinpoint the causes of poor performance is similarly burdened.

Circumventing this problem with quick and dirty scripts that summarize network problems and characterize performance is not difficult. If you install these checks into your account so that you are forced to view this data without having to make a special effort, you will probably find that, over time, you will have a much better feel for what normal performance on your network is like and be better able to react to unusual situations.

### Everyday Collisions

Packets collide. It's part of life on the big network—and even on the small network. Ethernet controllers expect this and retransmit packets when collisions are detected using a timing algorithm that makes a repeat collision unlikely. When the collision rate on a network begins to creep beyond a small percentage of transmitted packets, however, network performance begins to suffer.

One simple test of network performance, therefore, is to

**Figure 1. Evaluating dmesg Errors**

```
#!/bin/csh
#   eval_errs:           count certain errors from dmesg by type
#
dmesg | grep NFS | grep -v ok | sort | awk -f count_same
dmesg | grep ^le0: | awk '{print $1, $2, $3, $4}' | sort | \
    awk -f count_same
dmesg | grep ^xt0: | sort | awk -f count_same
dmesg | grep ^arp: | sort | awk -f count_same
```

**output:**

```
NFS server (pid137@/home) not responding still trying : 6
NFS server magic not responding still trying : 1
NFS server wizard not responding still trying : 5
NFS write error: on host monster remote file system full : 8
NFS write error: on host frog remote file system full : 6
le0: Receive: STP in : 26
le0: Receive: giant packet : 26
xt0: hard error bn=0 er=0x40 : 1
xt0: timeout interrupt : 1 arp: ether address is broadcast for IP address 80dc033a! : 10
```

calculate the collision rate as a percentage of overall packets. Every time I log into my network, I take a look at the collision rate. I don't expect to be startled, but I will notice if the rate starts to creep upward. I won't be able to avoid noticing. The one-line command shown below, called through my .login file, nudges me several times a day.

```
# netstat -i | grep ^le0 | awk '{print
    "Collision %: " $9 / ($5 + $7) * 100}'
```

**Everyday Errors**

netstat also provides a large number of network statistics—more than you will typically want to examine. However, by narrowing down what you choose to look at to the statistics most indicative of network troubles, you will not only familiarize yourself with the normal limits of your network performance but gain additional insights into the character of your network. You might want to know if the number of duplicate packets get above 1%. The following zinger of a

**Figure 2. awk Script for Counting Errors by Type**

```
# count_same: count the lines that are the same and print each unique line
#   along with a count of how many times it appeared
#
BEGIN {CNT = 1}
{
if (NR != 1) {
    if ($0 == PREVLIN)
        ++CNT
    else {
        print PREVLIN, ":", CNT
        CNT = 1
    }
    PREVLIN = $0
}
PREVLIN = $0
}
END {
    print PREVLIN, ":", CNT
}
```

**Figure 3. The checknet Script and Output**

```
#!/bin/csh
# check_eth: grab some telnet traffic and print stats
# showing host pairs and volume
#
if (`whoami` != "root") then
    echo "Sorry. You have to be root to use this proc"
    exit
endif if
($#argv == 2) then
    set SAMPLE=$2
else
    set SAMPLE=1000
endif
set EXPR="$1"
etherfind -c $SAMPLE $EXPR | awk -f chop3 | awk '{print $3, $4}' | \
    awk -f alpha_lines | sort | awk -f count_same | sort -nr +3 | head -5
```

**output:**

```
magic wizard : 228
spell xyz : 176
nextpage wizard : 148
elf wizard : 140 fool wiser : 111
```

one-line command will extract this from the output of the `netstat -s` command.

```
netstat -s | egrep 'packets received|completely
dup' | head -2 | awk '{print $1 " "}' | tr -d
"\012" | awk '{print "% dups: " $2 / $1 * 100}'
```

Another source of useful information on the status of your network is the messages that are logged in `/var/adm` and reported by `dmesg`. Reading through system messages when you're not looking for anything in particular, however, can be a fairly boring exercise. To conserve my time, I summarize the output of `dmesg` into counts of various types of

errors. I can always go back and read the detail if something looks worth pursuing.

Problems reported by `arp`, my disk controller, my Ethernet controller and NFS are displayed by the script shown in Figure 1. As with my collision and duplicate packets reports, I call this routine through my `.login` file so that I can't avoid confronting my errors every day. This helps me to anticipate the need to reformat or replace a disk that is complaining only occasionally.

The `awk` script that prints each type of error along with the count of how many times that error appears in the current messages is listed in Figure 2. This script can be used to summarize the occurrences of identical lines in any sorted file and might have other uses.

**Figure 4. Two awk Scripts for checknet**

```
# chop3: chop off top 3 lines
#
{
if (NR > 3)
    print $0
}

# alpha_lines: sort first 2 fields on each line
#
{
if ($1 < $2)
    print $1, $2, $3
else
    print $2, $1, $3
}
```

**Everyday Traffic**

Another useful way to glimpse activity on your network is to grab a sample of network traffic and characterize it. `etherfind` in SunOS 4.X and `snoop` in Solaris 2.X allow you to retrieve packets en route to other hosts and view them in detailed or summary form. These tools allow you to select packets on a wide variety of criteria, including source and destination hosts, protocol and packet size. You can even mix and match your criteria as shown in the example below, in which we select both on a host and a protocol.

```
# etherfind host nextpage or proto icmp
```

`etherfind` uses the network interface tap (NIT) to grab packets off the network that are not directed to

the local host. `snoop` uses the network packet filter and streams buffer modules to capture packets efficiently. In either case, the ability to capture packets belonging to other users and other hosts is a potential security problem on many networks and, for this reason, you need to be root to use these tools.

In the script shown in Figure 3, we use `etherfind` to capture a sample of 1,000 packets (or the number provided as a parameter to the script) of the packets specified by the expression (the first argument). We then excise the labels off the top of the output, arrange the hostnames in alphabetical order and sort and count the lines by pair to produce a list of host pairs by number of packets exchanged. We might use a script like this to see which hosts are responsible for the bulk of broadcast traffic or to evaluate which hosts are using telnet and where they're connecting. If you have a large number of hosts, you can always pass the output of this script to a head command to reduce the output to the most active host pairs.

```
# checknet "srcport 23 or dstport 23" | head -10
```

The `chop3` and `alpha_lines` `awk` scripts used within `checknet` are listed in Figure 4. Keep in mind when using `etherfind` that packets generated by the local host are not included in the output. `etherfind` does not reliably capture packets generated by its own host.

### Everyday Smarts

Don't be fooled by my "look how easy this is" tone. Diagnosing network problems is one of the most difficult tasks the system administrator faces. The multiplicity of problem sources and the complexity of the commands and tools for tracking down a problem make network performance analysis and troubleshooting an art. By learning to watch for problems and characterizing traffic on your network when everything is running smoothly, you will be preparing yourself with the insights you will need when problems appear. ➔

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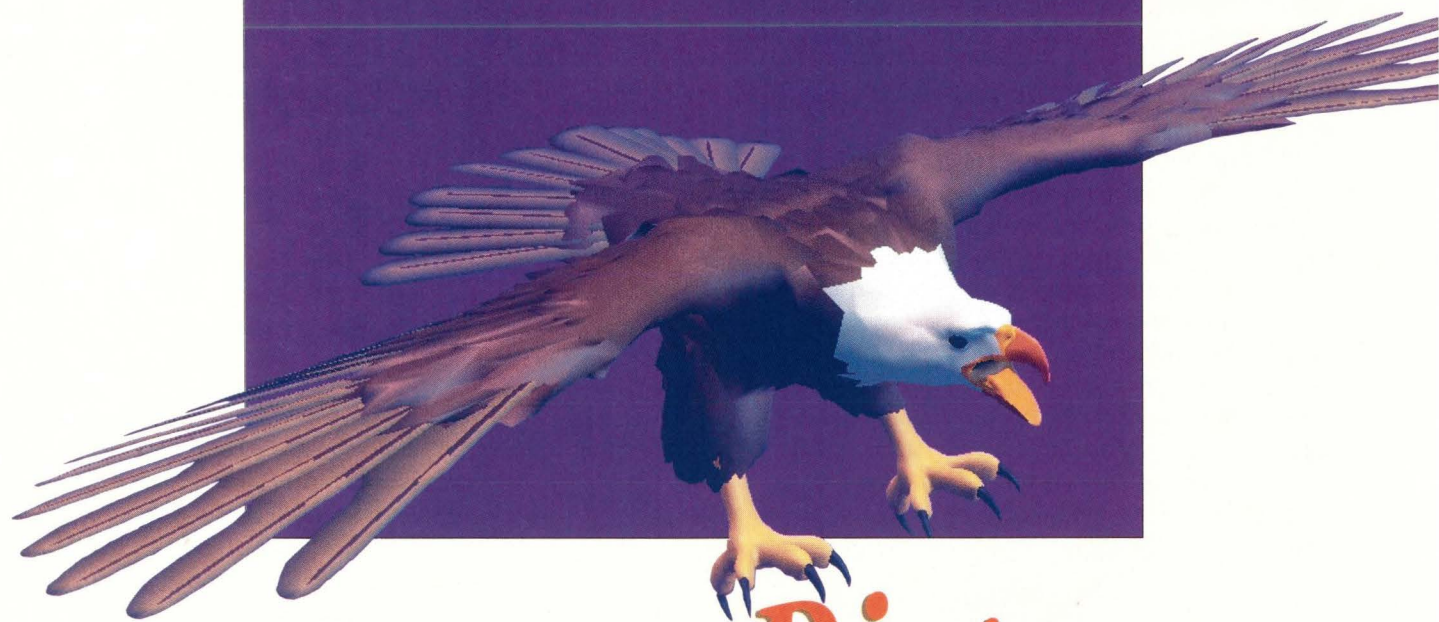
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GRAPHICS

# Suns in the Picture

by MICHAEL JAY TUCKER, Executive Editor

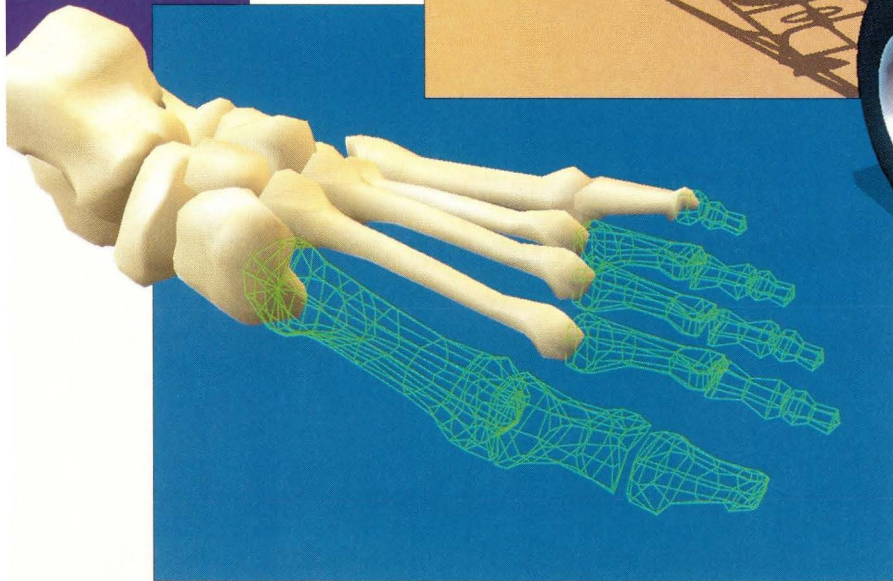
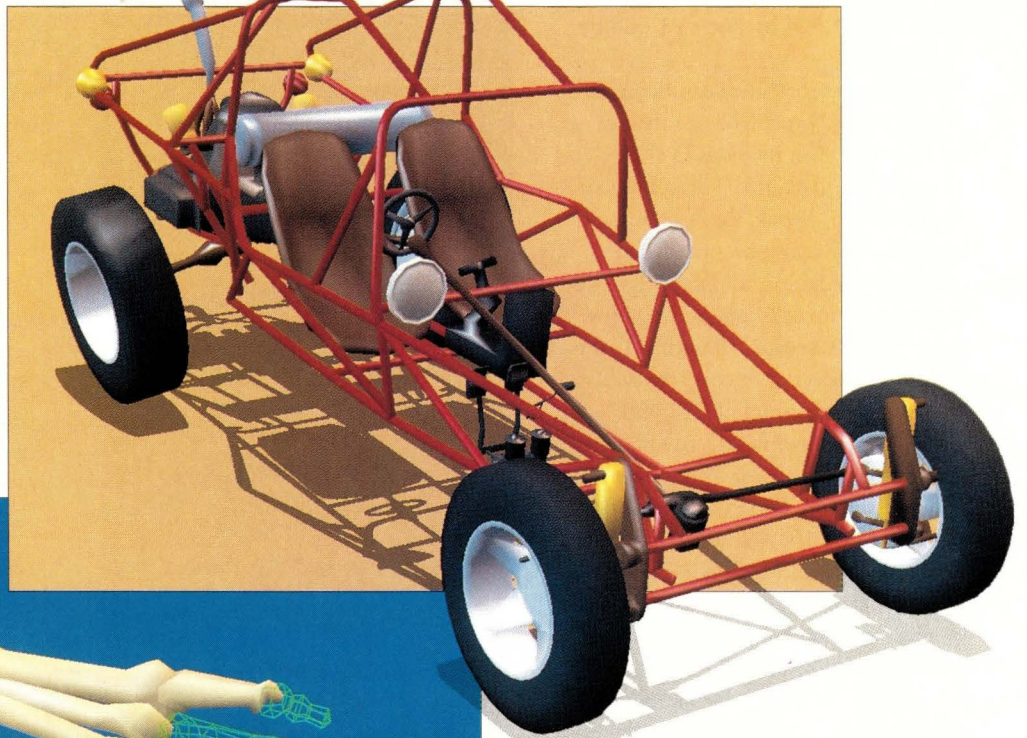
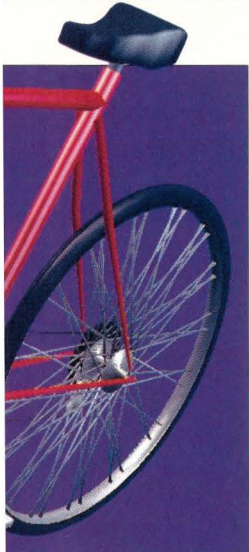
**F**ew markets are as diverse, as varied and as broad as graphics. Even the term “computer graphics” is subject to debate. Where once everyone knew what the expression meant—that is, pretty pictures created or manipulated by machine—now it is a handy expression for a number of different disciplines.

The term “graphics” now means everything: traditional graphics, “scientific visualization” (itself a term under stress), imaging, computer-based video, animation and so on. Yet such is the adaptability and flexibility of Sun Microsystems Computer Corp. workstations and compatibles that they are found in all of these fields. This special issue of *SunExpert* will look at a few, but by no means all, of the different ways that SPARCstations and their kin ought to be in pictures, and are.





*Increasingly, Sun workstations can and do play many roles in the various aspects of graphics and imaging.*



# Sun's New Graphics

This month, Sun itself began the pre-Siggraph season by introducing two new graphics hardware SBus boards for SPARCstations—the TurboGXplus and the ZX. The products will dramatically increase both 2D and 3D graphics performance on SPARCstations.

The TurboGXplus is an SBus board that provides fast 2D graphics. “It basically replaces the GX plus in the SPARCstation 10,” explains Ken Wong, product manager for the TurboGXplus. The company says the board will provide 970K 2D vectors per second, roughly twice as fast as the older GXplus.

Sun says the product also improves windowing performance. In addition, it has double buffering for smooth animation. The TurboGXplus can support a range of monitors and resolutions, from 1,024 by 768 to 1,600 by 1,280.

Graphics performance can be further improved by Direct Xlib, a software package that Sun includes in the Solaris 2.2 CD-ROM. This allows an application to bypass the X server and directly address graphics hardware.

Pricing for the TurboGXplus had not been firmed up as of press time. However, a SPARCstation 10 with a TurboGXplus is expected to cost somewhere “in the neighborhood of \$22,000.”

The ZX, meanwhile, is a 3D graphics accelerator available for SBus systems, ranging from the SPARCclassic to the SPARCstation 10. A double-width, double-height card occupying two SBus slots, ZX provides a variety of high-end graphics capabilities. These include gouraud shading and lighting, hardware line antialiasing with sub-pixel accuracy, per-pixel depth-cuing, dynamically tessellated NURBS in firmware and so on.

In terms of performance, ZX offers 750K 3D vectors per second (10 pixel lines), 400K antialiased 3D vectors per second (10 pixel lines).

The ZX can also output at a number of different resolutions, beginning at 1,280 by 1,024 and going to commercial TV standards. “It goes all the way down to NTSC or PAL,” says Bill Flem-

ing, senior product manager at Sun. “That means you can command the ZX to output at NTSC or PAL rate, and with a converter box, you’ve got a signal that you could put out on video.”

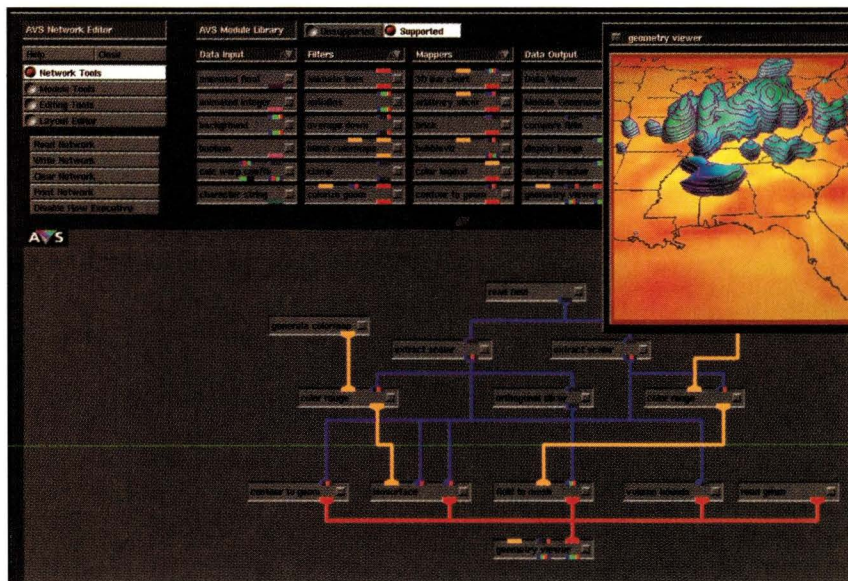
Moreover, the product comes bundled with a stereo monitor for 3D viewing. Again, prices had not been firmly established as of press time, but a complete SPARCstation, with the ZX and the stereo monitor, is expected to be as low as \$20,000.

The new products fit squarely into Sun’s historical pattern regarding graphics. SMCC has consistently shied away from the very high-end, extremely narrow niche graphics markets (such as 3D animation for the entertainment

industry). Instead, it maintains a position in the comfortable middle of graphics where mass markets are possible and where the company can play on the extreme flexibility of the SPARCstation as a platform.

Since the SPARCstation can be very easily customized by end users or developers, SMCC can offer not only individual products but a range of them, beginning with no graphics at all and ending with fairly high-performance systems. “Basically, you have the high end and the low,” says Niraj Swarup, product line manager for graphics at SMCC. “And, in between, you pick the best combination of features and price points for yourself.”

*A montage of images created using Advanced Visual Systems Inc.'s AVS visualization package shows the versatility of modern scientific graphics software.*



## Whatever Happened to Sci-Viz?

About the buzziest buzzword of the late 1980s was “scientific visualization.” This was described as the business of using computers to picture scientific data in easily and intuitively understood ways. Industry pundits and investors thought it was going to be a field ripe with money for the taking.

In fact, the sci-viz biz, as it was originally envisioned, largely fizzled. The companies that were supposed to make vast profits from it didn’t. “People thought it was big bucks,” says Dr. Brand Fortner, director of R&D for Spyglass Inc., a vendor of low-end visualization and plotting software for



the PC and Sun workstations. "That's not true anymore."

Stellar Computer and Ardent Computers, based in Massachusetts and California, respectively, are a classic example of what happened in the 1980s. The two companies were founded to offer very high-end, very powerful visualization machines. Neither company profited, and then they merged under the ill-fated name of Stardent. But the combined entity was still unable to thrive selling semiproprietary hardware in an age of open systems. Finally, the company simply shut its doors.

But it left behind a vigorous ghost—Advanced Visual Systems Inc. (AVS). "Essentially," says Hambelton Lord, AVS' director of product marketing, "we were the technology that came out of the company that was really useful." AVS' product is AVS, a high-end visualization software package that can run on Sun platforms. Where Stardent had a troubled history at best, AVS is actually selling rather well.

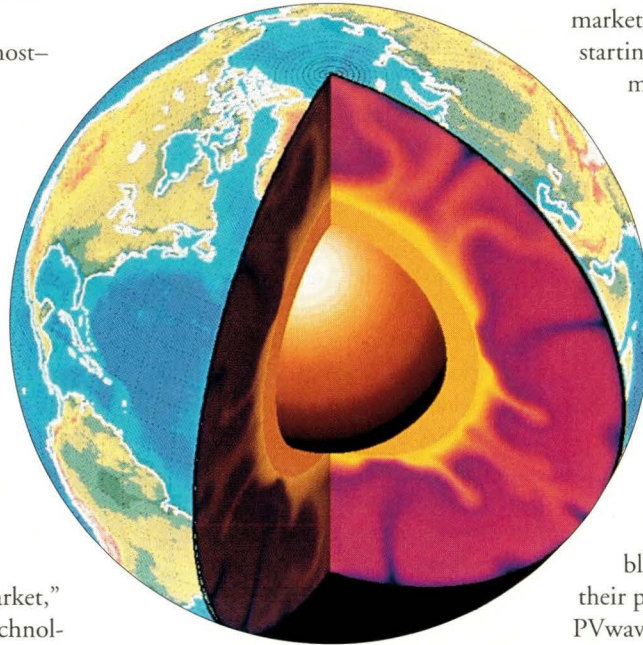
But, says AVS' Lord, its success as a product has little to do with scientific visualization as a market. "Visualization isn't a market," he explains. "It is an enabling technology." That was the error of the first great push in sci-viz. It was sold as though it were something people would want in its own right. In fact, scientific visualization was only useful to the degree to which it let people get their jobs done.

Thus AVS, which may be the leading scientific visualization package, sells itself as a graphics tool. And when it sells to end users, it sells into what the company cheerfully admits is a relatively limited market. "It is a fairly small community," says Lord. "Around the world, there are perhaps several thousand such people, mostly researchers."

In fact, the company actually plans to gain more users by becoming as transparent as possible. Reasoning that most researchers don't want to do graphics number crunching—"the majority of people out there don't want to do visualization, they have their own disciplines,"—the company is

seeking partnerships with other developers. The idea is to sell AVS as something that ISVs would purchase to give their own niche products visualization abilities. "Last year, 10% of our customers were developers," says Lord. "This year, it will be 20%."

A similar point of view comes from Research Systems Inc. (RSI), a maker of the IDL visualization software. "What we see is that scientists, our customers, want a set of tools with



*Using Research System Inc.'s IDL software, two data sets—elevation of earth's surface and simulated convection of earth's mantle—can be rendered in 3D to explore the magma flow that drives continental plate movement.*

which they can develop and distribute applications," says Jim Wilson, RSI's manager of communications.

He thinks that, in the future, scientific visualization vendors will increasingly have to sell development environments with which end users, developers or whoever can add graphics to niche applications. "We think that scientific visualization is a set of tools—mathematical and statistical analysis tools, plotting tools, 3D visualization tools and application development tools." He also notes that his company is building alliances with niche-market ISVs.

Spyglass' Fortner also believes that visualization is a tool and a low-end tool at that, "I think the high-end market has just plain gone away." His company, which has targeted the low end and the end user from its origins, is stressing ease of use and its commonality with plotting packages. Spyglass is meant for scientists or engineers who want to do their own visualizing but would just as soon not learn an entirely new graphics language to make it possible.

In fact, Lord thinks the sci-viz world is shrinking, with the high end of the market withering and the rest of it starting to consolidate around a few major names. "I think you're seeing that consolidation already," he notes. "I think you're seeing it in things like the merger which produced Visual Numerics."

Visual Numerics Inc. is the name of the new company created by the merger of visualization software vendor Precision Visuals and IMSL, maker of the famed numerical packages of the same name. The two companies recently blended both their business and their products, announcing in May PVwave:Advance, which has the visualization software of one company and the math strengths of the other.

"It is not like we just slapped the two products together," says Laurie Potratz, senior product manager for visual data analysis at Visual Numerics. "It was a thorough job. It took us 13<sup>3</sup>/<sub>4</sub> man-years to do it."

She says the merger of products and companies was a logical and natural result of complementary strengths. Precision Visuals had graphics, but not math. And, as for IMSL, she says, "our customers said we had the greatest thing since cookies when it came to numerics...but they wanted a 4GL way of accessing it."

At the same time, Visual Numerics announced another option, PVwave: Maple. This is a product that combines the company's own products with the symbolic math products of Waterloo Maple Software, Waterloo, Ontario. Visual Numerics believes that

PVwave:Maple will be able to successfully challenge Wolfram Research Inc.'s Mathematica, which likewise combines symbolic math with graphics. Mathematica, though, came from the PC and Mac platforms and still focuses much of its attention there.

And, of course, there are dozens of other companies and products that have expressed a very similar philoso-

phy. Integrated Systems Inc., for example, offers Xmath. It too has extensive visualization features and could probably compete as a sci-viz offering, but it is instead sold as a math package that happens to have visualization as a feature.

Thus it is that scientific visualization seems to have risen, fallen and then risen again. This time, though, it may

have finally found a successful strategy—that is, its products must never demand that end users be graphics programmers. It must either be extremely easy to use or else sold directly to developers who in turn incorporate it into niche products. In other words, scientific visualization will succeed, but only by vanishing from sight even as it makes data visible.

## Imaging: 'The Esoteric Is Affordable'

In the not too distant past, imaging was regarded as a field within graphics. Today, though, it is increasingly seen as a very different discipline doing very different things—just as computer-based video is now regarded as a separate field from graphics.

But, for Sun Microsystems Inc. platforms at least, imaging is among the most promising of all the visual markets because of sheer economics. Imaging has come increasingly off high-end, dedicated systems and onto standards-based open platforms. What was once a *very* expensive, complicated business of specialized systems has become cheaper and even commonplace. "The esoteric is now affordable," explains Susan Snell Solomon, a spokeswoman for imaging technology vendor Datacube Inc.

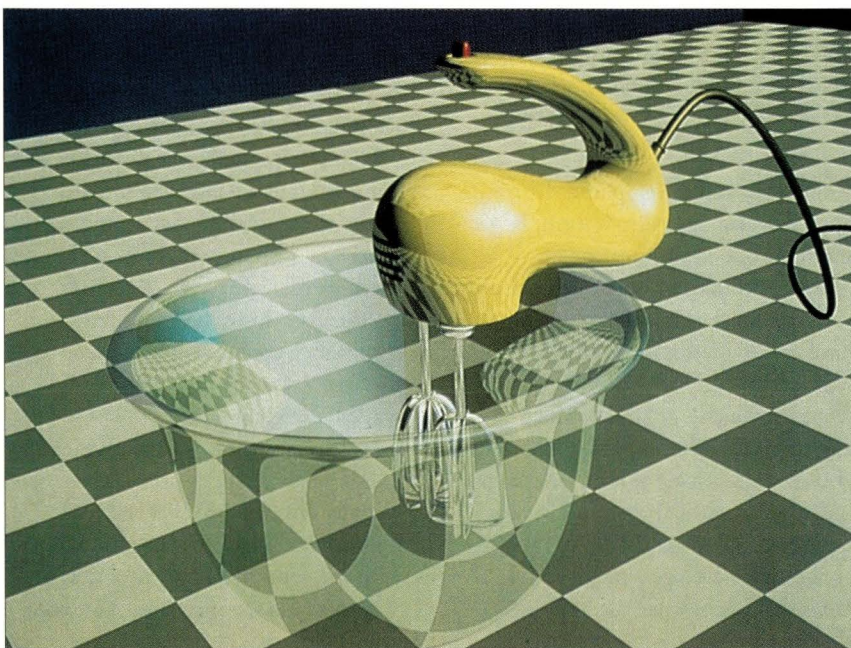
And the reduced costs and complexities have meant that a whole host of applications have suddenly been made available for the technology. "A lot of imaging applications are trying to come over from the old military market," says Solomon. "And many of the algorithms involved—target tracking, for instance—are just as applicable to industrial settings, like web inspection. The same is true for medical imaging."

Imaging is also finding itself in some unexpected places—such as legal and financial printing. "One of our major focuses now is the inspection of printed documents...high-value printed documents," says Richard Jaenicke, manager of product development for Ektron Applied Imaging Inc. Ektron, which is a subsidiary of Kodak, makes a variety of

imaging systems, including an imaging chassis that links to a SPARCstation via an SBus connector.

Ektron sells product into those markets in which printed paper has a powerful legal or economic value in its own right. "It is one of those fields where the commercial companies that have been contracted to do the printing have extremely high quality standards. If they have error rates of five parts in a million, they lose their contract." To avoid this result, Ektron's customers are configuring systems to inspect each and every part of each and every document.

Meanwhile, imaging's future may be rather like scientific visualization's present. As imaging comes down out of the high-end applications to the desk-



*With dedicated accelerators, a Sun workstation can provide some of the fastest and most dramatic images in the market. This image was produced by a SPARCstation attached to a deskside accelerator from Evans & Sutherland Computer Corp.*

tops of average users, developers will be forced to make it as simple as possible. It must, in other words, almost disappear, and take UNIX with it. "The real winner," says Ken Hilton, vice president of sales and marketing for imaging technology vendor Visual Information Technologies Inc. (VITec), "is the company that can best isolate the user from UNIX."

## Accelerators Race On

**S**un isn't alone in offering graphics accelerator products for its systems. There is a substantial industry devoted to providing such things—ranging from low-end boards all the way up to high-end systems like the Freedom towers from Evans & Sutherland Computer Corp.

All of these companies sell products that make Suns run graphics faster—but that may be all they have in common. Their customers want accelerated graphics, but often for very different reasons. Sometimes what they really want is Silicon Graphics Inc. workstations, but they've got Suns, and they need some way of getting SGI applications to run (sometimes) on SPARCstations.

As a result, there are companies out there that offer accelerators to help Suns deal with their Iris-envy. "A lot of companies have SGI for graphics and Suns for general-purpose work, and that's where we come in," says Joe DePaola, a spokesperson for DuPont Pixel Systems. DuPont offers a line of Intel Corp. i860 boards, plus an implementation of SGI's GL (see "A PEX on Both Your Houses?").

Other buyers, meanwhile, are developers who could not care less about SGI. "I have two kinds of customers," says Jason Lo, president of Integrix Inc., a vendor of board-level accelerators. "One is end users, but the other is the OEM channel." He says that this second group, Sun resellers, isn't after technology so much as the graphics punch necessary to make their product stand out. "They want differentiation for their products."

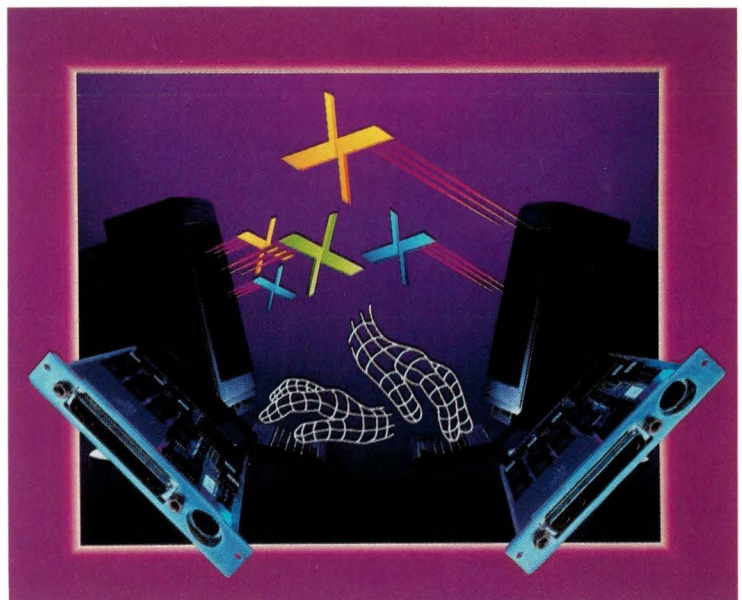
But the real kicker is that graphics accelerators' hottest market may have nothing to do with graphics. "What we found was that while graphics accelerators are nice, what the market really wanted was a way of adding users to a single workstation,"

explains Dana Witt, Esprit product manager for Megatek Corp. Megatek originally sold its accelerators as accelerators, but increasingly it has found that customers are eager for some means of allowing a single SPARCstation to drive multiple monitors. One of the unexpected benefits of graphics accelerators, like Megatek's Esprit products, is that they allow you to do so.

And Megatek isn't alone. Tech-

Source Inc., for example, offers the Gxtra line of accelerators to allow SPARCstations to support multiple terminals as well. It may be that, in an age of reduced budgets, the real future for accelerators is to become a kind of multiport device. "In these lean economic times," says Witt, "with companies trying to get the most out of every dollar, this compromise [between workstations and X terminals] works out really well."

*Graphics accelerators, like this Esprit board from Megatek Corp., can improve graphics performance on Sun workstations. The Esprit has also found a market giving multiuser capabilities to workstations.*



## A PEX on Both Your Houses?

**P**otentially the leading software issue for Suns is GL, the graphics library developed by Silicon Graphics Inc. that has become a de facto standard for graphics software. Since they could not run GL, SPARCstations have simply not been able to gain access to much of the world's leading graphics software.

To redress this, Sun and its partisans have experimented with a variety of strategies. One of these was XGL, Sun's X-based graphics library. "XGL was an

attempt to say, "We don't recognize Iris GL...we are going to establish another standard," says Joe DePaola, a spokesperson for DuPont Pixel Systems. "But it hasn't caught on."

More promising, says DePaola, is to implement Iris GL on Suns or accelerators attached to them. Several companies offer such GL implementations, among them DuPont Pixel and Portable Graphics Inc., the former Nth Portable Graphics. "We make GLware," says Jerry Norman, Portable

Graphics' vice president of sales and marketing, "which consists of NPGL, which is an Iris GL, and, soon, an OpenGL product for Sun and HP."

The two companies differ greatly in their approach to the problem. DuPont's GL, licensed from SGI, runs either on the company's own i860-based boards or on the SPARCstation,

but it does not employ Sun's XGL as a foundation. Portable Graphics' NPGL runs atop XGL.

Each says the other's approach is subject to certain limitations. DuPont says that while NPGL is very close to Sun's own system software, it fails to be completely Iris GL-compatible, and some GL-based applications will have

difficulty porting to the SPARCstation. Portable Graphics, meanwhile, argues that its XGL-based approach means that applications can benefit from Sun's own graphics hardware accelerators. As for DuPont's critique of Portable's use of XGL, Norman responds, "Is that relevant? What does it matter? We run our Sun version on top of XGL, and we run our HP version on HP's [graphics mechanism]...the bottom line is what you get in terms of acceleration."

In any case, both companies are looking at a new development in the very near future. SGI recently led an association of graphics vendors in the development of OpenGL, a graphics standard designed to be a de jure as well as de facto industry standard. "And it probably will be," says DuPont's DePaola, "though it is a few years off yet." Portable Graphics, which has an Iris GL and will have an OpenGL, says that the best strategy for developers is to use Iris GL with existing code and OpenGL for new efforts.

But if GL is today the standard for 3D graphics, could something else arise to challenge OpenGL tomorrow? Some industry observers have proposed PEX—the PHIGS Extension to X—as a possible contender, even though it is not directly comparable to GL in terms of its functions or aims. Already, such observers point out, PEX is a supplier of 3D functionality to the large and growing X community.

All the major X-oriented software vendors have announced plans to support it, and there are already PEX terminal makers such as ShoGraphics that have real markets for its products. "PEX lends itself to mechanical CAD types of applications," says Tad Furutsuki, manager of product marketing for ShoGraphics. "And I think, more and more, the MCAD environment is going to be driven by the pressure to reduce cost per seat."

GL partisans, however, remain unconcerned. "That's mostly client/server graphics," says Portable Graphics' Norman. "And there isn't much of that around yet. It'll probably be big in the future, but not today." ➤

## Companies Mentioned in this Article

### Advanced Visual Systems Inc. (AVS)

300 Fifth Ave.  
Waltham, MA 02154  
**Circle 151**

### Datacube Inc.

300 Rosewood Drive  
Danvers, MA 01923  
**Circle 152**

### DuPont Pixel Systems

2010 North First St., Suite 403  
San Jose, CA 95131  
**Circle 153**

### Ektron Applied Imaging Inc.

23 Crosby Drive  
Bedford, MA 01730  
**Circle 154**

### Evans and Sutherland Computer Corp.

580 Arapeen Drive  
P.O. Box 58700  
Salt Lake City, UT 84158  
**Circle 155**

### Integrated Systems Inc.

3260 Jay St.  
Santa Clara, CA 95054  
**Circle 156**

### Integrrix Inc.

1200 Lawrence Drive, #150  
Newbury Park, CA 91320  
**Circle 157**

### Megatek Corp.

9645 Scranton Road  
San Diego, CA 92121-3782  
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### Portable Graphics Inc.

2201 Donley Drive, Suite 365  
Austin, TX 78758-4538  
**Circle 159**

### Research Systems Inc. (RSI)

777 29th St., Suite 302  
Boulder, CO 80303  
**Circle 160**

### ShoGraphics

321 Soquel Way  
Sunnyvale, CA 94086  
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### Spyglass Inc.

1800 Woodfield Drive  
Savoy, IL 61874  
**Circle 162**

### Silicon Graphics Inc.

2011 North Shoreline Drive  
Mountain View, CA 94039-7311  
**Circle 163**

### Sun Microsystems Computer Corp.

2550 Garcia Ave.  
Mountain View, CA 94043-1100  
**Circle 164**

### Tech-Source Inc.

442 S. North Lake Blvd., Suite 1008  
Altamonte Springs, FL 32701  
**Circle 165**

### Visual Numerics Inc.

6230 Lookout Road  
Boulder, CO 80301  
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### Visual Information Technologies Inc. (VITec)

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Circle No. 15 on Inquiry Card

# A Sampler of Frame Buffers and Accelerators

Compiled by MAUREEN MCKEON

## Artecon

2460 Impala Drive  
Carlsbad, CA 92008  
Circle 200

### Model: SB-SGX200

**Product type:** Graphics accelerator  
**CPU:** All SPARC platforms  
**Video memory:** 2 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,280 by 1,024, 1,152 by 900, 1,024 by 768  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Contains complete SunGX and SunGX Plus graphics accelerator. It also has a frequency synthesizer to support many different monitors.  
**Price:** \$1,795

### Model: SB-SGX200K

**Product type:** Graphics accelerator  
**CPU:** All SPARC platforms  
**Video memory:** 2 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,280 by 1,024, 1,152 by 900, 1,024 by 768  
**Vendor-supplied device driver required:** Yes  
**Special application software:** N/A  
**Product description:** Contains a daughterboard for standard Sun keyboard/mouse and mono audio. It also has a frequency synthesizer to support many different monitors.  
**Price:** \$1,995

## Du Pont Pixel Systems

2010 North First St., Suite 403  
San Jose, CA 95131  
Circle 201

### Model: PX15-8

**Product type:** Graphics accelerator  
**CPU:** Intel i860  
**Video memory:** 4 MB  
**SBus slots utilized:** 2  
**Bit planes:** 8  
**Supported resolutions:** Up to 1,408 by 1,120  
**Vendor-supplied device driver required:** N/A  
**Special application software:** PX/Iris GL and PX/Iris Explorer

**Product description:** High-performance visual processor with 8-bit double buffered frame store and 8-bit overlay. Accelerates X and GL.  
**Price:** \$4,995

### Model: PX15-24

**Product type:** Graphics accelerator  
**CPU:** Intel i860  
**Video memory:** 4 MB  
**SBus slots utilized:** 2  
**Bit planes:** 24  
**Supported resolutions:** Up to 1,152 by 900  
**Vendor-supplied device driver required:** N/A  
**Special application software:** PX/Iris GL and PX/Iris Explorer  
**Product description:** High-performance visual processor with 24-bit frame store and 8-bit overlay. Accelerates X and GL.  
**Price:** \$5,495

## Evans & Sutherland Computer Corp.

580 Arapeen Drive, P.O. Box 58700  
Salt Lake City, UT 84158  
Circle 202

### Model: Freedom Series

**Product type:** Graphics accelerator  
**CPU:** SPARC 2/10  
**Video memory:** N/A  
**SBus slots utilized:** 1  
**Bit planes:** 24  
**Supported resolutions:** 1,280 by 1,024, all Sun color monitors  
**Vendor-supplied device driver required:** N/A  
**Special applications software:** Contact Evans & Sutherland  
**Product description:** Provides fastest 3D graphics available on SPARC platform. High performance and advanced features like texture mapping and transparency make it a good fit for graphics-intensive applications.  
**Price:** \$25,500-\$85,000

## Graphica Computer Corp.

6-21-6 Nagayama  
Tama-Shi, Tokyo 206, Japan  
Circle 203

### Model: PGM-5181V

**Product type:** Color frame buffer

**CPU:** SPARCstation 10  
**Video memory:** 2 MB  
**SBus slots utilized:** 1  
**Bit planes:** 24  
**Supported resolutions:** 1,024 by 1,024  
**Vendor-supplied device driver required:** No  
**Special applications software:** Venus, Arts, Pagelayout, Design-Taro, C-quel  
**Product description:** PGM-1581V can display large full-color images, which can be enlarged, rotated, etc. An i860 accelerator is incorporated.  
**Price:** Dependent on Japanese exchange rate

### Model: PGM-5481V

**Product type:** Color frame buffer  
**CPU:** SPARCstation 10  
**Video memory:** 2 MB  
**SBus slots utilized:** 1  
**Bit planes:** 24  
**Supported resolutions:** 1,024 by 1,024 (RGB type), 1,920 by 1,035 (HDTV type)  
**Vendor-supplied device driver required:** No  
**Special applications software:** C-quel  
**Product description:** PGM-1581V has the largest video memory among the PGM series. Can be connected to a multitude of I/O devices such as parallel operating disks (500 MB x 2) RS-232-C, H-Bus I/F, disk controller, 3 1/2-inch floppy, etc.  
**Price:** Dependent on Japanese exchange rate

## Integrax Inc.

1200 Lawrence Drive, Suite 150  
Newbury Park, CA 91320  
Circle 204

### Model: S20M

**Product type:** Monochrome frame buffer  
**CPU:** LSI 64825  
**Video memory:** 256 KB  
**SBus slots utilized:** 1  
**Bit planes:** 1  
**Supported resolutions:** 1,152 by 900  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Monochrome frame buffer designed to drive a standard monochrome monitor. Fully BW2-compatible.  
**Price:** \$295

### Model: S20C

**Product type:** Color frame buffer

**CPU:** LSI 64825  
**Video memory:** 1 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,152 by 900  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Fully compatible frame buffer capable of a resolution of up to 1,152 by 900 with 256 colors from a palette of 16.7 million.  
**Price:** \$495

**Model: S20V**  
**Product type:** Color frame buffer  
**CPU:** LSI 64825  
**Video memory:** 1 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,024 by 768  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Targeted to cost-sensitive situations or users upgrading from a PC environment. Uses a standard 15-pin SVGA connector and will drive any noninterlaced color SVGA monitor with a resolution of 1,024 by 768 with 256 colors from a palette of 16.7 million. Fully CG3-compatible.  
**Price:** \$495

**Model: SFB200**  
**Product type:** Color frame buffer  
**CPU:** LSI 64855  
**Video memory:** 1.25 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,152 by 900, 1,280 by 1,024  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Designed for users who require high-resolution graphics without the expense of purchasing a graphics accelerator card. Fully CG3-compatible.  
**Price:** \$695

**Model: SGX100**  
**Product type:** Color graphics accelerator  
**CPU:** Sun GX  
**Video memory:** 1 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,152 by 900  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Single-slot graphics accelerator that is fully CG6-compatible.  
**Price:** \$1,095

**Model: SFD100**  
**Product type:** Frame buffer  
**CPU:** LSI 64825  
**Video memory:** 256 KB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,280 by 1,024  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Designed to drive the Fujitsu 16-inch monochrome gas-plasma display.

play. Fully BW2-compatible.  
**Price:** \$1,495

**Model: SGX120**  
**Product type:** Color graphics accelerator  
**CPU:** Sun GX  
**Video memory:** 2 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,152 by 900, 1,280 by 1,024  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** High-resolution single-slot graphics accelerator that is fully CG6-compatible.  
**Price:** \$1,995

**Model: SGX160**  
**Product type:** Color graphics accelerator  
**CPU:** Sun GX  
**Video memory:** 2 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,600 by 1,280  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Single-slot, ultra-high-resolution graphics accelerator that is fully CG6-compatible.  
**Price:** \$2,795

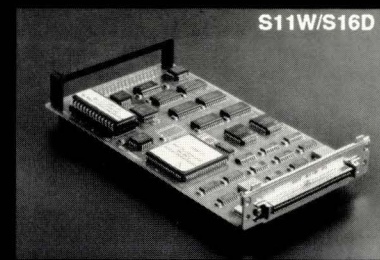
**Model: SGX220**  
**Product type:** Color graphics accelerator  
**CPU:** Sun GX  
**Video memory:** 4 MB  
**SBus slots utilized:** 1  
**Bit planes:** 8  
**Supported resolutions:** 1,280 by 1,024, 1,152 by 900  
**Vendor-supplied device driver required:** No  
**Special application software:** N/A  
**Product description:** Single-slot, double-buffered graphics accelerator that fully emulates the Sun GX+ card. Fully CG6-compatible.  
**Price:** \$2,995

**Megatek Corp.**  
 9645 Scranton Road  
 San Diego, CA 92121  
**Circle 205**

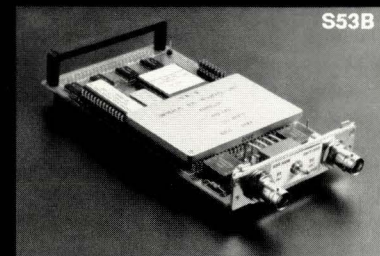
**Model: Megatek ESPRIX CL**  
**Product type:** Graphics accelerator  
**CPU:** SPARCstation 1, 1+, 2, 10, IPC, IPX  
**Video memory:** 1 MB  
**SBus slots:** 1  
**Bit planes:** 8  
**Supported resolutions:** SVGA, 640 by 480, 1,152 by 900  
**Vendor-supplied device driver required:** Yes  
**Special application software:** None  
**Product description:** Supports multiple workstation users on a single SPARC CPU. Includes a keyboard/mouse port and 8-bit color frame buffer. Accelerates Megatek's supported X11R5, OSF/Motif and Open Look and is compatible with OpenWindows and SunView. Supports up to 12 user-selectable video resolutions and

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provides graphics performance of over 1 million 2D vectors per second.

**Price:** \$1,495

**Model: Megatek ESPRIX**

**Product type:** Graphics accelerator

**CPU:** SPARCstation 1, 1+, 2, 10, IPC, IPX

**Video memory:** 2 MB

**SBus slots:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480, 1,600 by 1,280

**Vendor-supplied device driver required:** Yes

**Special application software:** None

**Product description:** Integrated hardware and software graphics accelerator providing 1-million-vector-per-second graphics performance comparable to high-end workstations from HP, SGI, IBM and DEC at entry-level prices. Included are a graphics rendering processor, hardware cursor, keyboard/mouse port and 8-bit color frame buffer. X11R5, OSF/Motif and Open Look acceleration is supported and is compatible with OpenWindows and SunView. 24 user-selectable video resolutions are supported.

**Price:** \$2,495

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**Parallax Graphics Inc.**

2500 Condensa St.

Santa Clara, CA 95051

**Circle 206**

**Model: Basic XVideo**

**Product type:** Video card including accelerated frame buffer

**CPU:** SPARCstation 2, 10, 600 MP, IPC, IPX and other SBus-compatible systems

**Video memory:** 4 MB

**SBus slots utilized:** 2

**Bit planes:** 24

**Supported resolutions:** 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special application software:** X11R5 server, OpenWindows 3.0 server, developers' tool kit APIs, RTVdisk (real-time video capture/play-back), VideoTool (adjust video size, color, inputs), MovieTool

**Product description:** Offers live, full-color video-in-a-window, with full support for either OpenWindows 3.0 or X11R5 with accelerated frame buffer (4-MB on-board memory); other applications run simultaneously without system slowdown. Supports NTSC, PAL, SECAM formats. Software control of video windows, frame grabber. Third-party software available.

**Price:** \$2,995 plus either \$495 for OpenWindows or \$695 for X11R5 software.

**Model: High Performance XVideo**

**Product type:** Video card including accelerated frame buffer

**CPU:** SPARCstation 2, 10, 600 MP, IPC, IPX, and other SBus compatible systems

**Video memory:** 4 MB

**SBus slots utilized:** 2

**Bit planes:** 24

**Supported resolutions:** 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special application software:** X11R5 server, OpenWindows 3.0 server, developers tool kit APIs, RTVdisk (real-time video capture/play-back), VideoTool (adjust video size, color, inputs), MovieTool

**Product description:** High-end, real-time video engine for Sun workstations with powerful hardware (JPEG compression, analog video-out, 2nd video-in options) and software (OpenWindows 3.0 and X11R5 support, developers tool kit. XVideo enables applications such as video teleconferencing and training. Real-time digital video support. Third-party software available.

**Price:** \$7,490-\$9,485 includes OpenWindows 3.0 support and developers tool kit. X11R5 available for additional \$395.

---

**RasterOps Corp.**

2500 Walsh Road

Santa Clara, CA 95051

**Circle 207**

**Model: 4510 SPARC Card TC/S**

**Product type:** Frame buffer

**CPU:** all SPARC up to SPARC 10, 600 MP

**Video memory:** 1.5 MB

**SBus slots utilized:** 1

**Bit planes:** 24

**Supported resolutions:** 640 by 480

**Vendor-supplied device driver required:** Yes for Solaris 1.X; Solaris 2.X supported by OS

**Special application software:** N/A

**Product description:** TC/S is 640 by 480. Frame buffer supports 67-kHz, 13-inch monitor. NTSC or PAL encoder is optional.

**Price:** \$1,199

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**Sun Microsystems Inc.**

2550 Garcia Ave.

Mountain View, CA 94043-1100

**Circle 208**

**Model: GX**

**Product type:** Graphics accelerator

**CPU:** Custom RISC processor

**Video memory:** 1 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special applications software:** N/A

**Product description:** 2D/3D wire-frame color graphics accelerator.

**Price:** \$2,200

**Model: Turbo GX Plus**

**Product type:** Graphics accelerator

**CPU:** Custom RISC processor

**Video memory:** 4 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 1,024 by 768, 1,152 by 900, 1,280 by 1,024, 1,600 by 1,280

**Vendor-supplied device driver required:** Yes

**Special applications software:** N/A

**Product description:** 2D/3D wire-frame color graphics accelerator.

**Price:** \$4,200

**Model: GS**

**Product type:** Graphics accelerator

**CPU:** 320C30

**Video memory:** N/A

**SBus slots utilized:** 3

**Bit planes:** 24

**Supported resolutions:** 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special applications software:** N/A

**Product description:** 3D solids color graphics accelerator.

**Price:** \$5,200

**Model: SPARCstation ZX Accelerator**

**Product type:** Graphics accelerator

**CPU:** 4 custom ASICs

**Video memory:** N/A

**SBus slots utilized:** 2

**Bit planes:** 24

**Supported resolutions:** 1,152 by 900, 1,280 by 1,024, NTSC, PAL, 900 by 680 (stereo)

**Vendor-supplied device driver required:** Yes

**Special applications software:** N/A

**Product description:** Premium 3D solids color graphics accelerator.

**Price:** \$12,995

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**Tech-Source Inc.**

442 S. North Lake Blvd., Suite 1008

Altamonte Springs, FL 32701

**Circle 209**

**Model: GXTRA/1**

**Product type:** Graphics accelerator

**CPU:** SPARC

**Video memory:** 1 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480, 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/NeWS, X11R4, X11R5

**Product description:** Single-slot SBus graphics accelerator that comes with a Weitek P9000 graphics processor, eight planes, 1-MB frame buffer, SunOS driver with X Window server, 15-foot monitor cable, installation/reference manuals, two-year telephone support, two-year hardware warranty and Sun Type 4- or Type 5-style keyboard/mouse port.

**Price:** \$1,450

**Model: GXTRA/2**

**Product type:** Graphics accelerator

**CPU:** SPARC

**Video memory:** 2 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480, 1,600 by 1,280

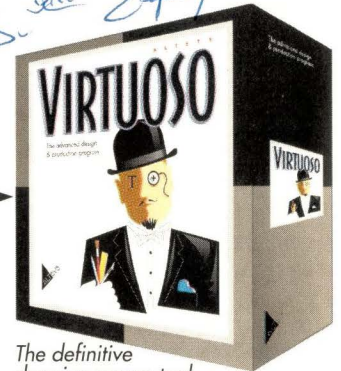
**Vendor-supplied device driver required:** Yes



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**Special application software:** X11/NeWS, X11R4, X11R5

**Product description:** Single-slot SBus graphics accelerator that comes with a Weitek P9000 graphics processor, eight planes, 2-MB frame buffer, SunOS driver with X Window server, 15-foot monitor cable, installation/ reference manuals, two-year telephone support, two-year hardware warranty and Sun Type 4- or Type 5-style keyboard/mouse port.  
**Price:** \$2,500

**Model:** **GXTRA/3**

**Product type:** Graphics accelerator

**CPU:** SPARC

**Video memory:** 3 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480, 1,600 by 1,280

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/NeWS, X11R4, X11R5

**Product description:** Single-slot SBus graphics accelerator that comes with a Weitek P9000 graphics processor, eight planes, 3-MB frame buffer, SunOS driver with X Window server, 15-foot monitor cable, installation/ reference manuals, two-year telephone support, two-year hardware warranty and Sun Type 4- or Type 5-style keyboard/mouse port.  
**Price:** \$4,000

**Model:** **GXTRA/3 stereo**

**Product type:** Graphics accelerator

**CPU:** SPARC

**Video memory:** 3 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 1,024 by 1,024 stereo

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/NeWS, X11R4, X11R5

**Product description:** Single-slot SBus graphics accelerator that comes with a SunOS CG4-compatible device driver, optimized X11R5 server, Weitek Power 9000 graphics processor, 3-MB 8-bit color with 4-bit color overlay frame buffer, hardware cursor, stereo display capability and Sun Type 4- or Type 5-style keyboard/mouse port.  
**Price:** \$4,500

**Model:** **GXTRA/4 CFP**

**Product type:** Graphics accelerator

**CPU:** SPARC

**Video memory:** 4 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480 to 1,280 by 1,024

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/NeWS, X11R4, X11R5

**Product description:** Single-slot SBus graphics accelerator that comes with a SunOS CG4-compatible device driver, optimized X11/NeWS server, Weitek Power 9000 graphics processor, 3-MB 8-bit color with 4-bit color overlay frame buffer, hardware cursor, stereo display capabil-

ity and Sun Type 4- or Type 5-style keyboard/mouse port.

**Price:** \$4,500

**Model:** **SUPER X**

**Product type:** Graphics accelerator

**CPU:** SPARC

**Video memory:** 10 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 2,048 by 2,048

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/NeWS, X11R4, X11R5

**Product description:** X Window System accelerator capable of driving super-high-resolution monitors such as the DDM2801 2,048-by-2,048 color monitor from Sony. Accelerates software written for the X Window System. High color resolution and graphics performance makes SUPER X suitable for such applications as air traffic control, anti-submarine warfare and imaging.  
**Price:** \$19,000 (price includes board, software, cable and manuals)

### Vigra Inc.

6044A Cornerstone Court  
San Diego, CA 92121

**Circle 210**

**Model:** **VS-10**

**Product type:** Frame buffer

**CPU:** SPARC

**Video memory:** 1 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480, 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special application software:** Solaris 2.1, X11R5, VxWorks

**Product description:** Single-slot SBus color frame buffer. Includes SunOS 4.1.3 driver on floppy disk.  
**Price:** \$695

**Model:** **VS-18**

**Product type:** Controller

**CPU:** SPARC

**Video memory:** 0.5 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480

**Vendor-supplied device driver required:** Yes

**Special application software:** Solaris 2.1, X11R5, VxWorks

**Product description:** Controller for Sharp Active Matrix color LCD panels. Models: LQ10DH11, LQ10DH15, LQ10D311, LQ14D311. Simultaneously displays 256 colors. Includes SunOS 4.1.3 driver.  
**Price:** \$895

**Model:** **VS-11**

**Product type:** Frame buffer

**CPU:** SPARC

**Video memory:** 2 MB

**SBus slots utilized:** 1

**Bit planes:** 8

**Supported resolutions:** 640 by 480, 1,280 by 1,024

**Vendor-supplied device driver required:** Yes

**Special application software:** Solaris 2.1, X11R5, VxWorks

**Product description:** Single-slot SBus color frame buffer. Includes SunOS 4.1.3 driver on diskette.  
**Price:** \$995

### Visual Information Technologies Inc.

3460 Lotus Drive

Plano, TX 75075

**Circle 211**

**Model:** **RasterFlex-TV**

**Product type:** Video-in-a-window accelerator

**CPU:** All Sun SPARCstations and compatibles

**Video memory:** N/A

**SBus slots utilized:** 1

**Bit planes:** N/A

**Supported resolutions:** 1,152 by 900 at 66 Hz, 1,280 by 1,024 at 67 Hz

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/News and X11R5 servers and video control application

**Product description:** Single-slot card brings "live-video-in-a-window" display to Sun SPARCstation and compatibles. It provides freeze-frame capability and allows individual frames from a video to be captured and stored for use in other applications.  
**Price:** \$1,795

**Model:** **RasterFlex-32**

**Product type:** Raster accelerator

**CPU:** All Sun SPARCstations and compatibles

**Video memory:** N/A

**SBus slots utilized:** 1

**Bit planes:** runs both 8- and 24-bit applications simultaneously

**Supported resolutions:** 1,152 by 900

**Vendor-supplied device driver required:** Yes

**Special application software:** X11/NeWS and X11R5 window system

**Product description:** Single-slot, high-performance, low-cost solution for the accelerated display and manipulation of 24-bit color.  
**Price:** \$3,995

**Model:** **RasterFlex-HR**

**Product type:** Raster accelerator

**CPU:** All Sun SPARCstations and compatibles

**Video memory:** N/A

**SBus slots utilized:** 2

**Bit planes:** runs 8- and 24-bit applications simultaneously

**Supported resolutions:** 1,280 by 1,024

**Vendor-supplied device driver required:** Yes

**Special application software:** Provides X11/NeWS and X11R5 window system

**Product description:** Windowing-based raster accelerator for 24-bit true color.  
**Price:** \$4,895

FACT:

# THE ONLY 100% SUN COMPATIBLE X TERMINAL JUST HAPPENS TO BE AN SBus CARD

Eliminate network gridlock and increase system performance...

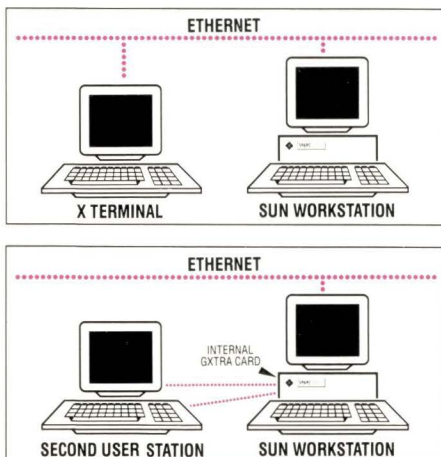
◆ *It's simple!* The GXTRA (pronounced gee-extra) SBus card, allows you to eliminate network traffic and maintain system performance by adding extra users to your workstation, rather than to your network.

The GXTRA functions *better than* an X terminal! Unlike the X terminal, the GXTRA connects directly to your SPARCstation SBus. This direct connection makes it possible to pass graphic commands at SBus speed, (100 Mbyte/second), *greatly increasing* total system performance.

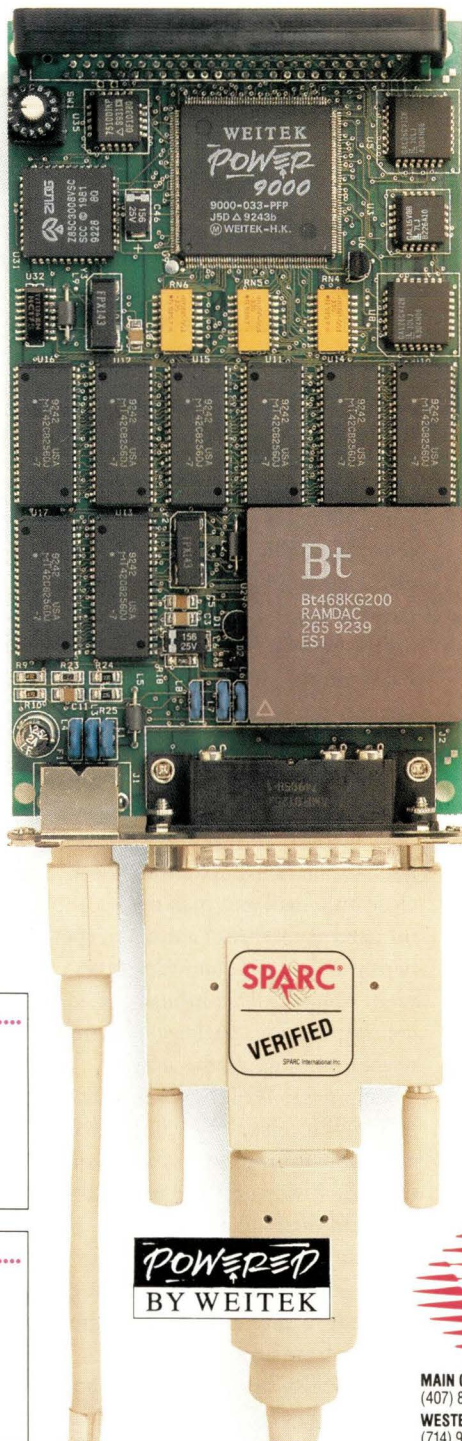
X terminals *must pass* commands over the ethernet. This results in commands colliding with other network traffic—causing gridlock and reducing system response time.

Adding GXTRA cards maintains 100% software and font compatibility with Sun SPARCstations, something X terminals *cannot* achieve.

◆ *Increase your capability, not your network traffic!*



Add users to your workstation without adding traffic to your network...



Put a workstation on every desk and lower your cost per seat...

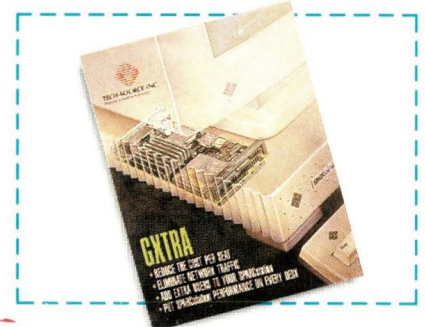
◆ *It's affordable!* The GXTRA allows you to add multiple users to your SPARCstation, reducing cost per seat and making higher performance systems more affordable. With this card, it's possible to add a user to any system with an SBus. Using multiple GXTRA cards can further reduce your cost per seat.

The GXTRA *affords* you the ability to put the power of a SPARCstation 10 at *every* user's fingertips.

If you're planning to purchase additional SPARCstations, X terminals, or networked PC's, you owe it to yourself to find out how the GXTRA can help you.

- ◆ *Reduce your cost per seat!*
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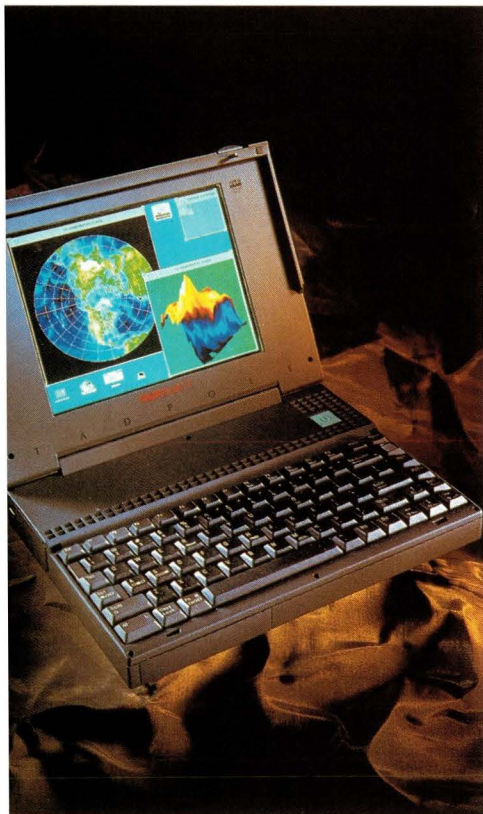
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# SPARCbook 2: Computing in Nomad's Land

by BARRY SHEIN, Technical Editor

**W**hat we have here, other than the LCD display, is a full-powered SPARCstation in a notebook-size package.



*The SPARCbook 2 pounds out an impressive 22 MIPS running the Dhrystone 2.1 benchmark.*

## SPARCbook 2

To paraphrase a line from the movie *Repo Man*, a nomad's life is always in tents. Nomadic computing is a neologism coined to describe the growing trend of computing on the road. Small, lightweight notebooks, originally running DOS, appeared on the scene and people took them along when they traveled, jotting down notes, referring to files, working on airplanes and in hotel rooms. The next step was connecting these systems back to the home system to check electronic mail and pick up or drop off needed files. Add a modem (perhaps the first and foremost accoutrement of nomadic computing) and a communications package, and this telecomputing became simple.

What next? Well, how about fax send and receive, POP clients that do a quick dial-in, pick up your mail to the local disk, and hang up and let you read the mail off-line? Not enough? OK, how about built-in SLIP, which lets your notebook become a full-fledged Internet host over the modem from anywhere?

The SPARCbook 2 from Tadpole Technologies Inc. has all these features and more for your desktop-in-a-lap.



First, let me start by giving you my general impression of where the notebook from Tadpole fits in the notebook hierarchy: If we use a car analogy, then perhaps a 286 with a 40-MB disk is your average beat-up Yugo, a 386SX with a 120-MB disk and 4-MB memory is, oh, a late-model nice car your parents might drive, and the SPARCbook 2 is a top-of-the-line Bentley with plush leather, fully outfitted bar, designed to be comfortable on the autobahn. Let me explain with 13 reasons:

- More than 22-MIPS, 40-MHz Cypress SPARC, 64-KB cache (measured with Dhrystone 2.1)
- Up to 64-MB memory (the model we tested had 32 MB)
- Up to two 250-MB internal disks
- 640-by-480 sidelit TFT color LCD flat-panel display, 256 simultaneous colors from a palette of 4,096
- External display adapter port, 1,152 by 900, 256 simultaneous colors from a palette of 16 million, PS/2-compatible connector
- External SCSI port, standard
- Thick-net (AUI) Ethernet port, standard
- Serial port
- Internal V.32/V.42bis 9.6-Kb/s modem with fax send/receive
- Internal or external mouse (more on this later)
- Sun-compatible 8-bit audio



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input/output

- Solaris 1.0.1 as modified for the SPARCbook
- OpenWindows 3.0

What we have here, other than perhaps the LCD screen display, is a full-powered SPARC workstation in a notebook-size package. The LCD display is admittedly a little small and low resolution, though absolutely high quality for a notebook computer. Tadpole has added a virtual window manager that lets you choose among six virtual windows. Instead of shrinking a large window on to the smaller LCD, Tadpole has chosen to leave the display output alone, so it's large and crisp and clear. Instead, you shift around on the virtual screen. There's no problem bringing up a decent shell tool to work in, or popping up several other applications from the shell or the familiar OpenWindows background menus. The color LCD screen is beautiful, really very good quality. I'm impressed.

### Just for Nomads

For nomadic computing, Tadpole has added the following features:

- Power-management features to extend battery life
- Faxtool (send and receive)
- POP electronic mail client
- SLIPtool (full Internet over the internal modem)
- Shutdown/start-up restore features

The power-management facilities include two windows: A battery indicator graphically displays the percentage of battery life left, and a configuration tool lets you control features such as when the machine should begin shutting itself down when left idle to save power. The battery monitor can

even keep track of up to eight batteries for you so you can track your spares. Battery life depends on many factors so is hard to predict, though nominally Tadpole claims 2 to 2½ hours. You can run the system in a slow mode (through the power-management window), which extends battery life, tell it to spin down the disk after only a minute or two of idle time, etc. Carrying extra batteries is another choice and no matter what you do is probably necessary for those long flights. Someday airlines will provide power plugs near the seats. I know I'd pay a reasonable fee to use one when I carry a notebook computer.

### Faxtool Frolic

The Faxtool was great fun to play with. It can transmit both PostScript and ASCII text files (the latter by automatically encoding them into PostScript files). The Faxtool's main window shows the status of both sent and received faxes. When you pop up the transmit window, it lets you enter fax phone numbers into a directory or just enter a one-shot. You can preview any fax you are about to send via the Faxtool top bar menu buttons. Receiving just works. Your received fax will be noted in the main Faxtool menu, and you can pop it up for viewing via Faxtool's menu.

I didn't try their POP or SLIP tools, but the idea is that POP is an Internet standard protocol (there are freeware servers available for UNIX) that lets you grab or send all your email in one shot and read received email locally. This cuts down on phone bills and lets you use the notebook and its window system to its full advantage to manage your electronic mail. Alternatively, you can set up UUCP if that's more convenient for your home site.

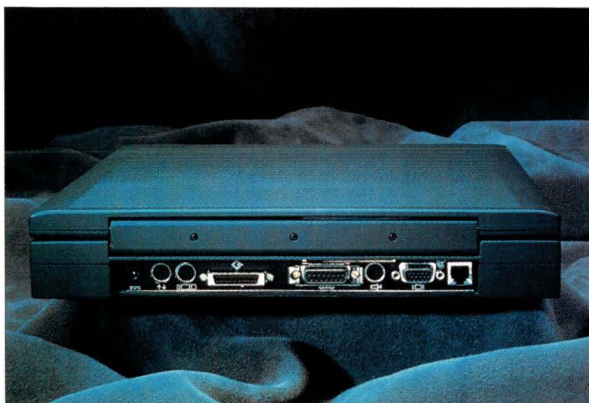
SLIP (Serial Line IP) is another Internet standard protocol that makes your notebook,

via a modem or serial line, a full-fledged host on an Internet network. Once you have established a SLIP connection, you can use FTP, Telnet, X11, SMTP and other Internet standard protocols from your notebook. You could even NFS-mount disks onto your notebook over a SLIP connection. In my experience, that requires a little tweaking of NFS options, but it can be done. So SLIP provides yet a third way to send and receive electronic mail. POP has an advantage because it holds your mail and waits for you to fetch it. Most SMTP (*sendmail*) implementations on your server host will just think you are down and keep trying to send mail to you (typically every 15 or 30 minutes), perhaps causing mailer-daemon messages to be sent back to your correspondents warning that mail hasn't been deliverable in some number of days. *sendmail*, out of the box, really expects a live connection to which it can usually deliver mail on demand.

One feature of the SPARCbook—unique to its Solaris implementation—is the ability to shut it down, saving the exact state of your work. When you bring it back up, even after powering the notebook off, your screen will come back exactly as you left it. This is handy in a nomadic environment where you might have to suddenly shut the box off to board a plane; airlines don't (yet) understand holding planes for system shutdowns. To shut the system down, you hit ALT-ESC-Off (Off is on the letter O key), which will save your state and power down the system. To bring it back up, you hit the big aqua power-on key. Both power-down and power-up each take about 60 seconds.

### Mouse Talk

The built-in mouse, as far as I know, is unique to Tadpole. It's a gimbal-mounted, regular-size key just to the right of the delete (backspace) key. To move the mouse, you gently press it at



**All things configured: Ports on the SPARCbook 2 include from left to right, power adapter, serial, keyboard/mouse, SCSI, Ethernet, audio, video and modem.**

an angle in the direction you wish the mouse to move. Pressing harder makes the mouse move faster. To select mouse buttons, you hold down the FN key (directly left of the space bar) and strike the CTRL A or S keys, which are mouse buttons left, center and right, respectively. This arrangement takes a little getting used to (play the X11 solitaire demo program to practice) and probably will turn off the change-averse, but I found that my fingers quickly got used to the arrangement and the movements became reasonably automatic. Alternatively, you can bring a serial mouse along with you, which can be plugged into the port on the back.

The built-in modem is available via the device `/dev/modem` and can be accessed directly through `tip` or `cu`. I put a simple entry in `/etc/remote` for it and dialed out with Hayes-compatible AT commands. This worked fine and as expected.

Dialing out like this does reveal one missing piece in the nomadic computing puzzle: a decent serial communications program! `Tip`, adequate for the simplest usage, is really showing its age compared with the sort of communications programs available for DOS and MacOS (Telix, Procomm, Zterm, White Knight, etc.). Besides ease of use, which `tip` scores about a C- on, modern serial communications support built-in screen capture, `zmodem`, `xmodem`, `kermit` and other reliable file transfer protocols (`zmodem` even supports restarting a partially transmitted file where it left off after a disruption). And I'm describing freeware and shareware programs whose professional versions typically cost under \$100 for PCs. C'mon guys, it's time to get with the (communications) program. There would still be times I'd use `tip` (its ability to pipe to and from UNIX programs is unique if a bit cranky at times), but it would be nice to see something modern to complement all these other nice tools.

### Sizing Down

Finally, the most important nomadic computing feature of all: the size and weight of the notebook. The dimensions are typical of a slim notebook at

11.8 inches by 8.5 inches by 1.95 inches (299.72mm by 215.9mm by 49.53mm). The system weighs 6.5 pounds (2.95 kg) with battery, 4.9 pounds (2.22 kg) without for a single disk system. A dual-disk system weighs 7 pounds (3.18 kg) and 5.4 pounds (2.45 kg) with and without battery, respectively. I assume from these figures we can conclude that a battery weighs 1.6 pounds (.73 kg). Add to that the power cube and cable, and whatever other cables, mice, etc., you want to carry along. It would still fit nicely, even with an extra battery or two, in a carry-on bag with plenty of room left over for a paperback and some other items. One thing I did notice is that the bottom of the notebook gets very warm when it's running, probably too warm to hold in your lap without some protection. Those who get chilled on airplanes might consider this a feature.

Overall, I'd have to rate the Tadpole SPARCbook a solid A. Add that serial communications program and I'd give it an A+. These folks are pushing the envelope of nomadic computing and have admirably provided all the basics for the future. I'll guess this notebook will be a favorite among developers of the new mobile computing environments. ➔

## SPARCbook 2

### Company

Tadpole Technology Inc.  
12012 Technology Blvd.  
Austin, TX 78727-6208

### Phone

(800) 232-6656

### Best Feature

Cutting-edge notebook system, too many to list.

### Worst Feature

Get a decent serial-communications program!

### Price

\$10,950

### Circle 168

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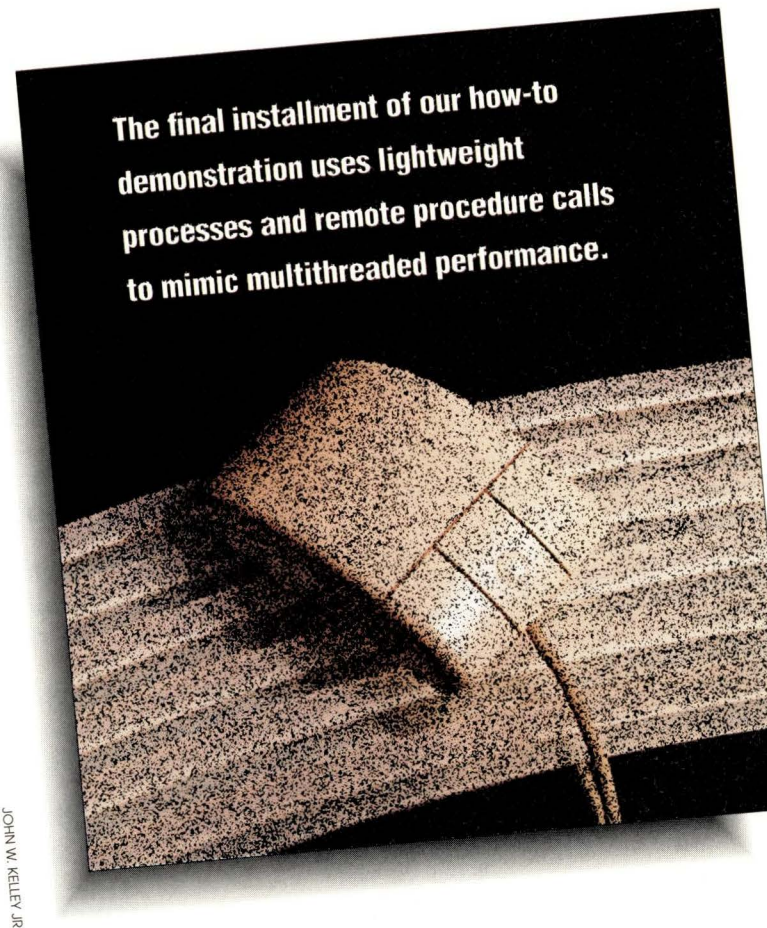
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## Parallel Processing on Your UNIX Network, Part II

by SEAN BURKE, Inference Corp.

In Part I (*SunExpert*, May, Page 65), we restructured an application to use multithreading, but until we get a multiprocessor machine with a kernel that supports multithreading, we won't see any performance benefit. (A Sun 630MP can have up to four processors, but SunOS 4.X won't permit you to assign your threads to more than one processor.) In the meantime, we can use RPCs to create a network-parallel application. The easiest way to use RPCs is to use `rpcgen`, the RPC protocol compiler. If you have used `rpcgen` before, this will be familiar. However, a number of caveats pertain to multithreading, so watch closely.



JOHN W. KELLEY JR.



What we are going to do is to split our program into two parts: a multithreaded application that calls a dummy  $f(x)$ , and a second program that runs on a remote host, which computes  $f(x)$  and returns the result to our dummy call. The former program is called the “client” process in RPC parlance, and the latter the “server” process. In between the two, we interpose code to communicate arguments and results over the network. The `rpcgen` utility will generate all the new code we need to do this, based on a specification of the interface to  $f(x)$ . Here is an RPC specification for our plotting program, in the file `plot_rpc.x`:

```
struct param
{
    double x;      /* argument to f(x) */
};

program PLOTPROG {
    version PLOTVERS
    { double F(param) = 1;
      } = 1;
    } = 0x20001000; /* RPC program number */
```

The specification above declares the following things: There is a structure of type `param`; there is an RPC program `PLOTPROG` with program number `0x20001000`; that `PLOTPROG` includes the function `F`, which takes a `param` structure argument and returns a double. The program number must be unique throughout your network, so we’ve chosen an unlikely one in the unreserved range. Sun will assign you a unique, reserved RPC number if you wish to distribute your application outside your organization.

#### Listing 1

```
double *f_1(argp, clnt)
param *argp;
CLIENT *clnt;
{
    static double res;

    bzero((char *)&res, sizeof(res));
    if (clnt_call(clnt, F, xdr_param, argp, xdr_double, &res, TIMEOUT) != RPC_SUCCESS) {
        return (NULL);
    }
    return (&res);
}
```

#### Listing 2

```
double *f_1(argp, clnt, res)
param *argp;
CLIENT *clnt;
double *res;
{
    if (clnt_call(clnt, F, xdr_param, argp, xdr_double, res, TIMEOUT) != RPC_SUCCESS) {
        return (NULL);
    }
    return (res);
}
```

## Pointer Potpourri

When you run `rpcgen` on this source file, four output files are produced: `plot_rpc.h`, `plot_rpc_clnt.c`, `plot_rpc_svc.c` and `plot_rpc_xdr.c`. The file `plot_rpc_clnt.c` defines a glue function `f_1()`, which we will call in place of  $f(x)$ . `f_1(x)` takes a pointer to the `param` struct for an argument and returns a pointer to a double as a result. You may ask, “Why all the pointers?” I’ll answer this question later when we discuss XDR. The glue function also takes a pointer to a client handle. Let us also defer discussion of client handles for the moment.

Normally you do not edit the files produced by `rpcgen`, because your edits will be lost the next time you run `rpcgen`. Unfortunately for us, the glue call defined in file `plot_rpc_clnt.c` is not reentrant (see Listing 1).

The problem lies in the static double “res”: This variable would be shared by all of the threads. We can’t put a monitor around it, since this would prevent threads from making the RPC call simultaneously. Instead, we need to make `clnt_call()` store its result in an area that is local to each thread. We do this by passing the address of a double as the third parameter to `f_1()`. This address will point to a stack variable in `thread_top()`’s stack frame as in Listing 2.

Again, if you run `rpcgen` later, this change will be lost. Since most changes you may make to `plot_rpc.x` will produce no changes in this file, you may wish to copy `plot_rpc_clnt.c` to another file at this point and build from the copy instead.

We must change `thread_top()` to call the glue function `f_1()`, instead of  $f(x)$ . We declare local variables “param p”

and “double res” to pass as parameters to `f_1(x)`. The call to `f_1()` becomes

```
p.x = index * 0.01;
points[index].x = p.x;
points[index].y = f_1(&p, client, &res);
```

Now we return to the question: Why do we pass and return pointers to things, rather than the things themselves? This is a requirement imposed by our use of XDR, the eXternal Data Representation. XDR defines a canonical network format for data, so that different machines can communicate with one another using RPCs. XDR allows little-endian machines to communicate with big-endian machines, or machines that use IEEE floating point format to communicate with VAXen, which have their own floating-point format. This means that you can run your server programs on other architectures, such as Intel boxes and VAXen, simply by recompiling them. The `plot_rpc_xdr.c` file is used by both client and server to pack and unpack network messages in XDR format. Each type of machine will have its own XDR library, which implements the appropriate conversions between network and native data formats.

The `plot_rpc_svc.c` file is the main module of your server program. It handles the details of registering your RPC program with the network daemons and calling the real version of `f_1()` (as opposed to the glue version defined in `plot_rpc_clnt.c`) to process a client request. I make it a practice to create a file called `plot_rpc_proc.c`, in which I place the definition of `f_1()` and any other server calls. This definition of `f_1()` will be similar to your original `f(x)` but modified to use a param pointer for input and to return a pointer to its result. Remember that it is an error to return a pointer to a stack variable, so the result variable must be declared static:

```
double *f_1(param *argp)
{
    static double res;
    res = f(argp->x);
    return (&res);
}
```

Note that we have defined `f_1(x)` as two functions in two separate files: in `plot_rpc_clnt.c` as a glue function that makes the RPC call, and in `plot_rpc_proc.c` as the function that actually computes the value of `f(x)` for the server process. The only difference between the two definitions is that the glue call takes two extra arguments:

```
double *f_1(param *argp, CLIENT *clnt, double *res) /* in plot_rpc_clnt.c */
double *f_1(param *argp)                          /* in plot_rpc_proc.c */
```

We would like to be able to link the real `f_1()` in place of the glue call in order to eliminate the RPC call, since this will simplify debugging our program. However, the static variable we use for the result will not work with multithreaded code. Now the glue call gets a pointer to a result variable as its third parameter, so we could define `f_1()` in `plot_rpc_proc.c` to take the same parameters as the glue call in

`plot_rpc_clnt.c`. Unfortunately, we would also have to edit `plot_rpc_svc.c` so it provides the extra parameters when calling `f_1()` from the RPC server. `plot_rpc_svc.c` is an `rpcgen` output, however, so we really don't want to edit it. The alternative is to use conditional compilation. We define the symbol `RPC` when compiling the RPC version of the code; otherwise it's undefined. Now we can define `f_1()` both ways:

```
#ifdef RPC
double *f_1(param *argp) {
    static double res;
    res = f(argp->x);
    return (&res);
}

#else /* no RPC */

double *f_1(param *argp, CLIENT *c, double *res) {
    *res = f(argp->x);
    return (res);
}
#endif /* RPC */
```

Now I will make good on my promise to discuss client handles. The client handle is a connection to a particular RPC server process on a particular remote host. We call out to a remote host using `clnt_create()` to make such a connection, using the program number, `PLOTPROG`, and version, `PLOTVERS`, to specify the service we wish to connect to. If such a service has been registered on the remote host, `clnt_create` returns a client handle that can be used to call any of the RPC functions, such as `f_1()`, defined by `PLOTPROG`. For simplicity, assume that we have placed a list of hostnames on our local network into the array `hosts[]`:

```
char *hosts[MAXHOSTS] = { "kenobi", etc. };
```

The client handle can be created simply by calling the library function `clnt_create()`. However, it is best to try to ping the remote host first, since `clnt_create()` waits 30 seconds to time out if the remote host is down or otherwise unreachable. It is difficult to modify this timeout period, so instead we use the `system()` call to ping the host with a one-second timeout, as shown in Listing 3.

Since we use the standard I/O library for the ping, we create all of our client handles prior to commencing multithreading. The handles are stored in an array, and we keep a

count of the handles successfully created, so that we know how many threads to spawn.

```
for (j = 0, nthreads = 0;
     j < MAXHOSTS && nthreads < MAXTHREADS;
     j++)
    if (clients[nthreads] = make_client_handle(hosts[j]))
        nthreads++;
```

**Listing 3**

```

CLIENT *make_client_handle(char *hostname)
{
    CLIENT *clnt = (CLIENT *) 0;
    char cmd[80];

    sprintf(cmd, "ping %s 1 >/dev/null", hostname);

    if (system(cmd) != 0)
        fprintf(stderr, "Unable to ping host %s\n", hostname);
    else if ((clnt = clnt_create(hostname, PLOTPROG, PLOTVERS, "udp")) == NULL)
        clnt_pcreateerror(hostname);

    return(clnt);
}

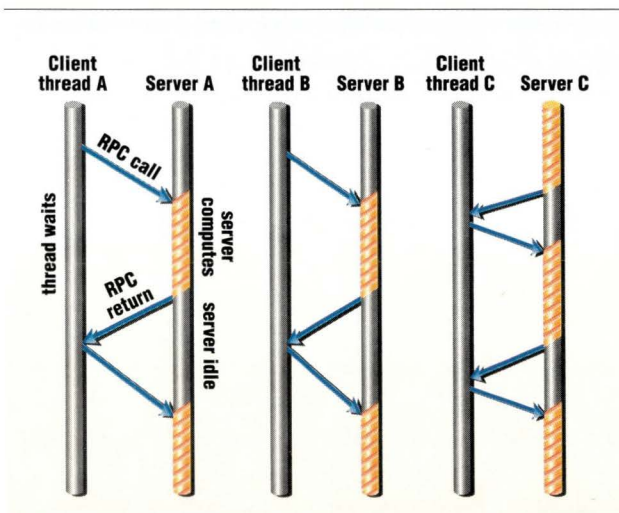
```

For each valid client handle that we obtain, we spawn a thread to communicate with the corresponding remote server. Each client handle is passed to its thread as a parameter to `thread_top()` when the thread is created by `lwp_create()`.

We've now covered all the essential features of the demo program, though the example code also includes some finer points that I haven't mentioned here. To create our client application, we compile `main.c`, `plot_rpc_clnt.c` and `plot_rpc_xdr.c`, and link them with the nonblocking I/O library (`-lnbio`) and the lightweight process library (`-llwp`) in that order. The server application is built from `plot_rpc_svc.c`, `plot_rpc_proc.c` together with `plot_rpc_xdr.c`. The example code contains two makefiles to perform these builds: `Makefile.rpc` builds the RPC client program, and `Makefile.svc` builds the RPC server program. A third makefile, `Makefile.norpc`, short-circuits the RPC mechanism by linking `main.c` and `plot_rpc_proc.c` to create a multithreaded application with normal, local procedure calls. `Makefile.norpc` does not define the symbol `RPC`.

The server programs must be running on each of the remote hosts before you run the client program, since the servers need

*For each compute server on the net, a client thread is created and bound to that server. Note that the server is idle during RPC turnaround. To use servers efficiently, make sure your work units are large compared with the RPC turnaround time.*



to register themselves with the network daemons on the remote hosts. An easy way to do this is to write a shell script that uses `rsh` to run `plot_svc` on the remote hosts. If you install the `plot_svc` executable in a directory that is on your default path, then the command `rsh -n hostname plot_svc &` will run `plot_svc` on host `hostname`, leaving your `rsh` in the background on your local host. After you are done, you may terminate the remote server by killing the local `rsh`, e.g., `kill %1`.

There are a variety of other ways to get your server processes running on the hosts in your network and to keep them running. If your network-parallel application is to be used by others, you may wish to conceal this issue from the user as far as possible. One way to do this is to start the server at boot time on each machine by adding to each machine's `/etc/rc.local` file. Your server process consumes few resources when it is not being used, so this approach is quite practical. No provision is made to restart the server if it crashes, so you may wish to use the `inetd` daemon instead. There isn't time enough to discuss the `inetd` now, so for now I can only refer you to the man pages.

**Summary**

Network parallel techniques can deliver major speedups for suitable problems using currently available hardware and software. Sun's RPC protocol proves once again to be an essential tool in the distributed-system programmer's tool kit. Sun's LWP library can, despite its limitations, provide useful multithreading functionality. Programmers will still have to take care with system libraries, such as `stdio`, which are generally not safe for multithreading. UNIX programmers don't need to wait for tomorrow's systems to begin thinking parallel.

*Editor's note: Sources for the plot demo discussed here and a nifty mandelbrot demo are available via ftp at netcom.com in pub/sean. They are compressed tar files. →*

**Sean Burke** is a senior programmer with Inference Corp. of El Segundo, CA. He has designed real-time monitoring and control systems, using UNIX workstations, embedded processor and UNIX/real-time hybrid architectures in tightly and loosely coupled multiprocessor configurations.

# NEW PRODUCTS

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

## Multimedia ConferenceStation

InSoft has entered the desktop videoconferencing market with the announcement of its turnkey ConferenceStation. It is based on Sun Microsystems Inc.'s SPARCclassic workstation and InSoft's Communique! multimedia teleconferencing software. According to InSoft, the new ConferenceStation allows users to run real-time, full-motion color videoconferencing in

heterogeneous UNIX environments and across data communications services such as ISDN, frame relay, ATM, SMDS, FDDI and Switched 56.

Also, Communique! provides multimedia and groupware facilities such as a shared whiteboard. Users can interactively display and mark up documents, drawings, video frames or images from any on-line application.

The engine of ConferenceStation is Communique!, an integrated set of multimedia and groupware software modules including the Virtual Conference Room, Communique!TV, Audio, Video, Shared Whiteboard, Shared Writeboard, Information Exchange, Text and Graphics. It uses an icon-based point-and-click, drag-and-drop user interface.

ConferenceStation can be configured with either a Sun VideoPix SBus card, RasterOp's SPARC TV II SBus card or Parallax

Graphics' XVideo-24SV board. An 8mm camera and high-quality Audio Technica microphone are included. Based on a 50-MHz SPARC Classic, ConferenceStation will ship with Solaris 2.X and a minimum of 24 MB of RAM, 424 MB of disk, and a 16-inch high-resolution color monitor. The base list price for one to four stations is \$8,995 per station with floating network licensing.

**InSoft Inc.**

Executive Park West One, Suite 307  
4718 Old Gettysburg Road  
Mechanicsburg, PA 17055  
Circle 101

## New Interactive UNIX

SunSoft has introduced Interactive UNIX System, Version 4.0. According to the company, its new features will increase system functionality, application compatibility and peripheral sup-

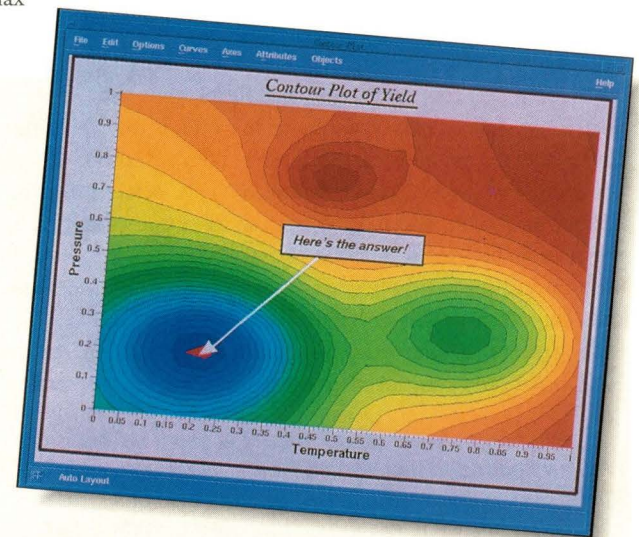
## Data Analysis Tool

BBN Software Products, a division of Bolt Beranek and Newman Inc., has announced BBN/Cornerstone. Cornerstone, an object-oriented data analysis package with a Motif GUI, has four primary modules: Data Navigator, Workmap, Dataset Editor and Data Visualization.

Data Navigator allows direct, transparent access to remote databases, including Ingres, Oracle, Sybase and ASCII files. It supports data sets drawn from RS/1, BBN's flagship data analysis tool, and also supports SGL WHERE clauses. Data can be exported to any supported source.

Workmap, which records each step in an analysis project, displays data sets, graphs and analysis objects in graphical or list form. These maps can be reused with new data or shared among work groups.

The spreadsheet-like Dataset Editor supports numerous manipulation techniques for viewing in-memory local or remote data. The Data Visualization module uses many standard graph types, including line, xy scatter plot, box plot, histogram, xyz scatter plot, 3D surface plot and others. To help with interpretation, users can explore data with curve fitting, linear or polynomial, or they can enhance views by interactively rotating 3D scatter



and surface plots, transforming axes from linear to log, or expanding or contracting a view.

Cornerstone also includes extensive context-sensitive on-line help with a built-in glossary of statistical terms. In addition to the base product, BBN offers optional analysis modules for multiple regression, multivariate analysis of variance and principal components analysis.

List prices start at \$1,795 for a single-user fixed license and \$2,395 for a single-user floating license.

**BBN Software Products**

150 Cambridge Park Drive  
Cambridge, MA 02140  
Circle 100

port. Also, according to SunSoft, the new product will run a number of The Santa Cruz Operation's SCO UNIX and Open Desktop applications, giving users access to more than 5,000 software packages.

New features include extended binary compatibility, which allows users to run SCO UNIX and Open Desktop applications in addition to others written to the Intel Binary Compatibility Standard, Issue 2 (iBCS2). MS-Windows applications support is planned for the second half of 1993. A new feature is tape distribution. The use of 150-MB, 1/4-inch tape simplifies installation and reduces system administration time. Other added features are long file names and symbolic links, bootable device drivers, selectable console support and new user guides and installation and maintenance manuals.

The Interactive UNIX System 4.0 is priced at \$495 in single quantity. The Base Solution, multiuser version is \$895 in single quantity. Current 3.0 users can upgrade to 4.0 for \$195.

**SunSoft Inc.**

2550 Garcia Ave.

Mountain View, CA 94043

Circle 102

### **X Apps Port to Windows 3.1**

A product that developers can use to port X applications to MS-Windows has been introduced by MicroImages. Called MicroImages X Server (MI/X), the product implements a complete X Window System server as an MS-Windows process. With the MI/X developer's kit, vendors who have an X-based application they wish to port to Windows can do so with relative ease.

There are two parts of MI/X. A developer's kit, priced at \$800, handles the actual port of the X application to the MS-Windows environment. On the Windows side of things, a runtime version of MI/X is what actually supports the X application. The runtime MI/X is priced at \$100 in quantities of one, and \$10 in quantities of 1,000.

**MicroImages Inc.**

201 N. 8th St.

Lincoln, NE 68508-1347

Circle 103

### **300-MFLOPS DSP Card**

Image & Signal Processing has announced the Blazer, a 6U VME array processor card that can support up to six Texas Instruments Inc. TMS230C40 digital signal processors. When fully configured with a maximum number of DSPs, the card can provide up to 300 MFLOPS and concurrent data transfer

capability exceeding 700 MB/s.

Three of the DSPs are on the Blazer's motherboard, while up to three more can be attached to it via plug-in modules. Alternatively, the modules may support I/O or other application-specific hardware. In addition, the Blazer has two parallel bus ports and a set of six communications ports—five of

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Circle No. 30 on Inquiry Card

which are used to provide point-to-point communications among the six processors while the sixth links to the front panel for external connections.

The Blazer also has .5 MB of SRAM connected to each parallel bus port. The port memory can be expanded up to 2 MB. Pricing on the Blazer ranges from \$15,000 to \$25,000, depending on the amount of memory and the number of processors.

**Image & Signal Processing Inc.**

120 Linden Ave.  
Long Beach, CA 90802  
Circle 104

### A Pair of Printers

QMS has added two printers to its Crown family of products: the 32-ppm QMS 3225 and the 20-ppm QMS 2025. The 3225 supports up to 100 users; the 2025, up to 60. Both printers can print on paper up to 11 by 17 inches and provide 300-by-300-dpi and 400-by-400-dpi resolution. Both provide standard serial, parallel and LocalTalk interfaces, plus an optional Ethernet or token-ring network interface.

As part of the Crown architecture, both printers support soft-loadable firmware, making it easy to add new features, upgrades and languages, and an Emulation Sensing Processor (ESP), which provides emulation switching between supported languages (PostScript Level 1 and 2, HP PCL 4, HP-GL/2, CCITT Group 4 and Line Printer. LN03Plus is available as an option).

The 2025's monthly duty cycle is 100,000 pages, and it lists for \$12,995. The 3225, with a duty cycle of 200,000 pages per month, sells for \$19,995. Various networking interface options, languages and sheet-input bins are priced separately.

**QMS Inc.**

One Magnum Pass  
Mobile, AL 36618  
Circle 105

### Snapshots of Disk Partitions

A product that creates virtual disk snapshots of physical partitions has been released by Minimus Software. The product, the SNAP pseudo device

driver, takes "snapshots" of the file structure on storage media. If the file system becomes corrupt at a later date, it can be compared with the snapshot and, if necessary, corrected.

The product requires no special hardware. Previous file system states can be accessed using standard UNIX commands. Moreover, SNAP operates at the disk driver level, which means it can work with programs that access raw disk, such as database applications. Pricing begins at \$595.

**Minimus Software**

8372 E. Lakeview Drive  
Parker, CO 80134  
Circle 106

### File-Migration Software

Transmigrator from Lachman Technology is the first in what Lachman claims will be a family of storage management products. Transmigrator is a software-only product that transparently assesses how often files are used and moves infrequently used files to less expensive storage media. Because the product works with most standard UNIX third-party network

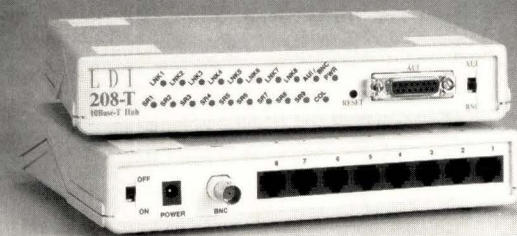
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**Lachman Technology Inc.**  
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Naperville, IL 60563  
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### **FLEXIm User Manual**

A user manual for one of the industry's most popular network license managers, Highland Software's Flexible License Manager (FLEXIm), has been



published. The FLEXIm End User Manual is a 45-page book containing six chapters: Introduction and Overview, The License File, Combining License Files, Selecting ServerNodes, Options File and License Administration Tools.

The company says the book was developed as the result of surveys of its users' needs. The book can be purchased through software vendors, or directly from Highland Software for \$20 plus tax and handling.

**Highland Software Inc.**  
1001 Elwell Court  
Palo Alto, CA 94303  
Circle 108

### **Program Debugging**

Virtual Technologies has ported Sentinel, a debugging environment for C and C++, to Solaris 2. Version 1.4 is a library of routines that can be linked to programs to help programmers search for bugs. By providing run-time verification of pointer use and memory allocation, Sentinel traps memory errors, traces stacks then reports the

source file, function name and line number of the problem statements.

Version 1.4 is easier to install than its previous release. For example, a developer can add "sentinel" before a link command, and Sentinel configures itself with the target software. Version 1.4 handles duplicate symbol references. An email option sends

reports to a specified recipient list.

Sentinel is supported on Solaris for X86, Solaris 1.X and 2.X, HP-UX, AIX 3.2, Ultrix, etc. The price ranges from \$395 to \$995, depending on platform.

**Virtual Technologies Inc.**  
46030 Manekin Plaza, Suite 160  
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## SunPics Color Printer

NeWSprinter CL+, the first color printer from Sun, is a PostScript-compatible color printer. The 360-dpi, four-color, ink-jet engine prints on plain or coated paper and transparencies. It supports numerous paper formats: U.S. letter, legal and tabloid and international A4 and A3. The NeWSprinter CL+ comes with NeWSprint 2.5 printing software, 5-meter parallel cable (two types), and a starter kit consisting of four ink cartridges, coated paper and overhead transparencies. NeWSprinter CL+ supports all Type 1 fonts and ships with 57 PostScript language-compatible F3 fonts. It is compatible with Solaris 2.

The CL+ features two new software packages: BalanceTool for controlling and managing color images on-screen, and FastRaster, a bypass mode for color bit-map printing that processes color raster images four to five times faster than PostScript images. List price is \$3,995.

### SunPics

2550 Garcia Ave.  
Mountain View, CA 94043  
Circle 110

## Presentation Graphics

Charts, graphs and presentations can be produced on your workstation with the Orator presentation graphics package offered by UniPress. The package,



developed by Soft-Tek and priced at \$495, is intended to provide easy-to-use presentation capabilities at a price lower than competing offerings, UniPress says.

Orator features links to data, spreadsheet and database files, and presentations can be created using overhead transparencies, 35mm slides, graphics files or paper. The package comes with six templates for text presentations, 10 charting and drawing tools, and a 1,024-symbol clip art library. The soft-

ware will run on Digital Equipment Corp., Hewlett-Packard Co., IBM Corp. and Sun Microsystems Inc. workstations and requires 5 MB of disk space for the program and 36 MB for the clip art library.

UniPress Software Inc.  
2025 Lincoln Highway  
Edison, NJ 08817  
Circle 111

## Remote Communications

The scsiMux Server from Central Data provides remote multiplexed serial channels to a variety of UNIX workstations and servers, including those from IBM Corp., Sun Microsystems Inc., Digital Equipment Corp., Hewlett-Packard Co. and others.

The device uses a statistical multiplexing algorithm to concentrate eight or 16 channels over a single synchronous composite line, letting users avoid hassles with RS-232 drivers and cables, says Central Data. Using a leased-line DSU or synchronous modem, users can transport data to the multiplexer at distances up to thousands of miles away.



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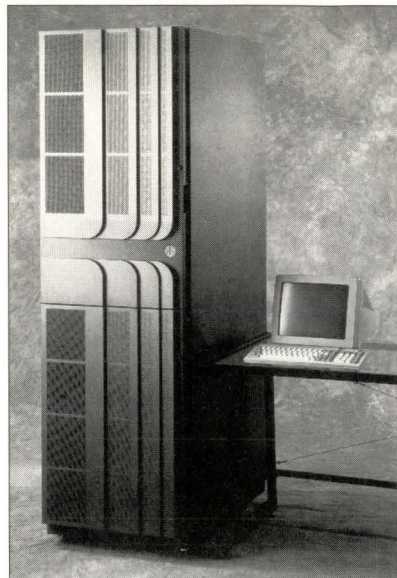


The scsiMux Server comes standalone or as a module that fits inside the company's new scsiComm Server to provide serial and parallel expansion. The scsiComm Server is available in a desktop or rack-mountable cabinet and accommodates up to four scsiServer modules, with prices ranging from \$795 to \$3,995, for a maximum of 64 serial ports. The \$3,995 multiplexer's serial ports can be set for speeds up to 19.2 Kb/s, and the composite line runs at 56 Kb/s.

**Central Data Corp.**  
1602 Newton Drive  
Champaign, IL 61821  
Circle 112

### NFS Network Server

Auspex has introduced the NS 6000 NetServer, which includes a dedicated application processor. Auspex claims the 6000, which replaces the NS 5500 in the company's product line, delivers up to four times the raw NFS I/O of a SPARCserver 690MP or SPARCcenter 2000. The company attributes this performance to its functional multiprocessing (FMP) architecture, which



separates network, file and disk management and allocates them to optimized processors.

The Solaris- and SPARC-based NS 6000 supports up to eight Ethernets with performance levels as high as 1,703 SPECnfs operations per second. The key to performance is the new MVIC, or MBus-to-VME interface

controller, which provides direct memory access to the host processor.

An NS 6000 can be configured with up to 640 MB of ECC memory, as much as 120 GB of disk capacity using 2-GB, 5¼-inch drives, and, in addition to the 40-MHz SPARC host processor, as many as three storage processors.

The NS 6000 is \$139,900 including software. Upgrades for installed NS 3000s and 5500s are available for \$20,000 with trade-in.

**Auspex Systems Inc.**  
2952 Bunker Hill Lane  
Santa Clara, CA 95054  
Circle 113

### Personal Laser Printer

SunExpress, a subsidiary of Sun Microsystems Inc., is distributing the new CalComp CCL400R laser printer. At 4 ppm and 400-dpi resolution, the CCL400R is suited for work groups of two to five users.

Based on a Canon USA Inc. engine, the CCL400R comes with SunPic's NeWSprint software, 57 fonts and support for Type 1 fonts. The printer

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comes standard with a built-in SCSI-2 interface card and a 2-meter SCSI-2 cable.

The printer also has a multipurpose tray that can hold 70 sheets of paper. An optional cassette capable of holding 250 sheets is available. The price is \$1,495.

**SunExpress**  
4 Omni Way  
Chelmsford, MA 01824-4191  
Circle 114

### SBus Terminal Options

The GXTRAstation ST line of X terminals comprises six models, from 15 inches to 21 inches with resolutions ranging from 1,024 by 768 to 1,600 by 1,280. They attach directly through the SBus. According to Tech-Source, this connection allows graphics commands to be passed at bus speeds (up to 20 MB/s) rather than network speeds.

The GXTRAstation runs all X clients locally, thereby easing the systems administration chores involved with supporting traditional X terminals while minimizing network traffic. Prices range

from \$2,450 for the ST115, a 15-inch color monitor with 1,024-by-768 resolution, to \$5,250 for the ST221, a 21-inch monitor with 1,600-by-1,280 resolution.

**Tech-Source Inc.**  
442 North Lake Blvd.  
Altamonte Springs, FL 32701  
Circle 115

### LMSI CD-ROM Improved

Laser Magnetic Storage International has unveiled the first 5¼-inch, half-height CD-ROM drive with motorized tray loading.

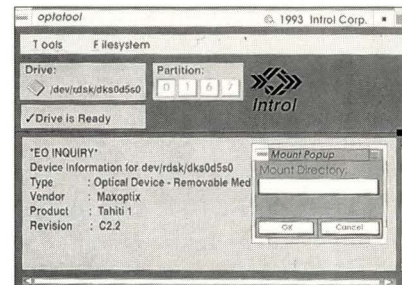
The CM215 offers a SCSI-2-compatible interface for use on a variety of platforms. This drive offers MPC and Photo CD Disc compatibility. Average access time is 360 ms. Price is \$499.

**Laser Magnetic Storage International**  
4425 Arrows West Drive  
Colorado Springs, CO 80907-3489  
Circle 116

### Two More Optical Drives

Introl now offers the Sharp Electronics Corp. JY-750 rewritable optical

disk drive and the IBM Corp. Model 0632 disk drive incorporated into



erasable optical subsystems. The JY-750 offers up to 650 MB of unformatted capacity per cartridge, a 256-KB cache buffer size and an average seek time of 40 msec.

The 0632 offers up to 650 MB of unformatted storage capacity per cartridge, a MTBF of 600,000 hours and a burst data rate of 4 MB/s. Prices for a subsystem with a Sharp drive start at \$2,595; with an IBM drive, at \$3,695.

**Introl Corp.**  
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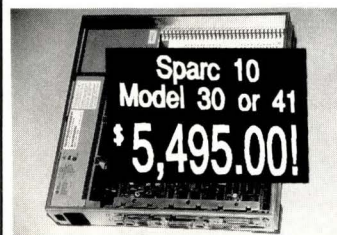
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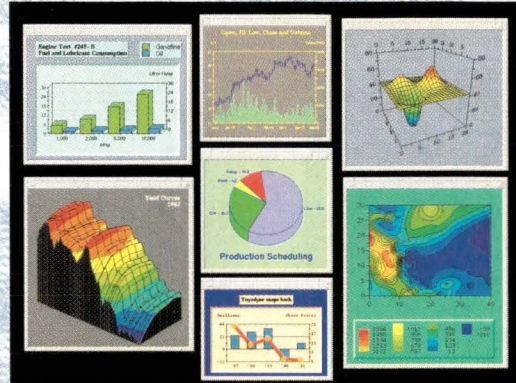
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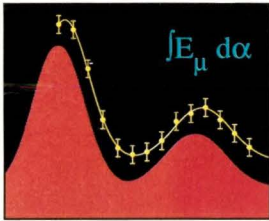
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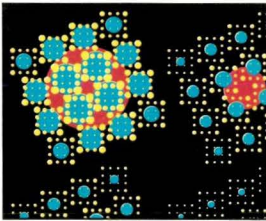
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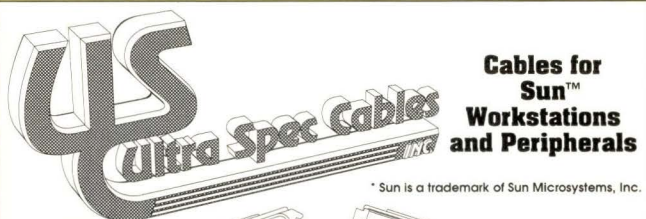
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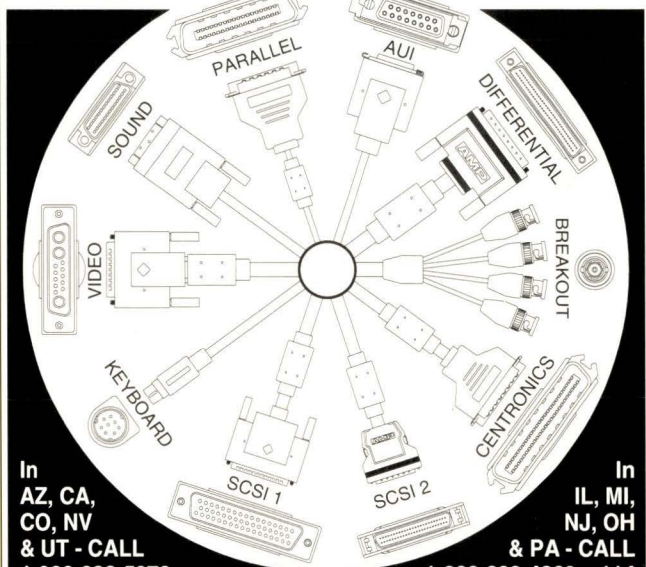


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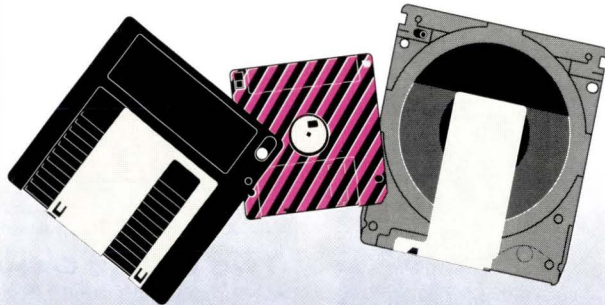
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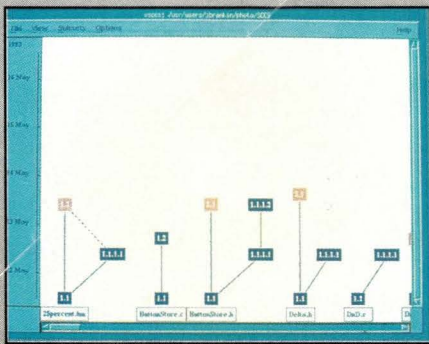
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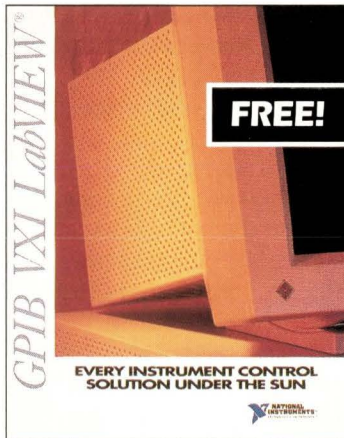


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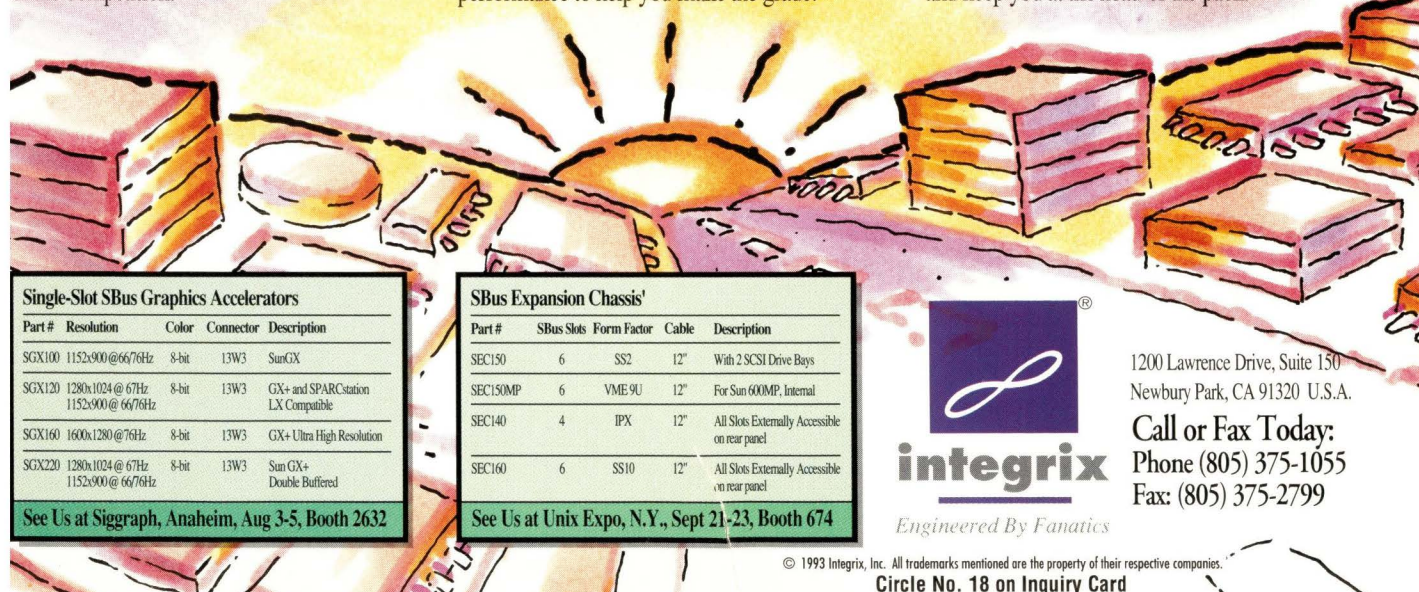
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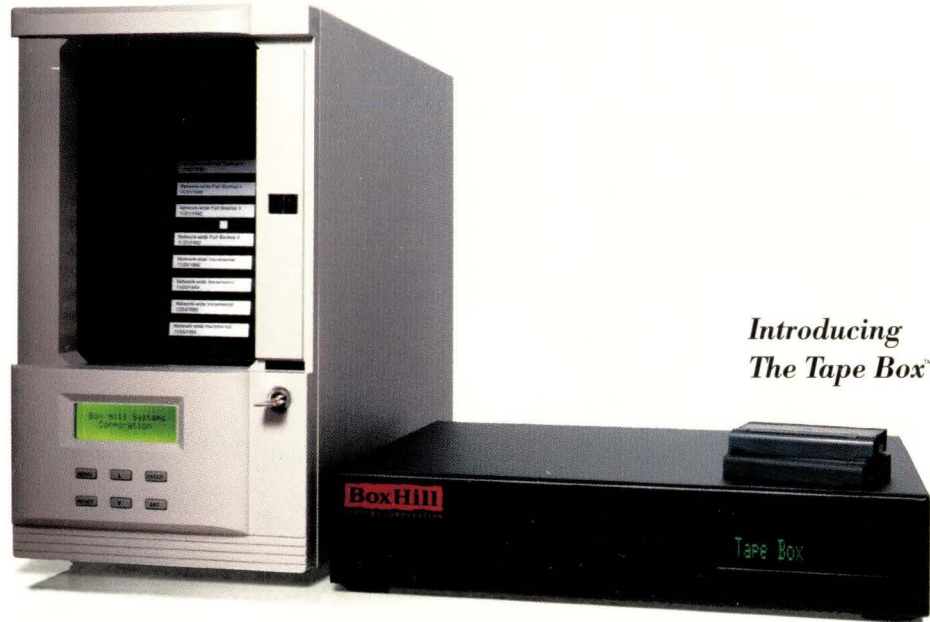


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