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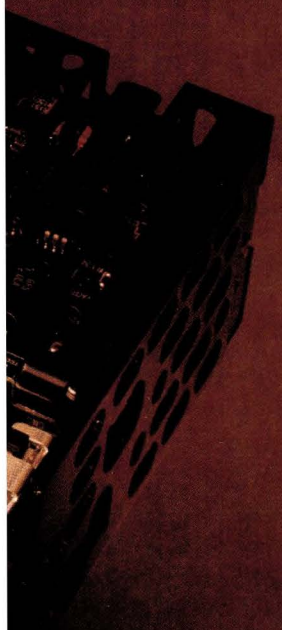

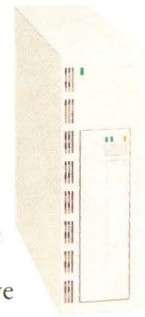

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CONTENTS

JUNE 1993 VOL. 4 NO. 6

FEATURES

44 **X Terminals: Is Bland Beautiful? –** X terminals, as a technology, aren't that exciting anymore. As a market, though, they're thrilling. Michael Jay Tucker

54 **A Sampling of X Terminals –** A look at 28 companies and their products. Maureen McKeon

64 **Product Reviews –** Trying on two X terminals and a printer for size. Barry Shein

Paper Sculpture by Jeff Nishinaka

NEWS

6 Includes: **SMCC Champions MP, Yet Another Solaris Incarnation, WABImania Strikes!, Sun To Kodak: Color Us Beautiful**

COLUMNS

18 **Ask Mr. Protocol – Mr. Protocol Finds Himself –** In the name of Science and Sun workstations, Mr. P bounces off to Baja California and grapples with a Global Positioning System. Michael O'Brien

26 **UNIX Basics – Arguments to Shell Scripts –** The whys and wherefores of writing shell script arguments. Peter Collinson

36 **I/Opener – Column 100 –** Looking back at an opus of more than 100 articles and columns, it's time to take stock. Richard Morin

40 **Systems Administration – Bye-Bye Bio –** A frank and first-hand account of negotiating the job-hunting jungle. S. Lee Henry

Qume QX15, Samsung Xcellent X11 Display Terminal, SunPics NeWSprinter 20 p. 64

DEPARTMENTS

4 **Editorial**
32 **Reader Feedback**
70 **New Products**
83 **The SunExpert Market**

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

SUNEXPERT Magazine (ISSN 1053–9239) is published monthly by Computer Publishing Group, 1330 Beacon St., Brookline, MA 02146-3202. Telephone (617) 739-7001. Second-class Postage Rates paid at Boston, MA, and at additional mailing offices. This publication is free to qualified subscribers as determined by the publisher. Subscription rates are $60 per year in the United States, and $95 (surface mail) and $150 (air mail) outside the United States. Subscription requests can be sent to: Circulation Department, *SUNEXPERT* Magazine, 1330 Beacon St., Brookline, MA 02146-3202 or electronically mailed to circ@expert.com.

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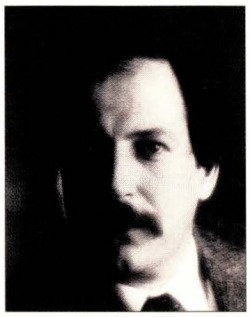
Editorial

MP in Your Future?

A variety of users have a variety of terms of endearment for multiprocessing (MP) systems. I've heard Malicious Problems, Mucho Profit, and, when you put the S in front for symmetric...well, I'd rather not say. But it seems to me that MP is as inevitable as death, taxes and Solaris 2.x if Sun's newest additions to its product line are any indicator. Just take a look at this month's lead News story, "SMCC Champions MP." And the motif (now it's okay to use that word at Sun) running through the entire News section is that Sun's planets, especially SunSoft and SunPro, are finally in sync with the hardware side of the business. SunPro has extended its SPARCworks Professional kit with a series of MP tools and SunSoft has announced Solaris 2.2 with user-accessible threads (for more details see "Yet Another Solaris Incarnation" in the News section).



But perhaps strategically more important to Sun as a commercial systems vendor was the May 11 announcement of the much ballyhooed Scorpion. Its official nomenclature is SPARCserver 1000. This 8-way MP departmental machine should get a lot of attention from MIS guys and gals wary of bringing in a box that doesn't have a three-letter operating system. The price points, as well as price/performance numbers, make it a compelling package. Prices begin at $36,700, but like the machine they scale very well. For example, a four-CPU version with 128 MB, 2-GB disk, CD drive and 4mm DAT goes for $75,700. And these servers come with a one-year on-site warranty. By the way, the 1000 uses a standard 15-amp circuit. I don't mean to give you a sales pitch, but this package is impressive. My only complaint is that the designers managed to use most of the SCSI addresses for themselves.

As Carl Stolle, group marketing manager for server products, ran through the key features of the 1000, I asked myself, "How many X, alphanumeric, serial X terminals or terminal servers can I hang off this machine?" "How low can I drive the cost-per-seat?" To me, the answers to these questions will make or break Sun in the commercial arena. Even MIS types can say yes to UNIX for the right price.

Doug Pryor

SUNEXPERT Magazine
Serving the Solaris/UNIX Workstation Network
JUNE 1993 VOL. 4 NO. 6

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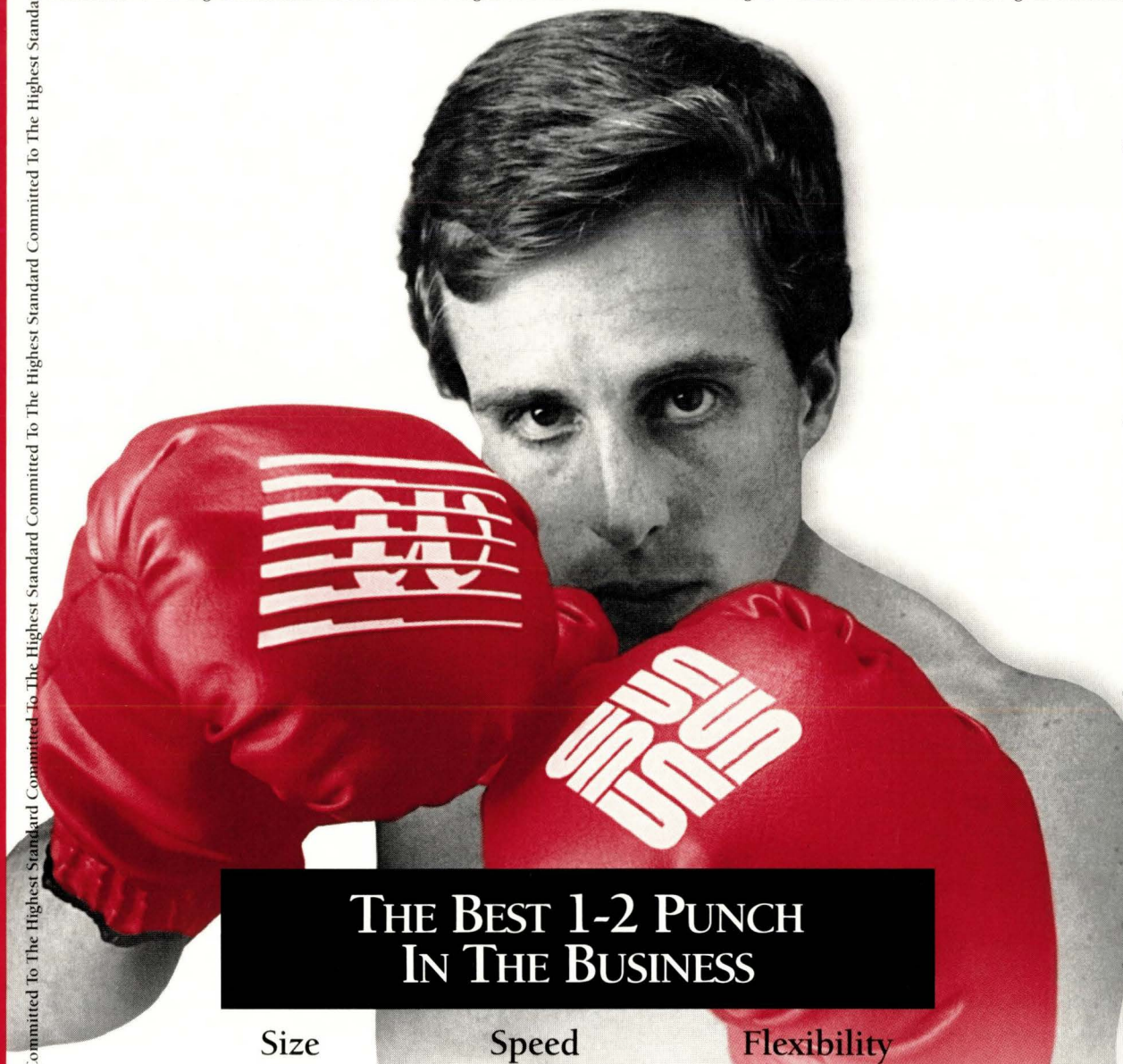

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NEWS

SMCC Champions MP

Sun Microsystems Computer Corp.'s systems plate is full this year, with nearly all of its new and anticipated systems coming in the form of multiprocessing desktop systems and servers.

Sun already claims to be the No. 1 UNIX multiprocessor vendor, based on its installed base of MP servers (consisting, at this point, of 600MPs and SPARCcenter 2000s), ahead of Sequent Computer Systems Inc., AT&T/NCR Corp., Pyramid Technology Corp. and a host of other players. At the end of calendar 1992, Sun claimed an installed base of 10,440 UNIX/MP servers. (To date, SMCC says it has sold 70,000 "MP-capable" SPARCstation 10s, with more than 3,000 of them currently running as MP systems.)

In April, Sun rolled out several MP members of its SPARCstation 10 family. It delivered the long-awaited Model 52, which has been rechristened the Model 512–with each digit representing, respectively, the processor speed (i.e., 50 MHz); cache (1 = yes, 0 = no); and the number of processors (i.e., 2). In July or August, SMCC will begin shipping the four-processor Model 54. The 512 originally was expected to feature 45-MHz SuperSPARCs; instead, it is based on the 50-MHz SuperSPARC+ chips, with SPECint92 performance of 65 to 68 and SPECfp92 ratings of 80 to 85. SMCC clipped the prices on both of these models, the 512MP by 20% to $33,745 and the 54MP by 22% to $22,745. Sun also slashed its price on the SPARCserver Model 30 to $13,995.

Also in April, SMCC introduced four new SPARCstation 10 models, all of which are expected to ship by the end of June. These systems are:

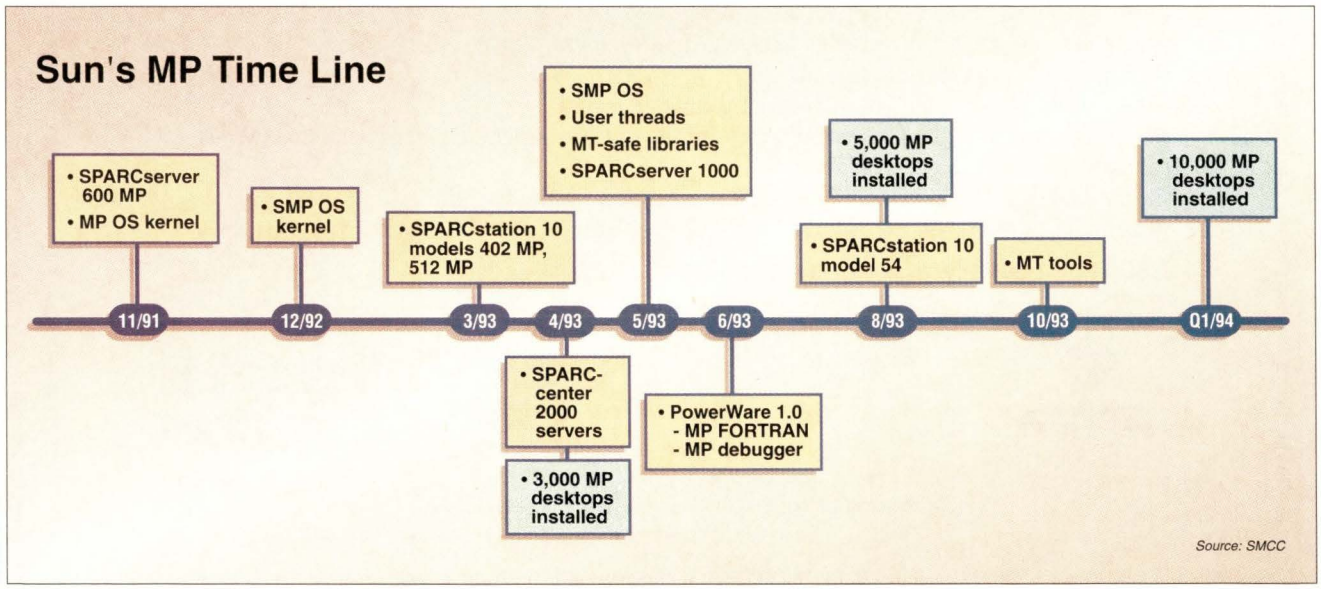
- **The Model 30LC –** a new entry-level desktop system based on a 36-MHz SuperSPARC and a 16-inch midrange color monitor. Price: $15,995.
- **The Model 40 –** a uniprocessor based on a 40-MHz SuperSPARC with 36 KB of on-chip cache, 32 MB of main memory and 1 GB of storage. Price: $20,745.
- **The Model 402MP –** a machine Sun is billing as "the industry's least expensive MP system." It features dual 40-MHz CPUs, 36 KB of on-chip cache per CPU, 32 MB of main memory and 1 GB of storage. Price: $24,745.
- **The Model 51 –** a uniprocessor based on a 50-MHz SuperSPARC+, 36 KB of on-chip cache, 1 MB of external cache, 64 MB of main memory and 1 GB of storage. Price: $27,745.

In May, at the same time as SMCC began shipping Solaris 2.2, the symmetrically multiprocessing version of Solaris with user-accessible threads, SMCC unveiled its eight-way SPARCserver 1000, code-named Scorpion. The departmental server can accommodate up to eight 50-MHz SuperSPARC+ processors, up to 2 GB of memory, 200-MB/s I/O bandwidth, up to 12 expansion slots, over 100-GB disk capacity and fault resilience. The 1000 has a surprisingly small footprint, measuring 8.2 by 19.4 by 21 inches. The system runs Solaris 2.2 only.

A one-CPU version with 32 MB of memory, a 1-GB disk and CD-ROM drive sells for an amazingly low $36,700, making it cheaper than some of Sun's SPARCstation 10 configurations. The two-CPU version, with 64 MB of memory, a 2-GB disk and CD drive, sells for $46,700. A four-CPU version, with 128 MB of memory, a 2-GB disk, CD drive and 4mm DAT backup system, goes for $75,700. All models come with a standard one-year, on-site warranty

This month, SMCC is slated to make available the MP FORTRAN and MP debugger technologies announced by SunSoft a couple of months ago. The two technologies are part of SunPro's

Multiprocessing rollouts galore are in store for Sun Microsystems Inc. users over the next few months.



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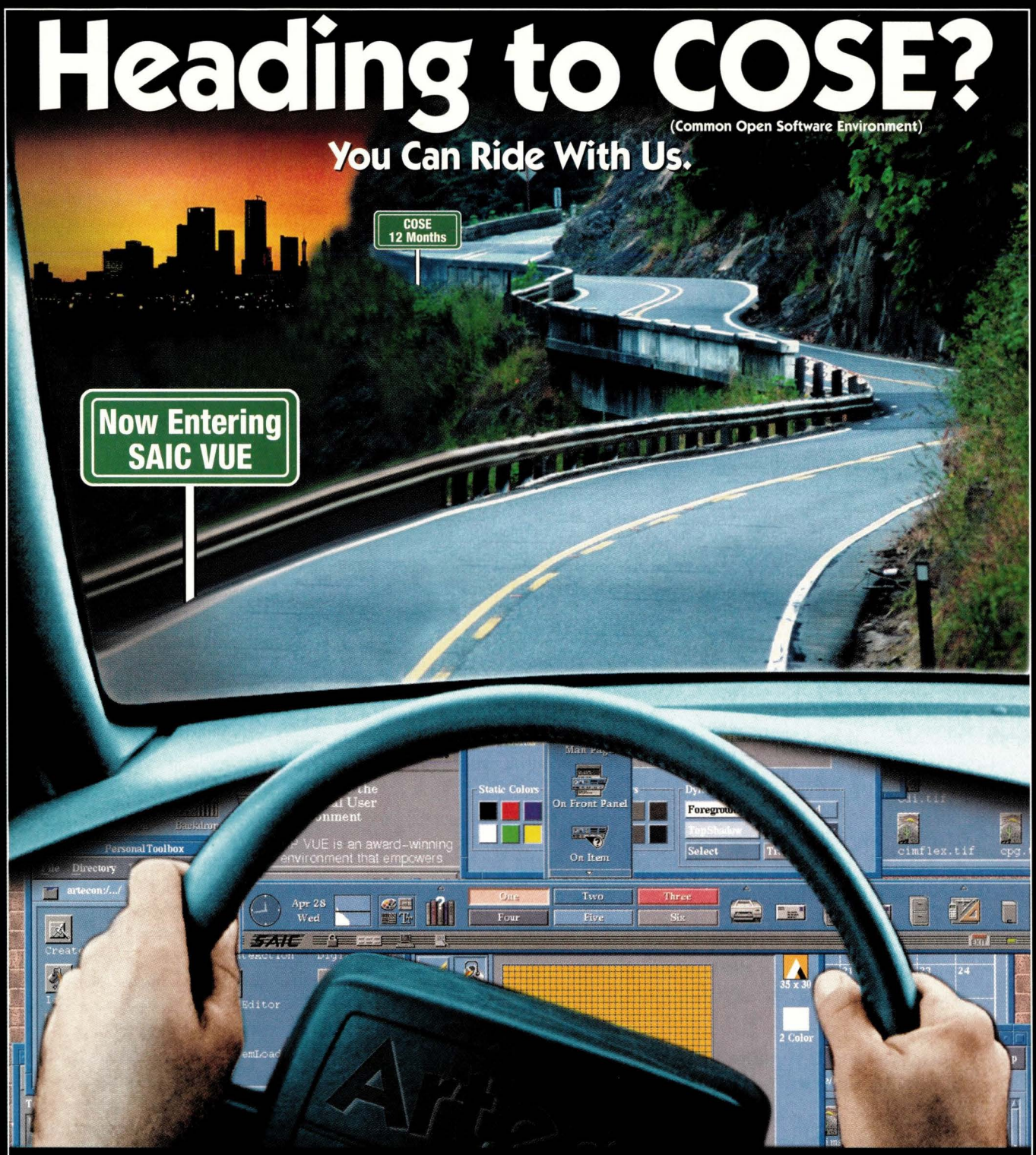

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COSE is the Common Open Software Environment recently announced by HP, IBM, SunSoft, USL, SCO and Univel, which includes a common desktop environment.

SAIC has ported HP's Visual User Environment (HP VUE) desktop interface to Sun SPARC and IBM RS/6000 workstations.

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MP Developer Early Access Kit, an extension to its SPARCworks Professional family of tools and compilers. The kit enables developers to write multiprocessing applications in FORTRAN, C or C++ by taking advantage of user-accessible threads.

The SPARCompiler FORTRAN MP, an add-on to SunPro's FORTRAN 77 compiler, provides automatic application parallelization. The SPARCworks Debugger MT, an add-on to the SPARCworks Debugger, allows developers to view, set breakpoints and navigate parallel executions of code. And the MT Compatible Language Libraries provide C, C++ and FORTRAN compiler run-time libraries that execute correctly in a multithreaded environment.

If all goes as planned, according to SMCC, Sun could claim to have an installed base of 5,000 MP desktops by August, and 10,000 MP desktops by the first quarter of 1994.–*mjf*

Yet Another Solaris Incarnation

Just when you had accepted the inevitable–that it is time to port to Solaris 2.1–SunSoft up and releases the next version, 2.2. And the follow-up, which most likely will go by 2.3, is just around the corner, due to ship in October.

There are a number of substantial enhancements in 2.2, not the least of which is its ability to run on X86-based platforms. Although SunSoft refers to its PC version of Solaris as Solaris for X86, rather than as 2.2, the two operating systems are, "feature for feature," in Sun's words, one and the same. SunSoft began delivering Solaris for X86 in late March. At press time, "more than 300" of a potential base of 7,500 applications were in the process of being ported to X86. SunSoft notes that users can also currently access the more than 1,800 applications that are in the process of being ported from Solaris 1.X to 2.X by downloading them from a Solaris SPARCserver to an X86-based client. Additionally, "many" of the 2,000 Interactive UNIX System applications can run unchanged on Solaris X86 in emulation mode, according to SunSoft.

Systems manufacturers, including AST Research Inc., CompuAdd Corp., Dell Computer Corp., Toshiba America Information Systems Inc. and Zenith Data Systems, have pledged to support Solaris on their desktops, servers and/or multiprocessing machines. SunSoft says that Solaris X86 also will run on hardware from Acer America Corp., Apricot, Compaq Computer Corp., Gateway 2000 Inc., IBM Corp., NCR Corp. and NEC Technologies Inc. Many of the largest U.S. software distributors, such as Ingram, Merisel, Tech Data Corp., Access Graphics Inc. and Gates F/A, have announced that they will carry the X86 product.

On both the Intel Corp. X86- and SPARC-based platforms, the latest and greatest Solaris release contains several brand-new features. Version 2.2 is the first Solaris release to provide user-accessible threads, which allow developers to speed up I/O processing and concurrency, especially for database applications, on either uniprocessors or multiprocessors. SunSoft also claims that 2.2 provides improved symmetric multiprocessing–in fact, a "more than 60% performance increase as measured in transactions per second on an eight-way processor system." Sun also claims to have tuned its networking capabilities in 2.2, providing a "10% to 15% improvement in networking operations per second."

SunSoft has added a number of systems administration enhancements to 2.2, as well. It has rolled out a network profiling tool that allows systems administrators to remotely tailor individuals' desktops. It has created an upgrade facility that allows sysadmins to release new Solaris versions to users. SunSoft has added to its Open Windows desktop a DeskSet application called Image Tool, which allows users to create, load, view, rotate, zoom and crop images for documents. It has also added a Network File Manager tool, which enables users to use icons and "point and click" to access CDs, floppies or files across a network.

Integrated into 2.2 is SunSoft's new Solaris Live! technology. Solaris Live! is a combination of user productivity tools and multimedia APIs for audio, imaging and video. Live! includes XIL, XGL, a new version of PEX and Direct XLib. It makes use of ToolTalk's specialized message set, called Media

Five Ways to Use MP Today

A substantial part of Sun Microsystems Inc.'s MP mission will be convincing customers that there are reasons they should crave MP systems today–not just a few years down the road after developers have devised multithreaded applications to run on them. According to Bob Pearson, director of advanced desktop systems for SMCC, there are five ways to take advantage of MP, only one of which requires the user to rewrite an application. The five present-day benefits of MP are these:

1. **Makes an operating system function faster by parallelizing administrative tasks, I/O, windowing functions, shell scripts, daemons, NFS, etc.**
2. **Runs two or more jobs at the same time (symmetric multiprocessing).**
3. **Breaks one program into major segments (i.e., graphics, I/O, compute, network, libraries)–a design philosophy already espoused by a number of applications.**
4. **Uses an automatic parallelizing compiler, which will provide the direct translation of source to optimized code.**
5. **Runs multithreaded applications (requires applications to be rewritten).**

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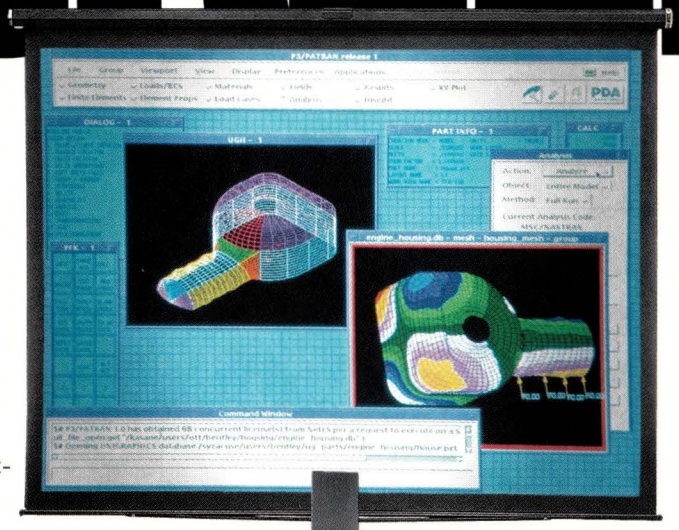

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Solaris for X86, a k a Solaris 2.2, runs on almost every 486-based PC in the book.

Exchange, to allow multimedia capabilities to be more easily integrated into an application. At the DeskSet level, users now have access to Multimedia MailTool, which allows them to attach images, audio or video files to their email, in addition to AudioTool and ImageTool.

Pricing for the X86 and SPARC versions of 2.2 is identical. A client desktop version goes for $795 and includes SunOS 5.0, ONC+ networking, multiprocessing, system and network administration tools, installation tools, DeskSet, run-time support for OpenWindows, ToolTalk and the XGL graphics tool kit. The Solaris Workgroup Server, for the "small to midrange departmental group," goes for $1,995 and includes all of the same features, plus server networking, naming services and remote administration tools. The Solaris Enterprise Server version sells for $5,995 and is "for a global enterprise allowing for compute-intensive tasks, data transaction processing and high-performance multiprocessing." It includes all of the same features and technologies as the Workgroup Server, plus advanced systems administration tools, commercial grade I/O and enterprisewide installation tools.

The Solaris Software Developer's Kit sells for $495 and includes all Solaris development utilities and tools, developer-specific documentation and optionally available compilers. The Solaris Driver Developer's Kit for hardware developers retails for $195 and consists of a suite of device-driver tools and documentation.–*mjf*

WABImania Strikes!

Those funny little 3D glasses that SunSelect mailed out to attendees of its WABImania event might have more than one use. Rather than focusing their attention on WABI–the Windows Application Binary Interface technology from SunSelect's Praxys Technologies acquisition–the shades could also function as blinders that will help Sun customers deflect the myriad other Windows-on-UNIX products that are emerging from a host of other vendors.

SunSelect has been demonstrating WABI at trade shows for some time now. By the time it got around to officially introducing the product at its May 5 press event, WABI was little more than one of a number of similar products in an increasingly crowded field. Other related products include Bristol Technology Inc.'s Wind/U (Microsoft Windows to UNIX/Motif), MainSoft Corp.'s MainWin, Visual Solutions' LibWXM, Insignia Solutions Inc.'s SoftPC and, some argue, Sun's own SunPC (which is basically SoftPC repackaged). Hunter Systems Inc., yet another participant in the DOS/Windows on UNIX battle, recently went Chapter 11.

Further complicating the scene is Microsoft Corp., which has been alternating between hinting and outright threatening that it plans to sue Sun for failing to pay Windows royalties. For now, however, it looks as if Microsoft has chosen to enter the fray itself, rather than litigate. Microsoft and Insignia are known to be working on

Solaris for X86: Who Needs Ya?

Just because SunSoft has managed to get Solaris for X86 out the door doesn't mean the product is guaranteed to be an overnight success. It's facing some tough competition in the 32-bit desktop operating system realm. And even the existing Sun customer base doesn't seem overwhelmed by the product.

At E.I. DuPont De Nemours Inc., where there are more than 20,000 X86 systems on desktops and lab benches, Solaris is only one technology under consideration to "extend the life of the systems and defer significant additional capital expenses," according to a DuPont corporate statement. "We have been quite pleasantly surprised at both the performance and the robustness of Solaris on Intel processors," acknowledges David Pensak, corporate adviser for computing technology.

At industrial-process automator The Foxboro Co., some existing DOS users need more than DOS can provide in the areas of multitasking, heterogeneous networking and an integrated GUI, according to the company. Foxboro "has chosen to migrate to Solaris for X86 when their user requirements exceed the limitations of DOS and where protection of their existing key investment is essential." No word from Foxboro on how many systems it is looking to upgrade or when, however.

Philip Morris, which currently runs Solaris on approximately 80 workstations, is a tad more definitive. The company says it plans to run seamless Solaris networks on SPARC and X86 systems. Again, there's no word on how many systems Philip Morris is looking to upgrade or when it plans to do so.

And 3M Co.'s medical imaging systems division, which uses Solaris on SPARC in its product development efforts, is doing little more than saying it thinks Solaris for X86 does what its maker claims. According to a corporate statement, "Solaris on X86 will allow for integration of SPARC and Intel platforms." Whether and when this integration could figure in 3M's purchasing plans is anyone's guess.–*mjf*

Scan

Sharp JX-320

Low Cost 300 DPI Color Scanner

The JX-320 offers a low cost solution for all scanning requirements by offering the ability to scan in color, grayscale and black & white modes.The JX-320, in its native mode, scans at a "true" 300 DPI.Using Sharp's proprietary algorithm resolution can be increased to 600 DPI, capturing the smallest detail. The SCSI -2 compliant scanner features Sharp's patented one-pass system ensuring high quality color while reducing scan times. Transparency Scanning option transforms the JX-320 into a professional level scanner offering both transparent and reflective scanning modes.

Sharp JX-610

600 DPI Professional Scanner

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 flourescent 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 Utiltiy, Network ScanServer Daemon, User Callable Programming Libraries, and the SCSI device Driver.

Product of the year

-Sun World Magazine-

SunWorld BEST PRODUCT 1992

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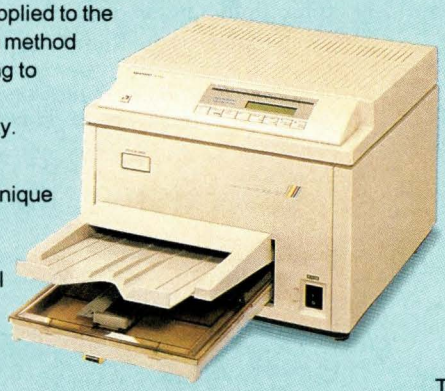
sun microsystems Value Added Reseller

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

The JX-7000 can also print on transparency film giving you untold creative potential for presentations.

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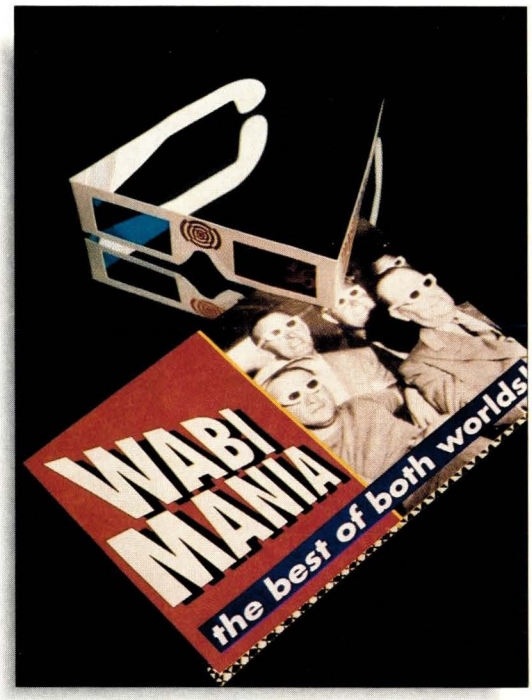
Print



JOHN W. KELLEY, JR.

Will WABImania grab Sun users? Or will one of the other Windows-on-UNIX competitive products suit their fancy?

their own Windows-on-UNIX option.

The Common Open Software Environment (COSE) Initiative has been rumored to be considering selecting WABI as part of its technology package. But at least one of the WABI competitors says that COSE is fearful of Microsoft's right to sue and is instead considering licensing one of the competitive Windows-on-UNIX technologies. Meanwhile Sun is developing a Public Windows API that it is proposing to X/Open as a standard.

And adding yet another twist is a recent co-development agreement announced between Insignia and Bristol. Insignia made a minority investment in Bristol. The two will "jointly develop products to allow Windows applications to run on UNIX desktops."–*mjf*

Sun to Kodak: Color Us Beautiful

SunSoft, SunPics and Sun Microsystems Computer Corp. will all be having their colors done, thanks to an agreement between Sun Microsystems Inc. and Eastman Kodak Co. Under the terms of the agreement, Kodak's ColorSense Color Management System technology and API will be incorporated into Solaris, Sun monitors and SunPics printing products by 1994.

SunSoft and Kodak have already published the Color Management spec that will provide, according to the pair, "a stable and consistent color interface that enables software developers to maintain accurate color within their applications for the Solaris distributed computing environment." A framework for third-party color management providers is due out this summer.

Kodak also will be providing two core ColorSense technologies: a color management module and a set of device color profiles for monitors, printers, scanners, Kodak's Photo CD disc and other peripherals currently under development by SMCC and SunPics. The color management module transforms data using the appropriate profiles to ensure that the color displayed on the monitor is the same color that makes its way to the printer. Additionally, Kodak will supply Sun with the "necessary methodology and information" to create other new ColorSense device color profiles in the future.

In addition to the Kodak announcement, SunPics has also unveiled the latest version of NeWSprint (Version 2.5) for Solaris 2.X users. Version 2.5 is upwardly compatible with NeWSprint 2.1, which runs on Solaris 1.X.

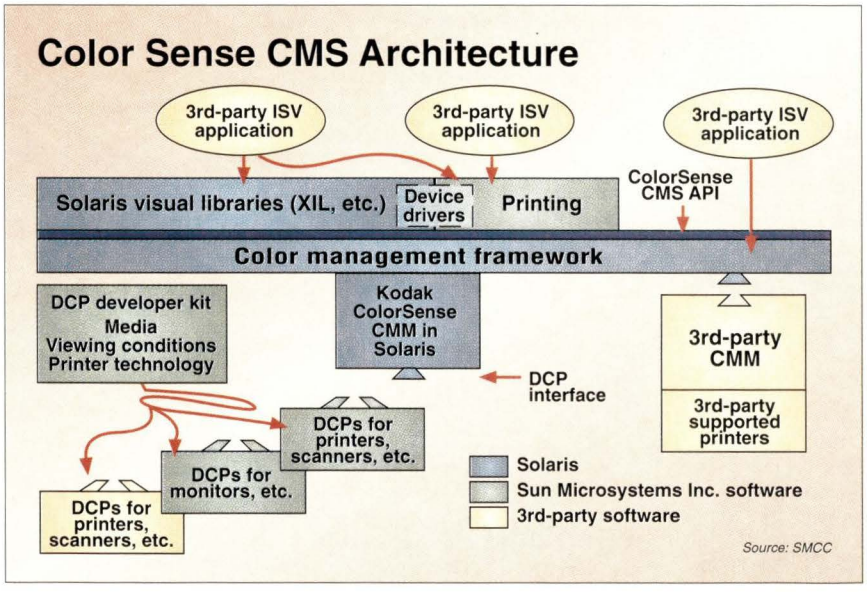
Version 2.5 features improved support for PostScript Level 2, enhanced support of TIFF formatted files and on-line help through Sun's AnswerBook software. A NeWSprint Transition Tool Kit, which will enable VARs and other NeWSprint resellers to create or upgrade device interfaces using 2.5, is also available.

NeWSprint 2.5 is available immediately through SunPics' resellers. It is priced at $695; upgrades for current NeWSprint customers are $345 per printer. The NeWSprinter 20 and SPARCprinter are now shipping with 2.5.–*mjf*

Project DOE– What's a Developer to Do?

SunSoft claims to have reached the second milestone in its work on the mysterious Project Distributed Objects Everywhere (DOE). Still, developers have yet to see much in the way of concrete products upon which they can build. At its Developers Conference, however, SunSoft did offer programmers some guidance so they can get a bit of a head start in their efforts to comply with Sun Microsystems Inc.'s next-generation

Eastman Kodak Co. is providing Sun with a color management module (CMM) and a set of device color profiles (DCPs) for a variety of peripherals.



HANNA DYER

The 5th Wave **By Rich Tennant**

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–Digital Review

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operating environment.

At the conference, SunSoft demonstrated the distributed object system, the second tangible piece of DOE. (The first was ToolTalk.) The system consists of the Distributed Object Management Facility (DOMF), which is SunSoft's implementation of the Object Management Group's Common Object Request Broker Architecture (CORBA), and a set of system objects. SunSoft says, "The system allows software developers to integrate existing applications and create new objects that seamlessly interoperate with each other." SunSoft has made the distributed object system available to members of its Distributed Object Council, a group of object developers and key end users.

Dr. Robert Hagmann, a senior staff engineer with SunSoft working on Project DOE, reminded developers about DOE's purpose and function at the conference. "Project DOE is an initiative–not a product. It is an enhancement to Solaris." He added that it is SunSoft's attempt to build a common framework for developers, users and systems administrators.

DOE's features will include object references; distributed "calls" on an object; a truly independent, object-oriented, distributed language; encapsulation of code; scalability; a framework; and related tools, Hagmann said. The language upon which DOE will be based is the OMG's Interface Definition Language (IDL). Developers should think of IDL as "an abstraction, not a programming language...that will support C and C++ initially," he said. DOE will provide as services just about everything one would expect from an object-oriented environment: compound naming, an object-oriented persistent storage management, associations/well-formed graphs of objects, properties (lists associated with objects), events and support for the whole software life cycle.

"DOE will evolve OpenWindows," Hagmann said. "It will bring distributed object functionality to OpenWindows and allow it to interoperate with Intrinsics-based applications."

So what can developers do now to prepare for all of these promises? Hagmann offers five suggestions:

- Start using threads now.
- Use C++ for all new development projects.
- Use ToolTalk as a way to help ease the transition to DOE. (ToolTalk APIs will be supported over DOE.)
- Write IDL-compatible interfaces. (For more on IDL, read the IDL chapter of the OMG CORBA specification and write `.h` files that are IDL-compatible.)
- Plan for replaceable components by segregating subcomponents using interfaces.
- Design applications so the semantic part has an interface, or, in other words, separate the "computation engine" of the application from the GUI.–*mjf*

Sun Unveils SPARC Group

Sun Microsystems Inc. has revealed more details of its SPARC Technology Group, an organization within Sun Microsystems Computer Corp. whose official mandate is to promote the use of SPARC outside the company. "You can sort of take this as the announcement of Sun the chip company," says Elaine Miller, technology licensing manager for the new group. "Our goal is take Sun into application areas where it hasn't been before."

To this end, the group ("not a new planet, an organization within SMCC," says Miller), will be licensing board- and even chip-level designs to alternative vendors. "I really need to stress the design end of this," says Miller. "We are not selling chips and boards. We are selling designs for chips and boards."

The group offers a variety of plans by which hardware developers can obtain access to these designs. "There is a whole buffet of rights," explains Miller, ranging from an "early access" option for developers who simply need to know something of Sun's long-term processor plans, to the very expensive option of licensing Sun's own designs for SuperSPARC and other SPARC variants. Pricing on the items in the buffet ranges "from a couple of hundred thousand dollars to several million, depending on the technology and the rights."

The chip license option is not to be confused with obtaining the SPARC interface specification from SPARC International. Instead, the licensee actually buys rights to Sun's own design for the CPU. Sun says that this will be more than worth a million-plus-dollar price tag. It cites as evidence the fact that Xerox Corp. has already signed an agreement to obtain rights on the microSPARC chip. "The proof of the pie is in the eating," says William Johnson, Sun's director of SPARC Business Engineering. "Clearly, Xerox has chosen to do this."

What remains to be seen is the impact of this new group on Sun's silicon suppliers, like Texas Instruments Inc. and a variety of other current or would-be SPARC vendors. Until quite recently, for instance, SuperSPARC and microSPARC were supposed to be Texas Instruments products.

"I think what happened is that Sun wanted a second source for the silicon," said one industry insider who asked not to be identified. "But they couldn't just go get one without making their relationship with TI difficult. So, instead, they don't go to TI and say 'Second source.' They say, 'Let's grow the market.' And that way they get their second source without pissing off the Long Horns [TI]."

But, be that as it may, board and systems vendors seem generally pleased by the creation of the group. Force Computers Inc., Campbell, CA, has been a long-term licensee of Sun's board designs. "It [the group] helps us," says Tom Griffiths, Force's manager of product marketing. "Before,we were dealing with a number of groups and invidiously at Sun. There was a lot of chasing around and heartburn in the relationship. [Now], we have a single contact point."–*mjt*

This Just In...

- Two new SPARCclassic configurations are now shipping from ***Sun Microsystems Computer Corp.*** The 32-MB memory, 424-MB disk SPARCclassic workstation, and the 32-MB memory, 1.05-GB disk SPARCclassic server are not meant to replace existing configurations; all 207-MB systems remain available.

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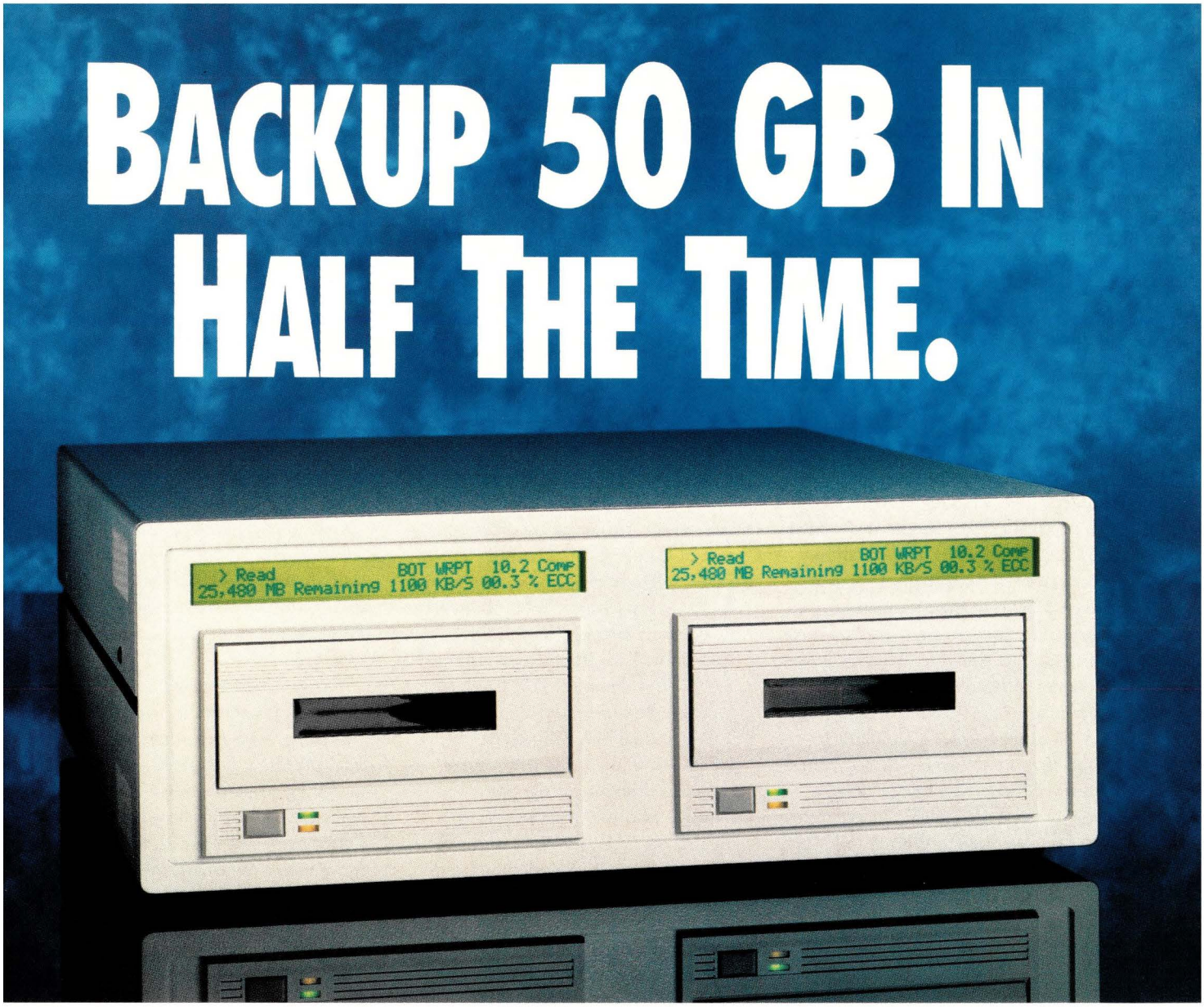

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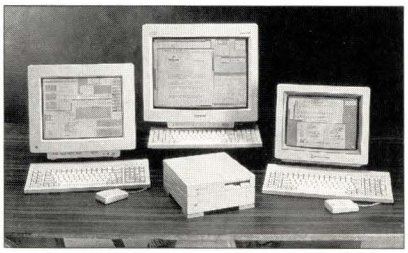
• ***SunPro*** has been busy during the past couple of months. Last month, it announced it was porting its ProWorks environment to the Univel Inc. UNIXware operating system. It has also slashed the price of its SPARCworks Professional C and ProWorks C development environments by nearly 40%, to $995 each. The software development arm of Sun has added to its pool of ProWorks distributors, signing on Access Graphics, Arrow Electronics, SunSoft and Tech Data Corp. SunPro has also launched the "Try and Buy Program" for both its SPARCworks and ProWorks customers. The program allows prospective customers to evaluate any SunPro products for free for 30 days, simply by obtaining an evaluation kit on a single CD from their local authorized reseller. If, after 30 days, the customer wants to buy software, the reseller can turn the software into a fully licensed product.

• An unlikely offer–helping Pick users migrate to UNIX–comes from ***Megatek Corp.***, San Diego. Besides providing all the requisite integration services, Megatek is offering the MultiUser Workstation for Pick users, which consists of a standard SPARCstation

Megatek Corp.'s MultiUser Workstation



IPX with a 16-inch monitor on the GX port, two Megatek Esprix graphics accelerator cards, two additional monitors and keyboards/mice, cables and X Window System software.

• The ***Silicon Graphics Inc.*** Iris Explorer visual application builder product is now available for SPARC systems, thanks to the efforts of ***The Numerical Algorithms Group (NAG)*** of Oxford, England. NAG says versions for Hewlett-Packard Co., IBM Corp. and Digital Equipment Corp. are due out soon. The actual port to Sun was done by Du Pont Pixel Ltd; NAG is managing the two international centers to aid users in porting to and using the environment.

• It was a heck of a third quarter for ***Sun Microsystems Inc.*** The company reported record revenues of $1.141 billion, up 20% over the corresponding period in fiscal 1992. Net income was off substantially, however, at $51.7 million, compared with $61.4 million for the third quarter in 1992. Gross margin declines were a result of "a heavier mix of upgrade shipments [as opposed to complete system sales], as well as increased shipments of non-systems components such as memory and storage," according to Sun. The company also experienced weaknesses in several European markets, Sun says.

• ***Sun Microsystems Computer Corp.*** has added two new ISDN products to its lineup. They are SunLink ISDN-BRI (Basic Rate Interface) Enabling Kit 1.0 and the SunISDN-BRI/SBI (Speaker Box Interface) Expansion Kit 1.0. The Enabling Kit includes CCITT-compliant ISDN protocol stacks and the software support required to run new and existing TCP/IP or UDP/IP applications transparently across ISDN telephone networks. It is intended to be used with computers with built-in ISDN-BRI ports, such as the SPARCstation 10 and LX systems. For those without built-in ISDN ports, the ISDN Expansion Kit provides a plug-in SBus card and the same software as the Enabling Kit. The Expansion Kit can also be used by customers requiring multiple BRI connections on a single system.

• An automated test framework for native and cross development is now available from the Free Software folks at ***Cygnus Support***, Mountain View, CA. Called DejaGnu, the framework is especially suited for regression testing, and tracks both expected and unexpected results of each test, highlighting successful fixes and newly created problems. The product runs on a variety of UNIX hosts.

• On the desktop storage front, ***SMCC*** has expanded its offerings with two new peripheral subsystems. The 4.2-GB Multi-Disk Pack is, according to Sun, "the smallest, high-quality 4-plus gigabyte desktop storage device on the market." The 5-GB 4mm Tape Desktop Backup Pack is "the fastest, lowest-cost DAT package available from any major UNIX computer vendor," Sun says. These two peripherals are also available combined with a CD-ROM drive in the new File and Database Server Option Packs, which come in three models.

• You've got just 30 days–until June 30–to take advantage of ***Frame Technology Corp.***'s special promotional price of $595 for FrameMaker. The package usually retails for $1,495. The promo price is available to purchasers of the SPARCclassic, SPARCstation LX or HP/Apollo 9000, Model 715/33 or 725/50. Customers need only show proof of purchase for one of these workstations to an authorized Frame VAR. Frame is based in San Jose, CA.

• Cambridge, England-based ***Tadpole Technology*** garnered its first design win using Texas Instruments Inc.'s microSPARC. Tadpole says it will be designing a microSPARC-based embedded processor board and will provide a Solaris 2.1 port for the board for "a major multinational corporation."

• Lots of changes are afoot in the network management world. ***Isicad Inc.***, Anaheim, CA, has ported its Command physical-management system to SunConnect's SunNet Manager. Command provides access to logical and physical connectivity information across multiprotocol networks, and offers integrated trouble-ticketing. Command was previously a Hewlett-Packard Co. OpenView application only. And Torrance, CA-based ***DeskTalk Systems Inc.*** has introduced a network management product that collects data from multiple management applications and provides multiple users with common access to and presentation of this data. The product that does all this is called TrendSystem, and it consists of seven components: TrendBase, TrendView, TrendGate, TrendLink, Trendstart, Trendrmon and Trendanalyzer.

• ***TCE Technology Group***, San Jose, CA, has formed a technology partnership with DeskTalk. ⊸

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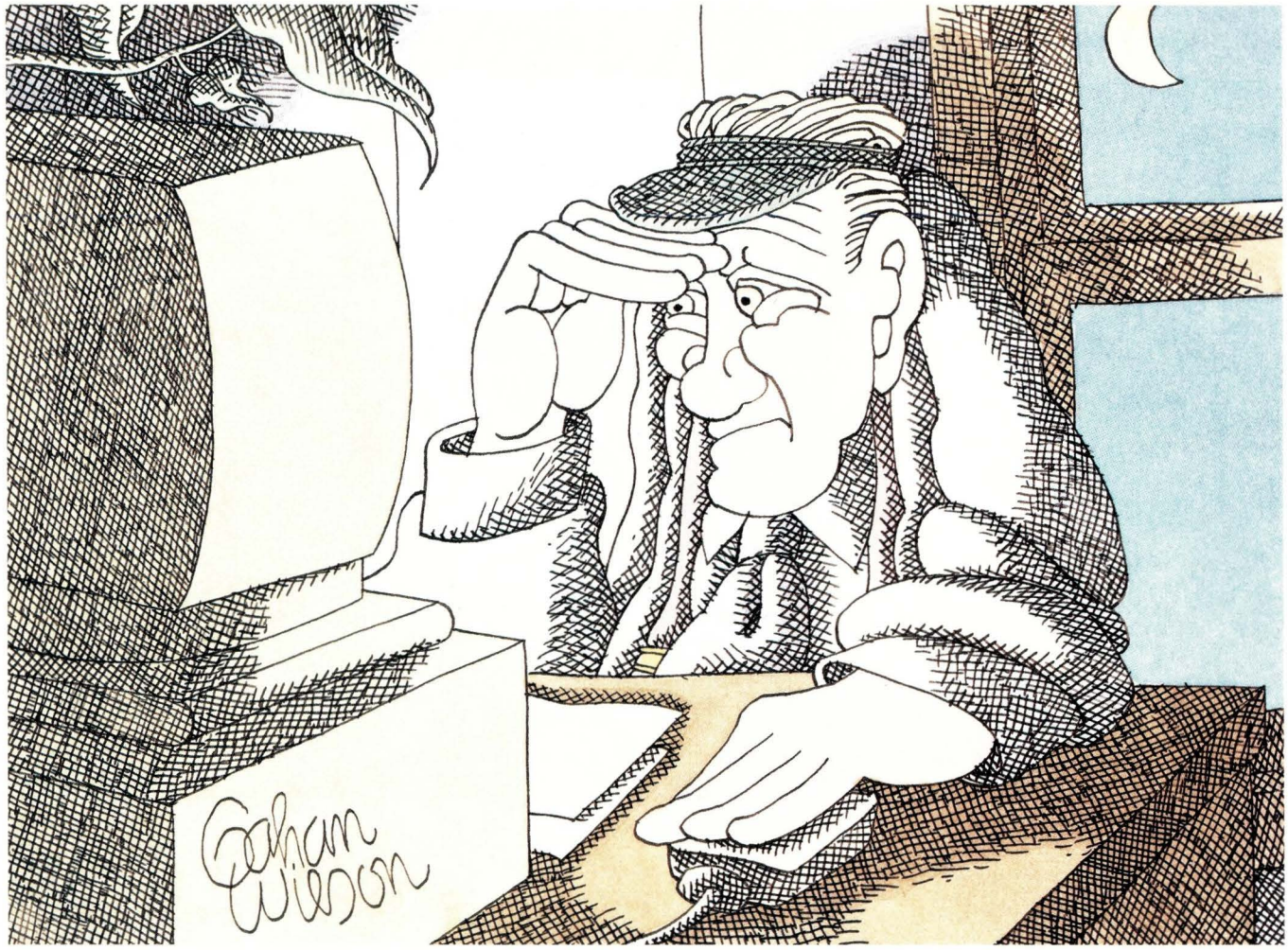

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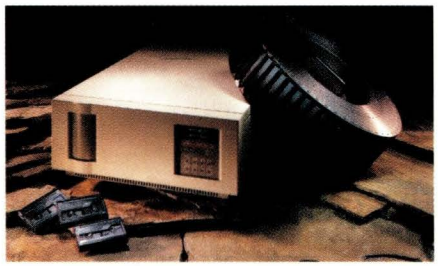

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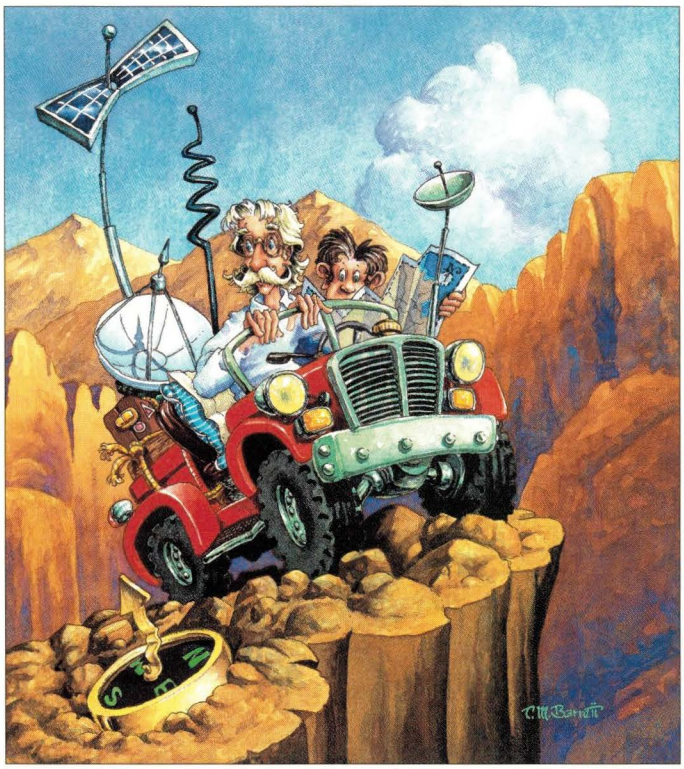

TOM BARRETT

Mr. Protocol Finds Himself

by MICHAEL O'BRIEN

"Wherefore art thou, Romeo?"
–An excellent question

"Buenos días, Señor!"
–A greeting fraught with meaning

"Yeah, I think that road."
–Prelude to an extended tour

Q: I hate to be the one to put up a fuss, but I don't generally associate this wilderness with computer workstations. Where the heck *are* we? And why are we here?

A: Fuss? What fuss? I realize that you've been bouncing around in a four-wheel-drive vehicle for an hour and a half now, and that you're lost, and that your kidneys will never be the same again, but rest assured that it is all in the name of science, and it *does* have something to do with Sun workstations. In fact, being here wouldn't do us much good if it weren't for them.

We are in Baja California, and we'll be here for the next week. Our purpose is to figure out just exactly where we are. It's going to take all week to do it.

Mr. Protocol, being more than a little virtual even at the best of times, has always found it difficult to pin down an actual location. He has therefore decided to get in some sorely needed practice in location-finding, and has joined this expedition to Baja California, more or less as supercargo, to further his aims. He claims, most strenuously, that the Mexican penchant for selling chocolate-chip cookies in unbelievably large boxes has absolutely nothing to do with the case. It would probably help his credibility somewhat if he hadn't developed a violent sugar buzz about 10 minutes after arrival in Ensenada.

What we are doing, in essence, is surveying. This old and venerable art probably started about the time we

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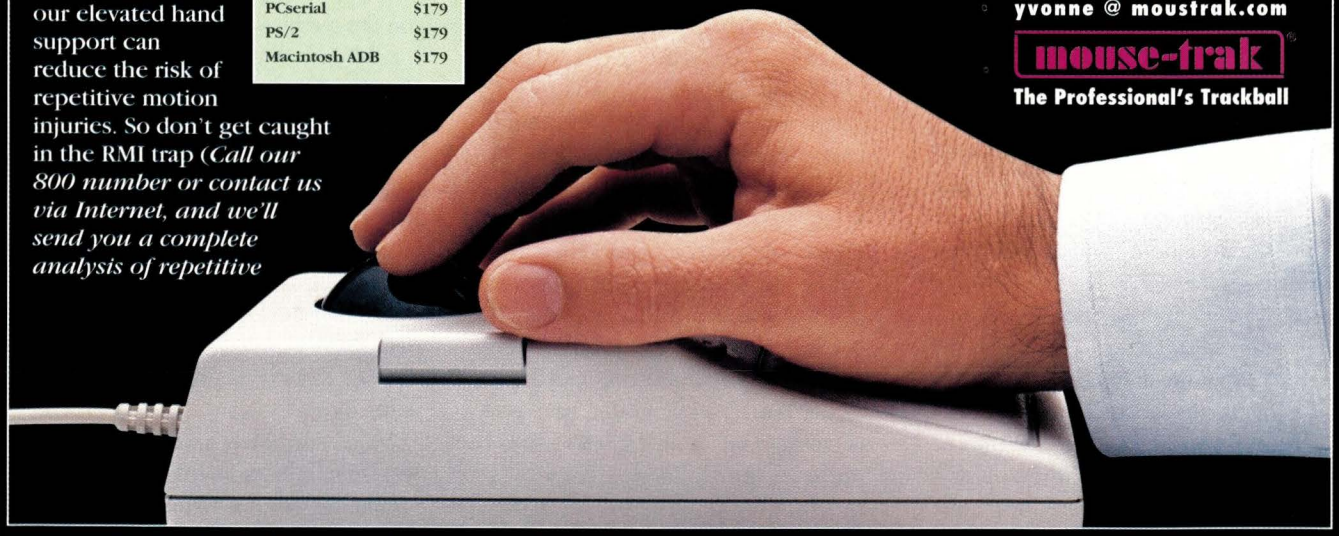

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gave up "hunter-gatherer" as a low-paying position and first started killing each other over the question of just which rock it was that marked off your field from my field, and sez who anyway?

The ancient Egyptians practiced this art in a really big way, as certain famous piles of stone in Lower Egypt testify. However, there is just so far that a stretched string can really get you, as the Gothic architects discovered when their faith proved insufficient to hold up the cathedral when the flying buttresses were skimped. The resulting stone piles proved rather more infamous than famous.

When dealing with direct reception of satellite signals, the number of sources of error is depressingly large.

Moving briskly along to the Father of Our Country, or at least, the country whose postal service is making out like a bandit on the second-class postage on this magazine, we find another surveyor. By this time the string had been replaced by optics: take a sight, lay down some tape, and *voilà!* Instant location. Of course, over the course of an entire state (we were, after all, laying down the law on an entirely new continent), you might be off by a few tens of feet, but so what?

Meanwhile, another pot was boiling. In their efforts to build a world empire, everyone who fancied themselves in the business of world empire-building was worrying about the problem of navigation. Determining latitude was easy, using star sightings, but longitude depended upon having an accurate clock. The old picture of the ship's cabin boy falling asleep over the hourglass was serious business. The British Admiralty went so far as to offer a substantial prize to the clockmaker who could produce the most accurate shipboard clock, able to compensate for the rolling of the ship. The timepieces in this contest, possibly the most amazing collection of intricate machinery in the world, now reside in the Maritime Museum at Greenwich, just down the hill from the Airy Circle, whose observations define the prime meridian of the world. Thus began a mania for accurate timekeeping whose distant descendants we will soon meet.

As times changed, so did surveying, though right up through the middle of the 20th century the transit and tape measure remained the standard. Once electronics became small, rugged and accurate enough to take into the field, though, all bets were off. The blandly named Electronic Distance Measurement technique uses a species of radar to measure distances, and up until quite recently the top-of-the-line standard used lasers to measure the distance between geodetic benchmarks.

Appealing as the image of laser beams flickering from mountaintop to mountaintop may be, the field of surveying has been handed an even more accurate tool, one not intended by the people who designed and built that tool. This is the Global Positioning System, or GPS.

GPS was designed as a military navigation system, to enable vehicles and troops to navigate under battlefield conditions. In order to sell the system, it has also been made available for civilian use, with "degraded" accuracy.

In principle, GPS operates using the descendants of the navigational clocks in the Greenwich museum. The GPS system uses a constellation of (currently) 21 satellites, each one carrying three atomic clocks, for purposes of redundancy. Each satellite continuously broadcasts a complex message. Navigation is performed using a GPS receiver, which receives and decodes this message. A GPS receiver consists not only of a collection of individual radio receivers, but also a very accurate clock (though not, generally, an atomic clock, as those things are about as large as suitcases).

Without going into yawning detail, the receiver compares its clock with the clock signal broadcast by a number of satellites simultaneously. The satellites also broadcast information on their own exact location (the "ephemeris"), so by measuring the delay in reception of the clock signal from several satellites at once, the receiver can compute its own position with a high degree of accuracy.

Now, here's a nice point. The weasel words here are "a high degree of accuracy." Compared with what? If you figure that those things are thousands of miles out there, then anything within a mile or so looks pretty darned accurate. Of course, under battlefield conditions, you'd like to be a little more precise. That's why you make your GPS receiver clock as accurate as you can, and why GPS uses very high frequencies, with wavelengths in the range of 20 centimeters.

The real accuracy of a GPS position determination depends on a number of factors. When dealing with direct reception of satellite signals, the number of sources of error is depressingly large. For one thing, the entirety of the Earth's atmosphere gets to chew on each signal. Second, the GPS receiver's clock may be off. The clocks on the satellites, while very good, aren't perfect either. Finally, a collection of satellites clustered together in one portion of the sky is not going to give as good a measuring base for figuring one's position as a collection of satellites scattered all over the sky, so the accuracy is something that changes over time, depending on how the satellites currently visible above the horizon happen to be distributed.

Then there is the matter of the deliberate lie.

Mr. Protocol has never envied those whose job it is to do things such as designing weapon systems. He happens to recognize the practical necessity but can't help feeling that it's ultimately depressing work. It's work made lighter, though, if navigation

ceases to be a really practical problem. If missile navigation is as easy as putting one of our own GPS receivers in the nose cone and letting it figure out the rest, then GPS ceases to be such a sterling military advantage. However, making GPS generally unavailable is a waste and a shame, not to mention politically difficult when you're asking for as many as 24 satellites (including some hot spares) on tick.

Enter the deliberate lie. GPS satellites actually encrypt the last few bits of their clock message in such a way as to make it look like clock drift. If you have the cryptographic keys to make sense of the bits, then you can get position accuracy down to something like 16 meters. However, if you don't have the key, you can still use the higher-order bits to get positional accuracy of between 30 and 100 meters. And, in fact, the ephemeris sent out by the satellites has also been diddled with somewhat.

Might as well go back to the stretched string, huh?

Mr. Protocol is glad you asked.

The answer, of course, is no. These are the accuracies obtainable with one GPS receiver. If you have more than one, you can do better. Much, much better. In fact, you can determine position to within a few millimeters. Which is what Mr. Protocol was doing down in Baja.

With two receivers, you can compare the phase of the signals received at each point, and, with enough crunch-power in the post-processing, you can not only eliminate the dithering in the clock signal, you can also fix up the satellite ephemeris to the point where you know where the satellite is to a precision much greater than that of the ephemeris it is sending out.

So back to Baja.

One of the most prominent features of the landscape around Ensenada is a huge long cliff that is several hundred feet high and is obviously the topographic evidence of a truly major fault. Like all the other faults in this region, this fault runs radially from the San Andreas fault, which in turn runs down the center of the Sea of Cortez, which separates the Baja peninsula from the mainland. It's therefore peculiar in the extreme to note that in all of recorded history, this fault has never given rise to a single earthquake.

Oh, there are earthquakes aplenty in the region, of course. However, they all show up on faults that have little or no visibility on the surface. To geologists, this is puzzling stuff. Faults are there to slip. Is this fault locked up and getting ready for a huge quake? Or is there just no tension across this fault, with all the energy being tied up elsewhere? That's what the expedition Mr. Protocol joined had gone down to find out.

A set of points was carefully chosen, first by looking at geological maps of the area, to find the fault lines, then by looking at topographic maps, to see where bedrock comes to the surface, then by looking at geographic maps, to find out where the roads go.

Oh, dear. That last reference to "roads" has caused Mr. Protocol to engage in a fit of severe coughing. Of all the criteria, if something's gotta go, accessibility by road is the first to go. Up until this trip, Mr. Protocol wasn't aware that roads got any worse than "tertiary." He has now been enlightened in this regard.

A GPS receiver site, as implemented in this survey, consists of a GPS receiver, two deep-cycle marine storage batteries to power it and an antenna. A GPS antenna can actually be rather small, since the signal comes in at a rampaging 50 baud (yep, that's right, 50 baud). However, the antennas used with this particular receiver are fitted with "choke rings," four or five concentric machined circles of steel three inches high and with an outer diameter of about a foot and a half, which cut off reflected signals from below the horizon. All in all the antenna, if photographed without benefit of anything to give it scale, looks like an alien scout ship.

The antenna may either be mounted on a tripod, or else set directly down on top of the benchmark. The latter is preferable but is only really feasible if the benchmark has been set into a sizable chunk of rock, since the antenna must be supported on short legs which, in turn, are set into plaster

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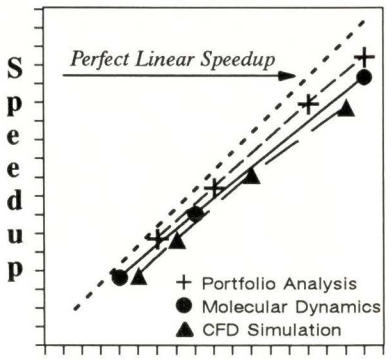

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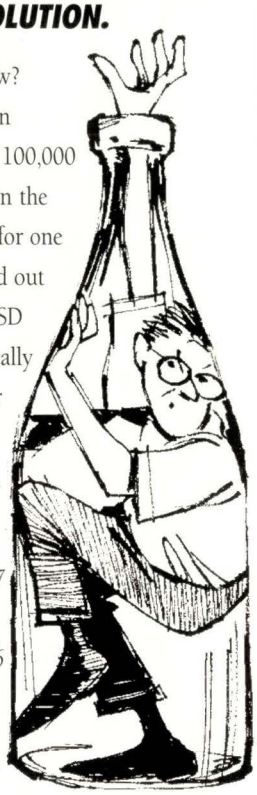

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of Paris to keep the whole thing in place for a week.

Some remote sites in insecure areas must be manned eight hours a day and taken down and set up each night and morning. Other sites run in an unmanned configuration, in which the receiver and batteries are placed in a "lock box" about the size and shape of a file cabinet lying on its back, which in turn is chained to eyebolts set into the rock. The batteries are recharged by means of a set of solar panels.

Mr. Protocol learned a number of things just from the experience of setting up and maintaining these sites. For one thing, one is liable to be challenged by up to seven armed Mexicans on horseback, asking what you happen to be doing on Uncle's land. A letter from a Mexican graduate university, acting as a partner in this expedition, comes in very handy here. Also, it may be noted that the severe rains that (American) California experienced this spring were shared by our neighbor to the south, and Baja at this point looks more like Ireland than the Sonoran desert. Finally, it may be taken as safely established that solar panel arrays do not work well when walked upon by cows, especially if said cow gets a leg entangled in the solar panel cable. That one was not a pretty sight. An amputation had to be performed and a field dressing installed. The patient was doing fine at last report. Oh, the cow was fine all along, the stupid brute. The solar panel array fared less well but, as I say, was doing fine at last report.

The GPS receivers are a marvel even by Mr. Protocol's standards. They have back-lit LCD displays, seem to operate well even at temperatures that must have exceeded 120° F, and possess "flashbank" cards (EEPROMs of some description on a credit-card sized mount) that can store 4 MB of data from the receiver. The receiver has an entire menu system for displaying the signal characteristics of the (up to eight) satellites being tracked, as well as provisions for reading out the flash-bank memory and checking what the signal quality has been over some period of time. The receivers currently cost about $10,000, which is better than the $100,000 price tag that used to apply to much less convenient systems (imagine a rubidium atomic clock in a suitcase accompanying each receiver).

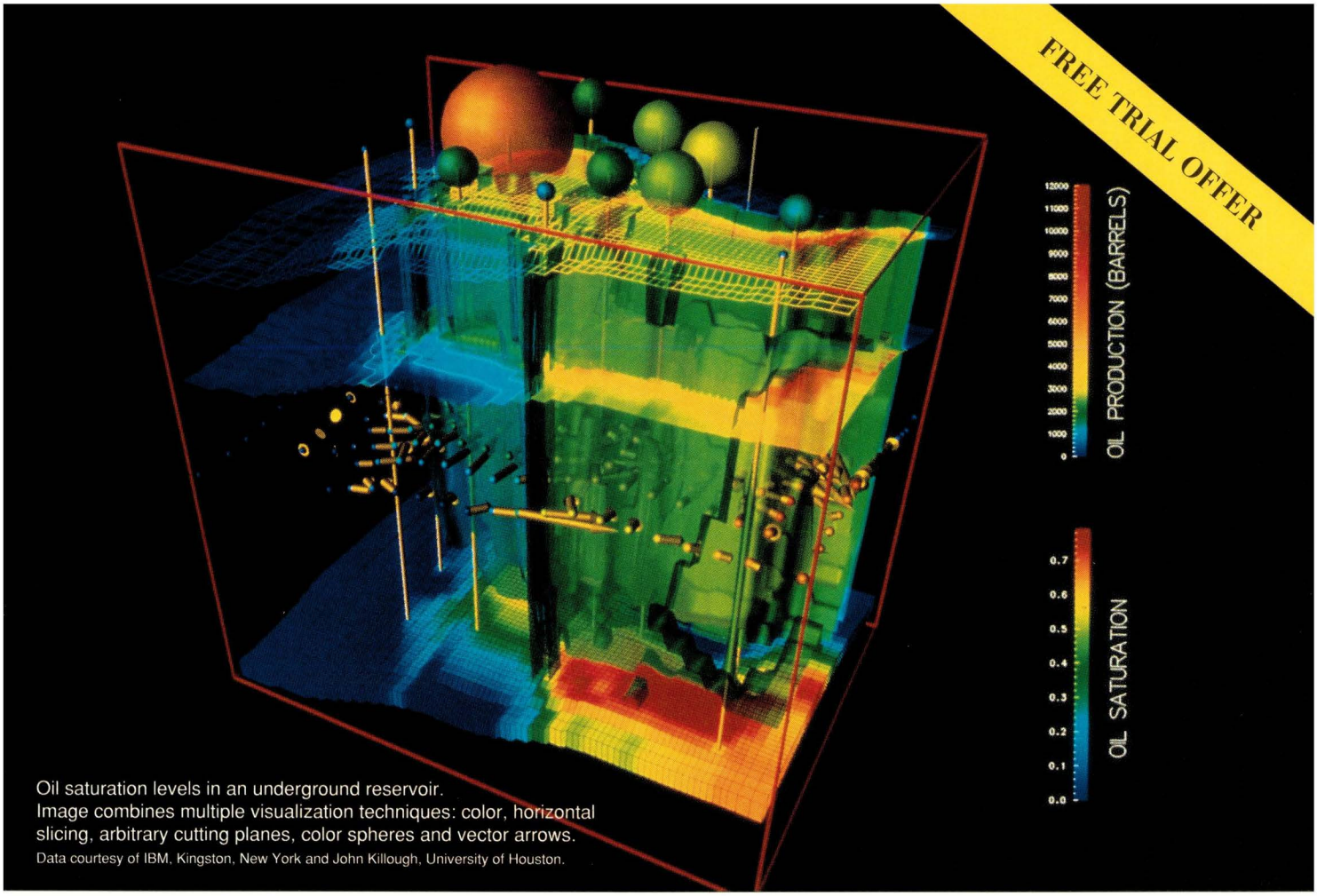
Five days' worth of data from all 14 GPS receivers in the experiment will then be reduced on a Sun workstation after everybody goes home and recovers. Considerable post-processing must be done to establish the true ephemeris for each satellite seen. Once that is done, the position of each point in the "network" can be found relative to all the others to an accuracy good to several millimeters. Next year, and the year after that, the same thing will be done again. In that way, the relative motion of each point, which is expected to amount to a few centimeters a year, will tell us how the various faults in the Baja peninsula are moving, which in turn will give us insight not only into how land moves near this area where the North American and Pacific crustal plates meet, but may also tell us what to expect–if anything–from the gigantic, silent fault.

Mr. Protocol figures that these particular Sun workstations will earn their keep. Right now he's busy contemplating a serious back-country tan line (despite #22 sunblock) and getting his digestive system back in order. ⊸

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`.



Oil saturation levels in an underground reservoir.
Image combines multiple visualization techniques: color, horizontal slicing, arbitrary cutting planes, color spheres and vector arrows.
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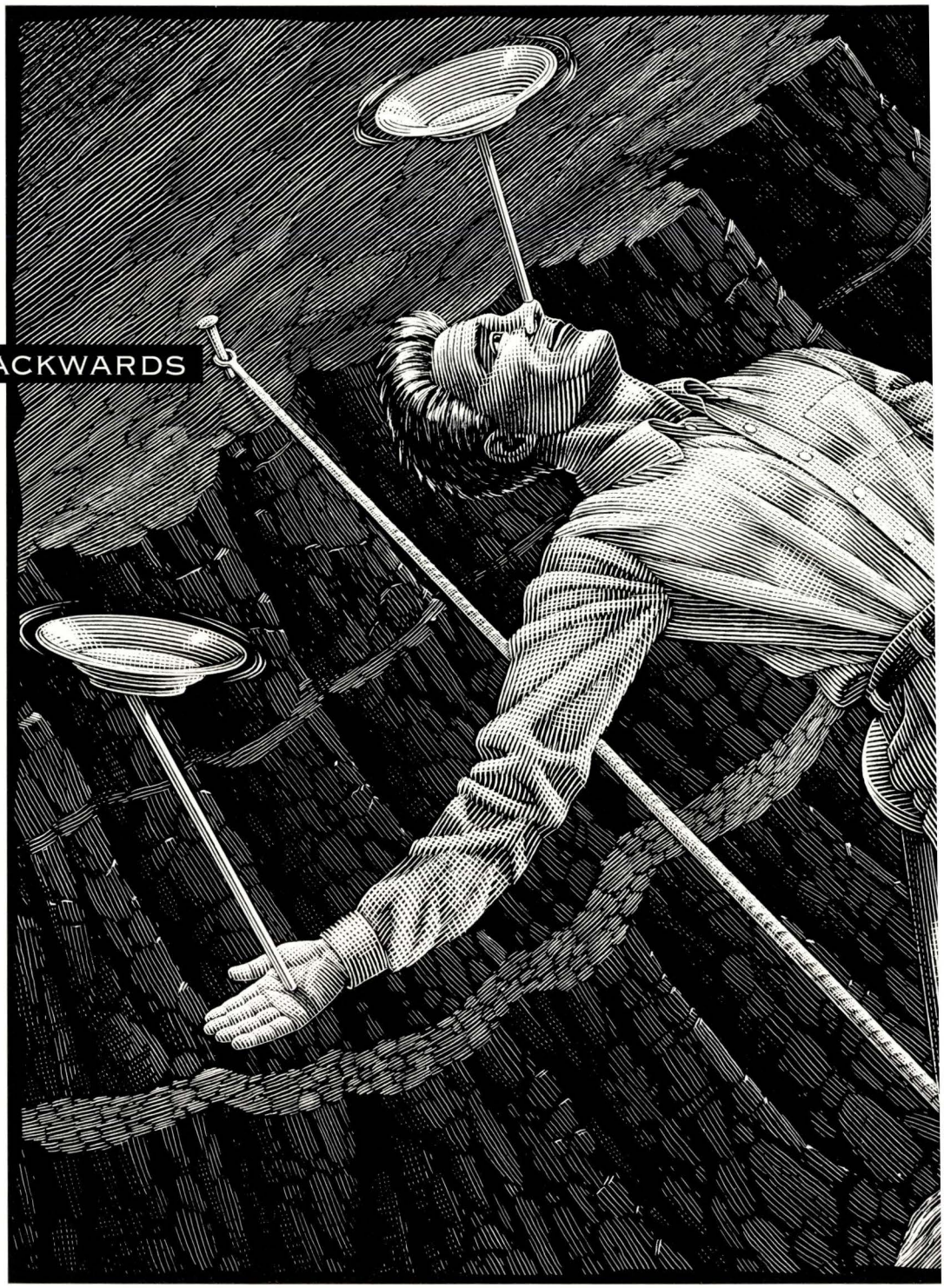

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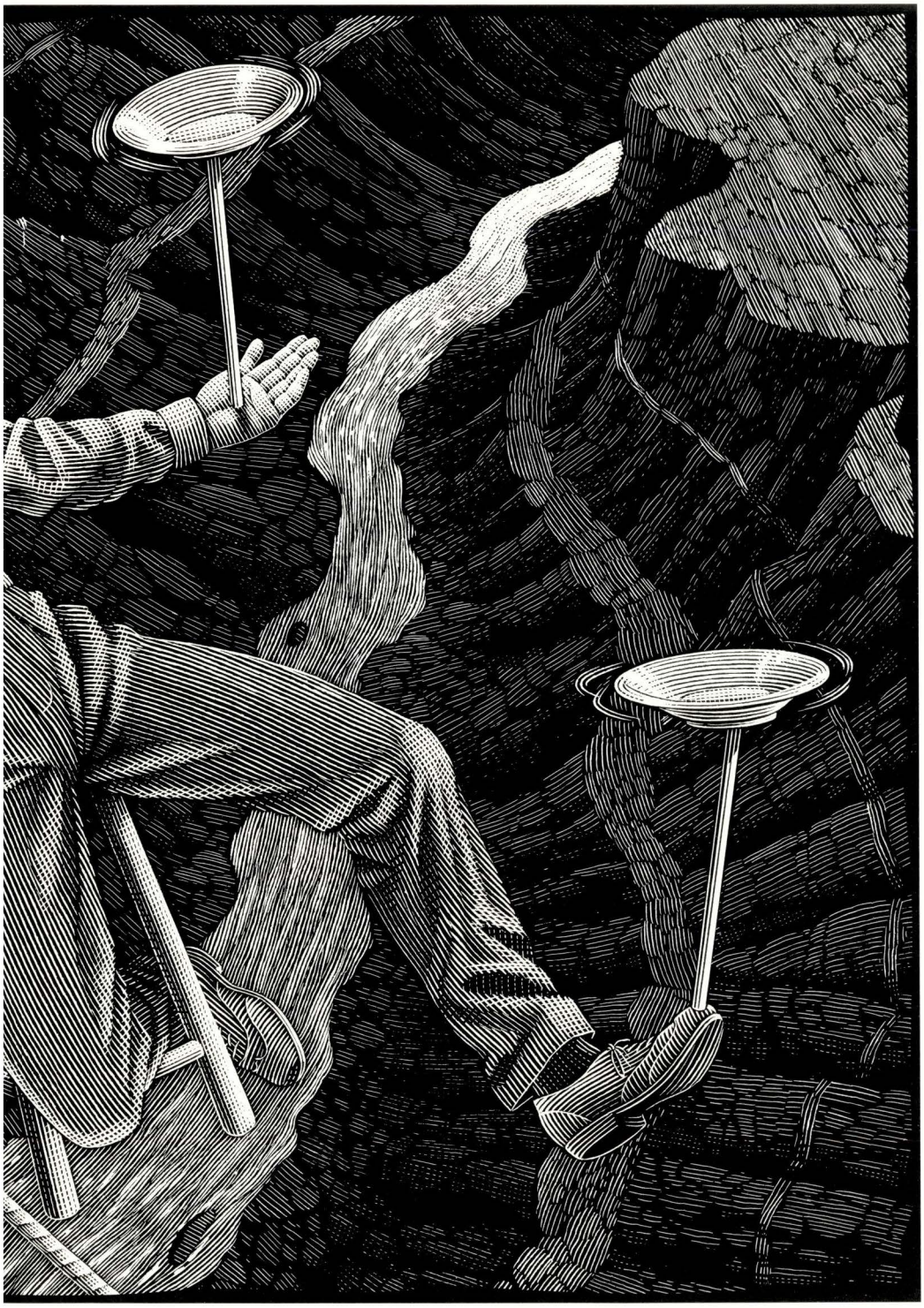

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KEITH GRAVES

Arguments to Shell Scripts

by **PETER COLLINSON**, Hillside Systems

I would guess that most people get into writing shell scripts because they recognize that they often use a bunch of commands together to do one job. You will save typing if you put all these commands into a file and turn on the execute bits with

```
% chmod +x newcmd
```

This creates a new command, called `newcmd`.

Step two is the realization that it would be helpful to use the new command independently of where you have moved in the file system. You have to tell the shell where to find the file, so it can read it when you type the name as a command. You want the new file to behave like any other command on the system.

This is easy. Just create a subdirectory in your home directory and place the file in it. Call the subdirectory `bin`. Why buck the trend? Many people do this. Then edit the `path` or `PATH` variable in the start-up file for your shell to contain the directory. This string tells the shell where to look for files that are commands.

You'll need to load the start-up file into the current shell by using `csh`'s `source` command or the "`.`" (*dot*) command for the Bourne and Korn shell. You should do this before logging out; otherwise a broken start-up file may stop you logging in again. Alternatively, you can test the new file by opening a window and saying

```
$ rlogin localhost
```

You can move about the file system once the start-up file has been read by the shell. The running shell will search your private `bin` when you type the command name.

Bourne and Korn shell users may elect to install these commands as a function named `newcmd` rather than a command script. It's a trade-off. If you have a large number of functions and aliases in your shell, it will need to do more when you log in, slowing things down. If the command is executed rarely, then perhaps it's better placed in a command file.

Also, you must use a command file if the command is ever likely to be executed from another command that is not your shell, perhaps from the "!" line in `vi`. I always feel that it's better to put complex commands into a file because they are easier to test. For the purposes of this article, I will discuss command files; some of those command files might be better implemented as shell functions. The coding is the same. Please don't write in complaining.

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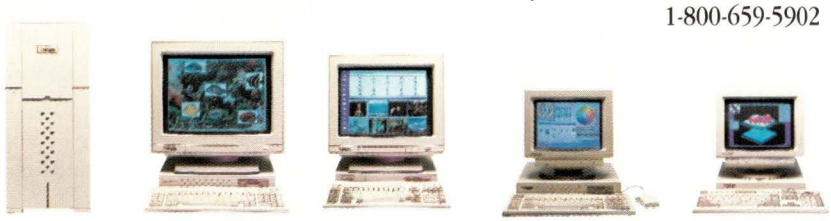

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Having created your new command, the next realization is that the lines in the file can be thought of as an algorithm. It would be a good idea to be able to supply arguments to the new command to take advantage of this. I wrote an article a year ago that explored this a little (see *SunExpert*, June 1992, Page 28). I have stolen the following example from that article.

Let's imagine that you are worried about saving the state of some files on a daily basis. You might write a script like

```
# backup script
cd /home/me/data
cp database database.sav
cp index index.sav
```

The idea of the script is to execute the two copy commands to save the state of two files. It starts by changing directory to a known place in the file system tree. You don't need to do this, but it makes the command more flexible. You can run it from anywhere and store it anywhere. You can also run the command from `at` or `cron`.

Simple Arguments

The `backup` command is limited because it contains fixed path names for the directory and the data files. What happens when you discover that you want to do these same actions for a set of files in a different directory? Many people start by simply copying the commands into a new file and then editing the bits that are different. This works, but isn't too elegant and doesn't scale. It's better to think that the script is a template of actions. The script above will be called by a command like

```
% backup
```

We know that we can give arguments to commands, so we would like to say something like

```
% backup db1
% backup db2
```

where the argument is the name of the data set that we want to save. Perhaps we would also like to say

```
% backup db1 db2
```

and have the script loop, doing several saves for us. Let's not skip ahead too much.

We now have a decision to make. Do we write our script using syntax from `csh` or aim our script at the Bourne/Korn shells? Most seasoned shell-script programmers will not use `csh` for serious work; the Bourne/Korn shells are much more powerful. Tom Christiansen's demolition job on `csh` scripts has recently been published in a book–see the "Further Reading" section at the end of this article. I am going to concentrate on writing Bourne shell scripts for the remainder of this article. They will work for the Korn shell too.

You can access the values of the first 10 arguments to a shell script by using "positional parameters." The first argument is referenced by `$1`, the second by `$2` and so on up to `$9`. The name of the command can be obtained by using `$0`. So, our `backup` script with a single argument becomes:

```
#!/bin/sh
# backup arg
cd /home/me/$1
cp database database.sav
cp index index.sav
```

When we call the script supplying `db1` as our argument, the `$1` in the `cd` command is replaced by the string in the argument, becoming

```
cd /home/me/db1
```

before the `cd` command is executed. You should think of the operation as a textual replacement.

What happens if we call the script with no argument? Well, `$1` is unset, and the shell will replace it with nothing. The `cd` command becomes:

```
cd /home/me/
```

and the `cp` commands will fail. This is reasonably OK in this example but might have worse and more dramatic effects if there were more destructive commands being executed in the command file. It's better to check for this case and avoid it.

```
#!/bin/sh
# backup arg
if [ "$1" = "" ]
then
   echo 'Usage: backup dirname'
else
   cd /home/me/$1
   cp database database.sav
   cp index index.sav
fi
```

This uses an `if` statement to see if the argument is empty. The square bracket syntax is a synonym for the `test` command. We could write the `if` statement like

```
if test "$1" = ""
```

I tend to use the square bracket syntax because it's easier to type and more readable.

The `test` command is run. If the strings are equal, it will return "success," and the first branch of the `if` will be taken. The `else` branch will be taken if it fails, when the strings are not equal. These days, `test` is a shell built-in command. Don't fall into the trap of creating a shell script called `test`.

It's a common mistake to forget to put double quotes around an argument that might be empty. If we had written

```
if [ $1 = "" ]
```

and `$1` is not set, the shell would attempt to execute the

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command

```
if [ = "" ]
```

giving rise to the error "test: argument expected." By placing double quotes around any argument, we ensure that it is passed into the command as a single entity. If `$1` is unset, then the null argument `""` will be passed into the command as a single empty argument. The `test` command will see correct syntax and not complain.

Having worried about robustness, I am going to ignore that topic for the rest of the article. You shouldn't though.

Loops

To make the command more useful, we want to be able to give it a number of arguments and have it jump into those directories to save the files. Here's an initial attempt at that:

```
#!/bin/sh
# backup args...
while [ "$1" != "" ]
do
   cd /home/me/$1
   cp database database.sav
   cp index index.sav
   shift
 done
```

This uses a `while` statement testing the first argument to the program. Let's see what happens when we call it with

```
$ backup db1 db2
```

The `test` in the `while` statement will check that the value of `$1` (`db1`) is not null. It isn't, so the `cd` command will be created and executed. This is followed by the two `cp` commands.

Now there is a new statement–`shift`. It rolls the positional parameters by one position, so the contents of `$1` are loaded from `$2`, `$2` is loaded from `$3` and so on. You can give `shift` an argument that is the number of places to roll. The default is one. In our example, the `shift` statement will make `$1` contain db2. We now see the `done` statement, and that will start the loop again. The `test` will succeed, and the internal part of the loop will be executed. This time `shift` will set `$1` to null; the `test` will fail. We are done.

The shell has some special syntax "`$#`" that allows you to access the number of positional parameters that are currently set. We can rewrite our loop using this:

```
#!/bin/sh
# backup args...
while [ $# -ne 0 ]
do
   cd /home/me/$1
   cp database database.sav
   cp index index.sav
   shift
done
```

The test statement is now doing an explicit numeric test for zero. The value of `$#` is decreased whenever a `shift` statement is executed, so we have a clean loop.

For Loops

You rarely see loops using `while` in shell scripts because the `for` statement has syntax that is designed to step through arguments easily. The `for` version of the script is

```
#!/bin/sh
# backup args...
for arg do
   cd /home/me/$arg
   cp database database.sav
   cp index index.sav
done
```

This is special syntax aimed at handling positional parameters. The loop is executed for each parameter that is set. The positional parameter is loaded into `arg` each time around the loop.

I think that this is too much magic and prefer to load the parameters explicitly in the `for` loop:

```
#!/bin/sh
# backup args...
for arg in "$@"
do
   cd /home/me/$arg
   cp database database.sav
   cp index index.sav
done
```

The `"$@"` in the `for` statement is internally replaced by the arguments to the program:

```
for arg in "db1" "db2"
```

and then the `for` loop is executed. There is no special reason in this example to use the fully quoted argument, but consider an application where the arguments to the script have embedded spaces. Here's a test script:

```
#!/bin/sh
# fortest args...
for str in "$@"V
do
   echo "[$str]"
done
```

If we call this with

```
$ fortest "tic tac" toe
[tic tac]
[toe]
$
```

The use of the `"$@"` operator has preserved the internal

spaces in original argument set. The `for` statement was expanded to

```
for str in "tic tac" "toe"
```

Try removing the double quotes from the `for` line in `fortest` and see what happens.

It's usually important to preserve the characters the shell uses internally to separate words on a line inside the loop. Sometimes it can be important to lose them too. If we use `"$*"` instead of `"$@"`:

```
#!/bin/sh
# fortest args...
for str in "$*"
do
   echo "[$str]"
done
```

and try the command again, we see a different result:

```
$ fortest "tic tac" toe
[tic tac toe]
```

The `"$*"` operator creates a `for` line like

```
for str in "tic tac toe"
```

and that becomes a single argument to the loop. Again, remove the quotes and see what happens. I tend to use `"$@"` to express the arguments; it preserves internal spaces and deals with the arguments exactly as the user has typed them.

Setting Positional Parameters

The shell provides you with a way of setting the positional parameters from inside the script using the `set` command. Actually, the `set` command is very overloaded. First, if it is called with no arguments, it will print the values of all the variables that are held in the shell.

Second, it can be used to set options to the shell. The shell itself can be called with options on the command line:

```
$ sh -x fortest 1 "2 3"
+ echo [1 2]
[1 2]
```

makes the shell run `fortest` in a mode where it prints commands and their expanded arguments just before they are run. This is useful as a debugging aid. The output is preceded by a "+" sign. You can see this above: The `echo` command is followed by its output. Notice that it does not print internal commands like the `for` statement.

The flags can be turned on by the `set` command inside the script

```
set -x
```


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They can be turned off by using a "+" command:

```
set +x
```

All the options to the shell can be set in this way. They are documented under the `set` command in the manual page.

The third way of using the `set` command is to parse a string and set up the positional parameters. We can use this to give our backup script the ability to have a default action:

```
#!/bin/sh
# backup args...
# if called with no args then
# default to the 'data' dir
if [ $# -eq 0 ]
then
  set data
fi
for arg in "$@"
do
  cd /home/me/$arg
  cp database database.sav
  cp index index.sav
done
```

If this script is called with no arguments, it calls the `set` command with a fixed string. This will set `$1` to `data`, and the `for` loop will then use that string as an argument.

The argument to the `set` command is a normal string. It will be parsed using its normal separators. So

```
set Hello World
```

will set `$1` to "Hello" and `$2` to "World."

You can use this to get information from commands:

```
set `date`
month=$2 day=$3 year=$6
```

This runs the `date` command and captures its arguments. On my machine today, the output from the `date` command looks like:

```
Tue Mar 30 11:51:34 BST 1993
```

BST stands for "British Summer Time" and is one of the foibles of my country. The output is split into words by the `set` command and loaded into positional parameters. If you count along, you will see that the name of the month is the second word, the number of the day is the third and the sixth word contains the year.

The shell allows you to change the idea of word separator. The `IFS` variable usually contains a space, a tab and a newline. It is used by the shell to determine where to break words. If we wanted to make the `set` command parse the colons in the date command like spaces, we might do some-

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UNIX Basics–Arguments to Shell Scripts	182	183	184
I/Opener–Column 100	185	186	187
Systems Administration–Bye-Bye Bio	188	189	190

thing like

```
# save IFS
oifs="$IFS"
# add a colon
IFS=":$IFS"
set `date`
# put IFS back
IFS="$oifs"
month=$2 day=$3 year=$8
hour=$4 min=$5 sec=$6
```

We first save the old value of `IFS`. Then we add a colon onto the start of it and parse the output from the `date` command. The year value is taken from `$8`, since now the hh:mm:ss string is being parsed into separate words.

We can use this trick to parse a UNIX database like the password file. Here's a script that prints the names of the users and their home directory.

```
#!/bin/sh
oifs="$IFS"
cat /etc/passwd |
while read pline
do
   IFS=':'
   set $pline
   IFS="$oifs"
   echo $1 $6
done
```

How the IFS works here is quite subtle. Let's start at the beginning. The first thing we do is to save the old state of the `IFS` variable. Then we `cat` the password file, producing a data stream that is piped into the `while` loop. The `read` statement takes a line from the input stream and places it into the `pline` variable. When the data stream finishes, the `read` statement will fail and the loop will terminate.

In the `pline` variable, we will have a whole line from the password file, perhaps

```
pc:++++:102:101:Peter Collinson:/home/pc:
```

I have set the password field to "++++" to help you resist the temptation to burn CPU cycles trying to exhaustively decrypt my password. Now we want to split the line into its fields. Notice that my name has a space in it, so we don't want the shell to parse it as two arguments, "Peter" and "Collinson."

We set the `IFS` variable to contain solely a colon and call `set`. We don't quote the variable because we want the shell to expand it using its current parsing rules. The line is split into separate arguments breaking the line on the colons. If we expand the line and insert artificial quoting to make things clear, `set` is called like

```
set "pc" "++++" "102" "101" \
    "Peter Collinson" "/home/pc" ""
```

I have split the line for printing purposes. The echo command prints `$1`, my login name and `$6`, my home directory. We now put IFS back to where it was and loop.

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There are some further complications, and I should correct them. Many of the lines in my password file have "'*" as their password entry; this stops people logging in as those users. So the "++++" in the `set` command above will be "*". What happens when the shell sees a star on the input line? Yes, it's expanded to the set of files in the current directory. We don't want this to happen. Also, what happens if some smart person comes along and inserts some flag like `-x` into their personal information? The `set` command will not turn debugging on, but it will eat the flag. Here's the script that defends against this problem:

```
#!/bin/sh
oifs="$IFS"
tr '*' '+' < /etc/passwd |
while read pline do
   IFS=':'
   set - - $pline
   IFS="$oifs"
   echo $1 $6
done
```

I have piped the output from the password file through the `tr` command, changing all the star characters into pluses. I have added the switch (- -) to the `set` command that says: There will be no more options on this input line. This is not special to the `set` command. Many commands understand it.

Finally, why did I say it was subtle? Well, if I change the internal field separators to a colon, why does the shell continue to work? Why don't I suddenly have to write commands that are separated by colons? In fact, in the simple example above, I don't really need to store and reset the `IFS` variable. It's just good practice for bigger scripts. The secret is in the order rules that the shell uses to deal with input. This is explained in some detail on the shell manual page.

Further Reading

I promised you the details of the book that contains Tom Christiansen's article on "Csh Considered Harmful." It and a lot of other goodies are to be found in a great new O'Reilly book: *UNIX Power Tools* by Jerry Peek, Tim O'Reilly and Mike Loukides, ISBN 0-553-35402-7. This is a joint venture with Bantam Books, which will be supplying it to bookstores. Alternatively, you can contact O'Reilly direct (for this book and this book only) 7 a.m. to 5 p.m. Pacific Time. Phone (707) 829-0515 or (800) 998-9938 in the United States or Canada, fax (707) 829-0104, email `order@ora.com`, or write O'Reilly & Associates, 103 Morris St., Sebastopol, CA 95472.

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

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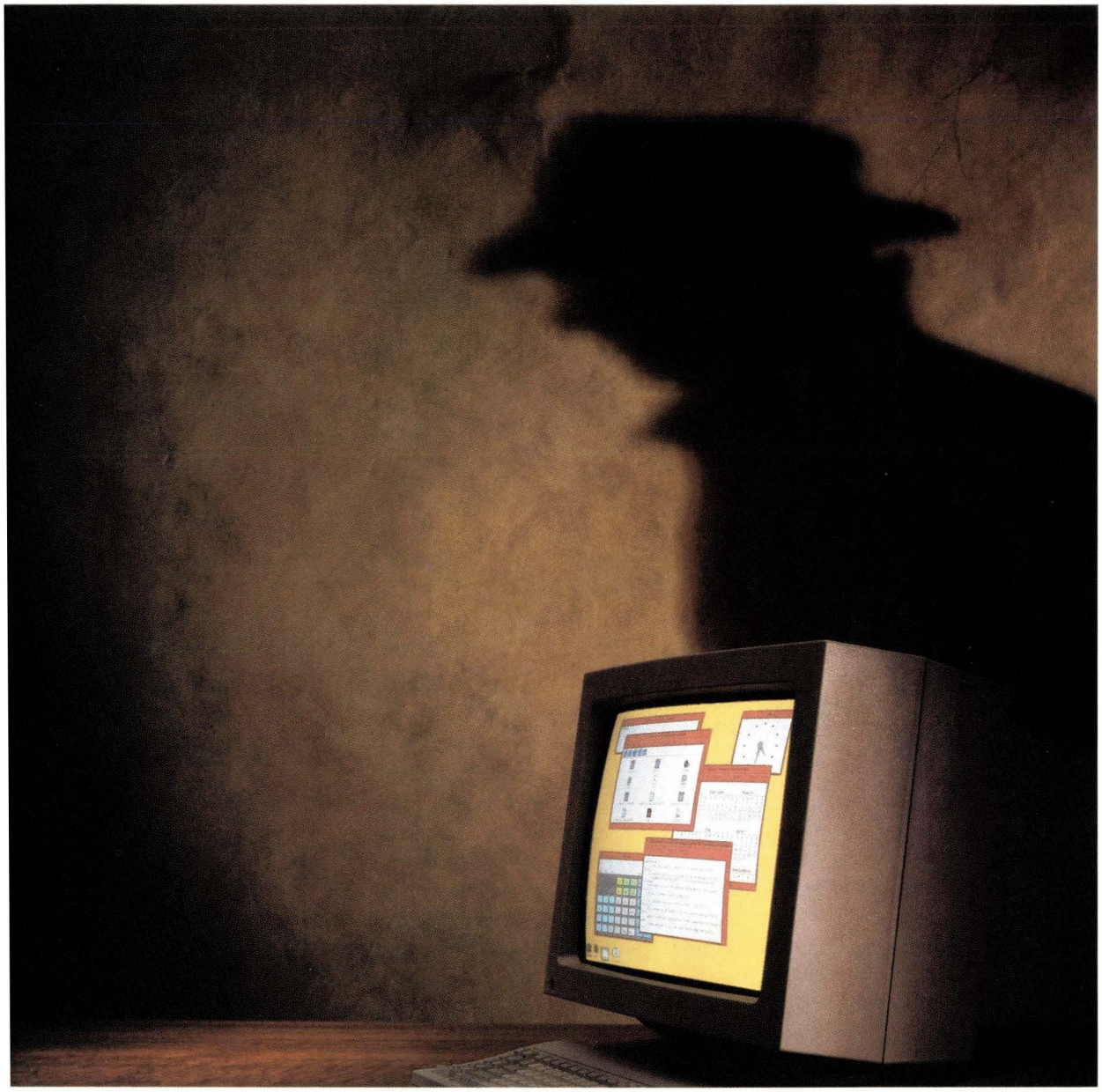

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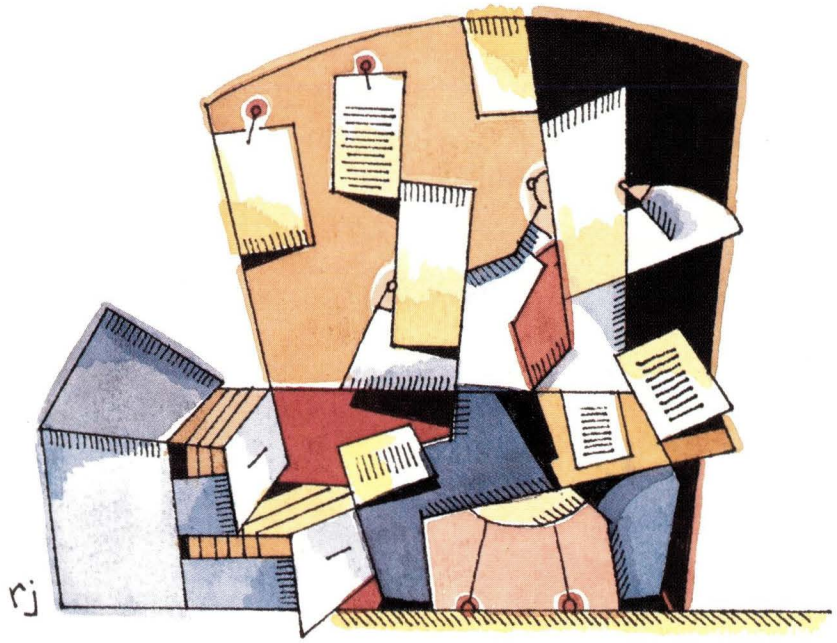

ROBIN JAREAUX

by RICHARD MORIN,
Technical Editor

Column 100

I am somewhat astonished to discover that I've written more than 100 columns and articles. Almost all of these appeared in *SunExpert* and *UNIX Review*, but I've had pieces in other magazines. A few pieces (generally for political reasons) never got into print.

At the risk of appearing self-indulgent (moi?), I'd like to take this opportunity to sketch out some personal history and reiterate a few themes from the past.

The Human Factor

In June 1984, Mark Compton took over as editor of *UNIX Review*. Feeling brave, I asked him if he'd like to run a "soapbox" column. It would be called "The Human Factor," but it wouldn't be limited to human factors issues. Amazingly, he said yes, and I found myself writing a column. My first piece (June 1984) discussed problems in the UNIX user interface. (Interested readers may also wish to look at my September/November 1984 columns). Let's examine the situation, nine years later, and see how far we've come.

"The command syntax of UNIX is inconsistent." Well, it's no worse now than it was then. It may even, on the average, be better. We still have a few dinosaurs like `find` and `dd`, but `getopt(3)` has kept scores of new monsters from arising.

"UNIX offers atrocious error messages." It still does, despite valiant efforts to the contrary. In 1984, my attempts to access the imaginary file "foo" yielded this:

```
chmod: can't access foo
diff: foo: No such file or directory
foo: No such file or directory
ld: foo: cannot open
lpr: cannot access foo
rm: foo nonexistent
```

The third command, `grep`, (see below) is so "modest" that it doesn't even identify itself. By SunOS 4.1.3, all but `lpr` had changed over to the format used by `diff`. On Solaris 2.1, things have diverged again:

```
chmod: WARNING: can't access foo
diff: foo: No such file or directory
grep: can't open foo
ld: fatal: file foo: cannot open file; errno=2
lpr: cannot access foo
foo: No such file or directory
```

I don't see this as an improvement, but then, I feel that way about much of Solaris. Verbosity has replaced consistency, and `rm` has become "modest." So much for progress.

"UNIX has, in general, very poor documentation." Well,

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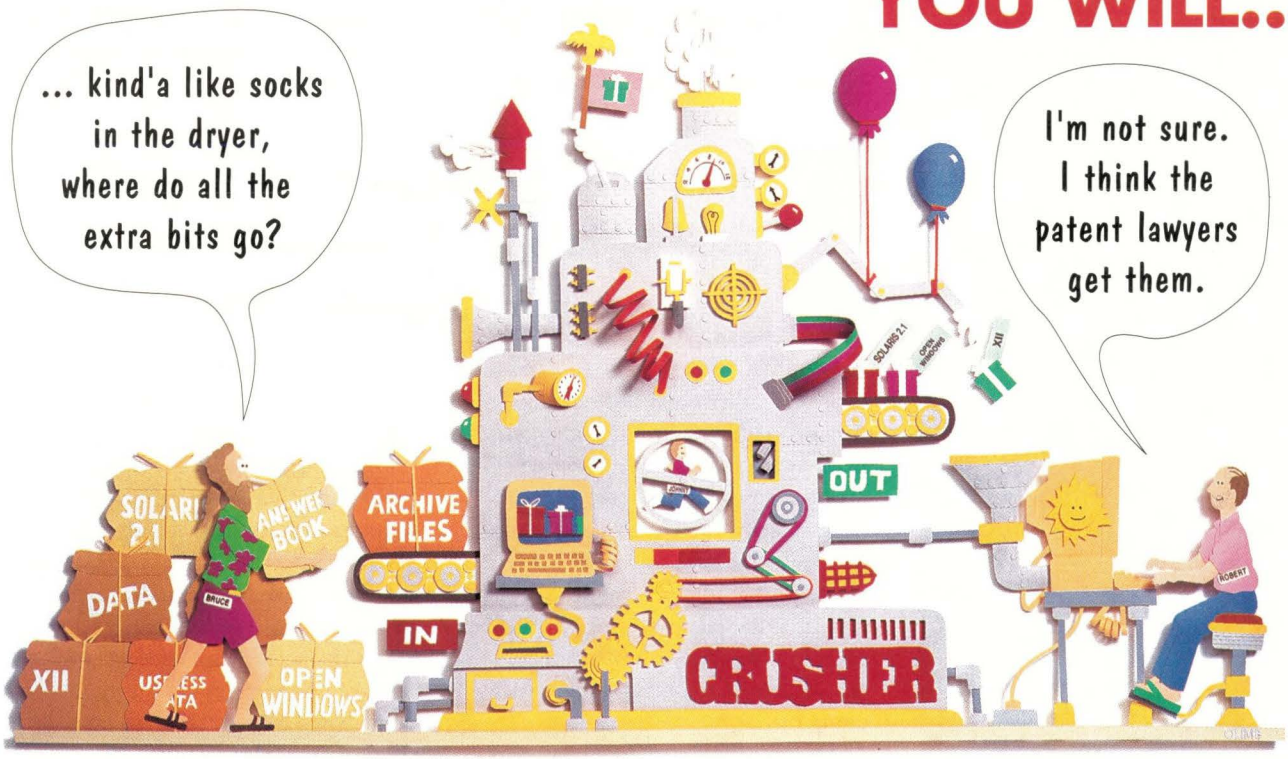

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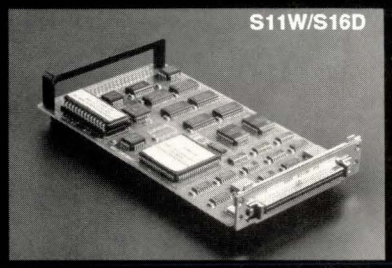

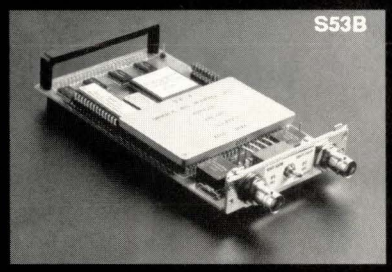

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the UNIX documentation has clearly gotten a lot *bigger*, and some of the explanations have become substantially more accessible. I'm not sure it's a total win, however. The 4.3BSD manual set (Usenix Association, (510) 528-8649) contains papers by Allman, Bourne, Horton, Joy, Kernighan, Lesk and dozens of other notable developers. Are the predigested results of a myriad nameless technical writers (myself included) a real improvement?

Fortunately, the UNIX book market has never been healthier, and many of the books are quite worthwhile. Careful buying and reading will yield good information on almost any desired UNIX topic. So, I guess we're doing OK.

"The exceedingly obliging nature of UNIX can be a problem." No help here. Most vendors still ship systems without setting IGNOREEOF or NOCLOBBER, let alone aliasing `cp` or `mv` to the `-i` forms. Lots of alternatives for `rm` are floating around the net, but none (that I know of) have made it onto any vendor's releases.

"UNIX has no inherent notion of graphics, windows or any of the other nifty features found on many new UNIX workstations. This forces vendors to develop proprietary (hence, nonportable) software." No comment.

Metered Software

"A Look at Software Distribution" (see *SunExpert*, November 1991, Page 40) proposed a simple variation on current license server technology. It uses a license server, authorization tokens, etc. The difference lies in the details.

Current servers have a fixed number of tokens that are loaned to users. If the number of users exceeds the number of tokens, some users lose out. This happens quite frequently, usually during "crisis mode" periods. Not good.

My approach uses short-lived (e.g., 5-minute) tokens. The server starts with a reasonable number of these, adding more each hour. Slack periods build up surpluses of tokens; crunches use them up. If the token supply gets too low, users have two options. They can purchase a single block of tokens, resolving any nonrecurring shortage.

Perhaps USL should get on with the main event (Windows NT) and retrain its lawyers for more productive work.

Alternatively, they can raise the server's token production rate.

This scheme also works very well for demos and short-term purchases. Vendors load up their demos with small numbers of tokens. Users can try out full-featured programs at some length, getting a real sense of their value. If a package seems worthwhile, users can purchase more tokens, a usage-based license, or whatever else seems reasonable.

The Elan License Manager has all the necessary hooks for this scheme, and some software vendors already supply "countdown" licenses. No vendors appear to use token refilling logic, however, so steady-state usage averaging is not supported. If you want it, ask your vendor!

May These Events

"May These Events" (see *SunExpert*, October 1992, Page 36/January, Page 29) detailed some of the history of the USL lawsuit against BSDI and the University of California. At this writing (April 12, 1993), USL doesn't seem to be doing very well. On March 3, U.S. District Court Judge Dickinson R. Debevoise denied USL's request for a preliminary injunction to stop the distribution of BSD/386. Regarding the copyright claim, he said: "...I find that Plaintiff has failed to demonstrate a likelihood that it can successfully defend its copyright in 32V. Plaintiff's claims of copyright violations are not a basis for injunctive relief." Later, regarding the trade secret claim, he said: "In summary, I find that I am unable

to ascertain whether any aspect of Net2 or BSD/386, be it an individual line of code or the overall system organization, deserves protection as Plaintiff's trade secret. Since Plaintiff has failed to provide enough evidence to establish a 'reasonable probability' that Net2 or BSD/386 contain trade secrets, I find that Plaintiff has failed to demonstrate a likelihood of success on the merits of its claim for misappropriation of trade secrets."

On March 15, USL requested a reconsideration of the copyright finding, arguing that the judge incorrectly assessed the number of copies of 32V that had been distributed. Judge Debevoise accepted the correction but denied the motion for reconsideration, finding that the exact number was not critical to his ruling.

USL certainly has the resources to keep the suit going, but the early returns are not encouraging. Perhaps USL should get on with the main event (Windows NT) and retrain its lawyers for more productive work.

Conferenciana

Several of my columns have talked about the benefits of attending user group conferences, trade shows and tutorials. With the recession easing a bit, you may be able to convince your manager to send you to one or more events. By picking your events carefully, and paying attention while you're there, you may come back with some money-saving (or making!) ideas.

The Sun User Group [(617) 232-0514, office@sug.org] runs technically oriented conferences for Sun users. I think SUG has the best Sun-related technical programs around. The speakers and panelists are experienced Sun programmers and administrators, internal Sun techies, and other knowledgeable folks. Marketing talks, if allowed at all, are relegated to a separate track. Consequently, the signal-to-noise ratio stays very high.

SUG has its big event every year in early December, at the San Jose Convention Center. The show combines tutorials, a conference and a trade show. Add a weekend in the San Francisco Bay area, and you have a pretty nifty excursion.

This year's show (December 7-9) is on "The Metamorphosis of SunOS: From Classroom to Boardroom." Subtopics include "Suns in the Corporate Environment," "Migrating from Mainframes to Suns," and "Conversion to Solaris 2: A Global Issue." Should be pretty interesting.

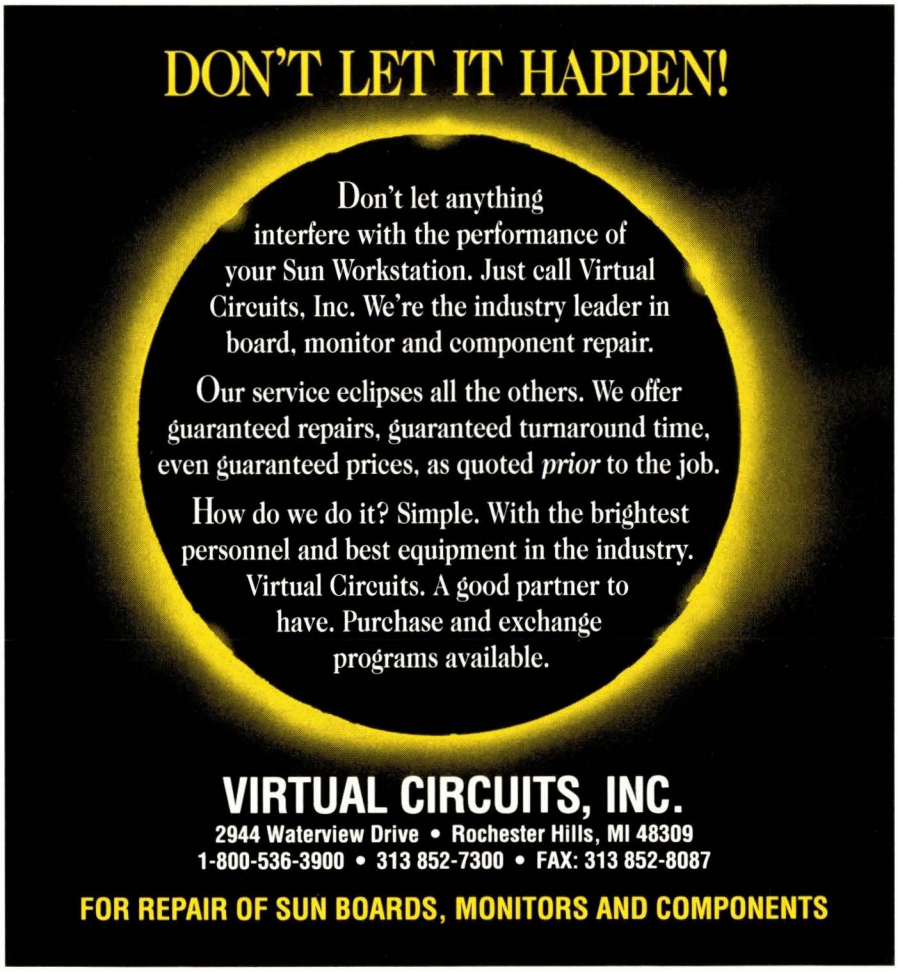
SUG is also running a small conference in the Boston area at the end of July.

Some folks (myself included) actually *like* small conferences and workshops, as they allow more casual interaction. On the other hand, the trade show won't be as big or as snazzy. In any case, if you can't get out to the main SUG event, this conference might be a reasonable alternative.

Usenix [(510) 528-8649, office@usenix.org] holds two general conferences each year. The summer conference will be in Cincinnati (June 21-25). The winter conference will be in San Francisco (January 17-21, 1994). Usenix events tend to be informal and information-rich. The talks tend to be more kernel-related than those at SUG events, but a fair amount of administration and application talks do sneak in.

Usenix also holds a variety of specialized workshops. Serious system administrators should check out the LISA and SANS events, and perhaps the UNIX Security Symposium. There are other workshops coming up on C++, Microkernels, Mobile & Location Independent Computing, SEDMS (Distributed and Multiprocessor Systems) and UNIX Application Development. Actually, any serious UNIX type should already belong to Usenix, and would already know about these events. (:-)

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@cfcl.com.



Circle No. 46 on Inquiry Card

PETER KALABOKIS

Bye-Bye Bio

by S. LEE HENRY

Whenever my family goes to a movie, we sit a while after it's over and watch the credits go by, waiting to catch the names of the foley artists–the folks who make the interesting sounds that are added to the background (horses trotting by, knocks on the door, gremlins being pureed in the blender and such). It takes a lot of skilled people besides actors to make a good movie, just like it takes a lot of skilled people besides columnists to make a successful magazine. For those few of you readers who, in similar fashion to my family in the theater, hang around for the credits, you will notice a change in my "bio" at the end of this column. No longer do I work for the amorphous "federal government." Instead, I have taken a job at Johns Hopkins University. This month's column is about the agony of changing jobs and what I learned about myself and the profession of systems administration in the process.

Job Hopping

Though the swapping out of the old bio and the introduction of the new may seem to have happened swiftly in "editorial space," I can assure you that the process of changing jobs was both time-consuming and required heavy soul-searching. Hard economic times have hit the nation's capital as they have hit many parts of the country, and though signs of a recovery may be appearing, there are a lot of people still looking for work. I had actually gone on a leave of absence from the U.S. government about six months earlier to write a book on Solaris 2.X. With federal downsizing taking place and a desire for technical challenge and management responsibility, I decided not to go back to Uncle Sam but to seek my fortunes elsewhere.

For some people, changing jobs is quite easy and they do it often. Many of us who have been attached to government agencies and large corporations, on the other hand, have spent decades simply moving between assignments internally, and "really" changing jobs is unfamiliar and traumatic.

Help Wanted

I began my search where all of my savvy friends claim one should not–the Sunday Employment Section. Each week, I'd clip out the most intriguing four or five ads and send in a resume. For each ad, I adjusted my cover letter to highlight the areas where I saw the best fit between me and the opening.

A lot of the ads looked the same–all "dynamic fast-growing firms" looking for people experienced with Sun systems, UNIX, TCP/IP, SQL databases and such. In retrospect, I

note that the choiceness of a position did not necessarily correlate with how well the ad stood out. Some were small and hard to read. Others jumped off the page. I also noticed that the ad's logic was hard to decipher: "Should one use an AND or an OR operator?" I thought nerdily, in reading the job requirements. Few ads said "two or more of the following..." Most just listed the requirements, and I hoped they meant "the more the merrier" and not "everything in this list or don't bother."

I also talked to a headhunter who promised exciting jobs in the intelligence field (and was right, I almost took one of these) and a consulting firm. Each of these avenues showed promise. In something more than a month, the headhunter came up with two firms that were "interested" in me. The consulting firm offered the very different approach of matching individuals with a series of short-term assignments. The several hundred professionals that they managed found that they were called in to do a specific technical job (never computer grunt work) and gained valuable experience through the sequence of projects and organizations with which they worked. They also never got embroiled in the office politics that wear so many of us down. Both these firms brought in leads that promised salaries at or exceeding my expectations. Lower offers that I considered only derived from my chasing after the want ads.

Responding to Your Ad...

My early ad-generated interviews were a waste of time. I hadn't included my expected salary and discovered that they were looking for junior systems administrators. Our field is a broad one, and our ranks range from people who have barely used a computer before to gurus who can build their own system software and debug the hairiest networking problems. Although my resume included considerable detail, it seemed that expected salary was taken as a more valid indicator of my "senior" status than my string of three-letter words (Sun, NFS, NIS, TCP, OSI, `csh`...). I made the correction in my approach and started including "expecting a salary in excess of $X, but negotiable" on my cover letters.

Over time, I learned more about what to look for. The word "senior" was a good indicator of an appropriate position, as were requirements for networking and debugging skills. Experience with heterogeneous networks and programming were also indicators to me that the job might require someone with my particular background.

The 'O' Word

Subsequent interviews were geared more to my level, but still I was accused of being "overqualified" on several occasions and was, frankly, taken by surprise at each of them. Being overqualified seemed like being too attractive. Imagine telling an applicant for a technical support position, "Sorry, you're too attractive. The customer is expecting a nerd." I shook my head. At first blush, overqualified seemed a euphemism for, "You want too much money." After a series of what seemed like stunningly successful interviews (at one marvelously organized company), the "O" word was delivered the following day. I was in shock. There is, however,

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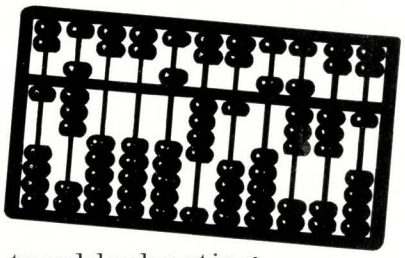

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much more to the prognosis of overqualification than the salary. Responsible companies, for a start, really want their employees to be challenged. They are not just looking for a bargain; they have much more riding on you than your salary. Responsible companies also don't want to pay you less than you know you're worth, even if you're desperate for work. This fact would, in time, fester and make you resentful of the jerk across the room who knows half what you do and gets paid more.

I also discovered that having gone on leave without pay to write a book was evaluated very differently by each of the interviewers. Some could not differentiate between writing a technical book and having a nervous breakdown (and more people can identify with the latter!). For me, the book represented professional payback; senior professionals owe something to their discipline. For them, it was suspect.

I had just about concluded that my opting to write the book had forced me into a very early retirement when the first reasonable offer arrived. Soon after, additional probes and offers appeared. The hard work had just begun.

Evaluating the Offers

Evaluating the job offer is a lot like deep sea fishing. You really can't see what you're reeling in, and it takes a lot of skill and positioning to bring in the trophy marlin and avoid the sharks.

There are many factors that need to be considered when you attempt to rank job offers. Gut feeling is only one (and not to be discounted–gut feeling most often means there's something appealing about the offer that you can't yet put into words). Salary is another. Benefits count too, though it's often hard to tell one benefits package from another. Other less obvious factors include living conditions (will you get a quiet office that you enjoy working in or be stuck in a bull pen with a bunch of chatty lowlife?) and the degree of nerve damage that will be inflicted by the commute. The resources provided for training, conferences and other growth opportunities are also important. You should always have the goal of staying current with technology, and any employer that values you should provide such opportunities.

Another factor is stability. Some companies, especially those traditionally tied to big government and defense contracts, where money is getting tight, will be looking for what I like to call "contract bait"; that is, they want to hire people with a suite of skills they can peddle to bring in much-needed new business. If you're risk-averse, you might want to avoid these situations. On the other hand, these opportunities may give you a chance to dramatically affect the success of a company and get in on the "ground floor" of some new business ventures. Some companies hire to fill gaps in contracts; others only when there is a fit with long-term needs. Some companies routinely lay off workers to clean out "dead wood"; others never lay off. Learn a little about the plans and the history of your potential employer.

The most important issue is whether you like the work, but even this is not a simple decision. There are many factors that determine how much you will like the work, and these you can only ferret out of your responses to the various opportunities. As painful a process as it is, job hunting will teach you some very important things about your own priorities. One trade-off you should always be conscious of is the one that involves old versus new skills. My daughter, Vail, having just played a lead part in a Shakespearean play at her high school, had an opportunity to audition for the same play at the neighborhood community center. Alternately, she could keep her time free for a series of one-act plays being put on at the school later in the year. Clearly, this decision is one that you will also face. Do you choose a job that you can do "in your sleep," knowing you will shine without trying? Or do you prefer a job in which you will have to work hard to learn something new? Most of us will find our preference is somewhere in between, but the ratio is truly a matter of individual comfort and adventurousness.

Another very critical issue is whether or not the job is "important." No amount of fringe benefits and office dressing can compete with importance in creating motivation and dedication to a task. What you need to watch out for, however, is this: Being important does not equal looking important does not equal feeling important. In the ideal job, you might get all three. More commonly, you are lucky to get one or two. Knowing which of the three "facets" of importance you need and which you can live without is a major step in understanding what to look for in a job that is right for you.

Some of the factors that I considered are listed below (in alphabetical order, not priority). You might make a similar list of the factors that are most important to you. Be sure to note on your list which of the factors relate to being, looking or feeling important and which relate to shining or developing new skills.

- Comfortable, quiet work area
- Good health and retirement benefits
- Heavy reliance on Sun systems/UNIX
- Interesting application area
- Interesting learning opportunities
- Lots of hands-on work
- Lots of smart people around
- Need for my expertise
- Network responsibilities as part of job
- No problem with my "outside" activities (i.e., writing, consulting)
- Reasonable commute or appropriate compensation
- Stable organization with good reputation
- Technically sophisticated work

Lessons

I sensed in my own evaluation of job offers that there were important lessons to be learned about managing and motivating technical people. I'd had a number of bosses who had never really understood what I needed or wanted (even when I told them). Following the process of my own evaluation revealed numerous factors that no management survey I'd ever responded to would have elicited. Management's traditional assumptions about what motivates their employees often break down when they are dealing with senior techni-

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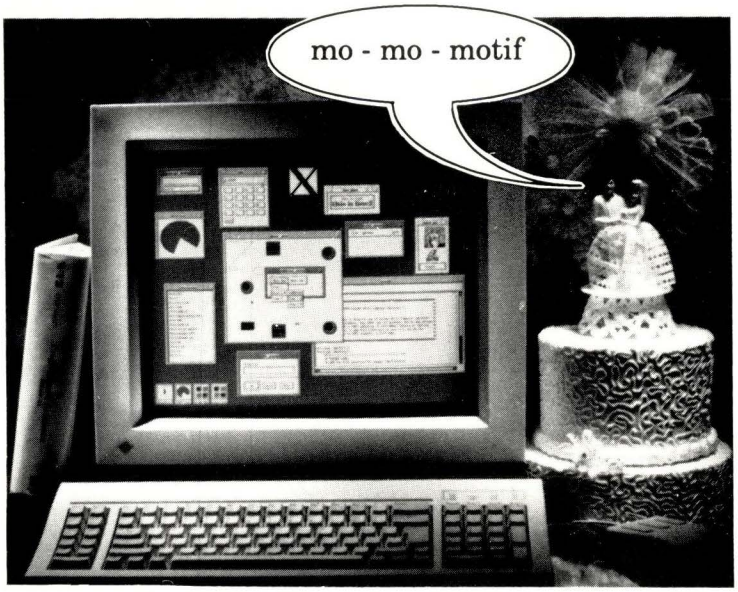

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cal professionals. After surviving the Job Hunt of '93, I am not surprised. I found that different jobs answered different needs and understood that the triple peaks of Pay, Power and Prestige were far too coarsely outlined against the horizon of possibility to determine whether I would be able to be an effective technical professional in any particular position. I'd had offers that ranged from $40K to $70K and was amused by how the money was simply one factor in my evaluation and far from my primary concern.

The Agony and the Ecstasy

The hardest part of job hunting (besides dealing with a paucity of offers) is dealing with a wealth of offers. It's as hard to turn down some offers as it is to be turned down yourself. Job hunting, after all, is a lot like playing poker. As you sit with the interviewer, you can't see each others' hands: You don't really know what he's got to lay on the table in terms of salaries and opportunities, and he doesn't know how your skills will be deployed in his environment. You and the interviewer are using your poker faces. The interviewer always wants you to feel comfortable and, therefore, often seems more interested and complimentary than he really is. You, too, might not react honestly during an interview. I feigned interest during one interview in which I was having severe doubts. In my defense, I wanted time to "digest" the job. It's hard to get an accurate image of what your daily workday would be like when you talk to a recruiter (or even a fellow technical type) for half an hour. In the interviewer's defense, maybe he was digesting me as well, trying to determine if I was a simple case of overkill or if he might find a way to make use of a senior UNIX techie that justified the bigger salary.

I agonized over each and every offer. I may someday wish I had taken one or the other of them. What you most want to know when you are looking for a job is how you'll feel about it in two or five years. Unfortunately, there is no good way to make that prediction. Every job is a collection of opportunities and problems, and you need to find the one that best fits with your particular set of skills and shortcomings.

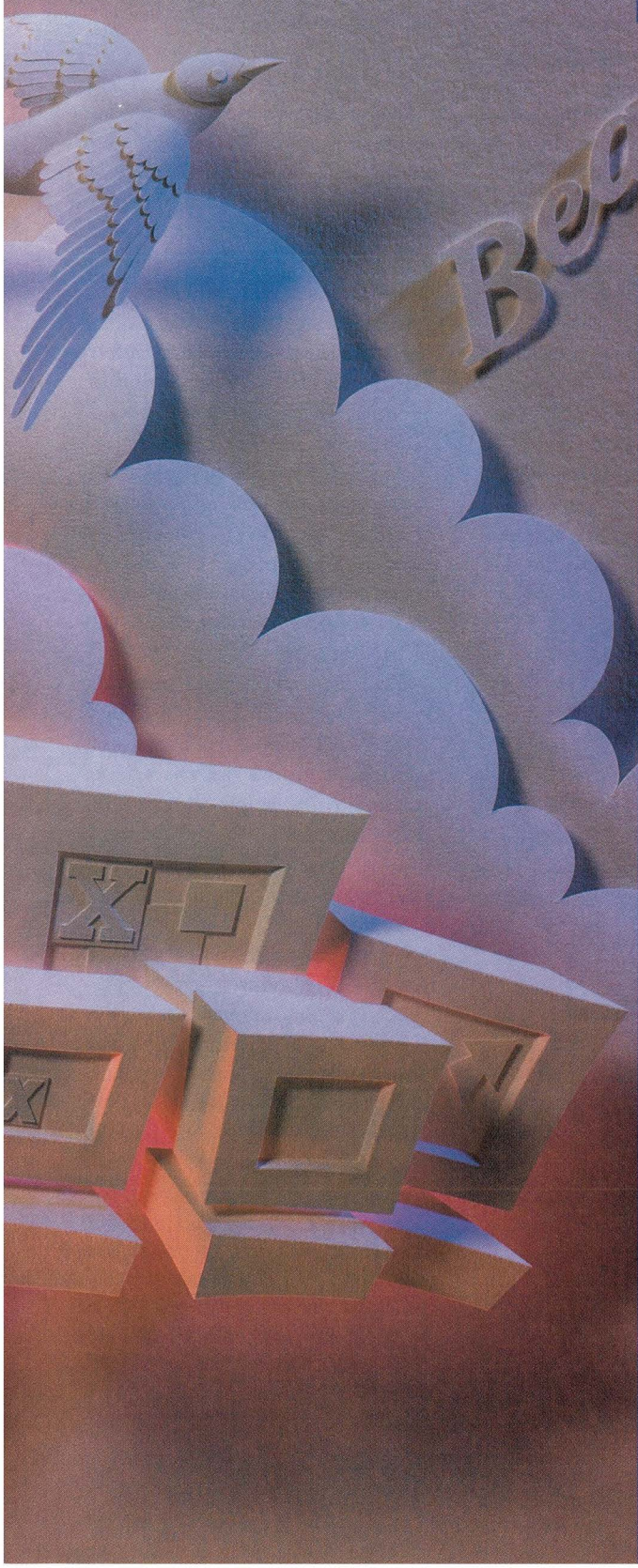
There is also a lot of agony in leaving the old job, even if it was unpleasant. I had outgrown a nice job and allowed resentment to build up too long before looking for a fresh opportunity. Still, I will miss all those folks without last names that I shared good and bad times with (so long, guys!). It's always hard to break the old bonds. You should always remember that one measure of importance is what you leave behind you and strive to leave a trail of accomplishment and professionalism.

At the same time, don't forget: It wasn't a job, it was an adventure. Right? ⊸

S. Lee Henry is on the board of directors of the Sun User Group and *used to* be a systems administrator for a large network of Suns in the federal government. She just started working at Johns Hopkins University, where she manages computer services for the Physics and Astronomy Department. Her email address is `slee@expert.com`.

X terminals, as a technology, aren't that exciting anymore. As a market, though, they're thrilling.

IS BLAND *Beautiful?*



Everyone has heard the Chinese curse, "May you live in interesting times."

That's one ill fate that X terminals don't have to worry about–for the moment. The year 1993 finds the X terminal business leaving its youth, and perhaps its adolescence, to enter a relatively comfortable maturity.

Where once, not that long ago, the industry wasn't at all sure that X terminals belonged in computing, now no one fails to pay them homage. Their technology, while continuing to evolve, is now more or less established.

Indeed, for most X terminal vendors, the real trick now is distinguishing themselves from one another. And most are scrambling to add features to their products that can, in any way, make them stand out in the crowd. "What you do," jokes Walt Keller, president of X technology developer and consultancy GraphOn Corp., "is arm your salespeople with extra features that, typically, nobody uses."

by MICHAEL JAY TUCKER
Executive Editor

PAPER SCULPTURE BY JEFF NISHINAKA

But that's not to say things are dull. The X terminal business continues to be rather thrilling. The X Business Group, a market research company, recently announced that X terminals are now a $499 million market. X Business says that the terminal market grew some 39% in 1992, with unit shipments expanding 62% to 197,161 units worldwide.

Besides which, maturity can be a perilous time–fraught with tensions, midlife crisis and even sincere questioning of one's own identity. Thus it is that, today, even as X terminals find their technology becoming less and less remarkable, their market has become a white knuckles affair. New profits are matched by new complications, new market demands and new competitors. Carefree youth, when nothing mattered much beyond comic books and football scores, has been replaced by mortgage payments, graying hair and a search for distinguishing features.

The X Players

In 1993, the X terminal market looks pretty much the way it has for years except that it's bigger. According to The X Business Group, Network Computing Devices Inc. (NCD) remains the leading supplier, with 28% of all units shipped in 1992, or 54,772 units total.

The next four slots in the ranking go to larger companies that sell X terminals to complement either their existing lines of servers and workstations, or existing lines of other electronic equipment. Second place goes to Hewlett-Packard Co. with 20%, Digital Equipment Corp. is number three at 12%, IBM Corp. is fourth at 10%, and Tektronix Inc. comes in fifth with 9%.

A collection of independents rounds out the remaining 21%. The list of those independents is long and grows on a daily basis. They range from the likes of Samsung Electronics Co. Ltd., which has a line of X terminals that may, eventually, complement the company's newly introduced line of PA-RISC-based HP workstation compatibles; to ASCII terminal vendor supreme, Wyse Technology, which already has one X terminal product and is talking about expanding to a full line of them. The market has grown, says Pan Kamal, Wyse's marketing manager for X terminals, to the point where "we can now do what we do best, which is squeeze every penny out of the hardware."

There are new players, like Pagine Corp., which in March announced what it says may be the fastest color X terminal on the market at 125,000 Xstones. There are increasing numbers of players coming into the market from Asia, such as Tatung Science and Technology Inc., which introduced on March 1 five different color X terminals, and Japan Computer Corp., which is trying to establish its presence in the North American market with a flat-screen color X terminal. There are joint ventures between Asian and American teams, as in Phase X Systems Inc. and Samsung.

In fact, the list is so long that for most vendors the real issue is simply standing out in the crowd. Most of the vendors seem to be taking two major strategies in an attempt to gain market recognition: hardware flexibility and software flexibility.

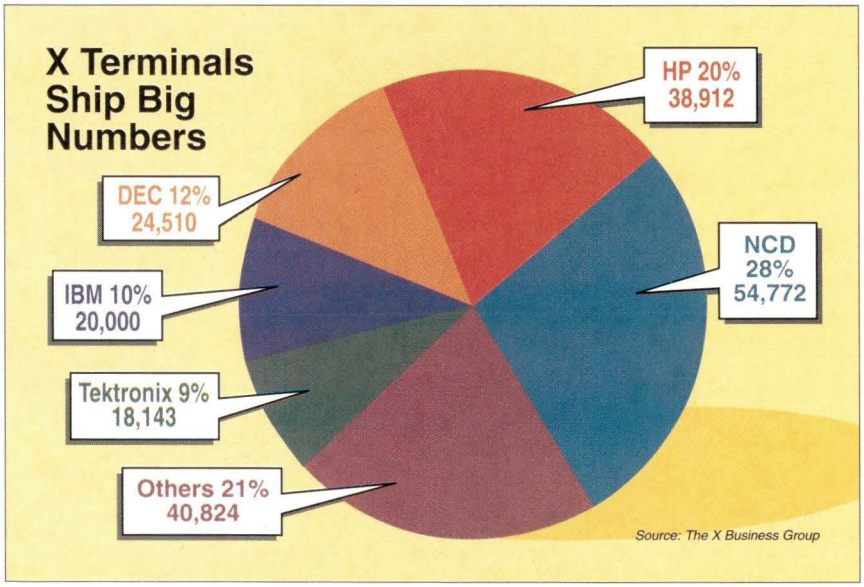
Put a Slot in It!

Perhaps the easiest way for a vendor to make a terminal recognizable is in hardware. Thus, for example, when Japan Computer, decided to enter the American X terminal market, it did so with the XfC–a flat-screen, color monitor terminal. "We'll sell CRT-based terminals," explains Richard A. Flores, the company's vice president, international sales division. "But with this product, we are aiming at market differentiation."

However, what has emerged as a recent trend has been rather more dramatic–the inclusion of ports and even buses in X terminals. The idea is that users, or systems administrators, can thus configure their systems for specialized purposes.

What may have been the first such attempt was the ill-fated TX 800C, from Visual Technology Inc. This remarkable little device was a color X terminal with a single SBus slot. In theory, users or developers willing to deal with attendant software issues could support SBus cards on their X terminal.

Sources inside the industry, though not at Visual or Sun Microsystems Inc., say the machine got its start as the result of an agreement with Sun. Supposedly, Sun planned to remarket the device as its own X terminal. However, Sun backed away from the



The X Business Group, an X-oriented market research firm, says there were a total of 197,161 X terminals shipped last year. The majority of that was split by NCD, HP, DEC, IBM and Tektronix. The remaining 21% went to a band of independent players.

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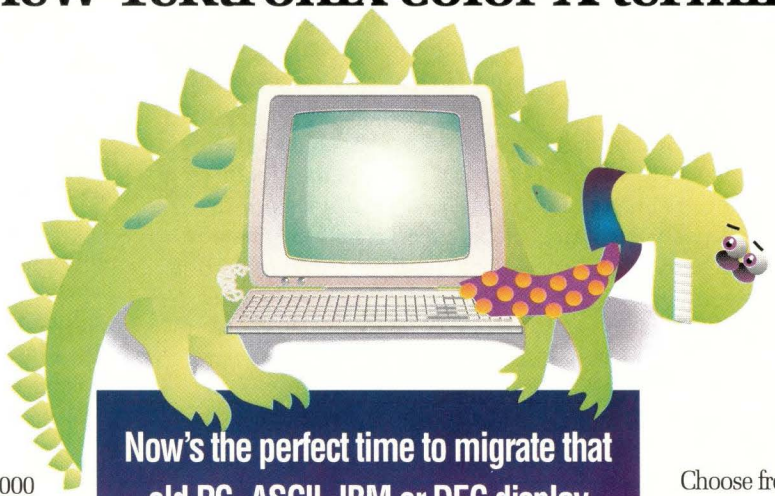

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Serial X: The Next Frontier

What is probably the next frontier for X terminals is the serial line. Customers want to be able to access their X applications over the phone from remote locations. Vendors are betting they will also want to replace serial-line ASCII terminals with X displays that don't require a network and its complexities.

To address the former market, almost all of the major PC X vendors have introduced data compression technologies that allow remote PCs to access X hosts without going through the sheer anguish of trying to use such protocols as Serial Line IP (SLIP). Network Computing Devices Inc.'s version, for example, is PC-Xremote.

The latter market, that of ASCII-style terminals that are also X terminals, is a bit trickier. Indeed, originally, it was thought that if buyers really wanted multiple screens on their character tubes, they would move instead to a new standard–Alpha Window terminals. These are character terminals that also have windowing capabilities. The Alpha standard was developed in the early 1990s by a coalition of ASCII terminal vendors and is promoted and governed by the Display Industries Association.

However, Alpha terminals have had a slow start. "Speaking for my own company," says Paul Vance, vice president of sales and marketing for Structured Software Solutions Inc., a developer of software for both character and Alpha terminals, "we expected it [the Alpha market] to develop a little faster than it did. The fact of the matter is, products have only just begun shipping."

Instead, he says, his customers mostly continue to buy products like his company's FacetTerm, which allows non-Alpha terminals to support multiple sessions, or turn to serial X. "That's a real interesting technology...if you can get someone into an X environment without a network, that's going to be very helpful."

One company that showed this sort of technology early on was GraphOn Corp., which developed a data compression technology that allows one of the company's X terminals to connect to a X application over standard phone lines. The company has also licensed its technology to such vendors as Qume Peripherals Inc.

"Our technology fits into two key markets," says GraphOn President Walt Keller, "the remote X terminal market and the low-end terminal market." To him, this doesn't mean low-end X terminals. It means, "ASCII terminals... ASCII terminals that can support X."

GraphOn is itself going after the remote X market. Specifically, he says, "we are focused on the home market." His licensees, though, are more interested in the commercial market, where MIS officers need access to X-based applications but are loath to either support a network or give up their ASCII terminals. Qume, for instance, markets a serial X terminal called the QX15, partly based on GraphOn technology, for that very purpose.

"We believe that the terminal market wants X," explains Shari Deriso, vice president of marketing for Qume, "but not the cost of going with a network." If she's right, then that is not a small market. "There are still 1.2 million terminals being sold every year," she notes. "And those are the people we are trying to reach."

And, of course, there's one other group that Qume reaches–programmers at Sun Microsystems Inc., which has purchased reasonably large numbers of QX15s so that its people can work at home when need be.

Thus the company that has most firmly argued against X terminals actually uses them itself–though with a neat bit of name changing. Officially, Sun classifies its QX15s as "remote workstations," rather than X terminals.

deal at the last minute, Visual claims.

Visual itself sold the TX 800C briefly but ultimately withdrew it from the market. "There was some interest in it but not a lot," notes Mike Bracca, Visual's vice president of product development. "There aren't many people looking to do weird things with their X terminals who need an SBus slot." Visual itself, meanwhile, no longer sells X terminals directly and is instead a consulting and engineering organization.

More promising, perhaps, is the PCMCIA port, the small connector developed for laptop PCs. Several vendors either have introduced or plan to introduce X terminals with PCMCIA capability. Visual is, in fact, working with terminal vendor Link Technologies Inc. on the very issue. "We're looking at it as an easy way to add such things as token ring, internal modem, flash memory and that sort of thing," says Bracca.

Link does not yet have X terminals. Some indication, though, of what may happen when it gets them comes from its recently introduced line of PCMCIA-equipped ASCII terminals. "We have already got commitments for 50,000 units for this calendar year," says Larry Schuster, Link's vice president of sales. His biggest problem, he says, is that not everyone knows what a PCMCIA port is. "It's an education process. People are just starting to learn about PCMCIA. It is kind of like what UNIX was like a couple of years ago."

A company that already has PCMCIA, though, is NCD. This year, NCD announced what it called an Ethernet-Serial-PCMCIA (ESP) board for existing NCD terminals. The ESP board provides one Ethernet port, two serial ports and a socket for a PCMCIA card. The plan in the short run was that the PCMCIA socket would give users an easy way to upgrade their X Window software. They could simply swap out a card instead of trying to replace a ROM chip. In the longer run, though, the company hopes that users will be able to exploit PCMCIA peripherals, ranging from modems and LAN adapters to disk drives.

A Minimalist Approach

However, the whole idea of hardware flexibility has its critics. "If you put in a bus, haven't you got a workstation?" asks Stephen King, director of marketing and engineering at the Network Displays Division of Tektronix "You've got to have a minimalist approach... you've got to adopt the mind-set that X terminals are terminals. You have to have as little in the box as possible."

He argues that adding too many hardware features to X terminals just increases their complexity, price and overhead in terms of systems administration. "The moment that the X terminal vendor starts to think they're more important than terminals," he warns, "they start to lose their focus."

Tektronix has instead chosen to add value to its products by making versions that connect uniquely well into several computer vendors' environments. One of its first product lines, for example, was a family of X terminals expressly configured to operate on Sun networks. At UniForum '93, meanwhile, the company showed another line of terminals, this one sporting 3270 emulation, token-ring connections and other features meant to bring mainframe users into the open systems environment.

Another critic of hardware flexibility is Hewlett-Packard, whose Waterloo, Ontario-based Panacom Automation Division sells X terminals into both the direct and indirect channels. "Providing hardware flexibility is only a small part of the puzzle," says K.C. Chavda, the Panacom Division's direct channel marketing manager. "The real problem is software. I mean, certainly, you can put a PCMCIA card in your terminal, but I'd hate to write a driver for it."

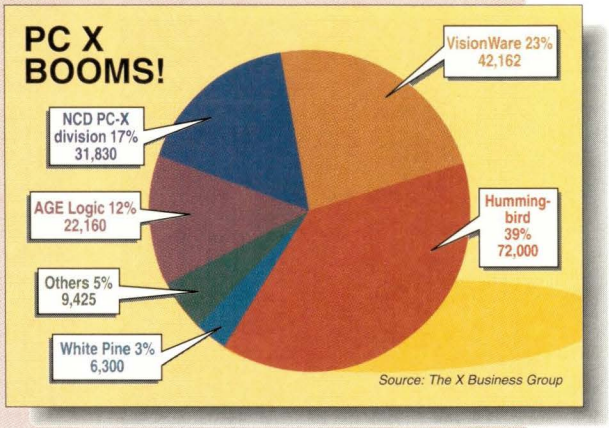
HP thinks that the real issues may be less technical. It is looking at distribution as a theme. Among other things, HP is looking at improving its relationships with VARs, OEMs and other indirect customers. It had recently instituted a whole series of price adjustments designed to give resellers a better margin while giving users lower costs. Explains Chavda, "There was one problem with our [former] programs. They weren't channel friendly."

Software flexibility is the other major strategy that X terminal vendors can select. "I believe that the companies will have to be able to distinguish themselves through software," says Paul Gunter, director of the X terminal division of C. Itoh/Itochu Technology Inc. "A lot of companies are coming into the market, particularly from Taiwan, thinking that it is a hardware issue. And they're going to get their butts burnt."

Instead, says Gunter, "X terminals are a software beast." He thinks that X terminals will have to provide system software and local clients. C. Itoh/Itochu provides both, including a real-time kernel that runs on its X termi-

PC X: Explosive Growth

While X terminals form an active market, PC X–the software and sometimes hardware that allow PCs and Macintoshes to act as X terminals–is equally vigorous. The ubiquitous X Business Group reports that PC X Server shipments for 1992 were up more than 200% from the year before. In terms of actual units shipped, this was 184,077 in 1992, up from 58,000 in 1991.



Among the top vendors of PC X servers, Hummingbird Communications Ltd. was number one with 39% of market share; VisionWare Ltd. was second with 23%; Network Computing Devices Inc. (which has entered the PC X market to complement its terminal business) was third with 17%; AGE Logic Inc. was fourth at 12%; and White Pine Software was number five at 3%.

PCs emulating X terminals are also hot. According to the X Business Group, there were 129,858 PC X servers shipped in 1992. Hummingbird, VisionWare, NCD and AGE Logic were the big players, with a growing number of smaller players taking 4% of the market.

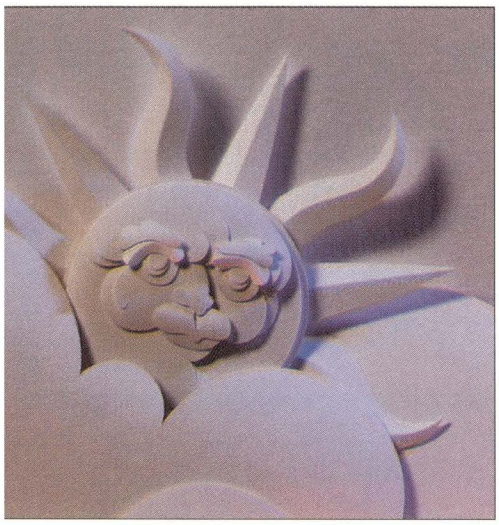
Thus the most fundamental characteristic of the PC X market is explosive growth. It is a growth that will slow, as those PCs that need to run X gradually become able to do so, but in the short term it may be the single most economically rewarding aspect of the X market. "It was 0% of our market a year and a quarter ago," says Craig Schmidt, vice president of marketing at AGE Logic. "Now, it is 40% to 50% of our business."

One factor that could sustain or even accelerate PC X is the arrival of Microsoft NT, for which there are already X implementations. "Whether you like NT or not," says Jan Adamek, vice president of marketing and sales for Hummingbird, "it will sell."

Which brings up the question of X terminals on NT servers. Microsoft Corp. has not been welcoming to the idea, perhaps on the same logic that Sun Microsystems Inc. practiced, that each terminal is a desktop system unsold. But that logic didn't alter the fact that customers wanted terminals anyway. And, says Wyse Technology's X terminal marketing manager Pan Kamal, "There's nothing to keep an X terminal from running on NT."

nals to provide some of the functions of an operating system. "It is a UNIX-like kernel," says Gunter. "It is something that we did ourselves. However, in our next release we will have a standardized UNIX kernel." That is to say, it will be a real-time kernel or OS currently marketed in the UNIX community, but Gunter could not identify it as of press time.

The advantage of the kernel, he says, is particularly apparent in things like remote system administration and problem diagnosis. "I can `telnet` into your system and do remote system diagnosis. That's important if you have remote offices and don't want a system administrator on site at each of them."



Local clients, meanwhile, provide such advantages as reductions of network traffic. Human Designed Systems Inc. (HDS), for example, has introduced an entire suite of such clients. "The idea is that you can save the host system to run whatever real application you have," explains Michael Kantrowitz, vice president of marketing for HDS.

He says the alternative, running smaller programs at the host, isn't pretty. "Take a simple little application, like a clock. Each time there's tick, that's network traffic. You run 10 of those clocks on 10 X terminals, and you bring the system to its knees."

DEC, meanwhile, takes the same route. In fact, in its recent introductions, it has taken a kind of a la carte approach. The buyer gets the basic X Window software free. Then, if they wish, they can select a package of local

Companies Mentioned in This Article

AGE Logic Inc.
9985 Pacific Heights Blvd.
San Diego, CA 92121
Circle 231

C. Itoh/Itochu Technology Inc.
2515 McCabe Way
P.O. Box 19657
Irvine, CA 92713-9657
Circle 232

Digital Equipment Corp.
146 Main St.
Maynard, MA 01754-2571
Circle 233

GraphOn Corp.
544 Division St.
Campbell, CA 95008
Circle 234

Hewlett-Packard (Canada) Ltd.
Panacom Automation Division
20 Lexington Road
Waterloo, Ontario
N2J 3Z3 Canada
Circle 235

Human Designed Systems Inc.
421 Feheley Drive
King of Prussia, PA 19406
Circle 236

Hummingbird Communications Ltd.
2900 John St., Unit 4
Markham, Ontario
CDL3R 563 Canada
Circle 237

IBM Corp.
Old Orchard Road
Armonk, NY 10504
Circle 238

Japan Computer Corp.
One Bridge Plaza, Suite 400
Fort Lee, NJ 07024
Circle 239

Link Technologies Inc.
46595 Landing Pkwy.
Fremont, CA 94538
Circle 240

Network Computing Devices Inc.
350 North Bernardo Ave.
Mountain View, CA 94043
Circle 241

Pagine Corp.
1961-A Concourse Drive
San Jose, CA 95131
Circle 242

Phase X Systems Inc.
1600 NW 167th Place
Beaverton, OR 97006
Circle 243

Qume Peripherals Inc.
260 South Milpitas Blvd.
Milpitas, CA 95035-5420
Circle 244

Samsung Electronics Co. Ltd.
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Beaverton, OR 97006
Circle 245

Sun Microsystems Inc.
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Mountain View, CA 94043-1100
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Plano, TX 75093
Circle 247

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1840 McCarthy Blvd.
Milpitas, CA 95035
Circle 248

Tektronix Inc.
Network Displays Division
26600 SW Pkwy.
P.O. Box 1000, M/S 60-787
Wilsonville, OR 97070-1000
Circle 249

VisionWare Ltd.
57 Cardigan Lane
Leeds, West Yorkshire
LS4 2LE England
Circle 250

Visual Technology Inc.
120 Flanders Road
Westboro, MA 01581
Circle 251

Wyse Technology
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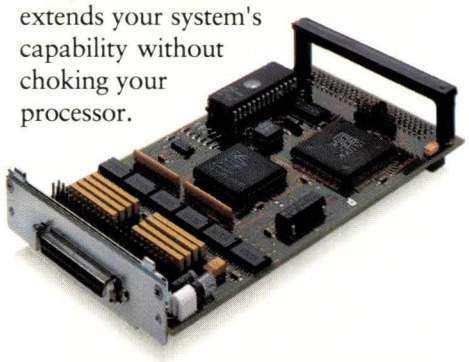

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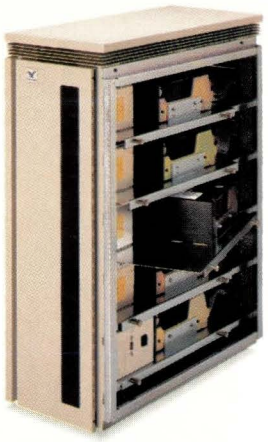

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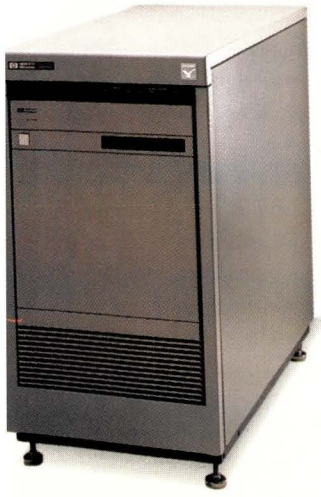

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clients at an additional charge. "What we're saying is, here is the basic software free of charge," says David Kurtzer, DEC's product marketing manager for the VXT 2000 family of X terminals. "If you really want to have local clients, you can buy our whole package."

The other way that vendors can distinguish their product in software is to attempt to make their own X-oriented innovations part of the standard X software package. DEC, for instance, now ships a compression technology that allows X terminals to better handle 2D images. Known as XIE, for X Imaging Extensions, the software compresses 2D data sets into much smaller packages that can be more easily transmitted over networks and still more easily manipulated within the relatively small confines of an X terminal's processor.

DEC is selling XIE as an add-on now, but, says Nina Hargus, DEC's product marketing manager for X terminals, "We donated it to the MIT X Consortium." And the X Consortium, in turn, took it to X technology vendor, AGE Logic Inc. "What AGE is doing, says Hargus, "is working on the integration of XIE in Revision 6 of X11."

As a result, most X terminal vendors will be able to include XIE in their system software with X11R6. "There will be a number of applications," notes Craig Schmidt, vice president of marketing for AGE Logic. "Medical imaging, for example. You could take an X-ray, say, call it up on an X terminal, manipulate it, turn it around, and so on...all in real time and interactively."

Meanwhile, what may be next in salable features for X terminals will be ease of use. "One of the things that keeps X terminals from being a commodity product right now is ease of use and administration," says DEC's Kurtzer.

The Blandification of X

Yet, ultimately, none of these features, software or hardware or ease of use, will make or break an X terminal vendor. Should any feature prove particularly attractive to customers, other vendors will swiftly and easily copy it. Indeed, that feature will probably become part of the X Window standard, the way the XIE is now slated for inclusion in X11R6.

What, then, will motivate people to buy one brand of X terminal over another? "I think," says Kam Chan, president of Tatung, "they will buy on price and performance, service and support, and the long-term stability of the company."

In other words, X terminals will be sold less on their own qualities and more on those of their vendors. The company that can maintain the lowest prices, offer the best support, and somehow convince the buyer that it will be around tomorrow to continue to provide support and upgrades will be the winner.

This will be increasingly true in the very near future, says Tektronix's King, as X terminals are now moving out of their traditional technical and engineering markets and into commercial accounts. "Right now, it [the salable feature] is software. But as we go into commercial markets, it will be support," he says. "Customers will expect to be able to plug in an X terminal and make it work."

The result, though, is a future for X terminals that is significantly different from its past. Where before, technical issues were preeminent, now market forces more akin to those that govern PCs and ASCII terminals may be the most important. "Today," says C. Itoh/Itochu's Gunter, "the market is still two distinct segments–the extremely low end, and that's the one that's growing, and the technical environment, and that's decreasing." It's the low end, he says, where X terminals will eventually be sold to downsizing MIS departments, that he thinks will increasingly shape the X terminal and its technology.

If so, then as the X terminal becomes increasingly bland as a technology, its market could be as breathtaking as a roller coaster. Existing vendors will struggle for position, and new ones will attempt to win it–and some of the new players will come from very different backgrounds, with very different assumptions, than those that have come before. ⊸

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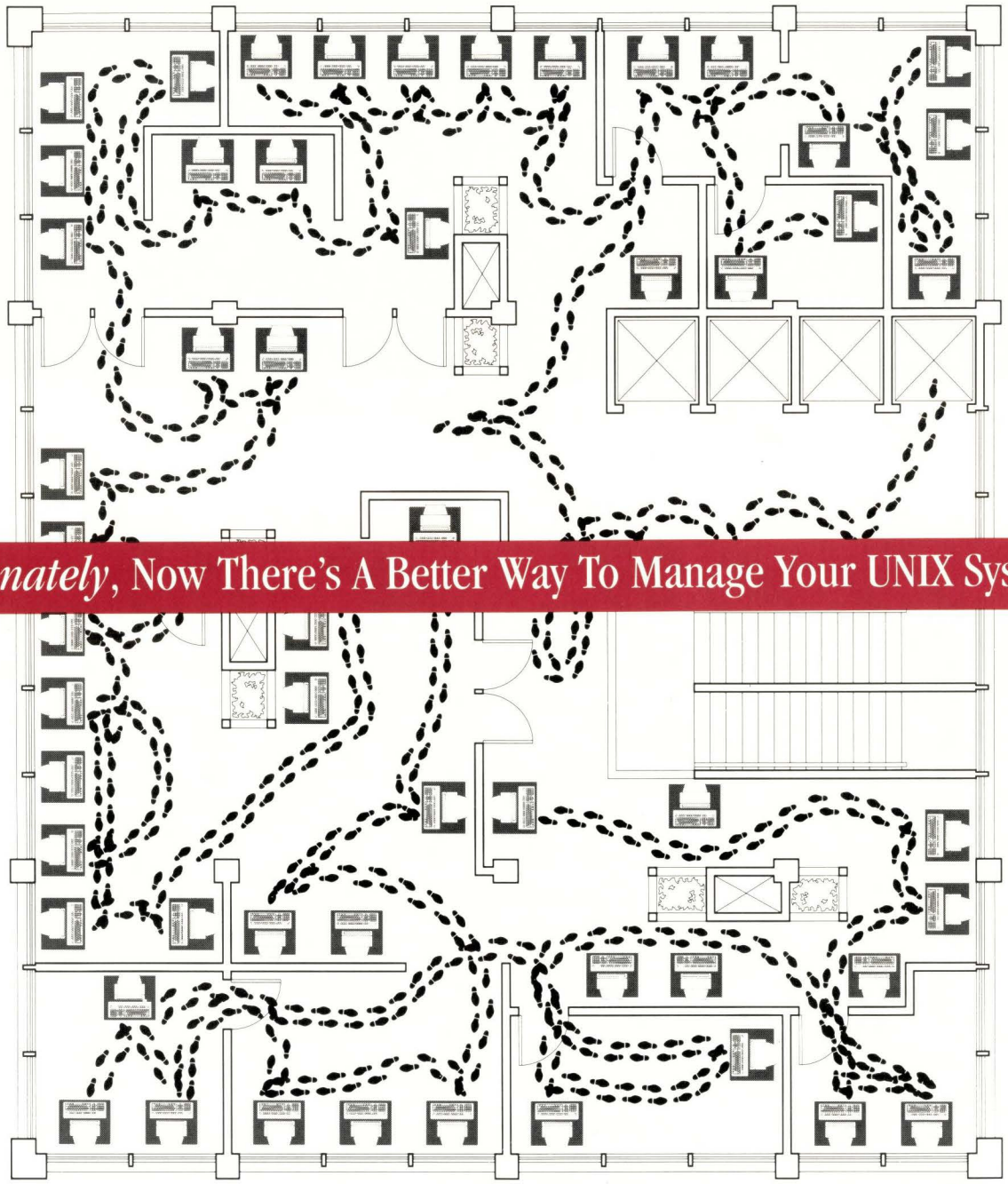

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SUMB3

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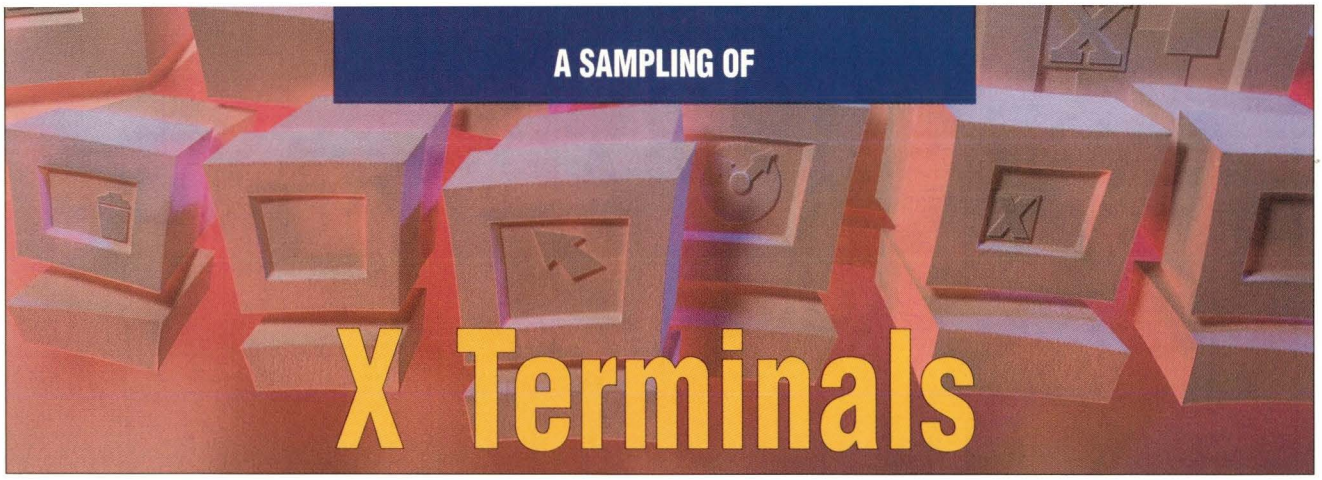

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Company / Model	Resolution (pixels)	Processor	Local memory (MB, min. to max.)	Refresh rate (Hz)	X11 release supported	X11 security/authority support	X-server location	X-remote support	Built-in window manager	Built in clients	Monitor characteristics	Screen size (inches)	SLIP support	Interfaces	Price ($)
Andataco Computer Peripherals, 9550 Waples St., San Diego, CA 92121. **Circle 200**															
NCD/15b	1024x800	68000	2-5	70	5	Y	PROM-based, download from host	Y	Y	—	M	15	Y	AUI, Ethernet, serial	call
NCD/15s	1024x800	68000	4-5	70	5	Y	PROM-based, download from host	Y	Y	—	M	15	Y	serial	call
NCD/15r	1024x800	R3000	4-20	70	5	Y	PROM-based, download from host	Y	Y	—	M	15	Y	AUI, Ethernet, serial	call
NCD/19r	1280x1024	R3000	4-20	70	5	Y	PROM-based, download from host	Y	Y	—	M	19	Y	AUI, Ethernet, serial	call
NCD/19g	1280x1024	88100	6-40	70	5	Y	PROM-based, download from host	Y	Y	—	G	19	Y	AUI, Ethernet, serial	call
NCD/14c	1024x768	68020	4-32	70	5	Y	PROM-based, download from host	Y	Y	—	C	14	Y	AUI, Ethernet, serial	call
NCD/17c	1024x768	68020	4-32	70	5	Y	PROM-based, download from host	Y	Y	—	C	17	Y	AUI, Ethernet, serial	call
NCD/17cr	1280x1024	88100	6-40	70	5	Y	PROM-based, download from host	Y	Y	—	C	17	Y	AUI, Ethernet, serial	call
NCD/19c	1280x1024	88100	6-40	70	5	Y	PROM-based, download from host	Y	Y	—	C	19	Y	AUI, Ethernet, serial	call
CIT/X15M	1280x960	68301, 34010	1-17	67	4	Y	ROM	N	Y	—	M	15	Y	AUI, Ethernet	call
CIT/XE17M	1280x1024	34020	5-33	70	4	Y	ROM	N	Y	—	M	17	Y	AUI, Ethernet	call
CIT/XEPL	1280x1024	34020	5-33	30	4	Y	ROM	N	Y	—	M	16	Y	AUI, Ethernet	call
CIT/XE19M	1280x1024	34020	5-33	70	4	Y	ROM	N	Y	—	M	19	Y	AUI, Ethernet	call
CIT/XE17C	1280x1024	34020	6-38	70	4	Y	ROM	N	Y	—	C	17	Y	AUI, Ethernet	call
CIT/XE19C	1280x1024	34020	6-38	70	4	Y	ROM	N	Y	—	C	19	Y	AUI, Ethernet	call
CIT/XE21C	1280x1024	34020	6-38	70	4	Y	ROM	N	Y	—	C	21	Y	AUI, Ethernet	call
Bull HN Information Systems Inc., Technology Park, Billerica, MA 01821. **Circle 201**															
NCD15b	1024x800	68000	4-5	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	M	15	Y	Ethernet, serial	1,195
NCD15r	1024x800	R3000	5-20	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	M	15	Y	Ethernet, serial	1,495
NCD14c	1024x768	68020	4-32	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	C	14	Y	Ethernet, serial	2,495
NCD19r	1280x1024	R3000	5-20	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	M	19	Y	Ethernet, serial	2,495
MCX14	1024x768	88100	6-68	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	G	14	Y	Ethernet, serial	3,295
MCX15	1024x768	88100	6-68	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	G	15	Y	Ethernet, serial	3,495
NCD19g	1280x1024	88100	6-40	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	G	19	Y	Ethernet, serial	3,995
MCX17	1152x900	88100	6-68	75	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	C	17	Y	Ethernet, serial	4,295
NCD17cr	1280x1024	88100	6-40	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	C	17	Y	Ethernet, serial	4,995
NCD19c	1280x1024	88100	6-40	70	5	Y	PROM-based, download from host	Y	Y	telnet, LAT, cterm, etc.	C	19	Y	Ethernet, serial	5,695

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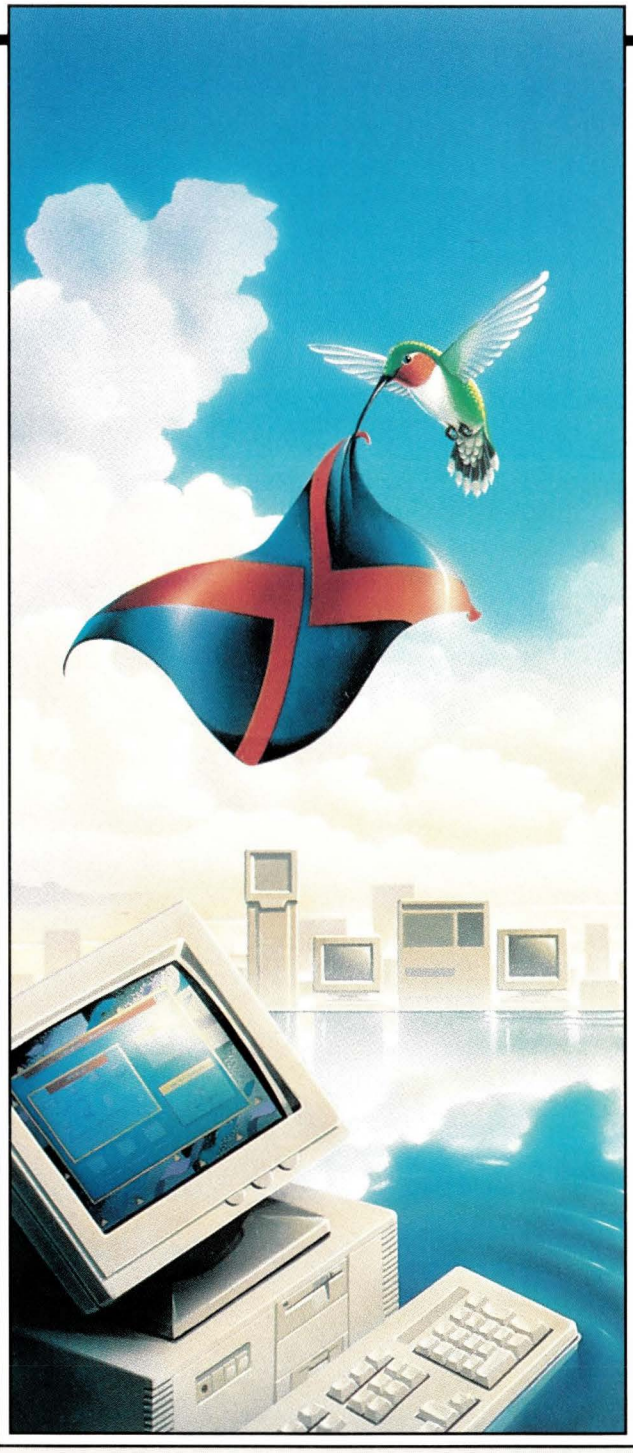

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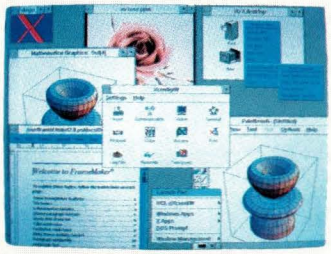

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Company / Model	Resolution (pixels)	Processor	Local memory (MB, min. to max.)	Refresh rate (Hz)	X11 release supported	X11 security/authority support	X-server location	X-remote support	Built-in window manager	Built in clients	Monitor characteristics	Screen size (inches)	SLIP support	Interfaces	Price ($)
C. Itoh Technology Inc., 2515 McCabe Way, Irvine, CA 92713. **Circle 202**															
CIT-XE17M	1280x1024	34020	4-36	72	4, 5	Y	ROM, download from host	Y	Y	Y	M	17	Y	Ethernet, AUI, serial	1,700
CIT-XE19N	1280x1024	34020	4-36	72	4, 5	Y	ROM, download from host	Y	Y	Y	M	19	Y	Ethernet, AUI, serial	1,988
CIT-XE17C	1280x1024	34020	4-36	72	4, 5	Y	ROM, download from host	Y	Y	Y	C	17	Y	Ethernet, AUI, serial	2,730
CIT-XE21C	1280x1024	34020	4-36	72	4, 5	Y	ROM, download from host	Y	Y	Y	M	21	Y	Ethernet, AUI, serial	3,100
Chuntex Electronic Co. Ltd., 6F No. 2, Alley 6, Lane 235, Pao Chiao Road, Hsin Tien, Taipei, Taiwan, R.O.C. **Circle 203**															
MX-11	1280x1024	29000	4-16	72	5	Y	ROM, download from host	P	Y	P	M	19	Y	Ethernet, AUI, serial	1,995
CX-11	1280x768	29000	4-16	72	5	Y	ROM, download from host	P	Y	P	C	15	Y	Ethernet, AUI, serial	2,695
CX-11	1024x768	29000	4-16	72	5	Y	ROM, download from host	P	Y	P	C	17	Y	Ethernet, AUI, serial	3,195
CX-21	1280x1024	29000	4-16	72	5	Y	ROM, download from host	P	Y	P	C	15	Y	Ethernet, AUI, serial	3,495
CX-21	1280x1024	29000	4-16	72	5	Y	ROM, download from host	P	Y	P	C	17	Y	Ethernet, AUI, serial	3,895
Daewoo Telecom Ltd., 275-6 Yangjae Dong, Scho'O-Gu, Seoul, Korea. **Circle 204**															
DTX-2407C/ 2327C	1024x800, 1152x900	34020	4-16	76	5	Y	ROM, download from host	P	N	local clients set up	C	17	Y	Ethernet, AUI, serial	3,000
Dickens Data Systems, 1175 Northmeadow Pkwy., #150, Roswell, GA 30076. **Circle 205**															
MAX-terminal	800x600	68000	—	78	4	N	on host	N	N	N	M	14	N	serial	795
Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571. **Circle 206**															
VXT2000	1024x768	50C	4-18	72	5	Y	download from host	P	Y	Y	M	15	N	Ethernet	1,295
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	M	17	N	Ethernet	2,095
VXT2000	1024x768	50C	4-18	72	5	Y	download from host	P	Y	Y	C	15	N	Ethernet	2,495
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	M	19	N	Ethernet	2,495
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	G	17	N	Ethernet	3,195
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	G	19	N	Ethernet	3,495
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	C	17	N	Ethernet	3,795
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	C	19	N	Ethernet	4,695
VXT2000	1280x1024	50C	4-18	72	5	Y	download from host	P	Y	Y	C	19	N	Ethernet	5,695
Falcon Systems Inc., 5816 Roseville Road, Sacramento, CA 95816. **Circle 207**															
FX-P11	1024x768	34020	4-12	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	M	15	Y	Ethernet, AUI, serial, etc.	995
FX-P13	1024x768	34020	4-12	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	G	15	Y	TCP/IP, DECnet, SLIP, etc.	1,695
FX-19M	1280x1024	29000	3-10	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	M	19	Y	Ethernet, SLIP, TCP/IP, DECnet	1,995
FX-P17	1024x768	34020	4-12	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	14	Y	Ethernet, AUI, serial, etc.	1,995
FX-P12	1280x1024	34020	4-12	60	5	Y	ROM	Y	Y	XIE, XMCS, etc.	M	19	Y	Ethernet, AUI, serial, etc.	2,495
FX-P334	1280x1024	34020, R3000	5-52	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	G	19	Y	TCP/IP, telnet, SLIP, DECnet	3,495
FX-P18	1152x900	34020	4-12	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	17	Y	TCP/IP, telnet, SLIP, DECnet	3,795
FX-17C	1024x768	29000	3-10	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	17	Y	Ethernet, AUI, serial, etc.	4,290
FX-P336	1152x900	34020, R3000	5-52	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	17	Y	TCP/IP, telnet, SLIP, DECnet	4,750
FX-P337	1152x900	34020, R3000	5-52	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	19	Y	TCP/IP, telnet, SLIP, DECnet	4,995
FX-CA1	1024x768	29000	4-16	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	17	Y	TCP/IP, telnet, SLIP, DECnet	5,390
FX-P338	1280x1024	34020, R3000	5-52	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	17	Y	TCP/IP, telnet, SLIP, DECnet	5,995
FX-CA2	1280x1024	29000	4-16	60	5	Y	ROM	Y	Y	telnet, cterm, etc.	C	17	Y	TCP/IP, telnet, SLIP, DECnet	6,590

N = no Y = yes P = planned
M = monochrome G = gray scale C = color

FACT:

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

Eliminate network gridlock and increase system performance...

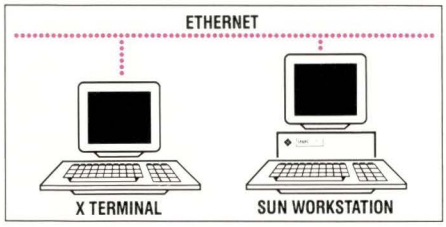
◆*It's simple!* The GXTRA *(pronounced gee-extra)* SBus card, allows you to eliminate network traffic and maintain system performance by adding extra users to your workstation, rather than to your network.

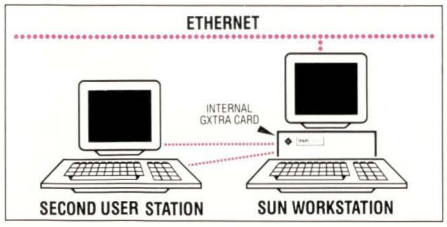
The GXTRA functions *better than* an X terminal! Unlike the X terminal, the GXTRA connects directly to your SPARCstation SBus. This direct connection makes it possible to pass graphic commands at SBus speed, (100 Mbyte/second), *greatly increasing* total system performance.

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

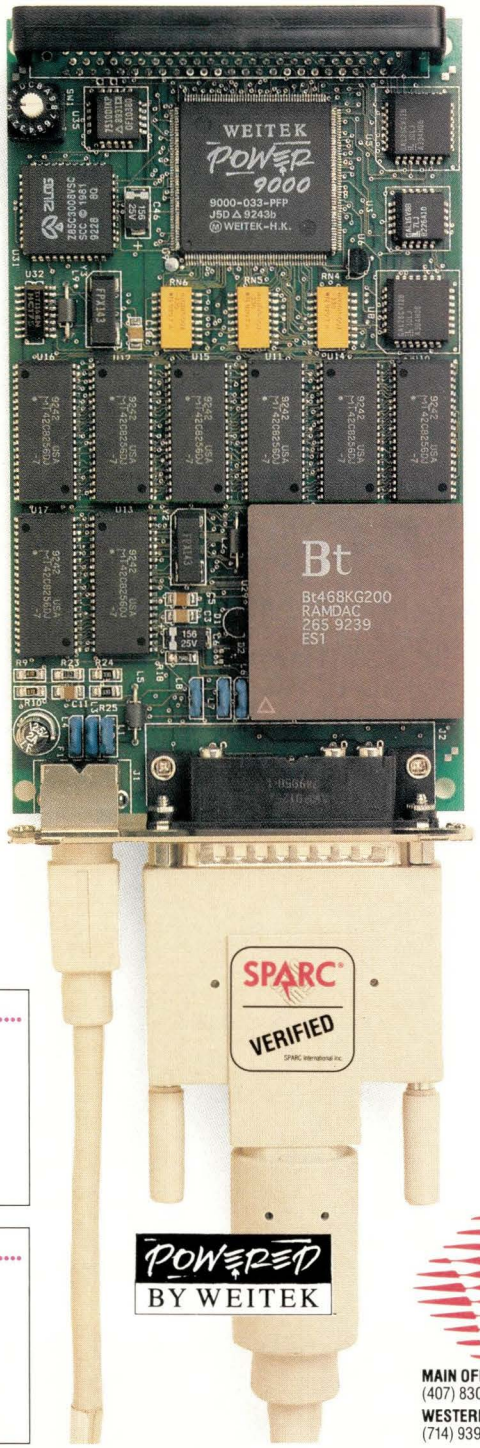
Adding GXTRA cards maintains 100% software and font compatibility with Sun SPARCstations, something X terminals *cannot* achieve.

◆*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.

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◆ *Eliminate network traffic!*
◆ *Put SPARCstation performance on every desk!*

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Circle No. 41 on Inquiry Card

Company Model	Resolution (pixels)	Processor	Local memory (MB, min. to max.)	Refresh rate (Hz)	X11 release supported	X11 security/authority support	X-server location	X-remote support	Built-in window manager	Built in clients	Monitor characteristics	Screen size (inches)	SLIP support	Interfaces	Price ($)
GraphOn Corp., 544 Division St., Campbell, CA 95008. **Circle 208**															
14	800x920	68000	—	75	5	N	located on host	Y	N	Y	M	14	N	serial	695
19S	1280x1024	68000	—	70	5	N	located on host	Y	N	Y	M	19	N	serial	1,595
21	1280x1024	68000	—	70	5	N	located on host	Y	N	Y	M	21	N	Ethernet, serial	1,795
Harris Adacom Network Services, 1100 Venture Court, Carrollton, TX 75006. **Circle 209**															
Hawk 3270/x	1280x1024	R3000	4-32	72	5	Y	located on host, remote host	N	Y	Y	M, G, C	14-19	Y	Ethernet, serial, token ring	995+
Hewlett-Packard Co., 3000 Hanover St., Palo Alto, CA 94304. **Circle 210**															
14Ci	1024x768	i960CA	4-18	60	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	14	Y	Ethernet, serial, parallel, AUI, BNC	2,495
19Mi	1280x1024	i960CA	4-18	72	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	M	19	Y	Ethernet, serial, parallel, AUI, BNC	2,495
15Ci	1024x768	i960CA	4-18	70	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	15	Y	Ethernet, serial, parallel, AUI, BNC	2,995
17Ci	1024x768	i960CA	4-18	75	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	17	Y	Ethernet, serial, parallel, AUI, BNC	3,495
19Ga	1280x1024	i960CA	4-18	72	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	G	19	Y	Ethernet, serial, parallel, AUI, BNC	3,495
17Ca	1024x768	i960CA	4-18	75	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	17	Y	Ethernet, serial, parallel, AUI, BNC	4,195
17Cs	1280x1024	i960CA	4-18	72	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	17	Y	Ethernet, serial, parallel, AUI, BNC	4,695
19Ca	1280x1024	i960CA	4-18	72	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	19	Y	Ethernet, serial, parallel, AUI, BNC	4,995
19Cs	1280x1024	i960CA	4-18	72	5	Y	tape, Flash ROM card, CD-ROM	N	Y	twm, hpterm, xterm	C	19	Y	Ethernet, serial, parallel, AUI, BNC	5,495
Hitachi America Ltd., 110 Summit Ave., Montvale, NJ 07645. **Circle 211**															
17x	1280x1024	88100	6-40	70	4	Y	download from host	N	Y	telnet	C	17	Y	Ethernet, serial	5,395
20x	1280x1024	88100	6-40	70	4	Y	download from host	N	Y	telnet	C	20	Y	Ethernet, serial	5,995
21x	1280x1024	88100	6-40	70	4	Y	download from host	N	Y	telnet	C	21	Y	Ethernet, serial	6,495
Human Designed Systems Inc., 421 Feheley Drive, King of Prussia, PA 19406. **Circle 212**															
FX15	1024x864	80960CA	4-68	72	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	M, G	15	Y	Ethernet, serial, parallel	1,099
FX14C	1024x768	80960CA	4-68	70	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	C	14	Y	Ethernet, serial, parallel	1,399
FX17	1152x900	80960CA	4-68	72	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	M, G	17	Y	Ethernet, serial, parallel	1,399
FX19	1280x1024	80960CA	4-68	70	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	M, G	19	Y	Ethernet, serial, parallel	1,699
FX17C	1028x864	80960CA	4-68	70	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	C	17	Y	Ethernet, serial, parallel	1,999
FX17CT	1028x1024, 1152x900	80960CA	4-68	70	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	C	17	Y	Ethernet, serial, parallel	2,299
FX19Ci	1280x1024	80960CA	4-68	70	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	C	19	Y	Ethernet, serial, parallel	2,999
FX19CT	1280x1024	80960CA	4-68	70	5	Y	download from host, FlashPROM	N	Y	xterm, clocks, calculator, user clients	C	19	Y	Ethernet, serial, parallel	3,199
IBM Corp., Old Orchard Road, Armonk, NY 10504. **Circle 213**															
7010-130	640x480, 1600x1200	34020, 80C186	2-16	60-76	4,5	Y	download from host	N	N	N	G, C	12-23	Y	Ethernet, token ring, serial, parallel	2,650
7010-150	1024x768, 1280x1024	88110	6-22	60-77	5	Y	download from host, FlashPROM	N	Y	N	G, C	16-23	Y	Ethernet, token ring, serial, parallel	2,995

N = no Y = yes P = planned
M = monochrome G = gray scale C = color

Aydin Monitors...
Rock Solid & Rock Mountable

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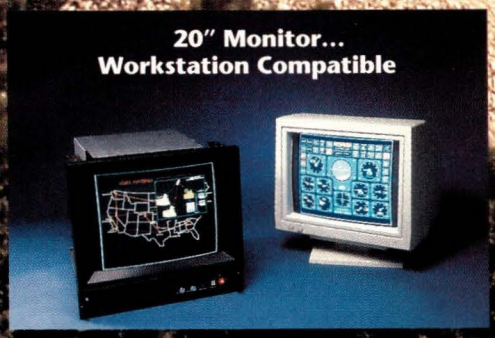

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Circle No. 7 on Inquiry Card

Company / Model	Resolution (pixels)	Processor	Local memory (MB, min. to max.)	Refresh rate (Hz)	X11 release supported	X11 security/authority support	X-server location	X-remote support	Built-in window manager	Built in clients	Monitor characteristics	Screen size (inches)	SLIP support	Interfaces	Price ($)
Japan Computer Corp., One Bridge Plaza, Suite 400, Fort Lee, NJ 07024. **Circle 214**															
QC15	1280x1024	R3000	4-32	74	5	Y	download from host, PROM	Y	Y	Y	C	15	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	2,495
GXM	1280x1024	R3000	4-32	72	5	Y	download from host, PROM	Y	Y	Y	M	17, 20	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	2,650-2,895
Flat Panel XFL	1152x900	68020	4-16	—	5	Y	download from host, PROM	Y	Y	Y	M	11 ½	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, Telnet, TFTP, NFS, SNMP	3,295
GXG	1280x1024	R3000	4-32	72	5	Y	download from host, PROM	Y	Y	Y	G	17, 20	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	3,495-3,995
Flat Panel XF	1280x1024	68030	4-16	—	5	Y	download from host, PROM	Y	Y	Y	M	11 ½	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	3,995
GXC	1280x1024	R3000	4-32	74	5	Y	download from host, PROM	Y	Y	Y	C	17, 20	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	3,495-3,995
GXP	1280x1024	R3000	4-32	74	5	Y	download from host, PROM	Y	Y	Y	C	17, 20	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	4,995-5,995
GX-PEX	1280x1024	R3000	4-32	74	5	Y	download from host, PROM	Y	Y	Y	C	17, 20	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	5,495-6,495
Flat Panel XFC	1280x1024	R3000	4-24	—	5	Y	download from host, PROM	Y	Y	Y	C	13	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	10,995
GFX	1280x1024	68030	4-32	74	5	Y	download from host, PROM	Y	Y	Y	C	17, 20	Y	TCP, IP, UDP, SLIP, ARP, RARP, BOOTP, telnet, TFTP, NFS, SNMP	9,995-10,995
Jupiter Systems, 1351 Harbor Bay Parkway, Suite 200, Alameda, CA 94501. **Circle 215**															
MX600	1280x1024	i960	4-128	72	5	Y	download from host	P	Y	xterm	C	19	N	Ethernet	6,500
Link Technologies Inc., 46595 Landing Parkway, Fremont, CA 94538. **Circle 216**															
LX400	1024x768	68020	2-12	62	3,4	Y	ROM, download from host	Y	Y	Y	M, G	14	Y	AUI, Ethernet, serial	964
LX1200	1280x1024	68030	6-37	70	3,4	Y	ROM, download from host	Y	Y	Y	C	—	Y	AUI, serial	2,964
NCR Corp., ADDS-X Station Div., 250 International Parkway, Suite 300, Heathrow, FL 32746. **Circle 217**															
XLR17	1152x900	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	M	17	N	Ethernet, serial, parallel	2,595
XLR19	1280x1024	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	M	19	N	Ethernet, serial, parallel	2,995
XLR17G	1152x900	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	G	17	N	Ethernet, serial, parallel	3,095
XLR14C	1024x768	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	C	14	N	Ethernet, serial, parallel	3,095
XLR15C	1024x768	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	C	15	N	Ethernet, serial, parallel	3,395
XLR19G	1280x1024	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	G	19	N	Ethernet, serial, parallel	3,495
XLR17C	1024x768	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	C	17	N	Ethernet, serial, parallel	4,295
XLR17Ch	1280x1024	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	C	17	N	Ethernet, serial, parallel	4,895
XLR19Ch	1280x1024	80960CA	4-32	72	5	Y	download from host, FlashPROM	N	Y	telnet	C	19	N	Ethernet, serial, parallel	5,895

N = no Y = yes P = planned
M = monochrome G = gray scale C = color

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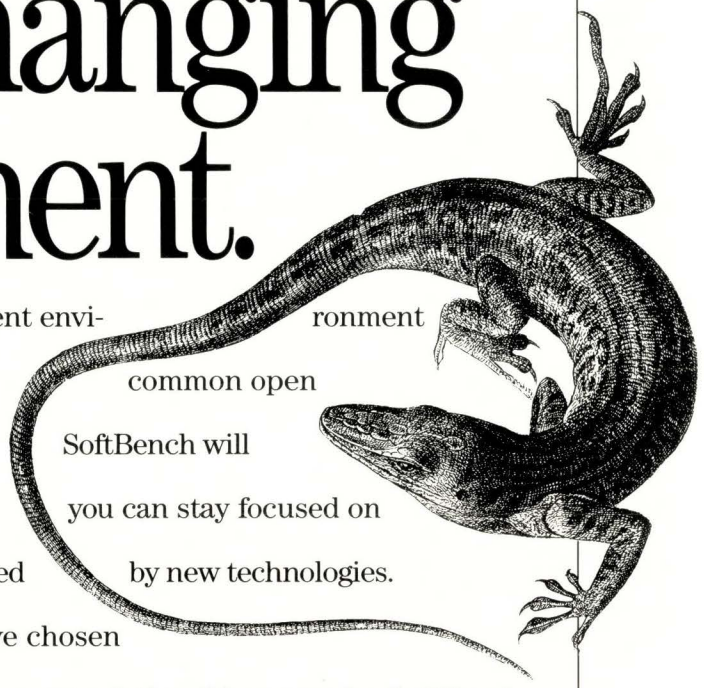

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Circle No. 17 on Inquiry Card

Company Model	Resolution (pixels)	Processor	Local memory (MB, min. to max.)	Refresh rate (Hz)	X11 release supported	X11 security/authority support	X-server location	X-remote support	Built-in window manager	Built in clients	Monitor characteristics	Screen size (inches)	SLIP support	Interfaces	Price ($)
Network Computing Devices Inc., 350 N. Bernardo Ave., Mountain View, CA 94043. **Circle 218**															
NCD15b	1024x800	68000	4-5	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	M	15	Y	AUI, Ethernet, serial, token ring	1,195
NCD15r	1024x800	R3000	5-20	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	M	15	Y	AUI, Ethernet, serial, token ring	1,495
NCD14c	1024x768	68020	4-32	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	C	14	Y	AUI, Ethernet, serial, token ring	2,495
NCD19r	1280x1024	R3000	5-20	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	M	19	Y	AUI, Ethernet, serial, token ring	2,495
MCX14	1024x768	88100	6-68	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	C	14	Y	AUI, Ethernet, serial, token ring	3,295
MCX15	1024x768	88100	6-68	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	C	15	Y	AUI, Ethernet, serial, token ring	3,495
NCD19g	1280X1024	88100	6-40	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	G	19	Y	AUI, Ethernet, serial, token ring	3,995
MCX17	1152X900	88100	6-68	75	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	C	17	Y	AUI, Ethernet, serial, token ring	4,295
NCD17cr	1280x1024	88100	6-40	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	C	17	Y	AUI, Ethernet, serial, token ring	4,995
NCD19c	1280x1024	88100	6-40	70	5	Y	download from host, PROM	Y	Y	telnet, LAT, etc.	C	19	Y	AUI, Ethernet, serial, token ring	5,695
Pagine Corp., 1961-A Concourse Drive, San Jose, CA 95131. **Circle 219**															
M2000	1280x1024	R3000	3-32	74	5	Y	PROM, download from host	P	Y	telnet, terminal configuration, terminal emulation, etc.	M	17	Y	Ethernet, serial	1,799
C2000	1280x1024	R3000	4-64	74	5	Y	PROM, download from host	P	Y	telnet, terminal configuration, terminal emulation, etc.	C	17	Y	Ethernet, serial	3,499
Phase X Systems Inc., 1600 N.W. 167th Place, Beaverton, OR 97006. **Circle 220**															
PX19M	1280x1024	29000	3-18	66	4, 5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	M	19	Y	AUI, Ethernet, serial	1,495
PX17C	1024x768	29000	3-10	60	4, 5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	C	17	Y	AUI, Ethernet, serial	1,695
PX14CA1	1024x768	29000	3-18	72	4, 5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	C	14	Y	AUI, Ethernet, serial	1,695
PX15CA1	1024x768	29000	3-18	72	4,5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	C	15	Y	AUI, Ethernet, serial	1,895
PX17CA1	1024x768	29000	3-18	72	4, 5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	C	17	Y	AUI, Ethernet, serial	2,395
PX17CA2	1280x1024	29000	3-18	72	4, 5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	C	17	Y	AUI, Ethernet, serial	3,095
PX19CA2	1280x1024	29000	3-18	72	4, 5	Y	PROM, download from host	Y	Y	telnet, cterm, LAT, etc.	C	19	Y	AUI, Ethernet, serial	3,495
Qume Peripherals Inc., 260 S. Milpitas Blvd., Milpitas, CA 95035. **Circle 221**															
QX15	800x600	68000	—	78	4, 5	Y	on host	Y	Y	Y	M	14	N	serial	699
Samsung Electronics Co. Ltd., 1600 N.W. 167th Place, #335, Beaverton, OR 97006. **Circle 222**															
SGS19M	1280x1024	29000	3-16	72	5	Y	ROM, download from host	N	Y	xclock, xterm	M	19	Y	AUI, Ethernet, serial	1,995
SGS14CA1	1024x768	29000	4-16	72	5	Y	ROM, download from host	N	Y	xclock, xterm	C	14	Y	AUI, Ethernet, serial	2,265
SGS17C	1024x768	29000	3-16	72	5	Y	ROM, download from host	N	Y	xclock, xterm	C	17	Y	AUI, Ethernet, serial	2,495
SGS15CA1	1024x768	29000	4-16	72	5	Y	ROM, download from host	N	Y	xclock, xterm	C	15	Y	AUI, Ethernet, serial	2,565
SGS17CA1	1024x768	29000	4-16	72	5	Y	ROM, download from host	N	Y	xclock, xterm	C	17	Y	AUI, Ethernet, serial	3,195
SGS19CA2	1280x1024	29000	4-16	72	5	Y	ROM, download from host	N	Y	xclock, xterm	C	19	Y	AUI, Ethernet, serial	4,495

N = no Y = yes P = planned
M = monochrome G = gray scale C = color

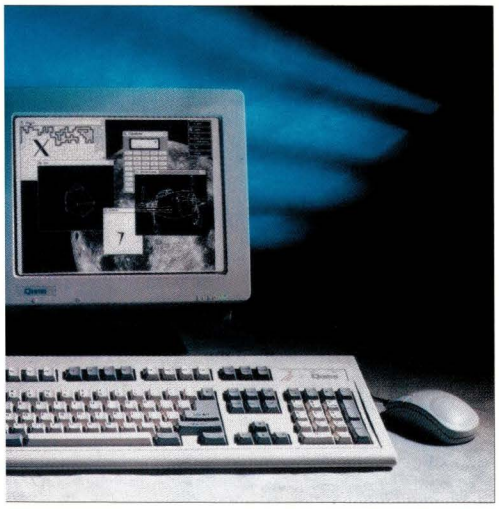
Company / Model	Resolution (pixels)	Processor	Local memory (MB, min. to max.)	Refresh rate (Hz)	X11 release supported	X11 security/authority support	X-server location	X-remote support	Built-in window manager	Built in clients	Monitor characteristics	Screen size (inches)	SLIP support	Interfaces	Price ($)
Sigma Information Systems Inc., 5775 Polaris Ave., Las Vegas, NV 89118. **Circle 223**															
ST-150/I Industrial Portable	1152x900	68020	2-16	—	5	Y	ROM, download from host	Y	Y	Y	M	11 ½	N	Ethernet, serial	5,525
Tandberg Data, 2649 Townsgate Road, Suite 600, Westlake Village, CA 91361. **Circle 224**															
TDV6310F	1024x768	34020	4-20	70	5	Y	download from host, FlashEPROM	P	Y	N	C	14	N	Ethernet, serial	call
TDV6230F	1280x960	34020	4-20	73	5	Y	download from host, Flash EPROM	P	Y	N	M, G	17	N	Ethernet, serial	call
TDV6330F	1024x768	34020	4-20	70	5	Y	download from host, Flash EPROM	P	Y	N	C	17	N	Ethernet, serial	call
Tatung Science and Technology Inc., 1840 McCarthy Blvd., Milpitas CA 95035. **Circle 225**															
TXT-14C	1024x768	340X	4-16	60	5	Y	ROM, download from host	Y	Y	Y	C	14	Y	Ethernet	1,890
TXT-15C	1152x900, 1024x768	340X	4-16	66	5	Y	ROM, download from host	Y	Y	Y	C	15	Y	Ethernet	2,190
TXT-17Ca	1152x900	340X	4-16	66	5	Y	ROM, download from host	Y	Y	Y	C	17	Y	Ethernet	2,890
TXT-17Cb	1280x1024	340X	4-16	60	5	Y	ROM, download from host	Y	Y	Y	C	17	Y	Ethernet	3,190
TXT-20C	1280x1024	340X	4-16	60	5	Y	ROM, download from host	Y	Y	Y	C	20	Y	Ethernet	3,790
Tektronix Inc., 26600 S.W. Parkway, Wilsonville, OR 97070. **Circle 226**															
XP11	1024x768	34020	4-16	70	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	M	15	N	AUI, Ethernet, serial	995
XP11T	1024x768	340X, 380C26	4-16	70	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	M	15	N	token ring, serial	1,495
XP13	1024x768	34020	4-16	70	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	G	15	N	AUI, Ethernet, serial	1,695
XP17	1024x768	34020	4-16	70	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	C	14	N	AUI, Ethernet, serial	1,995
XP12	1280x1024	34020	4-16	72	5	N	download from host, FlASH	Y	Y	telnet, LAT, cterm, etc.	M	19	N	AUI, Ethernet, serial	2,495
XP17T	1024x768	340X, 380C26	4-16	70	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	C	14	N	token ring, serial	2,495
XP12T	1280x1024	340X, 380C26	4-16	72	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	M	19	N	token ring, serial	2,995
XP334	1280x1024	R3000, 34020	5-32	72	5	—	download from host, Flash	N	Y	telnet, LAT, cterm, etc.	G	19	N	AUI, Ethernet, serial	3,495
XP18	1152x900	34020	4-16	72	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	C	17	N	AUI, Ethernet, serial	3,795
XP18T	1152x900	340X, 380C26	4-16	72	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	C	17	N	token ring, serial	4,295
XP336	1152x900	R3000, 34020	5-32	72	5	—	download from host, Flash	N	Y	telnet, LAT, cterm, etc.	C	17	N	AUI, Ethernet, serial	4,750
XP19T	1152x900	340X, 380C26	4-16	72	5	N	download from host, Flash	Y	Y	telnet, LAT, cterm, etc.	C	19	N	token ring, serial	4,895
XP337	1152x900	R3000, 34020	5-32	72	5	—	download from host, Flash	N	Y	telnet, LAT, cterm, etc.	C	19	N	AUI, Ethernet, serial	4,995
XP338	1280x1024	R3000, 34020	5-32	72	5	—	download from host, Flash	N	Y	telnet, LAT, cterm, etc.	C	19	N	AUI, Ethernet, serial	5,995
Wyse Technology, 3471 N. First St., San Jose, CA 95134. **Circle 227**															
WY-X5	1280x1024	68020	5	70	4	Y	EPROM, download from host	N	N	terminal, telnet	M	17	Y	Ethernet, serial	1,799

N = no Y = yes P = planned
M = monochrome G = gray scale C = color

Trying on Two X Terminals and a Printer for Size

by **BARRY SHEIN,** Technical Editor

This month finds us glued to the screens of two X terminals–a low-cost model that's found its perfect techno-ecological niche and a color model with excellent performance. We also perused a new generation of Sun printer that just might garner the ultimate recommendation.



Double duty: The Qume QX15 can act as a VT220 or an X terminal.

Qume QX15

Every so often we receive a product for review that isn't particularly sexy, makes no great claims to boldly go where no man page has gone before, yet fits a techno-ecological niche so neatly that we know you'll be interested. The Qume QX15 X terminal is one such rare bird.

This is a low-cost, 14-inch monochrome (CRTs are available in white, green or amber) X terminal with a 78-Hz refresh rate. The $699 price is competitive with a dumb ASCII terminal and is about half what you would pay for even a cheap PC clone. The QX15 is different than most X terminals you're accustomed to. It has serial ports only, no Ethernet. To be precise, the terminal has two serial ports (one for communications and another for a printer or another host) and a parallel port (if that's what your printer wants). The serial ports can run at up to 115 Kb/s, or at any typical speed below this.

The QX15 can do double-duty, acting as either a VT220-compatible terminal (the default on power-up), or an X terminal. To use it as an X terminal, you log into a host that has the software provided by Qume, set your path and enter an environment variable (`QUMEHOME`) to point at the directory with the software, and fire up `startxgo` or your own customized X11 start-up script modeled after Qume's sample. The screen blanks and, after a moment, voilá X11.

The QX15 X11 server emulates a 1,024-by-768 screen in a smaller physical area. Running the mouse off the edges instantaneously shifts the larger virtual screen around on the physical screen. Other than this small annoyance, it is a very usable monochrome X11 terminal.

Our first try of the terminal had it hooked up to a PortMaster (sold by Livingston Enterprises Inc.) Ethernet terminal server, which Qume provided us with. The PortMaster can run serial ports at 115 Kb/s, the full speed of the terminal. We were pleased with the performance, taking into account that

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this was a low-end sort of product. The performance won't compete with that bit-burner you paid $50,000 for, but it won't compete with your car payments either.

The next test was to hook the terminal to a V.32bis modem and dial into our system (a large Solbourne server) at 14.4 Kb/s. Because the modem will naturally use compression, we set the serial port to 57.6 Kb/s. (Unfortunately, our modem doesn't seem to support 115 Kb/s, but that's almost certainly not a bottleneck for a V.32bis connection.)

The question we were asking was, "How would this X terminal do if we were dialed in from home?" The answer we discovered: Very well, thank you. The performance was not really noticeably different from our first try with the same terminal hooked up to the terminal server at full speed, except perhaps in a few small cases. We tried several types of applications: running a shell window and simple text editing and listing, displaying a bit-mapped image (a scan of a snapshot), running `groff`'s X11 previewer, and a few X11 applications with menus and so forth (`xwaisq`, `xpostit`, etc.).

The performance over the V.32bis modem was completely acceptable, although not blindingly fast. Performance on text applications was very good. Displaying the dithered bitmap image was fine; it developed before our eyes in a few seconds. The only oddity we saw was that when `xwaisq` tried to pop down its Add Source menu, the terminal seemed to freeze for about 30 seconds. It wouldn't respond to the mouse or keyboard at all. Then it would suddenly catch up. I can almost believe there is some sort of glitch in the `xwaisq` program that is being covered up by all these very fast X11 servers we are accustomed to. We couldn't repeat the problem with other applications, which seemed to do similar sorts of menu pop-up/pop-down. Moving a window (in `twm`) was decidedly a little slow. The server had trouble tracking the window with the mouse and would fall far enough behind that it was easy to get a little confused as to where we were. But that's not too serious because it's not something I do all that often.

Installation of the software provided with the terminal was trivial. You just `tar` the install script off the tape, run it (answering a few questions about where you want the software installed), and a few minutes later you are ready to go. The terminal itself is configured by hitting the SELECT button on the keyboard, which puts you into a little built-in windowed application where you can choose (with the mouse and Qume's menus) various configuration options such as serial port speed, parity, flow control options, number of bits per character, printer setup, numerous typical VT220 compatibility options and soft function key setups.

The Qume X11 server runs on the host, not in the terminal as with most X terminals. The terminal itself runs its own set of graphical interface commands, which Qume's server translates to and from X11 requests and transmits on the serial line. This design makes more efficient use of precious serial line bandwidth than running the X11 protocol over, for example, a SLIP (Serial Line IP) connection. The approach seems to work, although it would take more formal benchmarking to say this with certainty. The last time I tried to run an X terminal over a modem via SLIP, V.32bis wasn't available.

If there was something I didn't like about this terminal, it was the keyboard's use of a PC layout with Control down below the Shift key and Caps Lock where, in my humble opinion, the Control key belongs. Also, Qume's Backspace key really transmits Backspace rather than Delete. It's all PC-centric; the usual Delete key is on the pad to the right of the main keyboard area. Oddly, the only option to control this was to swap Caps Lock with Shift via the setup menus. That's a new one on me. Fortunately, in X11, you can use `xmodmap` to redefine the key settings to your heart's content: I was able to convince the QX15 server to send the delete character when I hit the Backspace key and use the Caps Lock key for Control. I was happy, so no real complaint here.

If you need a low-end, inexpensive X11 terminal either to stick onto an existing serial port (perhaps in a location not accessible to your LAN) or use X11 over a modem, the Qume QX15 does this well. This terminal is not blindingly fast, it's not sexy, but it will do the job for most applications that are not graphics intensive, and it will allow access to even fairly graphics-intensive applications if required. Like I said, it fits a niche.

Qume QX15 X Terminal

Company
Qume Peripherals Inc.
260 S. Milpitas Blvd.
Milpitas, CA 95035-5420

Phone
(408) 942-4242

Fax
(408) 942-4200

Best Feature
Low-priced X11 terminal designed for serial applications such as X11 over a modem.

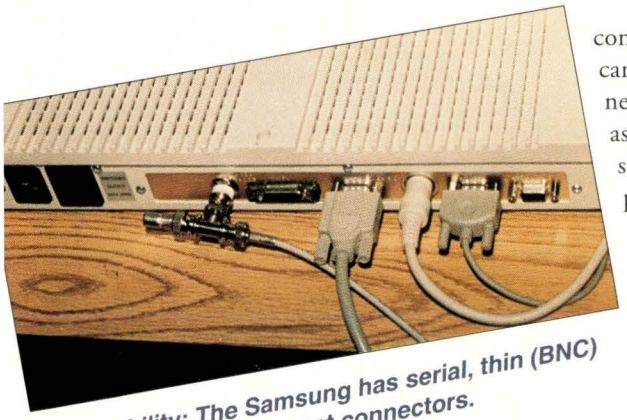
Worst Feature
The PC-style keyboard, but this is easily fixed with xmodmap, a standard X11 utility for remapping keys.

Price
$699;
X Server, $200 one-time site license fee

Circle 157

Samsung Xcellent X11 Display Terminal

Samsung X11 terminals come in several models, varying primarily with the monitor (1,024-by-768, monochrome vs. color and various monitor sizes). We reviewed the Xcellent SGS-CA2 19-inch color model with 1,280-by-1,024 resolution.



Port ability: The Samsung has serial, thin (BNC) and thick (AUI) Ethernet connectors.

If clothes make the man (ahem, person?), then monitors make the X terminal. The monitor (manufactured by Hewlett-Packard Co.) on our Samsung is stunning. Colors are crisp and bright, and there is a quietness to the screen image that one generally associates with HDTV. I cannot detect even a whisper of a flicker.

The keyboard is not the highest quality keyboard I have used. It feels a little soft. Layout is the predictable PC AT 101-key layout with the Control key below the Shift key, but `xmodmap` flips these around if that's your preference. The good news is that the keyboard uses a standard PC AT interface (round DIN connector), so this shortcoming is easily fixed: Inexpensive PC keyboards come in many variations.

The Samsung has serial, thin (BNC) and thick (AUI) Ethernet connectors. The serial port can be used either as the network adapter via SLIP or as a more conventional serial terminal (Samsung provides a terminal emulator in ROM), or for a printer. This model comes standard with 4 MB of memory, expandable to 16 MB with single in-line memory modules. Other models are available with 3 MB standard, expandable to 10 MB.

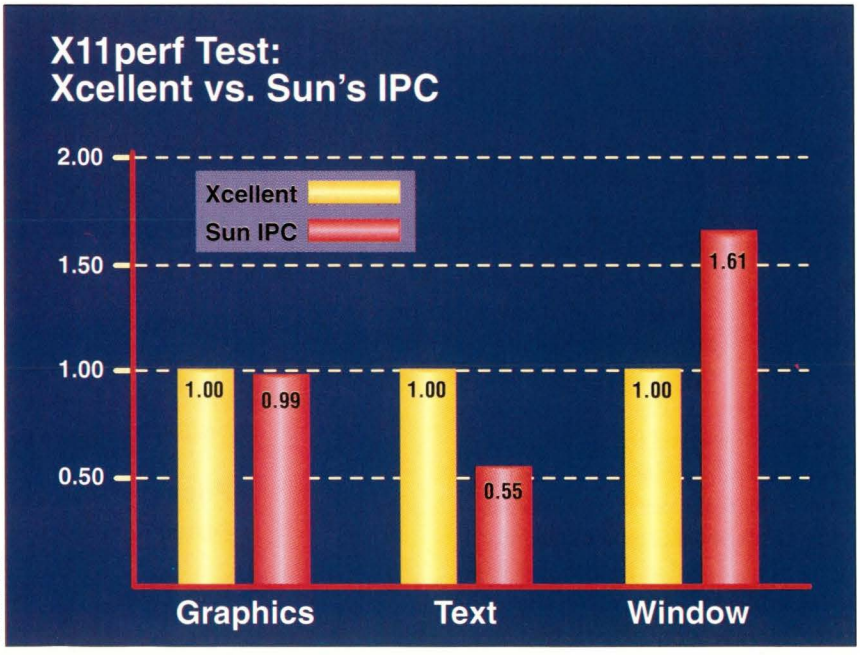
The Xcellent can either run entirely out of its own ROMs, including fonts, or you can purchase optional, downloadable software. The Motif Window Manager is built into the ROM. The terminal can use either TCP/IP or DECnet, supporting remote booting via either BOOTP (Internet) or MOP (DECnet). X11R5 is supported, including the SHAPE extensions, which allow non-rectangular windows. There is also support for XDM (X Display Manager) as well as support for establishing a connection via either Telnet (Internet) or Cterm (DECnet) as well as LAT.

The footprint of the system box is reasonable. It fits directly under the screen, which is inevitably large, as are all 19-inch screens.

To get some feel for performance, I ran x11perf 1.3, an X11 performance benchmark written by Joel McCormack, Phil Karlton, Susan Angebranndt and Chris Kent at Digital Equipment Corp. X11perf performs 268 different graphics tests (each repeated several times after a calibration run, and the best time summarized). Version 1.3 may not be the latest, but it is the version for which I have numbers on several other X11 servers, which are useful for comparison. I break the test results into three categories: graphics, text and window operations. I compared the Samsung to a Sun Microsystems Inc. IPC running these tests locally (i.e., not over the net). X11perf does automatic calibration on round-trip times to factor out the effect of a network.

Using the Samsung as a base for comparison (i.e., 1.00) lower numbers mean, on average, faster than the Samsung, higher numbers mean slower performance.

What the graph below says is that the Samsung is about the same as the IPC



HANNA DYER

Xcellent SGS-CA2

Company

Samsung Electronics Co. Ltd.
1600 NW 167th Place
Suite 335
Beaverton, OR 97006

Phone

(503) 645-9660

Fax

(503) 645-0207

Best Feature

Crisp screen, excellent performance.

Worst Feature

Setup menus that won't let you back up, some problem speaking to XDM.

Price

$4,495

Circle 158

on a range of general graphics operations used by x11perf, about half the speed on text, and the Samsung is faster on the group of window operations exercised by the benchmark. In my experience, this is good performance compared with a SPARC workstation. This good performance is not surprising; Samsung uses an AMD29000 RISC processor, more CPU power than most X terminals.

The only problems we had with this product were that some of the setup software was not as smooth as it might be. For example, some of the built-in menus can't be backtracked through. You have to exit and restart the setup mode once you go down through them. Also, we couldn't get XDM to work quite perfectly. XDM would often not restart and reprompt for a new login after someone logged out. These are not fatal flaws, but they were a little annoying.

In summary, the Samsung SGS-CA2 is a solid performer with an exceptional screen.

NeWSprinter 20

Albeit slowly, printers are evolving just like every other technology. The NeWSprinter 20 is a new generation of printer from Sun using a combination of new technologies: an inexpensive 20-ppm print engine, NeWSprint software and an SBus interface, as well as the general processing capabilities of the SPARC system that drives the printer.

NeWSprint software breaks from the (recent) past in printer design by doing most of the page processing on the workstation and basically sending a bit-mapped image of each page to the printer. The lingua franca of this print system is still Adobe Systems Inc. PostScript, and it uses Adobe utilities such as TranScript, but the PostScript runs in the attached workstation rather than the printer itself. Sun's claim is that the superior resources of the workstation (memory, CPU speed, etc.) make for faster overall print performance than trying to perform the same PostScript processing inside the printer. Rarely, if ever, do printers have state-of-the-art CPU and memory systems, let alone disk for large font sets and other resources that might be needed to process a complicated page. Let the printer just print is the philosophy of this approach, and let the computers (in the traditional sense) do all the processing.

The lingua franca of this print system is still Adobe Systems Inc. PostScript, but the PostScript runs in the attached workstation rather than the printer itself.

Are they right? I think they just might be. The NeWSprinter 20 is remarkably quick on even relatively complicated print jobs. For example, a 30-page `troff` job (pages from a book with multiple fonts and boxes, etc.) seems to come out, after a brief pause, as fast as the printer can turn pages. If it's not printing at a full 20 ppm, it certainly is close. Compare this output with most 20-ppm PostScript printers, which start and stop on each page, making you wonder why you spent all that money on a fast printer at all? Few PostScript printers I have used that do the PostScript processing in the printer seem to be able to even keep up with the old 8-ppm engines. The primary reason for buying faster engines of that type was to speed up very simple print jobs such as putting a lot of program code through `enscript`. Print quality was also very good to my eyes. Resolution is 300 or 400 dpi.

The printer itself is in a nice, small package. A long cord (32 feet, or about 10 meters) is provided to plug into the SBus board (you need an SBus to use this printer). We sat the printer outside of the office where the workstation it was attached to (an IPC) sits, on a small table. The printer comes with two large paper trays with slide adjustments to take either regular or legal paper as well as feed regular paper in landscape rather than portrait position. There is also a manual feed on the back. The printer supports paper sizes ranging from letter to tabloid (11 by 17 inches).

I liked this printer. It is fast, quiet, reasonably flexible and seems reliable. In fact, after reviewing this printer, I am seriously consider buying one for the office. That's not something I often say about a product in this column–the ultimate recommendation. ⊸

NeWSprinter 20

Company

SunPics
2550 Garcia Ave.
Mountain View, CA 94043-1100

Phone

(415) 960-1300

System Requirements:

Solaris 1.X, 16 MB of memory and an SBus slot

Best Feature:

Fast, drives 20-ppm engine at full speed even on complicated pages.

Worst Feature:

High cost of consummables. Toner kits are $249, a fuser unit is $399.

Price:

$4,150

Circle 159

New 8mm From TTi.

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What's more, this small drive is big on reliability. Engineered specifically for data applications, this new drive pushes MTBF to 80,000 hours—over twice that of traditional 8mm products. In addition, it comes with a two-year warranty.

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That's not all. The Series 8000 includes TTi's famous display technology that continuously shows real-time information on tape capacity, ECC error correction usage, and read/write rate. We've also added new front panel pushbuttons for compression and density select.

Plus there's a configurable SCSI interface for plug and play compatibility with the widest variety of computers including DEC, Sun, HP, Silicon Graphics, IBM AS/400, IBM PC, and RS/6000, Apple Macintosh and others.

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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.

EZ-RPC for Solaris

EZ-RPC is now available on Solaris 2.X for SPARC and X86 platforms. A product of NobleNet, EZ-RPC allows C programmers to distribute any C subroutine via remote procedure call (RPC) to any Solaris or UNIX-based server in a network. EZ-RCP automatically generates the source code to distribute subroutines across the network.

EZ-RPC runs under ONC+, allowing interoperability and interconnectivity among Solaris, SunSelect's PC-NFS, SunSoft's Interactive UNIX, and several other UNIX environments. EZ-RPC directly interfaces with RPC and TI/RPC libraries supplied by Sun. The company says that these libraries insulate EZ-RPC code from operating system and platform dependencies, and so EZ-RPC code is extremely portable. Pricing for a EZ-RPC developer's kit begins at $4,995 for a single-user system. Additional platforms are $1,495; additional seats are $495. The DOS/Windows version for SunSelect's PC-NFS is $995.

NobleNet Inc.
Southboro Technology Park
337 Turnpike Road
Southboro, MA 01772
Circle 101

X on NT

A product that allows systems running the NT operating system to support multiple X terminals has been introduced by Congruent. Called NtNix, the software runs on NT systems and provides the facilities to allow them to support X and X-based applications. The company says that the product will support X on NT and also make it easier for developers to port X applications to NT.

NtNix comes with several libraries that assist in this task. For example, NtNix comes with a library of BSD-like code that resides atop NT and gives it many of the features of UNIX, as far as the developer is concerned. It also has NT versions of the X programming library and a suite of standard X clients and applications for systems administration. Pricing is $395.

Congruent Corp.
100 Greene St.
New York, NY 10012
Circle 102

CICS-to-TCP/IP Tools

The CICS Programmer's Toolkit from Interlink is made to assist developers who are doing applications that allow IBM MVS mainframes to exchange data with systems on TCP/IP networks. The tool kit is an optional module for SNS/TCPaccess, Interlink's IBM mainframe software that links the MVS mainframe with LAN-based systems via TCP/IP.

The tool kit consists of a set of tools, called CICS/Tools, that automatically transfer data from one environment to another, and an application programming interface, the CICS/API, for developing more complex applications that allow for sophisticated conversation and bidirectional data exchange. CICS/Tools is prewritten CICS code that allows programmers to send or receive data between predefined locations over TCP or UDP. CICS/Tools provides a variety of processing options, including translation, file or record processing, name resolution, host and port resolution and statistics. CICS/API enables programmers to communicate with remote TCP or UDP processors. It is supported in four languages–assembler, COBOL, C and PL/1. Pricing ranges from $6,350 to $21,897,

DG Tape Array

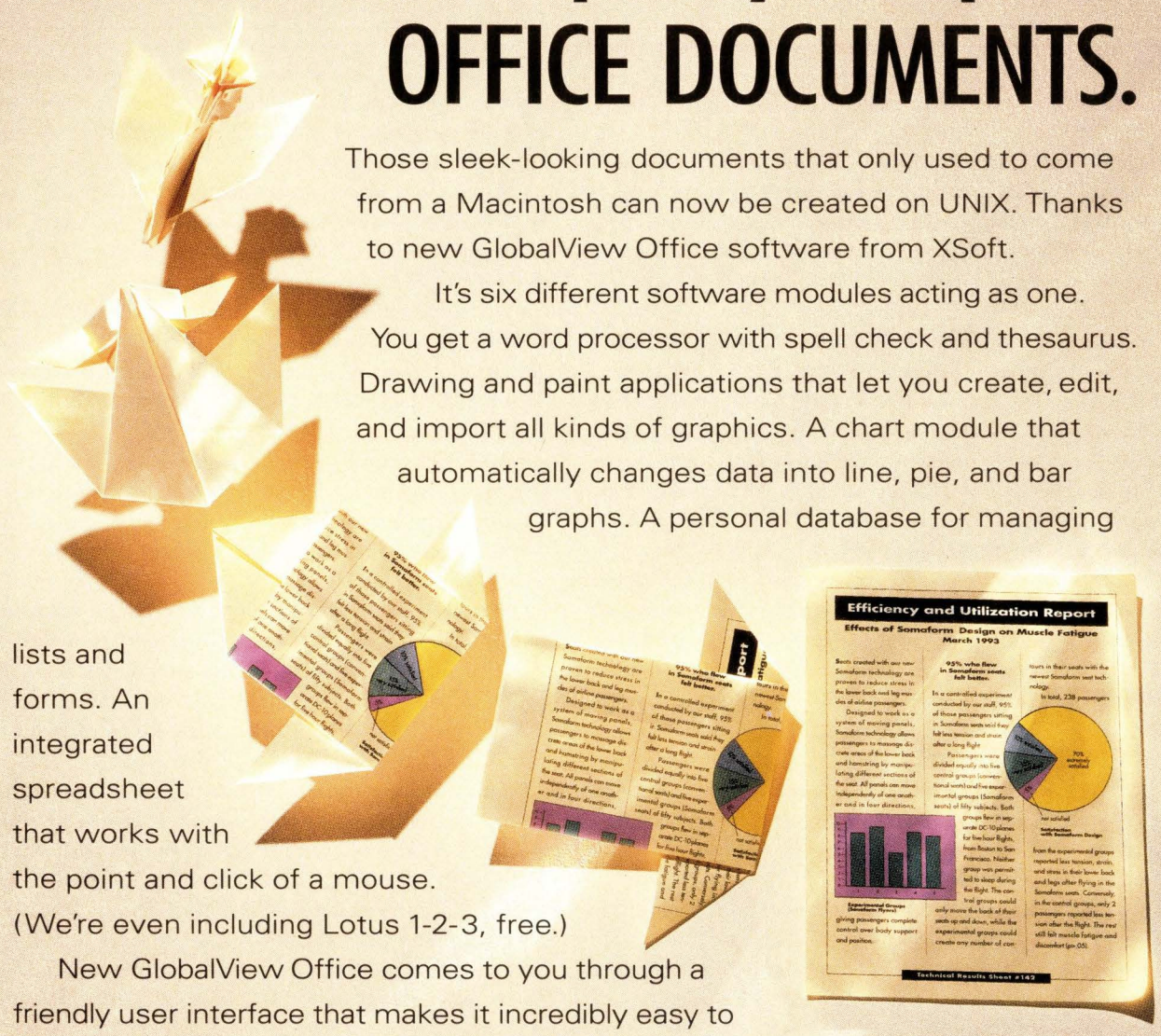
Data General's CLARiiON business unit has announced a tape array system for UNIX machines. Called the Series 400, the product is a backup system that supports up to seven 4mm DAT cartridges for as much as 30 GB of compressed storage. It can operate automatically for unattended overnight system backup.

The product uses the data striping technique to deliver data in parallel to the machine's multiple drives. The company says that this allows the Series 400 to function up to six times faster than conventional tape devices. It can back up data at a sustained rate of 3.5 GB per hour. Pricing for a five-drive entry-level model is $19,500.

Data General Corp.
CLARiiOn Business Unit
3400 Computer Drive
Westboro, MA 01580
Circle 100

XEROX

Sure, UNIX is great for designing JUMBO JETS. But NOW it's equally adept at OFFICE DOCUMENTS.



Those sleek-looking documents that only used to come from a Macintosh can now be created on UNIX. Thanks to new GlobalView Office software from XSoft.

It's six different software modules acting as one. You get a word processor with spell check and thesaurus. Drawing and paint applications that let you create, edit, and import all kinds of graphics. A chart module that automatically changes data into line, pie, and bar graphs. A personal database for managing lists and forms. An integrated spreadsheet that works with the point and click of a mouse. (We're even including Lotus 1-2-3, free.)

New GlobalView Office comes to you through a friendly user interface that makes it incredibly easy to learn. In fact, you'll be turning out compound documents in less than four hours.

GlobalView from XSoft is available now on Sun and IBM RS/6000. Curious? We'll send you a free white paper, "Intelligent documents: Working smarter, not harder." Just call 1-800-626-6775, ext. 127.

XSoft
A Division of Xerox

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Circle No. 48 on Inquiry Card

depending on which IBM system is used as a host.

Interlink Computer Sciences Inc.
47370 Fremont Blvd.
Fremont, CA 94538
Circle 103

Suns Read Mac, DOS Disks

Software that allows Sun workstations to access files on Macintosh and MS-DOS disks, and then to manipulate those files, has been released by Digital Instrumentation Technology.

Called TransferPro, the product allows users to insert standard removable media–Macintosh and DOS disks and cartridges–into their workstation drives. Their systems can then read the files on those disks and tape, and moreover, it can perform standard operations on them such as copying, moving, deleting, renaming, creating and removing files and directories, and so on.

The company says that TransferPro can also transfer files to SCSI devices, such as Bernoulli and SyQuestdrives, magneto-optical drives and removable hard disks. Pricing begins at $349.

Digital Instruments Technology Inc.
127 Eastgate Drive, #20500
Los Alamos, NM 87544
Circle 104

PC X from St. Louis

A PC X server for Windows that stresses ease of use and simple installation has just been released by IDE. Called FrameworX, the product combines X with TCP/IP and support software to integrate local DOS applications with the X Window System. FrameworX users can even cut and paste between X clients and DOS applications via the Microsoft Windows Clipboard facility.

There are three versions of the product: FrameworX, at $535, which is the standard model; FrameworX/plus, at $735, which includes TCP/IP and TCP/IP applications; and Frame-

Upgrades, Enhancements, Additions...

Editor's note: Sun Microsystems Inc. has recently announced Solaris 2.X. In an amazing show of support, dozens of companies have announced support of the operating system. This month's "Upgrades, Enhancements, Additions..." section is almost entirely composed of firms revealing their plans for Solaris product.

• Aurora, a vendor of SPARCstation enhancement products (ranging from multiport boards to OCRs), has announced that all of its products will now support Solaris 2.X. Moreover, the company has announced a 2.X upgrade policy whereby upgrades are free for products under warranty and $100 to $150 for products with expired warranties. **Aurora Technologies Inc.**, 176 Second Ave., Waltham, MA 02154. **Circle 105**

• DigiBoard, a vendor of connectivity and multiport products for the PC world, has announced support of Solaris 2.X running on Intel Corp. X86-based platforms. The company has a line of serial communication products that support between two and 896 users. **DigiBoard**, 6400 Flying Cloud Drive, Eden Prairie, MN 55344. **Circle 106**

• An Ada for Solaris 2.X on SPARC is now available from Alsys. The company provides AdaWorld, an Ada compiler, and the RISCAda line of real-time embedded system development tools. **Alsys Inc.**, 67 South Bedford St., Burlington, MA 01803. **Circle 107**

• And, from Ada to COBOL, Acucobol ported its ANSI-85 COBOL compiler, ACUCOBOL-85, to Solaris 2.1. The product features include programmable hot keys, advanced windowing, a user replaceable file system and a built-in source debugger. **Acucobol Inc.**, 7950 Silverton Ave., Suite 201, San Diego, CA 92126. **Circle 108**

• Sybase is now available on Solaris 2.1. Sybase says its database is on Solaris now and that its own next-generation product, Sybase 10, will be there by later this year. **Sybase Inc.**, 6475 Christie Ave., Emeryville, CA 94608. **Circle 109**

• Meanwhile, 4GL and database-oriented application vendors are following suit. Information Builders has released FOCUS, its 4GL, on Solaris 2.X. **Information Builders Inc.**, 1250 Broadway, NY, NY 10001-3782. **Circle 110**

• And, in a similar vein, Cognos announced plans to port its PowerHouse application development tools and environment to Solaris 2.X. **Cognos Inc.**, 67 S. Bedford St., Burlington, MA 01803. **Circle 111**

• Not to be outdone by relational database vendors, object-oriented database maker Objectivity has announced that its Objectivity/DB database will be on Solaris by midsummer. **Objectivity Inc.**, 800 El Camino Real, Menlo Park, CA 94025. **Circle 112**

• And once you've got a database, what's next but word processor supreme WordPerfect? WordPerfect has announced plans to put WordPerfect 5.1 on Solaris 2.X. **WordPerfect Corp.**, 1555 N. Technology Way, Orem, UT 84057. **Circle 113**

• Having written, you'll then naturally want to desktop publish. To this end, Frame Technology has announced that FrameMaker and FrameViewer publishing and distribution software packages are already shipping on Solaris 2.X. **Frame Technology Corp.**, 1010 Rincon Circle, San Jose, CA 95131. **Circle 114**

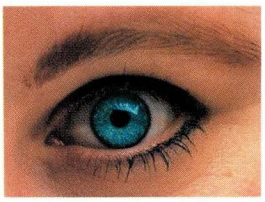
• And Suns are nothing if not nifty CAD platforms. Computervision began shipping its Personal Designer package on Solaris 2.X in March. **Computervision**, 100 Crosby Drive, Bedford, MA 01730-1480. **Circle 115**

• If CAD's there, can CASE be far behind? Interactive Development Environments has announced that its Software through Pictures product is now available on Solaris 2.X. **IDE Inc.**, 595 Market St., 10th Floor, San Francisco, CA 94105. **Circle 116**

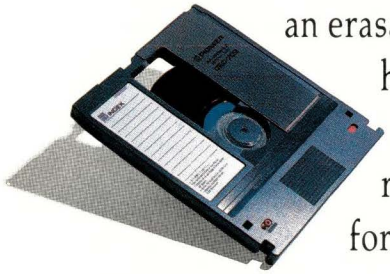
• Meanwhile, another CASE product vendor, Cadre Technologies, revealed that both its Teamwork and Ensemble products are to be on Solaris 2.X by August 31 of this year. **Cadre Technologies Inc.** 222 Richmond St., Providence, RI 02903. **Circle 117**

HALF HEIGHT FULL POWER

You've been waiting for a powerful optical storage drive that slides easily into any standard half-height computer bay. And Pioneer engineers did it. Presenting the **world's first** 5¼" half-height multifunction (rewritable/WORM) drive. *The DE-UH7101.*



This feature packed **optical** drive gives you everything. Half-height form factor, 53 msec average seek time, dust protection, SCSI interface, and removable media with 654 MBytes on a single 5¼" **optical disk**. The multifunction capability allows use as an erasable, rewritable work-horse drive. And as a WORM (write once read many) archiver for mass storage.



Along with great features, Pioneer continues to build **reliability** into every drive. By improving existing technology and reducing the number of parts we achieved an astounding 32,000 hours mean-time between failures.

The DE-UH7101 is available in internal or external units.

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Pioneer New Media Technologies, Inc.
OPTICAL MEMORY SYSTEMS DIVISION,
2265 E. 220th Street Long Beach, CA 90810

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worX/plus NFS, at $799, which provides NFS support as well. FrameworX requires an IBM-compatible PC AT or PS/2, a two- or three-button Microsoft mouse or compatible, 2 MB of RAM, 8 MB of space on the hard disk, and Microsoft Windows 3.X and DOS 4.X.

IDE Inc.
1078 Headquarters Park Drive
St. Louis, MO 63026
Circle 118

HP Shows Color X Terminal

Hewlett-Packard has announced a new color X terminal for less than $5,000. Called the Model 17Cs, the product has

a flicker-free, 17-inch, 1,280-by-1,024 Sony Trinitron flat-screen monitor. The 17Cs can display 256 colors. It also supports HP VUE/RX and HP SharedX. In addition, it comes standard with 4 MB of memory.

The system delivers up to 93,000 Xstones. The company says it is meant for users who need high-performance graphics and color in a system with a relatively small footprint. Pricing begins at $4,695.

Hewlett-Packard Ltd.
Panacom Automation Division
20 Lexington Road
Waterloo, Ontario
N2J 3Z3 Canada
Circle 119

$75 PC X

A PC X server for $75 has been introduced by Starnet Communications. X-lite has integrated TCP/IP and supports Clarkson (Crynwr) packet drivers. It uses CONFID.TEL for communications configuration. X-lite will support up to eight clients running on one or more hosts and supports `twm`, `mwm`, `olwm`, `uwm` and so on.

The company says that X-lite is meant for users who want X functionality on the cheap. With it, they can run `xterm`, `vi`, `mail`, `xmh` and so on. The company cautions that it is not meant for those wishing to run math or graph packages, but almost everything else will work fine. Starnet says the only standard X function missing from the package is the arc code, so that a few clients, such as xeyes, will not display.

The product comes with the MISC (fixed) fonts. However, the standard 75-dpi fonts are available as an option. Another option is support for Novell Inc.'s communication protocols. X-lite runs on any PC with 640 KB of memory, 2 MB of free disk space, a Microsoft Corp.-compatible mouse and driver, VGA functionality, an Ethernet card and DOS 3.X or higher.

Starnet Communications Corp.
3073 Lawrence Expressway
Santa Clara, CA 95051
Circle 120

PC X for Windows

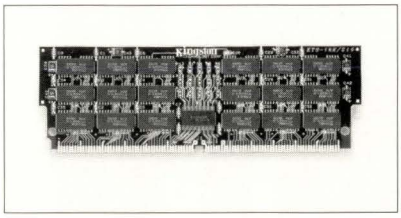
NetManage has begun shipping Xsession, a PC X server for Microsoft Corp. Windows. Xsession allows a PC equipped with the necessary network connections, and running MS Windows, to act as an X terminal. Moreover, Xsession includes both the X server and the TCP/IP protocol stack.

The company says the Xsession X server takes only 10 minutes to install and is 100% DLL. It requires 6 KB of base memory. Xsession can also be purchased bundled with the company's Chameleon and Chameleon NFS file transfer and communication software. The bundles, known as Chameleon/X and Chameleon NFS/X respectively, allow Windows applications to log into and share files with other TCP/IP computers. Pricing on Xsession is $445; on Chameleon/X it is $695; and on Chameleon NFS/X it is $790.

NetManage Inc.
20823 Stevens Creek Blvd.
Cupertino, CA 95014
Circle 121

SPARCstation 10 Memory Upgrades

Kingston Technology has unveiled memory upgrade kits for SPARCstation 10 systems. There is a 16- and a 64-MB kit. Both support the SPARCstation,



SPARCserver andSPARCengine 10 Models 30, 41, 512 and 54. Memory modules can be intermixed for a maximum of 512 MB of system memory.

The manufacturer's suggested retail prices for the 16- and 64-MB memory kits are $1,295 and $6,395, respectively. The kits are verified by SPARC International and come with a lifetime warranty.

Kingston Technology Corp.
17600 Newhope
Fountain Valley, CA 92708
Circle 122

SunRiver Personal Terminal

SunRiver has introduced another of its windowing terminals. The ST-VGA Personal Terminal combines with a standard VGA color monitor and a PC

keyboard to provide a display with up to 12 simultaneous tasks per user. It connects to a host system via SunRiver's communication technology, which is said to be 800 times faster than serial terminals and up to three times faster than typical LANs.

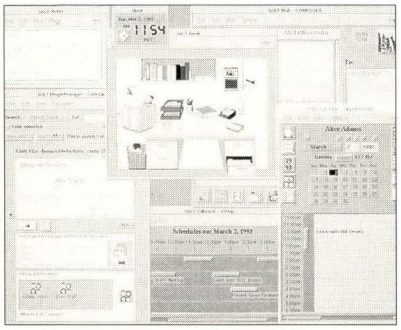
The company says that the Personal Terminal's typical setting would be a work group running off a single PC or workstation. The idea is to provide

network-style computing without actually having a network in place. To this end, the Personal Terminal will display applications running on such GUI environments as the X Window System, Alpha Windows and MS-Windows. Pricing begins at $599.

SunRiver Corp.
2600 McHale Court, Suite 125
Austin, TX 78758-4443
Circle 123

XALT Office BOPS

A business office productivity software (BOPS) package has been introduced by Xalt. Called Xalt Office, the product is a suite of five integrated



applications. The first is Xalt Desk, a graphical user environment. Xalt Desk takes as its metaphor a business office, complete with a desk with drawers that open and close. Second is Xalt Calendar, a personal and groupware scheduler. Third is Xalt People Manager, a Rolodex-style card file. Fourth is Xalt Notes, which allows the user to write and post a note electronically. Fifth is Xalt Mail, an email reader.

Xalt Office is currently available for the Sun SPARCstation and will shortly be available for Hewlett-Packard Co. 9000 Series 700/800 machines and IBM Corp. RISC System/6000s. Pricing on the package is $199.

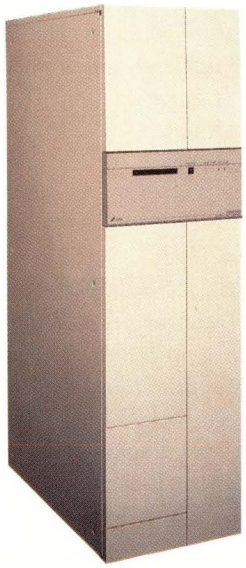
Xalt Software Corp.
Castle Crest Road, Suite 100
Walnut Creek, CA 94595-3420
Circle 124

Xview/OLIT-to-Motif Translator

A product that translates Xview and OLIT code to Motif source code has been announced by National Information Systems. Called Accent STP (for Sun Translation Pack), the company says that the product allows developers to take applications that use Xview or Open Look's Intrinsic Toolkit (OLIT) and port them to Motif with relative ease.

The company says that ACCENT STP will translate 85% to 100% of C language source code produced by Xview, OLIT and DEVGuide, including header files, to their equivalents (if they exist) in Motif. The product is priced at $4,995 for the first node-locked user license on a network, and $2,495 for each additional license.

National Information Systems Inc.
404 Moorpark Ave., Suite 200
San Jose, CA 95117-1852
Circle 125



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HDS Local Clients

A suite of local clients for its X terminals has been shown by Human Designed Systems. HDSperx is a set of personal productivity tools that can run locally on an HDS X terminal rather than bogging down a host or network. Among the clients are an IBM 370 emulator, HDS3270, and a calculator, HDScalc. There is also HDSterm, a VT320 emulator that supports color commands.

The suite includes HDSclock, an on-screen clock, and HDSsaver, a screen saver. The HDSperx package is included free with each HDS X terminal.

Human Designed Systems Inc.
421 Feheley Drive
King of Prussia, PA 19406
Circle 126

Serial X eXceeds eXpectations

Software that allows remote X terminals and PCs running as X displays to operate more quickly over serial lines has been introduced by Hummingbird Communications. The company has licensed Tektronix's Serial Xpress serial X product, crossed it with the firm's own PC X server products, and produced eXceed/Xpress. This new package allows PCs, laptops and notebooks to access UNIX and X Window System applications remotely via standard phone lines, using a modem or via direct RS-232 serial connections.

The company says that the new combined product can provide serial line communication at roughly 10 times the speed of the common Serial Line Internet Protocol (SLIP). Pricing for the PC X side of eXceed/Xpress is $249; the host software is $125.

Hummingbird Communications Ltd.
2900 John St., Unit 4
Markham, Ontario
L3R 5G3 Canada
Circle 127

More Imaging Platforms, Features

Excalibur Technologies has added a number of new platforms and features to its PixTex/EFS 3.0 document-imaging software. PixTex/EFS now supports servers from Sun, Digital Equipment Corp. and Hewlett-Packard Co. as well as IBM Corp. PC and Apple Computer Inc. Macintosh clients. New features enable the package to better index, store and retrieve digital information.

Among the new functions in Version 3.0 are a launch-and-land capability, which enables users to open an EFS document in their choice of existing editors during an EFS session and then modify the text or image from that document; a thesaurus option; and an optical character recognition template, which allows users to draw zones around information they want scanned.

Excalibur Technologies Corp.
9255 Towne Centre Drive
San Diego, CA 92121
Circle 128

Samsung HP Clone

Samsung Electronics has introduced workstations based on the PA-RISC processor. In effect, the machines are Hewlett-Packard Co. clones. Called the SWS715 workstations, the machines offer performance of 69 SPECmarks(89) at 50 MHz, 37 SPECint (92) and 72 SPECfp (92). The PA-RISC processor, the PA-7100, operates at speeds up to 50 MHz and

WORKSTATION
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25% FASTER w/SCSI-2 Interface, runs Solaris 1.x, 2.x

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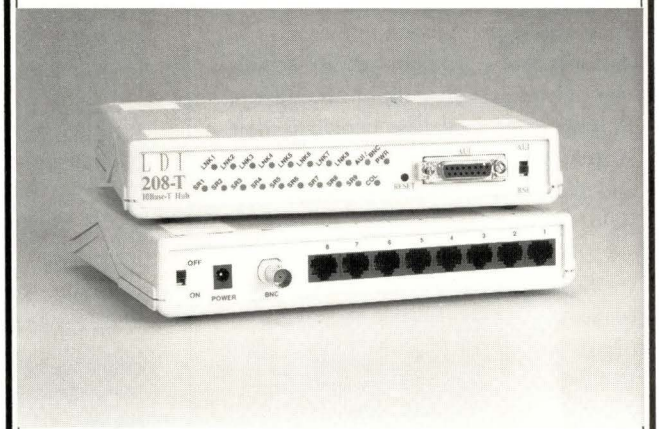

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609 Old County Road ▼ San Carlos, CA 94070
Tel: (800) 645-0035
Fax: (415) 593-2740
email: sales@ldi.com

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features two off-chip caches–64 KB for data and 64 KB for instruction. The system runs the SS-UX operating system, which the company says is binary-compatible with HP's HP-UX 9.0x.

The company says it is positioning the machines to play in markets in which HP does not itself maintain a strong presence–notably, multimedia and graphics. To this end, the SWS715 offers a graphics performance of 920,000 2D/3D vectors per second. There are also options for 24- and 48-plane graphics accelerators. Pricing for a system with 8 MB of RAM, keyboard, mouse and operating system (but not a disk or monitor) begins at $3,995. A more standard configuration, with the 50-MHz version of the processor, a 19-inch color monitor, 16 MB of RAM, a 525-MB hard disk, keyboard, mouse and OS, would be $13,995.

Samsung Electronics Co. Ltd.
Workstation Systems
3655 North First St.
San Jose, CA 95134-1713
Circle 129

A Dazzling DCE Delivery Debut

Atrium Technologies' Dazel is a distributed application that assists in the delivery of information within UNIX, Macintosh and DOS/Windows networked environments. It automatically delivers information to printers, faxes, email, voice and pagers in ASCII, SGML, SPDL, PostScript, PCL and MIF format. Atrium is calling the product "the industry's first integrated DCE [Distributed Computing Environment]-based distributed information delivery system."

Dazel is based on an enhanced version of Palladium, the OSF's distributed printing system standard. The product can be integrated with off-the-shelf applications; already, Frame Technology Corp. and Applix Inc. have integrated their offerings with Dazel.

Dazel is an example of a client/server product that makes extensive use of the Open Software Foundation's DCE. Components of the product include a graphical client delivery application; a delivery server; application development libraries; and an optional security module, the Distributed Access Control Manager.

Dazel supports SPARCstations with SunOS 4.1.2 or later and Transarc DCE v 1.0.1; HP 9000 Series 700

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- Even add new SBus slots.

Tens of thousands of satisfied customers are testament to Aurora quality. Benchmark tests prove the superior performance of Aurora products. Now our price list proves that all the benefits of the Aurora solution are available at the industry's lowest cost. With SPARC system expansion at these prices, SPARC system users will be the envy of the PC world.

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176 Second Avenue • Waltham, MA 02154
Tel: 617-290-4800 • Fax: 617-290-4844

SPARC is a registered trademark of SPARC International.

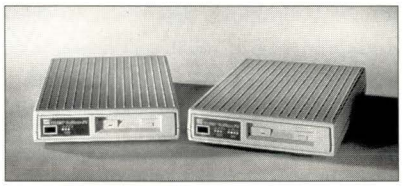
Circle No. 6 on Inquiry Card

with HP-UX 9.0.1 or later and DCE 1.0.1; IBM RS/6000 with AIX 3.2 or later and DCE 1.0.1. The Client Delivery Application (Motif-based) is $695 per user. The Delivery Server is priced at $4,995 per server. The Application Developers Library is $2,500 per license. A site license fee is $200,000. The optional Distributed Access Control Manager Service is $3,000 per server; DACM run time is $299 per node; and DACM System Management Tools are $595 per user. The DACM site license fee is $75,000.

Atrium Technologies
5000 Plaza on the Lakes, Suite 275
Austin, TX 78746
Circle 130

Telebit's Most Compact Modem

The NetBlazer PN is the newest, most compact and most cost-effective member of Telebit's NetBlazer family of leased-line and dial-up networking products. The PN measures 2.4 by 8.5 by 13 inches. It provides LAN-to-LAN connectivity, working transparently with all TCP/IP-, IPX- and AppleTalk-



based networks over analog, leased-line and switched digital services. It also supports client-to-LAN users over TCP/IP terminal service and remote nodes, IPX remote node and Apple Remote Access nodes. The NetBlazer PN is interoperable with other internetworking equipment via the PPP implementation.

The NetBlazer PN offers five levels of security, including password/ID, callback, crypotographic handshake, IP filtering and Kerberos. Remote users can configure NetBlazer PN by booting from a preconfigured floppy disk.

The PN is available in two models: the NetBlazer PN1 and NetBlazer PN2. The PN1 is equipped with an Ethernet interface supporting 10BaseT, 10Base5 and 10Base2, one serial DTE port and a built-in V.32bis modem. The PN2 is equipped with the same Ethernet interface and two serial DTE ports. The PN1 lists for $2,699 and the PN2 for $2,299.

Telebit Corp.
1315 Chesapeake Terrace
Sunnyvale, CA 94089
Circle 131

Pure Linking from Pure

Pure Software has begun shipping what it's calling "the industry's first standalone incremental linker." The product, which is a drop-in replacement for ordinary linkers, can reduce build times by more than 90%, according to the company. PureLink provides diagnostic information by identifying causes of undefined and multiply-defined symbols exactly. The product is available initially for C and C++ developers using SPARC platforms. Although it can work without Purify, Pure's error-detection tool, PureLink is a natural complement to Purify. Pricing begins at $10,000 for a 20-developer work group.

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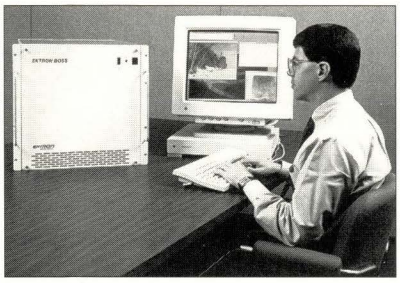
Image Processor

A transputer-based image processor for SBus systems has been introduced. The Ektron Boss parallel image processing accelerator, from Ektron



Applied Imaging, is a chassis device that attaches to a SPARCstation or compatible via an SBus connector. An entry-level system has 20 processors but may be extended up to 200. This means it has performance of between 500 and 5,000 MIPS, and 70 to "over 740" MFLOPS.

The product is, in effect, the company's VME board-level device modified for standalone duty. Ektron is a Kodak company, and its products were originally meant for the larger firm's image-processing business. However, the company says that the device can also be applied to nonimaging, compute-intensive problems. Pricing begins at $46,600.

Ektron Applied Imaging Inc.
23 Crosby Drive
Bedford, MA 01730
Circle 133

Gaining Insight on Debugging

ParaSoft has introduced an automatic debugger that can find compile-time errors, run-time errors and certain classes of algorithmic errors. The product, Insight, pinpoints compile-time errors in the calling sequence to standard libraries and erroneous format specifiers to the printf and scanf family. At run time, the product finds all memory reference errors, the company claims, as well as invalid memory pointers, invalid arguments to standard libraries, arbitrary user-specified parameters and return-code violations. Insight also includes an algorithm visualization system that allows programmers to see how their programs access memory arrays by displaying and animating the ways in which they operate on their data.

Insight is compatible with "most" other software debuggers, ParaSoft says. Its command-line switches are patterned after standard C compiler commands.

Insight is priced at $995 per language and is available on workstations from Sun, Digital Equipment Corp., Hewlett-Packard Co., IBM Corp. and Silicon Graphics Inc. It will support other platforms and operating systems in the near future.

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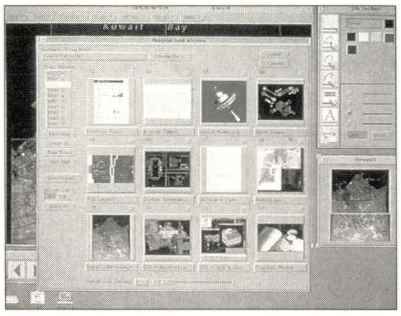
DataBeam Aims to Show Up ShowMe

An under-$1,000 desktop-based "personal conferencing solution," which competes with Sun's ShowMe product, is available from DataBeam.



FarSite lets users simultaneously share and edit text, images, graphics, spreadsheets, drawings and other forms of digital file information while simultaneously communicating over the phone with other users linked via a LAN or WAN. The product includes an embedded software utility called the Meeting-Manager. The manager coordinates electronic meetings in multinetwork, mixed and multipoint environments, while optimizing bandwidth efficiently.

FarSite is priced at $995 quantity one, with volume discounts available for OEMs and resellers. The product runs on SPARCstations, but DataBeam plans to make it available on Windows-based PCs, too, by the end of the year. Integraph Corp. offers a version of the product, which it calls CAD Conferencing, for its Clipper workstations.

DataBeam Corp.
3191 Nicholasville Road, Suite 600
Lexington, KY 40503
Circle 135

A Panoramic GUI View

IXI has added a product to its repertoire that complements its OSF/Motif Window Manager and X.desktop desktop manager. Called IXI Panorama, this "virtual work space" allows users to employ larger-than-normal screens and enables windows to be grouped together according to particular tasks. The product is aimed at UNIX users "who have crowded screens with overlapping windows, or who have to iconify running programs for additional space," the company explains.

Panorama offers a "sticky window" facility, so that windows can be glued to the front or back screen, and no matter where the user moves on the virtual screen, the sticky window moves, too. The product eliminates the need for mechanisms to ensure the same window is visible in multiple work spaces.

Panorama is shipping on SPARC workstations and will be available on other RISC and Intel Corp.-based platforms by the end of the third quarter. Pricing was still under consideration at press time.

The Santa Cruz Operation Inc.
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Wireless Multipoint Modem

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ban and rural areas without a license. The company expects demand for this model to come from companies with worldwide installations, where licensed multiple address standard frequencies are tough to obtain. The product's "buffered data design" allows for wireless multihop and multihub approaches to covering hard-to-reach areas.

The 64MP can replace or extend multidrop wireline modems or licensed multiple address radio systems. Users can change the network configuration on the fly. The product offers synchronous and asynchronous operation at speeds of up to 64 Kb/s. Both half- and full-duplex interface protocols are supported. Its 72 code-frequency channel combinations permit links from multiple related or unrelated AirLink networks nearby. Distances of up to 10 miles can be reached with standard antennas; greater distances are possible with custom antennas. Pricing begins at $2,900.

Cylink
310 North Mary Ave.
Sunnyvale, CA 94086
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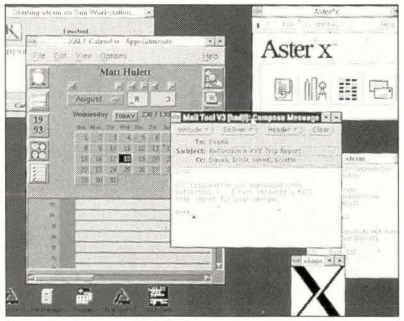
New X for Windows

Reflection X is a PC X terminal emulator that features X11R5 compliance and support for major X GUI standards. The company says the product



also supports major third-party TCP/IP products.

The product does not have its own X server. However, as an option, Reflection X can be bundled with the company's TCP Connection software. On its own, Reflection X is $499. With the TCP Connection option, it is $599.

Walker Richer & Quinn
2815 Eastlake Ave. E
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Circle 138

Compressed File System

Crusher, a UNIX file system from Magma, compresses and decompresses data on a workstation disk drive. It typically delivers a 2:1 compression ratio. It supports most file types, including directories, executables, links, sockets and mapped files. According to Magma, all systems administration tools, programming languages, applications and GUIs such as OpenWindows, Motif and the X Window System will operate in concert with Crusher.

With Crusher, users can create compressed partitions that will be automatically compressed and decompressed on the fly. In fact, Crusher uses the algorithms that many tape backup units employ and has been tested with drives from many leading vendors.

Installation does not require kernel modifications or recompiling. The price is $189. A demo version that allows users to create, compress and test a 20-MB partition is available.

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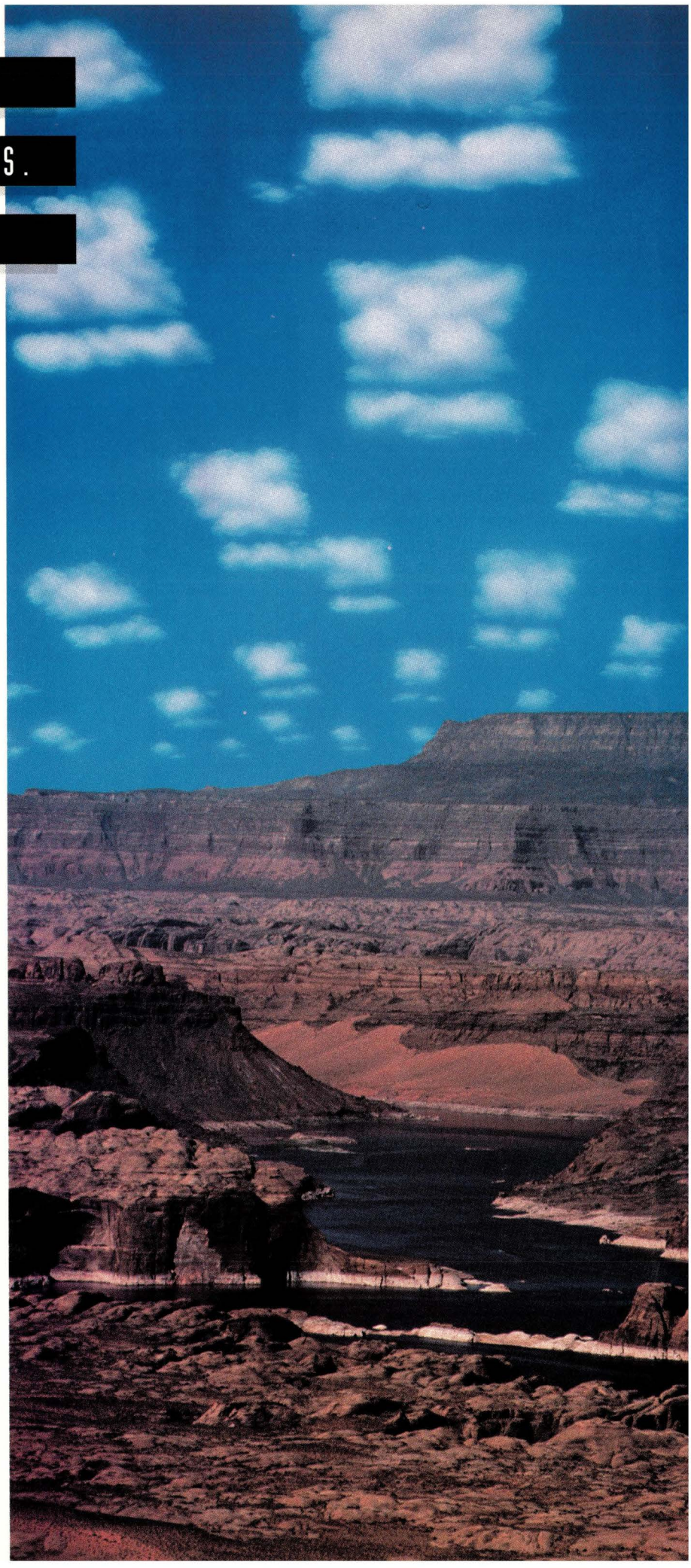

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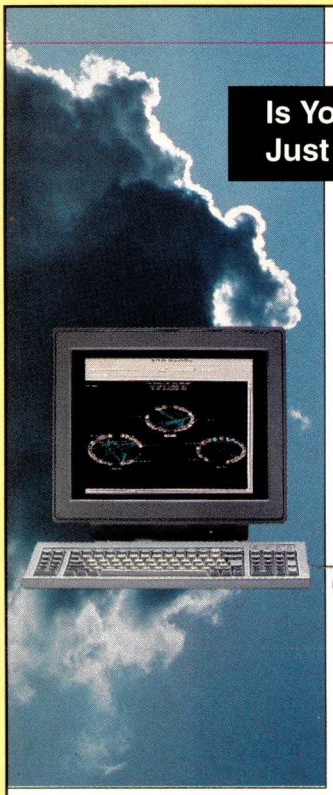

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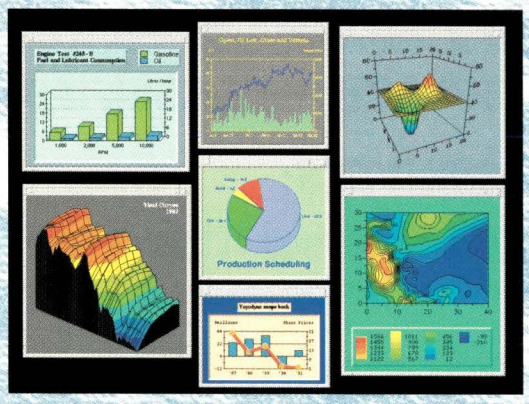

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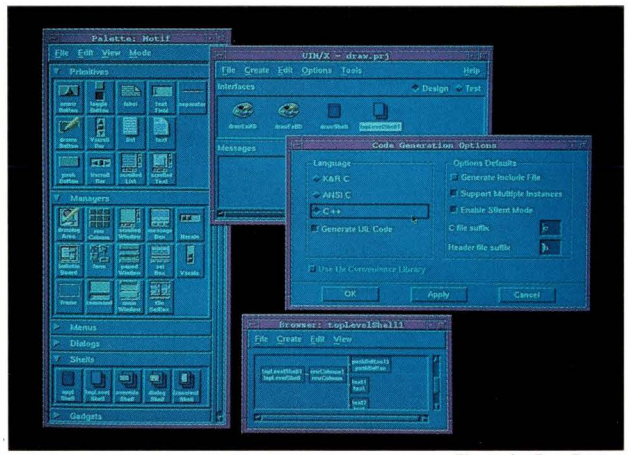

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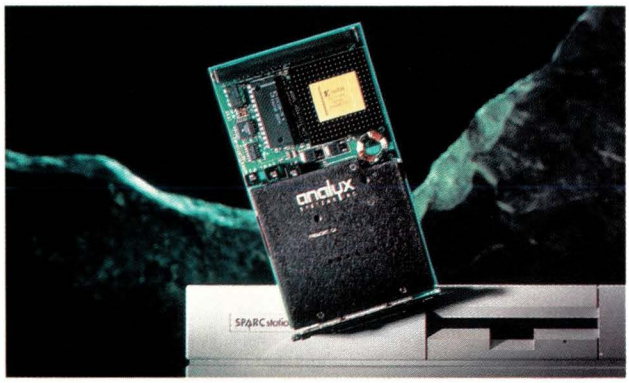

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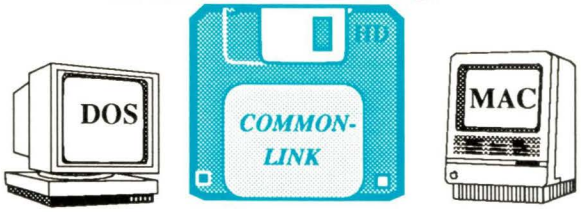

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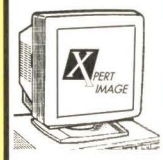

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READER INQUIRY NUMBER		PAGE
1	American Computer Rental	31
2	ANDATACO	2
3	Antares Microsystems	78
4	Apunix	11
5	Artecon	7
6	Aurora Technologies	77
7	Aydin Controls	59
8	Box Hill Systems	back cover
9	Computer Upgrade	75
10	Contemporary Cybernetics	15
11	Disk Emulation Systems	22
12	Engineering Design Team	38
13	Exabyte	inside front cover - 1
14	Falcon Systems	51
15	Golden Hills Computer Services	43
16	Hewlett-Packard	35
17	Hewlett-Packard	61
18	Hitachi America	29
19	Hitachi America	31
20	Hitachi America	33
21	Hummingbird Communications	55
	IBM Scientific Visualization	23
22	In Focus Systems	9
23	Integrix	inside back cover
24	Itac Systems	19
25	Lago Systems	17
26	Landmark Systems	53
27	Larabie Distributing	76
28	Magma	37
29	Minicomputer Exchange	34
30	Pacific Microcomputers	33
31	Parity Systems	65
32	Peripheral Solutions	80
33	Peripheral Devices	24-25
34	Pinnacle Data	78
35	Pioneer	73
36	Polaris Service	41
37	Rave Computer Association	79
38	Scientific Computing Associates	21
39	Sunar Systems	76
40	Tatung Science & Technology	27
41	Tech-Source	57
42	Tektronix	47
43	TGV	13
44	Transitional Technology	69
45	UniSolutions	81
	Unix Expo	82
46	Virtual Circuits	39
47	Workstation Technologies	5
48	X-Soft	71

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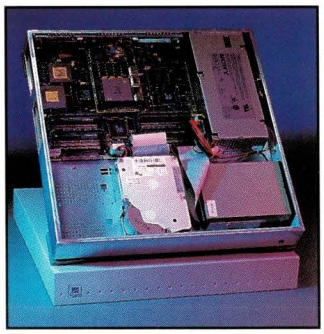

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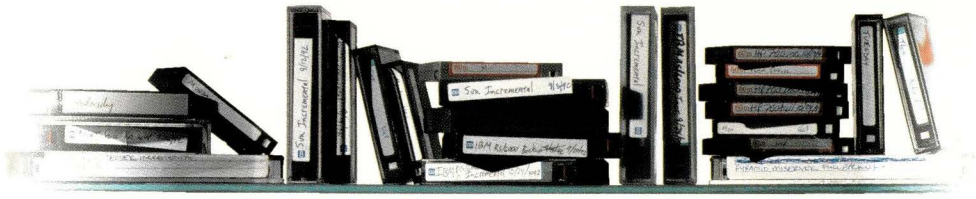

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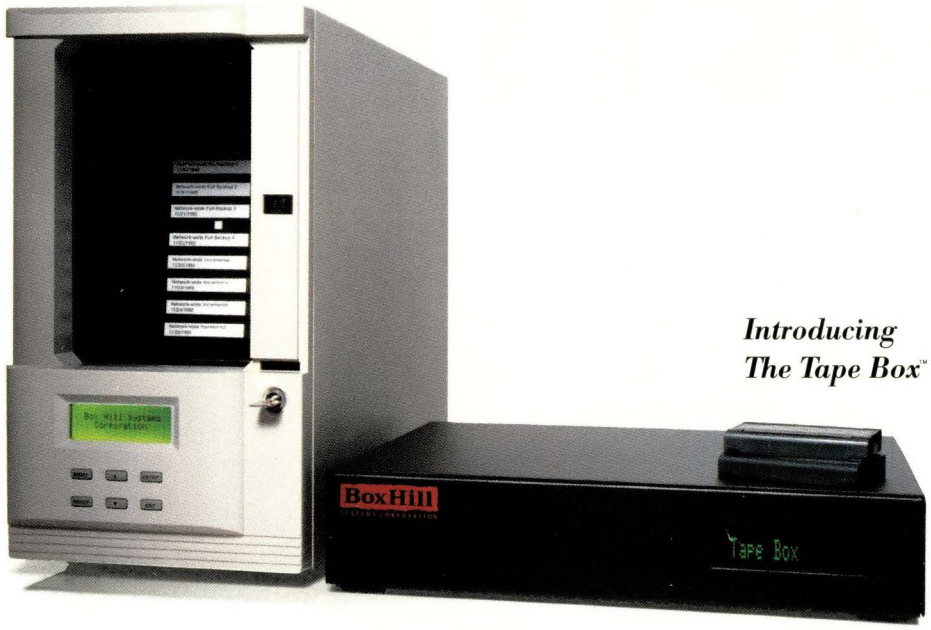

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